HERBICIDE RESISTANCE IN GRAIN SORGHUM

by

KELLAN SCOTT KERSHNER

B.S, Purdue University, 2005

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Agronomy
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

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Abstract

Sorghum acreage is declining throughout the United States because management options and yield have not maintained pace with maize improvements. The most extreme difference has been the absence of herbicide technology development for sorghum over the past twenty years. The objectives of this study were to evaluate the level of resistance, type of inheritance, and causal mutation of wild sorghums that are resistant to either acetyl-coenzyme A carboxylase (ACCase)-inhibiting herbicides or acetohydroxyacid synthase (AHAS)-inhibiting herbicides. ACCase-inhibiting herbicides used in this study were aryloxyphenoxypropionate (APP) family members fluazifop-P and quizalofop-P along with cyclohexanedione (CHD) family members clethodim and sethoxydim. The level of resistance was very high for APP herbicides but low to nonexistent to CHD herbicides. With genetic resistance to APP herbicides, the resistance factors, the ratio of resistance to susceptible, were greater than 54 to 64 for homozygous individuals and greater than 9 to 20 for heterozygous individuals. Resistance to CHD herbicides was very low with resistance factors ranging from one to about five. Genetic segregation studies indicate a single gene is the cause of resistance to APP herbicides. Sequencing identified a single mutation that results in cysteine replacing tryptophan (Trp-2027-Cys). Trp-2027-Cys has previously been reported to provide resistance to APP but not CHD herbicides. The other wild sorghum evaluated in this study was resistant to AHAS-inhibiting herbicides including imidazolinone (IM) family member, imazapyr, and sulfonylurea (SU) family member, nicosulfuron. Resistance factors in this genotype were very high, greater than 770 for the IM herbicide and greater than 500 for the SU herbicide, for both herbicide chemical families. Genetic segregation studies demonstrate that resistance was controlled by one major locus and two modifier loci. DNA sequencing of the AHAS gene identified two mutations, Val-560-Ile and Trp-574-Leu. Val-560-Ile is of unknown importance, but valine and isoleucine are similar and residue 560 is not conserved. Trp-574 is a conserved residue and Leu-574 is a known mutation that provides strong cross resistance to IM and SU herbicides. The results of these studies suggest that these sources of APP, SU, and IM resistance may provide useful herbicide resistance traits for use in sorghum.

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To God be the glory.

Dedication

I dedicate this dissertation to my childhood best friend, Zachary Lee Bertsch, who is currently fighting stage 4 cancer. I marvel at his dignity and pray for him, his wife Jenny, son Zion, and daughter Moriah. It seems like yesterday that we were goofing off at Boy Scout camp, canoeing the White Otter Wilderness Area, or hiking the Appalachian Trail. I draw encouragement from your attitude and strength from your resolve. Thank you for being my best friend.

Preface

This dissertation seeks to combine elements of Biochemistry, Genetics, Plant Breeding, and Weed Science so that an agricultural scientist can understand how upcoming releases of herbicide resistant sorghum are resistant to ACCase- and/or AHAS- inhibiting herbicides. It starts with a historic overview of US sorghum production, management, and breeding. This is followed by a description of ACCase, its role in the plant, its use as an herbicide target, and the development of resistance to inhibiting herbicides. The next section describes AHAS in a similar manner. The literature review ends with comments about gene flow between cultivated and wild sorghum and with a comparison of the ACCase verses AHAS technologies.

The next chapter describes the research preformed to characterize the ACCase resistance identified in sorghum. It starts with a dose response study that quantifies the level of resistance existing in the wild source, the level obtained in a heterozygous F_1 plant, and the degree of susceptibility of cultivated sorghum. Four herbicides were used, two aryloxyphenoxypropionates, fluazifop and quizalofop, and two cylohexanediones, clethodim and sethoxydim. The next study is a segregation experiment that evaluates the inheritance of the resistance. The last experiment is the sequencing of the ACCase CT domain looking specifically at six codons known to provide resistance when mutated. The results of these experiments are discussed with an emphasis on developing herbicide resistant grain sorghum hybrids for production agriculture.

The final chapter describes the research preformed to characterize the AHAS resistance identified in sorghum. It too starts with a dose response study that quantifies the level of resistance existing in the wild source and the degree of susceptibility of cultivated sorghum. Two herbicides were used: nicosulfuron, a sulfonylurea, and imazapyr, an imidazolinone. This is followed by a segregation experiment that evaluates the inheritance of the resistance. The last experiment is the sequencing of the AHAS gene looking specifically at six codons known to provide resistance when mutated. The results of these experiments are discussed with an emphasis on developing herbicide resistant grain sorghum hybrids for production agriculture.

It ends with the appendixes which contain the dose response datasets, SAS code, and SAS output. The SAS code should be most valuable to future researchers.

CHAPTER 1 - Sorghum Production and Putative Herbicide Targets

Sorghum bicolor (L.) Moench is the fifth most important cereal crop in the world based on total production. It is important not because it is the highest yielding (maize), most planted (wheat), feeds the most people (rice), or makes the most popular beer (barley). It is important because of where it can grow, how little water it uses, and how long it can survive in drought environments. Sorghum originated in the harsh environments in and around the vast plains of the Serengeti and Sahel regions of Africa (de Wet and Harlan, 1971). It is grown in similar drought-prone environments around the world. In these areas, it provides calories to people chronically short of food.

Sorghum was domesticated more than four thousand years ago in a process that required selection for traits like non-shattering grain, larger seed size, easy threashablilty, lack of dormancy, and regulated maturity. This likely occurred in the eastern half of sub-Saharan Africa and resulted in the primitive bicolor race. This early sorghum crop was transferred throughout Africa where it adapted to humid environments (race guinea), became widely adapted to more temperate environments in southern Africa (race kafir), became more refined and adapted to drought-prone environments of central Africa (race caudatum), and hitchhiked eastward with traders to India and with the spread of Islam (race durra). These five races carry distinctive characteristics that are used to classify modern grain sorghum into the five races and 10 intermediate types (Harlan and de Wet, 1972).

Sorghum came to the United States prior to the Civil War as introductions of sugar accumulating types. Post-bellum their cultivation became very important for production of sweet syrup. Currently, sorghum as a sugar crop is not a large market in the United States. The first documented arrival of grain sorghum to the United States was in the 1870s. It spread throughout the South and Southwest carrying its reputation of producing a yield in all but the worst drought and becoming a tangled mess of tall lodged plants. The first dwarf mutation came to national attention in 1905 and was simply noted that it came from Oklahoma, likely a prior year(s) farmer selection (Karper and Quinby, 1946). In 1918, a farmer in Arizona identified and selected a dwarf mutation within the dwarf crop. This became known as double dwarf milo that could be mechanically harvested with a wheat combine. It is important to note that the double dwarf

genotype actually has three of the four known major dwarf genes since cultivated sorghums naturally carry a single dwarf mutation (Quinby and Karper, 1954). The other major development in US sorghum production came in the 1950s when Stephens and Holland (1954) identified a source of cytoplasm male sterility that could be used to produce hybrid cultivars. The first hybrids were released in 1957, and almost 90% of sorghum producers were planting hybrid sorghums by the end of the decade.

Sorghum Production in the United States

Sorghum can be grown under many different cropping and management systems. The most common method in the United States is monoculture grain sorghum planted on 76 cm rows as part of a crop rotation on extensive fields without supplemental irrigation and with weed control attempted using preemergent herbicides. However, you will find variations on each of these items, some of which will be discussed below. Specifically, we will look at the Kansas Grain Sorghum Performance Trials conducted in Reno County to see how best management practices have changed over the years. First, we will look at historical records of sorghum production in the United States examining the rise and fall of sorghum production. Next, we will look at the effort and emphasis of sorghum breeders during this time. The last item in this section will focus on an analysis of the impact of weed competition on sorghum yields. This case study should provide the reader with a sense of the changes that have occurred during the development of this important crop in the United States.

A second purpose of the following sections is to show that sorghum production is declining in the United States. Sorghum producers are switching to corn because of greater yield potential even though it has a higher risk of failure during drought. This is because corn yields have increased at a faster rate than sorghum yields. Also, corn management and breeding has reduced the drought risk, shifted the planting date earlier, and increased the herbicide options available for the corn producer. With farmers shifting to corn, the sorghum industry is shrinking with potential risk of total disappearance.

History of Sorghum Production in the United States

As noted above, the development of dwarf hybrid sorghum was crucial for its use in the modern era. The United States Department of Agriculture (USDA, 2010) has state-specific crop records of sorghum production since the 1920s. These records are graphed to show hectares

planted for all purposes (Figure 1-1), hectares harvested for grain (Figure 1-2), grain yield (Figure 1-3), and grain production (Figure 1-4). The year 1957 is important on all four graphs as this marks the beginning of hybrid sorghum production in the US. Interestingly, the hectares planted to sorghum have been in steady decline since then. Prior to this, grain sorghum as a grain crop specifically was not the major use of sorghum hectares. Comparing hectares planted to hectares harvested prior to 1957, there was a large amount of on-farm use as a feed, forage, and silage. Additionally, seed-set failure would encourage on-farm use or abandonment and explain some of the differences between amount planted and harvested, especially in 1934 and 1936 at the worst of the dust bowl.

Kansas and Texas have been and are the largest sorghum producing states in the US. Historically, Nebraska and Missouri are next followed by a number of states throughout the South and Southwest. Production has been stable in Kansas, dropping in Texas, and greatly reduced in all the other states (Figure 1-4). Yields have been increasing through this entire time, so the area planted and harvested is negatively impacting production (Figures 1-1, 1-2, & 1-3). The most notable is the absolute drop-off of acreage in the other states. This is because of expanding corn hectares, with the Corn Belt growing into Nebraska and Missouri. Hidden within the Kansas data is the shift of sorghum hectares from the east towards the west as corn becomes established in eastern counties. Texas is harder to interpret because of the role of cotton and availability, price, and flow volume of irrigation water. Regardless, sorghum is losing hectares to corn. Historically, sorghum was valued for producing a yield, not the size of that yield. Today, farmers are more willing to risk crop failure relying on improvements in corn management and hybrids options to reduce the risk and increase yield potential. These trends are exacerbated by the fact that sorghum yield potential has not kept pace with modern corn breeding, increasing around 60% the annual gain of corn (Smith and Frederiksen, 2000).

Breeding Efforts

Since the 1870s, farmers and scientists have been selecting for higher yielding sorghum produced with large scale production methods (Smith and Frederiksen, 2000). In addition to reduction in height, early selections were important for maturity, straight neck, endosperm color, smut resistance, *Periconia* root rot resistance, and yield (Smith and Frederiksen, 2000). The development of hybrid sorghum in the 1950s greatly increased the interest in sorghum breeding

with at least 15 private and 18 public breeding programs; some with multiple locations. Around this same time, the importance of off-season nurseries was realized, allowing two or three generations advanced in a year.

Necessity required that much of this breeding effort be focused on defensive traits. First, it was downy mildew in the 1960s, followed by anthracnose. Greenbugs came to national attention in 1968 and threatened the entire industry until breeders identified sources of resistance. *Fusarium* causing small seed malady and maize dwarf mosaic virus were other problems occupying breeders' time. More recently in 1997, sooty stripe entered the list of diseases threatening sorghum production. Responding to all these challenges limited the effort breeders focused on yield. When they did focus on yield, it was a defensive focus towards the response to abiotic stress (Assefa and Staggenborg, 2010). Additionally, interest in sorghum breeding declined until the industry was just a skeleton of its former self. Together, a lack of funding and the focus on defensive traits limited annual increases in yield gain to just 60% of the gains realized in maize.

Changing Management and Production Methods

Best management practices have evolved over time seeking an optimal balance between yield and risk. Kansas State University conducts the Kansas Grain Sorghum Performance Trials to evaluate commercial genotypes under management similar to local producers (Kansas State University, 1957-2009). Table 1-1 lists the management practices at the Reno County location showing every five years over the 54 years of the trial's existence. Reno County is in central Kansas, representing an important area of sorghum production. From this table, it is clear that row spacing has decreased, plant populations have generally increased, and nitrogen fertilizer applied has increased. It is less clear if the planting date has moved forward, because of the large variation between years, but recent years have some of the earliest planting dates, a trend reported by Assefa and Staggenborg (2010). Cropping systems and rotations have also changed. Early in sorghum production history, sorghum was grown on wheat stubble that had been sitting fallow for 10 months. However, the last 25 years have seen variation in prior crops that reflect a movement by modern producers towards more intensive crop rotations. During this time, producers started applying more phosphorus fertilizer. In Table 1-1, it can be hard to draw inferences from the omission in 2008 because of phosphorus's stability in the soil. Producers are

known to apply several years of phosphorus fertilizer at one time which is likely the case in 2008 when the prior crop was soybeans. It is unlikely, yet unknown, if phosphorus was applied to prior crops in the first 25 years. Days to bloom was used to record maturity and was highly variable, which discounts any inferences that might be made. Pesticide products have changed greatly over the years. None were used in the early years. In the 1970s, they were first used to control insects like green bugs and chinch bugs. In the 1980s, regular use of herbicides began. Around the turn of the century, there was a shift towards broad-spectrum preemergent herbicides that require seeds treated with safeners, often with other pesticides added to the treatment. The weed control provided by herbicides is very important in intensive dryland agriculture since weeds compete for available water, as discussed below.

In summary, the Reno County trial location has seen more intensive farming practices over the last 54 years. As reported by Assefa and Staggenborg (2010), yields in the Kansas Grain Sorghum Performance Trials have increased an average of 46 kg ha^{-1} yr^{-1} across all studied dryland locations from 1957 to 2008. Reno County increased 58 kg ha^{-1} yr^{-1} during this time. For all dryland locations, 34% of the yield increase is attributed to nitrogen fertilizer. The other 66% is attributed to "improved hybrids and their interaction with agronomic practices and perhaps with environmental factors". This is not surprising since it has been observed in maize that breeding efforts and management practices changes need to be considered together, especially when looking at seeding rates (Duvick, 2005). The correct seeding rate is even more important in dryland sorghum because it infLeunces both yield potential and drought risk, since high plant densities increase intracrop competition for available water. Sorghum producers affect the balance between input cost, yield potential, and environmental risk with every decision they make.

Impact of Weeds on Sorghum Yield and Importance of Herbicide Use

Producers have long recognized the impact of weeds on crop yields. In marginal environments where sorghum is grown, the impact can be multiplied by the environmental interactions. This is apparent in Table 1-2 where large variations can be observed between years (Traore et al., 2003) or locations (Knezevic et al., 1997). Also, the timing of the weed pressure can impact the competitiveness of the weeds (Knezevic et al., 1997). From Table 1-2, it is clear that yield losses can easily reach 50% under specific conditions. For weed control, modern

producers apply a preemergent herbicide that requires activation by precipitation. Without rainfall or with too much rain, the herbicide will not offer adequate control allowing weeds to escape. Broadleaf weed escapes can be controlled by a variety of chemicals like carfentrazone, prosulfuron, halosulfuron, and 2,4-D. However, for grass weed escapes, the only chemical options are atrazine and quinclorac, neither of which provides good control to any grass except foxtail (Thompson et al., 2009). Producers have a definite need for broad-spectrum postemergent grass herbicides.

Acetyl-Coenzyme A Carboxylase as a Protein and as a Herbicide Target

Acetyl-Coenzyme A Carboxylase (ACCase) is the first step in *de novo* lipid biosynthesis providing the pathway with malonyl-Coenzyme A (CoA). It also provides malonyl-CoA for synthesis of secondary metabolites. ACCase uses ATP to attach bicarbonate to acetyl-CoA forming malonyl-CoA. *De novo* lipid biosynthesis occurs in the chloroplast stroma in contrast to secondary metabolites like very-long-chain fatty acids, flavonides, and anthocyanins, which are synthesized and modified in the cytosol. Neither malonyl-CoA nor acetyl-CoA can cross the chloroplast envelope. This necessitates two independent pools of malonyl-CoA and requires ACCase enzymes in both the chloroplast and the cytosol. Harwood (1988) described the generation of free acetate that could cross the chloroplast envelope and rapidly be converted to acetyl-CoA providing ready access to large amounts of acetyl-CoA required for *de novo* lipid synthesis. This leaves ACCase as the first controller, determining the flux through the fatty acid biosynthetic pathway (Post-Beittenmiller et al., 1992).

Discovery of the ACCase Protein

ACCase was discovered by two research groups, independently, in 1958 (Brady, 1958; Wakil, 1958). Both researchers worked on avian liver where it was noted that liver extract would form fatty acids from acetyl-CoA along with HCO_3^-, Mn^{2+}, ATP, and NADPH. They determined that the first step in formation of fatty acids was the formation of malonyl-CoA from acetyl-CoA, HCO_3^-, and ATP. Within two years, ACCase was identified in plants (Hatch and Stumpf, 1961) and other life forms. It was not until 1993 breakthroughs that differences that between monocots and dicots were discovered. In dicots, as represented by *Pisum sativum*, it was discovered that a subunit for ACCase was encoded in the chloroplast genome (Sasaki et al., 1993). This confirmed that dicots had a multi-subunit ACCase in their chloroplast in addition to the multi-domain

ACCase located in the cytosol. In monocots, as represented by *Zea mays*, it was determined that separate multi-domain ACCase enzymes are located in the cytosol and chloroplast (Egli et al., 1993). The different enzymes in monocots have divergent properties such as susceptibility to herbicides and can be separated *in vitro*. Across life, multi-subunit ACCases are found in bacteria and dicot chloroplast, and multi-domain ACCase are found in animals, yeast, cytosol of plants, and monocot chloroplast. In summary, monocots have two multi-domain ACCase with one located in the cytosol and the other in the chloroplast. Dicots have a multi-domain ACCase located in the cytosol and a multi-subunit ACCase located in the chloroplast. There are some exceptions; *Arabidopsis thaliana* has a third ACCase, a multi-domain enzyme located in the chloroplast, and a single report of a multi-subunit enzyme in *Z. mays* (Incledon and Hall, 1997).

ACCase Structure, Function, Regulation, and Conserved Residues

As reviewed by Délye (2005), ACCase contains three catalytic units that are either separate domains of a single peptide or subunits composed of different peptides. The three catalytic units are biotin carboxylase (BC), biotin carboxyl-carrier (BCC), and carboxyl transferase (CT). The multi-domain protein, where all three units are on a single peptide, can be referred to as homomeric. The multi-subunit protein can be referred to as heteromeric and is composed of single peptides for both BC and BCC subunits and two peptides (α and β) that form the CT catalytic unit. The β -CT is encoded in the chloroplast genome (Reverdatto et al., 1999) and the other peptides are encoded in the nuclear genome. Transit peptide sequences are required for peptides destined for plastids or mitochondria. Literature about ACCase is extensive, yet often specific to organism kingdom (bacteria, animal, plant) and/or enzyme structure (homomeric or heteromeric). The remainder of this paper will focus on the homomeric enzyme in plants.

Herbert et al. (1996) characterized the ACCase proteins from maize leaves, finding a chloroplastic isoform and a putative cytosolic isoform, and both were homomeric. The two isoforms had very similar binding constants for the substrates (HCO_3^-, ATP and acetyl-CoA) and products (ADP, P_i, and malonyl-CoA), but show subtle differences in their structure. Both isoforms had a Ter Ter mechanism which is where acetyl-CoA binds to the CT active site before ADP and P_i are released from the BC active site. However, it appears that the cytosolic isoform has a higher specificity for substrates and products at the CT active site. This would explain

greater herbicide sensitivity in the chloroplastic isoform which was 150 to 2000 times more sensitive than the cytosolic isoform. The kinetic parameters for the substrates and products were similar to earlier work by Nikolau and Hawke (1984). The kinetic parameters allow photosynthetic driven changes in pH, Mg^{2+} concentration, ATP concentration, and ADP concentration in the chloroplast to coordinate fatty acid synthesis with light availability.

With three functional domains, it is not surprising that the homomeric ACCase gene is large. However, the intron/exon structure is surprisingly complex. Wheat cytosolic ACCase with 2260 amino acid residues has a 7.4-kb cDNA sequence interrupted by 29 introns for a total length of 12-kb (Podkowinski et al., 1996). However, there is considerable sequence conservation within this vital metabolic enzyme; both at a broad enzyme level across all biotin containing enzymes (Samols et al., 1988) and at all ACCase active sites. The most extensive study on the CT active site was done by Délye et al. (2004) where 18 *Alepecurus myosuroides* populations contributing a total of 86 individuals were sequenced. Nonsynonymous substitutions were very few compared to synonymous substitution indicating the purifying selection placed on this enzyme. The conserved sequence allows comparison of resistance inducing mutations across multiple species. Interestingly, the Délye study noted that "most nonsynonymous substitutions were related to resistance to ACCase-inhibiting herbicides" for the 3,396-bp region surrounding the CT active site.

ACCase-Inhibiting Herbicides

In the 1970s, several new herbicide chemicals were in development. They did not affect broadleaf plants but provided broad-spectrum control of grasses. These herbicides can be classified into two different chemical families: aryloxyphenoxypropionate (APP) and cyclohexanedione (CHD). The chemical structures represented by these families are different but they have similar effects on plants suggesting a common mode-of-action. Herbicides representing these chemical families were being marketed by 1983 (DeFelice, 1998), but ACCase was not identified as the target until 1988 (Rendina and Felts, 1988; Secor and Cseke, 1988). Yet another ACCase-inhibiting herbicide representing a third chemical family, phenlypyrazolin, was commercialized by Syngenta in 2006 (Hofer et al., 2006). All of these chemicals work by inhibiting the chloroplastic ACCase, preventing synthesis of fatty acids

(Délye, 2005). This limits cell growth and compromises the cell membrane integrity, allowing metabolite leakage leading to rapid plant death.

The APP and CHD herbicides are reversible inhibitors of ACCase. They are mutually exclusive; only one herbicide molecule, regardless of family, can bind at a given time. They are nearly competitive with acetyl-CoA, which means they bind in the CT active site (Rendina et al., 1990). Three-dimensional modeling of the ACCase protein confirms that APP and CHD binding sites are overlapping, yet not identical, regions in the CT active site cavity (Délye et al., 2005b). As mentioned above, the herbicides can bind to all homomeric isoforms but bind more strongly, upwards of 2000 fold greater, to chloroplastic isoforms compared to cytosolic isoforms (Herbert et al., 1996). This suggests some important differences in the shape of the CT cavity between isoforms allow herbicidal activity on grasses but not significantly harming broadleaf plants.

Resistance to ACCase-Inhibiting Herbicides

Herbicide resistance exists when plants that were previously susceptible develop an ability to survive herbicide exposure. Resistance to ACCase-inhibiting herbicides appeared quickly after the release of APP and CHD herbicides, less than five years in a number of cases (Heap, 2010). The number of reported species with resistance is 37, and some of these species have widespread resistance, as discussed below. This requires careful consideration of APP and CHD herbicides for further use or for technologies that requires these herbicides.

Measuring Herbicide Affect and Resistance Factors

There are many ways to measure herbicide affect including enzyme inhibition, visual injury, growth reduction, and lethality. Regardless of the measurement, the result often reported is the herbicide concentration required for 50% of the effect. This would be the IC_{50} for enzyme inhibited to half the specific activity or GR_{50} for growth rate reduced by half. This is used to report resistance factors, expressing the ratio as the resistant value divided by the susceptible value. After reviewing much literature, some trends appear in resistance factors and their use in describing resistance. Resistance factors of less than five are very low and often are not statistically different than one even when reported. Resistance factors of 5 to 10 are low but can be very important as discussed below with the heterozygous IT maize. Resistance factors of 10 to 100 can be considered moderate. Resistance factors greater than 100 indicate high levels of

resistance that are sure to have an impact on the success of the resistance in nature or commercialization.

Types of Herbicide Resistance

Herbicide resistance can be grouped into two categories: target site resistance (TSR) and non target site resistance (NTSR). TSR, also called insensitive enzyme resistance, refers specifically to resistance caused by a mutation in the gene encoding the target enzyme that makes the enzyme less sensitive to the herbicide. NTSR is a much broader grouping that includes everything except TSR. One gray area in this classification is resistance caused by overproduction or increased specific activity of the target enzyme. For the purposes of this paper, this will be considered NTSR since resistance is provided by gene regulation or enzyme activity, not the herbicide binding site. Other aspects of NTSR include metabolism and absorption/translocation causes of resistance.

Target Site Resistance to APP and CHD Herbicides

TSR is the most commonly reported type of resistance to APP and CHD herbicides in literature, even if it is not the most common method of resistance, as discussed in the next section. This reflects the high resistance factors possible from TSR and the definitive authority provided by DNA sequencing. It is much easier to publish research that identifies a mutation in ACCase that provides strong resistance compared to results that only partially explain a NTSR phenotype. All TSR mutations reported occur in the CT domain which, not surprisingly, is the binding location for these herbicides (Rendina et al., 1990).

TSR can be confusing because of the number of papers and species involved. Amino acid residue numbers will not match for conserved residues in the CT domain located near the end of this large peptide. This is simplified by standardizing residue numbers according to a common sequence as was done by Délye et al. (2005b) and Liu et al. (2007). This is continued here where all amino acid residues are identified according their corresponding residue on EMBL/GenBank accession AJ310767, an ACCase sequence from *A. myosuroides*. The six known mutations are summarized in Table 1-3 where the chemical families indicated are not inclusive or exclusive. They are not inclusive because a specific family member may still be active as with clethodim and clodinafop against Ile-1781-Leu (Délye, 2005). They are not exclusive because not all

chemicals were used and because screening procedures might not be sensitive enough to identify slight decreases in susceptibility.

The most common mutation occurs at residue 1781 with a wild-type isoleucine and a mutant leucine, which is abbreviated Ile-1781-Leu. This mutation has been reported in *A. myosuroides* (Brown et al., 2002; Délye et al., 2005b), *Avena fatua* (Christoffers et al., 2002), *Avena sterilis* (Liu et al., 2007), *Lolium multiflorum* (White et al., 2005), *Lolium rigidum* (Tal and Rubin, 2004; Zhang and Powles, 2006a), and *Setaria viridis* (Délye et al., 2002). In large screens of more than 13,000 individuals, this mutation accounts for 44% (Délye et al., 2010) to 60% (Délye et al., 2007) of all resistance mutations identified. It provides a respectable amount of resistance to many APP and CHD herbicides.

The least reported mutations are Trp-1999-Cys and Gly-2096-Ala, which have been reported only once and twice, respectively. The reason for this might be explained by yeast-wheat chimeric ACCase screening in yeast (Liu et al., 2007). Trp-1999-Cys is resistant only to fenoxaprop and even then it grows significantly slower at half the rate of the wild type. Gly-2096-Ala was not able to sustain yeast growth, which calls into question its application outside of *A. myosuroides.*

The mutation that will be of interest later is Trp-2027-Cys. This residue is mostly buried at the bottom of the CT active-site cavity. The affect of this mutation is not well defined by the models, which reveal small allosteric changes that may not be accurately modeled (Délye et al., 2005b). If somewhat accurate, it suggests an indirect affect that changes the binding site or limits access to the herbicide binding site, which is located in the cavity. It is commonly reported to only offer APP resistance. Closer study of the results show slight protection against CHD herbicides with a resistance factor of 3 for clethodim (Délye and Michel, 2005) or significant growth rate changes for sethoxydim (Liu et al., 2007). The chimeric yeast study by Liu et al. (2007) verifies that this mutation provides robust APP resistance.

Metabolism Based Resistance to APP and CHD Herbicides

Metabolism based NTSR to APP and CHD herbicides is not well understood. The process seems to involve several different steps that might differ for different chemical molecules. Several different enzyme classes involved in the process have be identified, including glutathione S-transferases (GST) (Reade et al., 2004), O-glucosyltransferases (Brazier et al., 2002), and cytochrome P450 monoxygenases (P450) (Cocker et al., 2001). Metabolism-based

NTSR has been suggested or identified in *A. myosuroides* (Menendez and DePrado, 1996), *Avena* ssp. (Cocker et al., 2000), *Hordeum leporinum* (Matthews et al., 2000), *L. multiflorum* (Cocker et al., 2001), and *L. rigidum* (Vila-Aiub et al., 2005; Yu et al., 2009). Many of these studies include several genotypes, including TSR types. Often TSR has much higher resistance factors than NTSR, on the order of a factor of ten. Therefore, the relevance of NTSR in developing herbicide resistant sorghum appears minimal. However, there are two aspects that should be considered. First, TSR genotypes still need to dispose of the herbicide. If the plant is not dying, it is metabolizing and some level of herbicide metabolism should be expected. Second, NTSR could develop in the target weeds in herbicide resistant sorghum. As discussed below, herbicide resistant crops should be part of an integrated weed management program that addresses both TSR and NTSR resistance.

Fitness Cost of Mutations Associated with Herbicide Resistance

The fitness costs associated with a herbicide resistance mutation is an important consideration in weeds and for developing crop plants with resistance traits. Menchari et al. (2008) tested four different *A. myosuroides* genotypes and found no significant phenotypic differences between wild-type plants and plants carrying either Ile-1781-Leu or Ile-2041-Asn mutations. However, a significant reduction in biomass (42%), height (6%), and seed production (36%) was found for the homozygous Asp-2078-Gly mutant. However yeast-wheat chimeric ACCase experiments reported normal growth for the Asp-2078-Gly mutant (Liu et al., 2007). The same yeast-wheat chimeric ACCase study reported that Gly-2096-Ala mutant were not able to sustain yeast growth and Trp-1999-Cys mutant had a growth rate half that of the wildtype and other mutations. Another study using *Lolium rigidum* found a 13 to 25% reduction in biomass for cytochrome P450 metabolism resistance to APO herbicides (Vila-Aiub et al., 2005). It is clear that fitness cost from resistance is dependent upon the specific mutation involved.

Frequency of TSR Compared to NTSR

Two studies have examined large collections of *A. myosuroides*, genotyping over 27,000 individuals from 538 populations, combined (Délye et al., 2007; Délye et al., 2010). The earlier study reported mutations on a per plant basis and analyzed populations obtained from France. The later study reported mutations on an allele basis and analyzed populations obtained across the *A. myosuroides* growing area. The results of these studies are summarized in Table 1-4. Of

the mutations identified, Ile-1781-Leu is by far the most common and the least by a wide margin is Asp-2078-Gly. This supports the finding that Asp-2078-Gly imposes a significant fitness cost (Menchari et al., 2008). The reason for Ile-1781-Leu predominance is not known, but might reflect a fitness advantage over the other mutations or preexisting polymorphism in the populations.

Even with our understanding of TSR, there remains a large gap between observed resistance and observed mutations. At the population level, more than 35% are resistant but do not contain a known TSR mutation. Within resistant populations, the frequency of known resistance mutations does not come close to accounting for the frequency of resistance observed. NTSR is thought to account for this difference in frequency and may represent the majority of the resistance observed. The exact mechanism(s) of the NTSR is not known at this time. It should be noted that PCR based genotyping only examines the specific SNP in question. Trp-1999-Cys was not included in the study because it has not been reported in *A. myosuroides*. However, it is possible that Trp-1999-Cys or other ACCase mutations are contributing to some form of TSR currently attributed to NTSR. Yet, it is very doubtful that any such TSR, not yet identified, accounts for the observed levels of resistance found in *A. myosuroides*.

Geographical aspects of ACCase resistance were examined by Délye et al. (2010). Plant samples were collected across *A. myosuroides* range in Northwestern Europe and in South-central Turkey. Populations from Turkey had the least reported selection pressure according to field records. This was reflected in the amount of resistance and number of mutant alleles. Other sweeping generalizations show larger amounts of TSR in UK and France, where APP are intensively used. The authors suggest the amount of NTSR in Germany and The Netherlands is accounted for by their abundant use of urea herbicides. Regardless, the distribution of specific TSR alleles does not show a geographical pattern supporting redundant evolution as the cause for widespread resistance.

Was Quick Development of Resistance Related to the Specific Chemicals Used?

Some of the APP herbicides first released, diclofop and fenoxaprop, were used to control grass weeds in wheat. As a grass, wheat is normally sensitive to APP herbicides but can survive herbicide application by rapidly metabolizing certain APP herbicides (Tal et al., 1993). Likewise, rice (*Oryza sativa* L.) can metabolize cyhalofop-butyl (Ruiz-Santaella et al., 2006). Since wheat and rice have natural mechanisms to deal with specific chemicals, it is not surprising that similar

grasses like *Alopecurus myosuroides*, *Avena fatua*, *Hordeum leporinum*, and *Lolium rigidum* were able to develop resistance to these herbicides. This is alluded to in recent work by Délye et al. (2010) where they noted that wide spread NTSR and TSR resistance extended across much of *A. myosuroides* range. This widespread and heterogeneous resistance does not show a geographical pattern implying redundant evolution that occurred many times across Europe. It seems that the rapid development of NTSR to herbicides sprayed in European wheat fields should not be extrapolated onto other, harder to metabolize, APP and CHD herbicides.

Is Resistance Caused by Other Mode-of-Action Herbicides?

The Délye lab has generated and published an incredible wealth of knowledge on ACCase (Délye et al., 2002; Délye et al., 2003; Délye et al., 2004; Délye and Michel, 2005; Délye et al., 2005a; Délye, 2005; Délye et al., 2005b; Délye et al., 2007; Délye et al., 2010; Menchari et al., 2008; Petit et al., 2010). However, one controversial conclusion was that "metabolism-based resistance to ACC-inhibiting herbicides was mostly selected for by herbicides with other modes of action" as reported in Délye et al. (2007). This statement was made because 37 of 241 resistant *A. myosuroides* populations assayed were obtained from fields with no recorded ACCase-inhibiting herbicide applications in the records that extend an average of six years. The authors recognized the possibility that "resistance evolved and developed before the period surveyed." Yet, they claim their "results strongly suggest that, in the 37 populations in question, resistance...was mostly a side-effect of the selection for metabolism-based resistance to herbicides with mode(s) of action other then ACC inhibition." Although possible, it was not readily apparent that the data suggest, much less strongly suggest, that other herbicides were responsible for the development of resistance. However, this conclusion was used in subsequent papers examining other ACCase-inhibiting herbicides (Petit et al., 2010). The most recent work, Délye et al. (2010), has taken a softer stance on the role of other mode of actions. Yet, that work provides stronger evidence for the role of other mode of action herbicides in the development of NTSR. As noted above, Germany and The Netherlands use more urea herbicides and observed larger amounts of NTSR. It should be kept in mind that the fenoxaprop can be degraded by plant metabolism enzymes in wheat. Other herbicides might be harder and take longer to degrade, decreasing the amount of non-target side resistance.

APP and CHD Herbicide Resistance Found in Sorghum

Nine *Sorghum* ssp. populations have been reported and all but one are *S. halepense* (L.) Pers. (Heap, 2010). Only a few peer-reviewed journal articles have been published on these populations (Bradley and Hagood, 2001; Bradley et al., 2001; Burke et al., 2006a; Burke et al., 2006b; Smeda et al., 1997; Smeda et al., 2000) and a few non-peer-reviewed publications (Marles and Devine, 1993; Obermeier, 1998). Two of these populations have very low resistance factors to both APP and CHD herbicides and two other populations have high resistance factors to APP herbicides but very low resistance factors to CHD herbicides. The findings reported are overproduction of ACCase (Bradley et al., 2001), TSR that provides cross resistance (Burke et al., 2006b), and TSR that provides very little cross resistance (Obermeier, 1998; Smeda et al., 1997) as the causes for resistance. None of the TSR reports preformed successful sequencing to provide a casual mutation.

The predominance of resistance found in *S. halepense* can be explained by its rhizomes, which have higher resistance factors than seedlings and are more likely to survive or regrow after herbicide application. This also explains why some of the resistance factors reported are so small, since a small advantage could allow survival and subsequence attention by weed scientists. The population with the high resistance factor has the only mutation that would be useful as a trait donor. It would take considerable effort to move the trait from tetraploid *S. halepense* into diploid cultivated sorghum.

APP and CHD Herbicide Resistance Developed in Maize Tissue Culture

As reviewed by D. A. Somers (1996), University of Minnesota researchers developed herbicide-resistant germplasm that was released to corn breeding companies in 1990. It started with a rapid growing, nonregenerable cell line using consecutively higher concentrations of sethoxydim (Parker et al., 1990a). Three resistant lines were obtained with resistance factors up to 58 fold for sethoxydim. ACCase enzymes for all three lines were inhibited by sethoxydim but started with 3 fold greater specific activity providing malonyl-CoA for cell growth at herbicide concentrations lethal to the original line. Since the lines were nonregenerable, researchers started over using cells from embryos of the hybrid cross A188 and B73. Six resistant cell lines were developed and one of them extensively characterized by Parker et al. (1990b). Five of these lines were regenerated into plants and evaluated for allelic complementation (Marshall et al., 1992). Four were allelic and the fifth was allelic or very tightly linked. These are divided into three phenotypic classes with three alleles very resistant to CHD and moderately resistant to APP

herbicides, one allele evaluation moderately resistant to CHD and APP herbicides, and the last allele not resistant to CHD and moderately resistant to APP herbicides. One (or more) of these genotypes were evaluated in the field and did not show injury to sethoxydim applied at one, two and four times the use rate of 220 g ha^{-1} (Dotray et al., 1993). An independent study using commercial hybrids reported resistant factors of 181, 30, 27, and 7 fold increase in rates required for 50% control using sethoxydim, fluazifop, quizalofop, and clethodim, respectively (Young and Hart, 1997). Sethoxydim resistant corn hybrids were available to producers in 1996 (Duke, 2005) and enthusiastically accepted (Lane, 1998). However Poast Protected technology was completely surpassed by Roundup Ready technology for production of #2 yellow dent corn. Poast Protected technology retains some market in the sweet corn industry where its non-transgenic heritage is appreciated.

Acetohydroxyacid Synthase as a Protein and as a Herbicide Target

Acetohydroxyacid synthase (AHAS) catalyzes the condensation of a 2-ketoacid with pyruvate as the first common step in the branch chain amino acid (BCAA) biosynthesis pathway. BCAA are essential for life, but only bacteria, fungi, archaea, and plants have the entire pathway. Animals must obtain necessary BCAA from their diet. AHAS is the first common step because it can use two different 2-ketoacids, pyruvate or 2-ketobutyrate. Pyruvate is a central metabolite readily available in a plant cell. 2-Ketobutyrate is only known to be used in the isoleucine biosynthesis pathway and is formed from threonine by threonine deaminase. So AHAS is the second of five steps in the isoleucine biosynthesis pathway. For valine biosynthesis, AHAS is the first of four steps in the pathway. These four steps and their respective proteins, AHAS, ketol-acid reductoisomerase, dihydroxyacid dehydratase (DHAD), and transaminase (TA), are the exact same as in the threonine biosynthesis pathway. Leucine biosynthesis also uses the same enzymes, except between DHAD and TA are three steps catalyzed by 2-isopropylmalate synthase, 3-isopropylmalate dehydratase, and 3-isopropylmalate dehydrogenase. In summary, AHAS uses one pyruvate and one 2-ketobutyrate as part of the isoleucine biosynthesis pathway or two pyruvate molecules to start the pathway that makes valine or leucine.

Discovery of AHAS Protein and Naming Conflict

In 1958, Umbarger and Brown characterized a protein from *Escherichia coli* that formed acetolactate from pyruvate. They identified valine as an important regulator of both the enzyme

production and activity. Also identified were cofactors Mg^{+2} and thiamine diphosphate (ThDP, identified as TPP). The third cofactor, flavine adenine dinucleotide (FAD), was not identified until 1964 by Størmer and Umbarger. These early papers identified the enzyme as "acetolactate-forming enzyme" or "acetohydroxy acid synthetase". It does not appear that a standardized nomenclature was broadly accepted at the time and it has since changed, case in point being thiamine diphosphate. In 1984, the interaction between this enzyme and herbicide inhibitors was deduced (Chaleff and Mauvais, 1984; Shaner et al., 1984). As discussed below, there are several chemical families that target this enzyme including sulfonylurea (SU) and imidazolinone (IM) herbicides. Chaleff and Mauvais (1984) reported that acetolactate synthase (ALS) was the target of SU herbicides. Shaner et al. (1984) reported that AHAS was the likely target of IM herbicides. The ALS nomenclature was accepted by the agricultural sciences and used extensively, especially in recent years. However, biochemists recognized that ALS would be the correct name only if the reaction product was exclusively 2-acetolactate. This enzyme produces either 2-acetolactate or 2-aceto-2-hydroxybutyrate depending on the ketoacid substrate, pyruvate or 2-ketobutyrate, respectively. Therefore, AHAS is the correct name and will be used below. There is another enzyme that makes acetolactate exclusively which is called ALS (Pang et al., 2004).

AHAS Structure and Function

As reviewed by Duggleby et al. (2008), AHAS is composed of a catalytic subunit that has enzymatic activity and a regulatory subunit that greatly increases enzymatic activity. Both of these subunits readily form dimers with their respective, identical types. The *in situ* enzyme is composed of either 4 subunits, a dimer of each type as suggested by gel filtration studies, or 8 subunits, four subunits of each type as suggested by X-ray crystallography. Regardless, the minimal composition is a dimer because the active site is at the dimer interface. The active site is located within a channel that can be closed with a "lid". When the lid is open, the active site is readily accessible. With substrate binding, the lid forms to protect the catalytic reaction from side reactions that may occur (Abell and Schloss, 1991).

The active site is centered on the C2 atom of ThDP. This atom attacks pyruvate, releasing CO_2 and forming an enzyme-bound hydroxyethyl intermediate. This intermediate reacts with the 2-ketoacid to form the respective acetohydroxyacid. The ThDP is positioned by a divalent metal ion such as Mg^{2+}. The final cofactor, FAD, does not appear to be involved in the reaction but a

vestigial remnant that supports the quaternary structure. The quaternary structure is very important because ThDP is subjected to molecular forces imposing a specific conformation. This conformation favors the deprotonation of the C2 atom, which starts the enzymatic reaction.

The catalytic subunit is encoded in the nucleus with a leading signal sequence that targets the movement of the protein into the chloroplast. After the signal sequence is cleaved, the catalytic subunit folds into three domains: α, β, and γ. The FAD is strongly associated with the β domains. The ThDP and metal ion are bound by the γ domain. The lid is located at the carboxyl end of the polypeptide, following the γ domain. The α domain is important for dimer formation and forms the channel, protecting the active site, on the paired subunit. The herbicide binding site is located in this channel.

AHAS-Inhibiting Herbicides

As mentioned above, SU (sulfonylurea) and IM (imidazolinone) are two of several chemical families that inhibit AHAS. The SUs were first released in the early 1980s with chlorsulfuron followed by chlorimuron and many others. The first IM released was imazaquin in 1986 followed by several others (DeFelice, 1998). These chemicals are cheap to synthesize, have very low use rates and have very long soil residual activity. These characteristics allowed AHAS-inhibiting herbicides to gain a large market share and impose extreme selection pressure on weed populations. Other AHAS-inhibiting herbicides are represented in the triazolopyrimidine, pyrimidinyl-oxybenzoate, and sulfonylamino-carbonyl-triazolinone chemical families. These herbicides never had the popularity of SU and IM herbicides. All of these herbicides lost importance with the release of Roundup Ready™ crops and producers switching to glyphosate herbicides.

Resistance to AHAS Inhibiting Herbicides

TSR is the predominantly reported type of resistance to AHAS-inhibiting herbicides. TRS mutations can be divided into two groups representing variants found in the wild or native gene pools of diverse species and those identified through mutagenesis or in targeted screens. Mutations identified in weeds are summarized in Table 1-5 where the chemical families indicated are not inclusive or exclusive. Only SU and IM herbicides were tested against many of these mutations and their interactions with the other chemical families are not known. Mutations identified in targeted screens under intentional selection are very numerous with representatives

from yeast, *E. coli*, tobacco, or *A. thaliana*. The relevance of these mutations to field resistance is doubtful and were reviewed elsewhere (Duggleby et al., 2008; Tranel and Wright, 2002). Studies of natural genetic variation for AHAS-inhibiting herbicide resistance have found that resistance can be explained by mutations at six different residues of the AHAS enzyme. This is surprising since 18 residues are known to bind with SU, IM, or both families (McCourt et al., 2006). Of these six residues, the most notable is Trp-574, which is involved with recognition of the 2-ketoacid substrate and forms a π–stacking arrangement with binding herbicides (Duggleby et al., 2008). Leu-574 loses the high preference for 2-ketoburate observed in Trp-574 (Tittmann et al., 2005) and provides very strong resistance to SU and IM herbicides. The other interesting residue is Pro-197, located midway on the channel into the active site. Pro-197 can be replaced by at least seven different residues to produce an enzyme with resistance to SU herbicides. In sorghum, three resistance-providing alleles have been reported but the exact mutations are not known (Anderson et al., 1998; Lee et al., 1999).

NTSR to AHAS inhibitors has not been extensively reported with only a limited number of species having this pattern of resistance including *L. rigidum*, *Digitaria sanguinalis*, *Echinochloa phyllopogon*, and *Sinapis arvensis* (Fischer et al., 2000; Hidayat and Preston, 2001; Preston et al., 1996; Veldhuis et al., 2000). However, total AHAS inhibitor resistance is very extensive with reports of resistance in 107 species (Heap, 2010). The selection pressure by the first-generation, potent, long-lasting SU and IM herbicides had a profound effect on current weed populations. There are not many reports of fitness cost associated with this resistance. The only report is in *Solanum ptychanthum* that carries an Ala-205-Val mutation. Under optimal light conditions, the wild type allele has a higher reproductive output yet no difference in germination or above-ground biomass. This advantage disappears under suboptimal conditions (Ashigh and Tardif, 2009).

Crops Resistant to AHAS-inhibiting Herbicides

Many crops with resistance to IM and SU herbicides have been developed as reviewed by Shaner et al. (1996) and Saari and Mauvais (1996). Although these reviews are more than a decades old, not much has since developed because of changing research priorities and funding caused by the market dominance of Roundup Ready technology. The issue was reexamined in 2005 in volume 61, issue 3 of Pest Management Science. Cereal crops like maize, rice, and wheat are of most interest to sorghum researchers. Tan et al. (2005) does a good job of

summarizing rice and wheat where the commercialized mutations correspond to changes at residues Ser 653 (several cases) and Gly 654 (once) which were obtained from seed mutagenesis (Pozniak et al., 2004; Shivrain et al., 2010). Summarizing resistance in maize is more difficult.

Important for understanding resistant maize is the work of Bernasconi et al. (1995), characterizing two different mutations in cocklebur (*Xanthium* ssp.) and the related residue changes matching mutations in sequenced herbicide-resistant maize. The resistance profiles matched very closely, especially considering that the IT maize is heterozygous. The IT maize mutation corresponds to Ala-122-Thr (Bernasconi et al., 1995; Greaves et al., 1993) and the IR mutation corresponds to Trp-574-Leu (Bernasconi et al., 1995; Newhouse et al., 1991). There are two other maize mutations, IMR and *RI-12*, which are characterized but the causal mutations were not examined (Wright and Penner, 1998). IMR has a unique resistant factor profile for various herbicides, which includes resistance to SU herbicides but differs from IR, especially for imazamox. *RI-12* seems to share a resistance profile to IT (Wright and Penner, 1998) but, interestingly, came from the same selection experiment as IR (Newhouse et al., 1991). Commercialized IT is reportedly sold as heterozygous hybrids contrasted against IR and IMR, which are reportedly sold in hybrids homozygous for the trait (Wright and Penner, 1998). Heterozygous hybrids are easier and faster to bring to market since the trait is carried by only one parent.

The mutations arose from different diversity inducing and selecting methods. IT maize was developed using pollen mutagenesis; pollen was exposed to a mutagen and used for pollination with the progeny screened as seedlings by exposure to the herbicide (Shaner et al., 1996). IR maize was developed using tissue culture selection not unlike the ACCase work described earlier (Anderson and Georgeson, 1989; Newhouse et al., 1991). By extension, *RI-12* came from tissue culture selection. Also, IMR is reportedly from a tissue culture selection (Wright and Penner, 1998). Because this technology is held by private companies, it is hard to understand everything that has happened and is happening. IT maize has been rebranded as Clearfield and seems to be available in some markets today.

Gene Flow to Wild Sorghum and Integrated Weed Management

There are two weedy *Sorghum* species that grow throughout the United States: shattercane (*S. bicolor*) and johnsongrass (*S. halepense*). Shattercane is directly related to and

readily crosses with cultivated sorghum. Johnsongrass is a tetraploid that received half its genome from *S. bicolor* and the other half from *S. propinquum*. It has been shown that johnsongrass can cross with *S. bicolor* (Arriola and Ellstrand, 1996; Smeda et al., 2000). The result of this cross is either an unstable triploid or a tetraploid resulting from an unreduced *S. bicolor* gamete. In sorghum producing regions, putative cultivar-specific alleles were found in 32% of sampled johnsongrass individuals (Morrell et al., 2005). Given that sorghum is grown on three million hectares, it can be expected that genetic herbicide resistance will move from cultivated sorghum to shattercane and johnsongrass. This problem is not unique to sorghum as wheat and rice have genetic herbicide resistance and weedy relatives with potential gene flow (Gaines et al., 2008; Shivrain et al., 2010). But this punctuates the importance that herbicide resistant sorghum be used as part of an integrated weed management program. Crop rotation, rotation of herbicide mode-of-action, multiple mode-of-action herbicides in a season, mechanical weed control, and rouging will all decrease the possibility of herbicide resistance becoming establishing in the weed population.

Comparing ACCase and AHAS as Herbicide Targets in Sorghum

ACCase inhibitors provide good to excellent control of numerous grass weeds (Thompson et al., 2009) and do not have as many reports of resistance in warm season grasses (Heap, 2010). AHAS inhibitors provide good control to a large number of grass and broadleaf weeds. However, AHAS has extensive reports of resistance to weeds common in grain sorghum production. ACC inhibitors will likely be preferred by producers, yet the best option would be to tank mix these chemistries, decreasing the selection pressure on each enzyme in the weed population.

Figures and Tables

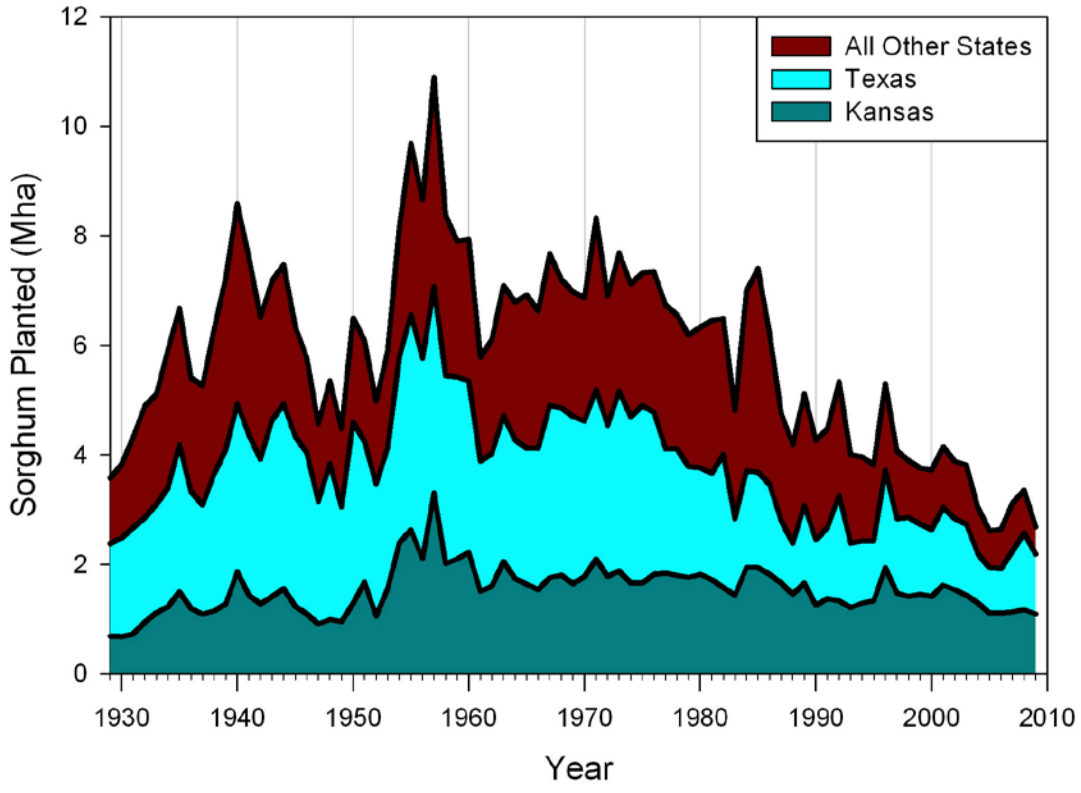

Figure 1-1. United States sorghum hectares planted for all purposes

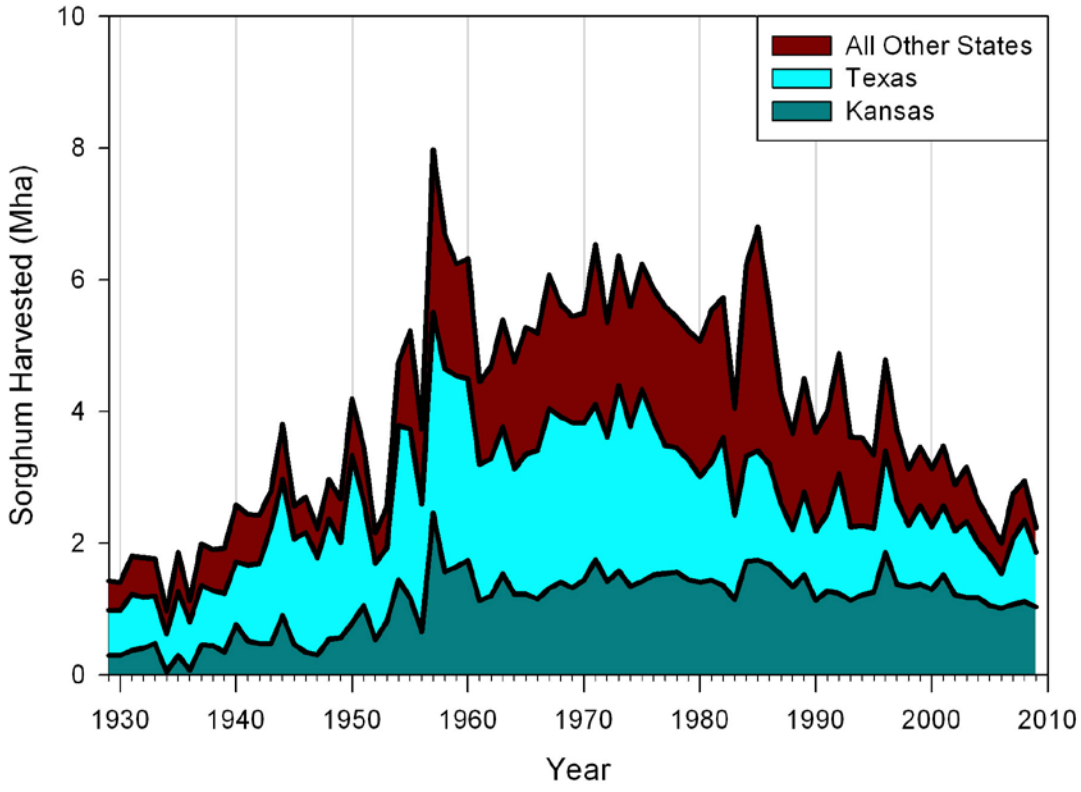

Figure 1-2 United States sorghum hectares harvested for grain

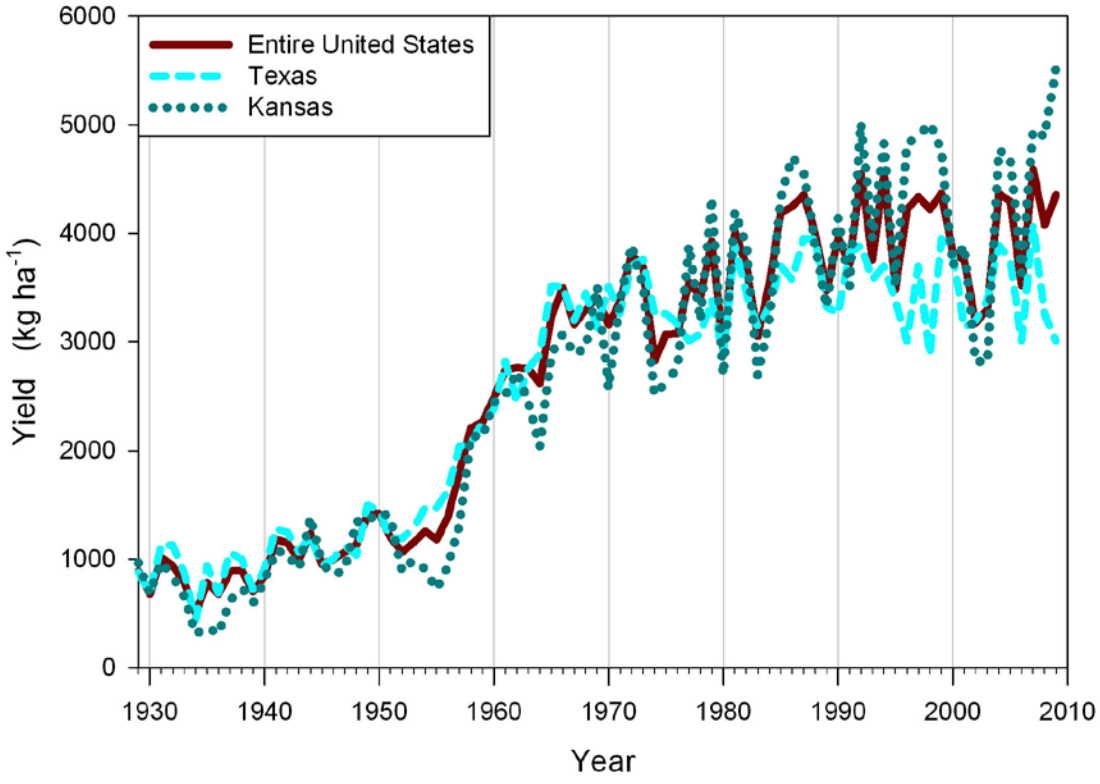

Figure 1-3 United States grain sorghum yield

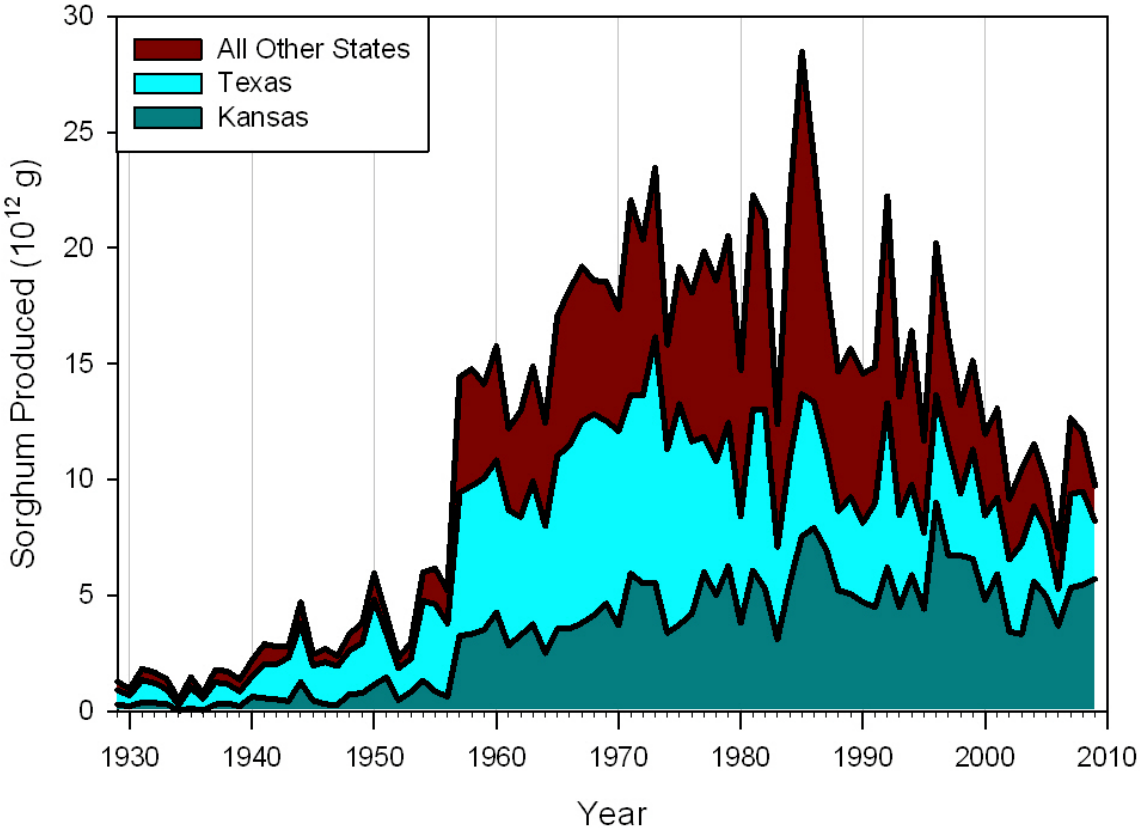

Figure 1-4 United States grain sorghum production

Table 1-1. Summary of the Kansas State University Reno County Kansas Grain Sorghum Performance Test

Year	Date Planted	Number of Entries	Population (plants/a)	Row Spacing (in)	----- Fertilizer -----			Prior Crop	Average Yield (bu/a)	Yield LSD (α= 0.05)	Days to Bloom	Pesticide Products
					N	P	K					
					------- lb/a -------							
1958	May 23	34	26000	40	-†	-	-	-	83	6	-	-
1963	June 7	56	26000	40	0	0	0	Wheat	77	6	58	Nothing
1968	May 30	45	26000	40	0	0	0	Wheat	49	5	63	Nothing
1973	June 20	84	23000	30	0	0	0	Wheat	34	11	88	Disyston and Atrazine
1978	June 13	77	23000	30	30	0	0	Wheat	48	9	62	Furadan
1983	June 8	-	23000	30	60	0	0	Wheat	29	18	54	Furadan and Bladex and Ramrod
1988	June 8	71	30000	30	75	0	0	Sorghum	80	14	59	Furadan and Ramrod with Atrazine
1993	June 8	50	30000	30	91	40	0	Oats	92	13-15	-	Furadan and Banvel
1998	May 27	79	35000	30	120	40	0	Wheat	93	19	64	-
2003	May 29	53	40000	30	120	40	0	Wheat	22	6	72	Bicep Lite II Magnum‡
2008	May 14	44	41000	30	120	0	0	Soybeans	113	13	67	RT3 and Dual II Magnum with Atrazine‡

† Datum not available from Kansas Grain Sorghum Performance Test is marked with a hash "-".
‡ Datum provided by personal communication with Jane Lingenfelser.

Table 1-2. Summary of grain sorghum yield reductions caused by weed competition

Source	Weed Type(s) and Other Distinguishing Factor(s)	Yield Reduction
Burnside et al. (1964)	Mixed, No Weed Control	57%
	Mixed, Postemergent Atrazine	25%
	Mixed, Low Rate Preemergent Atrazine	15%
	Mixed, High Rate Preemergent Atrazine	8%
Graham et al. (1988)	Pigweed, High Weed Density	69%
	Pigweed, Medium Weed Density	51%
	Pigweed, Low Weed Density	26%
Knezevic et al. (1997)	Pigweed, South Location with Early Pressure	~60%
	Pigweed, All Other Treatments	~5%
Schneweis et al. (1995)	Puncturevine	78%
Stahlman and Northam (1992)	Prairie cupgrass	42%
Traore et al. (2003)	Velvetleaf, 1996	61%
	Velvetleaf, 1997	16%
Wiese et al. (1983)	Pigweed	34%
	Barnyardgrass and other grasses	31%
	Johnsongrass	48%
	Shattercane	48%

Table 1-3. Summary of ACCase mutations providing resistance to herbicides

Wildtype Residue(s)	Residue Number	Mutant Residue(s)	Resistance Provided	Source
Isoleucine	1781	Leucine	CHD & APP	Brown et al. (2002); Christoffers et al. (2002); Délye et al. (2002); Délye et al. (2005); Liu et al. (2007); Tal and Rubin (2004); White et al. (2005); Zhang and Powles (2006a)
Tryptophan or Proline	1999	Cysteine	APP	Liu et al. (2007)
Tryptophan	2027	Cysteine	APP	Délye et al. (2005); Liu et al. (2007)
Isoleucine	2041	Asparagine or Valine	APP	Délye et al. (2003); Délye et al. (2005); Liu et al. (2007); Zhang and Powles (2006b)
Aspartate	2078	Glycine	CHD & APP	Délye et al. (2005); Liu et al. (2007)
Glycine	2096	Alanine	APP	Délye et al. (2005)

Table 1-4. Summary of two large phenotypic and genotypic evaluations of *A. myosuroides* populations

Item Reported	Délye et al. (2007)	Délye et al. (2010)
Total populations	243	297
Populations without fenoxaprop resistance	1%	16%
Populations with 1% to 20% of plants resistance	3%	2%
Populations with 21% to 50% of plants resistance	5%	12%
Populations more than 50% of plants resistance	91%	70%
Number of plants genotyped from all populations	13,188	14,256
Unit used to report mutation	plant	allele
Frequency of plants with a known mutation	20%	NA†
Frequency of alleles with a known mutation	NA‡	11%
Populations containing a known mutation	138	169
Total number of plants/alleles with mutations known to provide resistance to APP herbicides	2,594	3,239
Frequency of plants with more than one mutant codon among resistant mutations	4%	NA†
Frequency of Leu-1781 among resistant mutations	60%	44%
Frequency of Cys-2027 among resistant mutations	12%	18%
Frequency of Asn-2041 among resistant mutations	12%	19%
Frequency of Gly-2078 among resistant mutations	4%	4%
Frequency of Ala-2096 among resistant mutations	8%	15%

† NA: Not applicable because frequency calculated on an allele basis.
‡ NA: Not applicable because frequency calculated on a per plant basis.

Table 1-5. Summary of AHAS mutations observed in nature providing resistance to herbicides

Wildtype Residue	Residue Number	Mutant Residue(s)	Provides Resistance	Source
Alanine	122	Threonine	IM	Li et al. (2008)
Proline	197	Alanine, Arginine, Glutamine, Histine, Leucine, Serine, or Threonine	SU	Délye et al. (2009); Guttieri et al. (1995); Kolkman et al. (2004); Yu et al. (2003)
Alanine	205	Valine	IM & SU	Ashigh and Tardif (2009); Kolkman et al. (2004)
Tryptophan	574	Leucine	IM & SU	Patzoldt et al. (2001); Patzoldt and Tranel (2002)
Serine	653	Threonine, Asparagine, or Isoleucine	IM	Laplante et al. (2009)
Glycine	654	Aspartate	IM	Laplante et al. (2009)

CHAPTER 2 - Genetic Resistance to ACCase-Inhibiting Herbicides in Grain Sorghum

Introduction

Sorghum is the third largest cereal crop grown in the United States (USDA, 2010). It is grown on the southwestern Great Plains where its ability to survive drought is important. However, production has been declining because producers are switching to higher yielding corn. Sorghum yield potential has not kept pace with modern corn breeding, increasing at a rae around 60% the annual gain of corn (Smith and Frederiksen, 2000). Realized sorghum yields have increased an average of 46 kg ha^{-1} yr^{-1} in dryland Kansas yield trials but are unchanged for irrigated trials (Assefa and Staggenborg, 2010). Genetics is only part of the problem. Management options in sorghum have not kept pace with the major crops. Currently, sorghum producers only have preemergent herbicide options for broad spectrum grass control. Preemergent herbicide requires activation by precipitation and fails when too much or too little rainfall occurs after application. Grass weed control is fundamental to maintaining sorghum yield potential. Left unchecked, grassy weeds can reduce yields by as much as 42% (Stahlman and Northam, 1992) to 48% (Wiese et al., 1983). Grassy weed escapes are a frustrating issue for sorghum producers. It is unlikely that new chemical options will be developed to address this problem, so any herbicide answer must come from existing compounds like those found in the three chemical families that inhibit acetyl-coenzyme A carboxylase (ACCase): aryloxyphenoxypropionate (APP) (Secor and Cseke, 1988), cyclohexanedione (CHD) (Rendina and Felts, 1988), and phenlypyrazolin (Hofer et al., 2006).

ACCase (EC 6.4.1.2) catalyzes the first committed step in *de novo* lipid biosynthesis. Plants encode and produce at least two separate ACCase enzymes. A leading targeting sequence sends one to the plasmids to produce *de novo* lipids by catalyzing the initial step of adding a carboxyl group onto the common metabolite acetyl-CoA to form malonyl-CoA. Malonyl-CoA is the major carbon source for lipid synthesis and ACCase is shown to strongly control the flux through the lipid biosynthesis pathway (Post-Beittenmiller et al., 1992). The second ACCase protein is a membrane-bound enzyme whose location is not exactly known, but it provides extra-plastidial production of malonyl-CoA for very-long-chain fatty acid extension and secondary

metabolite biosynthesis (Kunst and Samuels, 2003). The ACCase inhibitors provide gramicide action because dicots have a structurally different chloroplastic multiunit enzyme (Cronan and Waldrop, 2002) and the cytosolic enzyme is much less sensitive to the herbicides (Egli et al., 1993). With chloroplastic ACCase inhibition, grasses cannot maintain membrane integrity causing metabolite leakage and rapid plant death (Délye, 2005).

The homomeric enzyme found in grasses is huge, 227-kD (Egli et al., 1993). It is encoded by a long gene with a cDNA of 7.4-kb and a complicated intro/exon structure (Podkowinski et al., 1996). It is composed of three domains: biotin carboxylase, biotin carboxyl-carrier, and carboxyl transferase (CT). Each of these performs different stepwise reactions to the carboxylation procedure that reflect a Ter Ter mechanism (Herbert et al., 1996). APP and CHD herbicides are nearly competitive with the substrate acetyl-CoA which identifies the CT active site as the herbicide binding site (Rendina et al., 1990). The CT active site is under strong selective pressure reflected by its highly conserved sequence with most deviations related to herbicide resistance (Délye et al., 2004).

By 1983, both APP and CHD herbicides were on the market in the United States (DeFelice, 1998). Within four years, there were reports of resistance to these herbicides and currently 37 species have been identified with resistance (Heap, 2010). Many of the resistant species are weeds found in wheat fields and are resistant to wheat herbicides that are naturally metabolized by wheat (Tal et al., 1993). It is not a surprise that a large amount of the resistance in the extensively researched *A. myosuroides* has been punitively assumed to be metabolism based since no resistance-providing mutations were identified in 37% of the resistant populations (Délye et al., 2007; Délye et al., 2010). However, a large fraction of the resistance is explained by target site resistance. Additionally, target site resistance is the most commonly identified cause of resistance in other species and has been reported in *Avena fatua* (Christoffers et al., 2002), *Avena sterilis* (Liu et al., 2007), *Lolium multiflorum* (White et al., 2005), *Lolium rigidum* (Tal and Rubin, 2004; Zhang and Powles, 2006a), and *Setaria viridis* (Délye et al., 2002).

There are six recorded mutations in ACCase, all located in the CT region, that provide resistance to APP and CHD herbicides (Table 2-1). All six provide a large amount of protection against at least one of the ACCase-inhibiting herbicides as reported in the sources listed in Table 2-1. Fitness cost has have been examined using plants for three of these mutations and only one (Asp-2078-Gly) showed decreased fitness (Menchari et al., 2008). All of the mutations have

been evaluated in a yeast-wheat chimeric ACCase experiment, which reported that the Gly-2096-Ala mutant was not able to sustain yeast growth and the Trp-1999-Cys mutant had a growth rate half that of the wildtype and other mutations. Together, these indicate that Ile-1781-Leu, Trp-2027-Cys, and Ile-2041-Asp/Val mutations would be acceptable for use in crop production.

Nine *Sorghum* ssp. populations have been reported with resistance to ACCase herbicides and all but one are johnsongrass (*Sorghum halepense* (L.) Pers.) (Heap, 2010). Only a few peer-reviewed journal articles have been published on these populations (Bradley and Hagood, 2001; Bradley et al., 2001; Burke et al., 2006a; Burke et al., 2006b; Smeda et al., 1997; Smeda et al., 2000) along with two non-peer-reviewed publications (Marles and Devine, 1993; Obermeier, 1998). Two of these populations have very low resistance factors to both APP and CHD herbicides and two other populations have high resistance factors to APP herbicides but very low resistance factors to CHD herbicides. The findings reported as the causes for resistance are: overproduction of ACCase (Bradley et al., 2001), TSR that provides cross resistance (Burke et al., 2006b), and TSR that provides very little cross resistance (Obermeier, 1998; Smeda et al., 1997). Neither of the TSR reports provides sequence information for a casual mutation.

Tissue culture selection has been used to select CHD resistant maize (*Zea mays* L.) (Parker et al., 1990a). Plants were regenerated from tissue culture selection (Marshall et al., 1992), evaluated (Dotray et al., 1993), and released to commercial breeders in 1990 (Somers, 1996) for the development of herbicide resistant maize. Likewise, genetic resistance to ACCase-inhibiting herbicides would provide sorghum producers options for post-emergent grass control. The problem of resistance moving into weedy relatives is a valid concern, but not unique to sorghum (Gaines et al., 2008; Shivrain et al., 2010) and should not prevent the adaptation of this technology for the strengthening of the sorghum industry.

The first step in developing a new herbicide resistant trait in grain sorghum would be to characterize the trait for commercial potential. The objectives of this study were (1) evaluate the level of resistance to different herbicides, (2) determine the type of inheritance, and (3) determine the causal mutation of herbicide resistance to ACCase-inhibiting herbicides in a wild sorghum.

Material and Methods

The sorghum plants used in these experiments included Tx623(ATx623 has male-sterile cytoplasm and BTx623 has male-fertile cytoplasm), an elite female seed parent line and first sorghum genome sequenced (Paterson et al., 2009), Tx430, an elite pollinator (male) parent (Miller, 1984), 00MN7645, an elite pollinator parent developed by Kansas State University in 2003, R91, a wild johnsongrass from Mississippi (Smeda et al., 1997) and three wild sorghum accessions originally collected as weed samples from soybean fields in Bolivia and subsequently propagated in greenhouse facilities at Kansas State University (Bol-15, Bol-45 and Bol-71). All plants were grown in a greenhouse maintained at 27° C during the day and 21° C at night. Supplemental lighting maintained 16- and 8-h periods for day and night, respectively. Plants were grown with Metro Mix 360 potting mixture in either nursery trays or Super Cell Cone-tainers depending on the experiment requirements (all greenhouse supplies obtained from Hummert International, St. Louis, MO). Spraying was conducted on seedlings 7-14 cm tall using a bench top sprayer which delivered 187 L ha^{-1} at 138 kPa using a single TEEJET 80015 LP nozzle.

Dose Response

Three wild sorghum accessions (Bol-15, Bol -45 and Bol -71) with high levels of resistance to ACCase-inhibiting herbicides were crossed onto the industry seed parent ATx623. The parental types and the F_1 progeny provided susceptible, resistant and heterozygous (F_1) genotypes for the dose response study, which was conducted twice (Run 1 and Run 2). Cone-tainers were used to grow and manage the seedlings individually, allowing them to be arranged into blocks according to size prior to spraying. Four herbicides representing two herbicide families were sprayed at seven rates for the dose response study. The rates were 1/16, 1/8, 1/4, 1/2, 1, 2 and 4 times the use rate. APP herbicides, fluazifop-P (Fusilade DX) and quizalofop-P (Assure II), were sprayed at a use rate of 210 and 61.7 g ai ha^{-1}, respectively. CHD herbicides, clethodim (Select) and sethoxydim (Poast Plus), were sprayed at a use rate of 140 and 210 g ai ha^{-1}, respectively. All treatments were applied in water with 1% (v/v) crop oil concentrate. Two weeks after treatment, the plants were visually scored for injury and above ground biomass collected. The harvested biomass was dried 72 h at 72 ° C and weighed with the evaluations based on the weight as a percent of block mean control (see Appendix A1 for data).

Statistical Analysis

Each herbicide was analyzed separately; first with ANOVA (see Appendix A2 for code) followed by fitting a response curve to the plotted least square means. The nested design structure used PROC GLM, SAS v9.2, to test for differences using expected mean square error based on runs and individual plants as random effects. The following were tested: individual plants within each accession, accessions within resistant genotype, accession within F_1 progeny, experimental runs, and between susceptible, resistant, and F_1 genotypes, in that order. Where significant effects were not observed, the plants, accessions, runs, and types were consolidated. If significant interaction effects were observed, secondary tests were performed on subsets of the interacting variables. Once consolidated groups were determined, PROC MIXED, SAS v9.2, was used to extract least square means along with standard errors based on the variability at each herbicide rate (upper error bars) and across the rates at the consolidated level (lower error bars). The extracted means were plotted in Sigma Plot and fitted with a log-logistic curve as advocated by Seefeldt et al. (1995). Where appropriate, the 50% injury (I_{50}) and 50% growth reductions (GR_{50}) were obtained from the fitted curve and the curve plotted on the dose response graph.

Segregation

The wild sorghum accession Bol-71 was crossed with BTx623, Tx430, and 00MN7645. The F_1 progeny were self pollinated to produce F_2 populations and F_1 progeny from (BTx623 x Bol-71) was backcrossed to ATx623 to produce BC1F1 populations. The four populations were evaluated for herbicide resistance and segregation; first separately and then combined. The segregating progeny were sprayed with 30.9 g ai ha^{-1} quizalofop and herbicide injury was scored two weeks after treatment. The experiment was conducted seven times for the F_2 populations and four times for the BC_1F_1 population, because of seed unavailability. Based on the apparent segregation pattern, a Pearson's chi-square analysis was used to evaluate the appropriateness of a single gene model.

Sequencing

Genomic DNA was extracted from R91, Bol-15, Bol-45, Bol-71 and Tx623 using a modified CTAB protocol derived from Saghai-Maroof et al. (1984). The carboxyl transferase

domain of the ACCase gene is known to have multiple mutation sites associated with APP and/or CHD herbicide resistance (Délye et al., 2005b; Liu et al., 2007). This region of the gene was amplified with two pairs of PCR primers designed for use in grasses (Délye and Michel, 2005). The first set used the forward primer 5'-CAACTCTGGTGCTIGGATIGGCA-3' and reverse primer 5'- GAACATAICTGAGCCACCTIAATATATT -3'. The second set used the forward primer 5'-CAGCITGATTCCCAIGAGCGITC-3' and reverse primer 5'-CCATGCAITCTTIGAGITCCTCTGA-3'. The DNA fragment was amplified using high-fidelity Easy-A polymerase (Agilent Technologies, Santa Clara, CA) and was initiated with 4 min denaturation at 94 °C, then cycled through 1 min denaturation at 94 °C, 45 s annealing at 60 °C, and 45 s amplification at 72 °C for 35 cycles, and finished with 10 min amplification at 72 °C. PCR products were purified using QIAquick PCR Purification Kit (QIAGEN, Valencia, CA) and sequencing of the amplicon was performed using an Applied Biosystems 3730 DNA Analyzer at the core KSU Genomics Sequencing Facility.

Results

Dose Response

ANOVA results (See Appendix A3 for ANOVA results) are summarized in Table 2-2. The visual response to fluazifop showed differences in experiment runs for F_1 type and differences between resistant, F_1, and susceptible types, which are plotted in Figure 2-1. The weight response to fluazifop, the visual response to quizalofop, and the weight response to quizalofop had differences between resistant, F_1, and susceptible types. The means of each of these different groups are plotted in Figures 2-2, 2-3, and 2-4. The visual and weight response to clethodim showed no differences between types and are each plotted on Figure 2-5. The visual response to sethoxydim had an interaction between types and runs. Secondary tests showed that with each run, resistant and F_1 types were not different from each other but were different from the susceptible type. All six least square means are plotted on Figure 2-6. Resistant and F_1 types for each run were not different but are plotted separately to view the underlying intricacies of the variability in the curves. The weight response to sethoxydim also had type by run interaction. Secondary tests showed differences for each run between resistant, F_1, and susceptible types, which are plotted on Figure 2-7.

The log-logistic curve was fitted to the means and plotted on the graphs if the mid-point (I_{50} or GR_{50}) was included in the range of the rates applied. The appropriate I_{50} and GR_{50} values, along with the corresponding resistance factors (given group divided by susceptible), are summarized in Table 2-3. The resistance factors to the APP herbicides were large, greater than 54 to 64 for homozygous individuals and greater than 9 to 20 for heterozygous individuals. Resistance to clethodim was non-existent (resistance factor of 1), since there were no differences in visual response, or non-detectable, since all rates severely reduced plant dry weight. Resistance to sethoxydim was very low with resistance factors ranging from one to slightly greater than 4.6. The resistance trait is partially dominant since the heterozygous individuals have slightly less than resistance factors than the homozygous resistant individuals.

Segregation

The segregation results were analyzed for goodness-of-fit to a single gene model. This expects a susceptible to resistant ratio of 1:3 for the F_2 population and of 1:1 for the BC_1F_1 population. All chi-squared tests were not significant and tabulated in Table 2-4. This provides strong evidence for a single major gene providing herbicide resistance.

Sequencing

The first primer set amplified a 500 basepair sequence and the second primer set amplified a 358 basepair sequence. Both sequences are contained within exon 32 of sorghum gene Sb06g003090 in the *S. bicolor* genome. The only polymorphism observed between Tx623 and all resistant plants was located at one of the known resistant-causing mutations. It was a single missense mutation in the third base of the codon for amino acid residue 2031 that corresponds to residue 2027 of ACCase in *A. myosuroides* (GenBank accession AJ310767). In R91, Bol-45, and Bol-71 a guanine to cytosine mutation in this residue changed amino acid residue tryptophan in the susceptible parent to cysteine in the resistant sorghum. A different mutation was observed in Bol-15, where the guanine was changed to thymine but the encoded residue was cysteine just like the other resistant plants.

Discussion

The visual response to fluazifop plotted on Figure 2-1 shows strong resistance in both the resistant and F_1 types. It is partially dominant since the F_1 resistance is less than the homozygous

genotype. This partial dominance is seen in all the responses to APP herbicides (Figures 2-1 to 2-4). The reason for the differences between runs in F_1 response could be several factors, including less stringent visual scoring of run 2 at light injury or the random variability inherent in biological experiments. The less stringent scoring of run 2 at light injury would help explain the interaction effect in Figure 2-6. In Figure 2-1, the response curve is not shown for resistance and F_1 run 2 because not enough of the curve is estimated by the data. The maximum rate is 4 times the use rate, which limits the numerator for the resistance factor calculations. The resistance factor is clearly greater than 54, but the exact number cannot be calculated (Table 2-3). For fluazifop visual response, it is clear the F_1 run 1 is near this value and the resistant is greater by more than a factor of 2 (factor of 2 would be 8 times the use rate).

The weight response to fluazifop (Figure 2-2) provides a clear GR_{50} for the F_1 type. It is well bracketed on both sides with data points. Neither susceptible nor resistant types provide an exact GR_{50} but it is clear that the resistant factor is much greater than 64. This is similar to the results of the visual response (Figure 2-3) and weight response (Figure 2-4) to quizalofop. These results are consistent with resistance provided by a mutant ACCase protein (Délye et al., 2005b; White et al., 2005). Additionally, the partial dominance observed here is consistent with previous research of heterozygous individuals (Marshall et al., 1992). This large amount of resistance would be excellent for protection against APP herbicides in sorghum production.

The visual (Figure 2-6) and weight (Figure 2-7) response to sethoxydime is more difficult to explain. However, the final conclusion is straightforward and agrees with previous research. The resistance factors are small, around 3, which is consistent with some mutant ACCase proteins (Délye et al., 2005) but not with the Ile-1781-Leu mutation (Tal and Rubin, 2004; Tardif et al., 1993; White et al., 2005) or with the Asp-2078-Gly mutation (Liu et al., 2007). Both of these have greater resistance factors for sethoxydim and other CHD herbicides. This straightforward conclusion is buried beneath the explanation for the significant interactions between types and runs. The core cause of this interaction is not clear. Some factors involved are that the susceptible of run 1 had less visible injury (Figure 2-6) and contained a high amount of variability (lower error bars, especially apparent in Figure 2-7). Less visible injury for run 1 is unusual because, in general, run 1 appeared to be scored harder, as discussed below. Higher variability is unusual because the susceptible weight response had small, lower error bars in Figures 2-2, 2-4, and 2-5. Together, this suggests that run 1 susceptible had an erratic and

unusual response to sethoxydim herbicide. Likewise, run 1 resistant and F_1 types were erratic, but to a lesser extent. This should not discount from the findings that the resistance factors are low.

In Figure 2-6, keep in mind that the F_1 types are different between runs. However the resistant types are not different between runs and there is no difference between F_1 and resistant types within each run. This could be plotted several ways as long as the F_1 types are separated. In Figure 2-6, all four are plotted separately so that the intricacies can be observed and it matches the number of consolidated groups in Figure 2-7. Also in Figure 2-6, the relaxed visual score of light injury for run 2 is obvious at rates 0.125 and 0.25. This is interesting because the researcher's proficiency at visual scoring increased greatly throughout run 1, and run 2 was conducted with closer guidance of the standards. This serves as a good example of the issues involved with subjective evaluations. The advantage of quantitative measurements over subjective scoring is tempered with the observation that the weight results contained more variability (all error bars) and was heavily affected by the erratic effect of sethoxydim in run 1. This would be a good time to note that asymmetric error bars greatly increase the information about the underlying variability in the data. This and the multiple-step ANOVA have only become possible in recent years with advanced computing power.

The visual and weight response (Figure 2-5) to clethodim herbicide did not find a difference between types. A single I_{50} of 0.065 times the use rate was determined. The GR_{50} could not be determined and it is uncertain if there is a difference between types for the weight response since all rates cause excessive injury. But this further supports the conclusion that the cause of resistance is not the Ile-1781-Leu mutation nor the Asp-2078-Gly mutation. This leaves only Trp-1999-Cys, Trp-2027-Cys, Gly-2096-Ala, and Ile-2041-Asn mutations as known sources of resistance. Furthermore, Trp-1999-Cys and Gly-2096-Ala are not desired because yeast-wheat chimeric protein studies reports null or reduced growth with these mutations, respectively. The does response study suggests that Trp-2027-Cys or Ile-2041-Asn as the causal mutation for this resistant wild sorghum.

A single gene hypothesis is strongly supported by the segregation study. It had very high probabilities for two of the populations and lower for the third. This variation is not unusual in greenhouse studies where the herbicides can be more potent (Obermeier, 1998). The question remains if the gene is a mutant ACCase or a gene involved with metabolism. Metabolism is

unlikely because the resistance factors observed are much higher than those reported for metabolism based resistance (Cocker et al., 2000; Cocker et al., 2001; Matthews et al., 2000). Thus the single gene supported by the segregation study and dose response study point to Trp-2027-Cys or Ile-2041-Asn mutations in the ACCase gene.

The sequencing experiment examined all six residues known to provide resistance and found a single mutation (Trp-2027-Cys) which is known to provide the resistance characterized in the dose response study. The ACCase protein has been extensively studied and only these sites have been reported as responsible for resistance (Délye et al., 2005; Liu et al., 2007). Additionally, we did not find any other possible mutations in the examined areas of the CT domain. CHD and APP herbicides bind to the CT domain and resistance providing mutations have been exclusively found there (Rendina et al., 1990). The sequencing experiment reported the Trp-2027-Cys mutation. The segregation experiment supports a single gene model. The dose response study produces a resistant factor profile expected from a Trp-2027-Cys mutation. This describes very strong APP resistance that is easy to transfer to sorghum hybrid seed parents for use by the industry.

The sequencing experiment produced some interesting findings because only one amino acid residue changing mutation was identified, yet this mutation occurred at least three times (R91, Bol-15, and Bol-45/Bol-71). It is strange that Trp-2027-Cys was the only mutation found. There is a wealth of information on ACCase resistance that proves that metabolism-base resistance is more common than a mutant ACCase protein, of which the most common mutation is Ile-1781-Leu (Délye et al., 2007; Délye et al., 2010). It is not that *Sorghum* ssp. lack other mutations. Burke et al. (2006b) and Obermeier (1998) report resistance caused by mutant ACCase-protein and each report a unique resistance factor profile. The profile for Burke et al. (2006b) is low resistance to APP and CHD herbicides. The profile for Obermeier (1998) is high resistance to fluazifop, intermediate resistance to quizalofop, and low resistance to CHD herbicides. These are both different from the profile as described in the dose response study. There are similarities between Obermeier (1998) and this profile. However, the resistance to quizalofop is closer to the value of the heterozygous F_1 reported above. Since johnsongrass is a tetraploid, it is possible that Obermeier (1998) was working with mixture of resistant and susceptible proteins and could have Trp-2027-Cys. Burke et al. (2006b) does not have either Trp-2027-Cys or Ile-1781-Leu. It is surprising that Ile-1781-Leu has not been reported in sorghum

since it is the most common source of target site resistance. It could be that the Ile-1781-Leu mutation is not viable in sorghum considering there are no reports of sorghum with high levels of resistance to CHD herbicides.

This wild sorghum shows extreme promise as a source of genetic resistance to ACCase inhibiting herbicides. The amount of resistance to APP herbicides reported in this study is adequate for weed control in sorghum production. It is advantageous that the heterozygous genotype is more sensitive to the herbicides, reducing the possibility of gene flow to wild species. Even more advantageous is the sensitivity of the resistant genotype to CHD herbicides, especially clethodim. This could be used to control volunteer sorghum seedlings in subsequence rotations that incorporate a crop tolerant to CHD herbicides. The single mutation in the ACCase gene allows easy transfer into elite grain sorghum seed parents. Germplasm involving elite by Bol-71 crosses have been released to the sorghum seed industry and specific APP herbicides are being labeled for use on sorghum.

Figures and Tables

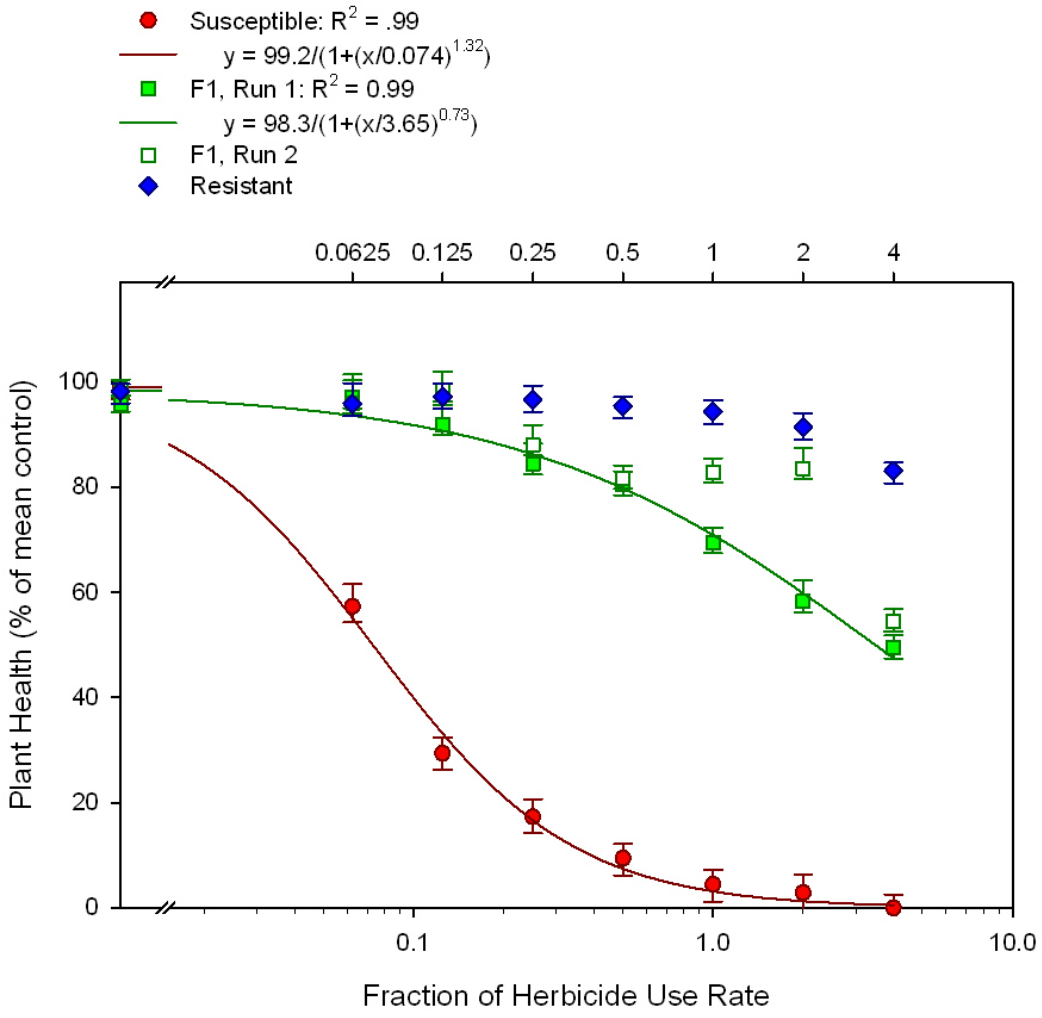

Figure 2-1. Dose response of visual plant injury to fluazifop for each genotype and each run, if statistically different. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group.

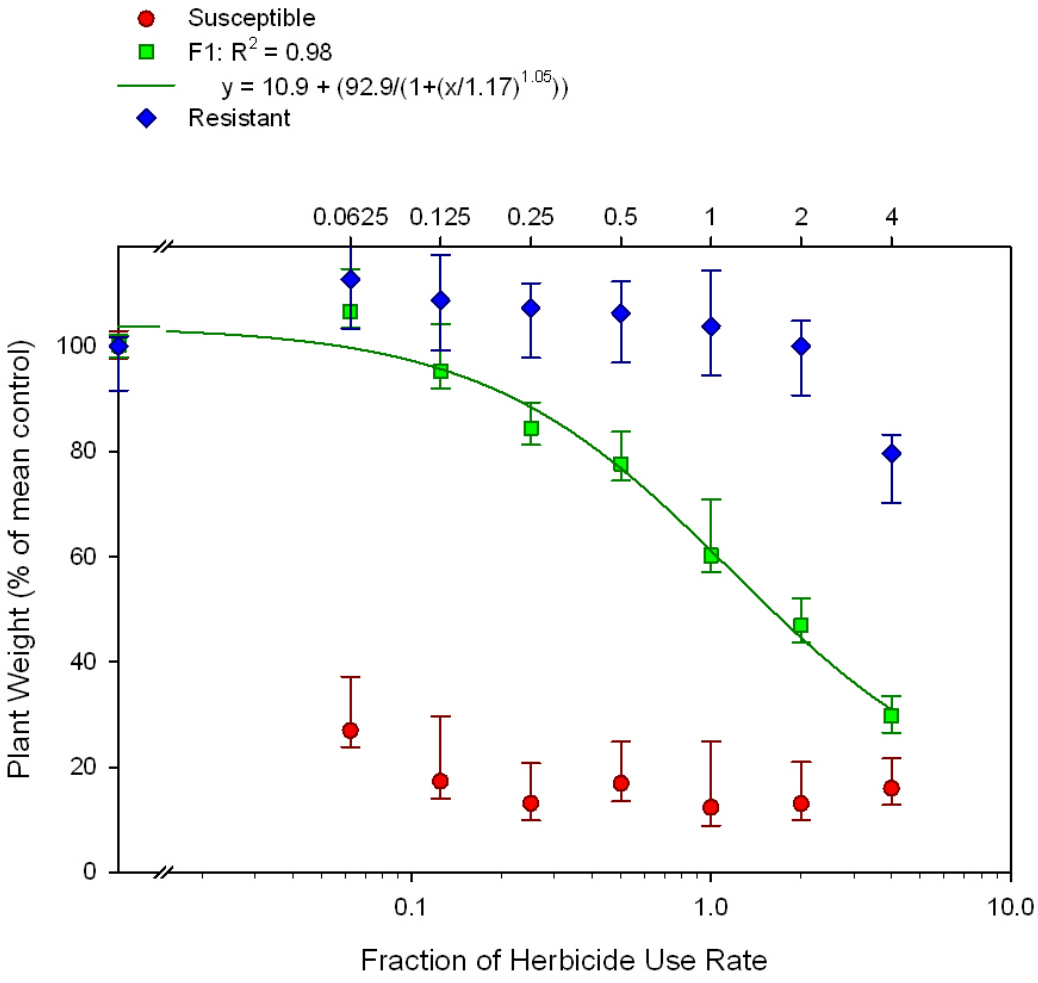

Figure 2-2. Dose response of plant weight to fluazifop for each genotype. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group.

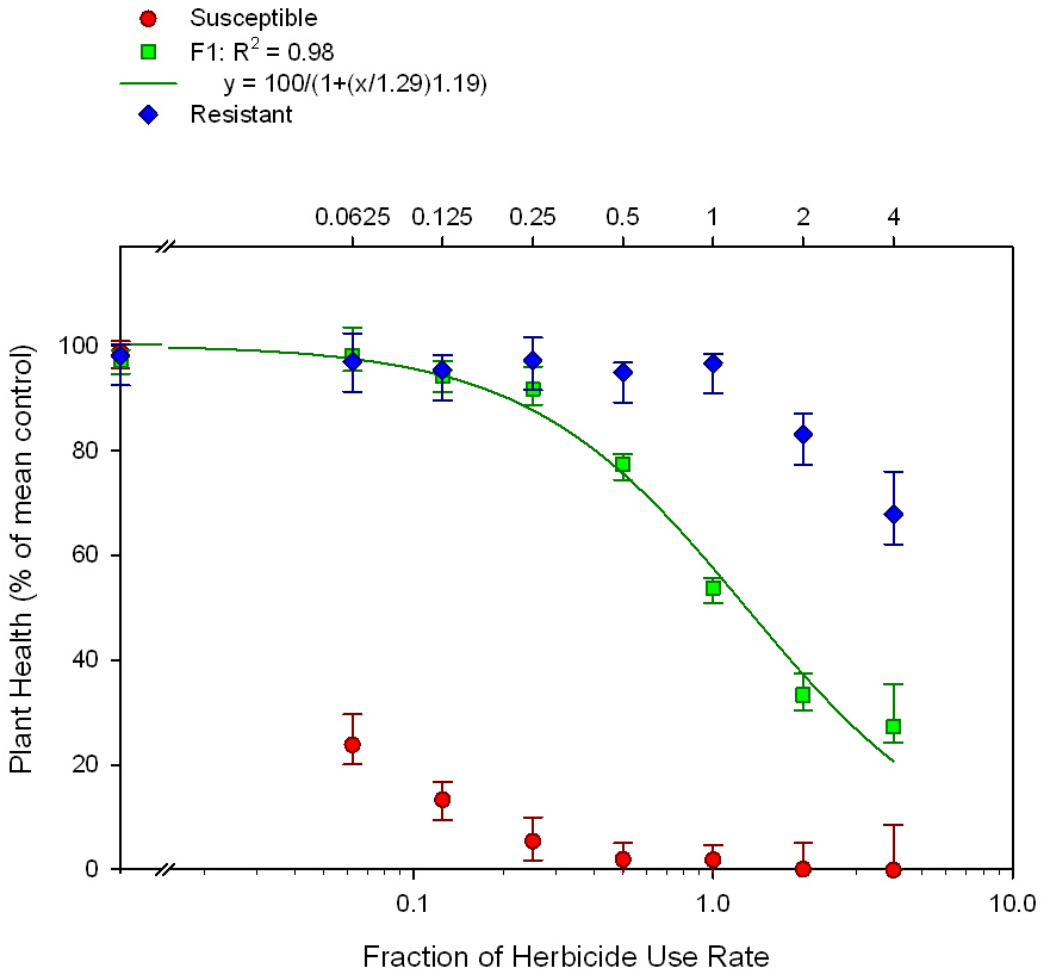

Figure 2-3. Dose response of visual plant injury to quizalofop for each genotype. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group.

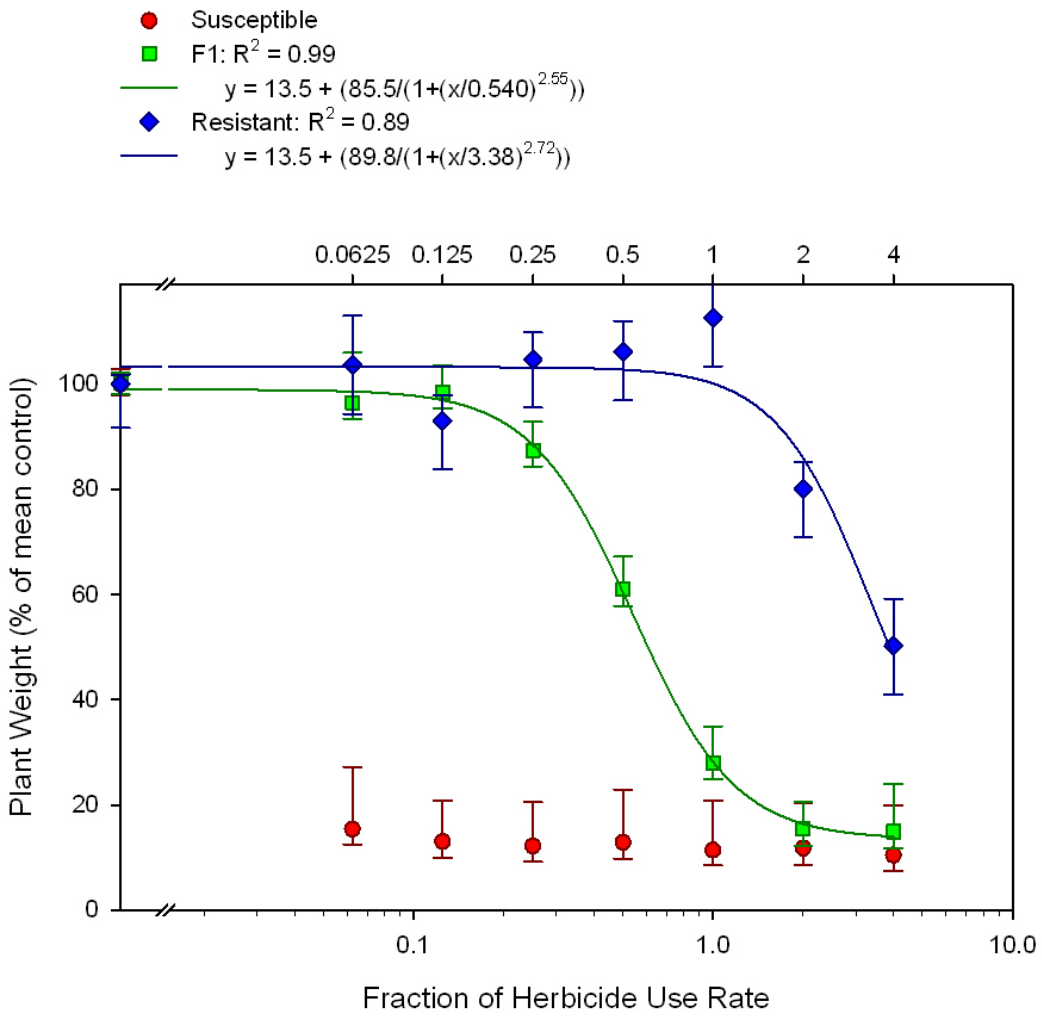

Figure 2-4. Dose response of plant weight to quizalofop for each genotype. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group.

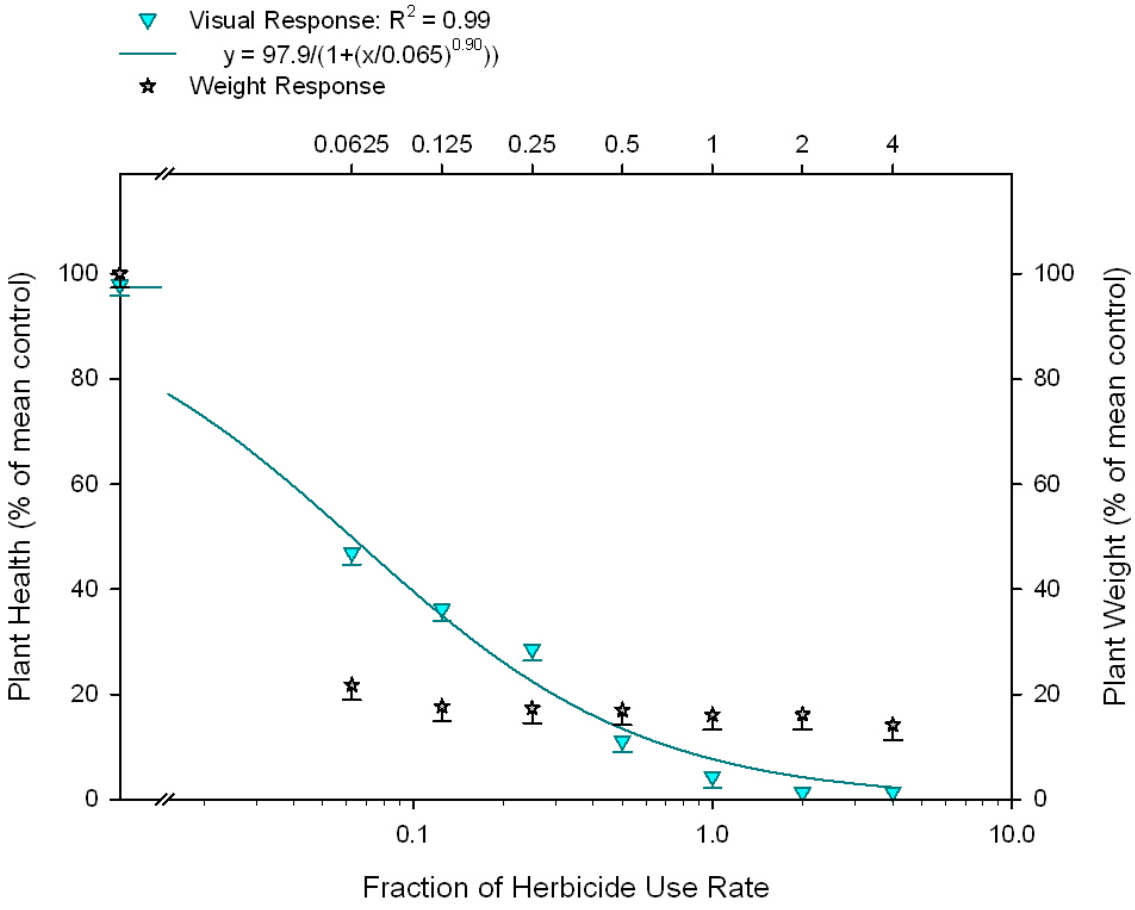

Figure 2-5. Clethodim dose response. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Lower error bars are standard errors for variation in means for a given group.

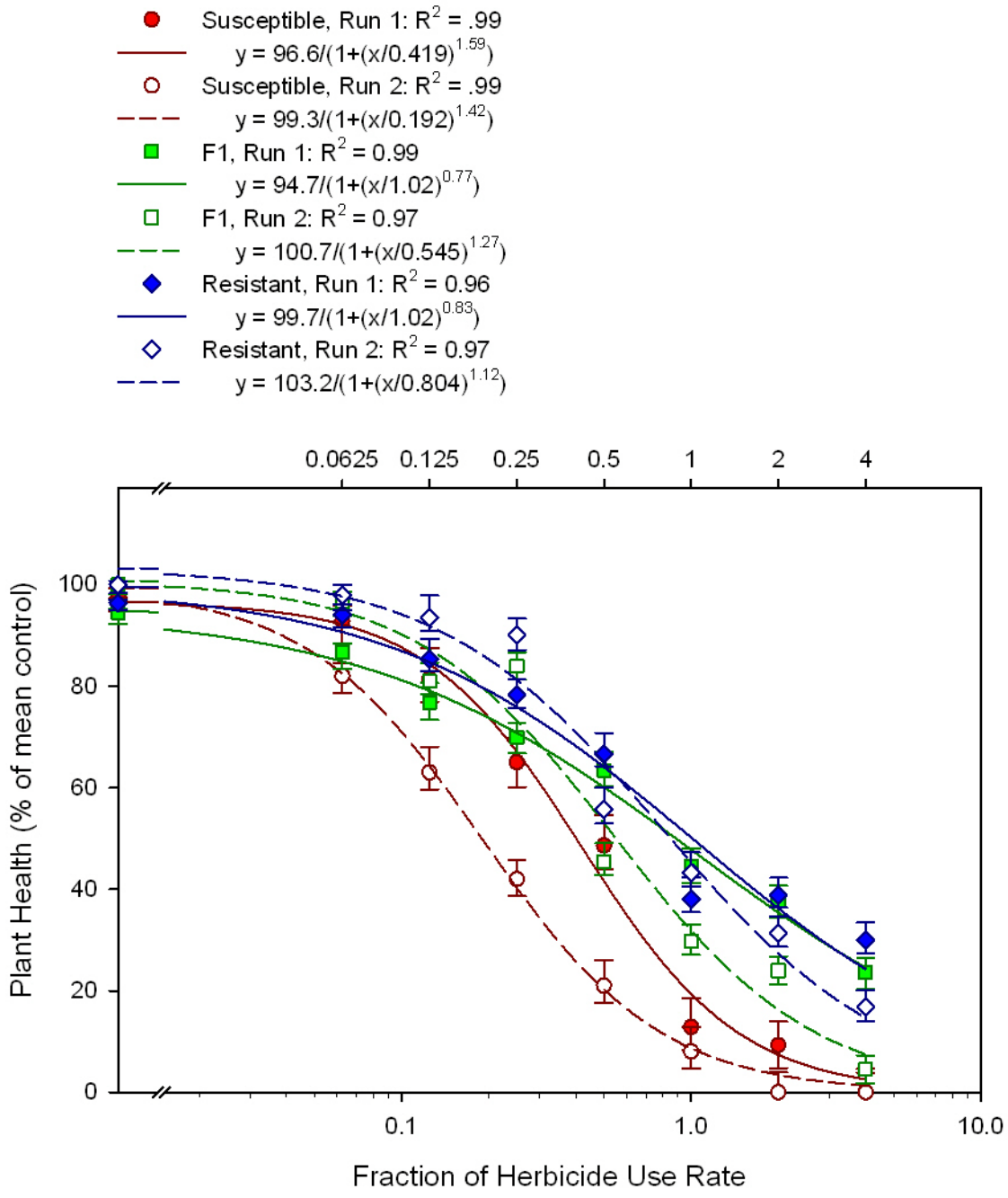

Figure 2-6. Dose response of visual plant injury to sethoxydim. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group. Resistant and F1 for each run could be combined but plotted separately for visualization.

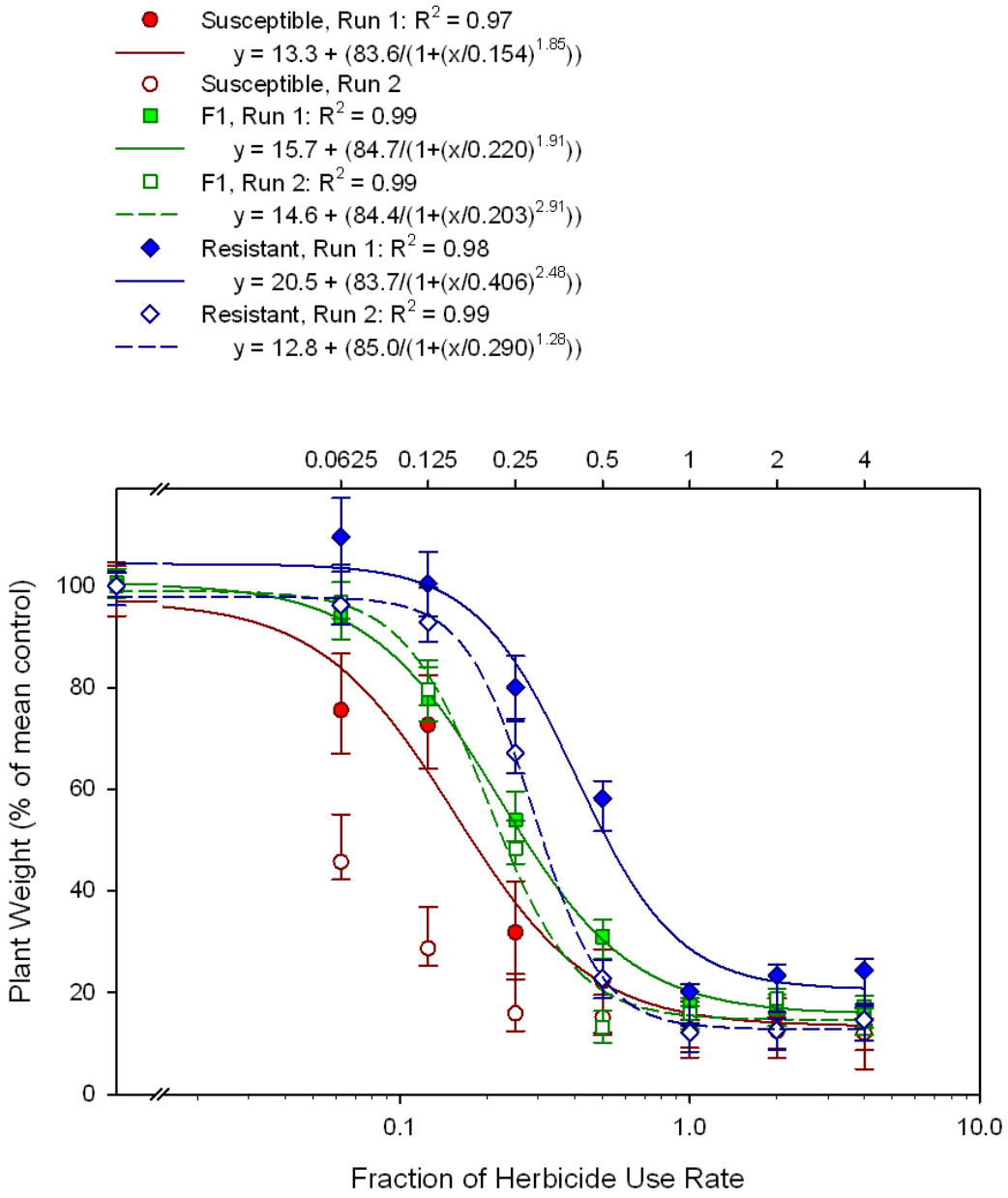

Figure 2-7. Dose response of plant weight to sethoxydim. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group.

Table 2-1. Summary of ACCase mutations providing resistance to herbicides

Wildtype Residue(s)	Residue Number	Mutant Residue(s)	Resistance Provided	Source
Isoleucine	1781	Leucine	CHD & APP	Brown et al. (2002); Christoffers et al. (2002); Délye et al. (2002); Délye et al. (2005); Liu et al. (2007); Tal and Rubin (2004); White et al. (2005); Zhang and Powles (2006a)
Tryptophan or Proline	1999	Cysteine	APP	Liu et al. (2007)
Tryptophan	2027	Cysteine	APP	Délye et al. (2005); Liu et al. (2007)
Isoleucine	2041	Asparagine or Valine	APP	Délye et al. (2003); Délye et al. (2005); Liu et al. (2007); Zhang and Powles (2006b)
Aspartate	2078	Glycine	CHD & APP	Délye et al. (2005); Liu et al. (2007)
Glycine	2096	Alanine	APP	Délye et al. (2005)

Table 2-2. Summary of GLM F-tests for differences of plant, accession, and type at seven herbicide rates

Source	Number of ANOVA Performed for Each Response	Fluazifop		Quizalofop		Clethodim		Sethoxydim	
		Visual	Weight	Visual	Weight	Visual	Weight	Visual	Weight
		---------- Number of Significant Test Results (alpha = 0.05) ----------							
Resistant Accessions with Nested Individual Plants									
Run	7	1	1	2	0	1	0	1	1
Accession	7	0	0	0	0	0	0	0	0
Run*Accession	7	0	0	1	1	1	2	1	0
Plant(Accession)	7	0	0	1	0	1	0	1	0
Run*Plant(Accession)	7	2	1	0	0	2	0	1	0
Resistant Accessions									
Run	7	2	1	2	0	0	2	2	1
Accession	7	1	1	0	0	1	0	0	0
Run*Accession	7	0	0	1	1	1	2	0	1
F_1 Accessions									
Run	7	5†	0	1	0	0	0	4†	0
Accession	7	2	0	0	0	0	1	0	0
Run*Accession	7	0	0	2	0	0	0	0	1
Susceptible Genotype									
Run	7	0	0	0	0	0	0	4†	3†
Everything									
Run	7	1	1	0	0	2	0	2	1
Type	7	7†	6†	7†	5†	1	0	1	1
Run*Type	7	2	1	1	1	0	2	5†	3†
Everything, Run 1									
Type	7	-‡	-	-	-	-	-	6†	2
Everything, Run 2									
Type	7	-	-	-	-	-	-	7†	5†
Resistant and F_1, Run 1									
Type	7	-	-	-	-	-	-	2	4†
Resistant and F_1, Run 2									
Type	7	-	-	-	-	-	-	2	4†

† Considered trends and must be plotted separately.

‡ Secondary tests not performed on herbicide responses without interaction trends

Table 2-3. Dose response 50% injury (I_{50}) and 50% growth reduction (GR_{50}) values

Herbicide	Genotype	I_{50}†	Resistance Factor	GR_{50}†	Resistance Factor
Fluazifop	Susceptible	0.074	1	< 0.0625	1
	F1, Run 1	3.65	49		
	F1, Run 2	> 4.0	> 54		
	F1, Both Runs			1.17	> 19
	Resistant	> 4.0	> 54	>4	>> 64
Quizalofop	Susceptible	< 0.0625	1	< 0.0625	1
	F1	1.29	> 20	0.540	> 9
	Resistant	> 4.0	>> 64	3.38	> 54
Clethodim	Combined	0.065	1	< 0.0625	-‡
Sethoxydim	Susceptible, Run 1	0.419	1	0.154	1
	F1, Run 1	1.02	2.4	0.220	1.4
	Resistant, Run 1	1.02	2.4	0.406	2.6
	Susceptible, Run 2	0.192	1	< 0.0625	1
	F1, Run 2	0.545	2.8	0.203	> 3.2
	Resistant, Run 2	0.804	4.2	0.290	> 4.64

† I_{50} and GR_{50} values are given as fraction of the use rate.

‡ The exact nature of the resistance cannot be determined with the current data

Table 2-4. Chi-square analysis of segergating herbicide resistant populations

Pedigree	Generation	---- Observed ----		---- Expected ----		P-Value
		Dead	Alive	Dead	Alive	
(BTx623 x Bol-71) – F_2	F_2	214	687	225.3	675.8	0.387
(RTx430 x Bol-71) – F_2	F_2	242	716	239.5	718.5	0.852
(R00MN7645 x Bol-71) – F_2	F_2	248	648	224	672	0.064
(ATx623 x (BTx623 x Bol-71)) – BC_1F_1	BC_1F_1	70	77	73.5	73.5	0.564

CHAPTER 3 - Genetic Resistance to AHAS-Inhibiting Herbicides in Grain Sorghum

Introduction

Sorghum bicolor (L.) Moench originated in the harsh environments in and around the vast plains of the Serengeti and Sahel regions of Africa (de Wet and Harlan, 1971). As a grain crop in the United States, it was introduced and widely distributed across the south into the arid west in the late 1800s (Karper and Quinby, 1946; Karper and Quinby, 1947). It became a major crop in the United States because of two developments, identification of dwarf mutants for adapting the crop to mechanical harvesting (Quinby and Karper, 1954) and development of a cytoplasmic male-sterility system to facilitate commercial production of F_1 hybrid seed (Stephens and Holland, 1954). However, sorghum acreage peaked in 1957 (USDA, 2010) and yields of irrigated grain sorghum hybrids have remained unchanged since that time (Assefa and Staggenborg, 2010). Sorghum breeders have focused on defensive traits and dryland yield has seen gains only 60% of the yield gains in corn (Smith and Frederiksen, 2000). Grain sorghum acreage has fallen 67% since 1985 (USDA, 2010) and the sorghum industry must receive more attention if this hearty crop is to survive.

Weed control is important in sorghum and failure can result in yield losses exceeding 50% (Burnside et al., 1964; Graham et al., 1988; Knezevic et al., 1997; Schneweis et al., 1995; Traore et al., 2003). Herbicides play an important role in weed control, especially under reduced tillage systems (Phillips, 1969). Grain sorghum producers generally use preemerge herbicides such as atrazine and metolachlor. These herbicides work well for managing weeds given adequate precipitation; however, erratic rainfall and poor soil moisture are common in most sorghum producing regions. When the preemerge herbicide fails, sorghum producers do not have a broad-spectrum postemerge herbicide for use against grasses. Under these conditions, grass weed escapes can only be controlled by directed herbicide application or mechanical cultivation (Splittstoesser and Derscheid, 1962). Grain sorghum needs additional herbicide options to remain competitive as a 21st century crop.

In the 1980s, non-transgenic herbicide resistance was developed in many crops including maize (Newhouse et al., 1991), soybean (Sebastian, 1989), wheat (Newhouse et al., 1992), and

others (Tan et al., 2005). Sorghum was not considered a candidate for any resistance technology because shattercane (*S. bicolor*) and johnsongrass (*S. halepense*) can cross with grain sorghum (Smeda et al., 2000). However, related weed species has not stopped rice (Shivrain et al., 2007), wheat (Gaines et al., 2008), or sunflower (Massinga et al., 2003) from utilizing resistance technologies. The other concern was preserving herbicide technology for crops in rotation with sorghum, specifically maize, soybeans, and wheat. These crops have since moved to newer, transgenic technologies. The sorghum industry has a critical need for weed control technologies.

Among the herbicide technologies developed over the past three decades, resistance to herbicides targeting acetohydroxyacid synthase (AHAS, EC 2.2.1.6) was developed in all the crops listed above, except sorghum. AHAS is the first common step in the branch-chain amino acid biosynthesis pathway. In plants, it is a nuclear encoded gene with a leading signal peptide that directs the enzyme to the chloroplast during protein synthesis. In the chloroplast, the active protein is a dimer of catalytic proteins along with a regulatory subunit for each catalytic protein (McCourt and Duggleby, 2006). The active site is located at the C2 atom of the thiamine diphosphate cofactor (Chipman et al., 2005). The dimer has two separate active sites located on the dimer interface buried within the protein. Substrates access the active site through a channel that can be blocked by herbicides.

AHAS-targeting herbicides are from sulfonylurea (SU), imidazolinone (IM), triazolopyrimidine, pyrimidinyl-oxybenzoate, or sulfonylamino-carbonyl-triazolinone chemical families. SU and IM were the first on the market, have the most commercialized molecules, and are the most commonly used. AHAS was not identified as the target enzyme until after herbicide commercialization in 1984 (Chaleff and Mauvais, 1984; Shaner et al., 1984). Chaleff and Mauvais (1984) identified the target as acetolactate synthase (ALS), which is partially correct. Acetolactate is one of the two acetohydroxyacid products with the other being 2-aceto-2-hydroxybutyrate for isoleucine production. The name AHAS was used by Shaner et al. (1984) and is the correct name for the enzyme. Unfortunately, ALS is still used, especially where SU herbicides are referenced.

A total of 107 species are reported with resistance to AHAS-targeting herbicides (Heap, 2010). As summarized in Table 3-1, many of the published reports on resistance identify a mutation in the enzyme as the cause of resistance although there are exceptions (Fischer et al., 2000; Hidayat and Preston, 2001; Preston et al., 1996; Veldhuis et al., 2000). There have only

been a few papers published that examine *Sorghum* ssp. with resistance (Anderson et al., 1998; Lee et al., 1999; Zelaya and Owen, 2004). The resistance in western Midwest shattercane has been examined and every report identifies a modified target enzyme as the cause of resistance with several different alleles identified. These alleles provide different amounts of resistance to different AHAS-inhibiting herbicides (Lee et al., 1999).

The first step in developing a new herbicide resistant trait in grain sorghum would be to characterize the trait for commercial potential. The objectives of this study were (1) evaluate the level of resistance to different herbicides, (2) determine the type of inheritance, and (3) determine the causal mutation of herbicide resistance to AHAS-inhibiting herbicides in a wild sorghum.

Material and Methods

Genetic Materials

In 1996, AHAS-inhibitor resistant wild sorghum (shattercane) in southwest Kansas was reported to the International Survey of Herbicide Resistant Weeds (Heap, 2010). Seeds of a resistant shattercane plant were collected in 2003 from a field referred to as Tailwind by the local farmer. This genotype is hereafter referred to as Tailwind (TW). A susceptible sorghum, Tx623, was used as a check in each experiment. Tx623, an elite sorghum parent line, was the first sorghum genome sequenced (Paterson et al., 2009). In DNA sequencing experiments, Tx430, an elite pollinator parent (Miller, 1984), was used as a second susceptible check. All plants were grown in a greenhouse at Kansas State University in Manhattan, KS. The temperature was maintained at 27 and 21 C day and night, respectively. Supplemental lighting maintained 16-h and 8-h periods for day and night, respectively. Plants were grown in Metro Mix 360 potting mixture in either nursery trays or Super Cell Cone-tainers™ depending on the experiment needs (all greenhouse supplies obtained from Hummert International, St. Lousis, MO). Herbicide spraying was conducted on 7-16 cm tall seedlings using a bench top sprayer delivering 187 L ha^{-1} at 138 kPa using a single TEEJET 80015 LP nozzle.

Dose Response

The resistant genotype, TW, and a susceptible check, genotype Tx623, were evaluated for their response to AHAS inhibiting herbicides. Cone-tainers™ were used to grow and manage the

seedlings individually allowing them to be arranged into blocks according to size prior to randomization of treatment application to individuals within the block. Two herbicides were sprayed at nine rates with replications organized in six blocks, and the experiment was repeated (Run 1 and Run 2). The rates were increased as a fraction of the use rate starting at 1/32 and doubled each time to 8 times the use rate with a complete set of rates as follows: 1/32, 1/16, 1/8, 1/4, 1/2, 1, 2, 4, and 8 times the use rate. The use rate for imazapyr (Arsenal), an IM herbicide, was 22.40 g ai ha^{-1} and for nicosulfuron (Accent), a SU herbicide, was 34.75 g ai ha^{-1}. All treatments were applied in water with 0.25% (v/v) non-ionic surfactant. Two weeks after treatment (WAT), the plants were visually scored for injury and above ground biomass collected. The harvested biomass was dried 72 h at 72° C and weighed with the evaluations based on the weight as a percent of block mean control.

Very High-Rate Dose Response

The very high-rate dose response was conducted using the same procedure as described above with higher herbicide rates extending from where the prior rates ended. The rates for imazapyr were 16, 32, 64, 128, 256, and 512 times the use rate. The rates for nicosulfuron were 16, 32, 64, 128, and 256 times the use rates. These rates approached the maximum concentration that could be used without changing the herbicide mixing and application protocol. The nicosulfuron required dissolving prior to mixing and both high concentrations experienced degrading of spray droplet consistency of size and evenness of distribution. Three blocks of susceptible and eight blocks of resistant genotypes were treated and the experiment was conducted twice (Run 3 and Run 4). Visual injury ratings were determined two weeks after herbicide application.

Statistical Analysis

The herbicides were analyzed separately using ANOVA followed by fitting a response curve to the plotted least square means. The randomized complete block design used PROC GLM, SAS v9.2, to test for differences using expected mean square error based on runs as a random effect. Where not significant, runs were combined. If significant interaction effects were observed, secondary tests were performed on subsets of the interacting variables. Once consolidated groups were determined, PROC MIXED, SAS v9.2, was used to extract least square means along with standard errors based on the variability at each herbicide rate and across

the rates at the consolidated level. The extracted means were plotted in Sigma Plot™ and when the 50% of the response was achieved, fitted with a log-logistic curve as advocated by Seefeldt et al. (1995). The SAS code is located in Appendix B3.

Segregation

Tailwind was crossed onto BTx623 and the resulting F_1 progeny were screened with herbicide. The plants were self pollinated to produce a F_2 population. This population was sprayed with 1 and 2 times the use rates of 22.40 g ai ha^{-1} for imazapyr and 34.75 g ai ha^{-1} for nicosulfuron when the plants were between 7 and 13 cm in height. The spray mixture contained 0.25 % (v/v) NIS. Two WAT, the plants were rated for observed visual injury with three apparent classes labeled as resistant, intermediate, and susceptible. The resistant phenotype was comparable to TW and the susceptible phenotype was comparable to Tx623. The intermediate plants were those with a phenotype of 25 and 90% injury. Based on the segregation pattern, a Pearson's chi-square analysis was used to evaluate the appropriateness of a single gene model and other gene models.

Sequencing

Genomic DNA was extracted from a resistant sorghum derived by selfing from TW, Tx623, and Tx430 using a modified CTAB protocol described by Saghai-Maroof et al. (1984). The first PCR reactions used an annealing temperature of 68 °C, the forward primer 5'-CCGACATCCTCGTCGAGGC TC-3', and the reverse primer 5'-ATGTCGACAAGCACCGGTCC-3'. The second PCR reactions used an annealing temperature of 62 °C, the forward primer 5'- GATTGTGCACATTGATATTGAT CC -3' and reverse primer 5'- CACATCACCCTTGTACCAGCTC-3'. The DNA fragment was amplified using high-fidelity Easy-A Polymerase (Agilent Technologies, Santa Clara, CA) and was initiated with 4 min denaturation at 94 °C then cycled through 1 min denaturation at 94 °C, 45 s annealing at temperature specified above, and 45 s amplification at 72 °C for 30 cycles and finished with 10 min amplification at 72 °C. PCR products were purified using QIAquick PCR Purification Kit (QIAGEN, Valencia, CA) and sequencing of the amplicon was performed using an Applied Biosystems 3730 DNA Analyzer at the core KSU Genomics Sequencing Facility.

Results

Dose Response

The dose response data are located in Appendix B1, the SAS code is located in Appendix B3, and the SAS output is located in Appendix B4. The results from the analysis of variance of the dose response experiment are summarized in Table 3-2. The visual response to imazapyr had a significant type effect trend so the resistant and susceptible were plotted separately in Figure 3-1. The resistant plants were not injured at the 8x rate of imazapyr so the I_{50} could not be determined. The susceptible genotype had an I_{50} of 0.657 times the use rate. The weight response to imazapyr did not have very clear ANOVA results unless alpha is raised to 0.10. This is would still require secondary testing, so alpha was kept at 0.05 and the secondary tests conducted. The secondary test found significant type effects at each run. The original tests showed that run effect was confounded with the type effect. Because the original test showed slight run effect for susceptible, the runs were plotted separately and the resistant runs were plotted together in Figure 3-2. The GR_{50} of the resistant genotype could not be determined at these rates and the GR_{50} of the susceptible genotype was 0.212 and 0.255 times the use rate for run one and two, respectively. The visual response to nicosulfuron was similar except the run effect was greater. The secondary tests were performed to ensure that a type effect existed at each run. Each type, resistant and susceptible, was plotted for each run in Figure 3-3. The I_{50} of the resistant genotype could not be determined and the I_{50} of the susceptible genotype was 0.508 and 0.212 times the use rate for run one and two, respectively. The weight response to nicosulfuron had a significant type effect trend so the resistant and susceptible were plotted separately in Figure 3-4. The GR_{50} of the resistant genotype could not be determined and the susceptible genotype had a GR_{50} of 0.022 times the use rate.

The data from the very high-rate dose response experiments are located in Appendix B2. The results of these experiments are similar to those described above. The susceptible genotype was killed at low rates of herbicide application and the resistant genotype had minor injury at all rates. The overall mean for plant injury at 512 times the use rate of imazapyr was 88 % of the untreated control and for the 256 times the use rate of nicosulfuron was 95% of the untreated control. This level of injury corresponds to speckling of the leaves and slight interveinal chlorosis. The speckling could be caused by the herbicide or the surfactants. Regardless, the I_{50}

values for the resistant genotype are much higher than the highest rate. Using the I_{50} values for the susceptible genotype described above, the resistance factor for imazapyr is at least 779 and for nicosulfuron at least 504.

Segregation

The herbicide resistance segregation data and chi-square probability values are listed in Table 3-3. The single gene model was rejected but it should be noted that this model did explain the ratio of 3:1 segregation between resistant (R) and intermediate (I) together against susceptible (S). However the intermediate phenotype was clearly present and formed an R:I ratio of 9:7. This can be explained by a single dominate major gene (Gene A) that provides a 3:1 ratio between R&I:S. Two other modifier genes (Gene B and C), each dominate, also contribute to the resistance phenotype with complementary gene action that provides a 9:7 ratio between R and I. Combining these genes together, there are three genes with a 27:21:16 ratio for R:I:S phenotype that have the underlying genotypes A-B-C-:A-bb-- or A---cc:aa---- as displayed in Figure 3-5. The chi-square test did not show a significant deviation of the observed segregation from the expected 27:21:16 ratio.

Sequencing

All DNA sequencing results were aligned to the amino acid residue number corresponding to the *Arabidopsis thaliana* AHAS gene (GenBank accession X51514). The only sequence close to the *A. thaliana* AHAS gene in the sorghum genome is Sb04g020680. Sb04g020680 is reported to have two exons separated by an intron. Our sequencing showed that the end of the reported intron is incorrect and some sequence is missing in the Phytozome genome.

PCR amplification and DNA sequencing of the AHAS gene in the areas surrounding Ala-122, Pro-197, Ala-205, Trp-574, Ser-653, and Gly-654 of the herbicide resistant genotype were compared with Tx623, Tx430, and the published sorghum genome sequence. Results of these studies identified two nonsynonymous changes in the sequence of the AHAS gene from the resistant genotype that caused a valine-560- isoleucine amino acid residue change and a tryptophan-574-leucine residue change.

Discussion

Genetic resistance to AHAS-inhibiting herbicides is relatively common. Herbicide resistance from target site mutations (Ashigh and Tardif, 2009; Bernasconi et al., 1995; Délye et al., 2009; Guttieri et al., 1995; Kolkman et al., 2004; Laplante et al., 2009; Li et al., 2008; Park and Mallory-Smith, 2004; Patzoldt et al., 2001; Patzoldt and Tranel, 2002; Uchino et al., 2007; Yu et al., 2003; Zelaya and Owen, 2004) are more widespread than metabolism-based resistance (Fischer et al., 2000; Hidayat and Preston, 2001; Preston et al., 1996; Shivrain et al., 2010). Metabolism-base resistance reports lower resistance factors than our findings. Several target site mutations provide resistance only to SU or IM herbicides, which does not match the cross-resistance in our findings. Mutations modifying Ala-122, Ser-653, and Gly-654 only provide resistance to IM herbicides (Laplante et al., 2009; Li et al., 2008). Mutations modifying Pro-197 are numinous and generally report only resistance to SU herbicides (Guttieri et al., 1995; Uchino et al., 2007; Yu et al., 2003). However Pro-197-Leu does have some resistance to IM herbicides (Kolkman et al., 2004; Uchino et al., 2007), but the resistance factor is much lower than the phenotypes observed in our dose response study. Ala-205-Val mutations provide medium to low amounts of resistance to SU herbicides (Ashigh and Tardif, 2006; Ashigh and Tardif, 2007; Baumgartner et al., 1999). Trp-574-Leu mutations provide high levels of resistance to both IM and SU herbicides (Franssen et al., 2001; Patzoldt et al., 2001; Patzoldt and Tranel, 2002; Sprague et al., 1997; Uchino et al., 2007). Trp-574-Leu is the only mutation that matches Tailwind's high levels of resistance to both IM and SU herbicides as reported in the dose response study.

Target site mutations are often described as a qualitative trait (Lee et al., 1999) but some reports suggest more to the resistance than the presence of an insensitive enzyme (White et al., 2002; Yu et al., 2003). This is seen in the difference between reports of simple 1:2:1 inheritance (Anderson et al., 1998) contrasted to more complicated segregation (Zelaya and Owen, 2004). Metabolism is a more quantitative trait involving multiple genes with less individual effect (Fischer et al., 2000; Preston et al., 1996; Siehl et al., 1996). This is consistent with our findings that Tailwind has a single major gene with at least two modifiers. The major gene is a mutant enzyme that is required for the plant to survive herbicide application. The modifiers are involved in metabolism or another cellular process involved with limiting the amount of active herbicide molecule in the chloroplast stroma. The modifiers are not required for the plant to survive

herbicide growth, but are required for the plant to maintain normal cellular processes and growth. This is similar to the conclusion made to previous complex segregations (Zelaya and Owen, 2004). Further work on these modifiers could help elucidate the complex interactions involved with herbicide metabolism and nontarget site resistance.

AHAS has been extensively studied and numerous studies report the conserved residues crucial to the enzyme function (Duggleby and Pang, 2000; Duggleby et al., 2008; McCourt and Duggleby, 2006; Tranel and Wright, 2002). Many of these residues are identified because of herbicide evaluations in the lab environment (Chong et al., 1999; Ott et al., 1996). There are 17 residues identified in lab studies that could be involved in resistance (Duggleby et al., 2008). But only six of these have been identified as sources of resistance observed in nature. These are the residues described above and summarized in Table 3-1. Of these six, the only report of fitness cost is in *Solanum ptychanthum* that carries an Ala-205-Val mutation (Ashigh and Tardif, 2007). Under optimal light conditions, the wild type allele has a higher reproductive output yet no difference in germination or above-ground biomass. This advantage disappears under suboptimal conditions (Ashigh and Tardif, 2009). AHAS must be under heavy selection pressure that limits the numerous possible mutations to just six residues observed in nature.

In plants, residue 560 is always one of two amino acids: valine or isoleucine (Duggleby and Pang, 2000). They are both branch chain amino acids that differ by only three atoms. It is interesting that leucine is not found at this residue since it is the third branch-chain amino acid. Crystal structures of the AHAS protein show that this residue is located away from the reaction center and away from the protein surface (PBD: 1Z8N). Our finding that Tailwind has an isoleucine residue and the susceptible, elite sorghum parent checks have a valine residue is not unique and is simply a polymorphic difference observed throughout all plant species.

Herbicide resistant maize was developed by three companies as explained by Wright and Penner (1998). The causal mutations for two of these are known because of the work of an independent researcher (Bernasconi et al., 1995). IT maize has the Ala-122-Thr mutation and IR maize has the Trp-574-Leu mutations. Both of these mutations were obtained through mutagenesis (Greaves et al., 1993; Newhouse et al., 1991; Shaner et al., 1996). As expected from the discussion above, IT maize is resistant only to IM herbicides and IR maize is resistant to both SU and IM herbicides (Bernasconi et al., 1995). An important side note is that IR maize hybrids were developed heterozygous for the resistant locus and IT maize hybrids were developed as

homozygous for the resistant locus (Wright and Penner, 1998). This is relevant for future development of hybrid sorghum that carries the Trp-574-Leu mutation.

The Trp-574-Leu mutation in Tailwind most likely is the major gene in the segregation study because of the many reports listed above, the resistance profiles of high IM and SU herbicide resistance matches the reports above, and because of the function Trp-574 has in the AHAS protein. Trp-574 is involved with recognition of the 2-ketoacid substrate and forms a π–stacking arrangement with the binding herbicides (Duggleby et al., 2008). Leu-574 loses the high preference for 2-ketoburate observed in Trp-574 (Tittmann et al., 2005) and cannot stack with the pyrimidine or triazine ring on the herbicides.

Tailwind is an excellent source of genetic resistance for the sorghum industry to obtain nontransgenic genetic herbicide resistant to graminicides. It offers very high resistance to IM and SU herbicides. Breeding programs should be ready to incorporate modifiers along with the mutant AHAS gene. Producers must be aware of the risk that this trait will move into shattercane without proper weed management. Crop rotation, changing herbicide mode-of-actions, scouting fields, and rouging are all parts to an integrated weed management program that will extend the life of this technology.

Figures and Tables

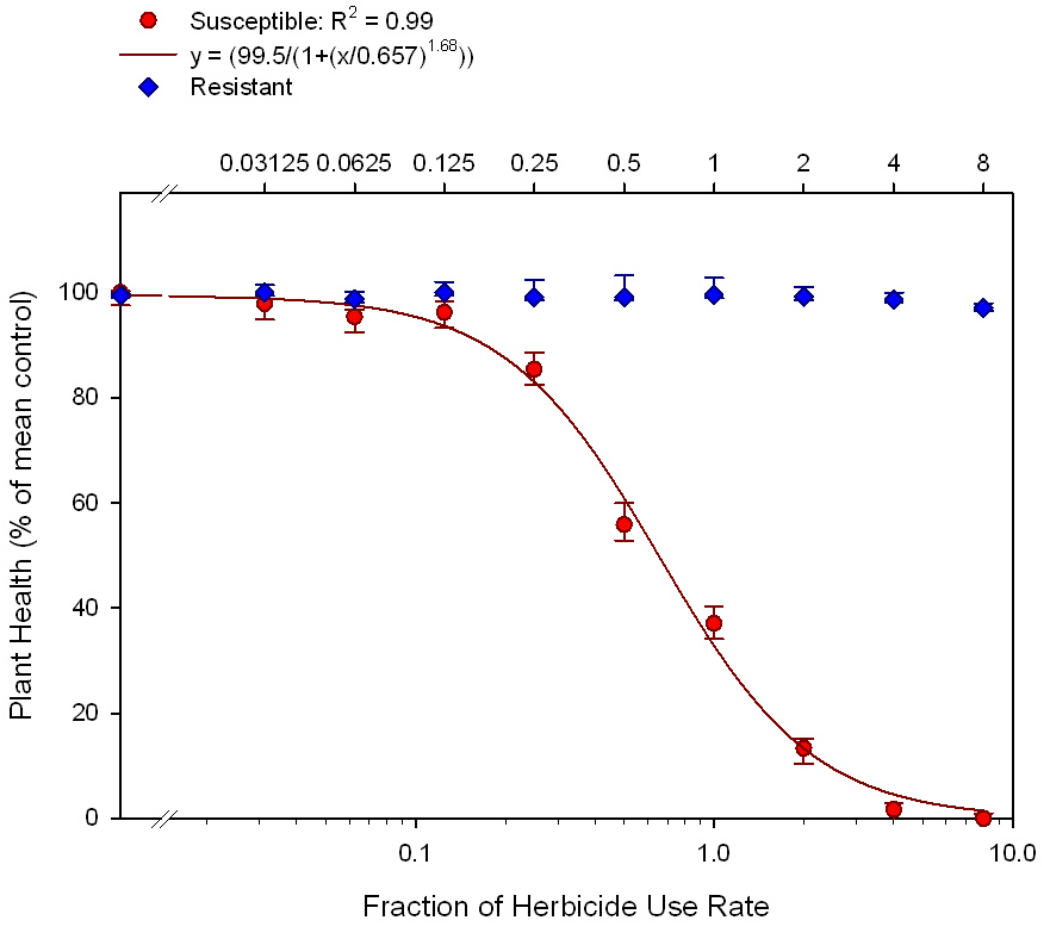

Figure 3-1. Dose response of visual plant injury to imazapyr for each genotype. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group.

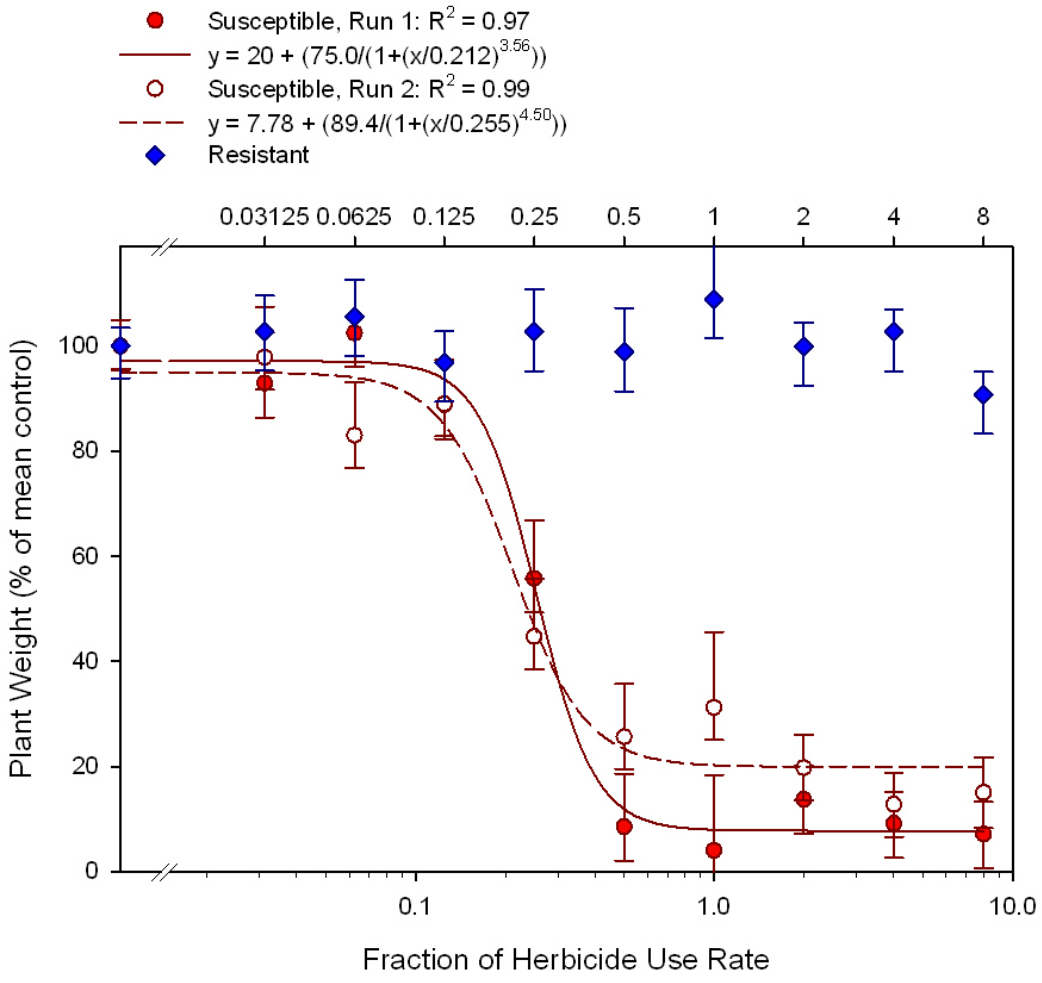

Figure 3-2. Dose response of plant weight to imazapyr for each run of susceptible genotype separately and for resistant genotype with runs combined. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group.

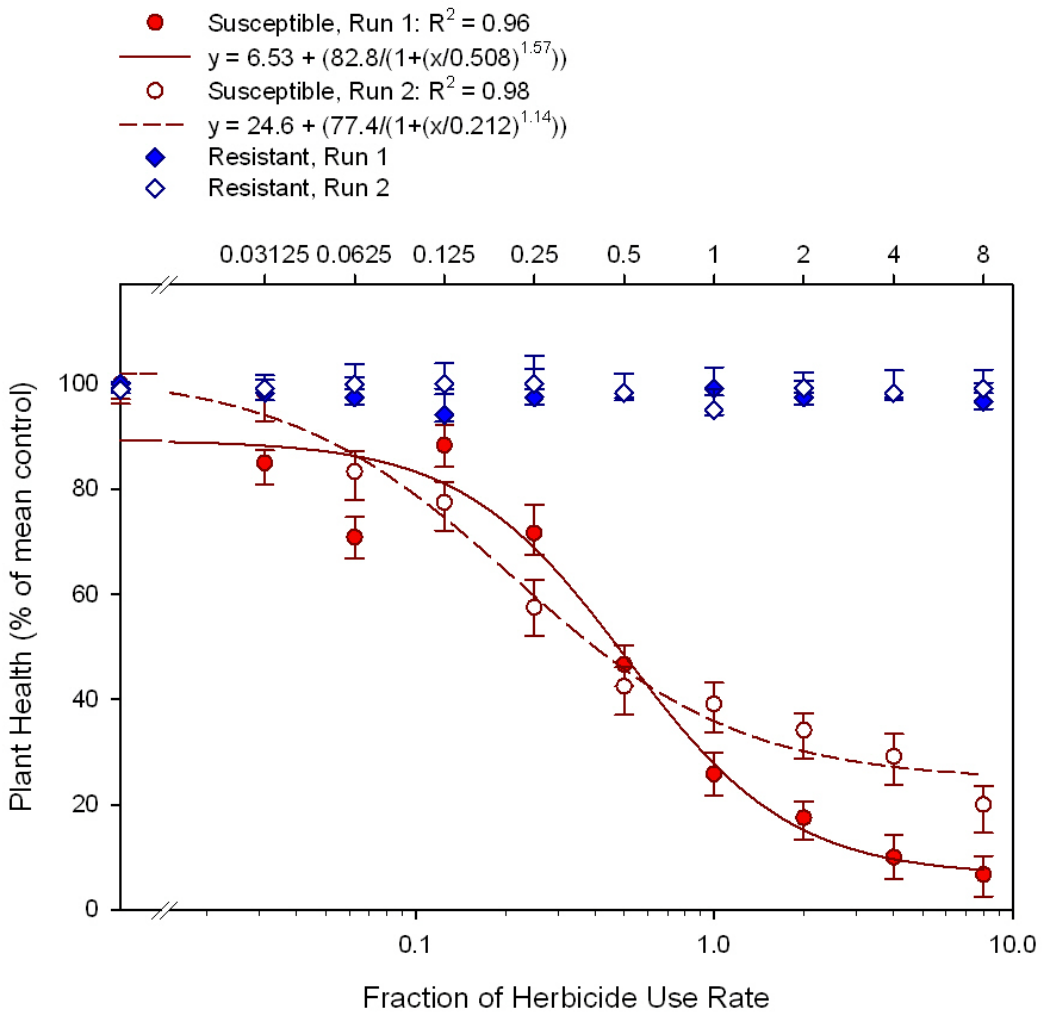

Figure 3-3. Dose response of plant weight to nicosulfuron for each genotype. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group.

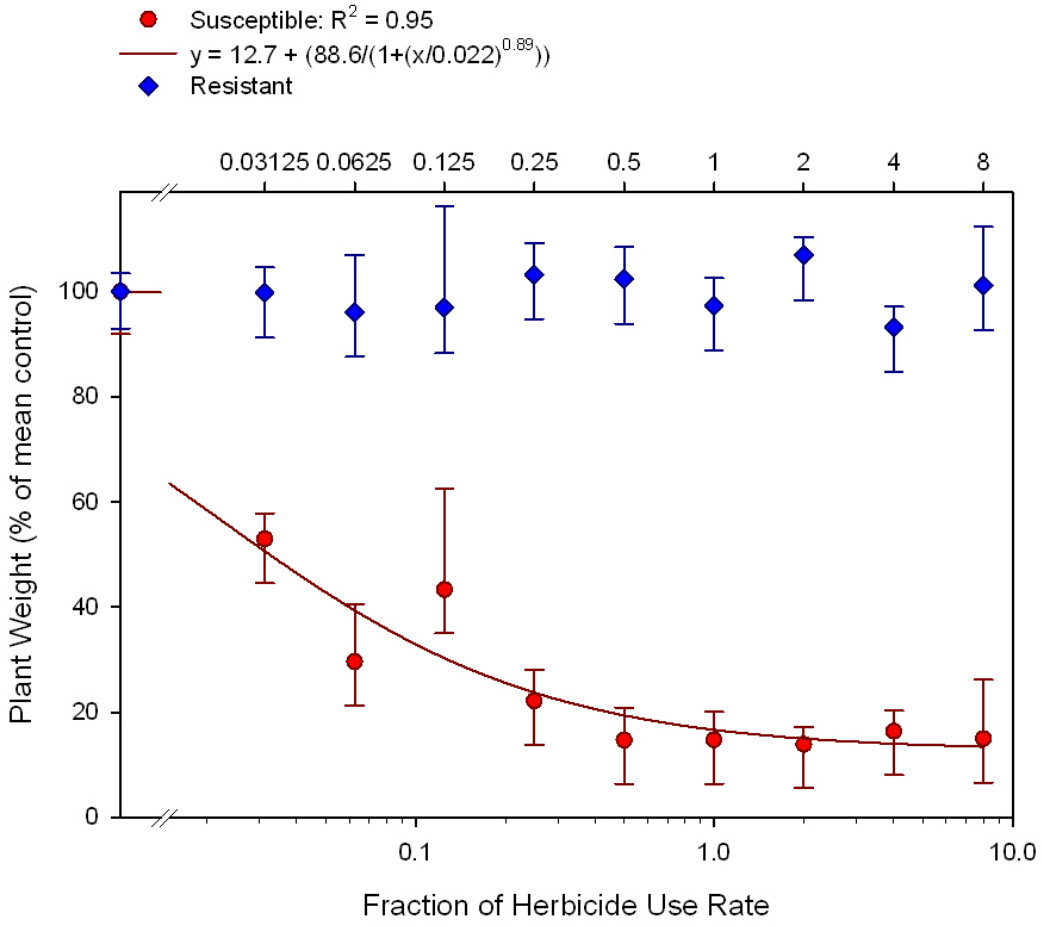

Figure 3-4. Dose response of plant weight to nicosulfuron for each genotype. Zero set to 0.00011 for log-logistic plotting as directed in Seefeldt et al. (1995). Upper error bars are standard errors for variation in means vertically at a given rate. Lower error bars are standard errors for variation in means for a given group.

	ABC	ABc	AbC	Abc	aBC	aBc	abC	abc
ABC	AABBCC	AABBCc	AABbCc	AABbCc	AaBBCC	AaBBCc	AaBbCc	AaBbCc
ABc	AABBCc	AABBcc	AABbCc	AABbcc	AaBBCc	AaBBcc	AaBbCc	AaBbcc
AbC	AABbCC	AABbCc	AAbbCC	AAbbCc	AaBbCC	AaBbCc	AabbCC	AabbCc
Abc	AABbCc	AABbcc	AAbbCc	AAbbcc	AaBbCc	AaBbcc	AabbCc	Aabbcc
aBC	AaBBCC	AaBBCc	AaBbCc	AaBbCc	aaBBCC	aaBBCc	aaBbCc	aaBbCc
aBc	AaBBCc	AaBBcc	AaBbCc	AaBbcc	aaBBCc	aaBBcc	aaBbCc	aaBbcc
abC	AaBbCC	AaBbCc	AabbCC	AabbCc	aaBbCC	aaBbCc	aabbCC	aabbCc
abc	AaBbCc	AaBbcc	AabbCc	Aabbcc	aaBbCc	aaBbcc	aabbCc	aabbcc

Figure 3-5. Three gene Punnett square with resistant (A-B-C-), intermediate (A-bb-- or A---cc), and susceptible (aa----) genotypes indicated by color (green, yellow, and red, respectively).

Table 3-1. Summary of AHAS mutations observed in nature providing resistance to herbicides

Wildtype Residue	Residue Number	Mutant Residue(s)	Provides Resistance	Source
Alanine	122	Threonine	IM	Li et al. (2008)
Proline	197	Alanine, Arginine, Glutamine, Histine, Leucine, Serine, or Threonine	SU	Délye et al. (2009); Guttieri et al. (1995); Kolkman et al. (2004); Yu et al. (2003)
Alanine	205	Valine	IM & SU	Ashigh and Tardif (2009); Kolkman et al. (2004)
Tryptophan	574	Leucine	IM & SU	Patzoldt et al. (2001); Patzoldt and Tranel (2002)
Serine	653	Threonine, Asparagine, or Isoleucine	IM	Laplante et al. (2009)
Glycine	654	Aspartate	IM	Laplante et al. (2009)

Table 3-2. Summary of GLM F-tests for differences of type at nine herbicide rates over two runs

Source	Number of ANOVA Performed for Each Response	Imazapyr		Nicosulfuron	
		Visual	Weight	Visual	Weight
		---------- Number of Significant Test Results (alpha = 0.05) ----------			
Resistant Genotype					
Run	9	0	0	3†	1
Susceptible Genotype					
Run	9	0	2	2	1
Everything					
Run	9	1	0	1	0
Type	9	5†	2	2†	4†
Run*Type	9	0	1	5†	1
Everything, Run 1					
Type	9	-‡	6†	8†	-
Everything, Run 2					
Type	9	-	6†	8†	-

† Considered trends and must be plotted separately.

‡ Secondary tests not performed on herbicide responses without interaction trends

Table 3-3. Chi-square analysis of segregating herbicide resistant F_2 populations

	---------- Number of Plants ----------				---------- P-Value ----------	
	<25% Injury (R†)	25-90% Injury (I)	>90% Injury (S)	Total	1:2 :1 (R:I:S)	27:21:16 (R:I:S)
Imazapyr, 1x	38	36	24	98	0.0043**	0.6907
Imazapyr, 2x	49	23	24	96	< 0.0001**	0.1302
Nicosulfuron, 1x	47	28	21	96	< 0.0001**	0.4051
Nicosulfuron, 2x	36	36	20	92	0.0007**	0.4244
Everything Combined	170	123	89	382	< 0.0001**	0.6152

**: significant at alpha = 0.01

†: R=Resistant Phenotype, I=Intermediate Phenotype, and S= Susceptible Phenotype.

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Appendix A - Supplemental Information for Chapter 2

Appendix A1. Dose Response Study Data

Run	Type	Accession	Plant	Herbicide	Rate	Rep	Net	Control	Percent	Score
1	susceptible	ATx623	ATx623	Sethoxydim	0.0625	1	0.136	0.3455	39.4	95
1	susceptible	ATx623	ATx623	Sethoxydim	0.125	1	0.086	0.3455	24.9	70
1	susceptible	ATx623	ATx623	Sethoxydim	0.5	1	.	.	.	30
1	susceptible	ATx623	ATx623	Sethoxydim	1	1	0.057	0.3455	16.5	10
1	susceptible	ATx623	ATx623	Sethoxydim	2	1	0.074	0.3455	21.4	40
1	susceptible	ATx623	ATx623	Sethoxydim	4	1	0.068	0.3455	19.7	0
1	susceptible	ATx623	ATx623	Quizalofop	0.0625	1	0.048	0.3455	13.9	40
1	susceptible	ATx623	ATx623	Quizalofop	0.125	1	0.054	0.3455	15.6	40
1	susceptible	ATx623	ATx623	Quizalofop	0.25	1	0.04	0.3455	11.6	0
1	susceptible	ATx623	ATx623	Quizalofop	0.5	1	0.066	0.3455	19.1	10
1	susceptible	ATx623	ATx623	Quizalofop	1	1	0.044	0.3455	12.7	20
1	susceptible	ATx623	ATx623	Quizalofop	2	1	0.06	0.3455	17.4	0
1	susceptible	ATx623	ATx623	Quizalofop	4	1	0.08	0.3455	23.2	0
1	susceptible	ATx623	ATx623	Fluazifop	0.0625	1	0.057	0.3455	16.5	30
1	susceptible	ATx623	ATx623	Fluazifop	0.125	1	0.057	0.3455	16.5	30
1	susceptible	ATx623	ATx623	Fluazifop	0.25	1	0.065	0.3455	18.8	40
1	susceptible	ATx623	ATx623	Fluazifop	0.5	1	0.072	0.3455	20.8	40
1	susceptible	ATx623	ATx623	Fluazifop	1	1	0.038	0.3455	11	0
1	susceptible	ATx623	ATx623	Fluazifop	2	1	0.05	0.3455	14.5	40
1	susceptible	ATx623	ATx623	Fluazifop	4	1	0.086	0.3455	24.9	0
1	susceptible	ATx623	ATx623	Clethodim	0.0625	1	0.075	0.3455	21.7	30
1	susceptible	ATx623	ATx623	Clethodim	0.125	1	0.039	0.3455	11.3	0
1	susceptible	ATx623	ATx623	Clethodim	0.5	1	0.087	0.3455	25.2	40
1	susceptible	ATx623	ATx623	Clethodim	1	1	0.05	0.3455	14.5	0
1	susceptible	ATx623	ATx623	Clethodim	2	1	0.053	0.3455	15.3	0
1	susceptible	ATx623	ATx623	Clethodim	4	1	0.067	0.3455	19.4	15
1	susceptible	ATx623	ATx623	Control	0	1	0.243	0.3455	70.3	100
1	susceptible	ATx623	ATx623	Control	0	1	0.448	0.3455	129.7	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.0625	2	0.143	0.2455	58.2	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.125	2	0.085	0.2455	34.6	80
1	susceptible	ATx623	ATx623	Sethoxydim	0.25	2	0.068	0.2455	27.7	80
1	susceptible	ATx623	ATx623	Sethoxydim	0.5	2	0.026	0.2455	10.6	40
1	susceptible	ATx623	ATx623	Sethoxydim	1	2	0.028	0.2455	11.4	40
1	susceptible	ATx623	ATx623	Sethoxydim	2	2	0.022	0.2455	9	0
1	susceptible	ATx623	ATx623	Sethoxydim	4	2	0.018	0.2455	7.3	0
1	susceptible	ATx623	ATx623	Quizalofop	0.0625	2	0.016	0.2455	6.5	35
1	susceptible	ATx623	ATx623	Quizalofop	0.25	2	0.008	0.2455	3.3	0
1	susceptible	ATx623	ATx623	Quizalofop	0.5	2	0.019	0.2455	7.7	0
1	susceptible	ATx623	ATx623	Quizalofop	1	2	0.01	0.2455	4.1	0
1	susceptible	ATx623	ATx623	Quizalofop	2	2	0.015	0.2455	6.1	0
1	susceptible	ATx623	ATx623	Quizalofop	4	2	0.01	0.2455	4.1	0
1	susceptible	ATx623	ATx623	Fluazifop	0.0625	2	0.092	0.2455	37.5	70
1	susceptible	ATx623	ATx623	Fluazifop	0.125	2	0.046	0.2455	18.7	40
1	susceptible	ATx623	ATx623	Fluazifop	0.25	2	0.034	0.2455	13.8	20
1	susceptible	ATx623	ATx623	Fluazifop	0.5	2	0.044	0.2455	17.9	20
1	susceptible	ATx623	ATx623	Fluazifop	1	2	0.005	0.2455	2	0
1	susceptible	ATx623	ATx623	Fluazifop	2	2	0.027	0.2455	11	0
1	susceptible	ATx623	ATx623	Fluazifop	4	2	0.025	0.2455	10.2	.
1	susceptible	ATx623	ATx623	Clethodim	0.0625	2	0.028	0.2455	11.4	5
1	susceptible	ATx623	ATx623	Clethodim	0.125	2	0.008	0.2455	3.3	30
1	susceptible	ATx623	ATx623	Clethodim	0.25	2	0.022	0.2455	9	0
1	susceptible	ATx623	ATx623	Clethodim	0.5	2	0.013	0.2455	5.3	0
1	susceptible	ATx623	ATx623	Clethodim	1	2	0.018	0.2455	7.3	0

1	susceptible	ATx623	ATx623	Clethodim	2	2	0.023	0.2455	9.4	0
1	susceptible	ATx623	ATx623	Clethodim	4	2	.	.	.	0
1	susceptible	ATx623	ATx623	Control	0	2	0.333	0.2455	135.6	.
1	susceptible	ATx623	ATx623	Control	0	2	0.158	0.2455	64.4	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.0625	3	0.195	0.39155	49.8	80
1	susceptible	ATx623	ATx623	Sethoxydim	0.125	3	0.373	0.39155	95.3	80
1	susceptible	ATx623	ATx623	Sethoxydim	0.25	3	0.062	0.39155	15.8	40
1	susceptible	ATx623	ATx623	Sethoxydim	0.5	3	0.102	0.39155	26.1	40
1	susceptible	ATx623	ATx623	Sethoxydim	1	3	0.063	0.39155	16.1	0
1	susceptible	ATx623	ATx623	Sethoxydim	2	3	0.055	0.39155	14	0
1	susceptible	ATx623	ATx623	Sethoxydim	4	3	0.047	0.39155	12	0
1	susceptible	ATx623	ATx623	Quizalofop	0.0625	3	0.057	0.39155	14.6	0
1	susceptible	ATx623	ATx623	Quizalofop	0.125	3	0.06	0.39155	15.3	0
1	susceptible	ATx623	ATx623	Quizalofop	0.25	3	0.038	0.39155	9.7	0
1	susceptible	ATx623	ATx623	Quizalofop	0.5	3	0.076	0.39155	19.4	0
1	susceptible	ATx623	ATx623	Quizalofop	1	3	0.056	0.39155	14.3	0
1	susceptible	ATx623	ATx623	Quizalofop	2	3	0.071	0.39155	18.1	0
1	susceptible	ATx623	ATx623	Quizalofop	4	3	0.056	0.39155	14.3	0
1	susceptible	ATx623	ATx623	Fluazifop	0.0625	3	0.107	0.39155	27.3	40
1	susceptible	ATx623	ATx623	Fluazifop	0.125	3	0.063	0.39155	16.1	30
1	susceptible	ATx623	ATx623	Fluazifop	0.25	3	0.037	0.39155	9.4	0
1	susceptible	ATx623	ATx623	Fluazifop	0.5	3	0.042	0.39155	10.7	.
1	susceptible	ATx623	ATx623	Fluazifop	1	3	0.069	0.39155	17.6	0
1	susceptible	ATx623	ATx623	Fluazifop	2	3	0.049	0.39155	12.5	0
1	susceptible	ATx623	ATx623	Fluazifop	4	3	0.062	0.39155	15.8	0
1	susceptible	ATx623	ATx623	Clethodim	0.0625	3	0.044	0.39155	11.2	0
1	susceptible	ATx623	ATx623	Clethodim	0.125	3	0.084	0.39155	21.5	0
1	susceptible	ATx623	ATx623	Clethodim	0.25	3	0.074	0.39155	18.9	0
1	susceptible	ATx623	ATx623	Clethodim	0.5	3	0.042	0.39155	10.7	10
1	susceptible	ATx623	ATx623	Clethodim	1	3	0.037	0.39155	9.4	0
1	susceptible	ATx623	ATx623	Clethodim	2	3	0.062	0.39155	15.8	0
1	susceptible	ATx623	ATx623	Clethodim	4	3	0.058	0.39155	14.8	0
1	susceptible	ATx623	ATx623	Control	0	3	0.2231	0.39155	57	90
1	susceptible	ATx623	ATx623	Control	0	3	0.56	0.39155	143	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.0625	4	0.299	0.3685	81.1	85
1	susceptible	ATx623	ATx623	Sethoxydim	0.125	4	0.235	0.3685	63.8	80
1	susceptible	ATx623	ATx623	Sethoxydim	0.25	4	0.158	0.3685	42.9	80
1	susceptible	ATx623	ATx623	Sethoxydim	0.5	4	.	.	.	70
1	susceptible	ATx623	ATx623	Sethoxydim	1	4	0.07	0.3685	19	30
1	susceptible	ATx623	ATx623	Sethoxydim	2	4	0.06	0.3685	16.3	0
1	susceptible	ATx623	ATx623	Sethoxydim	4	4	0.044	0.3685	11.9	0
1	susceptible	ATx623	ATx623	Quizalofop	0.0625	4	0.05	0.3685	13.6	0
1	susceptible	ATx623	ATx623	Quizalofop	0.125	4	0.041	0.3685	11.1	35
1	susceptible	ATx623	ATx623	Quizalofop	0.25	4	0.023	0.3685	6.2	0
1	susceptible	ATx623	ATx623	Quizalofop	1	4	0.025	0.3685	6.8	0
1	susceptible	ATx623	ATx623	Quizalofop	2	4	0.039	0.3685	10.6	0
1	susceptible	ATx623	ATx623	Quizalofop	4	4	0.034	0.3685	9.2	0
1	susceptible	ATx623	ATx623	Fluazifop	0.0625	4	0.131	0.3685	35.5	60
1	susceptible	ATx623	ATx623	Fluazifop	0.125	4	0.039	0.3685	10.6	35
1	susceptible	ATx623	ATx623	Fluazifop	0.25	4	0.027	0.3685	7.3	0
1	susceptible	ATx623	ATx623	Fluazifop	0.5	4	0.029	0.3685	7.9	10
1	susceptible	ATx623	ATx623	Fluazifop	1	4	0.046	0.3685	12.5	0
1	susceptible	ATx623	ATx623	Fluazifop	2	4	0.028	0.3685	7.6	0
1	susceptible	ATx623	ATx623	Fluazifop	4	4	0.028	0.3685	7.6	0
1	susceptible	ATx623	ATx623	Clethodim	0.0625	4	0.079	0.3685	21.4	35
1	susceptible	ATx623	ATx623	Clethodim	0.125	4	0.05	0.3685	13.6	40
1	susceptible	ATx623	ATx623	Clethodim	0.25	4	0.045	0.3685	12.2	0
1	susceptible	ATx623	ATx623	Clethodim	0.5	4	0.07	0.3685	19	0
1	susceptible	ATx623	ATx623	Clethodim	1	4	0.051	0.3685	13.8	0
1	susceptible	ATx623	ATx623	Clethodim	2	4	0.04	0.3685	10.9	0
1	susceptible	ATx623	ATx623	Clethodim	4	4	0.041	0.3685	11.1	0
1	susceptible	ATx623	ATx623	Control	0	4	0.345	0.3685	93.6	100

1	susceptible	ATx623	ATx623	Control	0	4	0.392	0.3685	106.4	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.0625	5	0.22	0.1665	132.1	90
1	susceptible	ATx623	ATx623	Sethoxydim	0.125	5	0.122	0.1665	73.3	70
1	susceptible	ATx623	ATx623	Sethoxydim	0.25	5	0.073	0.1665	43.8	40
1	susceptible	ATx623	ATx623	Sethoxydim	0.5	5	0.06	0.1665	36	50
1	susceptible	ATx623	ATx623	Sethoxydim	1	5	0.032	0.1665	19.2	0
1	susceptible	ATx623	ATx623	Sethoxydim	2	5	0.034	0.1665	20.4	0
1	susceptible	ATx623	ATx623	Sethoxydim	4	5	0.035	0.1665	21	0
1	susceptible	ATx623	ATx623	Quizalofop	0.0625	5	0.035	0.1665	21	0
1	susceptible	ATx623	ATx623	Quizalofop	0.25	5	.	.	.	0
1	susceptible	ATx623	ATx623	Quizalofop	0.5	5	0.026	0.1665	15.6	0
1	susceptible	ATx623	ATx623	Quizalofop	1	5	0.036	0.1665	21.6	0
1	susceptible	ATx623	ATx623	Quizalofop	2	5	.	.	.	0
1	susceptible	ATx623	ATx623	Fluazifop	0.0625	5	0.046	0.1665	27.6	40
1	susceptible	ATx623	ATx623	Fluazifop	0.125	5	0.053	0.1665	31.8	20
1	susceptible	ATx623	ATx623	Fluazifop	0.25	5	0.021	0.1665	12.6	5
1	susceptible	ATx623	ATx623	Fluazifop	0.5	5	0.059	0.1665	35.4	0
1	susceptible	ATx623	ATx623	Fluazifop	2	5	0.037	0.1665	22.2	.
1	susceptible	ATx623	ATx623	Fluazifop	4	5	0.039	0.1665	23.4	0
1	susceptible	ATx623	ATx623	Clethodim	0.125	5	0.045	0.1665	27	60
1	susceptible	ATx623	ATx623	Clethodim	0.25	5	0.046	0.1665	27.6	40
1	susceptible	ATx623	ATx623	Clethodim	0.5	5	0.03	0.1665	18	0
1	susceptible	ATx623	ATx623	Clethodim	1	5	0.029	0.1665	17.4	0
1	susceptible	ATx623	ATx623	Clethodim	2	5	0.032	0.1665	19.2	0
1	susceptible	ATx623	ATx623	Clethodim	4	5	0.039	0.1665	23.4	0
1	susceptible	ATx623	ATx623	Control	0	5	0.143	0.1665	85.9	85
1	susceptible	ATx623	ATx623	Control	0	5	0.19	0.1665	114.1	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.0625	8	0.101	0.1265	79.8	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.125	8	0.146	0.1265	115.4	90
1	susceptible	ATx623	ATx623	Sethoxydim	0.25	8	0.037	0.1265	29.2	70
1	susceptible	ATx623	ATx623	Sethoxydim	0.5	8	0.029	0.1265	22.9	60
1	susceptible	ATx623	ATx623	Sethoxydim	1	8	0.018	0.1265	14.2	0
1	susceptible	ATx623	ATx623	Sethoxydim	2	8	0.029	0.1265	22.9	25
1	susceptible	ATx623	ATx623	Sethoxydim	4	8	0.017	0.1265	13.4	0
1	susceptible	ATx623	ATx623	Quizalofop	0.0625	8	0.011	0.1265	8.7	.
1	susceptible	ATx623	ATx623	Quizalofop	0.125	8	0.027	0.1265	21.3	0
1	susceptible	ATx623	ATx623	Quizalofop	0.25	8	0.018	0.1265	14.2	0
1	susceptible	ATx623	ATx623	Quizalofop	0.5	8	0.022	0.1265	17.4	10
1	susceptible	ATx623	ATx623	Quizalofop	1	8	0.017	0.1265	13.4	0
1	susceptible	ATx623	ATx623	Quizalofop	2	8	0.009	0.1265	7.1	0
1	susceptible	ATx623	ATx623	Quizalofop	4	8	0.004	0.1265	3.2	0
1	susceptible	ATx623	ATx623	Fluazifop	0.0625	8	0.022	0.1265	17.4	40
1	susceptible	ATx623	ATx623	Fluazifop	0.125	8	0.024	0.1265	19	.
1	susceptible	ATx623	ATx623	Fluazifop	0.25	8	0.013	0.1265	10.3	30
1	susceptible	ATx623	ATx623	Fluazifop	0.5	8	0.017	0.1265	13.4	0
1	susceptible	ATx623	ATx623	Fluazifop	1	8	0.018	0.1265	14.2	0
1	susceptible	ATx623	ATx623	Fluazifop	2	8	0.014	0.1265	11.1	0
1	susceptible	ATx623	ATx623	Fluazifop	4	8	0.039	0.1265	30.8	0
1	susceptible	ATx623	ATx623	Clethodim	0.0625	8	0.014	0.1265	11.1	30
1	susceptible	ATx623	ATx623	Clethodim	0.125	8	0.036	0.1265	28.5	10
1	susceptible	ATx623	ATx623	Clethodim	0.25	8	0.013	0.1265	10.3	0
1	susceptible	ATx623	ATx623	Clethodim	0.5	8	.	.	.	20
1	susceptible	ATx623	ATx623	Clethodim	0.5	8	0.013	0.1265	10.3	0
1	susceptible	ATx623	ATx623	Clethodim	1	8	0.014	0.1265	11.1	0
1	susceptible	ATx623	ATx623	Clethodim	2	8	0.018	0.1265	14.2	0
1	susceptible	ATx623	ATx623	Clethodim	4	8	0.008	0.1265	6.3	0
1	susceptible	ATx623	ATx623	Control	0	8	0.071	0.1265	56.1	100
1	susceptible	ATx623	ATx623	Control	0	8	0.182	0.1265	143.9	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.0625	9	0.26	0.2955	88	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.125	9	0.299	0.2955	101.2	100
1	susceptible	ATx623	ATx623	Sethoxydim	0.25	9	0.093	0.2955	31.5	80
1	susceptible	ATx623	ATx623	Sethoxydim	0.5	9	0.045	0.2955	15.2	50

1	susceptible	ATx623	ATx623	Sethoxydim	1	9	0.041	0.2955	13.9	10
1	susceptible	ATx623	ATx623	Sethoxydim	2	9	0.016	0.2955	5.4	0
1	susceptible	ATx623	ATx623	Sethoxydim	4	9	0.027	0.2955	9.1	0
1	susceptible	ATx623	ATx623	Quizalofop	0.0625	9	0.015	0.2955	5.1	0
1	susceptible	ATx623	ATx623	Quizalofop	0.125	9	0.015	0.2955	5.1	0
1	susceptible	ATx623	ATx623	Quizalofop	0.25	9	0.034	0.2955	11.5	20
1	susceptible	ATx623	ATx623	Quizalofop	0.5	9	.	.	.	0
1	susceptible	ATx623	ATx623	Quizalofop	1	9	0.012	0.2955	4.1	0
1	susceptible	ATx623	ATx623	Quizalofop	4	9	0.012	0.2955	4.1	0
1	susceptible	ATx623	ATx623	Fluazifop	0.0625	9	0.128	0.2955	43.3	80
1	susceptible	ATx623	ATx623	Fluazifop	0.125	9	.	.	.	40
1	susceptible	ATx623	ATx623	Fluazifop	0.25	9	0.029	0.2955	9.8	40
1	susceptible	ATx623	ATx623	Fluazifop	1	9	0.021	0.2955	7.1	0
1	susceptible	ATx623	ATx623	Fluazifop	2	9	0.04	0.2955	13.5	0
1	susceptible	ATx623	ATx623	Fluazifop	4	9	0.016	0.2955	5.4	0
1	susceptible	ATx623	ATx623	Clethodim	0.0625	9	0.039	0.2955	13.2	30
1	susceptible	ATx623	ATx623	Clethodim	0.125	9	0.032	0.2955	10.8	0
1	susceptible	ATx623	ATx623	Clethodim	0.25	9	0.014	0.2955	4.7	0
1	susceptible	ATx623	ATx623	Clethodim	1	9	0.01	0.2955	3.4	0
1	susceptible	ATx623	ATx623	Clethodim	2	9	0.015	0.2955	5.1	.
1	susceptible	ATx623	ATx623	Clethodim	4	9	0.009	0.2955	3	0
1	susceptible	ATx623	ATx623	Control	0	9	0.269	0.2955	91	100
1	susceptible	ATx623	ATx623	Control	0	9	0.322	0.2955	109	100
1	Resistant	B71	71X	Sethoxydim	0.0625	1	0.235	0.1285	182.9	95
1	Resistant	B71	71X	Sethoxydim	0.125	1	0.164	0.1285	127.6	80
1	Resistant	B71	71X	Sethoxydim	0.25	1	0.117	0.1285	91.1	.
1	Resistant	B71	71X	Sethoxydim	0.5	1	0.064	0.1285	49.8	75
1	Resistant	B71	71X	Sethoxydim	2	1	0.085	0.1285	66.1	30
1	Resistant	B71	71X	Sethoxydim	4	1	0.029	0.1285	22.6	30
1	Resistant	B71	71X	Quizalofop	0.0625	1	0.112	0.1285	87.2	95
1	Resistant	B71	71X	Quizalofop	0.125	1	0.072	0.1285	56	90
1	Resistant	B71	71X	Quizalofop	0.25	1	0.113	0.1285	87.9	90
1	Resistant	B71	71X	Quizalofop	0.5	1	0.156	0.1285	121.4	100
1	Resistant	B71	71X	Quizalofop	1	1	0.371	0.1285	288.7	95
1	Resistant	B71	71X	Quizalofop	2	1	0.08	0.1285	62.3	95
1	Resistant	B71	71X	Quizalofop	4	1	0.107	0.1285	83.3	60
1	Resistant	B71	71X	Fluazifop	0.0625	1	0.207	0.1285	161.1	90
1	Resistant	B71	71X	Fluazifop	0.125	1	0.082	0.1285	63.8	90
1	Resistant	B71	71X	Fluazifop	0.25	1	0.168	0.1285	130.7	90
1	Resistant	B71	71X	Fluazifop	0.5	1	0.205	0.1285	159.5	90
1	Resistant	B71	71X	Fluazifop	1	1	0.114	0.1285	88.7	100
1	Resistant	B71	71X	Fluazifop	2	1	0.215	0.1285	167.3	85
1	Resistant	B71	71X	Fluazifop	4	1	0.102	0.1285	79.4	90
1	Resistant	B71	71X	Clethodim	0.0625	1	0.04	0.1285	31.1	.
1	Resistant	B71	71X	Clethodim	0.25	1	0.025	0.1285	19.5	20
1	Resistant	B71	71X	Clethodim	0.5	1	0.037	0.1285	28.8	0
1	Resistant	B71	71X	Clethodim	1	1	0.03	0.1285	23.3	20
1	Resistant	B71	71X	Clethodim	2	1	0.024	0.1285	18.7	0
1	Resistant	B71	71X	Clethodim	4	1	.	.	.	0
1	Resistant	B71	71X	Control	0	1	0.098	0.1285	76.3	95
1	Resistant	B71	71X	Control	0	1	0.159	0.1285	123.7	95
1	Resistant	B71	71X	Sethoxydim	0.0625	2	0.172	0.118	145.8	100
1	Resistant	B71	71X	Sethoxydim	0.125	2	0.11	0.118	93.2	95
1	Resistant	B71	71X	Sethoxydim	0.25	2	0.078	0.118	66.1	80
1	Resistant	B71	71X	Sethoxydim	0.5	2	0.088	0.118	74.6	.
1	Resistant	B71	71X	Sethoxydim	1	2	0.024	0.118	20.3	.
1	Resistant	B71	71X	Sethoxydim	2	2	0.029	0.118	24.6	.
1	Resistant	B71	71X	Sethoxydim	4	2	0.025	0.118	21.2	40
1	Resistant	B71	71X	Quizalofop	0.0625	2	0.108	0.118	91.5	95
1	Resistant	B71	71X	Quizalofop	0.125	2	0.124	0.118	105.1	100
1	Resistant	B71	71X	Quizalofop	0.25	2	0.111	0.118	94.1	100
1	Resistant	B71	71X	Quizalofop	0.5	2	0.194	0.118	164.4	100

1	Resistant	B71	71X	Quizalofop	1	2	0.18	0.118	152.5	.
1	Resistant	B71	71X	Quizalofop	2	2	0.218	0.118	184.7	.
1	Resistant	B71	71X	Quizalofop	4	2	0.021	0.118	17.8	.
1	Resistant	B71	71X	Fluazifop	0.0625	2	0.212	0.118	179.7	95
1	Resistant	B71	71X	Fluazifop	0.125	2	0.191	0.118	161.9	95
1	Resistant	B71	71X	Fluazifop	0.25	2	0.137	0.118	116.1	90
1	Resistant	B71	71X	Fluazifop	0.5	2	0.172	0.118	145.8	100
1	Resistant	B71	71X	Fluazifop	1	2	0.13	0.118	110.2	100
1	Resistant	B71	71X	Fluazifop	2	2	0.208	0.118	176.3	100
1	Resistant	B71	71X	Fluazifop	4	2	0.054	0.118	45.8	100
1	Resistant	B71	71X	Clethodim	0.0625	2	0.062	0.118	52.5	80
1	Resistant	B71	71X	Clethodim	0.125	2	0.016	0.118	13.6	30
1	Resistant	B71	71X	Clethodim	0.25	2	0.023	0.118	19.5	35
1	Resistant	B71	71X	Clethodim	0.5	2	0.019	0.118	16.1	20
1	Resistant	B71	71X	Clethodim	2	2	0.021	0.118	17.8	0
1	Resistant	B71	71X	Clethodim	4	2	0.035	0.118	29.7	0
1	Resistant	B71	71X	Control	0	2	0.101	0.118	85.6	100
1	Resistant	B71	71X	Control	0	2	0.135	0.118	114.4	100
1	Resistant	B71	71X	Quizalofop	0.0625	3	0.12	0.1865	64.3	90
1	Resistant	B71	71X	Quizalofop	0.125	3	0.082	0.1865	44	90
1	Resistant	B71	71X	Quizalofop	0.25	3	0.13	0.1865	69.7	100
1	Resistant	B71	71X	Quizalofop	0.5	3	0.036	0.1865	19.3	100
1	Resistant	B71	71X	Quizalofop	1	3	0.164	0.1865	87.9	95
1	Resistant	B71	71X	Quizalofop	2	3	0.091	0.1865	48.8	95
1	Resistant	B71	71X	Quizalofop	4	3	0.032	0.1865	17.2	70
1	Resistant	B71	71X	Fluazifop	0.0625	3	0.245	0.1865	131.4	100
1	Resistant	B71	71X	Fluazifop	0.125	3	0.12	0.1865	64.3	95
1	Resistant	B71	71X	Fluazifop	0.25	3	0.203	0.1865	108.8	90
1	Resistant	B71	71X	Fluazifop	0.5	3	0.114	0.1865	61.1	100
1	Resistant	B71	71X	Fluazifop	1	3	0.302	0.1865	161.9	90
1	Resistant	B71	71X	Fluazifop	2	3	0.146	0.1865	78.3	100
1	Resistant	B71	71X	Fluazifop	4	3	0.074	0.1865	39.7	95
1	Resistant	B71	71X	Clethodim	0.0625	3	0.025	0.1865	13.4	60
1	Resistant	B71	71X	Clethodim	0.125	3	0.02	0.1865	10.7	60
1	Resistant	B71	71X	Clethodim	0.25	3	0.013	0.1865	7	40
1	Resistant	B71	71X	Clethodim	0.5	3	0.012	0.1865	6.4	0
1	Resistant	B71	71X	Clethodim	1	3	0.011	0.1865	5.9	0
1	Resistant	B71	71X	Clethodim	2	3	0.017	0.1865	9.1	0
1	Resistant	B71	71X	Clethodim	4	3	0.014	0.1865	7.5	0
1	Resistant	B71	71X	Control	0	3	0.134	0.1865	71.8	100
1	Resistant	B71	71X	Control	0	3	0.239	0.1865	128.2	85
1	Resistant	B71	71W	Sethoxydim	0.0625	1	0.201	0.121	166.1	80
1	Resistant	B71	71W	Sethoxydim	0.125	1	0.233	0.121	192.6	90
1	Resistant	B71	71W	Sethoxydim	0.25	1	0.22	0.121	181.8	80
1	Resistant	B71	71W	Sethoxydim	0.5	1	0.119	0.121	98.3	30
1	Resistant	B71	71W	Sethoxydim	1	1	0.053	0.121	43.8	30
1	Resistant	B71	71W	Sethoxydim	2	1	.	.	.	30
1	Resistant	B71	71W	Sethoxydim	4	1	0.071	0.121	58.7	50
1	Resistant	B71	71W	Quizalofop	0.25	1	0.227	0.121	187.6	95
1	Resistant	B71	71W	Quizalofop	0.5	1	0.3	0.121	247.9	90
1	Resistant	B71	71W	Quizalofop	1	1	0.161	0.121	133.1	95
1	Resistant	B71	71W	Quizalofop	2	1	0.077	0.121	63.6	60
1	Resistant	B71	71W	Quizalofop	4	1	0.062	0.121	51.2	.
1	Resistant	B71	71W	Fluazifop	0.0625	1	0.208	0.121	171.9	95
1	Resistant	B71	71W	Fluazifop	0.125	1	0.161	0.121	133.1	95
1	Resistant	B71	71W	Fluazifop	0.25	1	0.216	0.121	178.5	95
1	Resistant	B71	71W	Fluazifop	0.5	1	0.141	0.121	116.5	90
1	Resistant	B71	71W	Fluazifop	1	1	0.272	0.121	224.8	100
1	Resistant	B71	71W	Fluazifop	2	1	0.216	0.121	178.5	85
1	Resistant	B71	71W	Fluazifop	4	1	0.137	0.121	113.2	80
1	Resistant	B71	71W	Clethodim	0.0625	1	0.069	0.121	57	50
1	Resistant	B71	71W	Clethodim	0.125	1	0.043	0.121	35.5	40

1	Resistant	B71	71W	Clethodim	0.25	1	0.054	0.121	44.6	50
1	Resistant	B71	71W	Clethodim	0.5	1	0.051	0.121	42.1	0
1	Resistant	B71	71W	Clethodim	1	1	0.066	0.121	54.5	0
1	Resistant	B71	71W	Clethodim	2	1	0.048	0.121	39.7	0
1	Resistant	B71	71W	Clethodim	4	1	0.009	0.121	7.4	0
1	Resistant	B71	71W	Control	0	1	0.096	0.121	79.3	95
1	Resistant	B71	71W	Control	0	1	0.146	0.121	120.7	100
1	Resistant	B71	71W	Sethoxydim	0.0625	2	0.327	0.3235	101.1	100
1	Resistant	B71	71W	Sethoxydim	0.125	2	0.235	0.3235	72.6	85
1	Resistant	B71	71W	Sethoxydim	0.25	2	0.128	0.3235	39.6	80
1	Resistant	B71	71W	Sethoxydim	0.5	2	0.223	0.3235	68.9	80
1	Resistant	B71	71W	Sethoxydim	1	2	0.026	0.3235	8	40
1	Resistant	B71	71W	Sethoxydim	2	2	0.03	0.3235	9.3	30
1	Resistant	B71	71W	Sethoxydim	4	2	0.032	0.3235	9.9	30
1	Resistant	B71	71W	Quizalofop	0.0625	2	0.346	0.3235	107	95
1	Resistant	B71	71W	Quizalofop	0.125	2	0.267	0.3235	82.5	100
1	Resistant	B71	71W	Quizalofop	0.25	2	0.212	0.3235	65.5	100
1	Resistant	B71	71W	Quizalofop	0.5	2	0.268	0.3235	82.8	100
1	Resistant	B71	71W	Quizalofop	1	2	0.358	0.3235	110.7	90
1	Resistant	B71	71W	Quizalofop	2	2	0.28	0.3235	86.6	95
1	Resistant	B71	71W	Quizalofop	4	2	0.156	0.3235	48.2	60
1	Resistant	B71	71W	Fluazifop	0.0625	2	0.537	0.3235	166	100
1	Resistant	B71	71W	Fluazifop	0.125	2	0.355	0.3235	109.7	95
1	Resistant	B71	71W	Fluazifop	0.25	2	0.334	0.3235	103.2	90
1	Resistant	B71	71W	Fluazifop	0.5	2	0.315	0.3235	97.4	100
1	Resistant	B71	71W	Fluazifop	1	2	0.256	0.3235	79.1	100
1	Resistant	B71	71W	Fluazifop	2	2	0.281	0.3235	86.9	85
1	Resistant	B71	71W	Fluazifop	4	2	0.154	0.3235	47.6	70
1	Resistant	B71	71W	Clethodim	0.0625	2	0.087	0.3235	26.9	65
1	Resistant	B71	71W	Clethodim	0.125	2	0.056	0.3235	17.3	30
1	Resistant	B71	71W	Clethodim	0.25	2	0.066	0.3235	20.4	50
1	Resistant	B71	71W	Clethodim	0.5	2	0.026	0.3235	8	30
1	Resistant	B71	71W	Clethodim	1	2	0.047	0.3235	14.5	30
1	Resistant	B71	71W	Clethodim	2	2	0.031	0.3235	9.6	0
1	Resistant	B71	71W	Clethodim	4	2	0.017	0.3235	5.3	0
1	Resistant	B71	71W	Control	0	2	0.316	0.3235	97.7	100
1	Resistant	B71	71W	Control	0	2	0.331	0.3235	102.3	100
1	Resistant	B71	71W	Sethoxydim	0.0625	3	0.275	0.159	173	90
1	Resistant	B71	71W	Sethoxydim	0.125	3	0.145	0.159	91.2	80
1	Resistant	B71	71W	Sethoxydim	0.25	3	0.153	0.159	96.2	80
1	Resistant	B71	71W	Sethoxydim	0.5	3	0.099	0.159	62.3	65
1	Resistant	B71	71W	Sethoxydim	1	3	0.03	0.159	18.9	30
1	Resistant	B71	71W	Sethoxydim	2	3	0.027	0.159	17	35
1	Resistant	B71	71W	Sethoxydim	4	3	0.028	0.159	17.6	.
1	Resistant	B71	71W	Quizalofop	0.0625	3	0.308	0.159	193.7	100
1	Resistant	B71	71W	Quizalofop	0.125	3	0.375	0.159	235.8	95
1	Resistant	B71	71W	Quizalofop	0.25	3	0.181	0.159	113.8	95
1	Resistant	B71	71W	Quizalofop	0.5	3	0.442	0.159	278	90
1	Resistant	B71	71W	Quizalofop	1	3	0.297	0.159	186.8	95
1	Resistant	B71	71W	Quizalofop	2	3	0.23	0.159	144.7	90
1	Resistant	B71	71W	Quizalofop	4	3	0.122	0.159	76.7	80
1	Resistant	B71	71W	Fluazifop	0.0625	3	0.297	0.159	186.8	100
1	Resistant	B71	71W	Fluazifop	0.125	3	0.239	0.159	150.3	100
1	Resistant	B71	71W	Fluazifop	0.25	3	0.242	0.159	152.2	90
1	Resistant	B71	71W	Fluazifop	0.5	3	0.283	0.159	178	90
1	Resistant	B71	71W	Fluazifop	1	3	0.341	0.159	214.5	90
1	Resistant	B71	71W	Fluazifop	2	3	0.259	0.159	162.9	95
1	Resistant	B71	71W	Fluazifop	4	3	0.24	0.159	150.9	80
1	Resistant	B71	71W	Clethodim	0.0625	3	0.097	0.159	61	85
1	Resistant	B71	71W	Clethodim	0.125	3	0.05	0.159	31.4	40
1	Resistant	B71	71W	Clethodim	0.25	3	0.041	0.159	25.8	50
1	Resistant	B71	71W	Clethodim	0.5	3	0.07	0.159	44	30

1	Resistant	B71	71W	Clethodim	1	3	0.056	0.159	35.2	10
1	Resistant	B71	71W	Clethodim	2	3	0.02	0.159	12.6	0
1	Resistant	B71	71W	Clethodim	4	3	0.04	0.159	25.2	0
1	Resistant	B71	71W	Control	0	3	0.132	0.159	83	100
1	Resistant	B71	71W	Control	0	3	0.186	0.159	117	75
1	Resistant	B71	71W	Sethoxydim	0.0625	4	0.276	0.3455	79.9	100
1	Resistant	B71	71W	Sethoxydim	0.125	4	0.485	0.3455	140.4	90
1	Resistant	B71	71W	Sethoxydim	0.25	4	0.196	0.3455	56.7	80
1	Resistant	B71	71W	Sethoxydim	0.5	4	0.089	0.3455	25.8	90
1	Resistant	B71	71W	Sethoxydim	1	4	0.046	0.3455	13.3	40
1	Resistant	B71	71W	Sethoxydim	2	4	0.037	0.3455	10.7	40
1	Resistant	B71	71W	Sethoxydim	4	4	0.014	0.3455	4.1	10
1	Resistant	B71	71W	Quizalofop	0.0625	4	0.529	0.3455	153.1	100
1	Resistant	B71	71W	Quizalofop	0.125	4	0.125	0.3455	36.2	90
1	Resistant	B71	71W	Quizalofop	0.25	4	0.547	0.3455	158.3	100
1	Resistant	B71	71W	Quizalofop	0.5	4	0.418	0.3455	121	100
1	Resistant	B71	71W	Quizalofop	1	4	0.133	0.3455	38.5	100
1	Resistant	B71	71W	Quizalofop	2	4	0.206	0.3455	59.6	80
1	Resistant	B71	71W	Quizalofop	4	4	0.056	0.3455	16.2	50
1	Resistant	B71	71W	Fluazifop	0.0625	4	0.374	0.3455	108.2	100
1	Resistant	B71	71W	Fluazifop	0.125	4	0.206	0.3455	59.6	100
1	Resistant	B71	71W	Fluazifop	0.25	4	0.154	0.3455	44.6	100
1	Resistant	B71	71W	Fluazifop	0.5	4	0.449	0.3455	130	90
1	Resistant	B71	71W	Fluazifop	1	4	0.157	0.3455	45.4	100
1	Resistant	B71	71W	Fluazifop	2	4	0.259	0.3455	75	90
1	Resistant	B71	71W	Fluazifop	4	4	0.416	0.3455	120.4	100
1	Resistant	B71	71W	Clethodim	0.0625	4	0.037	0.3455	10.7	40
1	Resistant	B71	71W	Clethodim	0.125	4	0.042	0.3455	12.2	45
1	Resistant	B71	71W	Clethodim	0.25	4	0.075	0.3455	21.7	50
1	Resistant	B71	71W	Clethodim	0.5	4	0.026	0.3455	7.5	10
1	Resistant	B71	71W	Clethodim	2	4	0.02	0.3455	5.8	0
1	Resistant	B71	71W	Clethodim	4	4	0.021	0.3455	6.1	0
1	Resistant	B71	71W	Control	0	4	0.312	0.3455	90.3	100
1	Resistant	B71	71W	Control	0	4	0.379	0.3455	109.7	100
1	Resistant	B71	71W	Quizalofop	0.0625	5	0.033	0.0765	43.1	.
1	Resistant	B71	71W	Quizalofop	0.25	5	0.025	0.0765	32.7	95
1	Resistant	B71	71W	Quizalofop	0.5	5	0.059	0.0765	77.1	100
1	Resistant	B71	71W	Quizalofop	1	5	0.05	0.0765	65.4	100
1	Resistant	B71	71W	Quizalofop	2	5	0.053	0.0765	69.3	90
1	Resistant	B71	71W	Quizalofop	4	5	0.023	0.0765	30.1	60
1	Resistant	B71	71W	Fluazifop	0.0625	5	0.05	0.0765	65.4	95
1	Resistant	B71	71W	Fluazifop	0.125	5	0.364	0.0765	475.8	100
1	Resistant	B71	71W	Fluazifop	0.25	5	0.054	0.0765	70.6	100
1	Resistant	B71	71W	Fluazifop	0.5	5	0.104	0.0765	135.9	95
1	Resistant	B71	71W	Fluazifop	1	5	0.111	0.0765	145.1	95
1	Resistant	B71	71W	Fluazifop	2	5	0.042	0.0765	54.9	90
1	Resistant	B71	71W	Fluazifop	4	5	.	.	.	70
1	Resistant	B71	71W	Control	0	5	0.04	0.0765	52.3	100
1	Resistant	B71	71W	Control	0	5	0.113	0.0765	147.7	100
1	Resistant	B45	45F	Sethoxydim	0.125	1	0.138	0.204	67.6	85
1	Resistant	B45	45F	Sethoxydim	0.25	1	0.164	0.204	80.4	80
1	Resistant	B45	45F	Sethoxydim	0.5	1	0.129	0.204	63.2	60
1	Resistant	B45	45F	Sethoxydim	1	1	0.026	0.204	12.7	40
1	Resistant	B45	45F	Sethoxydim	2	1	0.095	0.204	46.6	40
1	Resistant	B45	45F	Sethoxydim	4	1	0.123	0.204	60.3	40
1	Resistant	B45	45F	Quizalofop	0.0625	1	0.16	0.204	78.4	90
1	Resistant	B45	45F	Quizalofop	0.125	1	0.239	0.204	117.2	.
1	Resistant	B45	45F	Quizalofop	0.125	1	0.211	0.204	103.4	85
1	Resistant	B45	45F	Quizalofop	0.25	1	0.249	0.204	122.1	90
1	Resistant	B45	45F	Quizalofop	0.5	1	0.359	0.204	176	80
1	Resistant	B45	45F	Quizalofop	1	1	0.111	0.204	54.4	100
1	Resistant	B45	45F	Quizalofop	2	1	0.173	0.204	84.8	70

1	Resistant	B45	45F	Quizalofop	4	1	0.066	0.204	32.4	.
1	Resistant	B45	45F	Quizalofop	4	1	0.056	0.204	27.5	40
1	Resistant	B45	45F	Fluazifop	0.0625	1	0.202	0.204	99	95
1	Resistant	B45	45F	Fluazifop	0.125	1	0.206	0.204	101	90
1	Resistant	B45	45F	Fluazifop	0.25	1	0.204	0.204	100	95
1	Resistant	B45	45F	Fluazifop	0.5	1	0.214	0.204	104.9	95
1	Resistant	B45	45F	Fluazifop	1	1	0.253	0.204	124	95
1	Resistant	B45	45F	Fluazifop	2	1	0.138	0.204	67.6	90
1	Resistant	B45	45F	Fluazifop	4	1	0.232	0.204	113.7	80
1	Resistant	B45	45F	Clethodim	0.0625	1	0.074	0.204	36.3	40
1	Resistant	B45	45F	Clethodim	0.125	1	0.063	0.204	30.9	.
1	Resistant	B45	45F	Clethodim	0.125	1	0.036	0.204	17.6	40
1	Resistant	B45	45F	Clethodim	0.25	1	0.06	0.204	29.4	40
1	Resistant	B45	45F	Clethodim	0.5	1	0.073	0.204	35.8	40
1	Resistant	B45	45F	Clethodim	1	1	0.06	0.204	29.4	5
1	Resistant	B45	45F	Clethodim	2	1	0.117	0.204	57.4	0
1	Resistant	B45	45F	Clethodim	4	1	0.055	0.204	27	0
1	Resistant	B45	45F	Control	0	1	0.204	0.204	100	100
1	Resistant	B45	45F	Quizalofop	0.0625	2	0.075	0.241	31.1	100
1	Resistant	B45	45F	Quizalofop	0.125	2	0.224	0.241	92.9	95
1	Resistant	B45	45F	Quizalofop	0.25	2	0.164	0.241	68	100
1	Resistant	B45	45F	Quizalofop	0.5	2	0.086	0.241	35.7	100
1	Resistant	B45	45F	Quizalofop	1	2	0.424	0.241	175.9	95
1	Resistant	B45	45F	Quizalofop	2	2	0.082	0.241	34	50
1	Resistant	B45	45F	Quizalofop	4	2	0.051	0.241	21.2	40
1	Resistant	B45	45F	Fluazifop	0.0625	2	0.158	0.241	65.6	100
1	Resistant	B45	45F	Fluazifop	0.125	2	0.165	0.241	68.5	100
1	Resistant	B45	45F	Fluazifop	0.25	2	0.075	0.241	31.1	100
1	Resistant	B45	45F	Fluazifop	0.5	2	0.354	0.241	146.9	80
1	Resistant	B45	45F	Fluazifop	1	2	0.083	0.241	34.4	100
1	Resistant	B45	45F	Fluazifop	2	2	0.106	0.241	44	100
1	Resistant	B45	45F	Fluazifop	4	2	0.076	0.241	31.5	.
1	Resistant	B45	45F	Control	0	2	0.241	0.241	100	95
1	Resistant	B45	45A	Sethoxydim	0.0625	1	0.125	0.229	54.6	90
1	Resistant	B45	45A	Sethoxydim	0.125	1	0.289	0.229	126.2	90
1	Resistant	B45	45A	Sethoxydim	0.25	1	0.196	0.229	85.6	.
1	Resistant	B45	45A	Sethoxydim	0.25	1	0.127	0.229	55.5	70
1	Resistant	B45	45A	Sethoxydim	0.5	1	0.098	0.229	42.8	50
1	Resistant	B45	45A	Sethoxydim	1	1	0.061	0.229	26.6	30
1	Resistant	B45	45A	Sethoxydim	2	1	0.048	0.229	21	50
1	Resistant	B45	45A	Sethoxydim	4	1	0.051	0.229	22.3	20
1	Resistant	B45	45A	Quizalofop	0.0625	1	0.121	0.229	52.8	90
1	Resistant	B45	45A	Quizalofop	0.125	1	0.137	0.229	59.8	90
1	Resistant	B45	45A	Quizalofop	0.25	1	0.379	0.229	165.5	90
1	Resistant	B45	45A	Quizalofop	0.5	1	0.097	0.229	42.4	.
1	Resistant	B45	45A	Quizalofop	0.5	1	0.065	0.229	28.4	80
1	Resistant	B45	45A	Quizalofop	1	1	0.122	0.229	53.3	90
1	Resistant	B45	45A	Quizalofop	2	1	0.121	0.229	52.8	60
1	Resistant	B45	45A	Quizalofop	4	1	0.086	0.229	37.6	.
1	Resistant	B45	45A	Quizalofop	4	1	0.08	0.229	34.9	40
1	Resistant	B45	45A	Fluazifop	0.0625	1	0.147	0.229	64.2	90
1	Resistant	B45	45A	Fluazifop	0.125	1	0.15	0.229	65.5	100
1	Resistant	B45	45A	Fluazifop	0.25	1	0.174	0.229	76	100
1	Resistant	B45	45A	Fluazifop	0.5	1	0.254	0.229	110.9	90
1	Resistant	B45	45A	Fluazifop	1	1	0.219	0.229	95.6	90
1	Resistant	B45	45A	Fluazifop	2	1	0.246	0.229	107.4	80
1	Resistant	B45	45A	Fluazifop	4	1	0.194	0.229	84.7	85
1	Resistant	B45	45A	Clethodim	0.0625	1	0.08	0.229	34.9	40
1	Resistant	B45	45A	Clethodim	0.125	1	0.054	0.229	23.6	30
1	Resistant	B45	45A	Clethodim	0.25	1	0.046	0.229	20.1	40
1	Resistant	B45	45A	Clethodim	0.5	1	0.103	0.229	45	20
1	Resistant	B45	45A	Clethodim	1	1	.	.	.	10

1	Resistant	B45	45A	Clethodim	2	1	0.028	0.229	12.2	0
1	Resistant	B45	45A	Clethodim	4	1	0.04	0.229	17.5	0
1	Resistant	B45	45A	Control	0	1	0.2	0.229	87.3	95
1	Resistant	B45	45A	Control	0	1	0.258	0.229	112.7	90
1	Resistant	B45	45A	Sethoxydim	0.5	2	0.077	0.2065	37.3	75
1	Resistant	B45	45A	Quizalofop	0.0625	2	0.152	0.2065	73.6	95
1	Resistant	B45	45A	Quizalofop	0.125	2	0.238	0.2065	115.3	95
1	Resistant	B45	45A	Quizalofop	0.25	2	0.157	0.2065	76	100
1	Resistant	B45	45A	Quizalofop	0.5	2	0.127	0.2065	61.5	90
1	Resistant	B45	45A	Quizalofop	1	2	0.18	0.2065	87.2	90
1	Resistant	B45	45A	Quizalofop	2	2	0.181	0.2065	87.7	90
1	Resistant	B45	45A	Quizalofop	4	2	0.021	0.2065	10.2	30
1	Resistant	B45	45A	Fluazifop	0.0625	2	0.206	0.2065	99.8	90
1	Resistant	B45	45A	Fluazifop	0.125	2	0.174	0.2065	84.3	95
1	Resistant	B45	45A	Fluazifop	0.25	2	0.285	0.2065	138	90
1	Resistant	B45	45A	Fluazifop	0.5	2	0.231	0.2065	111.9	95
1	Resistant	B45	45A	Fluazifop	1	2	0.199	0.2065	96.4	95
1	Resistant	B45	45A	Fluazifop	2	2	0.057	0.2065	27.6	90
1	Resistant	B45	45A	Fluazifop	4	2	0.058	0.2065	28.1	85
1	Resistant	B45	45A	Clethodim	0.0625	2	0.034	0.2065	16.5	.
1	Resistant	B45	45A	Clethodim	0.125	2	0.056	0.2065	27.1	50
1	Resistant	B45	45A	Clethodim	0.25	2	0.036	0.2065	17.4	30
1	Resistant	B45	45A	Clethodim	0.5	2	0.035	0.2065	16.9	20
1	Resistant	B45	45A	Clethodim	1	2	0.039	0.2065	18.9	20
1	Resistant	B45	45A	Clethodim	2	2	0.033	0.2065	16	10
1	Resistant	B45	45A	Clethodim	4	2	0.016	0.2065	7.7	0
1	Resistant	B45	45A	Control	0	2	0.113	0.2065	54.7	95
1	Resistant	B45	45A	Control	0	2	0.3	0.2065	145.3	100
1	Resistant	B45	45A	Quizalofop	0.125	3	0.305	0.291	104.8	95
1	Resistant	B45	45A	Quizalofop	0.5	3	.	.	.	85
1	Resistant	B45	45A	Quizalofop	2	3	0.117	0.291	40.2	65
1	Resistant	B45	45A	Fluazifop	0.0625	3	0.567	0.291	194.8	75
1	Resistant	B15	15F	Sethoxydim	4	1	0.107	0.2815	38	.
1	Resistant	B15	15F	Quizalofop	0.125	1	0.26	0.2815	92.4	90
1	Resistant	B15	15F	Quizalofop	0.25	1	0.275	0.2815	97.7	95
1	Resistant	B15	15F	Quizalofop	0.5	1	0.307	0.2815	109.1	90
1	Resistant	B15	15F	Quizalofop	1	1	0.321	0.2815	114	90
1	Resistant	B15	15F	Quizalofop	2	1	0.138	0.2815	49	70
1	Resistant	B15	15F	Fluazifop	0.125	1	0.354	0.2815	125.8	90
1	Resistant	B15	15F	Fluazifop	0.25	1	0.421	0.2815	149.6	90
1	Resistant	B15	15F	Fluazifop	0.5	1	0.256	0.2815	90.9	95
1	Resistant	B15	15F	Fluazifop	1	1	0.406	0.2815	144.2	90
1	Resistant	B15	15F	Fluazifop	2	1	0.332	0.2815	117.9	85
1	Resistant	B15	15F	Fluazifop	4	1	0.238	0.2815	84.5	85
1	Resistant	B15	15F	Clethodim	0.0625	1	0.068	0.2815	24.2	30
1	Resistant	B15	15F	Clethodim	0.125	1	0.086	0.2815	30.6	40
1	Resistant	B15	15F	Clethodim	0.25	1	0.106	0.2815	37.7	40
1	Resistant	B15	15F	Clethodim	0.5	1	0.125	0.2815	44.4	20
1	Resistant	B15	15F	Clethodim	4	1	0.07	0.2815	24.9	0
1	Resistant	B15	15F	Control	0	1	0.257	0.2815	91.3	90
1	Resistant	B15	15F	Control	0	1	0.306	0.2815	108.7	95
1	Resistant	B15	15F	Sethoxydim	0.0625	2	0.512	0.384	133.3	100
1	Resistant	B15	15F	Sethoxydim	0.125	2	0.299	0.384	77.9	95
1	Resistant	B15	15F	Sethoxydim	0.25	2	0.202	0.384	52.6	85
1	Resistant	B15	15F	Sethoxydim	0.5	2	0.178	0.384	46.4	70
1	Resistant	B15	15F	Sethoxydim	1	2	0.101	0.384	26.3	90
1	Resistant	B15	15F	Sethoxydim	2	2	0.051	0.384	13.3	50
1	Resistant	B15	15F	Sethoxydim	4	2	0.079	0.384	20.6	30
1	Resistant	B15	15F	Quizalofop	0.0625	2	0.56	0.384	145.8	85
1	Resistant	B15	15F	Quizalofop	0.125	2	0.116	0.384	30.2	100
1	Resistant	B15	15F	Quizalofop	0.25	2	0.331	0.384	86.2	85
1	Resistant	B15	15F	Quizalofop	0.5	2	0.371	0.384	96.6	90

1	Resistant	B15	15F	Quizalofop	1	2	0.298	0.384	77.6	95
1	Resistant	B15	15F	Quizalofop	2	2	0.293	0.384	76.3	75
1	Resistant	B15	15F	Quizalofop	4	2	0.083	0.384	21.6	65
1	Resistant	B15	15F	Fluazifop	0.0625	2	0.416	0.384	108.3	90
1	Resistant	B15	15F	Fluazifop	0.125	2	0.195	0.384	50.8	95
1	Resistant	B15	15F	Fluazifop	0.25	2	0.26	0.384	67.7	95
1	Resistant	B15	15F	Fluazifop	0.5	2	0.503	0.384	131	90
1	Resistant	B15	15F	Fluazifop	1	2	0.378	0.384	98.4	85
1	Resistant	B15	15F	Fluazifop	2	2	0.421	0.384	109.6	90
1	Resistant	B15	15F	Fluazifop	4	2	.	.	.	85
1	Resistant	B15	15F	Clethodim	0.0625	2	0.082	0.384	21.4	80
1	Resistant	B15	15F	Clethodim	0.125	2	0.119	0.384	31	35
1	Resistant	B15	15F	Clethodim	0.25	2	0.057	0.384	14.8	35
1	Resistant	B15	15F	Clethodim	0.5	2	0.056	0.384	14.6	10
1	Resistant	B15	15F	Clethodim	1	2	0.069	0.384	18	0
1	Resistant	B15	15F	Clethodim	2	2	0.05	0.384	13	0
1	Resistant	B15	15F	Clethodim	4	2	0.047	0.384	12.2	0
1	Resistant	B15	15F	Control	0	2	0.375	0.384	97.7	95
1	Resistant	B15	15F	Control	0	2	0.393	0.384	102.3	95
1	Resistant	B15	15F	Sethoxydim	0.0625	3	.	.	.	100
1	Resistant	B15	15F	Sethoxydim	0.125	3	0.389	0.291	133.7	80
1	Resistant	B15	15F	Sethoxydim	0.25	3	0.34	0.291	116.8	80
1	Resistant	B15	15F	Sethoxydim	1	3	0.052	0.291	17.9	40
1	Resistant	B15	15F	Sethoxydim	2	3	0.038	0.291	13.1	40
1	Resistant	B15	15F	Sethoxydim	4	3	0.078	0.291	26.8	20
1	Resistant	B15	15F	Quizalofop	0.0625	3	0.246	0.291	84.5	95
1	Resistant	B15	15F	Quizalofop	0.25	3	0.526	0.291	180.8	95
1	Resistant	B15	15F	Quizalofop	1	3	0.304	0.291	104.5	95
1	Resistant	B15	15F	Quizalofop	4	3	0.089	0.291	30.6	60
1	Resistant	B15	15F	Fluazifop	0.125	3	0.333	0.291	114.4	95
1	Resistant	B15	15F	Fluazifop	0.25	3	0.333	0.291	114.4	95
1	Resistant	B15	15F	Fluazifop	0.5	3	0.365	0.291	125.4	100
1	Resistant	B15	15F	Fluazifop	1	3	0.342	0.291	117.5	95
1	Resistant	B15	15F	Fluazifop	2	3	0.405	0.291	139.2	80
1	Resistant	B15	15F	Fluazifop	4	3	0.305	0.291	104.8	75
1	Resistant	B15	15F	Clethodim	0.0625	3	0.244	0.291	83.8	60
1	Resistant	B15	15F	Clethodim	0.125	3	0.01	0.291	3.4	30
1	Resistant	B15	15F	Clethodim	0.25	3	0.013	0.291	4.5	0
1	Resistant	B15	15F	Clethodim	0.5	3	0.019	0.291	6.5	0
1	Resistant	B15	15F	Clethodim	1	3	0.036	0.291	12.4	0
1	Resistant	B15	15F	Clethodim	2	3	0.028	0.291	9.6	0
1	Resistant	B15	15F	Clethodim	4	3	0.021	0.291	7.2	0
1	Resistant	B15	15F	Control	0	3	0.222	0.291	76.3	95
1	Resistant	B15	15F	Control	0	3	0.36	0.291	123.7	95
1	Resistant	B15	15A	Sethoxydim	0.0625	1	0.429	0.484	88.6	.
1	Resistant	B15	15A	Sethoxydim	0.0625	1	0.262	0.484	54.1	95
1	Resistant	B15	15A	Sethoxydim	0.125	1	0.277	0.484	57.2	.
1	Resistant	B15	15A	Sethoxydim	0.125	1	0.147	0.484	30.4	80
1	Resistant	B15	15A	Sethoxydim	0.25	1	0.227	0.484	46.9	70
1	Resistant	B15	15A	Sethoxydim	0.5	1	0.268	0.484	55.4	.
1	Resistant	B15	15A	Sethoxydim	0.5	1	0.159	0.484	32.9	60
1	Resistant	B15	15A	Sethoxydim	1	1	0.098	0.484	20.2	.
1	Resistant	B15	15A	Sethoxydim	1	1	0.09	0.484	18.6	40
1	Resistant	B15	15A	Sethoxydim	2	1	.	.	.	60
1	Resistant	B15	15A	Sethoxydim	4	1	0.057	0.484	11.8	.
1	Resistant	B15	15A	Quizalofop	0.0625	1	0.445	0.484	91.9	.
1	Resistant	B15	15A	Quizalofop	0.0625	1	0.392	0.484	81	100
1	Resistant	B15	15A	Quizalofop	0.125	1	0.507	0.484	104.8	.
1	Resistant	B15	15A	Quizalofop	0.25	1	0.481	0.484	99.4	85
1	Resistant	B15	15A	Quizalofop	0.5	1	0.359	0.484	74.2	97
1	Resistant	B15	15A	Quizalofop	1	1	0.39	0.484	80.6	95
1	Resistant	B15	15A	Quizalofop	2	1	0.293	0.484	60.5	80

1	Resistant	B15	15A	Quizalofop	4	1	0.162	0.484	33.5	50
1	Resistant	B15	15A	Fluazifop	0.0625	1	0.404	0.484	83.5	.
1	Resistant	B15	15A	Fluazifop	0.0625	1	0.326	0.484	67.4	100
1	Resistant	B15	15A	Fluazifop	0.125	1	0.536	0.484	110.7	100
1	Resistant	B15	15A	Fluazifop	0.25	1	0.215	0.484	44.4	100
1	Resistant	B15	15A	Fluazifop	0.5	1	0.627	0.484	129.5	100
1	Resistant	B15	15A	Fluazifop	1	1	0.511	0.484	105.6	95
1	Resistant	B15	15A	Fluazifop	2	1	0.309	0.484	63.8	80
1	Resistant	B15	15A	Fluazifop	4	1	0.27	0.484	55.8	70
1	Resistant	B15	15A	Clethodim	0.0625	1	0.183	0.484	37.8	70
1	Resistant	B15	15A	Clethodim	0.125	1	0.232	0.484	47.9	40
1	Resistant	B15	15A	Clethodim	0.25	1	0.098	0.484	20.2	40
1	Resistant	B15	15A	Clethodim	0.5	1	0.109	0.484	22.5	10
1	Resistant	B15	15A	Clethodim	1	1	0.084	0.484	17.4	5
1	Resistant	B15	15A	Clethodim	2	1	0.106	0.484	21.9	.
1	Resistant	B15	15A	Clethodim	2	1	0.051	0.484	10.5	0
1	Resistant	B15	15A	Clethodim	4	1	0.091	0.484	18.8	0
1	Resistant	B15	15A	Control	0	1	0.391	0.484	80.8	100
1	Resistant	B15	15A	Control	0	1	0.577	0.484	119.2	100
1	Resistant	B15	15A	Quizalofop	0.0625	2	0.466	0.1505	309.6	100
1	Resistant	B15	15A	Quizalofop	0.125	2	0.046	0.1505	30.6	100
1	Resistant	B15	15A	Quizalofop	0.25	2	0.053	0.1505	35.2	100
1	Resistant	B15	15A	Quizalofop	0.5	2	0.342	0.1505	227.2	100
1	Resistant	B15	15A	Quizalofop	1	2	0.373	0.1505	247.8	100
1	Resistant	B15	15A	Quizalofop	2	2	0.368	0.1505	244.5	100
1	Resistant	B15	15A	Quizalofop	4	2	0.071	0.1505	47.2	65
1	Resistant	B15	15A	Fluazifop	0.0625	2	0.278	0.1505	184.7	90
1	Resistant	B15	15A	Fluazifop	0.125	2	0.209	0.1505	138.9	100
1	Resistant	B15	15A	Fluazifop	0.25	2	0.322	0.1505	214	100
1	Resistant	B15	15A	Fluazifop	0.5	2	0.183	0.1505	121.6	95
1	Resistant	B15	15A	Fluazifop	1	2	0.296	0.1505	196.7	80
1	Resistant	B15	15A	Fluazifop	2	2	0.125	0.1505	83.1	90
1	Resistant	B15	15A	Fluazifop	4	2	0.07	0.1505	46.5	80
1	Resistant	B15	15A	Clethodim	0.0625	2	0.03	0.1505	19.9	50
1	Resistant	B15	15A	Clethodim	0.125	2	0.015	0.1505	10	30
1	Resistant	B15	15A	Clethodim	0.25	2	0.029	0.1505	19.3	35
1	Resistant	B15	15A	Clethodim	0.5	2	0.014	0.1505	9.3	0
1	Resistant	B15	15A	Clethodim	1	2	0.044	0.1505	29.2	0
1	Resistant	B15	15A	Clethodim	2	2	0.09	0.1505	59.8	0
1	Resistant	B15	15A	Clethodim	4	2	0.042	0.1505	27.9	0
1	Resistant	B15	15A	Control	0	2	0.124	0.1505	82.4	100
1	Resistant	B15	15A	Control	0	2	0.177	0.1505	117.6	100
1	Resistant	B71	715	Quizalofop	0.0625	2	0.206	0.073	282.2	100
1	Resistant	B71	715	Quizalofop	0.125	2	0.042	0.073	57.5	.
1	Resistant	B71	715	Quizalofop	0.125	2	0.033	0.073	45.2	75
1	Resistant	B71	715	Quizalofop	0.25	2	0.125	0.073	171.2	100
1	Resistant	B71	715	Quizalofop	0.5	2	0.111	0.073	152.1	70
1	Resistant	B71	715	Quizalofop	1	2	0.162	0.073	221.9	100
1	Resistant	B71	715	Quizalofop	2	2	0.111	0.073	152.1	100
1	Resistant	B71	715	Quizalofop	4	2	0.025	0.073	34.2	60
1	Resistant	B71	715	Fluazifop	0.0625	2	0.19	0.073	260.3	90
1	Resistant	B71	715	Fluazifop	0.125	2	0.05	0.073	68.5	75
1	Resistant	B71	715	Fluazifop	0.25	2	0.153	0.073	209.6	70
1	Resistant	B71	715	Fluazifop	0.5	2	0.044	0.073	60.3	100
1	Resistant	B71	715	Fluazifop	1	2	0.101	0.073	138.4	100
1	Resistant	B71	715	Fluazifop	2	2	0.051	0.073	69.9	90
1	Resistant	B71	715	Fluazifop	4	2	0.131	0.073	179.5	90
1	Resistant	B71	715	Clethodim	0.0625	2	0.045	0.073	61.6	60
1	Resistant	B71	715	Clethodim	0.125	2	0.015	0.073	20.5	40
1	Resistant	B71	715	Clethodim	0.25	2	0.006	0.073	8.2	20
1	Resistant	B71	715	Clethodim	0.5	2	0.006	0.073	8.2	30
1	Resistant	B71	715	Clethodim	1	2	.	.	.	0

1	Resistant	B71	715	Clethodim	4	2	0.011	0.073	15.1	0
1	Resistant	B71	715	Control	0	2	.	.	.	100
1	Resistant	B71	715	Control	0	2	0.073	0.073	100	100
1	Resistant	B71	714	Sethoxydim	0.0625	1	0.129	0.138	93.5	95
1	Resistant	B71	714	Sethoxydim	0.125	1	0.201	0.138	145.7	100
1	Resistant	B71	714	Sethoxydim	0.5	1	0.095	0.138	68.8	50
1	Resistant	B71	714	Sethoxydim	1	1	.	.	.	20
1	Resistant	B71	714	Sethoxydim	2	1	0.037	0.138	26.8	.
1	Resistant	B71	714	Sethoxydim	4	1	0.018	0.138	13	40
1	Resistant	B71	714	Quizalofop	0.0625	1	0.241	0.138	174.6	95
1	Resistant	B71	714	Quizalofop	0.125	1	0.167	0.138	121	95
1	Resistant	B71	714	Quizalofop	0.25	1	0.117	0.138	84.8	95
1	Resistant	B71	714	Quizalofop	0.5	1	0.049	0.138	35.5	90
1	Resistant	B71	714	Quizalofop	1	1	.	.	.	90
1	Resistant	B71	714	Quizalofop	2	1	0.094	0.138	68.1	70
1	Resistant	B71	714	Quizalofop	4	1	0.064	0.138	46.4	70
1	Resistant	B71	714	Fluazifop	0.0625	1	0.071	0.138	51.4	70
1	Resistant	B71	714	Fluazifop	0.125	1	0.181	0.138	131.2	85
1	Resistant	B71	714	Fluazifop	0.25	1	0.191	0.138	138.4	90
1	Resistant	B71	714	Fluazifop	0.5	1	0.174	0.138	126.1	100
1	Resistant	B71	714	Fluazifop	1	1	.	.	.	90
1	Resistant	B71	714	Fluazifop	2	1	0.138	0.138	100	95
1	Resistant	B71	714	Fluazifop	4	1	0.082	0.138	59.4	85
1	Resistant	B71	714	Clethodim	0.0625	1	.	.	.	40
1	Resistant	B71	714	Clethodim	0.125	1	0.042	0.138	30.4	30
1	Resistant	B71	714	Clethodim	0.25	1	0.037	0.138	26.8	30
1	Resistant	B71	714	Clethodim	0.5	1	0.036	0.138	26.1	20
1	Resistant	B71	714	Clethodim	1	1	0.046	0.138	33.3	20
1	Resistant	B71	714	Clethodim	2	1	0.048	0.138	34.8	10
1	Resistant	B71	714	Clethodim	4	1	0.032	0.138	23.2	0
1	Resistant	B71	714	Control	0	1	0.108	0.138	78.3	100
1	Resistant	B71	714	Control	0	1	0.168	0.138	121.7	90
1	Resistant	B71	714	Sethoxydim	1	2	0.007	0.0615	11.4	.
1	Resistant	B71	714	Quizalofop	0.0625	2	0.091	0.0615	148	100
1	Resistant	B71	714	Quizalofop	0.125	2	0.058	0.0615	94.3	95
1	Resistant	B71	714	Quizalofop	0.25	2	0.123	0.0615	200	100
1	Resistant	B71	714	Quizalofop	0.5	2	0.094	0.0615	152.8	95
1	Resistant	B71	714	Quizalofop	1	2	0.068	0.0615	110.6	100
1	Resistant	B71	714	Quizalofop	2	2	0.144	0.0615	234.1	100
1	Resistant	B71	714	Quizalofop	4	2	0.025	0.0615	40.7	60
1	Resistant	B71	714	Fluazifop	0.0625	2	0.101	0.0615	164.2	100
1	Resistant	B71	714	Fluazifop	0.125	2	0.116	0.0615	188.6	100
1	Resistant	B71	714	Fluazifop	0.25	2	.	.	.	95
1	Resistant	B71	714	Fluazifop	0.5	2	0.06	0.0615	97.6	100
1	Resistant	B71	714	Fluazifop	1	2	0.13	0.0615	211.4	100
1	Resistant	B71	714	Fluazifop	2	2	0.194	0.0615	315.4	100
1	Resistant	B71	714	Fluazifop	4	2	0.039	0.0615	63.4	95
1	Resistant	B71	714	Clethodim	0.0625	2	0.044	0.0615	71.5	50
1	Resistant	B71	714	Clethodim	0.125	2	0.015	0.0615	24.4	50
1	Resistant	B71	714	Clethodim	0.5	2	0.003	0.0615	4.9	10
1	Resistant	B71	714	Clethodim	1	2	0.023	0.0615	37.4	20
1	Resistant	B71	714	Clethodim	2	2	0.019	0.0615	30.9	15
1	Resistant	B71	714	Clethodim	4	2	0.011	0.0615	17.9	10
1	Resistant	B71	714	Control	0	2	0.038	0.0615	61.8	100
1	Resistant	B71	714	Control	0	2	0.085	0.0615	138.2	100
1	Resistant	B45	628	Sethoxydim	0.0625	1	0.13	0.2275	57.1	85
1	Resistant	B45	628	Sethoxydim	0.125	1	0.134	0.2275	58.9	75
1	Resistant	B45	628	Sethoxydim	0.25	1	0.168	0.2275	73.8	80
1	Resistant	B45	628	Sethoxydim	0.5	1	0.108	0.2275	47.5	70
1	Resistant	B45	628	Sethoxydim	1	1	0.048	0.2275	21.1	30
1	Resistant	B45	628	Sethoxydim	2	1	0.037	0.2275	16.3	20
1	Resistant	B45	628	Sethoxydim	4	1	0.046	0.2275	20.2	.

1	Resistant	B45	628	Quizalofop	0.0625	1	0.201	0.2275	88.4	100
1	Resistant	B45	628	Quizalofop	0.125	1	0.302	0.2275	132.7	70
1	Resistant	B45	628	Quizalofop	0.25	1	0.284	0.2275	124.8	95
1	Resistant	B45	628	Quizalofop	0.5	1	0.237	0.2275	104.2	100
1	Resistant	B45	628	Quizalofop	2	1	0.107	0.2275	47	70
1	Resistant	B45	628	Quizalofop	4	1	.	.	.	20
1	Resistant	B45	628	Fluazifop	0.0625	1	0.225	0.2275	98.9	.
1	Resistant	B45	628	Fluazifop	0.125	1	0.193	0.2275	84.8	95
1	Resistant	B45	628	Fluazifop	0.25	1	0.339	0.2275	149	95
1	Resistant	B45	628	Fluazifop	0.5	1	0.154	0.2275	67.7	95
1	Resistant	B45	628	Fluazifop	1	1	0.207	0.2275	91	95
1	Resistant	B45	628	Fluazifop	2	1	0.179	0.2275	78.7	90
1	Resistant	B45	628	Fluazifop	4	1	0.218	0.2275	95.8	85
1	Resistant	B45	628	Clethodim	0.0625	1	0.097	0.2275	42.6	40
1	Resistant	B45	628	Clethodim	0.25	1	0.068	0.2275	29.9	40
1	Resistant	B45	628	Clethodim	0.5	1	0.083	0.2275	36.5	40
1	Resistant	B45	628	Clethodim	1	1	0.06	0.2275	26.4	20
1	Resistant	B45	628	Clethodim	2	1	0.077	0.2275	33.8	5
1	Resistant	B45	628	Clethodim	4	1	0.076	0.2275	33.4	10
1	Resistant	B45	628	Control	0	1	0.216	0.2275	94.9	100
1	Resistant	B45	628	Control	0	1	0.239	0.2275	105.1	95
1	Resistant	B45	628	Fluazifop	0.0625	2	.	.	.	95
1	Resistant	B45	628	Fluazifop	0.125	2	.	.	.	100
1	Resistant	B45	628	Fluazifop	0.25	2	.	.	.	100
1	Resistant	B45	628	Fluazifop	0.5	2	.	.	.	100
1	Resistant	B45	628	Fluazifop	1	2	.	.	.	85
1	Resistant	B45	628	Fluazifop	2	2	.	.	.	80
1	Resistant	B45	628	Control	0	2	.	.	.	100
1	Resistant	B45	628	Control	0	2	.	.	.	100
1	Resistant	B15	610	Sethoxydim	0.0625	1	0.325	0.283	114.8	95
1	Resistant	B15	610	Sethoxydim	0.125	1	0.253	0.283	89.4	85
1	Resistant	B15	610	Sethoxydim	0.25	1	0.26	0.283	91.9	80
1	Resistant	B15	610	Sethoxydim	0.5	1	0.269	0.283	95.1	65
1	Resistant	B15	610	Sethoxydim	1	1	0.089	0.283	31.4	.
1	Resistant	B15	610	Sethoxydim	2	1	0.083	0.283	29.3	40
1	Resistant	B15	610	Sethoxydim	4	1	0.072	0.283	25.4	40
1	Resistant	B15	610	Quizalofop	0.0625	1	0.401	0.283	141.7	90
1	Resistant	B15	610	Quizalofop	0.125	1	0.344	0.283	121.6	90
1	Resistant	B15	610	Quizalofop	0.25	1	0.39	0.283	137.8	90
1	Resistant	B15	610	Quizalofop	0.5	1	0.294	0.283	103.9	90
1	Resistant	B15	610	Quizalofop	1	1	0.26	0.283	91.9	75
1	Resistant	B15	610	Quizalofop	2	1	0.245	0.283	86.6	65
1	Resistant	B15	610	Quizalofop	4	1	0.129	0.283	45.6	40
1	Resistant	B15	610	Fluazifop	0.0625	1	0.371	0.283	131.1	85
1	Resistant	B15	610	Fluazifop	0.125	1	0.417	0.283	147.3	90
1	Resistant	B15	610	Fluazifop	0.25	1	0.223	0.283	78.8	95
1	Resistant	B15	610	Fluazifop	0.5	1	0.324	0.283	114.5	85
1	Resistant	B15	610	Fluazifop	1	1	0.299	0.283	105.7	95
1	Resistant	B15	610	Fluazifop	2	1	0.265	0.283	93.6	80
1	Resistant	B15	610	Fluazifop	4	1	0.268	0.283	94.7	65
1	Resistant	B15	610	Clethodim	0.0625	1	0.106	0.283	37.5	90
1	Resistant	B15	610	Clethodim	0.125	1	0.098	0.283	34.6	30
1	Resistant	B15	610	Clethodim	0.25	1	0.064	0.283	22.6	40
1	Resistant	B15	610	Clethodim	0.5	1	0.125	0.283	44.2	45
1	Resistant	B15	610	Clethodim	1	1	0.059	0.283	20.8	0
1	Resistant	B15	610	Clethodim	2	1	0.092	0.283	32.5	0
1	Resistant	B15	610	Clethodim	4	1	0.1	0.283	35.3	5
1	Resistant	B15	610	Control	0	1	0.228	0.283	80.6	85
1	Resistant	B15	610	Control	0	1	0.338	0.283	119.4	90
1	Resistant	B15	610	Sethoxydim	0.0625	2	0.298	0.3465	86	100
1	Resistant	B15	610	Sethoxydim	0.125	2	0.437	0.3465	126.1	85
1	Resistant	B15	610	Sethoxydim	0.25	2	0.241	0.3465	69.6	80

1	Resistant	B15	610	Sethoxydim	0.5	2	0.246	0.3465	71	80
1	Resistant	B15	610	Sethoxydim	1	2	0.048	0.3465	13.9	30
1	Resistant	B15	610	Sethoxydim	2	2	0.06	0.3465	17.3	40
1	Resistant	B15	610	Sethoxydim	4	2	.	.	.	30
1	Resistant	B15	610	Quizalofop	0.0625	2	0.389	0.3465	112.3	85
1	Resistant	B15	610	Quizalofop	0.125	2	0.111	0.3465	32	100
1	Resistant	B15	610	Quizalofop	0.25	2	0.352	0.3465	101.6	95
1	Resistant	B15	610	Quizalofop	0.5	2	0.287	0.3465	82.8	95
1	Resistant	B15	610	Quizalofop	1	2	0.474	0.3465	136.8	95
1	Resistant	B15	610	Quizalofop	2	2	0.075	0.3465	21.6	50
1	Resistant	B15	610	Quizalofop	4	2	0.027	0.3465	7.8	30
1	Resistant	B15	610	Fluazifop	0.0625	2	0.222	0.3465	64.1	100
1	Resistant	B15	610	Fluazifop	0.125	2	0.3	0.3465	86.6	95
1	Resistant	B15	610	Fluazifop	0.25	2	0.346	0.3465	99.9	95
1	Resistant	B15	610	Fluazifop	0.5	2	0.168	0.3465	48.5	95
1	Resistant	B15	610	Fluazifop	1	2	0.272	0.3465	78.5	95
1	Resistant	B15	610	Fluazifop	2	2	0.247	0.3465	71.3	95
1	Resistant	B15	610	Fluazifop	4	2	0.081	0.3465	23.4	85
1	Resistant	B15	610	Clethodim	0.0625	2	0.13	0.3465	37.5	80
1	Resistant	B15	610	Clethodim	0.125	2	0.049	0.3465	14.1	30
1	Resistant	B15	610	Clethodim	0.25	2	0.03	0.3465	8.7	40
1	Resistant	B15	610	Clethodim	0.5	2	0.03	0.3465	8.7	20
1	Resistant	B15	610	Clethodim	1	2	0.033	0.3465	9.5	10
1	Resistant	B15	610	Clethodim	2	2	0.031	0.3465	8.9	0
1	Resistant	B15	610	Clethodim	4	2	0.042	0.3465	12.1	0
1	Resistant	B15	610	Control	0	2	0.312	0.3465	90	100
1	Resistant	B15	610	Control	0	2	0.381	0.3465	110	100
1	Resistant	B15	610	Sethoxydim	0.0625	3	0.509	0.451	112.9	85
1	Resistant	B15	610	Sethoxydim	0.125	3	0.342	0.451	75.8	70
1	Resistant	B15	610	Sethoxydim	0.25	3	0.34	0.451	75.4	70
1	Resistant	B15	610	Sethoxydim	0.5	3	0.219	0.451	48.6	80
1	Resistant	B15	610	Sethoxydim	1	3	0.081	0.451	18	35
1	Resistant	B15	610	Sethoxydim	2	3	0.066	0.451	14.6	40
1	Resistant	B15	610	Sethoxydim	4	3	0.079	0.451	17.5	10
1	Resistant	B15	610	Quizalofop	0.0625	3	0.474	0.451	105.1	90
1	Resistant	B15	610	Quizalofop	0.125	3	0.295	0.451	65.4	100
1	Resistant	B15	610	Quizalofop	0.25	3	0.434	0.451	96.2	90
1	Resistant	B15	610	Quizalofop	0.5	3	0.5	0.451	110.9	95
1	Resistant	B15	610	Quizalofop	1	3	0.5	0.451	110.9	95
1	Resistant	B15	610	Quizalofop	2	3	0.204	0.451	45.2	60
1	Resistant	B15	610	Quizalofop	4	3	0.182	0.451	40.4	75
1	Resistant	B15	610	Fluazifop	0.0625	3	0.558	0.451	123.7	95
1	Resistant	B15	610	Fluazifop	0.125	3	0.554	0.451	122.8	90
1	Resistant	B15	610	Fluazifop	0.25	3	0.527	0.451	116.9	95
1	Resistant	B15	610	Fluazifop	0.5	3	0.531	0.451	117.7	85
1	Resistant	B15	610	Fluazifop	1	3	0.432	0.451	95.8	95
1	Resistant	B15	610	Fluazifop	2	3	0.448	0.451	99.3	80
1	Resistant	B15	610	Fluazifop	4	3	0.355	0.451	78.7	70
1	Resistant	B15	610	Clethodim	0.0625	3	0.089	0.451	19.7	40
1	Resistant	B15	610	Clethodim	0.125	3	0.032	0.451	7.1	40
1	Resistant	B15	610	Clethodim	0.25	3	0.086	0.451	19.1	30
1	Resistant	B15	610	Clethodim	0.5	3	0.089	0.451	19.7	30
1	Resistant	B15	610	Clethodim	1	3	0.057	0.451	12.6	0
1	Resistant	B15	610	Clethodim	2	3	0.102	0.451	22.6	0
1	Resistant	B15	610	Clethodim	4	3	0.035	0.451	7.8	0
1	Resistant	B15	610	Control	0	3	0.362	0.451	80.3	95
1	Resistant	B15	610	Control	0	3	0.54	0.451	119.7	90
1	Resistant	B15	610	Quizalofop	0.0625	4	0.54	0.617	87.5	80
1	Resistant	B15	610	Quizalofop	0.125	4	0.558	0.617	90.4	90
1	Resistant	B15	610	Quizalofop	0.25	4	0.546	0.617	88.5	90
1	Resistant	B15	610	Quizalofop	0.5	4	0.564	0.617	91.4	90
1	Resistant	B15	610	Quizalofop	1	4	0.52	0.617	84.3	100

1	Resistant	B15	610	Quizalofop	2	4	0.261	0.617	42.3	60
1	Resistant	B15	610	Quizalofop	4	4	0.158	0.617	25.6	70
1	Resistant	B15	610	Fluazifop	0.0625	4	0.566	0.617	91.7	85
1	Resistant	B15	610	Fluazifop	0.125	4	0.311	0.617	50.4	95
1	Resistant	B15	610	Fluazifop	0.25	4	0.537	0.617	87	90
1	Resistant	B15	610	Fluazifop	0.5	4	0.556	0.617	90.1	90
1	Resistant	B15	610	Fluazifop	1	4	0.616	0.617	99.8	65
1	Resistant	B15	610	Fluazifop	2	4	0.542	0.617	87.8	80
1	Resistant	B15	610	Fluazifop	4	4	0.516	0.617	83.6	70
1	Resistant	B15	610	Control	0	4	0.565	0.617	91.6	90
1	Resistant	B15	610	Control	0	4	0.669	0.617	108.4	100
1	F1	F1_B71	F1_B71	Sethoxydim	0.0625	1	0.418	0.287	145.6	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.125	1	0.239	0.287	83.3	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.25	1	0.215	0.287	74.9	70
1	F1	F1_B71	F1_B71	Sethoxydim	0.5	1	0.214	0.287	74.6	75
1	F1	F1_B71	F1_B71	Sethoxydim	1	1	0.08	0.287	27.9	50
1	F1	F1_B71	F1_B71	Sethoxydim	2	1	0.076	0.287	26.5	60
1	F1	F1_B71	F1_B71	Sethoxydim	4	1	0.108	0.287	37.6	40
1	F1	F1_B71	F1_B71	Quizalofop	0.0625	1	0.356	0.287	124	100
1	F1	F1_B71	F1_B71	Quizalofop	0.125	1	0.365	0.287	127.2	95
1	F1	F1_B71	F1_B71	Quizalofop	0.25	1	0.489	0.287	170.4	90
1	F1	F1_B71	F1_B71	Quizalofop	0.5	1	0.285	0.287	99.3	95
1	F1	F1_B71	F1_B71	Quizalofop	1	1	0.117	0.287	40.8	60
1	F1	F1_B71	F1_B71	Quizalofop	2	1	0.06	0.287	20.9	40
1	F1	F1_B71	F1_B71	Quizalofop	4	1	0.078	0.287	27.2	40
1	F1	F1_B71	F1_B71	Fluazifop	0.0625	1	0.395	0.287	137.6	90
1	F1	F1_B71	F1_B71	Fluazifop	0.125	1	0.386	0.287	134.5	100
1	F1	F1_B71	F1_B71	Fluazifop	0.25	1	0.34	0.287	118.5	95
1	F1	F1_B71	F1_B71	Fluazifop	0.5	1	0.283	0.287	98.6	90
1	F1	F1_B71	F1_B71	Fluazifop	1	1	0.176	0.287	61.3	80
1	F1	F1_B71	F1_B71	Fluazifop	2	1	0.222	0.287	77.4	70
1	F1	F1_B71	F1_B71	Fluazifop	4	1	0.129	0.287	44.9	60
1	F1	F1_B71	F1_B71	Clethodim	0.0625	1	0.084	0.287	29.3	40
1	F1	F1_B71	F1_B71	Clethodim	0.125	1	0.151	0.287	52.6	80
1	F1	F1_B71	F1_B71	Clethodim	0.25	1	0.093	0.287	32.4	40
1	F1	F1_B71	F1_B71	Clethodim	0.5	1	0.083	0.287	28.9	0
1	F1	F1_B71	F1_B71	Clethodim	1	1	0.136	0.287	47.4	10
1	F1	F1_B71	F1_B71	Clethodim	2	1	0.079	0.287	27.5	20
1	F1	F1_B71	F1_B71	Clethodim	4	1	0.095	0.287	33.1	10
1	F1	F1_B71	F1_B71	Control	0	1	0.279	0.287	97.2	100
1	F1	F1_B71	F1_B71	Control	0	1	0.353	0.287	123	95
1	F1	F1_B71	F1_B71	Sethoxydim	0.0625	2	0.265	0.4005	66.2	100
1	F1	F1_B71	F1_B71	Sethoxydim	0.125	2	0.275	0.4005	68.7	100
1	F1	F1_B71	F1_B71	Sethoxydim	0.25	2	0.143	0.4005	35.7	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.5	2	0.225	0.4005	56.2	80
1	F1	F1_B71	F1_B71	Sethoxydim	1	2	0.016	0.4005	4	30
1	F1	F1_B71	F1_B71	Sethoxydim	2	2	0.018	0.4005	4.5	30
1	F1	F1_B71	F1_B71	Sethoxydim	4	2	0.011	0.4005	2.7	30
1	F1	F1_B71	F1_B71	Quizalofop	0.0625	2	0.333	0.4005	83.1	100
1	F1	F1_B71	F1_B71	Quizalofop	0.125	2	0.338	0.4005	84.4	90
1	F1	F1_B71	F1_B71	Quizalofop	0.25	2	0.157	0.4005	39.2	100
1	F1	F1_B71	F1_B71	Quizalofop	0.5	2	0.154	0.4005	38.5	85
1	F1	F1_B71	F1_B71	Quizalofop	1	2	0.063	0.4005	15.7	55
1	F1	F1_B71	F1_B71	Quizalofop	2	2	0.033	0.4005	8.2	0
1	F1	F1_B71	F1_B71	Fluazifop	0.0625	2	0.402	0.4005	100.4	95
1	F1	F1_B71	F1_B71	Fluazifop	0.125	2	0.265	0.4005	66.2	100
1	F1	F1_B71	F1_B71	Fluazifop	0.25	2	0.351	0.4005	87.6	80
1	F1	F1_B71	F1_B71	Fluazifop	0.5	2	0.141	0.4005	35.2	95
1	F1	F1_B71	F1_B71	Fluazifop	1	2	0.103	0.4005	25.7	70
1	F1	F1_B71	F1_B71	Fluazifop	2	2	0.122	0.4005	30.5	75
1	F1	F1_B71	F1_B71	Fluazifop	4	2	0.08	0.4005	20	50
1	F1	F1_B71	F1_B71	Clethodim	0.0625	2	0.062	0.4005	15.5	75

1	F1	F1_B71	F1_B71	Clethodim	0.125	2	0.057	0.4005	14.2	65
1	F1	F1_B71	F1_B71	Clethodim	0.25	2	0.004	0.4005	1	15
1	F1	F1_B71	F1_B71	Clethodim	0.5	2	0.056	0.4005	14	10
1	F1	F1_B71	F1_B71	Clethodim	1	2	0.037	0.4005	9.2	0
1	F1	F1_B71	F1_B71	Clethodim	2	2	0.005	0.4005	1.2	0
1	F1	F1_B71	F1_B71	Clethodim	4	2	0.054	0.4005	13.5	0
1	F1	F1_B71	F1_B71	Control	0	2	0.348	0.4005	86.9	100
1	F1	F1_B71	F1_B71	Control	0	2	0.453	0.4005	113.1	100
1	F1	F1_B71	F1_B71	Sethoxydim	0.0625	3	0.322	0.415	77.6	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.125	3	0.386	0.415	93	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.25	3	0.273	0.415	65.8	60
1	F1	F1_B71	F1_B71	Sethoxydim	0.5	3	0.133	0.415	32	70
1	F1	F1_B71	F1_B71	Sethoxydim	1	3	0.085	0.415	20.5	70
1	F1	F1_B71	F1_B71	Sethoxydim	2	3	0.097	0.415	23.4	60
1	F1	F1_B71	F1_B71	Sethoxydim	4	3	0.078	0.415	18.8	40
1	F1	F1_B71	F1_B71	Quizalofop	0.0625	3	0.242	0.415	58.3	100
1	F1	F1_B71	F1_B71	Quizalofop	0.125	3	0.364	0.415	87.7	90
1	F1	F1_B71	F1_B71	Quizalofop	0.25	3	0.624	0.415	150.4	100
1	F1	F1_B71	F1_B71	Quizalofop	0.5	3	0.15	0.415	36.1	50
1	F1	F1_B71	F1_B71	Quizalofop	1	3	0.067	0.415	16.1	50
1	F1	F1_B71	F1_B71	Quizalofop	2	3	0.08	0.415	19.3	.
1	F1	F1_B71	F1_B71	Quizalofop	2	3	0.036	0.415	8.7	30
1	F1	F1_B71	F1_B71	Quizalofop	4	3	0.05	0.415	12	0
1	F1	F1_B71	F1_B71	Fluazifop	0.0625	3	0.502	0.415	121	100
1	F1	F1_B71	F1_B71	Fluazifop	0.125	3	0.54	0.415	130.1	100
1	F1	F1_B71	F1_B71	Fluazifop	0.25	3	0.42	0.415	101.2	100
1	F1	F1_B71	F1_B71	Fluazifop	0.5	3	0.5	0.415	120.5	95
1	F1	F1_B71	F1_B71	Fluazifop	1	3	0.558	0.415	134.5	80
1	F1	F1_B71	F1_B71	Fluazifop	2	3	0.188	0.415	45.3	50
1	F1	F1_B71	F1_B71	Fluazifop	4	3	0.151	0.415	36.4	60
1	F1	F1_B71	F1_B71	Clethodim	0.0625	3	0.088	0.415	21.2	40
1	F1	F1_B71	F1_B71	Clethodim	0.125	3	0.057	0.415	13.7	40
1	F1	F1_B71	F1_B71	Clethodim	0.25	3	0.072	0.415	17.3	20
1	F1	F1_B71	F1_B71	Clethodim	0.5	3	0.057	0.415	13.7	20
1	F1	F1_B71	F1_B71	Clethodim	1	3	0.084	0.415	20.2	0
1	F1	F1_B71	F1_B71	Clethodim	2	3	0.087	0.415	21	15
1	F1	F1_B71	F1_B71	Clethodim	4	3	0.065	0.415	15.7	0
1	F1	F1_B71	F1_B71	Control	0	3	0.327	0.415	78.8	80
1	F1	F1_B71	F1_B71	Control	0	3	0.503	0.415	121.2	90
1	F1	F1_B71	F1_B71	Sethoxydim	0.0625	4	0.595	0.587	101.4	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.125	4	0.537	0.587	91.5	85
1	F1	F1_B71	F1_B71	Sethoxydim	0.25	4	0.493	0.587	84	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.5	4	0.141	0.587	24	50
1	F1	F1_B71	F1_B71	Sethoxydim	1	4	0.109	0.587	18.6	5
1	F1	F1_B71	F1_B71	Sethoxydim	2	4	0.086	0.587	14.7	30
1	F1	F1_B71	F1_B71	Sethoxydim	4	4	0.046	0.587	7.8	0
1	F1	F1_B71	F1_B71	Quizalofop	0.0625	4	0.509	0.587	86.7	100
1	F1	F1_B71	F1_B71	Quizalofop	0.125	4	0.715	0.587	121.8	100
1	F1	F1_B71	F1_B71	Quizalofop	0.25	4	0.699	0.587	119.1	100
1	F1	F1_B71	F1_B71	Quizalofop	0.5	4	0.254	0.587	43.3	80
1	F1	F1_B71	F1_B71	Quizalofop	1	4	0.216	0.587	36.8	70
1	F1	F1_B71	F1_B71	Quizalofop	2	4	0.076	0.587	12.9	40
1	F1	F1_B71	F1_B71	Quizalofop	4	4	0.03	0.587	5.1	0
1	F1	F1_B71	F1_B71	Fluazifop	0.0625	4	0.658	0.587	112.1	95
1	F1	F1_B71	F1_B71	Fluazifop	0.125	4	0.648	0.587	110.4	85
1	F1	F1_B71	F1_B71	Fluazifop	0.25	4	0.591	0.587	100.7	80
1	F1	F1_B71	F1_B71	Fluazifop	0.5	4	0.549	0.587	93.5	70
1	F1	F1_B71	F1_B71	Fluazifop	1	4	0.152	0.587	25.9	60
1	F1	F1_B71	F1_B71	Fluazifop	2	4	0.272	0.587	46.3	65
1	F1	F1_B71	F1_B71	Fluazifop	4	4	0.193	0.587	32.9	50
1	F1	F1_B71	F1_B71	Clethodim	0.0625	4	0.09	0.587	15.3	40
1	F1	F1_B71	F1_B71	Clethodim	0.125	4	0.096	0.587	16.4	35

1	F1	F1_B71	F1_B71	Clethodim	0.25	4	0.097	0.587	16.5	35
1	F1	F1_B71	F1_B71	Clethodim	0.5	4	0.06	0.587	10.2	0
1	F1	F1_B71	F1_B71	Clethodim	1	4	0.056	0.587	9.5	0
1	F1	F1_B71	F1_B71	Clethodim	2	4	0.084	0.587	14.3	0
1	F1	F1_B71	F1_B71	Clethodim	4	4	0.079	0.587	13.5	10
1	F1	F1_B71	F1_B71	Control	0	4	0.472	0.587	80.4	100
1	F1	F1_B71	F1_B71	Control	0	4	0.702	0.587	119.6	100
1	F1	F1_B71	F1_B71	Sethoxydim	0.0625	5	0.441	0.4005	110.1	85
1	F1	F1_B71	F1_B71	Sethoxydim	0.125	5	0.22	0.4005	54.9	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.25	5	0.209	0.4005	52.2	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.5	5	0.1	0.4005	25	50
1	F1	F1_B71	F1_B71	Sethoxydim	1	5	.	.	.	95
1	F1	F1_B71	F1_B71	Sethoxydim	2	5	0.089	0.4005	22.2	60
1	F1	F1_B71	F1_B71	Sethoxydim	4	5	0.096	0.4005	24	0
1	F1	F1_B71	F1_B71	Quizalofop	0.0625	5	.	.	.	95
1	F1	F1_B71	F1_B71	Quizalofop	0.25	5	0.305	0.4005	76.2	100
1	F1	F1_B71	F1_B71	Quizalofop	0.5	5	0.095	0.4005	23.7	60
1	F1	F1_B71	F1_B71	Quizalofop	1	5	0.134	0.4005	33.5	70
1	F1	F1_B71	F1_B71	Quizalofop	2	5	0.089	0.4005	22.2	60
1	F1	F1_B71	F1_B71	Quizalofop	4	5	0.051	0.4005	12.7	0
1	F1	F1_B71	F1_B71	Fluazifop	0.0625	5	0.36	0.4005	89.9	95
1	F1	F1_B71	F1_B71	Fluazifop	0.125	5	0.306	0.4005	76.4	70
1	F1	F1_B71	F1_B71	Fluazifop	0.25	5	0.296	0.4005	73.9	75
1	F1	F1_B71	F1_B71	Fluazifop	0.5	5	0.352	0.4005	87.9	80
1	F1	F1_B71	F1_B71	Fluazifop	1	5	0.152	0.4005	38	70
1	F1	F1_B71	F1_B71	Fluazifop	2	5	0.121	0.4005	30.2	50
1	F1	F1_B71	F1_B71	Fluazifop	4	5	0.107	0.4005	26.7	30
1	F1	F1_B71	F1_B71	Clethodim	0.0625	5	0.079	0.4005	19.7	40
1	F1	F1_B71	F1_B71	Clethodim	0.125	5	0.061	0.4005	15.2	40
1	F1	F1_B71	F1_B71	Clethodim	0.25	5	0.082	0.4005	20.5	40
1	F1	F1_B71	F1_B71	Clethodim	0.5	5	0.054	0.4005	13.5	0
1	F1	F1_B71	F1_B71	Clethodim	1	5	0.079	0.4005	19.7	0
1	F1	F1_B71	F1_B71	Clethodim	2	5	0.082	0.4005	20.5	0
1	F1	F1_B71	F1_B71	Clethodim	4	5	0.065	0.4005	16.2	0
1	F1	F1_B71	F1_B71	Control	0	5	0.338	0.4005	84.4	95
1	F1	F1_B71	F1_B71	Control	0	5	0.463	0.4005	115.6	95
1	F1	F1_B71	F1_B71	Sethoxydim	0.0625	7	0.578	0.5655	102.2	100
1	F1	F1_B71	F1_B71	Sethoxydim	0.125	7	0.312	0.5655	55.2	90
1	F1	F1_B71	F1_B71	Sethoxydim	0.25	7	0.44	0.5655	77.8	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.5	7	0.242	0.5655	42.8	70
1	F1	F1_B71	F1_B71	Sethoxydim	1	7	0.09	0.5655	15.9	40
1	F1	F1_B71	F1_B71	Sethoxydim	2	7	0.075	0.5655	13.3	40
1	F1	F1_B71	F1_B71	Sethoxydim	4	7	0.067	0.5655	11.8	50
1	F1	F1_B71	F1_B71	Quizalofop	0.0625	7	0.61	0.5655	107.9	100
1	F1	F1_B71	F1_B71	Quizalofop	0.125	7	0.635	0.5655	112.3	90
1	F1	F1_B71	F1_B71	Quizalofop	0.25	7	0.157	0.5655	27.8	60
1	F1	F1_B71	F1_B71	Quizalofop	0.5	7	0.286	0.5655	50.6	100
1	F1	F1_B71	F1_B71	Quizalofop	1	7	0.095	0.5655	16.8	40
1	F1	F1_B71	F1_B71	Quizalofop	2	7	0.097	0.5655	17.2	40
1	F1	F1_B71	F1_B71	Quizalofop	4	7	0.083	0.5655	14.7	30
1	F1	F1_B71	F1_B71	Fluazifop	0.0625	7	0.61	0.5655	107.9	90
1	F1	F1_B71	F1_B71	Fluazifop	0.125	7	0.585	0.5655	103.4	100
1	F1	F1_B71	F1_B71	Fluazifop	0.25	7	0.414	0.5655	73.2	80
1	F1	F1_B71	F1_B71	Fluazifop	0.5	7	0.386	0.5655	68.3	70
1	F1	F1_B71	F1_B71	Fluazifop	1	7	0.201	0.5655	35.5	70
1	F1	F1_B71	F1_B71	Fluazifop	2	7	0.29	0.5655	51.3	60
1	F1	F1_B71	F1_B71	Fluazifop	4	7	0.08	0.5655	14.1	50
1	F1	F1_B71	F1_B71	Clethodim	0.0625	7	0.157	0.5655	27.8	55
1	F1	F1_B71	F1_B71	Clethodim	0.125	7	0.09	0.5655	15.9	40
1	F1	F1_B71	F1_B71	Clethodim	0.25	7	0.031	0.5655	5.5	40
1	F1	F1_B71	F1_B71	Clethodim	0.5	7	0.1	0.5655	17.7	35
1	F1	F1_B71	F1_B71	Clethodim	1	7	0.074	0.5655	13.1	0

1	F1	F1_B71	F1_B71	Clethodim	2	7	0.1	0.5655	17.7	30
1	F1	F1_B71	F1_B71	Clethodim	4	7	0.06	0.5655	10.6	.
1	F1	F1_B71	F1_B71	Control	0	7	0.457	0.5655	80.8	100
1	F1	F1_B71	F1_B71	Control	0	7	0.674	0.5655	119.2	100
1	F1	F1_B71	F1_B71	Sethoxydim	0.0625	8	0.402	0.5335	75.4	70
1	F1	F1_B71	F1_B71	Sethoxydim	0.25	8	0.181	0.5335	33.9	60
1	F1	F1_B71	F1_B71	Sethoxydim	0.5	8	0.206	0.5335	38.6	70
1	F1	F1_B71	F1_B71	Sethoxydim	1	8	0.101	0.5335	18.9	50
1	F1	F1_B71	F1_B71	Sethoxydim	2	8	0.108	0.5335	20.2	50
1	F1	F1_B71	F1_B71	Sethoxydim	4	8	0.084	0.5335	15.7	20
1	F1	F1_B71	F1_B71	Quizalofop	0.0625	8	0.633	0.5335	118.7	85
1	F1	F1_B71	F1_B71	Quizalofop	0.125	8	0.533	0.5335	99.9	90
1	F1	F1_B71	F1_B71	Quizalofop	0.25	8	0.496	0.5335	93	100
1	F1	F1_B71	F1_B71	Quizalofop	0.5	8	.	.	.	80
1	F1	F1_B71	F1_B71	Quizalofop	1	8	.	.	.	35
1	F1	F1_B71	F1_B71	Quizalofop	2	8	.	.	.	30
1	F1	F1_B71	F1_B71	Quizalofop	4	8	0.054	0.5335	10.1	30
1	F1	F1_B71	F1_B71	Fluazifop	0.0625	8	0.44	0.5335	82.5	90
1	F1	F1_B71	F1_B71	Fluazifop	0.125	8	0.458	0.5335	85.8	100
1	F1	F1_B71	F1_B71	Fluazifop	0.25	8	0.424	0.5335	79.5	75
1	F1	F1_B71	F1_B71	Fluazifop	0.5	8	0.579	0.5335	108.5	70
1	F1	F1_B71	F1_B71	Fluazifop	1	8	0.396	0.5335	74.2	70
1	F1	F1_B71	F1_B71	Fluazifop	2	8	0.196	0.5335	36.7	70
1	F1	F1_B71	F1_B71	Fluazifop	4	8	0.081	0.5335	15.2	40
1	F1	F1_B71	F1_B71	Clethodim	0.0625	8	0.06	0.5335	11.2	40
1	F1	F1_B71	F1_B71	Clethodim	0.125	8	0.078	0.5335	14.6	40
1	F1	F1_B71	F1_B71	Clethodim	0.25	8	0.064	0.5335	12	30
1	F1	F1_B71	F1_B71	Clethodim	0.5	8	0.089	0.5335	16.7	20
1	F1	F1_B71	F1_B71	Clethodim	1	8	0.038	0.5335	7.1	0
1	F1	F1_B71	F1_B71	Clethodim	2	8	0.104	0.5335	19.5	0
1	F1	F1_B71	F1_B71	Clethodim	4	8	0.109	0.5335	20.4	0
1	F1	F1_B71	F1_B71	Control	0	8	0.402	0.5335	75.4	80
1	F1	F1_B71	F1_B71	Control	0	8	0.665	0.5335	124.6	100
1	F1	F1_B71	F1_B71	Sethoxydim	0.0625	9	0.6	0.6895	87	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.125	9	0.284	0.6895	41.2	75
1	F1	F1_B71	F1_B71	Sethoxydim	0.25	9	0.323	0.6895	46.8	80
1	F1	F1_B71	F1_B71	Sethoxydim	0.5	9	0.15	0.6895	21.8	65
1	F1	F1_B71	F1_B71	Sethoxydim	1	9	0.1	0.6895	14.5	40
1	F1	F1_B71	F1_B71	Sethoxydim	2	9	0.071	0.6895	10.3	25
1	F1	F1_B71	F1_B71	Sethoxydim	4	9	0.075	0.6895	10.9	25
1	F1	F1_B71	F1_B71	Quizalofop	0.0625	9	0.528	0.6895	76.6	100
1	F1	F1_B71	F1_B71	Quizalofop	0.125	9	0.619	0.6895	89.8	100
1	F1	F1_B71	F1_B71	Quizalofop	0.25	9	0.588	0.6895	85.3	95
1	F1	F1_B71	F1_B71	Quizalofop	0.5	9	0.557	0.6895	80.8	80
1	F1	F1_B71	F1_B71	Quizalofop	1	9	0.099	0.6895	14.4	50
1	F1	F1_B71	F1_B71	Quizalofop	2	9	0.079	0.6895	11.5	35
1	F1	F1_B71	F1_B71	Quizalofop	4	9	0.086	0.6895	12.5	35
1	F1	F1_B71	F1_B71	Fluazifop	0.0625	9	0.646	0.6895	93.7	100
1	F1	F1_B71	F1_B71	Fluazifop	0.125	9	.	.	.	85
1	F1	F1_B71	F1_B71	Fluazifop	0.25	9	0.475	0.6895	68.9	75
1	F1	F1_B71	F1_B71	Fluazifop	0.5	9	0.367	0.6895	53.2	80
1	F1	F1_B71	F1_B71	Fluazifop	1	9	0.297	0.6895	43.1	70
1	F1	F1_B71	F1_B71	Fluazifop	2	9	0.219	0.6895	31.8	60
1	F1	F1_B71	F1_B71	Fluazifop	4	9	0.192	0.6895	27.8	50
1	F1	F1_B71	F1_B71	Clethodim	0.0625	9	0.063	0.6895	9.1	50
1	F1	F1_B71	F1_B71	Clethodim	0.125	9	0.06	0.6895	8.7	40
1	F1	F1_B71	F1_B71	Clethodim	0.25	9	0.077	0.6895	11.2	30
1	F1	F1_B71	F1_B71	Clethodim	0.5	9	0.043	0.6895	6.2	20
1	F1	F1_B71	F1_B71	Clethodim	1	9	0.073	0.6895	10.6	10
1	F1	F1_B71	F1_B71	Clethodim	2	9	0.06	0.6895	8.7	0
1	F1	F1_B71	F1_B71	Clethodim	4	9	0.059	0.6895	8.6	0
1	F1	F1_B71	F1_B71	Control	0	9	0.662	0.6895	96	100

1	F1	F1_B71	F1_B71	Control	0	9	0.717	0.6895	104	100
1	F1	F1_B45	F1_B45	Sethoxydim	0.0625	1	0.274	0.2915	94	90
1	F1	F1_B45	F1_B45	Sethoxydim	0.25	1	0.085	0.2915	29.2	50
1	F1	F1_B45	F1_B45	Sethoxydim	0.5	1	0.162	0.2915	55.6	60
1	F1	F1_B45	F1_B45	Sethoxydim	1	1	0.065	0.2915	22.3	50
1	F1	F1_B45	F1_B45	Sethoxydim	2	1	0.078	0.2915	26.8	40
1	F1	F1_B45	F1_B45	Sethoxydim	4	1	0.073	0.2915	25	40
1	F1	F1_B45	F1_B45	Quizalofop	0.0625	1	0.418	0.2915	143.4	100
1	F1	F1_B45	F1_B45	Quizalofop	0.125	1	0.243	0.2915	83.4	95
1	F1	F1_B45	F1_B45	Quizalofop	0.25	1	0.216	0.2915	74.1	60
1	F1	F1_B45	F1_B45	Quizalofop	0.5	1	0.325	0.2915	111.5	100
1	F1	F1_B45	F1_B45	Quizalofop	1	1	0.082	0.2915	28.1	40
1	F1	F1_B45	F1_B45	Quizalofop	2	1	0.076	0.2915	26.1	50
1	F1	F1_B45	F1_B45	Fluazifop	0.0625	1	0.471	0.2915	161.6	80
1	F1	F1_B45	F1_B45	Fluazifop	0.125	1	0.327	0.2915	112.2	85
1	F1	F1_B45	F1_B45	Fluazifop	0.25	1	0.337	0.2915	115.6	90
1	F1	F1_B45	F1_B45	Fluazifop	0.5	1	0.167	0.2915	57.3	80
1	F1	F1_B45	F1_B45	Fluazifop	1	1	0.16	0.2915	54.9	50
1	F1	F1_B45	F1_B45	Fluazifop	2	1	0.288	0.2915	98.8	60
1	F1	F1_B45	F1_B45	Fluazifop	4	1	0.107	0.2915	36.7	40
1	F1	F1_B45	F1_B45	Clethodim	0.0625	1	0.107	0.2915	36.7	80
1	F1	F1_B45	F1_B45	Clethodim	0.125	1	0.093	0.2915	31.9	50
1	F1	F1_B45	F1_B45	Clethodim	0.25	1	0.087	0.2915	29.8	50
1	F1	F1_B45	F1_B45	Clethodim	0.5	1	0.082	0.2915	28.1	50
1	F1	F1_B45	F1_B45	Clethodim	1	1	0.061	0.2915	20.9	0
1	F1	F1_B45	F1_B45	Clethodim	2	1	0.07	0.2915	24	0
1	F1	F1_B45	F1_B45	Clethodim	4	1	.	.	.	0
1	F1	F1_B45	F1_B45	Control	0	1	0.264	0.2915	90.6	100
1	F1	F1_B45	F1_B45	Control	0	1	0.319	0.2915	109.4	95
1	F1	F1_B45	F1_B45	Sethoxydim	0.0625	2	0.446	0.3095	144.1	100
1	F1	F1_B45	F1_B45	Sethoxydim	0.125	2	0.352	0.3095	113.7	85
1	F1	F1_B45	F1_B45	Sethoxydim	0.25	2	0.21	0.3095	67.9	70
1	F1	F1_B45	F1_B45	Sethoxydim	0.5	2	0.087	0.3095	28.1	80
1	F1	F1_B45	F1_B45	Sethoxydim	1	2	0.047	0.3095	15.2	50
1	F1	F1_B45	F1_B45	Sethoxydim	2	2	0.032	0.3095	10.3	40
1	F1	F1_B45	F1_B45	Sethoxydim	4	2	0.084	0.3095	27.1	25
1	F1	F1_B45	F1_B45	Quizalofop	0.0625	2	0.263	0.3095	85	95
1	F1	F1_B45	F1_B45	Quizalofop	0.125	2	0.286	0.3095	92.4	80
1	F1	F1_B45	F1_B45	Quizalofop	0.25	2	0.202	0.3095	65.3	90
1	F1	F1_B45	F1_B45	Quizalofop	0.5	2	0.151	0.3095	48.8	80
1	F1	F1_B45	F1_B45	Quizalofop	1	2	0.177	0.3095	57.2	85
1	F1	F1_B45	F1_B45	Quizalofop	2	2	0.078	0.3095	25.2	40
1	F1	F1_B45	F1_B45	Quizalofop	4	2	0.048	0.3095	15.5	40
1	F1	F1_B45	F1_B45	Fluazifop	0.0625	2	0.331	0.3095	106.9	80
1	F1	F1_B45	F1_B45	Fluazifop	0.125	2	0.348	0.3095	112.4	100
1	F1	F1_B45	F1_B45	Fluazifop	0.25	2	0.349	0.3095	112.8	80
1	F1	F1_B45	F1_B45	Fluazifop	0.5	2	0.335	0.3095	108.2	100
1	F1	F1_B45	F1_B45	Fluazifop	1	2	0.231	0.3095	74.6	80
1	F1	F1_B45	F1_B45	Fluazifop	2	2	0.21	0.3095	67.9	60
1	F1	F1_B45	F1_B45	Fluazifop	4	2	0.177	0.3095	57.2	55
1	F1	F1_B45	F1_B45	Clethodim	0.0625	2	0.106	0.3095	34.2	80
1	F1	F1_B45	F1_B45	Clethodim	0.125	2	0.031	0.3095	10	40
1	F1	F1_B45	F1_B45	Clethodim	0.25	2	0.031	0.3095	10	0
1	F1	F1_B45	F1_B45	Clethodim	0.5	2	0.041	0.3095	13.2	20
1	F1	F1_B45	F1_B45	Clethodim	1	2	0.027	0.3095	8.7	0
1	F1	F1_B45	F1_B45	Clethodim	2	2	0.049	0.3095	15.8	0
1	F1	F1_B45	F1_B45	Clethodim	4	2	0.024	0.3095	7.8	0
1	F1	F1_B45	F1_B45	Control	0	2	0.305	0.3095	98.5	90
1	F1	F1_B45	F1_B45	Control	0	2	0.314	0.3095	101.5	90
1	F1	F1_B45	F1_B45	Sethoxydim	0.0625	3	0.306	0.4505	67.9	100
1	F1	F1_B45	F1_B45	Sethoxydim	0.125	3	0.345	0.4505	76.6	30
1	F1	F1_B45	F1_B45	Sethoxydim	0.25	3	0.13	0.4505	28.9	70

1	F1	F1_B45	F1_B45	Sethoxydim	0.5	3	0.081	0.4505	18	75
1	F1	F1_B45	F1_B45	Sethoxydim	1	3	0.097	0.4505	21.5	80
1	F1	F1_B45	F1_B45	Sethoxydim	2	3	0.09	0.4505	20	30
1	F1	F1_B45	F1_B45	Sethoxydim	4	3	0.117	0.4505	26	30
1	F1	F1_B45	F1_B45	Quizalofop	0.0625	3	0.338	0.4505	75	100
1	F1	F1_B45	F1_B45	Quizalofop	0.125	3	0.259	0.4505	57.5	80
1	F1	F1_B45	F1_B45	Quizalofop	0.25	3	0.204	0.4505	45.3	70
1	F1	F1_B45	F1_B45	Quizalofop	0.5	3	0.154	0.4505	34.2	60
1	F1	F1_B45	F1_B45	Quizalofop	1	3	0.058	0.4505	12.9	50
1	F1	F1_B45	F1_B45	Quizalofop	2	3	0.057	0.4505	12.7	60
1	F1	F1_B45	F1_B45	Quizalofop	4	3	0.038	0.4505	8.4	40
1	F1	F1_B45	F1_B45	Fluazifop	0.0625	3	0.433	0.4505	96.1	100
1	F1	F1_B45	F1_B45	Fluazifop	0.125	3	0.322	0.4505	71.5	95
1	F1	F1_B45	F1_B45	Fluazifop	0.25	3	0.217	0.4505	48.2	80
1	F1	F1_B45	F1_B45	Fluazifop	0.5	3	0.242	0.4505	53.7	80
1	F1	F1_B45	F1_B45	Fluazifop	1	3	0.234	0.4505	51.9	70
1	F1	F1_B45	F1_B45	Fluazifop	2	3	0.109	0.4505	24.2	50
1	F1	F1_B45	F1_B45	Fluazifop	4	3	.	.	.	60
1	F1	F1_B45	F1_B45	Clethodim	0.0625	3	0.136	0.4505	30.2	.
1	F1	F1_B45	F1_B45	Clethodim	0.0625	3	0.06	0.4505	13.3	40
1	F1	F1_B45	F1_B45	Clethodim	0.125	3	0.077	0.4505	17.1	40
1	F1	F1_B45	F1_B45	Clethodim	0.25	3	0.098	0.4505	21.8	80
1	F1	F1_B45	F1_B45	Clethodim	0.5	3	0.079	0.4505	17.5	30
1	F1	F1_B45	F1_B45	Clethodim	1	3	0.084	0.4505	18.6	.
1	F1	F1_B45	F1_B45	Clethodim	2	3	0.066	0.4505	14.7	15
1	F1	F1_B45	F1_B45	Clethodim	4	3	0.046	0.4505	10.2	70
1	F1	F1_B45	F1_B45	Control	0	3	0.404	0.4505	89.7	70
1	F1	F1_B45	F1_B45	Control	0	3	0.497	0.4505	110.3	100
1	F1	F1_B45	F1_B45	Sethoxydim	0.0625	4	0.636	0.657	96.8	85
1	F1	F1_B45	F1_B45	Sethoxydim	0.125	4	0.468	0.657	71.2	80
1	F1	F1_B45	F1_B45	Sethoxydim	0.25	4	0.243	0.657	37	60
1	F1	F1_B45	F1_B45	Sethoxydim	0.5	4	0.069	0.657	10.5	30
1	F1	F1_B45	F1_B45	Sethoxydim	1	4	0.097	0.657	14.8	40
1	F1	F1_B45	F1_B45	Sethoxydim	2	4	0.05	0.657	7.6	30
1	F1	F1_B45	F1_B45	Sethoxydim	4	4	0.09	0.657	13.7	20
1	F1	F1_B45	F1_B45	Quizalofop	0.0625	4	0.591	0.657	90	100
1	F1	F1_B45	F1_B45	Quizalofop	0.125	4	0.502	0.657	76.4	90
1	F1	F1_B45	F1_B45	Quizalofop	0.25	4	0.185	0.657	28.2	80
1	F1	F1_B45	F1_B45	Quizalofop	0.5	4	0.575	0.657	87.5	95
1	F1	F1_B45	F1_B45	Quizalofop	1	4	0.216	0.657	32.9	50
1	F1	F1_B45	F1_B45	Quizalofop	2	4	0.082	0.657	12.5	40
1	F1	F1_B45	F1_B45	Quizalofop	4	4	0.093	0.657	14.2	30
1	F1	F1_B45	F1_B45	Fluazifop	0.0625	4	0.651	0.657	99.1	100
1	F1	F1_B45	F1_B45	Fluazifop	0.125	4	0.575	0.657	87.5	100
1	F1	F1_B45	F1_B45	Fluazifop	0.25	4	0.392	0.657	59.7	80
1	F1	F1_B45	F1_B45	Fluazifop	0.5	4	0.265	0.657	40.3	70
1	F1	F1_B45	F1_B45	Fluazifop	1	4	0.197	0.657	30	70
1	F1	F1_B45	F1_B45	Fluazifop	2	4	0.256	0.657	39	50
1	F1	F1_B45	F1_B45	Fluazifop	4	4	0.124	0.657	18.9	50
1	F1	F1_B45	F1_B45	Clethodim	0.0625	4	0.118	0.657	18	40
1	F1	F1_B45	F1_B45	Clethodim	0.125	4	0.101	0.657	15.4	30
1	F1	F1_B45	F1_B45	Clethodim	0.25	4	0.091	0.657	13.9	50
1	F1	F1_B45	F1_B45	Clethodim	0.5	4	0.056	0.657	8.5	0
1	F1	F1_B45	F1_B45	Clethodim	1	4	0.121	0.657	18.4	0
1	F1	F1_B45	F1_B45	Clethodim	2	4	0.043	0.657	6.5	0
1	F1	F1_B45	F1_B45	Clethodim	4	4	0.078	0.657	11.9	0
1	F1	F1_B45	F1_B45	Control	0	4	0.653	0.657	99.4	85
1	F1	F1_B45	F1_B45	Control	0	4	0.661	0.657	100.6	100
1	F1	F1_B45	F1_B45	Sethoxydim	0.0625	5	0.184	0.303	60.7	80
1	F1	F1_B45	F1_B45	Sethoxydim	0.125	5	0.244	0.303	80.5	65
1	F1	F1_B45	F1_B45	Sethoxydim	0.25	5	0.078	0.303	25.7	60
1	F1	F1_B45	F1_B45	Sethoxydim	0.5	5	0.1	0.303	33	90

1	F1	F1_B45	F1_B45	Sethoxydim	1	5	0.098	0.303	32.3	55
1	F1	F1_B45	F1_B45	Sethoxydim	2	5	0.076	0.303	25.1	30
1	F1	F1_B45	F1_B45	Sethoxydim	4	5	0.07	0.303	23.1	0
1	F1	F1_B45	F1_B45	Quizalofop	0.0625	5	0.37	0.303	122.1	95
1	F1	F1_B45	F1_B45	Quizalofop	0.25	5	0.176	0.303	58.1	45
1	F1	F1_B45	F1_B45	Quizalofop	0.5	5	0.114	0.303	37.6	90
1	F1	F1_B45	F1_B45	Quizalofop	1	5	0.074	0.303	24.4	85
1	F1	F1_B45	F1_B45	Quizalofop	2	5	.	.	.	10
1	F1	F1_B45	F1_B45	Fluazifop	0.0625	5	0.377	0.303	124.4	95
1	F1	F1_B45	F1_B45	Fluazifop	0.125	5	0.329	0.303	108.6	70
1	F1	F1_B45	F1_B45	Fluazifop	0.25	5	0.01	0.303	3.3	65
1	F1	F1_B45	F1_B45	Fluazifop	0.5	5	0.153	0.303	50.5	70
1	F1	F1_B45	F1_B45	Fluazifop	1	5	0.194	0.303	64	60
1	F1	F1_B45	F1_B45	Fluazifop	2	5	0.125	0.303	41.3	30
1	F1	F1_B45	F1_B45	Fluazifop	4	5	0.109	0.303	36	85
1	F1	F1_B45	F1_B45	Clethodim	0.0625	5	0.063	0.303	20.8	50
1	F1	F1_B45	F1_B45	Clethodim	0.125	5	0.103	0.303	34	40
1	F1	F1_B45	F1_B45	Clethodim	0.25	5	0.077	0.303	25.4	10
1	F1	F1_B45	F1_B45	Clethodim	0.5	5	0.093	0.303	30.7	0
1	F1	F1_B45	F1_B45	Clethodim	1	5	0.088	0.303	29	0
1	F1	F1_B45	F1_B45	Clethodim	2	5	0.105	0.303	34.7	0
1	F1	F1_B45	F1_B45	Clethodim	4	5	0.068	0.303	22.4	0
1	F1	F1_B45	F1_B45	Control	0	5	0.228	0.303	75.2	90
1	F1	F1_B45	F1_B45	Control	0	5	0.378	0.303	124.8	95
1	F1	F1_B45	F1_B45	Quizalofop	0.0625	7	0.166	0.1615	102.8	100
1	F1	F1_B45	F1_B45	Quizalofop	0.125	7	0.271	0.1615	167.8	90
1	F1	F1_B45	F1_B45	Quizalofop	0.25	7	0.179	0.1615	110.8	90
1	F1	F1_B45	F1_B45	Quizalofop	0.5	7	0.16	0.1615	99.1	90
1	F1	F1_B45	F1_B45	Quizalofop	1	7	0.158	0.1615	97.8	65
1	F1	F1_B45	F1_B45	Quizalofop	2	7	0.021	0.1615	13	40
1	F1	F1_B45	F1_B45	Quizalofop	4	7	0.012	0.1615	7.4	0
1	F1	F1_B45	F1_B45	Fluazifop	0.0625	7	0.269	0.1615	166.6	90
1	F1	F1_B45	F1_B45	Fluazifop	0.125	7	0.194	0.1615	120.1	100
1	F1	F1_B45	F1_B45	Fluazifop	0.25	7	0.203	0.1615	125.7	90
1	F1	F1_B45	F1_B45	Fluazifop	0.5	7	0.172	0.1615	106.5	80
1	F1	F1_B45	F1_B45	Fluazifop	1	7	0.201	0.1615	124.5	70
1	F1	F1_B45	F1_B45	Fluazifop	2	7	0.12	0.1615	74.3	60
1	F1	F1_B45	F1_B45	Fluazifop	4	7	0.075	0.1615	46.4	50
1	F1	F1_B45	F1_B45	Control	0	7	0.16	0.1615	99.1	100
1	F1	F1_B45	F1_B45	Control	0	7	0.163	0.1615	100.9	100
1	F1	F1_B45	F1_B45	Sethoxydim	0.0625	8	0.318	0.4765	66.7	90
1	F1	F1_B45	F1_B45	Sethoxydim	0.125	8	0.51	0.4765	107	40
1	F1	F1_B45	F1_B45	Sethoxydim	0.25	8	0.416	0.4765	87.3	80
1	F1	F1_B45	F1_B45	Sethoxydim	0.5	8	0.086	0.4765	18	50
1	F1	F1_B45	F1_B45	Sethoxydim	1	8	0.072	0.4765	15.1	15
1	F1	F1_B45	F1_B45	Sethoxydim	2	8	0.1	0.4765	21	40
1	F1	F1_B45	F1_B45	Sethoxydim	4	8	0.084	0.4765	17.6	.
1	F1	F1_B45	F1_B45	Quizalofop	0.0625	8	0.325	0.4765	68.2	90
1	F1	F1_B45	F1_B45	Quizalofop	0.125	8	0.385	0.4765	80.8	80
1	F1	F1_B45	F1_B45	Quizalofop	0.25	8	0.57	0.4765	119.6	90
1	F1	F1_B45	F1_B45	Quizalofop	0.5	8	0.122	0.4765	25.6	50
1	F1	F1_B45	F1_B45	Quizalofop	1	8	0.148	0.4765	31.1	50
1	F1	F1_B45	F1_B45	Quizalofop	2	8	0.084	0.4765	17.6	50
1	F1	F1_B45	F1_B45	Quizalofop	4	8	0.061	0.4765	12.8	40
1	F1	F1_B45	F1_B45	Fluazifop	0.0625	8	0.48	0.4765	100.7	.
1	F1	F1_B45	F1_B45	Fluazifop	0.125	8	0.409	0.4765	85.8	100
1	F1	F1_B45	F1_B45	Fluazifop	0.25	8	0.206	0.4765	43.2	90
1	F1	F1_B45	F1_B45	Fluazifop	0.5	8	0.498	0.4765	104.5	85
1	F1	F1_B45	F1_B45	Fluazifop	1	8	0.199	0.4765	41.8	70
1	F1	F1_B45	F1_B45	Fluazifop	2	8	.	.	.	60
1	F1	F1_B45	F1_B45	Fluazifop	4	8	0.125	0.4765	26.2	40
1	F1	F1_B45	F1_B45	Clethodim	0.0625	8	.	.	.	70

1	F1	F1_B45	F1_B45	Clethodim	0.125	8	0.105	0.4765	22	40
1	F1	F1_B45	F1_B45	Clethodim	0.25	8	0.121	0.4765	25.4	.
1	F1	F1_B45	F1_B45	Clethodim	0.5	8	0.082	0.4765	17.2	20
1	F1	F1_B45	F1_B45	Clethodim	1	8	0.09	0.4765	18.9	0
1	F1	F1_B45	F1_B45	Clethodim	2	8	0.077	0.4765	16.2	0
1	F1	F1_B45	F1_B45	Clethodim	4	8	0.061	0.4765	12.8	10
1	F1	F1_B45	F1_B45	Control	0	8	0.46	0.4765	96.5	85
1	F1	F1_B45	F1_B45	Control	0	8	0.493	0.4765	103.5	100
1	F1	F1_B45	F1_B45	Sethoxydim	0.0625	9	0.559	0.523	106.9	80
1	F1	F1_B45	F1_B45	Sethoxydim	0.125	9	0.429	0.523	82	80
1	F1	F1_B45	F1_B45	Sethoxydim	0.25	9	0.557	0.523	106.5	80
1	F1	F1_B45	F1_B45	Sethoxydim	0.5	9	0.105	0.523	20.1	40
1	F1	F1_B45	F1_B45	Sethoxydim	1	9	0.106	0.523	20.3	40
1	F1	F1_B45	F1_B45	Sethoxydim	2	9	0.107	0.523	20.5	40
1	F1	F1_B45	F1_B45	Sethoxydim	4	9	0.087	0.523	16.6	35
1	F1	F1_B45	F1_B45	Quizalofop	0.0625	9	0.641	0.523	122.6	90
1	F1	F1_B45	F1_B45	Quizalofop	0.125	9	0.64	0.523	122.4	70
1	F1	F1_B45	F1_B45	Quizalofop	0.25	9	0.248	0.523	47.4	65
1	F1	F1_B45	F1_B45	Quizalofop	0.5	9	0.25	0.523	47.8	70
1	F1	F1_B45	F1_B45	Quizalofop	1	9	0.081	0.523	15.5	30
1	F1	F1_B45	F1_B45	Quizalofop	2	9	0.057	0.523	10.9	10
1	F1	F1_B45	F1_B45	Quizalofop	4	9	0.067	0.523	12.8	50
1	F1	F1_B45	F1_B45	Fluazifop	0.0625	9	0.491	0.523	93.9	95
1	F1	F1_B45	F1_B45	Fluazifop	0.125	9	0.461	0.523	88.1	90
1	F1	F1_B45	F1_B45	Fluazifop	0.25	9	0.455	0.523	87	95
1	F1	F1_B45	F1_B45	Fluazifop	0.5	9	0.732	0.523	140	80
1	F1	F1_B45	F1_B45	Fluazifop	1	9	0.37	0.523	70.7	60
1	F1	F1_B45	F1_B45	Fluazifop	2	9	0.097	0.523	18.5	50
1	F1	F1_B45	F1_B45	Fluazifop	4	9	0.085	0.523	16.3	40
1	F1	F1_B45	F1_B45	Clethodim	0.0625	9	0.077	0.523	14.7	40
1	F1	F1_B45	F1_B45	Clethodim	0.125	9	0.105	0.523	20.1	40
1	F1	F1_B45	F1_B45	Clethodim	0.25	9	0.102	0.523	19.5	40
1	F1	F1_B45	F1_B45	Clethodim	0.5	9	0.075	0.523	14.3	0
1	F1	F1_B45	F1_B45	Clethodim	1	9	0.055	0.523	10.5	0
1	F1	F1_B45	F1_B45	Clethodim	2	9	0.141	0.523	27	5
1	F1	F1_B45	F1_B45	Clethodim	4	9	0.078	0.523	14.9	0
1	F1	F1_B45	F1_B45	Control	0	9	.	.	.	100
1	F1	F1_B45	F1_B45	Control	0	9	0.523	0.523	100	90
1	F1	F1_B15	F1_B15	Sethoxydim	0.125	1	0.183	0.3785	48.3	90
1	F1	F1_B15	F1_B15	Sethoxydim	0.25	1	0.331	0.3785	87.5	80
1	F1	F1_B15	F1_B15	Sethoxydim	0.5	1	0.123	0.3785	32.5	80
1	F1	F1_B15	F1_B15	Sethoxydim	1	1	.	.	.	20
1	F1	F1_B15	F1_B15	Sethoxydim	2	1	0.043	0.3785	11.4	0
1	F1	F1_B15	F1_B15	Sethoxydim	4	1	0.066	0.3785	17.4	40
1	F1	F1_B15	F1_B15	Quizalofop	0.0625	1	0.356	0.3785	94.1	100
1	F1	F1_B15	F1_B15	Quizalofop	0.125	1	0.373	0.3785	98.5	95
1	F1	F1_B15	F1_B15	Quizalofop	0.25	1	0.281	0.3785	74.2	100
1	F1	F1_B15	F1_B15	Quizalofop	0.5	1	0.387	0.3785	102.2	70
1	F1	F1_B15	F1_B15	Quizalofop	1	1	0.169	0.3785	44.6	40
1	F1	F1_B15	F1_B15	Quizalofop	2	1	0.184	0.3785	48.6	20
1	F1	F1_B15	F1_B15	Quizalofop	4	1	0.126	0.3785	33.3	20
1	F1	F1_B15	F1_B15	Fluazifop	0.0625	1	0.384	0.3785	101.5	100
1	F1	F1_B15	F1_B15	Fluazifop	0.125	1	0.384	0.3785	101.5	95
1	F1	F1_B15	F1_B15	Fluazifop	0.25	1	0.482	0.3785	127.3	85
1	F1	F1_B15	F1_B15	Fluazifop	0.5	1	0.314	0.3785	83	80
1	F1	F1_B15	F1_B15	Fluazifop	1	1	0.234	0.3785	61.8	70
1	F1	F1_B15	F1_B15	Fluazifop	2	1	0.195	0.3785	51.5	60
1	F1	F1_B15	F1_B15	Fluazifop	4	1	0.079	0.3785	20.9	50
1	F1	F1_B15	F1_B15	Clethodim	0.0625	1	0.126	0.3785	33.3	60
1	F1	F1_B15	F1_B15	Clethodim	0.125	1	0.067	0.3785	17.7	50
1	F1	F1_B15	F1_B15	Clethodim	0.25	1	0.076	0.3785	20.1	0
1	F1	F1_B15	F1_B15	Clethodim	0.5	1	0.155	0.3785	41	0

1	F1	F1_B15	F1_B15	Clethodim	1	1	0.047	0.3785	12.4	0
1	F1	F1_B15	F1_B15	Clethodim	2	1	0.067	0.3785	17.7	0
1	F1	F1_B15	F1_B15	Clethodim	4	1	0.07	0.3785	18.5	0
1	F1	F1_B15	F1_B15	Control	0	1	0.368	0.3785	97.2	85
1	F1	F1_B15	F1_B15	Control	0	1	0.389	0.3785	102.8	90
1	F1	F1_B15	F1_B15	Sethoxydim	0.0625	2	0.463	0.273	169.6	95
1	F1	F1_B15	F1_B15	Sethoxydim	0.125	2	0.234	0.273	85.7	95
1	F1	F1_B15	F1_B15	Sethoxydim	0.25	2	0.066	0.273	24.2	50
1	F1	F1_B15	F1_B15	Sethoxydim	0.5	2	.	.	.	60
1	F1	F1_B15	F1_B15	Sethoxydim	1	2	0.024	0.273	8.8	40
1	F1	F1_B15	F1_B15	Sethoxydim	2	2	0.049	0.273	17.9	35
1	F1	F1_B15	F1_B15	Sethoxydim	4	2	0.023	0.273	8.4	30
1	F1	F1_B15	F1_B15	Quizalofop	0.0625	2	0.271	0.273	99.3	100
1	F1	F1_B15	F1_B15	Quizalofop	0.125	2	0.183	0.273	67	100
1	F1	F1_B15	F1_B15	Quizalofop	0.25	2	0.301	0.273	110.3	80
1	F1	F1_B15	F1_B15	Quizalofop	0.5	2	0.315	0.273	115.4	90
1	F1	F1_B15	F1_B15	Quizalofop	1	2	0.07	0.273	25.6	50
1	F1	F1_B15	F1_B15	Quizalofop	2	2	0.03	0.273	11	30
1	F1	F1_B15	F1_B15	Quizalofop	4	2	0.045	0.273	16.5	0
1	F1	F1_B15	F1_B15	Fluazifop	0.0625	2	0.19	0.273	69.6	95
1	F1	F1_B15	F1_B15	Fluazifop	0.125	2	0.4	0.273	146.5	100
1	F1	F1_B15	F1_B15	Fluazifop	0.25	2	0.257	0.273	94.1	100
1	F1	F1_B15	F1_B15	Fluazifop	0.5	2	0.289	0.273	105.9	80
1	F1	F1_B15	F1_B15	Fluazifop	1	2	0.279	0.273	102.2	80
1	F1	F1_B15	F1_B15	Fluazifop	2	2	0.13	0.273	47.6	55
1	F1	F1_B15	F1_B15	Fluazifop	4	2	.	.	.	30
1	F1	F1_B15	F1_B15	Fluazifop	4	2	0.177	0.273	64.8	60
1	F1	F1_B15	F1_B15	Clethodim	0.0625	2	0.106	0.273	38.8	65
1	F1	F1_B15	F1_B15	Clethodim	0.125	2	0.026	0.273	9.5	35
1	F1	F1_B15	F1_B15	Clethodim	0.25	2	0.039	0.273	14.3	40
1	F1	F1_B15	F1_B15	Clethodim	0.5	2	0.019	0.273	7	0
1	F1	F1_B15	F1_B15	Clethodim	1	2	0.025	0.273	9.2	0
1	F1	F1_B15	F1_B15	Clethodim	2	2	0.027	0.273	9.9	0
1	F1	F1_B15	F1_B15	Clethodim	4	2	0.009	0.273	3.3	0
1	F1	F1_B15	F1_B15	Control	0	2	0.21	0.273	76.9	100
1	F1	F1_B15	F1_B15	Control	0	2	0.336	0.273	123.1	95
1	F1	F1_B15	F1_B15	Sethoxydim	0.0625	3	0.434	0.6575	66	80
1	F1	F1_B15	F1_B15	Sethoxydim	0.125	3	0.559	0.6575	85	70
1	F1	F1_B15	F1_B15	Sethoxydim	0.25	3	0.208	0.6575	31.6	80
1	F1	F1_B15	F1_B15	Sethoxydim	0.5	3	0.117	0.6575	17.8	70
1	F1	F1_B15	F1_B15	Sethoxydim	1	3	0.098	0.6575	14.9	40
1	F1	F1_B15	F1_B15	Sethoxydim	2	3	0.148	0.6575	22.5	40
1	F1	F1_B15	F1_B15	Sethoxydim	4	3	0.113	0.6575	17.2	0
1	F1	F1_B15	F1_B15	Quizalofop	0.0625	3	0.664	0.6575	101	95
1	F1	F1_B15	F1_B15	Quizalofop	0.125	3	0.648	0.6575	98.6	.
1	F1	F1_B15	F1_B15	Quizalofop	0.25	3	0.338	0.6575	51.4	95
1	F1	F1_B15	F1_B15	Quizalofop	0.5	3	0.314	0.6575	47.8	95
1	F1	F1_B15	F1_B15	Quizalofop	1	3	0.171	0.6575	26	50
1	F1	F1_B15	F1_B15	Quizalofop	2	3	0.061	0.6575	9.3	40
1	F1	F1_B15	F1_B15	Quizalofop	4	3	0.098	0.6575	14.9	30
1	F1	F1_B15	F1_B15	Fluazifop	0.0625	3	0.577	0.6575	87.8	90
1	F1	F1_B15	F1_B15	Fluazifop	0.125	3	0.601	0.6575	91.4	85
1	F1	F1_B15	F1_B15	Fluazifop	0.25	3	0.52	0.6575	79.1	80
1	F1	F1_B15	F1_B15	Fluazifop	0.5	3	0.578	0.6575	87.9	70
1	F1	F1_B15	F1_B15	Fluazifop	1	3	0.358	0.6575	54.4	65
1	F1	F1_B15	F1_B15	Fluazifop	2	3	0.253	0.6575	38.5	60
1	F1	F1_B15	F1_B15	Clethodim	0.0625	3	0.084	0.6575	12.8	40
1	F1	F1_B15	F1_B15	Clethodim	0.125	3	0.084	0.6575	12.8	40
1	F1	F1_B15	F1_B15	Clethodim	0.25	3	0.108	0.6575	16.4	50
1	F1	F1_B15	F1_B15	Clethodim	0.5	3	0.059	0.6575	9	0
1	F1	F1_B15	F1_B15	Clethodim	1	3	0.097	0.6575	14.8	25
1	F1	F1_B15	F1_B15	Clethodim	2	3	0.092	0.6575	14	0

1	F1	F1_B15	F1_B15	Clethodim	4	3	0.093	0.6575	14.1	0
1	F1	F1_B15	F1_B15	Control	0	3	0.624	0.6575	94.9	95
1	F1	F1_B15	F1_B15	Control	0	3	0.691	0.6575	105.1	90
1	F1	F1_B15	F1_B15	Sethoxydim	0.0625	9	0.325	0.6595	49.3	85
1	F1	F1_B15	F1_B15	Sethoxydim	0.125	9	0.56	0.6595	84.9	80
1	F1	F1_B15	F1_B15	Sethoxydim	0.25	9	0.186	0.6595	28.2	60
1	F1	F1_B15	F1_B15	Sethoxydim	0.5	9	0.053	0.6595	8	40
1	F1	F1_B15	F1_B15	Sethoxydim	1	9	0.06	0.6595	9.1	35
1	F1	F1_B15	F1_B15	Sethoxydim	4	9	0.049	0.6595	7.4	0
1	F1	F1_B15	F1_B15	Quizalofop	0.0625	9	0.669	0.6595	101.4	100
1	F1	F1_B15	F1_B15	Quizalofop	0.125	9	0.561	0.6595	85.1	100
1	F1	F1_B15	F1_B15	Quizalofop	0.25	9	0.52	0.6595	78.8	100
1	F1	F1_B15	F1_B15	Quizalofop	0.5	9	0.125	0.6595	19	30
1	F1	F1_B15	F1_B15	Quizalofop	1	9	0.081	0.6595	12.3	40
1	F1	F1_B15	F1_B15	Quizalofop	2	9	0.083	0.6595	12.6	10
1	F1	F1_B15	F1_B15	Quizalofop	4	9	0.082	0.6595	12.4	30
1	F1	F1_B15	F1_B15	Fluazifop	0.0625	9	0.536	0.6595	81.3	100
1	F1	F1_B15	F1_B15	Fluazifop	0.125	9	0.521	0.6595	79	80
1	F1	F1_B15	F1_B15	Fluazifop	0.25	9	0.26	0.6595	39.4	95
1	F1	F1_B15	F1_B15	Fluazifop	0.5	9	0.379	0.6595	57.5	85
1	F1	F1_B15	F1_B15	Fluazifop	1	9	0.247	0.6595	37.5	50
1	F1	F1_B15	F1_B15	Fluazifop	2	9	0.179	0.6595	27.1	70
1	F1	F1_B15	F1_B15	Fluazifop	4	9	0.162	0.6595	24.6	40
1	F1	F1_B15	F1_B15	Clethodim	0.0625	9	0.059	0.6595	8.9	40
1	F1	F1_B15	F1_B15	Clethodim	0.125	9	0.054	0.6595	8.2	40
1	F1	F1_B15	F1_B15	Clethodim	0.25	9	0.084	0.6595	12.7	10
1	F1	F1_B15	F1_B15	Clethodim	0.5	9	0.073	0.6595	11.1	0
1	F1	F1_B15	F1_B15	Clethodim	1	9	0.078	0.6595	11.8	0
1	F1	F1_B15	F1_B15	Clethodim	4	9	0.101	0.6595	15.3	0
1	F1	F1_B15	F1_B15	Control	0	9	0.659	0.6595	99.9	100
1	F1	F1_B15	F1_B15	Control	0	9	0.66	0.6595	100.1	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	1	0.323	0.768	42.1	90
2	susceptible	ATx623	ATx623	Sethoxydim	0.125	1	0.187	0.768	24.4	40
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	1	0.211	0.768	27.5	50
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	1	0.214	0.768	27.9	10
2	susceptible	ATx623	ATx623	Sethoxydim	1	1	0.125	0.768	16.3	0
2	susceptible	ATx623	ATx623	Sethoxydim	2	1	0.12	0.768	15.6	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	1	0.115	0.768	15	0
2	susceptible	ATx623	ATx623	Quizalofop	0.0625	1	0.156	0.768	20.3	20
2	susceptible	ATx623	ATx623	Quizalofop	0.125	1	0.159	0.768	20.7	0
2	susceptible	ATx623	ATx623	Quizalofop	0.25	1	0.13	0.768	16.9	0
2	susceptible	ATx623	ATx623	Quizalofop	0.5	1	0.15	0.768	19.5	0
2	susceptible	ATx623	ATx623	Quizalofop	1	1	0.121	0.768	15.8	0
2	susceptible	ATx623	ATx623	Quizalofop	2	1	0.107	0.768	13.9	0
2	susceptible	ATx623	ATx623	Quizalofop	4	1	0.115	0.768	15	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	1	0.159	0.768	20.7	45
2	susceptible	ATx623	ATx623	Fluazifop	0.125	1	0.129	0.768	16.8	0
2	susceptible	ATx623	ATx623	Fluazifop	0.25	1	0.15	0.768	19.5	0
2	susceptible	ATx623	ATx623	Fluazifop	0.5	1	0.118	0.768	15.4	0
2	susceptible	ATx623	ATx623	Fluazifop	1	1	0.121	0.768	15.8	0
2	susceptible	ATx623	ATx623	Fluazifop	2	1	0.154	0.768	20.1	0
2	susceptible	ATx623	ATx623	Fluazifop	4	1	0.142	0.768	18.5	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	1	0.141	0.768	18.4	20
2	susceptible	ATx623	ATx623	Clethodim	0.125	1	0.113	0.768	14.7	10
2	susceptible	ATx623	ATx623	Clethodim	0.25	1	0.154	0.768	20.1	0
2	susceptible	ATx623	ATx623	Clethodim	0.5	1	0.136	0.768	17.7	0
2	susceptible	ATx623	ATx623	Clethodim	1	1	0.12	0.768	15.6	0
2	susceptible	ATx623	ATx623	Clethodim	2	1	0.16	0.768	20.8	0
2	susceptible	ATx623	ATx623	Clethodim	4	1	0.121	0.768	15.8	0
2	susceptible	ATx623	ATx623	Control	0	1	0.736	0.768	95.9	95
2	susceptible	ATx623	ATx623	Control	0	1	0.799	0.768	104.1	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	2	0.421	0.607	69.4	100

2	susceptible	ATx623	ATx623	Sethoxydim	0.125	2	0.081	0.607	13.4	50
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	2	0.136	0.607	22.4	50
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	2	0.125	0.607	20.6	0
2	susceptible	ATx623	ATx623	Sethoxydim	1	2	0.114	0.607	18.8	30
2	susceptible	ATx623	ATx623	Sethoxydim	2	2	0.099	0.607	16.3	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	2	0.149	0.607	24.6	0
2	susceptible	ATx623	ATx623	Quizalofop	0.0625	2	0.29	0.607	47.8	20
2	susceptible	ATx623	ATx623	Quizalofop	0.125	2	0.124	0.607	20.4	0
2	susceptible	ATx623	ATx623	Quizalofop	0.25	2	0.098	0.607	16.2	0
2	susceptible	ATx623	ATx623	Quizalofop	0.5	2	0.136	0.607	22.4	0
2	susceptible	ATx623	ATx623	Quizalofop	1	2	0.071	0.607	11.7	0
2	susceptible	ATx623	ATx623	Quizalofop	2	2	0.132	0.607	21.8	0
2	susceptible	ATx623	ATx623	Quizalofop	4	2	0.082	0.607	13.5	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	2	0.464	0.607	76.5	80
2	susceptible	ATx623	ATx623	Fluazifop	0.125	2	0.21	0.607	34.6	40
2	susceptible	ATx623	ATx623	Fluazifop	0.5	2	0.103	0.607	17	0
2	susceptible	ATx623	ATx623	Fluazifop	1	2	0.117	0.607	19.3	10
2	susceptible	ATx623	ATx623	Fluazifop	2	2	0.133	0.607	21.9	0
2	susceptible	ATx623	ATx623	Fluazifop	4	2	0.201	0.607	33.1	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	2	0.088	0.607	14.5	40
2	susceptible	ATx623	ATx623	Clethodim	0.125	2	0.133	0.607	21.9	30
2	susceptible	ATx623	ATx623	Clethodim	0.25	2	0.154	0.607	25.4	20
2	susceptible	ATx623	ATx623	Clethodim	0.5	2	0.112	0.607	18.5	0
2	susceptible	ATx623	ATx623	Clethodim	1	2	0.135	0.607	22.3	0
2	susceptible	ATx623	ATx623	Clethodim	2	2	0.149	0.607	24.6	0
2	susceptible	ATx623	ATx623	Clethodim	4	2	0.083	0.607	13.7	0
2	susceptible	ATx623	ATx623	Control	0	2	0.552	0.607	91	100
2	susceptible	ATx623	ATx623	Control	0	2	0.661	0.607	109	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	3	0.457	0.744	61.4	80
2	susceptible	ATx623	ATx623	Sethoxydim	0.125	3	0.203	0.744	27.3	70
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	3	0.174	0.744	23.4	50
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	3	0.087	0.744	11.7	0
2	susceptible	ATx623	ATx623	Sethoxydim	1	3	0.079	0.744	10.6	0
2	susceptible	ATx623	ATx623	Sethoxydim	2	3	0.121	0.744	16.3	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	3	0.056	0.744	7.5	0
2	susceptible	ATx623	ATx623	Quizalofop	0.0625	3	0.095	0.744	12.8	30
2	susceptible	ATx623	ATx623	Quizalofop	0.125	3	0.055	0.744	7.4	0
2	susceptible	ATx623	ATx623	Quizalofop	0.25	3	0.114	0.744	15.3	0
2	susceptible	ATx623	ATx623	Quizalofop	0.5	3	0.086	0.744	11.6	0
2	susceptible	ATx623	ATx623	Quizalofop	1	3	0.077	0.744	10.3	0
2	susceptible	ATx623	ATx623	Quizalofop	4	3	0.077	0.744	10.3	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	3	0.162	0.744	21.8	90
2	susceptible	ATx623	ATx623	Fluazifop	0.125	3	0.113	0.744	15.2	50
2	susceptible	ATx623	ATx623	Fluazifop	0.25	3	0.134	0.744	18	0
2	susceptible	ATx623	ATx623	Fluazifop	0.5	3	0.193	0.744	25.9	30
2	susceptible	ATx623	ATx623	Fluazifop	1	3	0.096	0.744	12.9	0
2	susceptible	ATx623	ATx623	Fluazifop	2	3	0.058	0.744	7.8	0
2	susceptible	ATx623	ATx623	Fluazifop	4	3	0.071	0.744	9.5	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	3	0.086	0.744	11.6	0
2	susceptible	ATx623	ATx623	Clethodim	0.125	3	0.133	0.744	17.9	25
2	susceptible	ATx623	ATx623	Clethodim	0.25	3	0.051	0.744	6.9	40
2	susceptible	ATx623	ATx623	Clethodim	0.5	3	0.094	0.744	12.6	0
2	susceptible	ATx623	ATx623	Clethodim	1	3	0.089	0.744	12	0
2	susceptible	ATx623	ATx623	Clethodim	2	3	0.106	0.744	14.2	0
2	susceptible	ATx623	ATx623	Clethodim	4	3	0.084	0.744	11.3	0
2	susceptible	ATx623	ATx623	Control	0	3	0.741	0.744	99.6	100
2	susceptible	ATx623	ATx623	Control	0	3	0.747	0.744	100.4	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	4	0.104	0.682	15.2	70
2	susceptible	ATx623	ATx623	Sethoxydim	0.125	4	0.109	0.682	16	70
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	4	0.056	0.682	8.2	30
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	4	0.077	0.682	11.3	40
2	susceptible	ATx623	ATx623	Sethoxydim	1	4	0.05	0.682	7.3	0

2	susceptible	ATx623	ATx623	Sethoxydim	2	4	0.062	0.682	9.1	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	4	0.031	0.682	4.5	0
2	susceptible	ATx623	ATx623	Quizalofop	0.0625	4	0.038	0.682	5.6	0
2	susceptible	ATx623	ATx623	Quizalofop	0.125	4	0.07	0.682	10.3	30
2	susceptible	ATx623	ATx623	Quizalofop	0.25	4	0.032	0.682	4.7	40
2	susceptible	ATx623	ATx623	Quizalofop	0.5	4	0.052	0.682	7.6	0
2	susceptible	ATx623	ATx623	Quizalofop	1	4	0.047	0.682	6.9	10
2	susceptible	ATx623	ATx623	Quizalofop	2	4	0.047	0.682	6.9	0
2	susceptible	ATx623	ATx623	Quizalofop	4	4	0.058	0.682	8.5	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	4	0.063	0.682	9.2	40
2	susceptible	ATx623	ATx623	Fluazifop	0.125	4	0.051	0.682	7.5	40
2	susceptible	ATx623	ATx623	Fluazifop	0.25	4	0.032	0.682	4.7	40
2	susceptible	ATx623	ATx623	Fluazifop	0.5	4	.	.	.	0
2	susceptible	ATx623	ATx623	Fluazifop	1	4	0.062	0.682	9.1	30
2	susceptible	ATx623	ATx623	Fluazifop	2	4	0.043	0.682	6.3	0
2	susceptible	ATx623	ATx623	Fluazifop	4	4	0.066	0.682	9.7	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	4	0.065	0.682	9.5	30
2	susceptible	ATx623	ATx623	Clethodim	0.125	4	0.071	0.682	10.4	30
2	susceptible	ATx623	ATx623	Clethodim	0.25	4	0.11	0.682	16.1	20
2	susceptible	ATx623	ATx623	Clethodim	0.5	4	0.028	0.682	4.1	0
2	susceptible	ATx623	ATx623	Clethodim	1	4	0.036	0.682	5.3	20
2	susceptible	ATx623	ATx623	Clethodim	2	4	0.073	0.682	10.7	0
2	susceptible	ATx623	ATx623	Clethodim	4	4	0.069	0.682	10.1	0
2	susceptible	ATx623	ATx623	Control	0	4	0.507	0.682	74.3	100
2	susceptible	ATx623	ATx623	Control	0	4	0.857	0.682	125.7	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	5	0.144	0.446	32.3	70
2	susceptible	ATx623	ATx623	Sethoxydim	0.125	5	0.222	0.446	49.8	80
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	5	0.046	0.446	10.3	30
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	5	0.059	0.446	13.2	30
2	susceptible	ATx623	ATx623	Sethoxydim	1	5	0.06	0.446	13.5	0
2	susceptible	ATx623	ATx623	Sethoxydim	2	5	0.033	0.446	7.4	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	5	0.044	0.446	9.9	0
2	susceptible	ATx623	ATx623	Quizalofop	0.0625	5	0.045	0.446	10.1	25
2	susceptible	ATx623	ATx623	Quizalofop	0.125	5	0.034	0.446	7.6	20
2	susceptible	ATx623	ATx623	Quizalofop	0.25	5	0.029	0.446	6.5	0
2	susceptible	ATx623	ATx623	Quizalofop	0.5	5	0.044	0.446	9.9	0
2	susceptible	ATx623	ATx623	Quizalofop	1	5	0.06	0.446	13.5	0
2	susceptible	ATx623	ATx623	Quizalofop	2	5	0.031	0.446	7	0
2	susceptible	ATx623	ATx623	Quizalofop	4	5	0.021	0.446	4.7	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	5	0.046	0.446	10.3	50
2	susceptible	ATx623	ATx623	Fluazifop	0.125	5	0.03	0.446	6.7	0
2	susceptible	ATx623	ATx623	Fluazifop	0.25	5	0.046	0.446	10.3	20
2	susceptible	ATx623	ATx623	Fluazifop	0.5	5	0.056	0.446	12.6	0
2	susceptible	ATx623	ATx623	Fluazifop	1	5	0.037	0.446	8.3	0
2	susceptible	ATx623	ATx623	Fluazifop	2	5	0.066	0.446	14.8	0
2	susceptible	ATx623	ATx623	Fluazifop	4	5	0.031	0.446	7	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	5	0.063	0.446	14.1	40
2	susceptible	ATx623	ATx623	Clethodim	0.125	5	0.045	0.446	10.1	40
2	susceptible	ATx623	ATx623	Clethodim	0.25	5	0.053	0.446	11.9	30
2	susceptible	ATx623	ATx623	Clethodim	0.5	5	0.038	0.446	8.5	0
2	susceptible	ATx623	ATx623	Clethodim	1	5	0.019	0.446	4.3	0
2	susceptible	ATx623	ATx623	Clethodim	2	5	0.044	0.446	9.9	0
2	susceptible	ATx623	ATx623	Clethodim	4	5	0.041	0.446	9.2	0
2	susceptible	ATx623	ATx623	Control	0	5	0.371	0.446	83.2	100
2	susceptible	ATx623	ATx623	Control	0	5	0.521	0.446	116.8	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	6	0.241	0.666	36.2	70
2	susceptible	ATx623	ATx623	Sethoxydim	0.125	6	0.223	0.666	33.5	50
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	6	0.174	0.666	26.1	40
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	6	0.126	0.666	18.9	20
2	susceptible	ATx623	ATx623	Sethoxydim	1	6	0.139	0.666	20.9	0
2	susceptible	ATx623	ATx623	Sethoxydim	2	6	0.088	0.666	13.2	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	6	0.139	0.666	20.9	0

2	susceptible	ATx623	ATx623	Quizalofop	0.0625	6	0.153	0.666	23	0
2	susceptible	ATx623	ATx623	Quizalofop	0.125	6	0.124	0.666	18.6	0
2	susceptible	ATx623	ATx623	Quizalofop	0.25	6	0.186	0.666	27.9	0
2	susceptible	ATx623	ATx623	Quizalofop	0.5	6	0.084	0.666	12.6	0
2	susceptible	ATx623	ATx623	Quizalofop	1	6	0.079	0.666	11.9	0
2	susceptible	ATx623	ATx623	Quizalofop	2	6	0.111	0.666	16.7	0
2	susceptible	ATx623	ATx623	Quizalofop	4	6	0.164	0.666	24.6	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	6	0.17	0.666	25.5	40
2	susceptible	ATx623	ATx623	Fluazifop	0.125	6	0.161	0.666	24.2	30
2	susceptible	ATx623	ATx623	Fluazifop	0.25	6	0.196	0.666	29.5	0
2	susceptible	ATx623	ATx623	Fluazifop	0.5	6	0.156	0.666	23.4	0
2	susceptible	ATx623	ATx623	Fluazifop	1	6	0.135	0.666	20.3	0
2	susceptible	ATx623	ATx623	Fluazifop	2	6	0.09	0.666	13.5	0
2	susceptible	ATx623	ATx623	Fluazifop	4	6	0.169	0.666	25.4	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	6	0.096	0.666	14.4	0
2	susceptible	ATx623	ATx623	Clethodim	0.125	6	0.188	0.666	28.2	5
2	susceptible	ATx623	ATx623	Clethodim	0.25	6	0.167	0.666	25.1	0
2	susceptible	ATx623	ATx623	Clethodim	0.5	6	0.127	0.666	19.1	0
2	susceptible	ATx623	ATx623	Clethodim	1	6	0.067	0.666	10.1	0
2	susceptible	ATx623	ATx623	Clethodim	2	6	0.1	0.666	15	0
2	susceptible	ATx623	ATx623	Clethodim	4	6	0.134	0.666	20.1	0
2	susceptible	ATx623	ATx623	Control	0	6	0.621	0.666	93.3	100
2	susceptible	ATx623	ATx623	Control	0	6	0.71	0.666	106.7	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	7	0.45	0.921	48.9	90
2	susceptible	ATx623	ATx623	Sethoxydim	0.125	7	0.156	0.921	16.9	40
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	7	0.179	0.921	19.4	40
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	7	0.136	0.921	14.8	0
2	susceptible	ATx623	ATx623	Sethoxydim	1	7	0.134	0.921	14.6	30
2	susceptible	ATx623	ATx623	Sethoxydim	2	7	0.181	0.921	19.7	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	7	0.13	0.921	14.1	0
2	susceptible	ATx623	ATx623	Quizalofop	0.0625	7	0.145	0.921	15.8	80
2	susceptible	ATx623	ATx623	Quizalofop	0.125	7	0.121	0.921	13.1	0
2	susceptible	ATx623	ATx623	Quizalofop	0.25	7	0.14	0.921	15.2	0
2	susceptible	ATx623	ATx623	Quizalofop	0.5	7	0.082	0.921	8.9	0
2	susceptible	ATx623	ATx623	Quizalofop	1	7	0.097	0.921	10.5	0
2	susceptible	ATx623	ATx623	Quizalofop	2	7	0.132	0.921	14.3	0
2	susceptible	ATx623	ATx623	Quizalofop	4	7	0.105	0.921	11.4	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	7	0.182	0.921	19.8	80
2	susceptible	ATx623	ATx623	Fluazifop	0.125	7	0.135	0.921	14.7	30
2	susceptible	ATx623	ATx623	Fluazifop	0.25	7	0.134	0.921	14.6	0
2	susceptible	ATx623	ATx623	Fluazifop	0.5	7	0.13	0.921	14.1	0
2	susceptible	ATx623	ATx623	Fluazifop	1	7	0.113	0.921	12.3	0
2	susceptible	ATx623	ATx623	Fluazifop	2	7	0.118	0.921	12.8	0
2	susceptible	ATx623	ATx623	Fluazifop	4	7	0.121	0.921	13.1	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	7	0.18	0.921	19.6	0
2	susceptible	ATx623	ATx623	Clethodim	0.125	7	0.065	0.921	7.1	0
2	susceptible	ATx623	ATx623	Clethodim	0.25	7	0.076	0.921	8.3	0
2	susceptible	ATx623	ATx623	Clethodim	0.5	7	0.148	0.921	16.1	0
2	susceptible	ATx623	ATx623	Clethodim	1	7	0.123	0.921	13.4	0
2	susceptible	ATx623	ATx623	Clethodim	2	7	0.114	0.921	12.4	0
2	susceptible	ATx623	ATx623	Clethodim	4	7	0.166	0.921	18	0
2	susceptible	ATx623	ATx623	Control	0	7	0.888	0.921	96.5	100
2	susceptible	ATx623	ATx623	Control	0	7	0.953	0.921	103.5	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	8	0.669	0.934	71.6	90
2	susceptible	ATx623	ATx623	Sethoxydim	0.125	8	0.463	0.934	49.6	90
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	8	0.078	0.934	8.4	50
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	8	0.107	0.934	11.5	20
2	susceptible	ATx623	ATx623	Sethoxydim	1	8	0.093	0.934	10	20
2	susceptible	ATx623	ATx623	Sethoxydim	2	8	0.068	0.934	7.3	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	8	0.064	0.934	6.9	0
2	susceptible	ATx623	ATx623	Quizalofop	0.0625	8	0.241	0.934	25.8	100
2	susceptible	ATx623	ATx623	Quizalofop	0.125	8	0.101	0.934	10.8	20

2	susceptible	ATx623	ATx623	Quizalofop	0.25	8	0.089	0.934	9.5	10
2	susceptible	ATx623	ATx623	Quizalofop	0.5	8	0.052	0.934	5.6	0
2	susceptible	ATx623	ATx623	Quizalofop	1	8	0.087	0.934	9.3	0
2	susceptible	ATx623	ATx623	Quizalofop	2	8	0.071	0.934	7.6	0
2	susceptible	ATx623	ATx623	Quizalofop	4	8	0.053	0.934	5.7	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	8	0.258	0.934	27.6	60
2	susceptible	ATx623	ATx623	Fluazifop	0.125	8	0.066	0.934	7.1	40
2	susceptible	ATx623	ATx623	Fluazifop	0.25	8	0.104	0.934	11.1	0
2	susceptible	ATx623	ATx623	Fluazifop	0.5	8	0.103	0.934	11	0
2	susceptible	ATx623	ATx623	Fluazifop	2	8	0.127	0.934	13.6	0
2	susceptible	ATx623	ATx623	Fluazifop	4	8	0.106	0.934	11.3	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	8	0.157	0.934	16.8	0
2	susceptible	ATx623	ATx623	Clethodim	0.125	8	0.071	0.934	7.6	0
2	susceptible	ATx623	ATx623	Clethodim	0.25	8	0.119	0.934	12.7	20
2	susceptible	ATx623	ATx623	Clethodim	0.5	8	0.076	0.934	8.1	0
2	susceptible	ATx623	ATx623	Clethodim	1	8	0.059	0.934	6.3	0
2	susceptible	ATx623	ATx623	Clethodim	2	8	0.104	0.934	11.1	0
2	susceptible	ATx623	ATx623	Clethodim	4	8	0.114	0.934	12.2	0
2	susceptible	ATx623	ATx623	Control	0	8	0.885	0.934	94.8	100
2	susceptible	ATx623	ATx623	Control	0	8	0.983	0.934	105.2	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	9	0.207	0.73	28.4	90
2	susceptible	ATx623	ATx623	Sethoxydim	0.125	9	0.331	0.73	45.4	80
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	9	0.033	0.73	4.5	40
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	9	0.09	0.73	12.3	40
2	susceptible	ATx623	ATx623	Sethoxydim	1	9	0.052	0.73	7.1	0
2	susceptible	ATx623	ATx623	Sethoxydim	2	9	0.074	0.73	10.1	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	9	0.064	0.73	8.8	0
2	susceptible	ATx623	ATx623	Quizalofop	0.0625	9	0.099	0.73	13.6	30
2	susceptible	ATx623	ATx623	Quizalofop	0.125	9	0.048	0.73	6.6	30
2	susceptible	ATx623	ATx623	Quizalofop	0.25	9	0.104	0.73	14.3	0
2	susceptible	ATx623	ATx623	Quizalofop	0.5	9	0.045	0.73	6.2	10
2	susceptible	ATx623	ATx623	Quizalofop	1	9	0.061	0.73	8.4	0
2	susceptible	ATx623	ATx623	Quizalofop	2	9	0.071	0.73	9.7	0
2	susceptible	ATx623	ATx623	Quizalofop	4	9	0.089	0.73	12.2	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	9	0.087	0.73	11.9	70
2	susceptible	ATx623	ATx623	Fluazifop	0.125	9	0.095	0.73	13	40
2	susceptible	ATx623	ATx623	Fluazifop	0.25	9	0.068	0.73	9.3	30
2	susceptible	ATx623	ATx623	Fluazifop	0.5	9	0.043	0.73	5.9	40
2	susceptible	ATx623	ATx623	Fluazifop	1	9	0.127	0.73	17.4	0
2	susceptible	ATx623	ATx623	Fluazifop	2	9	0.051	0.73	7	0
2	susceptible	ATx623	ATx623	Fluazifop	4	9	0.091	0.73	12.5	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	9	0.11	0.73	15.1	10
2	susceptible	ATx623	ATx623	Clethodim	0.125	9	0.037	0.73	5.1	30
2	susceptible	ATx623	ATx623	Clethodim	0.25	9	0.095	0.73	13	0
2	susceptible	ATx623	ATx623	Clethodim	0.5	9	0.061	0.73	8.4	0
2	susceptible	ATx623	ATx623	Clethodim	1	9	0.097	0.73	13.3	0
2	susceptible	ATx623	ATx623	Clethodim	2	9	0.05	0.73	6.9	0
2	susceptible	ATx623	ATx623	Clethodim	4	9	0.085	0.73	11.7	0
2	susceptible	ATx623	ATx623	Control	0	9	0.639	0.73	87.6	100
2	susceptible	ATx623	ATx623	Control	0	9	0.82	0.73	112.4	100
2	susceptible	ATx623	ATx623	Sethoxydim	0.0625	10	0.132	0.258	51.2	70
2	susceptible	ATx623	ATx623	Sethoxydim	0.125	10	0.027	0.258	10.5	60
2	susceptible	ATx623	ATx623	Sethoxydim	0.25	10	0.022	0.258	8.5	40
2	susceptible	ATx623	ATx623	Sethoxydim	0.5	10	0.022	0.258	8.5	50
2	susceptible	ATx623	ATx623	Sethoxydim	1	10	0.016	0.258	6.2	0
2	susceptible	ATx623	ATx623	Sethoxydim	2	10	0.025	0.258	9.7	0
2	susceptible	ATx623	ATx623	Sethoxydim	4	10	0.022	0.258	8.5	0
2	susceptible	ATx623	ATx623	Quizalofop	0.0625	10	0.02	0.258	7.8	30
2	susceptible	ATx623	ATx623	Quizalofop	0.125	10	0.042	0.258	16.3	30
2	susceptible	ATx623	ATx623	Quizalofop	0.25	10	0.033	0.258	12.8	30
2	susceptible	ATx623	ATx623	Quizalofop	0.5	10	0.025	0.258	9.7	0
2	susceptible	ATx623	ATx623	Quizalofop	1	10	0.023	0.258	8.9	0

2	susceptible	ATx623	ATx623	Quizalofop	2	10	0.014	0.258	5.4	0
2	susceptible	ATx623	ATx623	Quizalofop	4	10	0.017	0.258	6.6	0
2	susceptible	ATx623	ATx623	Fluazifop	0.0625	10	0.064	0.258	24.8	70
2	susceptible	ATx623	ATx623	Fluazifop	0.125	10	0.019	0.258	7.4	0
2	susceptible	ATx623	ATx623	Fluazifop	0.25	10	0.028	0.258	10.9	50
2	susceptible	ATx623	ATx623	Fluazifop	0.5	10	0.023	0.258	8.9	0
2	susceptible	ATx623	ATx623	Fluazifop	1	10	0.019	0.258	7.4	30
2	susceptible	ATx623	ATx623	Fluazifop	2	10	0.03	0.258	11.6	0
2	susceptible	ATx623	ATx623	Fluazifop	4	10	0.034	0.258	13.2	0
2	susceptible	ATx623	ATx623	Clethodim	0.0625	10	0.034	0.258	13.2	20
2	susceptible	ATx623	ATx623	Clethodim	0.125	10	0.018	0.258	7	50
2	susceptible	ATx623	ATx623	Clethodim	0.25	10	0.019	0.258	7.4	0
2	susceptible	ATx623	ATx623	Clethodim	0.5	10	0.021	0.258	8.1	0
2	susceptible	ATx623	ATx623	Clethodim	1	10	0.028	0.258	10.9	0
2	susceptible	ATx623	ATx623	Clethodim	2	10	0.014	0.258	5.4	0
2	susceptible	ATx623	ATx623	Clethodim	4	10	0.037	0.258	14.3	0
2	susceptible	ATx623	ATx623	Control	0	10	0.222	0.258	86	100
2	susceptible	ATx623	ATx623	Control	0	10	0.294	0.258	114	100
2	Resistant	B71	71X	Sethoxydim	0.0625	3	0.908	0.909	99.9	100
2	Resistant	B71	71X	Sethoxydim	0.125	3	1.07	0.909	117.7	85
2	Resistant	B71	71X	Sethoxydim	0.25	3	0.925	0.909	101.8	85
2	Resistant	B71	71X	Sethoxydim	0.5	3	0.215	0.909	23.7	55
2	Resistant	B71	71X	Sethoxydim	1	3	0.082	0.909	9	40
2	Resistant	B71	71X	Sethoxydim	2	3	0.104	0.909	11.4	40
2	Resistant	B71	71X	Sethoxydim	4	3	0.162	0.909	17.8	30
2	Resistant	B71	71X	Quizalofop	0.0625	3	1.001	0.909	110.1	100
2	Resistant	B71	71X	Quizalofop	0.125	3	1.308	0.909	143.9	100
2	Resistant	B71	71X	Quizalofop	0.25	3	1.364	0.909	150.1	100
2	Resistant	B71	71X	Quizalofop	0.5	3	0.541	0.909	59.5	100
2	Resistant	B71	71X	Quizalofop	1	3	0.702	0.909	77.2	100
2	Resistant	B71	71X	Quizalofop	2	3	.	.	.	95
2	Resistant	B71	71X	Quizalofop	4	3	0.749	0.909	82.4	70
2	Resistant	B71	71X	Fluazifop	0.0625	3	0.938	0.909	103.2	100
2	Resistant	B71	71X	Fluazifop	0.125	3	0.934	0.909	102.8	100
2	Resistant	B71	71X	Fluazifop	0.25	3	1.112	0.909	122.3	100
2	Resistant	B71	71X	Fluazifop	0.5	3	1.572	0.909	172.9	100
2	Resistant	B71	71X	Fluazifop	1	3	0.963	0.909	105.9	95
2	Resistant	B71	71X	Fluazifop	2	3	1.262	0.909	138.8	95
2	Resistant	B71	71X	Fluazifop	4	3	0.953	0.909	104.8	90
2	Resistant	B71	71X	Clethodim	0.0625	3	0.385	0.909	42.4	100
2	Resistant	B71	71X	Clethodim	0.125	3	0.094	0.909	10.3	40
2	Resistant	B71	71X	Clethodim	0.25	3	0.143	0.909	15.7	40
2	Resistant	B71	71X	Clethodim	0.5	3	0.152	0.909	16.7	0
2	Resistant	B71	71X	Clethodim	1	3	0.12	0.909	13.2	0
2	Resistant	B71	71X	Clethodim	2	3	0.116	0.909	12.8	0
2	Resistant	B71	71X	Clethodim	4	3	0.011	0.909	1.2	0
2	Resistant	B71	71X	Control	0	3	0.909	0.909	100	100
2	Resistant	B71	71X	Sethoxydim	0.0625	4	0.693	0.788	88	100
2	Resistant	B71	71X	Sethoxydim	0.125	4	0.873	0.788	110.9	95
2	Resistant	B71	71X	Sethoxydim	0.25	4	0.414	0.788	52.6	70
2	Resistant	B71	71X	Sethoxydim	0.5	4	0.071	0.788	9	50
2	Resistant	B71	71X	Sethoxydim	1	4	0.053	0.788	6.7	50
2	Resistant	B71	71X	Sethoxydim	2	4	0.092	0.788	11.7	50
2	Resistant	B71	71X	Sethoxydim	4	4	0.152	0.788	19.3	20
2	Resistant	B71	71X	Quizalofop	0.0625	4	.	.	.	100
2	Resistant	B71	71X	Quizalofop	0.125	4	0.692	0.788	87.9	100
2	Resistant	B71	71X	Quizalofop	0.25	4	0.696	0.788	88.4	100
2	Resistant	B71	71X	Quizalofop	0.5	4	0.904	0.788	114.8	100
2	Resistant	B71	71X	Quizalofop	1	4	1.399	0.788	177.7	100
2	Resistant	B71	71X	Quizalofop	2	4	0.513	0.788	65.1	95
2	Resistant	B71	71X	Quizalofop	4	4	0.394	0.788	50	100
2	Resistant	B71	71X	Fluazifop	0.0625	4	0.686	0.788	87.1	100

2	Resistant	B71	71X	Fluazifop	0.125	4	0.279	0.788	35.4	100
2	Resistant	B71	71X	Fluazifop	0.25	4	0.847	0.788	107.6	100
2	Resistant	B71	71X	Fluazifop	0.5	4	0.872	0.788	110.7	100
2	Resistant	B71	71X	Fluazifop	1	4	0.519	0.788	65.9	100
2	Resistant	B71	71X	Fluazifop	2	4	0.688	0.788	87.4	100
2	Resistant	B71	71X	Fluazifop	4	4	0.538	0.788	68.3	100
2	Resistant	B71	71X	Clethodim	0.0625	4	0.177	0.788	22.5	80
2	Resistant	B71	71X	Clethodim	0.125	4	0.083	0.788	10.5	50
2	Resistant	B71	71X	Clethodim	0.25	4	0.165	0.788	21	40
2	Resistant	B71	71X	Clethodim	0.5	4	0.064	0.788	8.1	0
2	Resistant	B71	71X	Clethodim	1	4	0.029	0.788	3.7	0
2	Resistant	B71	71X	Clethodim	2	4	0.089	0.788	11.3	0
2	Resistant	B71	71X	Clethodim	4	4	0.073	0.788	9.3	0
2	Resistant	B71	71X	Control	0	4	0.675	0.788	85.7	100
2	Resistant	B71	71X	Control	0	4	0.9	0.788	114.3	100
2	Resistant	B71	71X	Sethoxydim	0.0625	5	0.644	0.666	96.8	100
2	Resistant	B71	71X	Sethoxydim	0.125	5	0.449	0.666	67.5	95
2	Resistant	B71	71X	Sethoxydim	0.25	5	0.394	0.666	59.2	90
2	Resistant	B71	71X	Sethoxydim	0.5	5	0.364	0.666	54.7	85
2	Resistant	B71	71X	Sethoxydim	1	5	0.051	0.666	7.7	50
2	Resistant	B71	71X	Sethoxydim	2	5	0.073	0.666	11	40
2	Resistant	B71	71X	Sethoxydim	4	5	0.077	0.666	11.6	20
2	Resistant	B71	71X	Quizalofop	0.0625	5	0.554	0.666	83.2	100
2	Resistant	B71	71X	Quizalofop	0.125	5	0.659	0.666	99	100
2	Resistant	B71	71X	Quizalofop	0.25	5	0.566	0.666	85	100
2	Resistant	B71	71X	Quizalofop	0.5	5	0.798	0.666	119.9	90
2	Resistant	B71	71X	Quizalofop	1	5	0.545	0.666	81.9	100
2	Resistant	B71	71X	Quizalofop	2	5	0.639	0.666	96	100
2	Resistant	B71	71X	Quizalofop	4	5	0.244	0.666	36.7	80
2	Resistant	B71	71X	Fluazifop	0.0625	5	0.741	0.666	111.3	100
2	Resistant	B71	71X	Fluazifop	0.125	5	0.675	0.666	101.4	100
2	Resistant	B71	71X	Fluazifop	0.25	5	0.857	0.666	128.8	100
2	Resistant	B71	71X	Fluazifop	0.5	5	0.615	0.666	92.4	100
2	Resistant	B71	71X	Fluazifop	1	5	0.528	0.666	79.3	100
2	Resistant	B71	71X	Fluazifop	2	5	0.568	0.666	85.3	90
2	Resistant	B71	71X	Fluazifop	4	5	0.573	0.666	86.1	90
2	Resistant	B71	71X	Clethodim	0.0625	5	0.081	0.666	12.2	50
2	Resistant	B71	71X	Clethodim	0.125	5	0.071	0.666	10.7	40
2	Resistant	B71	71X	Clethodim	0.25	5	0.061	0.666	9.2	30
2	Resistant	B71	71X	Clethodim	0.5	5	0.082	0.666	12.3	30
2	Resistant	B71	71X	Clethodim	1	5	0.068	0.666	10.2	10
2	Resistant	B71	71X	Clethodim	2	5	0.052	0.666	7.8	0
2	Resistant	B71	71X	Clethodim	4	5	0.01	0.666	1.5	0
2	Resistant	B71	71X	Control	0	5	0.562	0.666	84.4	100
2	Resistant	B71	71X	Control	0	5	0.769	0.666	115.6	100
2	Resistant	B71	71X	Sethoxydim	0.0625	9	0.761	0.687	110.8	100
2	Resistant	B71	71X	Sethoxydim	0.125	9	0.628	0.687	91.4	100
2	Resistant	B71	71X	Sethoxydim	0.25	9	0.396	0.687	57.6	100
2	Resistant	B71	71X	Sethoxydim	0.5	9	0.067	0.687	9.8	50
2	Resistant	B71	71X	Sethoxydim	1	9	0.071	0.687	10.3	50
2	Resistant	B71	71X	Sethoxydim	2	9	0.057	0.687	8.3	50
2	Resistant	B71	71X	Sethoxydim	4	9	0.08	0.687	11.6	0
2	Resistant	B71	71X	Quizalofop	0.0625	9	0.421	0.687	61.3	100
2	Resistant	B71	71X	Quizalofop	0.125	9	0.821	0.687	119.5	100
2	Resistant	B71	71X	Quizalofop	0.25	9	0.944	0.687	137.4	100
2	Resistant	B71	71X	Quizalofop	0.5	9	0.597	0.687	86.9	100
2	Resistant	B71	71X	Quizalofop	1	9	0.808	0.687	117.6	100
2	Resistant	B71	71X	Quizalofop	2	9	0.557	0.687	81.1	100
2	Resistant	B71	71X	Quizalofop	4	9	0.499	0.687	72.6	70
2	Resistant	B71	71X	Fluazifop	0.0625	9	0.643	0.687	93.6	100
2	Resistant	B71	71X	Fluazifop	0.125	9	0.764	0.687	111.2	100
2	Resistant	B71	71X	Fluazifop	0.25	9	0.629	0.687	91.6	100

2	Resistant	B71	71X	Fluazifop	0.5	9	0.913	0.687	132.9	100
2	Resistant	B71	71X	Fluazifop	1	9	0.951	0.687	138.4	100
2	Resistant	B71	71X	Fluazifop	2	9	0.85	0.687	123.7	100
2	Resistant	B71	71X	Fluazifop	4	9	0.547	0.687	79.6	100
2	Resistant	B71	71X	Clethodim	0.0625	9	0.08	0.687	11.6	50
2	Resistant	B71	71X	Clethodim	0.125	9	0.059	0.687	8.6	50
2	Resistant	B71	71X	Clethodim	0.25	9	0.126	0.687	18.3	40
2	Resistant	B71	71X	Clethodim	0.5	9	0.078	0.687	11.4	0
2	Resistant	B71	71X	Clethodim	1	9	0.057	0.687	8.3	0
2	Resistant	B71	71X	Clethodim	2	9	0.056	0.687	8.2	0
2	Resistant	B71	71X	Clethodim	4	9	0.061	0.687	8.9	0
2	Resistant	B71	71X	Control	0	9	0.59	0.687	85.9	100
2	Resistant	B71	71X	Control	0	9	0.784	0.687	114.1	100
2	Resistant	B45	45F	Sethoxydim	0.0625	4	1.107	0.74	149.7	100
2	Resistant	B45	45F	Sethoxydim	0.125	4	0.645	0.74	87.2	100
2	Resistant	B45	45F	Sethoxydim	0.25	4	0.439	0.74	59.4	95
2	Resistant	B45	45F	Sethoxydim	0.5	4	0.413	0.74	55.8	80
2	Resistant	B45	45F	Sethoxydim	1	4	0.086	0.74	11.6	50
2	Resistant	B45	45F	Sethoxydim	2	4	0.131	0.74	17.7	20
2	Resistant	B45	45F	Sethoxydim	4	4	0.126	0.74	17	30
2	Resistant	B45	45F	Quizalofop	0.0625	4	0.67	0.74	90.6	100
2	Resistant	B45	45F	Quizalofop	0.125	4	0.762	0.74	103	100
2	Resistant	B45	45F	Quizalofop	0.25	4	0.643	0.74	87	100
2	Resistant	B45	45F	Quizalofop	0.5	4	0.932	0.74	126	100
2	Resistant	B45	45F	Quizalofop	1	4	0.778	0.74	105.2	100
2	Resistant	B45	45F	Quizalofop	2	4	0.331	0.74	44.8	95
2	Resistant	B45	45F	Quizalofop	4	4	0.387	0.74	52.3	60
2	Resistant	B45	45F	Fluazifop	0.0625	4	1.184	0.74	160.1	100
2	Resistant	B45	45F	Fluazifop	0.125	4	0.912	0.74	123.3	100
2	Resistant	B45	45F	Fluazifop	0.25	4	0.948	0.74	128.2	100
2	Resistant	B45	45F	Fluazifop	0.5	4	0.685	0.74	92.6	100
2	Resistant	B45	45F	Fluazifop	1	4	0.671	0.74	90.7	100
2	Resistant	B45	45F	Fluazifop	2	4	0.75	0.74	101.4	80
2	Resistant	B45	45F	Fluazifop	4	4	1.105	0.74	149.4	90
2	Resistant	B45	45F	Clethodim	0.0625	4	0.227	0.74	30.7	60
2	Resistant	B45	45F	Clethodim	0.125	4	0.076	0.74	10.3	40
2	Resistant	B45	45F	Clethodim	0.25	4	0.132	0.74	17.8	30
2	Resistant	B45	45F	Clethodim	0.5	4	0.116	0.74	15.7	40
2	Resistant	B45	45F	Clethodim	1	4	0.181	0.74	24.5	5
2	Resistant	B45	45F	Clethodim	2	4	0.093	0.74	12.6	0
2	Resistant	B45	45F	Clethodim	4	4	0.07	0.74	9.5	0
2	Resistant	B45	45F	Control	0	4	0.722	0.74	97.6	100
2	Resistant	B45	45F	Control	0	4	0.757	0.74	102.4	100
2	Resistant	B45	45F	Quizalofop	0.0625	5	0.549	0.754	72.8	100
2	Resistant	B45	45F	Quizalofop	0.125	5	0.371	0.754	49.2	100
2	Resistant	B45	45F	Quizalofop	4	5	0.198	0.754	26.3	60
2	Resistant	B45	45F	Fluazifop	0.0625	5	0.782	0.754	103.7	.
2	Resistant	B45	45F	Fluazifop	0.25	5	0.753	0.754	99.9	100
2	Resistant	B45	45F	Fluazifop	0.5	5	0.488	0.754	64.7	100
2	Resistant	B45	45F	Fluazifop	1	5	0.497	0.754	65.9	100
2	Resistant	B45	45F	Clethodim	0.125	5	0.058	0.754	7.7	50
2	Resistant	B45	45F	Clethodim	1	5	0.115	0.754	15.3	10
2	Resistant	B45	45F	Clethodim	2	5	0.059	0.754	7.8	0
2	Resistant	B45	45F	Control	0	5	0.754	0.754	100	100
2	Resistant	B45	45A	Sethoxydim	0.0625	3	0.923	0.875	105.5	100
2	Resistant	B45	45A	Sethoxydim	0.125	3	0.695	0.875	79.5	90
2	Resistant	B45	45A	Sethoxydim	0.25	3	0.936	0.875	107	85
2	Resistant	B45	45A	Sethoxydim	0.5	3	0.127	0.875	14.5	80
2	Resistant	B45	45A	Sethoxydim	1	3	0.068	0.875	7.8	30
2	Resistant	B45	45A	Sethoxydim	2	3	0.084	0.875	9.6	20
2	Resistant	B45	45A	Sethoxydim	4	3	0.061	0.875	7	5
2	Resistant	B45	45A	Quizalofop	0.0625	3	1.112	0.875	127.2	100

2	Resistant	B45	45A	Quizalofop	0.125	3	1.226	0.875	140.2	100
2	Resistant	B45	45A	Quizalofop	0.25	3	1.1	0.875	125.8	100
2	Resistant	B45	45A	Quizalofop	0.5	3	1.023	0.875	117	100
2	Resistant	B45	45A	Quizalofop	1	3	0.786	0.875	89.9	90
2	Resistant	B45	45A	Quizalofop	2	3	0.495	0.875	56.6	90
2	Resistant	B45	45A	Quizalofop	4	3	0.511	0.875	58.4	70
2	Resistant	B45	45A	Fluazifop	0.0625	3	0.821	0.875	93.9	100
2	Resistant	B45	45A	Fluazifop	0.125	3	0.96	0.875	109.8	100
2	Resistant	B45	45A	Fluazifop	0.25	3	.	.	.	100
2	Resistant	B45	45A	Fluazifop	0.5	3	0.881	0.875	100.7	100
2	Resistant	B45	45A	Fluazifop	1	3	0.981	0.875	112.2	100
2	Resistant	B45	45A	Fluazifop	2	3	0.769	0.875	87.9	100
2	Resistant	B45	45A	Fluazifop	4	3	0.773	0.875	88.4	80
2	Resistant	B45	45A	Clethodim	0.0625	3	0.15	0.875	17.2	90
2	Resistant	B45	45A	Clethodim	0.125	3	0.163	0.875	18.6	30
2	Resistant	B45	45A	Clethodim	0.25	3	0.123	0.875	14.1	20
2	Resistant	B45	45A	Clethodim	0.5	3	0.089	0.875	10.2	30
2	Resistant	B45	45A	Clethodim	1	3	0.06	0.875	6.9	0
2	Resistant	B45	45A	Clethodim	2	3	0.144	0.875	16.5	0
2	Resistant	B45	45A	Clethodim	4	3	0.092	0.875	10.5	0
2	Resistant	B45	45A	Control	0	3	0.856	0.875	97.9	100
2	Resistant	B45	45A	Control	0	3	0.893	0.875	102.1	100
2	Resistant	B45	45A	Quizalofop	0.25	5	0.644	0.543	118.6	100
2	Resistant	B45	45A	Quizalofop	0.5	5	0.615	0.543	113.3	95
2	Resistant	B45	45A	Quizalofop	1	5	0.602	0.543	110.9	95
2	Resistant	B45	45A	Quizalofop	2	5	0.37	0.543	68.1	100
2	Resistant	B45	45A	Fluazifop	0.0625	5	.	.	.	100
2	Resistant	B45	45A	Fluazifop	0.125	5	0.613	0.543	112.9	100
2	Resistant	B45	45A	Fluazifop	0.5	5	0.543	0.543	100	.
2	Resistant	B45	45A	Fluazifop	2	5	0.564	0.543	103.9	90
2	Resistant	B45	45A	Fluazifop	4	5	.	.	.	85
2	Resistant	B45	45A	Clethodim	0.0625	5	0.096	0.543	17.7	50
2	Resistant	B45	45A	Clethodim	0.25	5	0.06	0.543	11	40
2	Resistant	B45	45A	Clethodim	0.5	5	0.07	0.543	12.9	50
2	Resistant	B45	45A	Clethodim	4	5	0.048	0.543	8.8	0
2	Resistant	B45	45A	Control	0	5	0.543	0.543	100	100
2	Resistant	B15	15F	Quizalofop	0.0625	1	1.211	1.264	95.8	100
2	Resistant	B15	15F	Quizalofop	0.125	1	1.356	1.264	107.3	100
2	Resistant	B15	15F	Quizalofop	0.25	1	1.44	1.264	113.9	100
2	Resistant	B15	15F	Quizalofop	0.5	1	1.114	1.264	88.1	100
2	Resistant	B15	15F	Quizalofop	1	1	1.432	1.264	113.3	100
2	Resistant	B15	15F	Quizalofop	2	1	1.201	1.264	95	85
2	Resistant	B15	15F	Quizalofop	4	1	1.108	1.264	87.7	75
2	Resistant	B15	15F	Fluazifop	0.0625	1	1.499	1.264	118.6	100
2	Resistant	B15	15F	Fluazifop	0.125	1	1.211	1.264	95.8	100
2	Resistant	B15	15F	Fluazifop	0.25	1	1.326	1.264	104.9	100
2	Resistant	B15	15F	Fluazifop	0.5	1	1.234	1.264	97.6	100
2	Resistant	B15	15F	Fluazifop	1	1	1.232	1.264	97.5	100
2	Resistant	B15	15F	Fluazifop	2	1	0.962	1.264	76.1	100
2	Resistant	B15	15F	Fluazifop	4	1	0.928	1.264	73.4	75
2	Resistant	B15	15F	Clethodim	0.25	1	0.337	1.264	26.7	25
2	Resistant	B15	15F	Clethodim	0.5	1	0.356	1.264	28.2	15
2	Resistant	B15	15F	Clethodim	1	1	0.212	1.264	16.8	0
2	Resistant	B15	15F	Clethodim	2	1	0.144	1.264	11.4	0
2	Resistant	B15	15F	Clethodim	4	1	0.325	1.264	25.7	0
2	Resistant	B15	15F	Control	0	1	1.102	1.264	87.2	100
2	Resistant	B15	15F	Control	0	1	1.426	1.264	112.8	100
2	Resistant	B15	15F	Sethoxydim	0.0625	2	1.002	1.01	99.2	100
2	Resistant	B15	15F	Sethoxydim	0.125	2	0.817	1.01	80.9	100
2	Resistant	B15	15F	Sethoxydim	0.25	2	0.858	1.01	85	100
2	Resistant	B15	15F	Sethoxydim	0.5	2	0.243	1.01	24.1	40
2	Resistant	B15	15F	Sethoxydim	1	2	0.137	1.01	13.6	40

2	Resistant	B15	15F	Sethoxydim	2	2	0.233	1.01	23.1	40
2	Resistant	B15	15F	Sethoxydim	4	2	0.187	1.01	18.5	10
2	Resistant	B15	15F	Quizalofop	0.0625	2	0.881	1.01	87.2	100
2	Resistant	B15	15F	Quizalofop	0.125	2	1.077	1.01	106.6	95
2	Resistant	B15	15F	Quizalofop	0.25	2	1.016	1.01	100.6	100
2	Resistant	B15	15F	Quizalofop	0.5	2	1.155	1.01	114.4	100
2	Resistant	B15	15F	Quizalofop	1	2	0.968	1.01	95.8	100
2	Resistant	B15	15F	Quizalofop	2	2	0.881	1.01	87.2	80
2	Resistant	B15	15F	Quizalofop	4	2	0.74	1.01	73.3	100
2	Resistant	B15	15F	Fluazifop	0.0625	2	0.929	1.01	92	100
2	Resistant	B15	15F	Fluazifop	0.125	2	0.899	1.01	89	100
2	Resistant	B15	15F	Fluazifop	0.25	2	0.765	1.01	75.7	100
2	Resistant	B15	15F	Fluazifop	0.5	2	1.08	1.01	106.9	100
2	Resistant	B15	15F	Fluazifop	1	2	0.976	1.01	96.6	.
2	Resistant	B15	15F	Fluazifop	2	2	0.993	1.01	98.3	90
2	Resistant	B15	15F	Fluazifop	4	2	1.048	1.01	103.8	70
2	Resistant	B15	15F	Clethodim	0.0625	2	0.162	1.01	16	30
2	Resistant	B15	15F	Clethodim	0.125	2	0.285	1.01	28.2	30
2	Resistant	B15	15F	Clethodim	0.25	2	0.258	1.01	25.5	20
2	Resistant	B15	15F	Clethodim	0.5	2	0.228	1.01	22.6	0
2	Resistant	B15	15F	Clethodim	1	2	0.154	1.01	15.2	0
2	Resistant	B15	15F	Clethodim	2	2	0.107	1.01	10.6	0
2	Resistant	B15	15F	Clethodim	4	2	0.221	1.01	21.9	0
2	Resistant	B15	15F	Control	0	2	0.925	1.01	91.6	.
2	Resistant	B15	15F	Control	0	2	1.095	1.01	108.4	100
2	Resistant	B15	15F	Quizalofop	0.25	3	0.93	0.96	96.9	100
2	Resistant	B15	15F	Quizalofop	0.5	3	0.852	0.96	88.8	100
2	Resistant	B15	15F	Quizalofop	1	3	1.055	0.96	110	100
2	Resistant	B15	15F	Fluazifop	0.0625	3	1.066	0.96	111.1	80
2	Resistant	B15	15F	Fluazifop	0.125	3	1.109	0.96	115.6	100
2	Resistant	B15	15F	Fluazifop	0.25	3	0.832	0.96	86.7	100
2	Resistant	B15	15F	Fluazifop	0.5	3	0.943	0.96	98.3	100
2	Resistant	B15	15F	Fluazifop	1	3	0.756	0.96	78.8	90
2	Resistant	B15	15F	Fluazifop	2	3	0.812	0.96	84.6	100
2	Resistant	B15	15F	Fluazifop	4	3	0.811	0.96	84.5	80
2	Resistant	B15	15F	Control	0	3	0.862	0.96	89.8	100
2	Resistant	B15	15F	Control	0	3	1.057	0.96	110.2	100
2	Resistant	B15	15A	Quizalofop	0.0625	1	1.29	1.538	83.9	100
2	Resistant	B15	15A	Quizalofop	0.125	1	1.498	1.538	97.4	100
2	Resistant	B15	15A	Quizalofop	0.25	1	1.21	1.538	78.7	100
2	Resistant	B15	15A	Quizalofop	0.5	1	1.429	1.538	92.9	100
2	Resistant	B15	15A	Quizalofop	1	1	1.035	1.538	67.3	95
2	Resistant	B15	15A	Quizalofop	2	1	1.132	1.538	73.6	60
2	Resistant	B15	15A	Quizalofop	4	1	0.836	1.538	54.4	60
2	Resistant	B15	15A	Fluazifop	0.0625	1	1.713	1.538	111.4	100
2	Resistant	B15	15A	Fluazifop	0.125	1	1.547	1.538	100.6	100
2	Resistant	B15	15A	Fluazifop	0.25	1	1.349	1.538	87.7	100
2	Resistant	B15	15A	Fluazifop	0.5	1	1.602	1.538	104.2	60
2	Resistant	B15	15A	Fluazifop	1	1	1.218	1.538	79.2	80
2	Resistant	B15	15A	Fluazifop	2	1	1.396	1.538	90.8	100
2	Resistant	B15	15A	Fluazifop	4	1	1.149	1.538	74.7	65
2	Resistant	B15	15A	Clethodim	0.0625	1	0.361	1.538	23.5	30
2	Resistant	B15	15A	Clethodim	0.125	1	0.408	1.538	26.5	30
2	Resistant	B15	15A	Clethodim	0.25	1	0.435	1.538	28.3	30
2	Resistant	B15	15A	Clethodim	0.5	1	0.309	1.538	20.1	0
2	Resistant	B15	15A	Clethodim	1	1	0.255	1.538	16.6	0
2	Resistant	B15	15A	Control	0	1	1.478	1.538	96.1	100
2	Resistant	B15	15A	Control	0	1	1.598	1.538	103.9	100
2	Resistant	B15	15A	Quizalofop	0.0625	2	1.387	1.015	136.7	100
2	Resistant	B15	15A	Quizalofop	0.125	2	1.117	1.015	110.1	100
2	Resistant	B15	15A	Quizalofop	0.25	2	1.333	1.015	131.4	100
2	Resistant	B15	15A	Quizalofop	0.5	2	1.097	1.015	108.1	100

2	Resistant	B15	15A	Quizalofop	1	2	1.296	1.015	127.7	100
2	Resistant	B15	15A	Quizalofop	2	2	0.834	1.015	82.2	85
2	Resistant	B15	15A	Quizalofop	4	2	1.102	1.015	108.6	90
2	Resistant	B15	15A	Fluazifop	0.0625	2	1.328	1.015	130.9	100
2	Resistant	B15	15A	Fluazifop	0.125	2	0.89	1.015	87.7	100
2	Resistant	B15	15A	Fluazifop	0.25	2	0.734	1.015	72.4	100
2	Resistant	B15	15A	Fluazifop	0.5	2	1.069	1.015	105.4	100
2	Resistant	B15	15A	Fluazifop	1	2	1.179	1.015	116.2	100
2	Resistant	B15	15A	Fluazifop	2	2	0.671	1.015	66.1	100
2	Resistant	B15	15A	Fluazifop	4	2	0.951	1.015	93.7	70
2	Resistant	B15	15A	Control	0	2	0.905	1.015	89.2	100
2	Resistant	B15	15A	Control	0	2	1.124	1.015	110.8	100
2	Resistant	B71	715	Sethoxydim	0.0625	5	0.561	0.641	87.5	100
2	Resistant	B71	715	Sethoxydim	0.125	5	0.619	0.641	96.6	100
2	Resistant	B71	715	Sethoxydim	0.5	5	0.148	0.641	23.1	100
2	Resistant	B71	715	Sethoxydim	1	5	0.073	0.641	11.4	50
2	Resistant	B71	715	Sethoxydim	2	5	0.016	0.641	2.5	10
2	Resistant	B71	715	Sethoxydim	4	5	.	.	.	0
2	Resistant	B71	715	Quizalofop	0.0625	5	0.521	0.641	81.3	100
2	Resistant	B71	715	Quizalofop	0.125	5	0.365	0.641	56.9	100
2	Resistant	B71	715	Quizalofop	0.25	5	0.412	0.641	64.3	100
2	Resistant	B71	715	Quizalofop	0.5	5	.	.	.	70
2	Resistant	B71	715	Quizalofop	1	5	0.504	0.641	78.6	100
2	Resistant	B71	715	Quizalofop	2	5	0.321	0.641	50.1	100
2	Resistant	B71	715	Quizalofop	4	5	0.379	0.641	59.1	95
2	Resistant	B71	715	Fluazifop	0.0625	5	.	.	.	100
2	Resistant	B71	715	Fluazifop	0.125	5	0.661	0.641	103.1	100
2	Resistant	B71	715	Fluazifop	0.25	5	.	.	.	100
2	Resistant	B71	715	Fluazifop	0.5	5	0.608	0.641	94.9	100
2	Resistant	B71	715	Fluazifop	1	5	0.296	0.641	46.2	70
2	Resistant	B71	715	Fluazifop	2	5	0.624	0.641	97.3	90
2	Resistant	B71	715	Fluazifop	4	5	0.39	0.641	60.8	90
2	Resistant	B71	715	Clethodim	0.0625	5	0.045	0.641	7	30
2	Resistant	B71	715	Clethodim	0.125	5	0.049	0.641	7.6	20
2	Resistant	B71	715	Clethodim	0.25	5	0.045	0.641	7	0
2	Resistant	B71	715	Clethodim	0.5	5	0.064	0.641	10	30
2	Resistant	B71	715	Clethodim	1	5	0.069	0.641	10.8	0
2	Resistant	B71	715	Clethodim	2	5	0.042	0.641	6.6	0
2	Resistant	B71	715	Clethodim	4	5	0.069	0.641	10.8	0
2	Resistant	B71	715	Control	0	5	.	.	.	100
2	Resistant	B71	715	Control	0	5	0.641	0.641	100	100
2	Resistant	B71	714	Sethoxydim	0.0625	3	1.134	1.181	96	100
2	Resistant	B71	714	Sethoxydim	0.125	3	1.315	1.181	111.3	95
2	Resistant	B71	714	Sethoxydim	0.25	3	0.844	1.181	71.5	85
2	Resistant	B71	714	Sethoxydim	0.5	3	0.147	1.181	12.4	30
2	Resistant	B71	714	Sethoxydim	1	3	0.084	1.181	7.1	40
2	Resistant	B71	714	Sethoxydim	2	3	0.131	1.181	11.1	40
2	Resistant	B71	714	Sethoxydim	4	3	.	.	.	30
2	Resistant	B71	714	Quizalofop	0.0625	3	0.829	1.181	70.2	100
2	Resistant	B71	714	Quizalofop	0.125	3	1.209	1.181	102.4	100
2	Resistant	B71	714	Quizalofop	0.25	3	0.965	1.181	81.7	100
2	Resistant	B71	714	Quizalofop	0.5	3	1.269	1.181	107.5	100
2	Resistant	B71	714	Quizalofop	1	3	1.01	1.181	85.5	100
2	Resistant	B71	714	Quizalofop	2	3	0.957	1.181	81	100
2	Resistant	B71	714	Quizalofop	4	3	0.531	1.181	45	95
2	Resistant	B71	714	Fluazifop	0.0625	3	1.223	1.181	103.6	100
2	Resistant	B71	714	Fluazifop	0.125	3	1.062	1.181	89.9	100
2	Resistant	B71	714	Fluazifop	0.25	3	1.134	1.181	96	100
2	Resistant	B71	714	Fluazifop	0.5	3	.	.	.	100
2	Resistant	B71	714	Fluazifop	1	3	1.308	1.181	110.8	100
2	Resistant	B71	714	Fluazifop	2	3	0.925	1.181	78.3	90
2	Resistant	B71	714	Fluazifop	4	3	0.868	1.181	73.5	90

2	Resistant	B71	714	Clethodim	0.0625	3	0.095	1.181	8	50
2	Resistant	B71	714	Clethodim	0.125	3	0.127	1.181	10.8	40
2	Resistant	B71	714	Clethodim	0.25	3	0.155	1.181	13.1	30
2	Resistant	B71	714	Clethodim	0.5	3	0.131	1.181	11.1	20
2	Resistant	B71	714	Clethodim	1	3	0.104	1.181	8.8	0
2	Resistant	B71	714	Clethodim	4	3	0.099	1.181	8.4	0
2	Resistant	B71	714	Control	0	3	1.129	1.181	95.6	100
2	Resistant	B71	714	Control	0	3	1.233	1.181	104.4	100
2	Resistant	B71	714	Sethoxydim	0.0625	4	0.725	0.882	82.2	100
2	Resistant	B71	714	Sethoxydim	0.125	4	1.047	0.882	118.8	100
2	Resistant	B71	714	Sethoxydim	0.25	4	0.387	0.882	43.9	100
2	Resistant	B71	714	Sethoxydim	0.5	4	0.055	0.882	6.2	30
2	Resistant	B71	714	Sethoxydim	1	4	0.093	0.882	10.6	50
2	Resistant	B71	714	Sethoxydim	2	4	0.051	0.882	5.8	30
2	Resistant	B71	714	Sethoxydim	4	4	0.098	0.882	11.1	30
2	Resistant	B71	714	Quizalofop	0.0625	4	0.803	0.882	91.1	100
2	Resistant	B71	714	Quizalofop	0.125	4	0.764	0.882	86.7	100
2	Resistant	B71	714	Quizalofop	0.25	4	0.79	0.882	89.6	100
2	Resistant	B71	714	Quizalofop	0.5	4	0.716	0.882	81.2	100
2	Resistant	B71	714	Quizalofop	1	4	0.893	0.882	101.3	100
2	Resistant	B71	714	Quizalofop	2	4	0.872	0.882	98.9	100
2	Resistant	B71	714	Quizalofop	4	4	0.64	0.882	72.6	90
2	Resistant	B71	714	Fluazifop	0.0625	4	0.507	0.882	57.5	100
2	Resistant	B71	714	Fluazifop	0.125	4	0.918	0.882	104.1	100
2	Resistant	B71	714	Fluazifop	0.25	4	1.097	0.882	124.4	100
2	Resistant	B71	714	Fluazifop	0.5	4	0.722	0.882	81.9	100
2	Resistant	B71	714	Fluazifop	1	4	0.462	0.882	52.4	100
2	Resistant	B71	714	Fluazifop	2	4	0.911	0.882	103.3	100
2	Resistant	B71	714	Fluazifop	4	4	0.453	0.882	51.4	95
2	Resistant	B71	714	Clethodim	0.0625	4	0.104	0.882	11.8	50
2	Resistant	B71	714	Clethodim	0.125	4	0.118	0.882	13.4	50
2	Resistant	B71	714	Clethodim	0.25	4	0.085	0.882	9.6	40
2	Resistant	B71	714	Clethodim	0.5	4	0.08	0.882	9.1	0
2	Resistant	B71	714	Clethodim	1	4	0.067	0.882	7.6	0
2	Resistant	B71	714	Clethodim	2	4	0.095	0.882	10.8	0
2	Resistant	B71	714	Control	0	4	0.811	0.882	92	100
2	Resistant	B71	714	Control	0	4	0.952	0.882	108	100
2	Resistant	B71	714	Quizalofop	0.0625	5	0.622	1.051	59.2	100
2	Resistant	B71	714	Quizalofop	0.125	5	0.966	1.051	91.9	100
2	Resistant	B71	714	Quizalofop	0.25	5	1.007	1.051	95.8	100
2	Resistant	B71	714	Quizalofop	0.5	5	0.913	1.051	86.9	100
2	Resistant	B71	714	Quizalofop	1	5	1.035	1.051	98.5	100
2	Resistant	B71	714	Quizalofop	2	5	0.533	1.051	50.7	80
2	Resistant	B71	714	Quizalofop	4	5	0.202	1.051	19.2	80
2	Resistant	B71	714	Fluazifop	0.0625	5	0.81	1.051	77.1	100
2	Resistant	B71	714	Fluazifop	0.125	5	1.171	1.051	111.4	100
2	Resistant	B71	714	Fluazifop	0.25	5	.	.	.	100
2	Resistant	B71	714	Fluazifop	0.5	5	0.718	1.051	68.3	100
2	Resistant	B71	714	Fluazifop	1	5	0.642	1.051	61.1	100
2	Resistant	B71	714	Fluazifop	2	5	0.842	1.051	80.1	100
2	Resistant	B71	714	Fluazifop	4	5	0.955	1.051	90.9	65
2	Resistant	B71	714	Clethodim	0.0625	5	0.11	1.051	10.5	60
2	Resistant	B71	714	Clethodim	0.125	5	0.078	1.051	7.4	50
2	Resistant	B71	714	Clethodim	0.25	5	0.08	1.051	7.6	20
2	Resistant	B71	714	Clethodim	0.5	5	0.052	1.051	4.9	0
2	Resistant	B71	714	Clethodim	1	5	0.081	1.051	7.7	20
2	Resistant	B71	714	Clethodim	2	5	0.099	1.051	9.4	0
2	Resistant	B71	714	Clethodim	4	5	0.142	1.051	13.5	0
2	Resistant	B71	714	Control	0	5	0.65	1.051	61.8	100
2	Resistant	B71	714	Control	0	5	1.452	1.051	138.2	100
2	Resistant	B45	628	Sethoxydim	0.0625	4	0.45	0.614	73.3	100
2	Resistant	B45	628	Sethoxydim	0.125	4	0.451	0.614	73.5	100

2	Resistant	B45	628	Sethoxydim	0.25	4	0.444	0.614	72.4	80
2	Resistant	B45	628	Sethoxydim	0.5	4	0.135	0.614	22	50
2	Resistant	B45	628	Sethoxydim	1	4	0.061	0.614	9.9	40
2	Resistant	B45	628	Sethoxydim	2	4	0.056	0.614	9.1	30
2	Resistant	B45	628	Sethoxydim	4	4	0.066	0.614	10.8	30
2	Resistant	B45	628	Quizalofop	0.0625	4	0.463	0.614	75.5	100
2	Resistant	B45	628	Quizalofop	0.125	4	0.473	0.614	77.1	100
2	Resistant	B45	628	Quizalofop	0.25	4	0.536	0.614	87.4	100
2	Resistant	B45	628	Quizalofop	0.5	4	0.557	0.614	90.8	100
2	Resistant	B45	628	Quizalofop	1	4	0.622	0.614	101.4	100
2	Resistant	B45	628	Quizalofop	2	4	0.36	0.614	58.7	80
2	Resistant	B45	628	Quizalofop	4	4	.	.	.	80
2	Resistant	B45	628	Fluazifop	0.0625	4	0.689	0.614	112.3	100
2	Resistant	B45	628	Fluazifop	0.125	4	.	.	.	100
2	Resistant	B45	628	Fluazifop	0.25	4	0.521	0.614	84.9	100
2	Resistant	B45	628	Fluazifop	0.5	4	0.635	0.614	103.5	100
2	Resistant	B45	628	Fluazifop	1	4	0.418	0.614	68.1	100
2	Resistant	B45	628	Fluazifop	2	4	0.723	0.614	117.8	100
2	Resistant	B45	628	Fluazifop	4	4	0.33	0.614	53.8	100
2	Resistant	B45	628	Clethodim	0.0625	4	0.189	0.614	30.8	60
2	Resistant	B45	628	Clethodim	0.125	4	0.076	0.614	12.4	40
2	Resistant	B45	628	Clethodim	0.25	4	0.107	0.614	17.4	30
2	Resistant	B45	628	Clethodim	0.5	4	0.057	0.614	9.3	40
2	Resistant	B45	628	Clethodim	1	4	0.124	0.614	20.2	10
2	Resistant	B45	628	Clethodim	2	4	0.055	0.614	9	0
2	Resistant	B45	628	Clethodim	4	4	0.079	0.614	12.9	0
2	Resistant	B45	628	Control	0	4	0.489	0.614	79.7	100
2	Resistant	B45	628	Control	0	4	0.738	0.614	120.3	100
2	Resistant	B45	628	Quizalofop	0.0625	5	0.337	0.469	71.9	100
2	Resistant	B45	628	Quizalofop	0.125	5	0.568	0.469	121.1	85
2	Resistant	B45	628	Quizalofop	0.25	5	0.277	0.469	59.1	95
2	Resistant	B45	628	Quizalofop	0.5	5	0.443	0.469	94.5	100
2	Resistant	B45	628	Quizalofop	1	5	0.571	0.469	121.7	100
2	Resistant	B45	628	Quizalofop	2	5	0.254	0.469	54.2	90
2	Resistant	B45	628	Quizalofop	4	5	0.468	0.469	99.8	95
2	Resistant	B45	628	Fluazifop	0.0625	5	0.385	0.469	82.1	100
2	Resistant	B45	628	Fluazifop	0.125	5	0.346	0.469	73.8	100
2	Resistant	B45	628	Fluazifop	0.25	5	0.398	0.469	84.9	100
2	Resistant	B45	628	Fluazifop	0.5	5	0.462	0.469	98.5	100
2	Resistant	B45	628	Fluazifop	1	5	0.443	0.469	94.5	100
2	Resistant	B45	628	Fluazifop	2	5	0.248	0.469	52.9	100
2	Resistant	B45	628	Fluazifop	4	5	0.308	0.469	65.7	80
2	Resistant	B45	628	Clethodim	0.0625	5	0.036	0.469	7.7	40
2	Resistant	B45	628	Clethodim	0.125	5	0.102	0.469	21.7	40
2	Resistant	B45	628	Clethodim	0.25	5	0.029	0.469	6.2	30
2	Resistant	B45	628	Clethodim	0.5	5	0.139	0.469	29.6	30
2	Resistant	B45	628	Clethodim	1	5	0.019	0.469	4.1	0
2	Resistant	B45	628	Clethodim	2	5	0.103	0.469	22	0
2	Resistant	B45	628	Clethodim	4	5	0.05	0.469	10.7	0
2	Resistant	B45	628	Control	0	5	0.351	0.469	74.8	100
2	Resistant	B45	628	Control	0	5	0.587	0.469	125.2	100
2	Resistant	B15	610	Sethoxydim	0.0625	1	1.171	1.083	108.1	90
2	Resistant	B15	610	Sethoxydim	0.125	1	1.19	1.083	109.9	70
2	Resistant	B15	610	Sethoxydim	0.25	1	0.511	1.083	47.2	100
2	Resistant	B15	610	Sethoxydim	0.5	1	0.282	1.083	26	50
2	Resistant	B15	610	Sethoxydim	1	1	0.323	1.083	29.8	30
2	Resistant	B15	610	Sethoxydim	2	1	0.256	1.083	23.6	20
2	Resistant	B15	610	Sethoxydim	4	1	0.193	1.083	17.8	0
2	Resistant	B15	610	Quizalofop	0.0625	1	1.249	1.083	115.3	100
2	Resistant	B15	610	Quizalofop	0.125	1	1.519	1.083	140.3	90
2	Resistant	B15	610	Quizalofop	0.25	1	1.346	1.083	124.3	100
2	Resistant	B15	610	Quizalofop	0.5	1	1.254	1.083	115.8	95

2	Resistant	B15	610	Quizalofop	1	1	1.333	1.083	123.1	100
2	Resistant	B15	610	Quizalofop	2	1	1.163	1.083	107.4	80
2	Resistant	B15	610	Quizalofop	4	1	1.009	1.083	93.2	85
2	Resistant	B15	610	Fluazifop	0.0625	1	1.19	1.083	109.9	100
2	Resistant	B15	610	Fluazifop	0.125	1	1.261	1.083	116.4	100
2	Resistant	B15	610	Fluazifop	0.25	1	1.397	1.083	129	100
2	Resistant	B15	610	Fluazifop	0.5	1	1.249	1.083	115.3	80
2	Resistant	B15	610	Fluazifop	1	1	1.066	1.083	98.4	90
2	Resistant	B15	610	Fluazifop	2	1	1.158	1.083	106.9	100
2	Resistant	B15	610	Fluazifop	4	1	1.123	1.083	103.7	65
2	Resistant	B15	610	Clethodim	0.0625	1	0.284	1.083	26.2	50
2	Resistant	B15	610	Clethodim	0.125	1	0.506	1.083	46.7	40
2	Resistant	B15	610	Clethodim	0.25	1	0.257	1.083	23.7	30
2	Resistant	B15	610	Clethodim	0.5	1	0.272	1.083	25.1	0
2	Resistant	B15	610	Clethodim	1	1	0.296	1.083	27.3	0
2	Resistant	B15	610	Clethodim	2	1	0.25	1.083	23.1	0
2	Resistant	B15	610	Clethodim	4	1	0.123	1.083	11.4	0
2	Resistant	B15	610	Control	0	1	1.057	1.083	97.6	100
2	Resistant	B15	610	Control	0	1	1.109	1.083	102.4	100
2	Resistant	B15	610	Sethoxydim	0.0625	2	1.163	1.423	81.7	80
2	Resistant	B15	610	Sethoxydim	0.125	2	0.972	1.423	68.3	80
2	Resistant	B15	610	Sethoxydim	0.25	2	0.793	1.423	55.7	100
2	Resistant	B15	610	Sethoxydim	0.5	2	0.324	1.423	22.8	40
2	Resistant	B15	610	Sethoxydim	1	2	0.234	1.423	16.4	45
2	Resistant	B15	610	Sethoxydim	2	2	0.272	1.423	19.1	20
2	Resistant	B15	610	Sethoxydim	4	2	0.255	1.423	17.9	30
2	Resistant	B15	610	Quizalofop	0.0625	2	1.173	1.423	82.4	.
2	Resistant	B15	610	Quizalofop	0.125	2	1.184	1.423	83.2	100
2	Resistant	B15	610	Quizalofop	0.25	2	1.151	1.423	80.9	100
2	Resistant	B15	610	Quizalofop	0.5	2	1.188	1.423	83.5	100
2	Resistant	B15	610	Quizalofop	1	2	0.991	1.423	69.6	100
2	Resistant	B15	610	Quizalofop	2	2	1.116	1.423	78.4	80
2	Resistant	B15	610	Quizalofop	4	2	1.086	1.423	76.3	95
2	Resistant	B15	610	Fluazifop	0.0625	2	1.065	1.423	74.8	100
2	Resistant	B15	610	Fluazifop	0.125	2	1.279	1.423	89.9	100
2	Resistant	B15	610	Fluazifop	0.25	2	1.183	1.423	83.1	100
2	Resistant	B15	610	Fluazifop	0.5	2	0.962	1.423	67.6	100
2	Resistant	B15	610	Fluazifop	1	2	1.218	1.423	85.6	100
2	Resistant	B15	610	Fluazifop	2	2	1.312	1.423	92.2	65
2	Resistant	B15	610	Fluazifop	4	2	0.667	1.423	46.9	100
2	Resistant	B15	610	Clethodim	0.0625	2	0.184	1.423	12.9	40
2	Resistant	B15	610	Clethodim	0.125	2	0.305	1.423	21.4	40
2	Resistant	B15	610	Clethodim	0.25	2	0.339	1.423	23.8	30
2	Resistant	B15	610	Clethodim	0.5	2	0.317	1.423	22.3	5
2	Resistant	B15	610	Clethodim	1	2	0.283	1.423	19.9	30
2	Resistant	B15	610	Clethodim	2	2	0.22	1.423	15.5	0
2	Resistant	B15	610	Clethodim	4	2	0.207	1.423	14.5	0
2	Resistant	B15	610	Control	0	2	1.258	1.423	88.4	100
2	Resistant	B15	610	Control	0	2	1.588	1.423	111.6	100
2	Resistant	B15	610	Sethoxydim	0.0625	3	0.932	1.375	67.8	100
2	Resistant	B15	610	Sethoxydim	0.125	3	1.179	1.375	85.7	100
2	Resistant	B15	610	Sethoxydim	0.25	3	0.793	1.375	57.7	80
2	Resistant	B15	610	Sethoxydim	0.5	3	0.191	1.375	13.9	40
2	Resistant	B15	610	Sethoxydim	1	3	0.255	1.375	18.5	40
2	Resistant	B15	610	Sethoxydim	2	3	0.167	1.375	12.1	30
2	Resistant	B15	610	Sethoxydim	4	3	0.215	1.375	15.6	0
2	Resistant	B15	610	Quizalofop	0.0625	3	1.09	1.375	79.3	100
2	Resistant	B15	610	Quizalofop	0.125	3	1.18	1.375	85.8	100
2	Resistant	B15	610	Quizalofop	0.25	3	1.062	1.375	77.2	100
2	Resistant	B15	610	Quizalofop	0.5	3	1.257	1.375	91.4	100
2	Resistant	B15	610	Quizalofop	1	3	1.307	1.375	95.1	100
2	Resistant	B15	610	Quizalofop	2	3	0.762	1.375	55.4	100

2	Resistant	B15	610	Quizalofop	4	3	1.086	1.375	79	80
2	Resistant	B15	610	Fluazifop	0.0625	3	0.773	1.375	56.2	100
2	Resistant	B15	610	Fluazifop	0.125	3	1.11	1.375	80.7	100
2	Resistant	B15	610	Fluazifop	0.25	3	1.087	1.375	79.1	100
2	Resistant	B15	610	Fluazifop	0.5	3	1.073	1.375	78	100
2	Resistant	B15	610	Fluazifop	1	3	0.945	1.375	68.7	90
2	Resistant	B15	610	Fluazifop	2	3	0.991	1.375	72.1	90
2	Resistant	B15	610	Fluazifop	4	3	0.644	1.375	46.8	85
2	Resistant	B15	610	Clethodim	0.0625	3	0.137	1.375	10	50
2	Resistant	B15	610	Clethodim	0.125	3	0.136	1.375	9.9	30
2	Resistant	B15	610	Clethodim	0.25	3	0.136	1.375	9.9	50
2	Resistant	B15	610	Clethodim	0.5	3	0.214	1.375	15.6	0
2	Resistant	B15	610	Clethodim	1	3	0.181	1.375	13.2	20
2	Resistant	B15	610	Clethodim	2	3	0.096	1.375	7	0
2	Resistant	B15	610	Clethodim	4	3	0.115	1.375	8.4	0
2	Resistant	B15	610	Control	0	3	1.367	1.375	99.4	100
2	Resistant	B15	610	Control	0	3	1.383	1.375	100.6	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.0625	1	0.901	0.865	104.2	85
2	F1	F1_B71	F1_B71	Sethoxydim	0.125	1	0.904	0.865	104.5	80
2	F1	F1_B71	F1_B71	Sethoxydim	0.25	1	0.811	0.865	93.8	70
2	F1	F1_B71	F1_B71	Sethoxydim	0.5	1	0.147	0.865	17	50
2	F1	F1_B71	F1_B71	Sethoxydim	1	1	0.184	0.865	21.3	50
2	F1	F1_B71	F1_B71	Sethoxydim	2	1	0.182	0.865	21	35
2	F1	F1_B71	F1_B71	Sethoxydim	4	1	0.145	0.865	16.8	40
2	F1	F1_B71	F1_B71	Quizalofop	0.0625	1	0.854	0.865	98.7	100
2	F1	F1_B71	F1_B71	Quizalofop	0.125	1	0.745	0.865	86.1	100
2	F1	F1_B71	F1_B71	Quizalofop	0.25	1	0.649	0.865	75	85
2	F1	F1_B71	F1_B71	Quizalofop	0.5	1	0.135	0.865	15.6	50
2	F1	F1_B71	F1_B71	Quizalofop	1	1	0.22	0.865	25.4	40
2	F1	F1_B71	F1_B71	Quizalofop	2	1	0.151	0.865	17.5	20
2	F1	F1_B71	F1_B71	Quizalofop	4	1	0.168	0.865	19.4	30
2	F1	F1_B71	F1_B71	Fluazifop	0.0625	1	0.795	0.865	91.9	100
2	F1	F1_B71	F1_B71	Fluazifop	0.125	1	0.96	0.865	111	90
2	F1	F1_B71	F1_B71	Fluazifop	0.25	1	0.789	0.865	91.2	95
2	F1	F1_B71	F1_B71	Fluazifop	0.5	1	0.509	0.865	58.8	80
2	F1	F1_B71	F1_B71	Fluazifop	1	1	0.571	0.865	66	90
2	F1	F1_B71	F1_B71	Fluazifop	2	1	0.432	0.865	49.9	80
2	F1	F1_B71	F1_B71	Fluazifop	4	1	0.234	0.865	27.1	40
2	F1	F1_B71	F1_B71	Clethodim	0.0625	1	0.151	0.865	17.5	40
2	F1	F1_B71	F1_B71	Clethodim	0.125	1	0.114	0.865	13.2	35
2	F1	F1_B71	F1_B71	Clethodim	0.25	1	0.17	0.865	19.7	30
2	F1	F1_B71	F1_B71	Clethodim	0.5	1	0.144	0.865	16.6	10
2	F1	F1_B71	F1_B71	Clethodim	1	1	0.134	0.865	15.5	20
2	F1	F1_B71	F1_B71	Clethodim	2	1	0.079	0.865	9.1	0
2	F1	F1_B71	F1_B71	Clethodim	4	1	0.13	0.865	15	0
2	F1	F1_B71	F1_B71	Control	0	1	0.861	0.865	99.5	100
2	F1	F1_B71	F1_B71	Control	0	1	0.869	0.865	100.5	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.0625	2	0.516	1.006	51.3	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.125	2	0.853	1.006	84.8	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.25	2	0.644	1.006	64	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.5	2	0.114	1.006	11.3	50
2	F1	F1_B71	F1_B71	Sethoxydim	1	2	0.139	1.006	13.8	20
2	F1	F1_B71	F1_B71	Sethoxydim	2	2	0.153	1.006	15.2	30
2	F1	F1_B71	F1_B71	Sethoxydim	4	2	0.121	1.006	12	0
2	F1	F1_B71	F1_B71	Quizalofop	0.0625	2	0.764	1.006	75.9	100
2	F1	F1_B71	F1_B71	Quizalofop	0.125	2	0.647	1.006	64.3	100
2	F1	F1_B71	F1_B71	Quizalofop	0.25	2	0.522	1.006	51.9	100
2	F1	F1_B71	F1_B71	Quizalofop	0.5	2	0.701	1.006	69.7	100
2	F1	F1_B71	F1_B71	Quizalofop	1	2	0.666	1.006	66.2	70
2	F1	F1_B71	F1_B71	Quizalofop	2	2	0.139	1.006	13.8	40
2	F1	F1_B71	F1_B71	Quizalofop	4	2	0.19	1.006	18.9	20
2	F1	F1_B71	F1_B71	Fluazifop	0.0625	2	0.713	1.006	70.9	100

2	F1	F1_B71	F1_B71	Fluazifop	0.125	2	0.961	1.006	95.5	100
2	F1	F1_B71	F1_B71	Fluazifop	0.25	2	0.917	1.006	91.2	65
2	F1	F1_B71	F1_B71	Fluazifop	0.5	2	0.546	1.006	54.3	70
2	F1	F1_B71	F1_B71	Fluazifop	1	2	0.529	1.006	52.6	65
2	F1	F1_B71	F1_B71	Fluazifop	2	2	0.495	1.006	49.2	100
2	F1	F1_B71	F1_B71	Fluazifop	4	2	0.372	1.006	37	60
2	F1	F1_B71	F1_B71	Clethodim	0.0625	2	0.134	1.006	13.3	45
2	F1	F1_B71	F1_B71	Clethodim	0.125	2	0.24	1.006	23.9	30
2	F1	F1_B71	F1_B71	Clethodim	0.25	2	0.201	1.006	20	30
2	F1	F1_B71	F1_B71	Clethodim	0.5	2	0.113	1.006	11.2	20
2	F1	F1_B71	F1_B71	Clethodim	1	2	0.163	1.006	16.2	10
2	F1	F1_B71	F1_B71	Clethodim	2	2	0.172	1.006	17.1	0
2	F1	F1_B71	F1_B71	Clethodim	4	2	0.138	1.006	13.7	0
2	F1	F1_B71	F1_B71	Control	0	2	0.972	1.006	96.6	100
2	F1	F1_B71	F1_B71	Control	0	2	1.04	1.006	103.4	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.0625	3	1.087	1.213	89.6	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.125	3	0.952	1.213	78.5	85
2	F1	F1_B71	F1_B71	Sethoxydim	0.25	3	0.668	1.213	55.1	70
2	F1	F1_B71	F1_B71	Sethoxydim	0.5	3	0.171	1.213	14.1	50
2	F1	F1_B71	F1_B71	Sethoxydim	1	3	0.161	1.213	13.3	30
2	F1	F1_B71	F1_B71	Sethoxydim	2	3	0.166	1.213	13.7	40
2	F1	F1_B71	F1_B71	Sethoxydim	4	3	0.222	1.213	18.3	30
2	F1	F1_B71	F1_B71	Quizalofop	0.0625	3	0.998	1.213	82.3	100
2	F1	F1_B71	F1_B71	Quizalofop	0.125	3	0.946	1.213	78	100
2	F1	F1_B71	F1_B71	Quizalofop	0.25	3	0.924	1.213	76.2	100
2	F1	F1_B71	F1_B71	Quizalofop	0.5	3	1.192	1.213	98.3	100
2	F1	F1_B71	F1_B71	Quizalofop	1	3	0.159	1.213	13.1	40
2	F1	F1_B71	F1_B71	Quizalofop	2	3	0.146	1.213	12	35
2	F1	F1_B71	F1_B71	Quizalofop	4	3	0.162	1.213	13.4	40
2	F1	F1_B71	F1_B71	Fluazifop	0.0625	3	1.206	1.213	99.5	100
2	F1	F1_B71	F1_B71	Fluazifop	0.125	3	1.228	1.213	101.3	100
2	F1	F1_B71	F1_B71	Fluazifop	0.25	3	1.041	1.213	85.9	100
2	F1	F1_B71	F1_B71	Fluazifop	0.5	3	0.906	1.213	74.7	80
2	F1	F1_B71	F1_B71	Fluazifop	1	3	0.763	1.213	62.9	70
2	F1	F1_B71	F1_B71	Fluazifop	2	3	0.587	1.213	48.4	85
2	F1	F1_B71	F1_B71	Fluazifop	4	3	0.4	1.213	33	55
2	F1	F1_B71	F1_B71	Clethodim	0.0625	3	0.13	1.213	10.7	50
2	F1	F1_B71	F1_B71	Clethodim	0.125	3	0.136	1.213	11.2	45
2	F1	F1_B71	F1_B71	Clethodim	0.25	3	0.159	1.213	13.1	30
2	F1	F1_B71	F1_B71	Clethodim	0.5	3	0.161	1.213	13.3	0
2	F1	F1_B71	F1_B71	Clethodim	1	3	0.145	1.213	12	0
2	F1	F1_B71	F1_B71	Clethodim	2	3	0.148	1.213	12.2	0
2	F1	F1_B71	F1_B71	Clethodim	4	3	0.191	1.213	15.8	0
2	F1	F1_B71	F1_B71	Control	0	3	1.063	1.213	87.7	100
2	F1	F1_B71	F1_B71	Control	0	3	1.362	1.213	112.3	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.0625	4	1.026	0.818	125.4	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.125	4	0.654	0.818	80	85
2	F1	F1_B71	F1_B71	Sethoxydim	0.25	4	0.351	0.818	42.9	90
2	F1	F1_B71	F1_B71	Sethoxydim	0.5	4	0.116	0.818	14.2	50
2	F1	F1_B71	F1_B71	Sethoxydim	1	4	0.142	0.818	17.4	30
2	F1	F1_B71	F1_B71	Sethoxydim	2	4	0.131	0.818	16	30
2	F1	F1_B71	F1_B71	Sethoxydim	4	4	0.083	0.818	10.1	20
2	F1	F1_B71	F1_B71	Quizalofop	0.0625	4	1.004	0.818	122.7	100
2	F1	F1_B71	F1_B71	Quizalofop	0.125	4	0.798	0.818	97.6	100
2	F1	F1_B71	F1_B71	Quizalofop	0.25	4	0.985	0.818	120.4	95
2	F1	F1_B71	F1_B71	Quizalofop	0.5	4	0.752	0.818	91.9	80
2	F1	F1_B71	F1_B71	Quizalofop	1	4	0.117	0.818	14.3	40
2	F1	F1_B71	F1_B71	Quizalofop	2	4	0.089	0.818	10.9	40
2	F1	F1_B71	F1_B71	Quizalofop	4	4	0.121	0.818	14.8	20
2	F1	F1_B71	F1_B71	Fluazifop	0.0625	4	1.083	0.818	132.4	95
2	F1	F1_B71	F1_B71	Fluazifop	0.125	4	0.512	0.818	62.6	100
2	F1	F1_B71	F1_B71	Fluazifop	0.25	4	0.856	0.818	104.6	95

2	F1	F1_B71	F1_B71	Fluazifop	0.5	4	0.544	0.818	66.5	70
2	F1	F1_B71	F1_B71	Fluazifop	1	4	0.629	0.818	76.9	85
2	F1	F1_B71	F1_B71	Fluazifop	2	4	0.569	0.818	69.6	70
2	F1	F1_B71	F1_B71	Fluazifop	4	4	0.227	0.818	27.8	60
2	F1	F1_B71	F1_B71	Clethodim	0.0625	4	0.066	0.818	8.1	50
2	F1	F1_B71	F1_B71	Clethodim	0.125	4	0.152	0.818	18.6	50
2	F1	F1_B71	F1_B71	Clethodim	0.25	4	0.123	0.818	15	30
2	F1	F1_B71	F1_B71	Clethodim	0.5	4	0.148	0.818	18.1	20
2	F1	F1_B71	F1_B71	Clethodim	1	4	0.119	0.818	14.5	10
2	F1	F1_B71	F1_B71	Clethodim	2	4	0.138	0.818	16.9	0
2	F1	F1_B71	F1_B71	Clethodim	4	4	0.106	0.818	13	0
2	F1	F1_B71	F1_B71	Control	0	4	0.792	0.818	96.8	100
2	F1	F1_B71	F1_B71	Control	0	4	0.844	0.818	103.2	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.0625	5	0.752	0.611	123.2	90
2	F1	F1_B71	F1_B71	Sethoxydim	0.125	5	0.646	0.611	105.8	80
2	F1	F1_B71	F1_B71	Sethoxydim	0.25	5	0.615	0.611	100.7	80
2	F1	F1_B71	F1_B71	Sethoxydim	0.5	5	0.041	0.611	6.7	50
2	F1	F1_B71	F1_B71	Sethoxydim	1	5	0.085	0.611	13.9	40
2	F1	F1_B71	F1_B71	Sethoxydim	2	5	0.16	0.611	26.2	20
2	F1	F1_B71	F1_B71	Sethoxydim	4	5	.	.	.	0
2	F1	F1_B71	F1_B71	Quizalofop	0.0625	5	0.574	0.611	94	100
2	F1	F1_B71	F1_B71	Quizalofop	0.125	5	0.867	0.611	142	95
2	F1	F1_B71	F1_B71	Quizalofop	0.25	5	0.693	0.611	113.5	100
2	F1	F1_B71	F1_B71	Quizalofop	0.5	5	0.381	0.611	62.4	90
2	F1	F1_B71	F1_B71	Quizalofop	1	5	0.076	0.611	12.4	40
2	F1	F1_B71	F1_B71	Quizalofop	2	5	0.07	0.611	11.5	40
2	F1	F1_B71	F1_B71	Quizalofop	4	5	0.083	0.611	13.6	15
2	F1	F1_B71	F1_B71	Fluazifop	0.0625	5	0.835	0.611	136.8	100
2	F1	F1_B71	F1_B71	Fluazifop	0.125	5	0.829	0.611	135.8	100
2	F1	F1_B71	F1_B71	Fluazifop	0.25	5	0.765	0.611	125.3	90
2	F1	F1_B71	F1_B71	Fluazifop	0.5	5	0.235	0.611	38.5	90
2	F1	F1_B71	F1_B71	Fluazifop	1	5	0.382	0.611	62.6	75
2	F1	F1_B71	F1_B71	Fluazifop	2	5	0.185	0.611	30.3	70
2	F1	F1_B71	F1_B71	Fluazifop	4	5	0.069	0.611	11.3	50
2	F1	F1_B71	F1_B71	Clethodim	0.0625	5	0.083	0.611	13.6	50
2	F1	F1_B71	F1_B71	Clethodim	0.125	5	0.054	0.611	8.8	40
2	F1	F1_B71	F1_B71	Clethodim	0.25	5	0.099	0.611	16.2	30
2	F1	F1_B71	F1_B71	Clethodim	0.5	5	0.091	0.611	14.9	0
2	F1	F1_B71	F1_B71	Clethodim	1	5	.	.	.	0
2	F1	F1_B71	F1_B71	Clethodim	2	5	0.082	0.611	13.4	0
2	F1	F1_B71	F1_B71	Clethodim	4	5	0.054	0.611	8.8	0
2	F1	F1_B71	F1_B71	Control	0	5	0.545	0.611	89.3	100
2	F1	F1_B71	F1_B71	Control	0	5	0.676	0.611	110.7	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.0625	6	0.875	0.944	92.7	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.125	6	.	.	.	0
2	F1	F1_B71	F1_B71	Sethoxydim	0.25	6	0.446	0.944	47.3	80
2	F1	F1_B71	F1_B71	Sethoxydim	0.5	6	0.141	0.944	14.9	50
2	F1	F1_B71	F1_B71	Sethoxydim	1	6	0.218	0.944	23.1	30
2	F1	F1_B71	F1_B71	Sethoxydim	2	6	0.258	0.944	27.3	20
2	F1	F1_B71	F1_B71	Sethoxydim	4	6	0.18	0.944	19.1	0
2	F1	F1_B71	F1_B71	Quizalofop	0.0625	6	1.028	0.944	109	100
2	F1	F1_B71	F1_B71	Quizalofop	0.125	6	1.015	0.944	107.6	95
2	F1	F1_B71	F1_B71	Quizalofop	0.25	6	0.936	0.944	99.2	100
2	F1	F1_B71	F1_B71	Quizalofop	0.5	6	0.399	0.944	42.3	70
2	F1	F1_B71	F1_B71	Quizalofop	1	6	0.193	0.944	20.5	55
2	F1	F1_B71	F1_B71	Quizalofop	2	6	0.166	0.944	17.6	40
2	F1	F1_B71	F1_B71	Quizalofop	4	6	0.159	0.944	16.9	30
2	F1	F1_B71	F1_B71	Fluazifop	0.0625	6	1.129	0.944	119.7	100
2	F1	F1_B71	F1_B71	Fluazifop	0.125	6	0.74	0.944	78.4	100
2	F1	F1_B71	F1_B71	Fluazifop	0.25	6	1.334	0.944	141.4	100
2	F1	F1_B71	F1_B71	Fluazifop	0.5	6	0.764	0.944	81	80
2	F1	F1_B71	F1_B71	Fluazifop	1	6	0.94	0.944	99.6	90

2	F1	F1_B71	F1_B71	Fluazifop	2	6	0.431	0.944	45.7	70
2	F1	F1_B71	F1_B71	Fluazifop	4	6	0.206	0.944	21.8	50
2	F1	F1_B71	F1_B71	Clethodim	0.0625	6	0.197	0.944	20.9	95
2	F1	F1_B71	F1_B71	Clethodim	0.125	6	0.25	0.944	26.5	35
2	F1	F1_B71	F1_B71	Clethodim	0.25	6	0.213	0.944	22.6	30
2	F1	F1_B71	F1_B71	Clethodim	0.5	6	0.141	0.944	14.9	0
2	F1	F1_B71	F1_B71	Clethodim	1	6	.	.	.	0
2	F1	F1_B71	F1_B71	Clethodim	4	6	0.182	0.944	19.3	0
2	F1	F1_B71	F1_B71	Control	0	6	0.9	0.944	95.4	100
2	F1	F1_B71	F1_B71	Control	0	6	0.987	0.944	104.6	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.0625	7	0.995	0.837	118.9	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.125	7	0.685	0.837	81.9	70
2	F1	F1_B71	F1_B71	Sethoxydim	0.25	7	0.62	0.837	74.1	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.5	7	0.119	0.837	14.2	50
2	F1	F1_B71	F1_B71	Sethoxydim	1	7	0.147	0.837	17.6	40
2	F1	F1_B71	F1_B71	Sethoxydim	2	7	0.248	0.837	29.6	30
2	F1	F1_B71	F1_B71	Sethoxydim	4	7	0.176	0.837	21	0
2	F1	F1_B71	F1_B71	Quizalofop	0.0625	7	0.721	0.837	86.2	100
2	F1	F1_B71	F1_B71	Quizalofop	0.125	7	1.147	0.837	137.1	100
2	F1	F1_B71	F1_B71	Quizalofop	0.25	7	0.645	0.837	77.1	100
2	F1	F1_B71	F1_B71	Quizalofop	0.5	7	0.487	0.837	58.2	100
2	F1	F1_B71	F1_B71	Quizalofop	1	7	0.38	0.837	45.4	60
2	F1	F1_B71	F1_B71	Quizalofop	2	7	0.152	0.837	18.2	40
2	F1	F1_B71	F1_B71	Quizalofop	4	7	0.179	0.837	21.4	40
2	F1	F1_B71	F1_B71	Fluazifop	0.0625	7	0.851	0.837	101.7	100
2	F1	F1_B71	F1_B71	Fluazifop	0.125	7	1.131	0.837	135.2	100
2	F1	F1_B71	F1_B71	Fluazifop	0.25	7	0.625	0.837	74.7	100
2	F1	F1_B71	F1_B71	Fluazifop	0.5	7	0.694	0.837	83	100
2	F1	F1_B71	F1_B71	Fluazifop	1	7	0.57	0.837	68.1	100
2	F1	F1_B71	F1_B71	Fluazifop	2	7	.	.	.	100
2	F1	F1_B71	F1_B71	Fluazifop	2	7	0.561	0.837	67.1	100
2	F1	F1_B71	F1_B71	Fluazifop	4	7	0.418	0.837	50	60
2	F1	F1_B71	F1_B71	Clethodim	0.0625	7	0.164	0.837	19.6	50
2	F1	F1_B71	F1_B71	Clethodim	0.125	7	0.206	0.837	24.6	30
2	F1	F1_B71	F1_B71	Clethodim	0.25	7	0.197	0.837	23.6	30
2	F1	F1_B71	F1_B71	Clethodim	0.5	7	0.194	0.837	23.2	0
2	F1	F1_B71	F1_B71	Clethodim	1	7	0.201	0.837	24	0
2	F1	F1_B71	F1_B71	Clethodim	2	7	0.166	0.837	19.8	0
2	F1	F1_B71	F1_B71	Clethodim	4	7	0.165	0.837	19.7	0
2	F1	F1_B71	F1_B71	Control	0	7	0.679	0.837	81.2	100
2	F1	F1_B71	F1_B71	Control	0	7	0.994	0.837	118.8	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.0625	8	0.823	1.003	82.1	100
2	F1	F1_B71	F1_B71	Sethoxydim	0.125	8	0.903	1.003	90	70
2	F1	F1_B71	F1_B71	Sethoxydim	0.25	8	0.172	1.003	17.1	50
2	F1	F1_B71	F1_B71	Sethoxydim	0.5	8	0.149	1.003	14.9	50
2	F1	F1_B71	F1_B71	Sethoxydim	1	8	0.14	1.003	14	30
2	F1	F1_B71	F1_B71	Sethoxydim	2	8	0.18	1.003	17.9	45
2	F1	F1_B71	F1_B71	Sethoxydim	4	8	0.174	1.003	17.3	0
2	F1	F1_B71	F1_B71	Quizalofop	0.0625	8	0.461	1.003	46	100
2	F1	F1_B71	F1_B71	Quizalofop	0.125	8	0.994	1.003	99.1	95
2	F1	F1_B71	F1_B71	Quizalofop	0.25	8	1.105	1.003	110.2	100
2	F1	F1_B71	F1_B71	Quizalofop	0.5	8	0.461	1.003	46	65
2	F1	F1_B71	F1_B71	Quizalofop	1	8	0.413	1.003	41.2	50
2	F1	F1_B71	F1_B71	Quizalofop	2	8	0.158	1.003	15.8	50
2	F1	F1_B71	F1_B71	Quizalofop	4	8	0.171	1.003	17	30
2	F1	F1_B71	F1_B71	Fluazifop	0.0625	8	0.984	1.003	98.1	100
2	F1	F1_B71	F1_B71	Fluazifop	0.125	8	0.964	1.003	96.1	100
2	F1	F1_B71	F1_B71	Fluazifop	0.25	8	0.878	1.003	87.5	65
2	F1	F1_B71	F1_B71	Fluazifop	0.5	8	0.803	1.003	80.1	80
2	F1	F1_B71	F1_B71	Fluazifop	1	8	0.787	1.003	78.5	70
2	F1	F1_B71	F1_B71	Fluazifop	2	8	0.408	1.003	40.7	85
2	F1	F1_B71	F1_B71	Fluazifop	4	8	0.428	1.003	42.7	65

2	F1	F1_B71	F1_B71	Clethodim	0.0625	8	0.158	1.003	15.8	50
2	F1	F1_B71	F1_B71	Clethodim	0.125	8	0.149	1.003	14.9	30
2	F1	F1_B71	F1_B71	Clethodim	0.25	8	0.134	1.003	13.4	30
2	F1	F1_B71	F1_B71	Clethodim	0.5	8	0.183	1.003	18.2	0
2	F1	F1_B71	F1_B71	Clethodim	1	8	0.15	1.003	15	0
2	F1	F1_B71	F1_B71	Clethodim	2	8	0.139	1.003	13.9	0
2	F1	F1_B71	F1_B71	Clethodim	4	8	0.133	1.003	13.3	0
2	F1	F1_B71	F1_B71	Control	0	8	0.972	1.003	96.9	100
2	F1	F1_B71	F1_B71	Control	0	8	1.034	1.003	103.1	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.0625	1	0.894	1.034	86.5	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.125	1	0.792	1.034	76.6	80
2	F1	F1_B45	F1_B45	Sethoxydim	0.25	1	0.276	1.034	26.7	70
2	F1	F1_B45	F1_B45	Sethoxydim	0.5	1	0.195	1.034	18.9	20
2	F1	F1_B45	F1_B45	Sethoxydim	1	1	0.193	1.034	18.7	20
2	F1	F1_B45	F1_B45	Sethoxydim	2	1	0.179	1.034	17.3	20
2	F1	F1_B45	F1_B45	Sethoxydim	4	1	0.152	1.034	14.7	0
2	F1	F1_B45	F1_B45	Quizalofop	0.0625	1	1.213	1.034	117.4	100
2	F1	F1_B45	F1_B45	Quizalofop	0.125	1	1.301	1.034	125.9	95
2	F1	F1_B45	F1_B45	Quizalofop	0.25	1	1.211	1.034	117.2	95
2	F1	F1_B45	F1_B45	Quizalofop	0.5	1	0.882	1.034	85.3	70
2	F1	F1_B45	F1_B45	Quizalofop	1	1	0.17	1.034	16.4	50
2	F1	F1_B45	F1_B45	Quizalofop	2	1	0.183	1.034	17.7	40
2	F1	F1_B45	F1_B45	Quizalofop	4	1	0.233	1.034	22.5	40
2	F1	F1_B45	F1_B45	Fluazifop	0.0625	1	1.054	1.034	102	100
2	F1	F1_B45	F1_B45	Fluazifop	0.125	1	0.753	1.034	72.9	100
2	F1	F1_B45	F1_B45	Fluazifop	0.25	1	0.965	1.034	93.4	80
2	F1	F1_B45	F1_B45	Fluazifop	0.5	1	0.754	1.034	73	80
2	F1	F1_B45	F1_B45	Fluazifop	1	1	0.769	1.034	74.4	70
2	F1	F1_B45	F1_B45	Fluazifop	2	1	0.546	1.034	52.8	70
2	F1	F1_B45	F1_B45	Fluazifop	4	1	0.376	1.034	36.4	50
2	F1	F1_B45	F1_B45	Clethodim	0.0625	1	0.131	1.034	12.7	40
2	F1	F1_B45	F1_B45	Clethodim	0.125	1	0.152	1.034	14.7	40
2	F1	F1_B45	F1_B45	Clethodim	0.25	1	0.193	1.034	18.7	30
2	F1	F1_B45	F1_B45	Clethodim	0.5	1	0.165	1.034	16	0
2	F1	F1_B45	F1_B45	Clethodim	1	1	0.17	1.034	16.4	0
2	F1	F1_B45	F1_B45	Clethodim	2	1	0.199	1.034	19.3	0
2	F1	F1_B45	F1_B45	Clethodim	4	1	0.145	1.034	14	0
2	F1	F1_B45	F1_B45	Control	0	1	1.013	1.034	98	100
2	F1	F1_B45	F1_B45	Control	0	1	1.054	1.034	102	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.0625	2	1.057	1.024	103.2	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.125	2	0.805	1.024	78.6	70
2	F1	F1_B45	F1_B45	Sethoxydim	0.25	2	0.73	1.024	71.3	60
2	F1	F1_B45	F1_B45	Sethoxydim	0.5	2	0.189	1.024	18.5	20
2	F1	F1_B45	F1_B45	Sethoxydim	1	2	0.248	1.024	24.2	30
2	F1	F1_B45	F1_B45	Sethoxydim	2	2	0.252	1.024	24.6	30
2	F1	F1_B45	F1_B45	Sethoxydim	4	2	0.112	1.024	10.9	0
2	F1	F1_B45	F1_B45	Quizalofop	0.0625	2	0.909	1.024	88.8	100
2	F1	F1_B45	F1_B45	Quizalofop	0.125	2	0.954	1.024	93.2	100
2	F1	F1_B45	F1_B45	Quizalofop	0.25	2	1.085	1.024	106	100
2	F1	F1_B45	F1_B45	Quizalofop	0.5	2	0.62	1.024	60.5	60
2	F1	F1_B45	F1_B45	Quizalofop	1	2	0.435	1.024	42.5	90
2	F1	F1_B45	F1_B45	Quizalofop	2	2	0.221	1.024	21.6	40
2	F1	F1_B45	F1_B45	Quizalofop	4	2	0.208	1.024	20.3	40
2	F1	F1_B45	F1_B45	Fluazifop	0.0625	2	0.982	1.024	95.9	100
2	F1	F1_B45	F1_B45	Fluazifop	0.125	2	0.955	1.024	93.3	100
2	F1	F1_B45	F1_B45	Fluazifop	0.25	2	0.773	1.024	75.5	70
2	F1	F1_B45	F1_B45	Fluazifop	0.5	2	0.717	1.024	70	80
2	F1	F1_B45	F1_B45	Fluazifop	1	2	0.654	1.024	63.9	80
2	F1	F1_B45	F1_B45	Fluazifop	2	2	0.456	1.024	44.5	80
2	F1	F1_B45	F1_B45	Fluazifop	4	2	0.49	1.024	47.9	70
2	F1	F1_B45	F1_B45	Clethodim	0.0625	2	0.209	1.024	20.4	20
2	F1	F1_B45	F1_B45	Clethodim	0.125	2	0.203	1.024	19.8	40

2	F1	F1_B45	F1_B45	Clethodim	0.25	2	0.284	1.024	27.7	35
2	F1	F1_B45	F1_B45	Clethodim	0.5	2	0.247	1.024	24.1	0
2	F1	F1_B45	F1_B45	Clethodim	1	2	0.204	1.024	19.9	0
2	F1	F1_B45	F1_B45	Clethodim	2	2	0.124	1.024	12.1	0
2	F1	F1_B45	F1_B45	Clethodim	4	2	0.181	1.024	17.7	0
2	F1	F1_B45	F1_B45	Control	0	2	0.919	1.024	89.7	100
2	F1	F1_B45	F1_B45	Control	0	2	1.129	1.024	110.3	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.0625	3	1.242	1.13	109.9	95
2	F1	F1_B45	F1_B45	Sethoxydim	0.125	3	1.076	1.13	95.2	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.25	3	0.508	1.13	45	70
2	F1	F1_B45	F1_B45	Sethoxydim	0.5	3	0.172	1.13	15.2	50
2	F1	F1_B45	F1_B45	Sethoxydim	1	3	0.149	1.13	13.2	30
2	F1	F1_B45	F1_B45	Sethoxydim	2	3	0.143	1.13	12.7	40
2	F1	F1_B45	F1_B45	Sethoxydim	4	3	0.196	1.13	17.3	0
2	F1	F1_B45	F1_B45	Quizalofop	0.0625	3	0.976	1.13	86.4	100
2	F1	F1_B45	F1_B45	Quizalofop	0.125	3	1.02	1.13	90.3	100
2	F1	F1_B45	F1_B45	Quizalofop	0.25	3	1.081	1.13	95.7	95
2	F1	F1_B45	F1_B45	Quizalofop	0.5	3	0.895	1.13	79.2	100
2	F1	F1_B45	F1_B45	Quizalofop	1	3	0.275	1.13	24.3	40
2	F1	F1_B45	F1_B45	Quizalofop	2	3	0.152	1.13	13.5	50
2	F1	F1_B45	F1_B45	Quizalofop	4	3	0.2	1.13	17.7	20
2	F1	F1_B45	F1_B45	Fluazifop	0.0625	3	1.393	1.13	123.3	100
2	F1	F1_B45	F1_B45	Fluazifop	0.125	3	1.096	1.13	97	100
2	F1	F1_B45	F1_B45	Fluazifop	0.25	3	0.942	1.13	83.4	.
2	F1	F1_B45	F1_B45	Fluazifop	0.5	3	1.097	1.13	97.1	90
2	F1	F1_B45	F1_B45	Fluazifop	1	3	0.816	1.13	72.2	85
2	F1	F1_B45	F1_B45	Fluazifop	2	3	0.469	1.13	41.5	80
2	F1	F1_B45	F1_B45	Fluazifop	4	3	0.266	1.13	23.5	80
2	F1	F1_B45	F1_B45	Clethodim	0.0625	3	0.112	1.13	9.9	50
2	F1	F1_B45	F1_B45	Clethodim	0.125	3	0.144	1.13	12.7	40
2	F1	F1_B45	F1_B45	Clethodim	0.25	3	0.261	1.13	23.1	35
2	F1	F1_B45	F1_B45	Clethodim	0.5	3	0.187	1.13	16.5	5
2	F1	F1_B45	F1_B45	Clethodim	1	3	0.195	1.13	17.3	0
2	F1	F1_B45	F1_B45	Clethodim	2	3	0.192	1.13	17	0
2	F1	F1_B45	F1_B45	Clethodim	4	3	0.146	1.13	12.9	0
2	F1	F1_B45	F1_B45	Control	0	3	1.12	1.13	99.1	100
2	F1	F1_B45	F1_B45	Control	0	3	1.14	1.13	100.9	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.0625	4	1.036	0.761	136.1	80
2	F1	F1_B45	F1_B45	Sethoxydim	0.125	4	0.728	0.761	95.7	80
2	F1	F1_B45	F1_B45	Sethoxydim	0.25	4	0.191	0.761	25.1	90
2	F1	F1_B45	F1_B45	Sethoxydim	0.5	4	0.051	0.761	6.7	50
2	F1	F1_B45	F1_B45	Sethoxydim	1	4	0.167	0.761	21.9	40
2	F1	F1_B45	F1_B45	Sethoxydim	2	4	0.167	0.761	21.9	20
2	F1	F1_B45	F1_B45	Sethoxydim	4	4	0.143	0.761	18.8	0
2	F1	F1_B45	F1_B45	Quizalofop	0.0625	4	1.1	0.761	144.5	100
2	F1	F1_B45	F1_B45	Quizalofop	0.125	4	0.881	0.761	115.8	90
2	F1	F1_B45	F1_B45	Quizalofop	0.25	4	1.165	0.761	153.1	100
2	F1	F1_B45	F1_B45	Quizalofop	0.5	4	0.473	0.761	62.2	70
2	F1	F1_B45	F1_B45	Quizalofop	1	4	0.057	0.761	7.5	100
2	F1	F1_B45	F1_B45	Quizalofop	2	4	0.094	0.761	12.4	50
2	F1	F1_B45	F1_B45	Quizalofop	4	4	0.103	0.761	13.5	50
2	F1	F1_B45	F1_B45	Fluazifop	0.0625	4	1.249	0.761	164.1	100
2	F1	F1_B45	F1_B45	Fluazifop	0.125	4	0.842	0.761	110.6	100
2	F1	F1_B45	F1_B45	Fluazifop	0.25	4	0.686	0.761	90.1	70
2	F1	F1_B45	F1_B45	Fluazifop	0.5	4	0.384	0.761	50.5	65
2	F1	F1_B45	F1_B45	Fluazifop	1	4	0.404	0.761	53.1	90
2	F1	F1_B45	F1_B45	Fluazifop	2	4	0.49	0.761	64.4	80
2	F1	F1_B45	F1_B45	Fluazifop	4	4	0.259	0.761	34	60
2	F1	F1_B45	F1_B45	Clethodim	0.0625	4	0.086	0.761	11.3	50
2	F1	F1_B45	F1_B45	Clethodim	0.125	4	0.099	0.761	13	40
2	F1	F1_B45	F1_B45	Clethodim	0.25	4	0.094	0.761	12.4	40
2	F1	F1_B45	F1_B45	Clethodim	0.5	4	0.142	0.761	18.7	0

2	F1	F1_B45	F1_B45	Clethodim	1	4	0.157	0.761	20.6	30
2	F1	F1_B45	F1_B45	Clethodim	2	4	0.108	0.761	14.2	0
2	F1	F1_B45	F1_B45	Clethodim	4	4	0.097	0.761	12.7	0
2	F1	F1_B45	F1_B45	Control	0	4	0.753	0.761	98.9	100
2	F1	F1_B45	F1_B45	Control	0	4	0.769	0.761	101.1	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.0625	5	.	.	.	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.125	5	.	.	.	95
2	F1	F1_B45	F1_B45	Sethoxydim	0.25	5	.	.	.	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.5	5	.	.	.	30
2	F1	F1_B45	F1_B45	Sethoxydim	1	5	.	.	.	0
2	F1	F1_B45	F1_B45	Sethoxydim	2	5	.	.	.	0
2	F1	F1_B45	F1_B45	Sethoxydim	4	5	.	.	.	0
2	F1	F1_B45	F1_B45	Quizalofop	0.0625	5	0.701	0.605	115.9	100
2	F1	F1_B45	F1_B45	Quizalofop	0.125	5	0.501	0.605	82.8	100
2	F1	F1_B45	F1_B45	Quizalofop	0.25	5	0.541	0.605	89.4	100
2	F1	F1_B45	F1_B45	Quizalofop	0.5	5	0.13	0.605	21.5	65
2	F1	F1_B45	F1_B45	Quizalofop	1	5	0.165	0.605	27.3	50
2	F1	F1_B45	F1_B45	Quizalofop	2	5	0.032	0.605	5.3	0
2	F1	F1_B45	F1_B45	Quizalofop	4	5	0.048	0.605	7.9	25
2	F1	F1_B45	F1_B45	Fluazifop	0.0625	5	0.681	0.605	112.6	100
2	F1	F1_B45	F1_B45	Fluazifop	0.125	5	0.378	0.605	62.5	100
2	F1	F1_B45	F1_B45	Fluazifop	0.25	5	0.357	0.605	59	100
2	F1	F1_B45	F1_B45	Fluazifop	0.5	5	0.473	0.605	78.2	80
2	F1	F1_B45	F1_B45	Fluazifop	1	5	0.217	0.605	35.9	95
2	F1	F1_B45	F1_B45	Fluazifop	2	5	0.18	0.605	29.8	95
2	F1	F1_B45	F1_B45	Fluazifop	4	5	0.065	0.605	10.7	55
2	F1	F1_B45	F1_B45	Clethodim	0.0625	5	.	.	.	50
2	F1	F1_B45	F1_B45	Clethodim	0.125	5	0.051	0.605	8.4	50
2	F1	F1_B45	F1_B45	Clethodim	0.25	5	0.092	0.605	15.2	30
2	F1	F1_B45	F1_B45	Clethodim	0.5	5	0.059	0.605	9.8	0
2	F1	F1_B45	F1_B45	Clethodim	2	5	0.065	0.605	10.7	0
2	F1	F1_B45	F1_B45	Clethodim	4	5	0.057	0.605	9.4	0
2	F1	F1_B45	F1_B45	Control	0	5	0.4	0.605	66.1	100
2	F1	F1_B45	F1_B45	Control	0	5	0.81	0.605	133.9	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.0625	6	0.857	0.899	95.3	95
2	F1	F1_B45	F1_B45	Sethoxydim	0.125	6	0.486	0.899	54.1	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.25	6	0.271	0.899	30.1	95
2	F1	F1_B45	F1_B45	Sethoxydim	0.5	6	0.179	0.899	19.9	40
2	F1	F1_B45	F1_B45	Sethoxydim	1	6	0.14	0.899	15.6	20
2	F1	F1_B45	F1_B45	Sethoxydim	2	6	0.191	0.899	21.2	10
2	F1	F1_B45	F1_B45	Sethoxydim	4	6	0.125	0.899	13.9	0
2	F1	F1_B45	F1_B45	Quizalofop	0.0625	6	0.554	0.899	61.6	100
2	F1	F1_B45	F1_B45	Quizalofop	0.125	6	0.808	0.899	89.9	95
2	F1	F1_B45	F1_B45	Quizalofop	0.25	6	0.852	0.899	94.8	95
2	F1	F1_B45	F1_B45	Quizalofop	0.5	6	0.343	0.899	38.2	80
2	F1	F1_B45	F1_B45	Quizalofop	1	6	0.106	0.899	11.8	40
2	F1	F1_B45	F1_B45	Quizalofop	2	6	0.157	0.899	17.5	30
2	F1	F1_B45	F1_B45	Quizalofop	4	6	0.128	0.899	14.2	10
2	F1	F1_B45	F1_B45	Fluazifop	0.0625	6	1.001	0.899	111.3	95
2	F1	F1_B45	F1_B45	Fluazifop	0.125	6	0.92	0.899	102.3	95
2	F1	F1_B45	F1_B45	Fluazifop	0.25	6	0.727	0.899	80.9	90
2	F1	F1_B45	F1_B45	Fluazifop	0.5	6	0.674	0.899	75	70
2	F1	F1_B45	F1_B45	Fluazifop	1	6	0.576	0.899	64.1	75
2	F1	F1_B45	F1_B45	Fluazifop	2	6	0.441	0.899	49.1	.
2	F1	F1_B45	F1_B45	Fluazifop	4	6	0.198	0.899	22	50
2	F1	F1_B45	F1_B45	Clethodim	0.0625	6	0.142	0.899	15.8	50
2	F1	F1_B45	F1_B45	Clethodim	0.125	6	0.206	0.899	22.9	20
2	F1	F1_B45	F1_B45	Clethodim	0.25	6	0.138	0.899	15.4	25
2	F1	F1_B45	F1_B45	Clethodim	0.5	6	0.122	0.899	13.6	10
2	F1	F1_B45	F1_B45	Clethodim	1	6	0.183	0.899	20.4	0
2	F1	F1_B45	F1_B45	Clethodim	2	6	0.143	0.899	15.9	0
2	F1	F1_B45	F1_B45	Clethodim	4	6	0.132	0.899	14.7	0

2	F1	F1_B45	F1_B45	Control	0	6	0.853	0.899	94.9	100
2	F1	F1_B45	F1_B45	Control	0	6	0.945	0.899	105.1	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.0625	7	1.003	0.838	119.7	.
2	F1	F1_B45	F1_B45	Sethoxydim	0.125	7	0.672	0.838	80.2	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.25	7	0.603	0.838	72	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.5	7	0.104	0.838	12.4	50
2	F1	F1_B45	F1_B45	Sethoxydim	1	7	0.163	0.838	19.5	20
2	F1	F1_B45	F1_B45	Sethoxydim	2	7	0.211	0.838	25.2	0
2	F1	F1_B45	F1_B45	Sethoxydim	4	7	0.139	0.838	16.6	0
2	F1	F1_B45	F1_B45	Quizalofop	0.0625	7	0.973	0.838	116.1	100
2	F1	F1_B45	F1_B45	Quizalofop	0.125	7	0.847	0.838	101.1	100
2	F1	F1_B45	F1_B45	Quizalofop	0.25	7	0.682	0.838	81.4	100
2	F1	F1_B45	F1_B45	Quizalofop	0.5	7	0.514	0.838	61.3	100
2	F1	F1_B45	F1_B45	Quizalofop	1	7	0.189	0.838	22.6	60
2	F1	F1_B45	F1_B45	Quizalofop	2	7	0.191	0.838	22.8	30
2	F1	F1_B45	F1_B45	Quizalofop	4	7	0.205	0.838	24.5	20
2	F1	F1_B45	F1_B45	Fluazifop	0.0625	7	0.971	0.838	115.9	100
2	F1	F1_B45	F1_B45	Fluazifop	0.125	7	0.646	0.838	77.1	100
2	F1	F1_B45	F1_B45	Fluazifop	0.25	7	0.398	0.838	47.5	95
2	F1	F1_B45	F1_B45	Fluazifop	0.5	7	0.608	0.838	72.6	70
2	F1	F1_B45	F1_B45	Fluazifop	1	7	0.588	0.838	70.2	100
2	F1	F1_B45	F1_B45	Fluazifop	2	7	0.405	0.838	48.3	100
2	F1	F1_B45	F1_B45	Fluazifop	4	7	0.164	0.838	19.6	50
2	F1	F1_B45	F1_B45	Clethodim	0.0625	7	0.135	0.838	16.1	45
2	F1	F1_B45	F1_B45	Clethodim	0.125	7	.	.	.	40
2	F1	F1_B45	F1_B45	Clethodim	0.25	7	0.2	0.838	23.9	30
2	F1	F1_B45	F1_B45	Clethodim	0.5	7	0.143	0.838	17.1	0
2	F1	F1_B45	F1_B45	Clethodim	1	7	0.145	0.838	17.3	0
2	F1	F1_B45	F1_B45	Clethodim	2	7	0.186	0.838	22.2	0
2	F1	F1_B45	F1_B45	Clethodim	4	7	0.106	0.838	12.6	0
2	F1	F1_B45	F1_B45	Control	0	7	0.782	0.838	93.3	100
2	F1	F1_B45	F1_B45	Control	0	7	0.894	0.838	106.7	100
2	F1	F1_B45	F1_B45	Sethoxydim	0.0625	8	1.068	1.1	97.1	95
2	F1	F1_B45	F1_B45	Sethoxydim	0.125	8	0.568	1.1	51.7	70
2	F1	F1_B45	F1_B45	Sethoxydim	0.25	8	0.446	1.1	40.6	85
2	F1	F1_B45	F1_B45	Sethoxydim	0.5	8	0.083	1.1	7.5	50
2	F1	F1_B45	F1_B45	Sethoxydim	1	8	0.084	1.1	7.6	40
2	F1	F1_B45	F1_B45	Sethoxydim	2	8	0.163	1.1	14.8	30
2	F1	F1_B45	F1_B45	Sethoxydim	4	8	0.103	1.1	9.4	0
2	F1	F1_B45	F1_B45	Quizalofop	0.0625	8	0.859	1.1	78.1	100
2	F1	F1_B45	F1_B45	Quizalofop	0.125	8	0.987	1.1	89.8	100
2	F1	F1_B45	F1_B45	Quizalofop	0.25	8	1.099	1.1	100	100
2	F1	F1_B45	F1_B45	Quizalofop	0.5	8	0.957	1.1	87	60
2	F1	F1_B45	F1_B45	Quizalofop	1	8	0.107	1.1	9.7	30
2	F1	F1_B45	F1_B45	Quizalofop	2	8	0.11	1.1	10	50
2	F1	F1_B45	F1_B45	Quizalofop	4	8	0.17	1.1	15.5	30
2	F1	F1_B45	F1_B45	Fluazifop	0.0625	8	0.938	1.1	85.3	100
2	F1	F1_B45	F1_B45	Fluazifop	0.125	8	1.007	1.1	91.6	100
2	F1	F1_B45	F1_B45	Fluazifop	0.25	8	1.073	1.1	97.6	90
2	F1	F1_B45	F1_B45	Fluazifop	0.5	8	0.528	1.1	48	80
2	F1	F1_B45	F1_B45	Fluazifop	1	8	0.328	1.1	29.8	80
2	F1	F1_B45	F1_B45	Fluazifop	2	8	0.702	1.1	63.8	90
2	F1	F1_B45	F1_B45	Fluazifop	4	8	0.224	1.1	20.4	40
2	F1	F1_B45	F1_B45	Clethodim	0.0625	8	0.072	1.1	6.5	50
2	F1	F1_B45	F1_B45	Clethodim	0.125	8	0.125	1.1	11.4	40
2	F1	F1_B45	F1_B45	Clethodim	0.25	8	0.224	1.1	20.4	20
2	F1	F1_B45	F1_B45	Clethodim	0.5	8	0.208	1.1	18.9	0
2	F1	F1_B45	F1_B45	Clethodim	1	8	0.219	1.1	19.9	0
2	F1	F1_B45	F1_B45	Clethodim	2	8	0.167	1.1	15.2	0
2	F1	F1_B45	F1_B45	Clethodim	4	8	0.141	1.1	12.8	0
2	F1	F1_B45	F1_B45	Control	0	8	1.072	1.1	97.5	100
2	F1	F1_B45	F1_B45	Control	0	8	1.127	1.1	102.5	100

2	F1	F1_B45	F1_B45	Sethoxydim	0.0625	10	0.756	0.818	92.4	.
2	F1	F1_B45	F1_B45	Sethoxydim	0.125	10	0.417	0.818	51	.
2	F1	F1_B45	F1_B45	Sethoxydim	0.25	10	0.107	0.818	13.1	.
2	F1	F1_B45	F1_B45	Sethoxydim	0.5	10	0.05	0.818	6.1	.
2	F1	F1_B45	F1_B45	Sethoxydim	1	10	0.132	0.818	16.1	.
2	F1	F1_B45	F1_B45	Sethoxydim	2	10	0.062	0.818	7.6	.
2	F1	F1_B45	F1_B45	Sethoxydim	4	10	0.087	0.818	10.6	.
2	F1	F1_B45	F1_B45	Quizalofop	0.0625	10	0.876	0.818	107.1	.
2	F1	F1_B45	F1_B45	Quizalofop	0.125	10	0.721	0.818	88.1	.
2	F1	F1_B45	F1_B45	Quizalofop	0.25	10	0.67	0.818	81.9	.
2	F1	F1_B45	F1_B45	Quizalofop	0.5	10	0.328	0.818	40.1	.
2	F1	F1_B45	F1_B45	Quizalofop	1	10	0.367	0.818	44.9	.
2	F1	F1_B45	F1_B45	Quizalofop	2	10	0.041	0.818	5	.
2	F1	F1_B45	F1_B45	Quizalofop	4	10	0.062	0.818	7.6	.
2	F1	F1_B45	F1_B45	Fluazifop	0.0625	10	0.724	0.818	88.5	.
2	F1	F1_B45	F1_B45	Fluazifop	0.125	10	0.603	0.818	73.7	.
2	F1	F1_B45	F1_B45	Fluazifop	0.25	10	0.602	0.818	73.6	.
2	F1	F1_B45	F1_B45	Fluazifop	0.5	10	0.598	0.818	73.1	.
2	F1	F1_B45	F1_B45	Fluazifop	1	10	0.284	0.818	34.7	.
2	F1	F1_B45	F1_B45	Fluazifop	2	10	0.193	0.818	23.6	.
2	F1	F1_B45	F1_B45	Fluazifop	4	10	0.216	0.818	26.4	.
2	F1	F1_B45	F1_B45	Clethodim	0.0625	10	0.089	0.818	10.9	.
2	F1	F1_B45	F1_B45	Clethodim	0.125	10	0.199	0.818	24.3	.
2	F1	F1_B45	F1_B45	Clethodim	0.25	10	0.112	0.818	13.7	.
2	F1	F1_B45	F1_B45	Clethodim	0.5	10	0.115	0.818	14.1	.
2	F1	F1_B45	F1_B45	Clethodim	2	10	0.073	0.818	8.9	.
2	F1	F1_B45	F1_B45	Control	0	10	0.714	0.818	87.3	.
2	F1	F1_B45	F1_B45	Control	0	10	0.922	0.818	112.7	.
2	F1	F1_B15	F1_B15	Sethoxydim	0.125	1	0.936	1.119	83.7	.
2	F1	F1_B15	F1_B15	Sethoxydim	0.125	1	0.922	1.119	82.4	75
2	F1	F1_B15	F1_B15	Sethoxydim	0.25	1	0.284	1.119	25.4	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.5	1	0.21	1.119	18.8	50
2	F1	F1_B15	F1_B15	Sethoxydim	1	1	0.139	1.119	12.4	35
2	F1	F1_B15	F1_B15	Sethoxydim	2	1	0.202	1.119	18.1	0
2	F1	F1_B15	F1_B15	Sethoxydim	4	1	0.2	1.119	17.9	0
2	F1	F1_B15	F1_B15	Quizalofop	0.0625	1	1.04	1.119	93	80
2	F1	F1_B15	F1_B15	Quizalofop	0.125	1	1.138	1.119	101.7	100
2	F1	F1_B15	F1_B15	Quizalofop	0.25	1	0.834	1.119	74.6	90
2	F1	F1_B15	F1_B15	Quizalofop	0.5	1	0.957	1.119	85.6	95
2	F1	F1_B15	F1_B15	Quizalofop	1	1	0.147	1.119	13.1	40
2	F1	F1_B15	F1_B15	Quizalofop	2	1	0.209	1.119	18.7	30
2	F1	F1_B15	F1_B15	Quizalofop	4	1	0.141	1.119	12.6	50
2	F1	F1_B15	F1_B15	Fluazifop	0.0625	1	1.063	1.119	95	100
2	F1	F1_B15	F1_B15	Fluazifop	0.125	1	0.901	1.119	80.6	100
2	F1	F1_B15	F1_B15	Fluazifop	0.25	1	0.894	1.119	79.9	95
2	F1	F1_B15	F1_B15	Fluazifop	0.5	1	1.105	1.119	98.8	90
2	F1	F1_B15	F1_B15	Fluazifop	1	1	0.545	1.119	48.7	85
2	F1	F1_B15	F1_B15	Fluazifop	2	1	0.213	1.119	19	50
2	F1	F1_B15	F1_B15	Fluazifop	4	1	0.288	1.119	25.7	40
2	F1	F1_B15	F1_B15	Clethodim	0.0625	1	0.165	1.119	14.8	50
2	F1	F1_B15	F1_B15	Clethodim	0.125	1	0.208	1.119	18.6	45
2	F1	F1_B15	F1_B15	Clethodim	0.25	1	0.16	1.119	14.3	40
2	F1	F1_B15	F1_B15	Clethodim	0.5	1	0.216	1.119	19.3	0
2	F1	F1_B15	F1_B15	Clethodim	1	1	0.141	1.119	12.6	0
2	F1	F1_B15	F1_B15	Clethodim	2	1	0.216	1.119	19.3	0
2	F1	F1_B15	F1_B15	Clethodim	4	1	0.088	1.119	7.9	0
2	F1	F1_B15	F1_B15	Control	0	1	1.081	1.119	96.6	100
2	F1	F1_B15	F1_B15	Control	0	1	1.156	1.119	103.4	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.0625	2	0.824	1.212	68	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.125	2	0.719	1.212	59.3	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.25	2	0.468	1.212	38.6	70
2	F1	F1_B15	F1_B15	Sethoxydim	0.5	2	0.13	1.212	10.7	50

2	F1	F1_B15	F1_B15	Sethoxydim	1	2	0.149	1.212	12.3	40
2	F1	F1_B15	F1_B15	Sethoxydim	2	2	0.189	1.212	15.6	20
2	F1	F1_B15	F1_B15	Sethoxydim	4	2	0.225	1.212	18.6	0
2	F1	F1_B15	F1_B15	Quizalofop	0.0625	2	0.755	1.212	62.3	100
2	F1	F1_B15	F1_B15	Quizalofop	0.125	2	0.937	1.212	77.3	100
2	F1	F1_B15	F1_B15	Quizalofop	0.25	2	1.071	1.212	88.4	100
2	F1	F1_B15	F1_B15	Quizalofop	1	2	0.244	1.212	20.1	90
2	F1	F1_B15	F1_B15	Quizalofop	2	2	0.126	1.212	10.4	30
2	F1	F1_B15	F1_B15	Quizalofop	4	2	0.149	1.212	12.3	40
2	F1	F1_B15	F1_B15	Fluazifop	0.0625	2	0.977	1.212	80.6	100
2	F1	F1_B15	F1_B15	Fluazifop	0.125	2	0.798	1.212	65.8	100
2	F1	F1_B15	F1_B15	Fluazifop	0.25	2	0.89	1.212	73.4	100
2	F1	F1_B15	F1_B15	Fluazifop	0.5	2	0.769	1.212	63.4	100
2	F1	F1_B15	F1_B15	Fluazifop	1	2	0.731	1.212	60.3	100
2	F1	F1_B15	F1_B15	Fluazifop	2	2	0.479	1.212	39.5	100
2	F1	F1_B15	F1_B15	Fluazifop	4	2	0.536	1.212	44.2	60
2	F1	F1_B15	F1_B15	Clethodim	0.0625	2	0.185	1.212	15.3	50
2	F1	F1_B15	F1_B15	Clethodim	0.125	2	0.24	1.212	19.8	30
2	F1	F1_B15	F1_B15	Clethodim	0.25	2	0.202	1.212	16.7	20
2	F1	F1_B15	F1_B15	Clethodim	0.5	2	0.076	1.212	6.3	40
2	F1	F1_B15	F1_B15	Clethodim	1	2	0.131	1.212	10.8	0
2	F1	F1_B15	F1_B15	Clethodim	2	2	0.158	1.212	13	0
2	F1	F1_B15	F1_B15	Clethodim	4	2	0.136	1.212	11.2	0
2	F1	F1_B15	F1_B15	Control	0	2	1.212	1.212	100	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.0625	3	1.06	1.211	87.5	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.125	3	0.782	1.211	64.6	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.25	3	0.582	1.211	48.1	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.5	3	0.142	1.211	11.7	50
2	F1	F1_B15	F1_B15	Sethoxydim	1	3	0.08	1.211	6.6	20
2	F1	F1_B15	F1_B15	Sethoxydim	2	3	0.148	1.211	12.2	30
2	F1	F1_B15	F1_B15	Sethoxydim	4	3	0.072	1.211	5.9	0
2	F1	F1_B15	F1_B15	Quizalofop	0.0625	3	1.352	1.211	111.6	100
2	F1	F1_B15	F1_B15	Quizalofop	0.125	3	1.054	1.211	87	100
2	F1	F1_B15	F1_B15	Quizalofop	0.25	3	0.98	1.211	80.9	100
2	F1	F1_B15	F1_B15	Quizalofop	0.5	3	0.771	1.211	63.7	70
2	F1	F1_B15	F1_B15	Quizalofop	1	3	0.254	1.211	21	50
2	F1	F1_B15	F1_B15	Quizalofop	2	3	0.119	1.211	9.8	5
2	F1	F1_B15	F1_B15	Quizalofop	4	3	0.207	1.211	17.1	40
2	F1	F1_B15	F1_B15	Fluazifop	0.0625	3	1.206	1.211	99.6	100
2	F1	F1_B15	F1_B15	Fluazifop	0.125	3	0.941	1.211	77.7	80
2	F1	F1_B15	F1_B15	Fluazifop	0.25	3	1.085	1.211	89.6	80
2	F1	F1_B15	F1_B15	Fluazifop	0.5	3	0.953	1.211	78.7	90
2	F1	F1_B15	F1_B15	Fluazifop	1	3	0.492	1.211	40.6	80
2	F1	F1_B15	F1_B15	Fluazifop	2	3	0.815	1.211	67.3	80
2	F1	F1_B15	F1_B15	Fluazifop	4	3	0.146	1.211	12.1	50
2	F1	F1_B15	F1_B15	Clethodim	0.0625	3	0.13	1.211	10.7	30
2	F1	F1_B15	F1_B15	Clethodim	0.125	3	0.14	1.211	11.6	30
2	F1	F1_B15	F1_B15	Clethodim	0.25	3	0.124	1.211	10.2	20
2	F1	F1_B15	F1_B15	Clethodim	0.5	3	0.065	1.211	5.4	0
2	F1	F1_B15	F1_B15	Clethodim	1	3	0.16	1.211	13.2	0
2	F1	F1_B15	F1_B15	Clethodim	2	3	0.136	1.211	11.2	0
2	F1	F1_B15	F1_B15	Clethodim	4	3	0.094	1.211	7.8	0
2	F1	F1_B15	F1_B15	Control	0	3	1.141	1.211	94.2	100
2	F1	F1_B15	F1_B15	Control	0	3	1.281	1.211	105.8	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.0625	4	0.42	0.768	54.7	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.125	4	0.719	0.768	93.7	80
2	F1	F1_B15	F1_B15	Sethoxydim	0.25	4	0.272	0.768	35.4	100
2	F1	F1_B15	F1_B15	Sethoxydim	0.5	4	0.078	0.768	10.2	50
2	F1	F1_B15	F1_B15	Sethoxydim	1	4	0.122	0.768	15.9	30
2	F1	F1_B15	F1_B15	Sethoxydim	2	4	0.132	0.768	17.2	30
2	F1	F1_B15	F1_B15	Sethoxydim	4	4	0.095	0.768	12.4	0
2	F1	F1_B15	F1_B15	Quizalofop	0.0625	4	0.779	0.768	101.5	100

2	F1	F1_B15	F1_B15	Quizalofop	0.125	4	1.047	0.768	136.4	100
2	F1	F1_B15	F1_B15	Quizalofop	0.25	4	0.561	0.768	73.1	100
2	F1	F1_B15	F1_B15	Quizalofop	0.5	4	0.472	0.768	61.5	60
2	F1	F1_B15	F1_B15	Quizalofop	1	4	0.249	0.768	32.4	30
2	F1	F1_B15	F1_B15	Quizalofop	2	4	0.103	0.768	13.4	30
2	F1	F1_B15	F1_B15	Quizalofop	4	4	0.059	0.768	7.7	40
2	F1	F1_B15	F1_B15	Fluazifop	0.0625	4	0.859	0.768	111.9	100
2	F1	F1_B15	F1_B15	Fluazifop	0.125	4	0.54	0.768	70.4	100
2	F1	F1_B15	F1_B15	Fluazifop	0.25	4	0.609	0.768	79.3	80
2	F1	F1_B15	F1_B15	Fluazifop	0.5	4	0.797	0.768	103.8	100
2	F1	F1_B15	F1_B15	Fluazifop	1	4	0.383	0.768	49.9	80
2	F1	F1_B15	F1_B15	Fluazifop	2	4	0.422	0.768	55	100
2	F1	F1_B15	F1_B15	Fluazifop	4	4	0.162	0.768	21.1	60
2	F1	F1_B15	F1_B15	Clethodim	0.0625	4	0.084	0.768	10.9	50
2	F1	F1_B15	F1_B15	Clethodim	0.125	4	0.093	0.768	12.1	40
2	F1	F1_B15	F1_B15	Clethodim	0.25	4	0.087	0.768	11.3	40
2	F1	F1_B15	F1_B15	Clethodim	0.5	4	.	.	.	0
2	F1	F1_B15	F1_B15	Clethodim	1	4	0.115	0.768	15	0
2	F1	F1_B15	F1_B15	Clethodim	2	4	0.08	0.768	10.4	0
2	F1	F1_B15	F1_B15	Clethodim	4	4	0.142	0.768	18.5	0
2	F1	F1_B15	F1_B15	Control	0	4	0.742	0.768	96.7	100
2	F1	F1_B15	F1_B15	Control	0	4	0.793	0.768	103.3	100
2	F1	F1_B15	F1_B15	Quizalofop	0.0625	5	.	.	.	100
2	F1	F1_B15	F1_B15	Quizalofop	0.125	5	.	.	.	90
2	F1	F1_B15	F1_B15	Quizalofop	0.25	5	.	.	.	100
2	F1	F1_B15	F1_B15	Quizalofop	0.5	5	.	.	.	60
2	F1	F1_B15	F1_B15	Quizalofop	1	5	.	.	.	75
2	F1	F1_B15	F1_B15	Quizalofop	2	5	.	.	.	0
2	F1	F1_B15	F1_B15	Quizalofop	4	5	.	.	.	0
2	F1	F1_B15	F1_B15	Fluazifop	0.0625	5	.	.	.	100
2	F1	F1_B15	F1_B15	Fluazifop	0.125	5	.	.	.	100
2	F1	F1_B15	F1_B15	Fluazifop	0.25	5	.	.	.	100
2	F1	F1_B15	F1_B15	Fluazifop	0.5	5	.	.	.	70
2	F1	F1_B15	F1_B15	Fluazifop	1	5	.	.	.	100
2	F1	F1_B15	F1_B15	Fluazifop	2	5	.	.	.	70
2	F1	F1_B15	F1_B15	Fluazifop	4	5	.	.	.	40
2	F1	F1_B15	F1_B15	Clethodim	0.25	5	.	.	.	30
2	F1	F1_B15	F1_B15	Clethodim	0.5	5	.	.	.	0
2	F1	F1_B15	F1_B15	Clethodim	1	5	.	.	.	0
2	F1	F1_B15	F1_B15	Control	0	5	.	.	.	100
2	F1	F1_B15	F1_B15	Control	0	5	.	.	.	100

Appendix A2. SAS Code for Dose Response Analysis

```
options nodate pageno=1;
*This is the SAS code for Kellan's does response study;
*Each herbicide is analysis separately;
*Enter the herbicide (Fluazifop, Quizalofop, Clethodim, & Sethoxydim);
%let Herbicide=Sethoxydim;
*Enter the corresponding Herb abbreviations (Fluaz, Quiz, Cleth, & Seth);
%let Herb=Seth;
*ensure that the infile path is correct;
%let Infile_1="F:\ACCdata.txt";
%let OutPath= F:\output\;
*OK, now you are ready to submit!;
*Expected output: (in SAS output (listing))
    Step1:  Run*Specific(Group) ANOVA for Res
    Step2:  Run*Group ANOVA for F1 and Res
    Step2b: Run ANOVA for 623
    Step3:  Run*Type ANOVA for Everything
    Step3b: Type ANOVA for Everything from Run1       (only given for Seth)
    Step3c: Type ANOVA for Everything from Run 2      (only given for Seth)
    Step3d: Type ANOVA for Resistant and F1, Run 1    (only given for Seth)
    Step3e: Type ANOVA for Resistant and F1, Run 2    (only given for Seth)
*Expected output: (Export)
   *Two .txt files containing lsmeans for Sigma Plot with absolute values for error bars for Given Rate (upper bars) and
Consolidated Group (lower bars)
   *These files are tailored base on previous findings of the first 3 steps;
*The following should not need any attention;
%let Library=work.ACCDoseResponse;
*Rates  0.0625, 0.125, 0.25, 0.5 , 1, 2, 4;
%let Rate0=0; %let Rate1=0.0625; %let Rate2=0.125; %let Rate3=0.25;
%let Rate4=0.5; %let Rate5=1; %let Rate6=2; %let Rate7=4;
title1 "Kellan Kershner: ACC &Herbicide Dose Response";
proc import datafile=&Infile_1 out=&Library dbms=TAB;
run;
data &Herb;
  set ACCDoseResponse;
  if herbicide= "Control" then herbicide="&Herbicide";
run;
data &Herb;
  set &Herb;
  where herbicide= "&Herbicide";
run;
%macro TypeData (Typ,Type);
%*This creates Type Level data sets;
data &Herb&Typ;
  set &Herb;
  where Type = "&Type";
  Rate&Typ = Rate;
  Score&Typ = Score;
run;
%mend TypeData;
%TypeData(F1,F1)
%TypeData(Sus,susceptible)
%TypeData(Res,Resistant)
run;
%macro DataRate (Rt, Rate);
%*This creates a data set for specified rate using the entire dataset - used for lsmeans only;
data &Herb&Rt ;
  set &Herb;
  where Rate = &Rate;
```

```
run;
%mend DataRate;
%DataRate(Rate0, &Rate0)
%DataRate(Rate1, &Rate1)
%DataRate(Rate2, &Rate2)
%DataRate(Rate3, &Rate3)
%DataRate(Rate4, &Rate4)
%DataRate(Rate5, &Rate5)
%DataRate(Rate6, &Rate6)
%DataRate(Rate7, &Rate7)
run;

%macro TypeDataRate (Typ, Rt, Rate);
%*This creates a data set for specified rate at the type level;
data &Herb&Typ&Rt ;
  set &Herb&Typ;
  where Rate = &Rate;
run;
%mend TypeDataRate;
%TypeDataRate(Res, Rate0, &Rate0)
%TypeDataRate(Res, Rate1, &Rate1)
%TypeDataRate(Res, Rate2, &Rate2)
%TypeDataRate(Res, Rate3, &Rate3)
%TypeDataRate(Res, Rate4, &Rate4)
%TypeDataRate(Res, Rate5, &Rate5)
%TypeDataRate(Res, Rate6, &Rate6)
%TypeDataRate(Res, Rate7, &Rate7)
%TypeDataRate(Sus, Rate0, &Rate0)
%TypeDataRate(Sus, Rate1, &Rate1)
%TypeDataRate(Sus, Rate2, &Rate2)
%TypeDataRate(Sus, Rate3, &Rate3)
%TypeDataRate(Sus, Rate4, &Rate4)
%TypeDataRate(Sus, Rate5, &Rate5)
%TypeDataRate(Sus, Rate6, &Rate6)
%TypeDataRate(Sus, Rate7, &Rate7)
%TypeDataRate(F1, Rate0, &Rate0)
%TypeDataRate(F1, Rate1, &Rate1)
%TypeDataRate(F1, Rate2, &Rate2)
%TypeDataRate(F1, Rate3, &Rate3)
%TypeDataRate(F1, Rate4, &Rate4)
%TypeDataRate(F1, Rate5, &Rate5)
%TypeDataRate(F1, Rate6, &Rate6)
%TypeDataRate(F1, Rate7, &Rate7)
run;
*Now that we have the data sets, we need to test them;
ods listing close; *Step 1: Run*Plant(Accession) ANOVA for Res;
%macro PlantGLMtest (Response, R, y, Typ, Rt);
title2 'Testing specific parents nested within Res genotypes';
Proc glm data= &Herb&Typ&Rt ;
  ods output RandomModelANOVA=Plant&Herb&R&Typ&Rt;
  class run Accession Plant;
  model &y = run Accession run*Accession Plant(Accession) run*Plant(Accession)/SS3;
  random run run*Accession Plant(Accession) run*Plant(Accession)/test;
run;
data Plant&Herb&R&Typ&Rt (drop=Dependent HypothesisType Control MS Error);
  set Plant&Herb&R&Typ&Rt;
  TypeRate = "Step1&Typ&Rt";
run;
%mend PlantGLMtest;
%PlantGLMtest (Visual, V, Score, Res, Rate1)
%PlantGLMtest (Visual, V, Score, Res, Rate2)
%PlantGLMtest (Visual, V, Score, Res, Rate3)
```

```
%PlantGLMtest (Visual, V, Score, Res, Rate4)
%PlantGLMtest (Visual, V, Score, Res, Rate5)
%PlantGLMtest (Visual, V, Score, Res, Rate6)
%PlantGLMtest (Visual, V, Score, Res, Rate7)
run;
%macro MergeStep1 (Response, R);
title2 'Merging Results from Step 1';
data Step1Random&Herb&R;
set Plant&Herb&R.ResRate1
        Plant&Herb&R.ResRate2    Plant&Herb&R.ResRate3
        Plant&Herb&R.ResRate4    Plant&Herb&R.ResRate5
        Plant&Herb&R.ResRate6    Plant&Herb&R.ResRate7; run;
%mend MergeStep1;
%MergeStep1 (Visual, V)
run;
ods output close; ods listing;
title2 "&Herb Visual - Step 1: Run*Specific(Group) ANOVA for Res";
Proc Print data=Step1Random&Herb.V;
run;
ods listing close; *Step 2: Run*Group ANOVA for F1 and Res;
%macro AccessionGLMtest (Response, R, y, Typ, Rt);
Proc glm data= &Herb&Typ&Rt ;
  ods output RandomModelANOVA=Accession&Herb&R&Typ&Rt;
  class run Accession;
  model &y = run Accession run*Accession/SS3;
  random run run*Accession/test;
run;
data Accession&Herb&R&Typ&Rt (drop=Dependent HypothesisType Control MS Error);
  set Accession&Herb&R&Typ&Rt;
  TypeRate = "Step2&Typ&Rt";
run;
%mend AccessionGLMtest;
%AccessionGLMtest (Visual, V, Score, F1, Rate1)
%AccessionGLMtest (Visual, V, Score, F1, Rate2)
%AccessionGLMtest (Visual, V, Score, F1, Rate3)
%AccessionGLMtest (Visual, V, Score, F1, Rate4)
%AccessionGLMtest (Visual, V, Score, F1, Rate5)
%AccessionGLMtest (Visual, V, Score, F1, Rate6)
%AccessionGLMtest (Visual, V, Score, F1, Rate7)
%AccessionGLMtest (Visual, V, Score, Res, Rate1)
%AccessionGLMtest (Visual, V, Score, Res, Rate2)
%AccessionGLMtest (Visual, V, Score, Res, Rate3)
%AccessionGLMtest (Visual, V, Score, Res, Rate4)
%AccessionGLMtest (Visual, V, Score, Res, Rate5)
%AccessionGLMtest (Visual, V, Score, Res, Rate6)
%AccessionGLMtest (Visual, V, Score, Res, Rate7)
run;
%macro MergeStep2 (Response, R);
data Step2Accession&Herb&R;
set Accession&Herb&R.ResRate1
        Accession&Herb&R.ResRate2        Accession&Herb&R.ResRate3
        Accession&Herb&R.ResRate4        Accession&Herb&R.ResRate5
        Accession&Herb&R.ResRate6        Accession&Herb&R.ResRate7
   Accession&Herb&R.F1Rate1
        Accession&Herb&R.F1Rate2         Accession&Herb&R.F1Rate3
        Accession&Herb&R.F1Rate4         Accession&Herb&R.F1Rate5
        Accession&Herb&R.F1Rate6         Accession&Herb&R.F1Rate7; run;
%mend MergeStep2;
%MergeStep2 (Visual, V)
run;
ods output close; ods listing;
title2 "&Herb Visual - Step 2: Run*Group ANOVA for F1 and Res";
```

```
Proc Print data=Step2Accession&Herb.V;
run;
ods listing close; *Step 2b: Run ANOVA for Tx623;
%macro Tx623GLMtest (Response, R, y, Typ, Rt);
Proc glm data= &Herb&Typ&Rt ;
  ods output RandomModelANOVA=Tx623&Herb&R&Typ&Rt;
  class run;
  model &y = run/SS3;
  random run/test;
run;
data Tx623&Herb&R&Typ&Rt (drop=Dependent HypothesisType Control MS Error);
  set Tx623&Herb&R&Typ&Rt;
  TypeRate = "Step2b&Typ&Rt";
run;
%mend Tx623GLMtest;
%Tx623GLMtest (Visual, V, Score, Sus, Rate1)
%Tx623GLMtest (Visual, V, Score, Sus, Rate2)
%Tx623GLMtest (Visual, V, Score, Sus, Rate3)
%Tx623GLMtest (Visual, V, Score, Sus, Rate4)
%Tx623GLMtest (Visual, V, Score, Sus, Rate5)
%Tx623GLMtest (Visual, V, Score, Sus, Rate6)
%Tx623GLMtest (Visual, V, Score, Sus, Rate7)
run;
%macro MergeStep2b (Response, R);
data Step2bTx623&Herb&R;
set  Tx623&Herb&R.SusRate1
            Tx623&Herb&R.SusRate2    Tx623&Herb&R.SusRate3
            Tx623&Herb&R.SusRate4    Tx623&Herb&R.SusRate5
            Tx623&Herb&R.SusRate6    Tx623&Herb&R.SusRate7; run;
%mend MergeStep2b;
%MergeStep2b (Visual, V)
run;
quit;
ods output close; ods listing;
title2 "&Herb Visual - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)";
Proc Print data=Step2bTx623&Herb.V;
run;
ods listing close; *Step 3: Run*Type ANOVA for Everything;
%macro TypeGLMtest (Response, R, y, Rt);
title2 "Testing Everything at &Rt";
Proc glm data= &Herb&Rt ;
  ods output RandomModelANOVA=Type&Herb&R&Rt;
  class run Type;
  model &y = run Type run*Type/SS3;
  random run run*Type/test;
run;
data Type&Herb&R&Rt (drop=Dependent HypothesisType Control MS Error);
  set Type&Herb&R&Rt;
  TypeRate = "Step3ALL&Rt";
run;
%mend TypeGLMtest;
%TypeGLMtest (Visual, V, Score, Rate1)
%TypeGLMtest (Visual, V, Score, Rate2)
%TypeGLMtest (Visual, V, Score, Rate3)
%TypeGLMtest (Visual, V, Score, Rate4)
%TypeGLMtest (Visual, V, Score, Rate5)
%TypeGLMtest (Visual, V, Score, Rate6)
%TypeGLMtest (Visual, V, Score, Rate7)
run;
%macro MergeStep3 (Response, R);
data Step3Type&Herb&R;
set Type&Herb&R.Rate1
```

```
        Type&Herb&R.Rate2       Type&Herb&R.Rate3
        Type&Herb&R.Rate4       Type&Herb&R.Rate5
        Type&Herb&R.Rate6       Type&Herb&R.Rate7; run;
%mend MergeStep3;
%MergeStep3 (Visual, V)
run;
quit;
ods output close; ods listing;
title2 "&Herb Visual - Step 3: Run*Type ANOVA for Everything";
Proc Print data=Step3Type&Herb.V;
run;
*This ends the Visual GLM F-test;
*Starting Weight GLM F-test;
ods listing close;
%PlantGLMtest (Weight, W, Percent, Res, Rate1)
%PlantGLMtest (Weight, W, Percent, Res, Rate2)
%PlantGLMtest (Weight, W, Percent, Res, Rate3)
%PlantGLMtest (Weight, W, Percent, Res, Rate4)
%PlantGLMtest (Weight, W, Percent, Res, Rate5)
%PlantGLMtest (Weight, W, Percent, Res, Rate6)
%PlantGLMtest (Weight, W, Percent, Res, Rate7)
run;
%MergeStep1 (Weight, W)
run;
%AccessionGLMtest (Weight, W, Percent, F1, Rate1)
%AccessionGLMtest (Weight, W, Percent, F1, Rate2)
%AccessionGLMtest (Weight, W, Percent, F1, Rate3)
%AccessionGLMtest (Weight, W, Percent, F1, Rate4)
%AccessionGLMtest (Weight, W, Percent, F1, Rate5)
%AccessionGLMtest (Weight, W, Percent, F1, Rate6)
%AccessionGLMtest (Weight, W, Percent, F1, Rate7)
%AccessionGLMtest (Weight, W, Percent, Res, Rate1)
%AccessionGLMtest (Weight, W, Percent, Res, Rate2)
%AccessionGLMtest (Weight, W, Percent, Res, Rate3)
%AccessionGLMtest (Weight, W, Percent, Res, Rate4)
%AccessionGLMtest (Weight, W, Percent, Res, Rate5)
%AccessionGLMtest (Weight, W, Percent, Res, Rate6)
%AccessionGLMtest (Weight, W, Percent, Res, Rate7)
run;
%MergeStep2 (Weight, W)
run;
%Tx623GLMtest (Weight, W, Percent, Sus, Rate1)
%Tx623GLMtest (Weight, W, Percent, Sus, Rate2)
%Tx623GLMtest (Weight, W, Percent, Sus, Rate3)
%Tx623GLMtest (Weight, W, Percent, Sus, Rate4)
%Tx623GLMtest (Weight, W, Percent, Sus, Rate5)
%Tx623GLMtest (Weight, W, Percent, Sus, Rate6)
%Tx623GLMtest (Weight, W, Percent, Sus, Rate7)
run;
%MergeStep2b (Weight, W)
run;
%TypeGLMtest (Weight, W, Percent, Rate1)
%TypeGLMtest (Weight, W, Percent, Rate2)
%TypeGLMtest (Weight, W, Percent, Rate3)
%TypeGLMtest (Weight, W, Percent, Rate4)
%TypeGLMtest (Weight, W, Percent, Rate5)
%TypeGLMtest (Weight, W, Percent, Rate6)
%TypeGLMtest (Weight, W, Percent, Rate7)
run;
%MergeStep3 (Weight, W)
run;
quit;
```

```
ods output close; ods listing;
title2 "&Herb Weight - Step 1: Run*Specific(Group) ANOVA for Res";
Proc Print data=Step1Random&Herb.W; run;
title2 "&Herb Weight - Step 2: Run*Group ANOVA for F1 and Res";
Proc Print data=Step2Accession&Herb.W; run;
title2 "&Herb Weight - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)";
Proc Print data=Step2bTx623&Herb.W; run;
title2 "&Herb Weight - Step 3: Run*Type ANOVA for Everything";
Proc Print data=Step3Type&Herb.W; run;
ods listing close; *egg; *ods trace on; *ods trace off;
*This ends the Weight GLM F-test;
*Starting GLM F-Test Step 3Q - Seth Only;
*Step 3b: Type ANOVA for Everything, Run 1;
*Step 3c: Type ANOVA for Everything, Run 2;
*Step 3d: Type ANOVA for Res and F1, Run 1;
*Step 3e: Type ANOVA for Res and F1, Run 1;
%macro TypeGLMtestStepQ (Response, R, y, Rt, Step);
%if &Step=Step3b %then %do;
title2 "GLM F-Test Step 3b: Testing Everything at Run 1";
  data &Herb&Rt&Step;
    set &Herb&Rt;
      if Run =2 then delete; run;
%end;
%if &Step=Step3c %then %do;
title2 "GLM F-Test Step 3c: Testing Everything at Run 2";
  data &Herb&Rt&Step;
    set &Herb&Rt;
      if Run =1 then delete; run;
%end;
%else %if &Step=Step3d %then %do;
title2 "GLM F-Test Step 3d: Testing Resistant and F1 at Run 1";
  data &Herb&Rt&Step;
    set &Herb&Rt;
      if Run =2 then delete; run;
  data &Herb&Rt&Step;
    set &Herb&Rt&Step;
      if Type ="susceptible" then delete; run;
%end;
%if &Step=Step3e %then %do;
title2 "GLM F-Test Step 3e: Testing Resistant and F1 at Run 2";
data &Herb&Rt&Step;
    set &Herb&Rt;
      if Run =1 then delete; run;
  data &Herb&Rt&Step;
    set &Herb&Rt&Step;
      if Type ="susceptible" then delete; run;
%end;
Proc glm data= &Herb&Rt&Step;
  ods output OverallANOVA=&Step&Herb&R&Rt;
  class Type;
  model &y = Type/SS3;
run;
data &Step&Herb&R&Rt (drop=Dependent MS);
  set &Step&Herb&R&Rt;
  TypeRate = "&Step&Rt";
run;
%mend TypeGLMtestStepQ;
%TypeGLMtestStepQ (Visual, V, Score, Rate1, Step3b)
%TypeGLMtestStepQ (Visual, V, Score, Rate2, Step3b)
%TypeGLMtestStepQ (Visual, V, Score, Rate3, Step3b)
%TypeGLMtestStepQ (Visual, V, Score, Rate4, Step3b)
%TypeGLMtestStepQ (Visual, V, Score, Rate5, Step3b)
```

```
%TypeGLMtestStepQ (Visual, V, Score, Rate6, Step3b)
%TypeGLMtestStepQ (Visual, V, Score, Rate7, Step3b)
run;
%macro MergeStepExtras (Response, R, Step);
data &Step.Type&Herb&R;
set &Step&Herb&R.Rate1
        &Step&Herb&R.Rate2      &Step&Herb&R.Rate3
        &Step&Herb&R.Rate4      &Step&Herb&R.Rate5
        &Step&Herb&R.Rate6      &Step&Herb&R.Rate7; run;
%mend MergeStepExtras;
%MergeStepExtras (Visual, V, Step3b)
%TypeGLMtestStepQ (Visual, V, Score, Rate1, Step3c)
%TypeGLMtestStepQ (Visual, V, Score, Rate2, Step3c)
%TypeGLMtestStepQ (Visual, V, Score, Rate3, Step3c)
%TypeGLMtestStepQ (Visual, V, Score, Rate4, Step3c)
%TypeGLMtestStepQ (Visual, V, Score, Rate5, Step3c)
%TypeGLMtestStepQ (Visual, V, Score, Rate6, Step3c)
%TypeGLMtestStepQ (Visual, V, Score, Rate7, Step3c)
%MergeStepExtras (Visual, V, Step3c)
%TypeGLMtestStepQ (Visual, V, Score, Rate1, Step3d)
%TypeGLMtestStepQ (Visual, V, Score, Rate2, Step3d)
%TypeGLMtestStepQ (Visual, V, Score, Rate3, Step3d)
%TypeGLMtestStepQ (Visual, V, Score, Rate4, Step3d)
%TypeGLMtestStepQ (Visual, V, Score, Rate5, Step3d)
%TypeGLMtestStepQ (Visual, V, Score, Rate6, Step3d)
%TypeGLMtestStepQ (Visual, V, Score, Rate7, Step3d)
%MergeStepExtras (Visual, V, Step3d)
%TypeGLMtestStepQ (Visual, V, Score, Rate1, Step3e)
%TypeGLMtestStepQ (Visual, V, Score, Rate2, Step3e)
%TypeGLMtestStepQ (Visual, V, Score, Rate3, Step3e)
%TypeGLMtestStepQ (Visual, V, Score, Rate4, Step3e)
%TypeGLMtestStepQ (Visual, V, Score, Rate5, Step3e)
%TypeGLMtestStepQ (Visual, V, Score, Rate6, Step3e)
%TypeGLMtestStepQ (Visual, V, Score, Rate7, Step3e)
%MergeStepExtras (Visual, V, Step3e)
run;
quit;
*This ends Step 3XandQ for Visual and starts Weight;
%TypeGLMtestStepQ (Weight, W, Percent, Rate1, Step3b)
%TypeGLMtestStepQ (Weight, W, Percent, Rate2, Step3b)
%TypeGLMtestStepQ (Weight, W, Percent, Rate3, Step3b)
%TypeGLMtestStepQ (Weight, W, Percent, Rate4, Step3b)
%TypeGLMtestStepQ (Weight, W, Percent, Rate5, Step3b)
%TypeGLMtestStepQ (Weight, W, Percent, Rate6, Step3b)
%TypeGLMtestStepQ (Weight, W, Percent, Rate7, Step3b)
%MergeStepExtras (Weight, W, Step3b)
%TypeGLMtestStepQ (Weight, W, Percent, Rate1, Step3c)
%TypeGLMtestStepQ (Weight, W, Percent, Rate2, Step3c)
%TypeGLMtestStepQ (Weight, W, Percent, Rate3, Step3c)
%TypeGLMtestStepQ (Weight, W, Percent, Rate4, Step3c)
%TypeGLMtestStepQ (Weight, W, Percent, Rate5, Step3c)
%TypeGLMtestStepQ (Weight, W, Percent, Rate6, Step3c)
%TypeGLMtestStepQ (Weight, W, Percent, Rate7, Step3c)
%MergeStepExtras (Weight, W, Step3c)
%TypeGLMtestStepQ (Weight, W, Percent, Rate1, Step3d)
%TypeGLMtestStepQ (Weight, W, Percent, Rate2, Step3d)
%TypeGLMtestStepQ (Weight, W, Percent, Rate3, Step3d)
%TypeGLMtestStepQ (Weight, W, Percent, Rate4, Step3d)
%TypeGLMtestStepQ (Weight, W, Percent, Rate5, Step3d)
%TypeGLMtestStepQ (Weight, W, Percent, Rate6, Step3d)
%TypeGLMtestStepQ (Weight, W, Percent, Rate7, Step3d)
%MergeStepExtras (Weight, W, Step3d)
```

```
%TypeGLMtestStepQ (Weight, W, Percent, Rate1, Step3e)
%TypeGLMtestStepQ (Weight, W, Percent, Rate2, Step3e)
%TypeGLMtestStepQ (Weight, W, Percent, Rate3, Step3e)
%TypeGLMtestStepQ (Weight, W, Percent, Rate4, Step3e)
%TypeGLMtestStepQ (Weight, W, Percent, Rate5, Step3e)
%TypeGLMtestStepQ (Weight, W, Percent, Rate6, Step3e)
%TypeGLMtestStepQ (Weight, W, Percent, Rate7, Step3e)
%MergeStepExtras (Weight, W, Step3e)
run;
quit;
*This ends GLM F-Test Step 3XandQ - Seth Only;
*Starting Visual LSMeans with correct SE for export to Sigma Plot;
%macro TypeLSMeans (Response, R, y, Rt, Rate);
%*Mixed LSMeans for Everything at Rate;
title2 "Mixed LSMeans for Everything at &Rt";
Proc mixed data= &Herb&Rt ;
  ods output LSMeans=LSMeans&Herb&R&Rt;
  class run Type;
  model &y = Type / ddfm=satterth;
  random run run*Type;
  lsmeans Type / cl;
run;
data LSMeans&Herb&R&Rt;
  set LSMeans&Herb&R&Rt;
  Rate = input ("&Rate",best6.);
run;
%mend TypeLSMeans;
%TypeLSMeans (Visual, V, Score, Rate0, &Rate0)
%TypeLSMeans (Visual, V, Score, Rate1, &Rate1)
%TypeLSMeans (Visual, V, Score, Rate2, &Rate2)
%TypeLSMeans (Visual, V, Score, Rate3, &Rate3)
%TypeLSMeans (Visual, V, Score, Rate4, &Rate4)
%TypeLSMeans (Visual, V, Score, Rate5, &Rate5)
%TypeLSMeans (Visual, V, Score, Rate6, &Rate6)
%TypeLSMeans (Visual, V, Score, Rate7, &Rate7)
run;
%macro MergeLSMeans (Response, R);
data LSMeans&Herb&R.standard;
set LSMeans&Herb&R.Rate0   LSMeans&Herb&R.Rate1
            LSMeans&Herb&R.Rate2     LSMeans&Herb&R.Rate3
            LSMeans&Herb&R.Rate4     LSMeans&Herb&R.Rate5
            LSMeans&Herb&R.Rate6     LSMeans&Herb&R.Rate7; run;
%mend MergeLSMeans;
%MergeLSMeans (Visual, V)
run;

%macro TypeLSMeansOut (Response, R, y, Typ,Type, Incoming);
%*This creates LSMeans sets at each type level (Splits Everything at Rate into Type at Rate);
data LSMeans&Herb&R&Typ (drop=Effect Rate Type Estimate StdErr DF tValue Probt Alpha Lower Upper);
  set LSMeans&Herb&R&Incoming;
  where Type = "&Type";
  Rate&Herb&R&Typ = Rate;
  LS&Herb&R&Typ = Estimate;
  SE&Herb&R&Typ = StdErr;
run;
%mend TypeLSMeansOut;
%TypeLSMeansOut(Visual, V, Score, F1,F1,standard)
%TypeLSMeansOut(Visual, V, Score, Sus,susceptible,standard)
%TypeLSMeansOut(Visual, V, Score, Res,Resistant,standard)
run;

%macro RateLSMeans (Response, R, y, Typ);
```

```
%*Mixed (LS)Means for Rates at Type;
title2 "Mixed LSMeans for Rates at &Typ";
Proc mixed data= &Herb&Typ ;
  ods output LSMeans=XMeans&Herb&R&Typ;
  class run Rate;
  model &y = Rate / ddfm=satterth;
  random run run*Rate;
  lsmeans Rate / cl;
run;
data XMeans&Herb&R&Typ (drop= Effect DF tValue Probt Alpha Lower Upper);
  set XMeans&Herb&R&Typ;
  rename Estimate = Mean&Herb&R&Typ;
  rename StdErr = SEm&Herb&R&Typ;
run;
proc sort data=XMeans&Herb&R&Typ;
  by Rate;
run;
data Xmeans&Herb&R&Typ (drop= Rate);
  set Xmeans&Herb&R&Typ;
  Rate&Herb&R&Typ = Rate;
run;
%mend RateLSMeans;
%RateLSMeans(Visual, V, Score, F1)
%RateLSMeans(Visual, V, Score, Sus)
%RateLSMeans(Visual, V, Score, Res)
run;

%macro Match (Response, R, y, Typ);
*%This merges the Type at Rate with the correct Rate at Type results;
data Match&Herb&R&Typ;
  merge LSMeans&Herb&R&Typ XMeans&Herb&R&Typ;
  by Rate&Herb&R&Typ;
run;

*%This creates absolute values for the SE and calculates the difference between lsmeans;
data Match&Herb&R&Typ (drop= Mean&Herb&R&Typ SE&Herb&R&Typ SEm&Herb&R&Typ);
  set Match&Herb&R&Typ;
  Dif&Herb&R&Typ = LS&Herb&R&Typ - Mean&Herb&R&Typ;
  AbR&Herb&R&Typ = LS&Herb&R&Typ + SE&Herb&R&Typ;
  AbT&Herb&R&Typ = LS&Herb&R&Typ - SEm&Herb&R&Typ;
*%AbR = Absolute Value for the SE at given Rate :: for upper error bars;
*%AbT = Absolute Value for the SE at given Type :: for lower error bars;
run;
%mend Match;
%Match(Visual, V, Score, F1)
%Match(Visual, V, Score, Sus)
%Match(Visual, V, Score, Res)
run;
%macro ExportMerge (Response, R);
data SigmaDif&Herb&R;
  merge Match&Herb&R.F1
        Match&Herb&R.Res
        Match&Herb&R.Sus; run;
%mend ExportMerge;
%ExportMerge (Visual, V)
run;
*Proc Export data=SigmaDif&Herb.V was here, now moved to bottom;
*This ends Visual LSMeans;
*Starting Weight LSMeans with correct SE for export to Sigma Plot;
%TypeLSMeans (Weight, W, Percent, Rate0, &Rate0)
%TypeLSMeans (Weight, W, Percent, Rate1, &Rate1)
%TypeLSMeans (Weight, W, Percent, Rate2, &Rate2)
```

```
%TypeLSMeans (Weight, W, Percent, Rate3, &Rate3)
%TypeLSMeans (Weight, W, Percent, Rate4, &Rate4)
%TypeLSMeans (Weight, W, Percent, Rate5, &Rate5)
%TypeLSMeans (Weight, W, Percent, Rate6, &Rate6)
%TypeLSMeans (Weight, W, Percent, Rate7, &Rate7)
run;
%MergeLSMeans (Weight, W)
run;
%TypeLSMeansOut(Weight, W, Percent, F1,F1,standard)
%TypeLSMeansOut(Weight, W, Percent, Sus,susceptible,standard)
%TypeLSMeansOut(Weight, W, Percent, Res,Resistant,standard)
run;
%RateLSMeans(Weight, W, Percent, F1)
%RateLSMeans(Weight, W, Percent, Sus)
%RateLSMeans(Weight, W, Percent, Res)
run;
%Match(Weight, W, Percent, F1)
%Match(Weight, W, Percent, Sus)
%Match(Weight, W, Percent, Res)
run;
%ExportMerge (Weight, W)
run;
*proc export data=SigmaDif&Herb.W was here, moved to bottom;
*This ends Weight LSMeans;
*Starting Visual LSMeans with Split Runs for F1 - For Fluaz Visual;
%macro RunTypeData (Typ,Rn,Run);
%*This Splits F1 into Run1 and Run2;
data &Herb&Typ&Rn;
  set &Herb&Typ;
  where Run = &Run;
  Type = "&Typ&Rn";
  Rate&Typ = Rate;
run;
%mend RunTypeData;
%RunTypeData(F1,R1,1)
%RunTypeData(F1,R2,2)
run;
data &Herb.Run1;
set &Herb.F1R1 &Herb.F1R2 &Herb.Res &Herb.Sus;
run;
%macro RunDataRate (Rt, Rate, Run);
%*This creates a RunData set for specified rate using the entire Run&Herb dataset;
%*note the Run set significes that F1 is split into seperate runs;
data &Herb&Rt&Run ;
  set &Herb&Run;
  where Rate = &Rate;
run;
%mend RunDataRate;
%RunDataRate(Rate0, &Rate0, Run1)
%RunDataRate(Rate1, &Rate1, Run1)
%RunDataRate(Rate2, &Rate2, Run1)
%RunDataRate(Rate3, &Rate3, Run1)
%RunDataRate(Rate4, &Rate4, Run1)
%RunDataRate(Rate5, &Rate5, Run1)
%RunDataRate(Rate6, &Rate6, Run1)
%RunDataRate(Rate7, &Rate7, Run1)
run;
data &Herb.ResR;
set &Herb.Res;
run;
data &Herb.SusR;
set &Herb.Sus;
```

```
run;
data &Herb.All;
set &Herb;
run;
*This is all the special datasets for spliting runs;
%TypeLSMeans (Visual, V, Score, Rate0Run1, &Rate0)
%TypeLSMeans (Visual, V, Score, Rate1Run1, &Rate1)
%TypeLSMeans (Visual, V, Score, Rate2Run1, &Rate2)
%TypeLSMeans (Visual, V, Score, Rate3Run1, &Rate3)
%TypeLSMeans (Visual, V, Score, Rate4Run1, &Rate4)
%TypeLSMeans (Visual, V, Score, Rate5Run1, &Rate5)
%TypeLSMeans (Visual, V, Score, Rate6Run1, &Rate6)
%TypeLSMeans (Visual, V, Score, Rate7Run1, &Rate7)
run;
%macro MergeLSMeansRuns (Response, R, Run);
data LSMeans&Herb&R&Run;
set LSMeans&Herb&R.Rate0&Run      LSMeans&Herb&R.Rate1&Run
            LSMeans&Herb&R.Rate2&Run          LSMeans&Herb&R.Rate3&Run
            LSMeans&Herb&R.Rate4&Run          LSMeans&Herb&R.Rate5&Run
            LSMeans&Herb&R.Rate6&Run          LSMeans&Herb&R.Rate7&Run ;
run;
%mend MergeLSMeansRuns;
%MergeLSMeansRuns (Visual, V, Run1)
run;
%TypeLSMeansOut(Visual, V, Score, F1R1, F1R1,run1)
%TypeLSMeansOut(Visual, V, Score, F1R2, F1R2,run1)
%TypeLSMeansOut(Visual, V, Score, SusR, susceptible,run1)
%TypeLSMeansOut(Visual, V, Score, ResR, Resistant,run1)
run;
%macro RateLSMeansWOruns (Response, R, y, Typ);
%*Mixed (LS)Means for Rates at Type;
title2 "Mixed LSMeans for Rates at &Typ";
Proc mixed data= &Herb&Typ ;
  ods output LSMeans=XMeans&Herb&R&Typ;
  class Rate;
  model &y = Rate / ddfm=satterth;
  lsmeans Rate / cl;
run;
data XMeans&Herb&R&Typ (drop= Effect DF tValue Probt Alpha Lower Upper);
  set XMeans&Herb&R&Typ;
  rename Estimate = Mean&Herb&R&Typ;
  rename StdErr = SEm&Herb&R&Typ;
run;
proc sort data=XMeans&Herb&R&Typ;
  by Rate;
run;
data Xmeans&Herb&R&Typ (drop= Rate);
  set Xmeans&Herb&R&Typ;
  Rate&Herb&R&Typ = Rate;
run;
%mend RateLSMeansWOruns;
%RateLSMeansWOruns(Visual, V, Score, F1R1)
%RateLSMeansWOruns(Visual, V, Score, F1R2)
%RateLSMeans(Visual, V, Score, SusR)
%RateLSMeans(Visual, V, Score, ResR)
run;
%Match(Visual, V, Score, F1R1)
%Match(Visual, V, Score, F1R2)
%Match(Visual, V, Score, SusR)
%Match(Visual, V, Score, ResR)
run;
data Sigma&Herb.VRun1;
```

```
  merge Match&Herb.VF1R1
        Match&Herb.VResR
        Match&Herb.VSusR
                        Match&Herb.VF1R2;
run;
*proc export data=Sigma&Herb.VRun was here, moved to bottom;
*End Spliting Runs  - For Fluaz Visual;
*Start All LSMeans;
%RateLSMeans(Visual, V, Score, All)
%RateLSMeans(Weight, W, Percent, All)
%macro ExportReady (Response, R, y, Typ);
data Sigma&Herb&R&Typ (drop= Mean&Herb&R&Typ SEm&Herb&R&Typ Rate&Herb&R&Typ);
 set Xmeans&Herb&R&Typ;
              &Herb&R.Rate = Rate&Herb&R&Typ;
              &Herb&R.LS = Mean&Herb&R&Typ;
              &Herb&R.SE =SEm&Herb&R&Typ;
run;
%mend ExportReady;
%ExportReady(Visual, V, Score, All)
%ExportReady(Weight, W, Percent, All)
quit;
*proc export data=Sigma&Herb.VAll was here, moved to bottom;
*End All LSMeans;
*Starting Visual LSMeans with Split Runs for F1 - For Seth Visual;
%RunTypeData(Res,R1,1)
%RunTypeData(Res,R2,2)
%RunTypeData(Sus,R1,1)
%RunTypeData(Sus,R2,2)
run;
data &Herb.Run2;
set &Herb.SusR1 &Herb.SusR2 &Herb.ResR1 &Herb.ResR2 &Herb.F1R1 &Herb.F1R2;
run;
%RunDataRate(Rate0, &Rate0, Run2)
%RunDataRate(Rate1, &Rate1, Run2)
%RunDataRate(Rate2, &Rate2, Run2)
%RunDataRate(Rate3, &Rate3, Run2)
%RunDataRate(Rate4, &Rate4, Run2)
%RunDataRate(Rate5, &Rate5, Run2)
%RunDataRate(Rate6, &Rate6, Run2)
%RunDataRate(Rate7, &Rate7, Run2)
run;
*This is all the special datasets for spliting runs for Run2 analysis;
%TypeLSMeans (Visual, V, Score, Rate0Run2, &Rate0)
%TypeLSMeans (Visual, V, Score, Rate1Run2, &Rate1)
%TypeLSMeans (Visual, V, Score, Rate2Run2, &Rate2)
%TypeLSMeans (Visual, V, Score, Rate3Run2, &Rate3)
%TypeLSMeans (Visual, V, Score, Rate4Run2, &Rate4)
%TypeLSMeans (Visual, V, Score, Rate5Run2, &Rate5)
%TypeLSMeans (Visual, V, Score, Rate6Run2, &Rate6)
%TypeLSMeans (Visual, V, Score, Rate7Run2, &Rate7)
run;
%MergeLSMeansRuns (Visual, V, Run2)
run;
%TypeLSMeansOut(Visual, V, Score, SusR1, SusR1,run2)
%TypeLSMeansOut(Visual, V, Score, SusR2, SusR2,run2)
%TypeLSMeansOut(Visual, V, Score, ResR1, ResR1,run2)
%TypeLSMeansOut(Visual, V, Score, ResR2, ResR2,run2)
%TypeLSMeansOut(Visual, V, Score, F1R1, F1R1,run2)
%TypeLSMeansOut(Visual, V, Score, F1R2, F1R2,run2)
run;
%RateLSMeansWOruns(Visual, V, Score, SusR1)
%RateLSMeansWOruns(Visual, V, Score, SusR2)
```

```
%RateLSMeansWOruns(Visual, V, Score, ResR1)
%RateLSMeansWOruns(Visual, V, Score, ResR2)
run;
%Match(Visual, V, Score, F1R1)
%Match(Visual, V, Score, F1R2)
%Match(Visual, V, Score, SusR1)
%Match(Visual, V, Score, SusR2)
%Match(Visual, V, Score, ResR1)
%Match(Visual, V, Score, ResR2)
run;
data Sigma&Herb.VRun2;
  merge Match&Herb.VSusR1
      Match&Herb.VSusR2
      Match&Herb.VResR1
      Match&Herb.VResR2
      Match&Herb.VF1R1
                  Match&Herb.VF1R2;
run;
*proc export data=Sigma&Herb.VRun was here, moved to bottom;
*End Visual Starting Weight;
%TypeLSMeans (Weight, W, Percent, Rate0Run2, &Rate0)
%TypeLSMeans (Weight, W, Percent, Rate1Run2, &Rate1)
%TypeLSMeans (Weight, W, Percent, Rate2Run2, &Rate2)
%TypeLSMeans (Weight, W, Percent, Rate3Run2, &Rate3)
%TypeLSMeans (Weight, W, Percent, Rate4Run2, &Rate4)
%TypeLSMeans (Weight, W, Percent, Rate5Run2, &Rate5)
%TypeLSMeans (Weight, W, Percent, Rate6Run2, &Rate6)
%TypeLSMeans (Weight, W, Percent, Rate7Run2, &Rate7)
run;
%MergeLSMeansRuns (Weight, W, Run2)
run;
%TypeLSMeansOut(Weight, W, Percent, SusR1, SusR1,run2)
%TypeLSMeansOut(Weight, W, Percent, SusR2, SusR2,run2)
%TypeLSMeansOut(Weight, W, Percent, ResR1, ResR1,run2)
%TypeLSMeansOut(Weight, W, Percent, ResR2, ResR2,run2)
%TypeLSMeansOut(Weight, W, Percent, F1R1, F1R1,run2)
%TypeLSMeansOut(Weight, W, Percent, F1R2, F1R2,run2)
%RateLSMeansWOruns(Weight, W, Percent, SusR1)
%RateLSMeansWOruns(Weight, W, Percent, SusR2)
%RateLSMeansWOruns(Weight, W, Percent, ResR1)
%RateLSMeansWOruns(Weight, W, Percent, ResR2)
%RateLSMeansWOruns(Weight, W, Percent, F1R1)
%RateLSMeansWOruns(Weight, W, Percent, F1R2)
run;
%Match(Weight, W, Percent, F1R1)
%Match(Weight, W, Percent, F1R2)
%Match(Weight, W, Percent, SusR1)
%Match(Weight, W, Percent, SusR2)
%Match(Weight, W, Percent, ResR1)
%Match(Weight, W, Percent, ResR2)
run;
data Sigma&Herb.WRun2;
  merge Match&Herb.WSusR1
      Match&Herb.WSusR2
      Match&Herb.WResR1
      Match&Herb.WResR2
      Match&Herb.WF1R1
                  Match&Herb.WF1R2;
run;
*End Spliting Runs;
*End LSMeans;
*Start Final Resusts Output;
```

```
ods output close; ods listing;
%macro Results (Almost);
  %if %upcase(&Herbicide)=QUIZALOFOP %then %do;
proc export data=SigmaDif&Herb.V
  outfile="&Outpath&Herb.VisualSigma_Types.txt"
  dbms=dlm;      delimiter=','; run;
proc export data=SigmaDif&Herb.W
  outfile="&Outpath&Herb.WeightSigma_Types.txt"
  dbms=dlm;      delimiter=','; run;
%end;
  %else %if %upcase(&Herbicide)=FLUAZIFOP %then %do;
proc export data=Sigma&Herb.VRun1
  outfile="&Outpath&Herb.VisualSigma_SplitRuns4F1.txt"
  dbms=dlm;      delimiter=','; run;
proc export data=SigmaDif&Herb.W
  outfile="&Outpath&Herb.WeightSigma_Types.txt"
  dbms=dlm;      delimiter=','; run;
%end;
  %else %if %upcase(&Herbicide)=CLETHODIM %then %do;
proc export data=Sigma&Herb.VAll
  outfile="&Outpath.&Herb.VisualSigma_EverythingAsOne.txt"
  dbms=dlm;      delimiter=','; run;
proc export data=Sigma&Herb.WAll
  outfile="&Outpath.&Herb.WeightSigma_EverythingAsOne.txt"
  dbms=dlm;      delimiter=','; run;
%end;
  %else %if %upcase(&Herbicide)=SETHOXYDIM %then %do;
title2 "&Herb Visual - Step 3b: Run*Type ANOVA for Everything Except SusR2";
  Proc Print data=Step3bType&Herb.V; run;
title2 "&Herb Visual - Step 3c: Type ANOVA for Everything at Run 1";
  Proc Print data=Step3cType&Herb.V; run;
title2 "&Herb Visual - Step 3d: Type ANOVA for Resistant and F1 at Run 1";
  Proc Print data=Step3dType&Herb.V; run;
title2 "&Herb Visual - Step 3e: Type ANOVA for Resistant and F1 at Run 2";
  Proc Print data=Step3eType&Herb.V; run;
proc export data=Sigma&Herb.VRun2
  outfile="&Outpath&Herb.VisualSigma_SplitRunsAll.txt"
  dbms=dlm;      delimiter=','; run;
title2 "&Herb Weight - Step 3b: Run*Type ANOVA for Everything Except SusR2";
  Proc Print data=Step3bType&Herb.W; run;
title2 "&Herb Weight - Step 3c: Type ANOVA for Everything at Run 1";
  Proc Print data=Step3cType&Herb.W; run;
title2 "&Herb Weight - Step 3d: Type ANOVA for Resistant and F1 at Run 1";
  Proc Print data=Step3dType&Herb.W; run;
title2 "&Herb Weight - Step 3e: Type ANOVA for Resistant and F1 at Run 2";
  Proc Print data=Step3eType&Herb.W; run;
proc export data=Sigma&Herb.WRun2
  outfile="&Outpath&Herb.WeightSigma_SplitRunsAll.txt"
  dbms=dlm;      delimiter=','; run;
%end;
  %else %put Error: Incorrect herbicide entered. Please try again.;
%mend Results;
%Results (DONE)
run;
quit;
```

Appendix A3. SAS Output from Dose Response Analysis

Fluaz Visual - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	476.246585	35.56	0.0244	Step1ResRate1
2	Error	2.0853	27.930446	_	_	Step1ResRate1
3	Accession	2	17.186850	0.26	0.7976	Step1ResRate1
4	Error	1.9005	63.974009	_	_	Step1ResRate1
5	Run*Accession	2	26.395508	0.44	0.6589	Step1ResRate1
6	Error	7.847	235.250381	_	_	Step1ResRate1
7	Plant(Accession)	7	360.174715	1.93	0.2683	Step1ResRate1
8	Error	4.1392	110.091727	_	_	Step1ResRate1
9	Run*Plant(Accession)	6	171.387359	0.63	0.7045	Step1ResRate1
10	Error: MS(Error)	26	1177.916667	_	_	Step1ResRate1
11	Run	1	437.575758	5.88	0.1356	Step1ResRate2
12	Error	2.0093	149.586759	_	_	Step1ResRate2
13	Accession	2	60.297509	0.28	0.7756	Step1ResRate2
14	Error	2.8183	305.186505	_	_	Step1ResRate2
15	Run*Accession	2	151.190176	2.66	0.1446	Step1ResRate2
16	Error	6.3699	180.992189	_	_	Step1ResRate2
17	Plant(Accession)	7	415.166766	1.86	0.2409	Step1ResRate2
18	Error	5.6828	181.570735	_	_	Step1ResRate2
19	Run*Plant(Accession)	6	180.865054	3.06	0.0198	Step1ResRate2
20	Error: MS(Error)	28	275.833333	_	_	Step1ResRate2
21	Run	1	540.928030	4.10	0.1798	Step1ResRate3
22	Error	2.0042	264.287863	_	_	Step1ResRate3
23	Accession	2	156.520889	0.46	0.6758	Step1ResRate3
24	Error	2.3969	404.763352	_	_	Step1ResRate3
25	Run*Accession	2	268.129679	3.78	0.0840	Step1ResRate3
26	Error	6.236	221.081026	_	_	Step1ResRate3
27	Plant(Accession)	7	445.427157	1.56	0.3049	Step1ResRate3
28	Error	5.796	235.838884	_	_	Step1ResRate3
29	Run*Plant(Accession)	6	228.088507	4.77	0.0018	Step1ResRate3
30	Error: MS(Error)	28	222.916667	_	_	Step1ResRate3
31	Run	1	35.018939	0.44	0.5749	Step1ResRate4
32	Error	2.0469	163.782719	_	_	Step1ResRate4
33	Accession	2	272.251442	2.25	0.5012	Step1ResRate4
34	Error	0.6805	41.158730	_	_	Step1ResRate4
35	Run*Accession	2	160.988624	1.13	0.3771	Step1ResRate4
36	Error	6.8315	487.172990	_	_	Step1ResRate4
37	Plant(Accession)	7	360.129215	0.69	0.6852	Step1ResRate4
38	Error	5.306	396.970702	_	_	Step1ResRate4
39	Run*Plant(Accession)	6	438.156277	1.38	0.2572	Step1ResRate4
40	Error: MS(Error)	28	1482.083333	_	_	Step1ResRate4
41	Run	1	11.625744	0.07	0.8121	Step1ResRate5
42	Error	2.0169	320.946399	_	_	Step1ResRate5
43	Accession	2	229.634756	0.86	0.6053	Step1ResRate5
44	Error	1.0069	134.239864	_	_	Step1ResRate5
45	Run*Accession	2	320.928695	1.93	0.2190	Step1ResRate5
46	Error	6.6376	553.036162	_	_	Step1ResRate5
47	Plant(Accession)	7	347.063593	0.56	0.7679	Step1ResRate5
48	Error	5.3558	476.287109	_	_	Step1ResRate5
49	Run*Plant(Accession)	6	514.862727	1.60	0.1845	Step1ResRate5

Fluaz Visual - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error: MS(Error)	27	1444.583333	_	_	Step1ResRate5
51	Run	1	160.303030	2.24	0.2698	Step1ResRate6
52	Error	2.0552	146.917509	_	_	Step1ResRate6
53	Accession	2	138.705391	1.69	0.6752	Step1ResRate6
54	Error	0.3212	13.161902	_	_	Step1ResRate6
55	Run*Accession	2	143.538145	0.82	0.4790	Step1ResRate6
56	Error	6.7035	584.421555	_	_	Step1ResRate6
57	Plant(Accession)	7	423.089102	0.65	0.7095	Step1ResRate6
58	Error	5.4085	504.196549	_	_	Step1ResRate6
59	Run*Plant(Accession)	6	540.823567	1.62	0.1773	Step1ResRate6
60	Error: MS(Error)	28	1553.333333	_	_	Step1ResRate6
61	Run	1	0.614754	0.02	0.8943	Step1ResRate7
62	Error	2.6102	75.057578	_	_	Step1ResRate7
63	Accession	2	1277.488216	10.56	0.1579	Step1ResRate7
64	Error	1.2948	78.308529	_	_	Step1ResRate7
65	Run*Accession	2	52.221525	0.36	0.7078	Step1ResRate7
66	Error	8.2026	593.973533	_	_	Step1ResRate7
67	Plant(Accession)	7	779.038177	1.68	0.3072	Step1ResRate7
68	Error	4.5037	298.658818	_	_	Step1ResRate7
69	Run*Plant(Accession)	6	415.634848	0.71	0.6473	Step1ResRate7
70	Error: MS(Error)	26	2550.000000	_	_	Step1ResRate7

Fluaz Visual - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	490.930466	35.78	0.0179	Step2ResRate1
2	Error	2.3609	32.391516	_	_	Step2ResRate1
3	Accession	2	44.227861	1.71	0.3692	Step2ResRate1
4	Error	2	25.880821	_	_	Step2ResRate1
5	Run*Accession	2	25.880821	0.29	0.7516	Step2ResRate1
6	Error: MS(Error)	39	1754.599567	_	_	Step2ResRate1
7	Run	1	284.161791	33.96	0.0199	Step2ResRate2
8	Error	2.3157	19.374167	_	_	Step2ResRate2
9	Accession	2	16.029009	1.00	0.5000	Step2ResRate2
10	Error	2	16.029009	_	_	Step2ResRate2
11	Run*Accession	2	16.029009	0.41	0.6692	Step2ResRate2
12	Error: MS(Error)	41	810.101010	_	_	Step2ResRate2
13	Run	1	370.842914	11.17	0.0752	Step2ResRate3
14	Error	2.0746	68.865510	_	_	Step2ResRate3
15	Accession	2	67.198077	1.00	0.5000	Step2ResRate3
16	Error	2	67.198077	_	_	Step2ResRate3
17	Run*Accession	2	67.198077	1.67	0.2006	Step2ResRate3
18	Error: MS(Error)	41	824.242424	_	_	Step2ResRate3
19	Run	1	156.331981	2.97	0.2193	Step2ResRate4
20	Error	2.1329	112.410296	_	_	Step2ResRate4
21	Accession	2	255.853652	2.43	0.2914	Step2ResRate4
22	Error	2	105.220065	_	_	Step2ResRate4
23	Run*Accession	2	105.220065	0.94	0.3972	Step2ResRate4
24	Error: MS(Error)	41	2283.964646	_	_	Step2ResRate4
25	Run	1	119.474760	1.90	0.2968	Step2ResRate5
26	Error	2.1003	132.244705	_	_	Step2ResRate5
27	Accession	2	345.476188	2.74	0.2676	Step2ResRate5
28	Error	2	126.209477	_	_	Step2ResRate5
29	Run*Accession	2	126.209477	1.09	0.3454	Step2ResRate5
30	Error: MS(Error)	40	2311.701840	_	_	Step2ResRate5
31	Run	1	382.651944	11.84	0.0637	Step2ResRate6
32	Error	2.2426	72.472462	_	_	Step2ResRate6
33	Accession	2	236.823205	3.76	0.2099	Step2ResRate6
34	Error	2	62.919239	_	_	Step2ResRate6
35	Run*Accession	2	62.919239	0.52	0.5962	Step2ResRate6
36	Error: MS(Error)	41	2462.487374	_	_	Step2ResRate6
37	Run	1	47.863885	2.73	0.1651	Step2ResRate7
38	Error	4.5716	80.292970	_	_	Step2ResRate7
39	Accession	2	1379.276770	56.07	0.0175	Step2ResRate7
40	Error	2	24.598770	_	_	Step2ResRate7
41	Run*Accession	2	24.598770	0.13	0.8814	Step2ResRate7
42	Error: MS(Error)	39	3788.775253	_	_	Step2ResRate7
43	Run	1	288.028795	19.53	0.0390	Step2F1Rate1
44	Error	2.227	32.845297	_	_	Step2F1Rate1
45	Accession	2	43.322173	1.49	0.4017	Step2F1Rate1
46	Error	2	29.092262	_	_	Step2F1Rate1
47	Run*Accession	2	29.092262	0.74	0.4855	Step2F1Rate1
48	Error: MS(Error)	34	670.089286	_	_	Step2F1Rate1
49	Run	1	385.016447	105.50	<.0001	Step2F1Rate2

Fluaz Visual - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error	28.838	105.240598	_	_	Step2F1Rate2
51	Accession	2	54.592391	41.00	0.0238	Step2F1Rate2
52	Error	2	1.331522	_	_	Step2F1Rate2
53	Run*Accession	2	1.331522	0.01	0.9903	Step2F1Rate2
54	Error: MS(Error)	35	2379.375000	_	_	Step2F1Rate2
55	Run	1	74.649446	2.14	0.2484	Step2F1Rate3
56	Error	2.7323	95.445520	_	_	Step2F1Rate3
57	Accession	2	219.304315	3.53	0.2208	Step2F1Rate3
58	Error	2	62.161458	_	_	Step2F1Rate3
59	Run*Accession	2	62.161458	0.24	0.7876	Step2F1Rate3
60	Error: MS(Error)	34	4395.000000	_	_	Step2F1Rate3
61	Run	1	59.210526	0.37	0.6029	Step2F1Rate4
62	Error	2.1085	339.026996	_	_	Step2F1Rate4
63	Accession	2	183.152174	0.56	0.6415	Step2F1Rate4
64	Error	2	327.717391	_	_	Step2F1Rate4
65	Run*Accession	2	327.717391	1.73	0.1919	Step2F1Rate4
66	Error: MS(Error)	35	3312.500000	_	_	Step2F1Rate4
67	Run	1	2657.960526	18.33	0.0451	Step2F1Rate5
68	Error	2.1302	308.851912	_	_	Step2F1Rate5
69	Accession	2	30.951087	0.11	0.9047	Step2F1Rate5
70	Error	2	293.994565	_	_	Step2F1Rate5
71	Run*Accession	2	293.994565	1.45	0.2492	Step2F1Rate5
72	Error: MS(Error)	35	3557.500000	_	_	Step2F1Rate5
73	Run	1	5615.938136	33.56	0.0236	Step2F1Rate6
74	Error	2.1684	362.914121	_	_	Step2F1Rate6
75	Accession	2	179.791631	0.53	0.6516	Step2F1Rate6
76	Error	2	336.213728	_	_	Step2F1Rate6
77	Run*Accession	2	336.213728	1.11	0.3402	Step2F1Rate6
78	Error: MS(Error)	35	5290.972222	_	_	Step2F1Rate6
79	Run	1	256.990132	27.05	0.0002	Step2F1Rate7
80	Error	12.949	123.011165	_	_	Step2F1Rate7
81	Accession	2	295.788043	41.08	0.0238	Step2F1Rate7
82	Error	2	7.201087	_	_	Step2F1Rate7
83	Run*Accession	2	7.201087	0.03	0.9740	Step2F1Rate7
84	Error: MS(Error)	35	4784.375000	_	_	Step2F1Rate7

Fluaz Visual - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	504.726891	1.50	0.2396	Step2bSusRate1
2	Error: MS(Error)	15	5048.214286	_	_	Step2bSusRate1
3	Run	1	113.437500	0.43	0.5229	Step2bSusRate2
4	Error: MS(Error)	14	3697.500000	_	_	Step2bSusRate2
5	Run	1	54.786706	0.15	0.7052	Step2bSusRate3
6	Error: MS(Error)	14	5143.650794	_	_	Step2bSusRate3
7	Run	1	163.333333	0.68	0.4250	Step2bSusRate4
8	Error: MS(Error)	13	3130.000000	_	_	Step2bSusRate4
9	Run	1	217.777778	2.09	0.1721	Step2bSusRate5
10	Error: MS(Error)	13	1355.555556	_	_	Step2bSusRate5
11	Run	1	166.666667	1.75	0.2071	Step2bSusRate6
12	Error: MS(Error)	14	1333.333333	_	_	Step2bSusRate6
13	Run	1	0	.	.	Step2bSusRate7
14	Error: MS(Error)	14	0	_	_	Step2bSusRate7

Fluaz Visual - Step 3: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	1250.197073	26.35	0.0132	Step3ALLRate1
2	Error	3.0971	146.953727	_	_	Step3ALLRate1
3	Type	2	21260	246.11	0.0040	Step3ALLRate1
4	Error: MS(Run*Type)	2	86.384075	_	_	Step3ALLRate1
5	Run*Type	2	86.384075	0.54	0.5819	Step3ALLRate1
6	Error: MS(Error)	96	7615.468358	_	_	Step3ALLRate1
7	Run	1	85.847645	0.46	0.5612	Step3ALLRate2
8	Error	2.2514	421.486561	_	_	Step3ALLRate2
9	Type	2	56814	136.66	0.0073	Step3ALLRate2
10	Error: MS(Run*Type)	2	415.738431	_	_	Step3ALLRate2
11	Run*Type	2	415.738431	2.92	0.0587	Step3ALLRate2
12	Error: MS(Error)	98	6980.320513	_	_	Step3ALLRate2
13	Run	1	85.002829	0.59	0.5091	Step3ALLRate3
14	Error	2.4882	359.285484	_	_	Step3ALLRate3
15	Type	2	76379	255.35	0.0039	Step3ALLRate3
16	Error: MS(Run*Type)	2	299.112065	_	_	Step3ALLRate3
17	Run*Type	2	299.112065	1.34	0.2654	Step3ALLRate3
18	Error: MS(Error)	97	10787	_	_	Step3ALLRate3
19	Run	1	15.396127	0.12	0.7521	Step3ALLRate4
20	Error	2.7389	346.024137	_	_	Step3ALLRate4
21	Type	2	75499	284.85	0.0035	Step3ALLRate4
22	Error: MS(Run*Type)	2	265.053216	_	_	Step3ALLRate4
23	Run*Type	2	265.053216	1.34	0.2677	Step3ALLRate4
24	Error: MS(Error)	97	9621.199634	_	_	Step3ALLRate4
25	Run	1	1485.329203	3.67	0.1870	Step3ALLRate5
26	Error	2.1389	864.809567	_	_	Step3ALLRate5
27	Type	2	89816	96.61	0.0102	Step3ALLRate5
28	Error: MS(Run*Type)	2	929.664688	_	_	Step3ALLRate5
29	Run*Type	2	929.664688	5.53	0.0053	Step3ALLRate5
30	Error: MS(Error)	96	8067.854090	_	_	Step3ALLRate5
31	Run	1	1309.690352	0.85	0.4522	Step3ALLRate6
32	Error	2.0404	3143.226915	_	_	Step3ALLRate6
33	Type	2	88108	24.52	0.0392	Step3ALLRate6
34	Error: MS(Run*Type)	2	3593.455260	_	_	Step3ALLRate6
35	Run*Type	2	3593.455260	17.70	<.0001	Step3ALLRate6
36	Error: MS(Error)	98	9946.396520	_	_	Step3ALLRate6
37	Run	1	101.340536	1.84	0.2481	Step3ALLRate7
38	Error	3.8893	213.980450	_	_	Step3ALLRate7
39	Type	2	80309	870.52	0.0011	Step3ALLRate7
40	Error: MS(Run*Type)	2	92.254179	_	_	Step3ALLRate7
41	Run*Type	2	92.254179	0.43	0.6510	Step3ALLRate7
42	Error: MS(Error)	96	10270	_	_	Step3ALLRate7

Fluaz Weight - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	1279.915849	0.67	0.4975	Step1ResRate1
2	Error	2.0796	3999.917821	_	_	Step1ResRate1
3	Accession	2	9307.196403	1.21	0.3746	Step1ResRate1
4	Error	4.8812	18793	_	_	Step1ResRate1
5	Run*Accession	2	3813.937079	2.44	0.1900	Step1ResRate1
6	Error	4.5629	3561.509256	_	_	Step1ResRate1
7	Plant(Accession)	7	18940	3.58	0.1160	Step1ResRate1
8	Error	4.053	3066.923539	_	_	Step1ResRate1
9	Run*Plant(Accession)	5	3995.661546	0.49	0.7816	Step1ResRate1
10	Error: MS(Error)	27	44138	_	_	Step1ResRate1
11	Run	1	0.430335	0.00	0.9844	Step1ResRate2
12	Error	3.0695	2959.396275	_	_	Step1ResRate2
13	Accession	2	3769.270040	0.65	0.5625	Step1ResRate2
14	Error	5.0903	14862	_	_	Step1ResRate2
15	Run*Accession	2	1612.268172	0.62	0.5515	Step1ResRate2
16	Error	16.173	21115	_	_	Step1ResRate2
17	Plant(Accession)	7	21378	7.59	0.2597	Step1ResRate2
18	Error	1.0535	423.979170	_	_	Step1ResRate2
19	Run*Plant(Accession)	6	5043.130522	0.16	0.9840	Step1ResRate2
20	Error: MS(Error)	26	132738	_	_	Step1ResRate2
21	Run	1	1766.881579	10.63	0.0442	Step1ResRate3
22	Error	3.1369	521.376937	_	_	Step1ResRate3
23	Accession	2	7227.536248	-6.09	.	Step1ResRate3
24	Error	0.2747	-162.968559	_	_	Step1ResRate3
25	Run*Accession	2	270.145283	0.08	0.9253	Step1ResRate3
26	Error	5.097	8737.419527	_	_	Step1ResRate3
27	Plant(Accession)	7	9828.950972	0.81	0.6205	Step1ResRate3
28	Error	4.1483	7184.803557	_	_	Step1ResRate3
29	Run*Plant(Accession)	4	6941.374720	1.11	0.3753	Step1ResRate3
30	Error: MS(Error)	25	39195	_	_	Step1ResRate3
31	Run	1	430.327567	2.40	0.2423	Step1ResRate4
32	Error	2.359	422.141792	_	_	Step1ResRate4
33	Accession	2	382.127110	0.33	0.7786	Step1ResRate4
34	Error	0.9514	551.867010	_	_	Step1ResRate4
35	Run*Accession	2	335.910871	0.21	0.8120	Step1ResRate4
36	Error	7.0018	5479.942837	_	_	Step1ResRate4
37	Plant(Accession)	7	9003.480512	1.63	0.3047	Step1ResRate4
38	Error	5.0581	3999.115205	_	_	Step1ResRate4
39	Run*Plant(Accession)	6	4717.761967	1.06	0.4090	Step1ResRate4
40	Error: MS(Error)	27	19988	_	_	Step1ResRate4
41	Run	1	11328	2.68	0.2403	Step1ResRate5
42	Error	2.0471	8647.690445	_	_	Step1ResRate5
43	Accession	2	2992.182175	0.34	0.7543	Step1ResRate5
44	Error	1.5514	6824.616595	_	_	Step1ResRate5
45	Run*Accession	2	8594.087643	2.93	0.1155	Step1ResRate5
46	Error	7.3753	10803	_	_	Step1ResRate5
47	Plant(Accession)	7	8058.442715	0.81	0.6136	Step1ResRate5
48	Error	4.7876	6763.961117	_	_	Step1ResRate5
49	Run*Plant(Accession)	6	8643.427221	0.83	0.5551	Step1ResRate5

Fluaz Weight - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error: MS(Error)	26	44939	_	_	Step1ResRate5
51	Run	1	547.506466	0.19	0.7015	Step1ResRate6
52	Error	2.0711	5850.787276	_	_	Step1ResRate6
53	Accession	2	7371.715262	1.40	0.4922	Step1ResRate6
54	Error	1.1438	3003.463906	_	_	Step1ResRate6
55	Run*Accession	2	5697.450570	1.49	0.2864	Step1ResRate6
56	Error	7.3011	13949	_	_	Step1ResRate6
57	Plant(Accession)	7	10925	0.82	0.6109	Step1ResRate6
58	Error	4.9695	9485.752776	_	_	Step1ResRate6
59	Run*Plant(Accession)	6	11458	1.00	0.4485	Step1ResRate6
60	Error: MS(Error)	27	51813	_	_	Step1ResRate6
61	Run	1	23.702177	0.02	0.9128	Step1ResRate7
62	Error	2.0643	3212.995322	_	_	Step1ResRate7
63	Accession	2	1306.868833	1.23	0.8485	Step1ResRate7
64	Error	0.102	54.344138	_	_	Step1ResRate7
65	Run*Accession	2	3160.497081	0.71	0.5244	Step1ResRate7
66	Error	6.416	14181	_	_	Step1ResRate7
67	Plant(Accession)	7	9424.213528	0.54	0.7784	Step1ResRate7
68	Error	5.6869	14115	_	_	Step1ResRate7
69	Run*Plant(Accession)	6	14111	2.94	0.0272	Step1ResRate7
70	Error: MS(Error)	24	19227	_	_	Step1ResRate7

Fluaz Weight - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	4049.436770	0.90	0.4417	Step2ResRate1
2	Error	2.0336	9159.830141	_	_	Step2ResRate1
3	Accession	2	2428.474162	0.27	0.7900	Step2ResRate1
4	Error	2	9133.002355	_	_	Step2ResRate1
5	Run*Accession	2	9133.002355	2.67	0.0822	Step2ResRate1
6	Error: MS(Error)	39	66812	_	_	Step2ResRate1
7	Run	1	1386.749576	0.30	0.6350	Step2ResRate2
8	Error	2.2331	10403	_	_	Step2ResRate2
9	Accession	2	5713.002430	0.61	0.6220	Step2ResRate2
10	Error	2	9399.928724	_	_	Step2ResRate2
11	Run*Accession	2	9399.928724	1.17	0.3225	Step2ResRate2
12	Error: MS(Error)	39	157304	_	_	Step2ResRate2
13	Run	1	1014.132266	3.16	0.1673	Step2ResRate3
14	Error	3.211	1029.171598	_	_	Step2ResRate3
15	Accession	2	3611.435007	6.84	0.1276	Step2ResRate3
16	Error	2	528.246113	_	_	Step2ResRate3
17	Run*Accession	2	528.246113	0.17	0.8430	Step2ResRate3
18	Error: MS(Error)	36	55410	_	_	Step2ResRate3
19	Run	1	1669.034884	45.29	<.0001	Step2ResRate4
20	Error	9.5691	352.652358	_	_	Step2ResRate4
21	Accession	2	1448.422445	43.59	0.0224	Step2ResRate4
22	Error	2	33.230579	_	_	Step2ResRate4
23	Run*Accession	2	33.230579	0.02	0.9803	Step2ResRate4
24	Error: MS(Error)	40	33304	_	_	Step2ResRate4
25	Run	1	8815.082661	3.13	0.2135	Step2ResRate5
26	Error	2.0865	5870.549716	_	_	Step2ResRate5
27	Accession	2	3983.257992	0.69	0.5900	Step2ResRate5
28	Error	2	5731.794892	_	_	Step2ResRate5
29	Run*Accession	2	5731.794892	1.89	0.1650	Step2ResRate5
30	Error: MS(Error)	39	59221	_	_	Step2ResRate5
31	Run	1	320.056200	0.11	0.7750	Step2ResRate6
32	Error	2.107	6405.781917	_	_	Step2ResRate6
33	Accession	2	10612	1.72	0.3682	Step2ResRate6
34	Error	2	6184.576055	_	_	Step2ResRate6
35	Run*Accession	2	6184.576055	1.66	0.2021	Step2ResRate6
36	Error: MS(Error)	40	74296	_	_	Step2ResRate6
37	Run	1	168.851358	0.19	0.6967	Step2ResRate7
38	Error	2.3235	2013.587284	_	_	Step2ResRate7
39	Accession	2	605.250678	0.36	0.7373	Step2ResRate7
40	Error	2	1698.342344	_	_	Step2ResRate7
41	Run*Accession	2	1698.342344	0.72	0.4925	Step2ResRate7
42	Error: MS(Error)	37	43522	_	_	Step2ResRate7
43	Run	1	23.256463	0.08	0.7937	Step2F1Rate1
44	Error	2.5871	717.301252	_	_	Step2F1Rate1
45	Accession	2	3120.233776	5.97	0.1435	Step2F1Rate1
46	Error	2	522.883776	_	_	Step2F1Rate1
47	Run*Accession	2	522.883776	0.53	0.5937	Step2F1Rate1
48	Error: MS(Error)	35	17290	_	_	Step2F1Rate1
49	Run	1	1711.819504	2.61	0.2371	Step2F1Rate2

Fluaz Weight - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error	2.1827	1430.582722	_	_	Step2F1Rate2
51	Accession	2	1006.405181	0.75	0.5706	Step2F1Rate2
52	Error	2	1337.300524	_	_	Step2F1Rate2
53	Run*Accession	2	1337.300524	1.47	0.2438	Step2F1Rate2
54	Error: MS(Error)	34	15449	_	_	Step2F1Rate2
55	Run	1	129.806956	0.55	0.5080	Step2F1Rate3
56	Error	3.1591	739.378718	_	_	Step2F1Rate3
57	Accession	2	2670.325788	6.69	0.1300	Step2F1Rate3
58	Error	2	398.881477	_	_	Step2F1Rate3
59	Run*Accession	2	398.881477	0.28	0.7562	Step2F1Rate3
60	Error: MS(Error)	35	24783	_	_	Step2F1Rate3
61	Run	1	648.677817	2.48	0.2203	Step2F1Rate4
62	Error	2.7911	731.215327	_	_	Step2F1Rate4
63	Accession	2	530.831810	1.12	0.4725	Step2F1Rate4
64	Error	2	475.453506	_	_	Step2F1Rate4
65	Run*Accession	2	475.453506	0.40	0.6733	Step2F1Rate4
66	Error: MS(Error)	35	20794	_	_	Step2F1Rate4
67	Run	1	44.957817	0.05	0.8386	Step2F1Rate5
68	Error	2.207	1898.289524	_	_	Step2F1Rate5
69	Accession	2	199.765661	0.11	0.8979	Step2F1Rate5
70	Error	2	1757.002672	_	_	Step2F1Rate5
71	Run*Accession	2	1757.002672	1.44	0.2497	Step2F1Rate5
72	Error: MS(Error)	35	21291	_	_	Step2F1Rate5
73	Run	1	23.644721	0.14	0.7329	Step2F1Rate6
74	Error	2.5959	425.179687	_	_	Step2F1Rate6
75	Accession	2	193.256386	0.63	0.6129	Step2F1Rate6
76	Error	2	306.043792	_	_	Step2F1Rate6
77	Run*Accession	2	306.043792	0.46	0.6324	Step2F1Rate6
78	Error: MS(Error)	34	11200	_	_	Step2F1Rate6
79	Run	1	182.708238	0.97	0.4134	Step2F1Rate7
80	Error	2.3998	452.248291	_	_	Step2F1Rate7
81	Accession	2	20.866670	0.06	0.9478	Step2F1Rate7
82	Error	2	379.204718	_	_	Step2F1Rate7
83	Run*Accession	2	379.204718	1.07	0.3547	Step2F1Rate7
84	Error: MS(Error)	33	5848.330060	_	_	Step2F1Rate7

Fluaz Weight - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	83.012176	0.31	0.5835	Step2bSusRate1
2	Error: MS(Error)	15	3966.069000	_	_	Step2bSusRate1
3	Run	1	61.915042	0.89	0.3604	Step2bSusRate2
4	Error: MS(Error)	14	969.564333	_	_	Step2bSusRate2
5	Run	1	24.546915	0.67	0.4266	Step2bSusRate3
6	Error: MS(Error)	14	512.597460	_	_	Step2bSusRate3
7	Run	1	27.666778	0.44	0.5200	Step2bSusRate4
8	Error: MS(Error)	13	822.517222	_	_	Step2bSusRate4
9	Run	1	30.508444	1.18	0.2980	Step2bSusRate5
10	Error: MS(Error)	13	337.435556	_	_	Step2bSusRate5
11	Run	1	0.278353	0.01	0.9165	Step2bSusRate6
12	Error: MS(Error)	15	367.244000	_	_	Step2bSusRate6
13	Run	1	9.783538	0.13	0.7271	Step2bSusRate7
14	Error: MS(Error)	15	1160.355286	_	_	Step2bSusRate7

Fluaz Weight - Step 3: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	2105.255306	1.21	0.3714	Step3ALLRate1
2	Error	2.3359	4058.801022	_	_	Step3ALLRate1
3	Type	2	94613	25.89	0.0372	Step3ALLRate1
4	Error: MS(Run*Type)	2	3654.295399	_	_	Step3ALLRate1
5	Run*Type	2	3654.295399	1.69	0.1900	Step3ALLRate1
6	Error: MS(Error)	97	104892	_	_	Step3ALLRate1
7	Run	1	2711.840747	3.84	0.1008	Step3ALLRate2
8	Error	5.6409	3983.771218	_	_	Step3ALLRate2
9	Type	2	96011	98.51	0.0100	Step3ALLRate2
10	Error: MS(Run*Type)	2	974.634314	_	_	Step3ALLRate2
11	Run*Type	2	974.634314	0.24	0.7876	Step3ALLRate2
12	Error: MS(Error)	95	193452	_	_	Step3ALLRate2
13	Run	1	96.089319	0.10	0.7801	Step3ALLRate3
14	Error	2.5548	2554.049364	_	_	Step3ALLRate3
15	Type	2	99602	49.46	0.0198	Step3ALLRate3
16	Error: MS(Run*Type)	2	2013.668465	_	_	Step3ALLRate3
17	Run*Type	2	2013.668465	1.06	0.3499	Step3ALLRate3
18	Error: MS(Error)	93	88173	_	_	Step3ALLRate3
19	Run	1	1560.134757	6.92	0.0392	Step3ALLRate4
20	Error	5.9838	1349.606522	_	_	Step3ALLRate4
21	Type	2	89414	289.55	0.0034	Step3ALLRate4
22	Error: MS(Run*Type)	2	308.803720	_	_	Step3ALLRate4
23	Run*Type	2	308.803720	0.26	0.7731	Step3ALLRate4
24	Error: MS(Error)	96	57436	_	_	Step3ALLRate4
25	Run	1	2180.787219	0.64	0.5020	Step3ALLRate5
26	Error	2.1932	7507.759779	_	_	Step3ALLRate5
27	Type	2	101914	13.13	0.0708	Step3ALLRate5
28	Error: MS(Run*Type)	2	7760.795134	_	_	Step3ALLRate5
29	Run*Type	2	7760.795134	3.96	0.0222	Step3ALLRate5
30	Error: MS(Error)	95	93030	_	_	Step3ALLRate5
31	Run	1	363.295613	0.51	0.5285	Step3ALLRate6
32	Error	2.9738	2134.290681	_	_	Step3ALLRate6
33	Type	2	111626	83.47	0.0118	Step3ALLRate6
34	Error: MS(Run*Type)	2	1337.313122	_	_	Step3ALLRate6
35	Run*Type	2	1337.313122	0.62	0.5395	Step3ALLRate6
36	Error: MS(Error)	97	104449	_	_	Step3ALLRate6
37	Run	1	36.568167	0.39	0.5438	Step3ALLRate7
38	Error	15.647	1485.325146	_	_	Step3ALLRate7
39	Type	2	72269	985.49	0.0010	Step3ALLRate7
40	Error: MS(Run*Type)	2	73.332569	_	_	Step3ALLRate7
41	Run*Type	2	73.332569	0.06	0.9381	Step3ALLRate7
42	Error: MS(Error)	93	53346	_	_	Step3ALLRate7

Quiz Visual - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	202.885929	10.58	0.0816	Step1ResRate1
2	Error	2.0247	38.836013	_	_	Step1ResRate1
3	Accession	2	51.332096	1.58	0.5650	Step1ResRate1
4	Error	0.6409	10.389527	_	_	Step1ResRate1
5	Run*Accession	2	38.566514	0.79	0.4951	Step1ResRate1
6	Error	6.3732	156.259699	_	_	Step1ResRate1
7	Plant(Accession)	7	161.129243	0.87	0.5762	Step1ResRate1
8	Error	5.7613	152.102086	_	_	Step1ResRate1
9	Run*Plant(Accession)	6	153.609036	2.48	0.0551	Step1ResRate1
10	Error: MS(Error)	22	227.083333	_	_	Step1ResRate1
11	Run	1	619.354839	5.34	0.1469	Step1ResRate2
12	Error	2.0031	232.435984	_	_	Step1ResRate2
13	Accession	2	216.154428	0.63	0.5886	Step1ResRate2
14	Error	3.1181	533.954802	_	_	Step1ResRate2
15	Run*Accession	2	232.815867	2.83	0.1299	Step1ResRate2
16	Error	6.5979	271.780182	_	_	Step1ResRate2
17	Plant(Accession)	7	662.091843	2.15	0.1917	Step1ResRate2
18	Error	5.6754	249.530309	_	_	Step1ResRate2
19	Run*Plant(Accession)	6	257.288900	1.88	0.1279	Step1ResRate2
20	Error: MS(Error)	23	525.000000	_	_	Step1ResRate2
21	Run	1	190.535201	5.85	0.1338	Step1ResRate3
22	Error	2.0495	66.778609	_	_	Step1ResRate3
23	Accession	2	67.875994	0.92	0.5202	Step1ResRate3
24	Error	2.0085	74.004881	_	_	Step1ResRate3
25	Run*Accession	2	66.057062	12.18	0.0003	Step1ResRate3
26	Error	21.683	58.802124	_	_	Step1ResRate3
27	Plant(Accession)	7	9.806687	3653.59	1.0000	Step1ResRate3
28	Error	315E-9	1.209693E-10	_	_	Step1ResRate3
29	Run*Plant(Accession)	6	8.271028	0.09	0.9970	Step1ResRate3
30	Error: MS(Error)	27	419.583333	_	_	Step1ResRate3
31	Run	1	207.933908	9.03	0.0920	Step1ResRate4
32	Error	2.0577	47.388351	_	_	Step1ResRate4
33	Accession	2	340.858948	0.84	0.4755	Step1ResRate4
34	Error	6.0884	1232.173164	_	_	Step1ResRate4
35	Run*Accession	2	46.195056	0.79	0.4902	Step1ResRate4
36	Error	6.7286	195.676733	_	_	Step1ResRate4
37	Plant(Accession)	7	1543.180424	7.08	0.0201	Step1ResRate4
38	Error	5.3106	165.259465	_	_	Step1ResRate4
39	Run*Plant(Accession)	6	180.062237	1.57	0.1943	Step1ResRate4
40	Error: MS(Error)	27	516.166667	_	_	Step1ResRate4
41	Run	1	100.152027	18.70	0.0326	Step1ResRate5
42	Error	2.507	13.428506	_	_	Step1ResRate5
43	Accession	2	33.445966	1.57	0.4927	Step1ResRate5
44	Error	0.9915	10.548682	_	_	Step1ResRate5
45	Run*Accession	2	9.876012	0.37	0.6997	Step1ResRate5
46	Error	7.8489	103.663262	_	_	Step1ResRate5
47	Plant(Accession)	7	142.470702	1.76	0.2986	Step1ResRate5
48	Error	4.1983	48.499433	_	_	Step1ResRate5
49	Run*Plant(Accession)	5	60.051142	0.56	0.7279	Step1ResRate5

Quiz Visual - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error: MS(Error)	26	555.416667	_	_	Step1ResRate5
51	Run	1	1093.767361	3.54	0.1992	Step1ResRate6
52	Error	2.0224	624.643425	_	_	Step1ResRate6
53	Accession	2	2065.397945	5.86	0.4935	Step1ResRate6
54	Error	0.4199	74.026685	_	_	Step1ResRate6
55	Run*Accession	2	622.484783	1.31	0.3322	Step1ResRate6
56	Error	6.4935	1540.169699	_	_	Step1ResRate6
57	Plant(Accession)	7	701.916830	0.39	0.8754	Step1ResRate6
58	Error	5.4511	1397.381181	_	_	Step1ResRate6
59	Run*Plant(Accession)	6	1471.912353	1.88	0.1240	Step1ResRate6
60	Error: MS(Error)	25	3261.250000	_	_	Step1ResRate6
61	Run	1	7237.038934	34.66	0.0261	Step1ResRate7
62	Error	2.0513	428.275759	_	_	Step1ResRate7
63	Accession	2	3132.132270	34.52	0.8130	Step1ResRate7
64	Error	0.0585	2.654688	_	_	Step1ResRate7
65	Run*Accession	2	418.761088	1.05	0.4022	Step1ResRate7
66	Error	6.7745	1357.218466	_	_	Step1ResRate7
67	Plant(Accession)	7	237.696964	0.17	0.9828	Step1ResRate7
68	Error	5.3235	1090.748622	_	_	Step1ResRate7
69	Run*Plant(Accession)	6	1215.350275	1.19	0.3481	Step1ResRate7
70	Error: MS(Error)	23	3927.083333	_	_	Step1ResRate7

Quiz Visual - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	337.995883	9.62	0.0876	Step2ResRate1
2	Error	2.0458	71.861864	_	_	Step2ResRate1
3	Accession	2	71.185149	1.00	0.5000	Step2ResRate1
4	Error	2	71.185149	_	_	Step2ResRate1
5	Run*Accession	2	71.185149	2.18	0.1283	Step2ResRate1
6	Error: MS(Error)	35	571.875000	_	_	Step2ResRate1
7	Run	1	388.847345	9.20	0.0903	Step2ResRate2
8	Error	2.0613	87.153113	_	_	Step2ResRate2
9	Accession	2	116.889286	1.38	0.4201	Step2ResRate2
10	Error	2	84.688929	_	_	Step2ResRate2
11	Run*Accession	2	84.688929	1.10	0.3431	Step2ResRate2
12	Error: MS(Error)	36	1383.174603	_	_	Step2ResRate2
13	Run	1	266.216522	7.48	0.1087	Step2ResRate3
14	Error	2.0528	73.091123	_	_	Step2ResRate3
15	Accession	2	70.218018	0.96	0.5110	Step2ResRate3
16	Error	2	73.377490	_	_	Step2ResRate3
17	Run*Accession	2	73.377490	3.35	0.0452	Step2ResRate3
18	Error: MS(Error)	40	438.181818	_	_	Step2ResRate3
19	Run	1	336.676593	4.68	0.1579	Step2ResRate4
20	Error	2.0857	150.190172	_	_	Step2ResRate4
21	Accession	2	42.962504	0.30	0.7714	Step2ResRate4
22	Error	2	144.949657	_	_	Step2ResRate4
23	Run*Accession	2	144.949657	1.31	0.2809	Step2ResRate4
24	Error: MS(Error)	40	2211.492424	_	_	Step2ResRate4
25	Run	1	193.904345	24.36	0.0197	Step2ResRate5
26	Error	2.7389	21.805489	_	_	Step2ResRate5
27	Accession	2	46.988909	3.26	0.2350	Step2ResRate5
28	Error	2	14.434952	_	_	Step2ResRate5
29	Run*Accession	2	14.434952	0.36	0.6996	Step2ResRate5
30	Error: MS(Error)	38	760.625000	_	_	Step2ResRate5
31	Run	1	2219.621587	11.48	0.0737	Step2ResRate6
32	Error	2.0663	399.528221	_	_	Step2ResRate6
33	Accession	2	2344.880070	6.03	0.1422	Step2ResRate6
34	Error	2	388.797571	_	_	Step2ResRate6
35	Run*Accession	2	388.797571	1.33	0.2758	Step2ResRate6
36	Error: MS(Error)	38	5543.214286	_	_	Step2ResRate6
37	Run	1	8443.117749	35.75	0.0246	Step2ResRate7
38	Error	2.0742	489.856779	_	_	Step2ResRate7
39	Accession	2	2819.263121	5.91	0.1447	Step2ResRate7
40	Error	2	477.049223	_	_	Step2ResRate7
41	Run*Accession	2	477.049223	1.55	0.2257	Step2ResRate7
42	Error: MS(Error)	36	5532.589286	_	_	Step2ResRate7
43	Run	1	12.894737	0.42	0.5821	Step2F1Rate1
44	Error	2.115	65.635462	_	_	Step2F1Rate1
45	Accession	2	10.978261	0.17	0.8519	Step2F1Rate1
46	Error	2	63.152174	_	_	Step2F1Rate1
47	Run*Accession	2	63.152174	1.63	0.2096	Step2F1Rate1
48	Error: MS(Error)	35	676.250000	_	_	Step2F1Rate1
49	Run	1	308.105347	2.15	0.2773	Step2F1Rate2

Quiz Visual - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error	2.0447	292.380384	_	_	Step2F1Rate2
51	Accession	2	359.082691	1.19	0.4564	Step2F1Rate2
52	Error	2	301.443678	_	_	Step2F1Rate2
53	Run*Accession	2	301.443678	5.92	0.0065	Step2F1Rate2
54	Error: MS(Error)	32	814.970238	_	_	Step2F1Rate2
55	Run	1	1146.315789	2.43	0.2571	Step2F1Rate3
56	Error	2.0423	964.713881	_	_	Step2F1Rate3
57	Accession	2	894.864130	0.91	0.5223	Step2F1Rate3
58	Error	2	978.288043	_	_	Step2F1Rate3
59	Run*Accession	2	978.288043	4.41	0.0195	Step2F1Rate3
60	Error: MS(Error)	35	3880.000000	_	_	Step2F1Rate3
61	Run	1	0.390625	0.01	0.9422	Step2F1Rate4
62	Error	4.4097	292.720184	_	_	Step2F1Rate4
63	Accession	2	438.437500	4.63	0.1776	Step2F1Rate4
64	Error	2	94.687500	_	_	Step2F1Rate4
65	Run*Accession	2	94.687500	0.13	0.8746	Step2F1Rate4
66	Error: MS(Error)	34	11966	_	_	Step2F1Rate4
67	Run	1	71.644737	0.36	0.6014	Step2F1Rate5
68	Error	2.337	464.596325	_	_	Step2F1Rate5
69	Accession	2	332.364130	0.86	0.5366	Step2F1Rate5
70	Error	2	384.809783	_	_	Step2F1Rate5
71	Run*Accession	2	384.809783	0.57	0.5699	Step2F1Rate5
72	Error: MS(Error)	35	11786	_	_	Step2F1Rate5
73	Run	1	12.894737	0.17	0.7147	Step2F1Rate6
74	Error	2.6606	207.496827	_	_	Step2F1Rate6
75	Accession	2	1478.369565	10.45	0.0873	Step2F1Rate6
76	Error	2	141.413043	_	_	Step2F1Rate6
77	Run*Accession	2	141.413043	0.30	0.7421	Step2F1Rate6
78	Error: MS(Error)	35	8226.250000	_	_	Step2F1Rate6
79	Run	1	353.127246	1.39	0.3540	Step2F1Rate7
80	Error	2.1108	535.737089	_	_	Step2F1Rate7
81	Accession	2	419.157243	0.82	0.5483	Step2F1Rate7
82	Error	2	508.782863	_	_	Step2F1Rate7
83	Run*Accession	2	508.782863	1.09	0.3496	Step2F1Rate7
84	Error: MS(Error)	32	7493.511905	_	_	Step2F1Rate7

Quiz Visual - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	1653.750000	2.07	0.1723	Step2bSusRate1
2	Error: MS(Error)	14	11190	_	_	Step2bSusRate1
3	Run	1	13.333333	0.05	0.8276	Step2bSusRate2
4	Error: MS(Error)	13	3510.000000	_	_	Step2bSusRate2
5	Run	1	108.907563	0.71	0.4129	Step2bSusRate3
6	Error: MS(Error)	15	2302.857143	_	_	Step2bSusRate3
7	Run	1	20.416667	1.28	0.2769	Step2bSusRate4
8	Error: MS(Error)	14	223.333333	_	_	Step2bSusRate4
9	Run	1	14.201681	0.49	0.4937	Step2bSusRate5
10	Error: MS(Error)	15	432.857143	_	_	Step2bSusRate5
11	Run	1	0	.	.	Step2bSusRate6
12	Error: MS(Error)	13	0	_	_	Step2bSusRate6
13	Run	1	0	.	.	Step2bSusRate7
14	Error: MS(Error)	14	0	_	_	Step2bSusRate7

Quiz Visual - Step 3: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	1782.278088	3.88	0.1777	Step3ALLRate1
2	Error	2.1698	997.560186	_	_	Step3ALLRate1
3	Type	2	70558	69.28	0.0142	Step3ALLRate1
4	Error: MS(Run*Type)	2	1018.513161	_	_	Step3ALLRate1
5	Run*Type	2	1018.513161	3.70	0.0286	Step3ALLRate1
6	Error: MS(Error)	92	12677	_	_	Step3ALLRate1
7	Run	1	276.971354	2.53	0.2279	Step3ALLRate2
8	Error	2.4967	273.615326	_	_	Step3ALLRate2
9	Type	2	74516	320.01	0.0031	Step3ALLRate2
10	Error: MS(Run*Type)	2	232.853321	_	_	Step3ALLRate2
11	Run*Type	2	232.853321	1.59	0.2090	Step3ALLRate2
12	Error: MS(Error)	89	6503.464477	_	_	Step3ALLRate2
13	Run	1	1178.562901	7.51	0.0953	Step3ALLRate3
14	Error	2.3086	362.304993	_	_	Step3ALLRate3
15	Type	2	110798	332.42	0.0030	Step3ALLRate3
16	Error: MS(Run*Type)	2	333.307117	_	_	Step3ALLRate3
17	Run*Type	2	333.307117	1.89	0.1560	Step3ALLRate3
18	Error: MS(Error)	98	8624.238095	_	_	Step3ALLRate3
19	Run	1	12.215638	0.11	0.7665	Step3ALLRate4
20	Error	3.0969	360.130666	_	_	Step3ALLRate4
21	Type	2	98271	449.65	0.0022	Step3ALLRate4
22	Error: MS(Run*Type)	2	218.550258	_	_	Step3ALLRate4
23	Run*Type	2	218.550258	0.69	0.5022	Step3ALLRate4
24	Error: MS(Error)	96	15122	_	_	Step3ALLRate4
25	Run	1	31.055484	0.40	0.5694	Step3ALLRate5
26	Error	3.2627	254.288649	_	_	Step3ALLRate5
27	Type	2	115007	831.31	0.0012	Step3ALLRate5
28	Error: MS(Run*Type)	2	138.343641	_	_	Step3ALLRate5
29	Run*Type	2	138.343641	0.48	0.6182	Step3ALLRate5
30	Error: MS(Error)	96	13737	_	_	Step3ALLRate5
31	Run	1	318.174536	0.61	0.5073	Step3ALLRate6
32	Error	2.253	1168.184390	_	_	Step3ALLRate6
33	Type	2	95524	82.73	0.0119	Step3ALLRate6
34	Error: MS(Run*Type)	2	1154.637796	_	_	Step3ALLRate6
35	Run*Type	2	1154.637796	2.96	0.0566	Step3ALLRate6
36	Error: MS(Error)	94	18329	_	_	Step3ALLRate6
37	Run	1	2291.846766	1.60	0.3296	Step3ALLRate7
38	Error	2.0688	2960.858620	_	_	Step3ALLRate7
39	Type	2	62708	19.49	0.0488	Step3ALLRate7
40	Error: MS(Run*Type)	2	3218.270293	_	_	Step3ALLRate7
41	Run*Type	2	3218.270293	8.41	0.0004	Step3ALLRate7
42	Error: MS(Error)	90	17214	_	_	Step3ALLRate7

Quiz Weight - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	9202.118347	1.07	0.4092	Step1ResRate1
2	Error	2.0216	17434	_	_	Step1ResRate1
3	Accession	2	8492.910604	0.46	0.6916	Step1ResRate1
4	Error	1.7012	15652	_	_	Step1ResRate1
5	Run*Accession	2	17506	2.72	0.1360	Step1ResRate1
6	Error	6.7369	21665	_	_	Step1ResRate1
7	Plant(Accession)	7	22431	0.95	0.5383	Step1ResRate1
8	Error	5.3938	18186	_	_	Step1ResRate1
9	Run*Plant(Accession)	6	19762	1.43	0.2458	Step1ResRate1
10	Error: MS(Error)	24	55432	_	_	Step1ResRate1
11	Run	1	1790.838068	1.43	0.3518	Step1ResRate2
12	Error	2.0577	2583.003609	_	_	Step1ResRate2
13	Accession	2	2805.881410	0.87	0.5341	Step1ResRate2
14	Error	2.019	3257.858442	_	_	Step1ResRate2
15	Run*Accession	2	2502.658118	1.22	0.3505	Step1ResRate2
16	Error	7.1626	7357.893037	_	_	Step1ResRate2
17	Plant(Accession)	7	9372.424264	1.39	0.3680	Step1ResRate2
18	Error	5.1396	4954.268438	_	_	Step1ResRate2
19	Run*Plant(Accession)	6	5960.805838	0.62	0.7155	Step1ResRate2
20	Error: MS(Error)	26	41932	_	_	Step1ResRate2
21	Run	1	3314.586207	1.99	0.2884	Step1ResRate3
22	Error	2.1041	3512.344628	_	_	Step1ResRate3
23	Accession	2	477.739105	0.88	0.9441	Step1ResRate3
24	Error	0.0276	7.506343	_	_	Step1ResRate3
25	Run*Accession	2	3339.920850	0.79	0.4896	Step1ResRate3
26	Error	6.9785	14703	_	_	Step1ResRate3
27	Plant(Accession)	7	5164.916524	0.33	0.9079	Step1ResRate3
28	Error	5.2111	11491	_	_	Step1ResRate3
29	Run*Plant(Accession)	6	12931	1.31	0.2857	Step1ResRate3
30	Error: MS(Error)	27	44348	_	_	Step1ResRate3
31	Run	1	15.715484	0.01	0.9281	Step1ResRate4
32	Error	2.249	3492.769273	_	_	Step1ResRate4
33	Accession	2	2371.483893	0.42	0.6824	Step1ResRate4
34	Error	3.9394	11078	_	_	Step1ResRate4
35	Run*Accession	2	2975.824864	1.58	0.3018	Step1ResRate4
36	Error	4.5356	4275.031509	_	_	Step1ResRate4
37	Plant(Accession)	7	14866	2.35	0.2134	Step1ResRate4
38	Error	3.9968	3608.197382	_	_	Step1ResRate4
39	Run*Plant(Accession)	5	4870.487551	0.33	0.8924	Step1ResRate4
40	Error: MS(Error)	27	80499	_	_	Step1ResRate4
41	Run	1	6553.704352	1.84	0.3028	Step1ResRate5
42	Error	2.0845	7408.203235	_	_	Step1ResRate5
43	Accession	2	2183.786288	0.22	0.8194	Step1ResRate5
44	Error	2.0333	10088	_	_	Step1ResRate5
45	Run*Accession	2	7177.323288	1.88	0.2202	Step1ResRate5
46	Error	7.2328	13814	_	_	Step1ResRate5
47	Plant(Accession)	7	19684	1.61	0.3340	Step1ResRate5
48	Error	4.1374	7233.555249	_	_	Step1ResRate5
49	Run*Plant(Accession)	5	9019.408055	0.68	0.6444	Step1ResRate5

Quiz Weight - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error: MS(Error)	26	69242	_	_	Step1ResRate5
51	Run	1	4523.976814	1.35	0.3638	Step1ResRate6
52	Error	2.034	6826.599844	_	_	Step1ResRate6
53	Accession	2	8695.513655	1.22	0.4817	Step1ResRate6
54	Error	1.5454	5525.809638	_	_	Step1ResRate6
55	Run*Accession	2	6742.367398	1.69	0.2505	Step1ResRate6
56	Error	7.1315	14213	_	_	Step1ResRate6
57	Plant(Accession)	7	14173	1.04	0.5052	Step1ResRate6
58	Error	4.7238	9212.889936	_	_	Step1ResRate6
59	Run*Plant(Accession)	6	11854	0.90	0.5128	Step1ResRate6
60	Error: MS(Error)	25	55097	_	_	Step1ResRate6
61	Run	1	6545.608992	6.77	0.1208	Step1ResRate7
62	Error	2.0114	1945.966083	_	_	Step1ResRate7
63	Accession	2	518.280883	0.20	0.8314	Step1ResRate7
64	Error	2.7696	3633.080491	_	_	Step1ResRate7
65	Run*Accession	2	1945.847509	6.67	0.0162	Step1ResRate7
66	Error	9.2169	1345.049529	_	_	Step1ResRate7
67	Plant(Accession)	7	2543.291877	3.36	0.1273	Step1ResRate7
68	Error	4.0563	438.468649	_	_	Step1ResRate7
69	Run*Plant(Accession)	5	583.684617	0.27	0.9265	Step1ResRate7
70	Error: MS(Error)	26	11328	_	_	Step1ResRate7

Quiz Weight - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	4544.119906	0.97	0.4255	Step2ResRate1
2	Error	2.065	9665.810040	_	_	Step2ResRate1
3	Accession	2	8963.514199	0.94	0.5141	Step2ResRate1
4	Error	2	9485.251782	_	_	Step2ResRate1
5	Run*Accession	2	9485.251782	1.83	0.1743	Step2ResRate1
6	Error: MS(Error)	37	95785	_	_	Step2ResRate1
7	Run	1	1784.442061	1.38	0.3576	Step2ResRate2
8	Error	2.0698	2676.628918	_	_	Step2ResRate2
9	Accession	2	1154.349297	0.45	0.6910	Step2ResRate2
10	Error	2	2581.738862	_	_	Step2ResRate2
11	Run*Accession	2	2581.738862	0.90	0.4163	Step2ResRate2
12	Error: MS(Error)	39	56170	_	_	Step2ResRate2
13	Run	1	1343.205411	4.37	0.1218	Step2ResRate3
14	Error	3.2057	984.799342	_	_	Step2ResRate3
15	Accession	2	275.520528	0.54	0.6473	Step2ResRate3
16	Error	2	505.721422	_	_	Step2ResRate3
17	Run*Accession	2	505.721422	0.16	0.8494	Step2ResRate3
18	Error: MS(Error)	40	61715	_	_	Step2ResRate3
19	Run	1	412.532422	0.10	0.7849	Step2ResRate4
20	Error	2.0541	8788.809823	_	_	Step2ResRate4
21	Accession	2	3055.250953	0.35	0.7386	Step2ResRate4
22	Error	2	8632.315173	_	_	Step2ResRate4
23	Run*Accession	2	8632.315173	1.66	0.2033	Step2ResRate4
24	Error: MS(Error)	39	101421	_	_	Step2ResRate4
25	Run	1	1796.177334	0.92	0.4250	Step2ResRate5
26	Error	2.3384	4545.376903	_	_	Step2ResRate5
27	Accession	2	3084.749923	0.81	0.5530	Step2ResRate5
28	Error	2	3816.482921	_	_	Step2ResRate5
29	Run*Accession	2	3816.482921	0.76	0.4759	Step2ResRate5
30	Error: MS(Error)	38	95754	_	_	Step2ResRate5
31	Run	1	954.946713	0.62	0.5088	Step2ResRate6
32	Error	2.1083	3229.182947	_	_	Step2ResRate6
33	Accession	2	7598.373698	2.50	0.2858	Step2ResRate6
34	Error	2	3041.221052	_	_	Step2ResRate6
35	Run*Accession	2	3041.221052	0.72	0.4919	Step2ResRate6
36	Error: MS(Error)	38	79934	_	_	Step2ResRate6
37	Run	1	9990.954072	7.04	0.1149	Step2ResRate7
38	Error	2.044	2901.027803	_	_	Step2ResRate7
39	Accession	2	1150.141976	0.39	0.7178	Step2ResRate7
40	Error	2	2925.479207	_	_	Step2ResRate7
41	Run*Accession	2	2925.479207	3.83	0.0306	Step2ResRate7
42	Error: MS(Error)	38	14517	_	_	Step2ResRate7
43	Run	1	109.503185	1.44	0.2741	Step2F1Rate1
44	Error	6.1894	470.809286	_	_	Step2F1Rate1
45	Accession	2	799.026632	8.83	0.1018	Step2F1Rate1
46	Error	2	90.521518	_	_	Step2F1Rate1
47	Run*Accession	2	90.521518	0.08	0.9203	Step2F1Rate1
48	Error: MS(Error)	34	18493	_	_	Step2F1Rate1
49	Run	1	133.176700	0.72	0.4596	Step2F1Rate2

Quiz Weight - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error	2.926	540.505513	_	_	Step2F1Rate2
51	Accession	2	412.274501	1.28	0.4391	Step2F1Rate2
52	Error	2	322.746194	_	_	Step2F1Rate2
53	Run*Accession	2	322.746194	0.27	0.7613	Step2F1Rate2
54	Error: MS(Error)	33	19365	_	_	Step2F1Rate2
55	Run	1	876.782553	0.54	0.5341	Step2F1Rate3
56	Error	2.1749	3541.929458	_	_	Step2F1Rate3
57	Accession	2	1100.453657	0.33	0.7528	Step2F1Rate3
58	Error	2	3351.329519	_	_	Step2F1Rate3
59	Run*Accession	2	3351.329519	1.70	0.1968	Step2F1Rate3
60	Error: MS(Error)	35	34425	_	_	Step2F1Rate3
61	Run	1	18.592896	0.11	0.7465	Step2F1Rate4
62	Error	6.9469	1141.135511	_	_	Step2F1Rate4
63	Accession	2	901.887533	4.75	0.1738	Step2F1Rate4
64	Error	2	189.756748	_	_	Step2F1Rate4
65	Run*Accession	2	189.756748	0.11	0.8932	Step2F1Rate4
66	Error: MS(Error)	33	27618	_	_	Step2F1Rate4
67	Run	1	224.751446	0.61	0.5105	Step2F1Rate5
68	Error	2.2348	830.108294	_	_	Step2F1Rate5
69	Accession	2	196.143627	0.26	0.7925	Step2F1Rate5
70	Error	2	749.007286	_	_	Step2F1Rate5
71	Run*Accession	2	749.007286	1.15	0.3281	Step2F1Rate5
72	Error: MS(Error)	34	11054	_	_	Step2F1Rate5
73	Run	1	112.536827	3.42	0.1794	Step2F1Rate6
74	Error	2.5083	82.611406	_	_	Step2F1Rate6
75	Accession	2	18.072286	0.29	0.7760	Step2F1Rate6
76	Error	2	62.614031	_	_	Step2F1Rate6
77	Run*Accession	2	62.614031	0.54	0.5876	Step2F1Rate6
78	Error: MS(Error)	34	1971.075198	_	_	Step2F1Rate6
79	Run	1	0.496103	0.01	0.9463	Step2F1Rate7
80	Error	2.0689	178.764914	_	_	Step2F1Rate7
81	Accession	2	22.576243	0.13	0.8876	Step2F1Rate7
82	Error	2	178.342029	_	_	Step2F1Rate7
83	Run*Accession	2	178.342029	2.90	0.0693	Step2F1Rate7
84	Error: MS(Error)	32	982.359286	_	_	Step2F1Rate7

Quiz Weight - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	165.809782	1.62	0.2221	Step2bSusRate1
2	Error: MS(Error)	15	1532.572571	_	_	Step2bSusRate1
3	Run	1	0.833333	0.03	0.8740	Step2bSusRate2
4	Error: MS(Error)	13	414.244000	_	_	Step2bSusRate2
5	Run	1	76.388167	2.36	0.1471	Step2bSusRate3
6	Error: MS(Error)	14	453.889333	_	_	Step2bSusRate3
7	Run	1	65.712000	2.33	0.1509	Step2bSusRate4
8	Error: MS(Error)	13	366.652000	_	_	Step2bSusRate4
9	Run	1	0.322824	0.02	0.9016	Step2bSusRate5
10	Error: MS(Error)	15	306.176000	_	_	Step2bSusRate5
11	Run	1	0.469587	0.02	0.9039	Step2bSusRate6
12	Error: MS(Error)	12	370.847556	_	_	Step2bSusRate6
13	Run	1	9.204167	0.21	0.6530	Step2bSusRate7
14	Error: MS(Error)	14	610.693333	_	_	Step2bSusRate7

Quiz Weight - Step 3: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	1552.189027	0.59	0.5141	Step3ALLRate1
2	Error	2.2678	5959.190556	_	_	Step3ALLRate1
3	Type	2	99524	17.93	0.0528	Step3ALLRate1
4	Error: MS(Run*Type)	2	5550.849180	_	_	Step3ALLRate1
5	Run*Type	2	5550.849180	1.92	0.1520	Step3ALLRate1
6	Error: MS(Error)	94	135718	_	_	Step3ALLRate1
7	Run	1	475.795716	0.91	0.3951	Step3ALLRate2
8	Error	3.8926	2031.031136	_	_	Step3ALLRate2
9	Type	2	78654	87.36	0.0113	Step3ALLRate2
10	Error: MS(Run*Type)	2	900.380210	_	_	Step3ALLRate2
11	Run*Type	2	900.380210	0.52	0.5976	Step3ALLRate2
12	Error: MS(Error)	93	80872	_	_	Step3ALLRate2
13	Run	1	68.218811	0.05	0.8427	Step3ALLRate3
14	Error	2.5261	3575.249142	_	_	Step3ALLRate3
15	Type	2	97702	33.03	0.0294	Step3ALLRate3
16	Error: MS(Run*Type)	2	2958.252507	_	_	Step3ALLRate3
17	Run*Type	2	2958.252507	1.41	0.2495	Step3ALLRate3
18	Error: MS(Error)	97	101871	_	_	Step3ALLRate3
19	Run	1	531.229521	0.78	0.4159	Step3ALLRate4
20	Error	5.304	3621.004117	_	_	Step3ALLRate4
21	Type	2	99126	98.38	0.0101	Step3ALLRate4
22	Error: MS(Run*Type)	2	1007.550101	_	_	Step3ALLRate4
23	Run*Type	2	1007.550101	0.33	0.7229	Step3ALLRate4
24	Error: MS(Error)	93	143905	_	_	Step3ALLRate4
25	Run	1	1516.005862	1.70	0.2883	Step3ALLRate5
26	Error	2.8106	2499.821389	_	_	Step3ALLRate5
27	Type	2	200634	118.34	0.0084	Step3ALLRate5
28	Error: MS(Run*Type)	2	1695.360787	_	_	Step3ALLRate5
29	Run*Type	2	1695.360787	0.70	0.4988	Step3ALLRate5
30	Error: MS(Error)	95	114937	_	_	Step3ALLRate5
31	Run	1	518.556499	1.09	0.3405	Step3ALLRate6
32	Error	5.3751	2549.867499	_	_	Step3ALLRate6
33	Type	2	99919	141.94	0.0070	Step3ALLRate6
34	Error: MS(Run*Type)	2	703.965528	_	_	Step3ALLRate6
35	Run*Type	2	703.965528	0.34	0.7105	Step3ALLRate6
36	Error: MS(Error)	92	94395	_	_	Step3ALLRate6
37	Run	1	2404.055079	1.09	0.4038	Step3ALLRate7
38	Error	2.0526	4530.955434	_	_	Step3ALLRate7
39	Type	2	32145	6.42	0.1347	Step3ALLRate7
40	Error: MS(Run*Type)	2	5005.744513	_	_	Step3ALLRate7
41	Run*Type	2	5005.744513	11.37	<.0001	Step3ALLRate7
42	Error: MS(Error)	92	20244	_	_	Step3ALLRate7

Cleth Visual - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	143.678161	0.13	0.7564	Step1ResRate1
2	Error	2.0195	2305.650656	_	_	Step1ResRate1
3	Accession	2	258.485927	0.09	0.9182	Step1ResRate1
4	Error	2.5889	3792.669270	_	_	Step1ResRate1
5	Run*Accession	2	2305.965827	8.66	0.0073	Step1ResRate1
6	Error	9.4685	1261.190647	_	_	Step1ResRate1
7	Plant(Accession)	7	2205.547666	3.78	0.1805	Step1ResRate1
8	Error	2.5261	210.426358	_	_	Step1ResRate1
9	Run*Plant(Accession)	6	679.853480	0.30	0.9297	Step1ResRate1
10	Error: MS(Error)	19	7200.000000	_	_	Step1ResRate1
11	Run	1	57.270694	11.78	0.0272	Step1ResRate2
12	Error	3.9361	19.142875	_	_	Step1ResRate2
13	Accession	2	228.358721	-7.15	.	Step1ResRate2
14	Error	0.1204	-1.923475	_	_	Step1ResRate2
15	Run*Accession	2	6.985195	0.05	0.9548	Step1ResRate2
16	Error	6.2056	465.532894	_	_	Step1ResRate2
17	Plant(Accession)	7	491.378047	0.92	0.5644	Step1ResRate2
18	Error	4.1693	316.801323	_	_	Step1ResRate2
19	Run*Plant(Accession)	5	377.609890	1.06	0.4089	Step1ResRate2
20	Error: MS(Error)	20	1418.750000	_	_	Step1ResRate2
21	Run	1	211.739659	12.93	0.0542	Step1ResRate3
22	Error	2.3533	38.541524	_	_	Step1ResRate3
23	Accession	2	124.069021	0.24	0.7948	Step1ResRate3
24	Error	5.1395	1326.922859	_	_	Step1ResRate3
25	Run*Accession	2	30.587949	0.29	0.7588	Step1ResRate3
26	Error	8.2258	440.684704	_	_	Step1ResRate3
27	Plant(Accession)	7	2154.465282	6.88	0.0411	Step1ResRate3
28	Error	3.9797	178.070455	_	_	Step1ResRate3
29	Run*Plant(Accession)	6	297.784971	0.51	0.7951	Step1ResRate3
30	Error: MS(Error)	21	2050.000000	_	_	Step1ResRate3
31	Run	1	82.442748	0.43	0.5771	Step1ResRate4
32	Error	2.0421	389.217955	_	_	Step1ResRate4
33	Accession	2	3499.349216	7.34	0.1377	Step1ResRate4
34	Error	1.7846	425.264002	_	_	Step1ResRate4
35	Run*Accession	2	383.027157	1.24	0.3451	Step1ResRate4
36	Error	7.148	1104.508408	_	_	Step1ResRate4
37	Plant(Accession)	7	1435.244665	1.28	0.4027	Step1ResRate4
38	Error	5.1327	819.865999	_	_	Step1ResRate4
39	Run*Plant(Accession)	6	942.927513	1.20	0.3426	Step1ResRate4
40	Error: MS(Error)	22	2879.166667	_	_	Step1ResRate4
41	Run	1	125.000000	1.05	0.4109	Step1ResRate5
42	Error	2.033	240.961929	_	_	Step1ResRate5
43	Accession	2	133.090171	0.44	0.6915	Step1ResRate5
44	Error	2.2857	349.297835	_	_	Step1ResRate5
45	Run*Accession	2	237.733023	1.89	0.2178	Step1ResRate5
46	Error	7.3583	463.098037	_	_	Step1ResRate5
47	Plant(Accession)	7	634.020763	1.52	0.3311	Step1ResRate5
48	Error	5.0466	299.943506	_	_	Step1ResRate5
49	Run*Plant(Accession)	6	366.280284	0.70	0.6560	Step1ResRate5

Cleth Visual - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error: MS(Error)	19	1666.666667	_	_	Step1ResRate5
51	Run	1	69.189189	3.02	0.2324	Step1ResRate6
52	Error	1.882	43.186350	_	_	Step1ResRate6
53	Accession	2	23.595832	0.70	0.7397	Step1ResRate6
54	Error	0.4043	6.849952	_	_	Step1ResRate6
55	Run*Accession	2	48.100304	0.81	0.5060	Step1ResRate6
56	Error	3.9284	116.012767	_	_	Step1ResRate6
57	Plant(Accession)	7	179.380342	0.87	0.5924	Step1ResRate6
58	Error	3.9321	115.663278	_	_	Step1ResRate6
59	Run*Plant(Accession)	4	109.795322	8.78	0.0003	Step1ResRate6
60	Error: MS(Error)	20	62.500000	_	_	Step1ResRate6
61	Run	1	27.591157	8.31	0.1200	Step1ResRate7
62	Error	1.7358	5.765718	_	_	Step1ResRate7
63	Accession	2	11.075202	-4.50	.	Step1ResRate7
64	Error	0.0219	-0.026969	_	_	Step1ResRate7
65	Run*Accession	2	7.235421	0.28	0.7697	Step1ResRate7
66	Error	4.9849	65.338527	_	_	Step1ResRate7
67	Plant(Accession)	7	72.520376	0.72	0.6655	Step1ResRate7
68	Error	4.7231	67.675795	_	_	Step1ResRate7
69	Run*Plant(Accession)	5	65.227920	4.11	0.0093	Step1ResRate7
70	Error: MS(Error)	21	66.666667	_	_	Step1ResRate7

Cleth Visual - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	6.362803	0.01	0.9449	Step2ResRate1
2	Error	2.0731	2180.505219	_	_	Step2ResRate1
3	Accession	2	597.947748	0.27	0.7858	Step2ResRate1
4	Error	2	2194.081468	_	_	Step2ResRate1
5	Run*Accession	2	2194.081468	3.42	0.0452	Step2ResRate1
6	Error: MS(Error)	32	10276	_	_	Step2ResRate1
7	Run	1	2.250599	0.24	0.6396	Step2ResRate2
8	Error	6.2131	57.768284	_	_	Step2ResRate2
9	Accession	2	398.637494	36.28	0.0268	Step2ResRate2
10	Error	2	10.987430	_	_	Step2ResRate2
11	Run*Accession	2	10.987430	0.08	0.9255	Step2ResRate2
12	Error: MS(Error)	32	2264.097222	_	_	Step2ResRate2
13	Run	1	313.210227	6.30	0.1030	Step2ResRate3
14	Error	2.5203	125.394902	_	_	Step2ResRate3
15	Accession	2	50.761869	0.55	0.6448	Step2ResRate3
16	Error	2	92.167233	_	_	Step2ResRate3
17	Run*Accession	2	92.167233	0.33	0.7235	Step2ResRate3
18	Error: MS(Error)	34	4795.833333	_	_	Step2ResRate3
19	Run	1	114.958693	0.38	0.6000	Step2ResRate4
20	Error	2.0886	639.114434	_	_	Step2ResRate4
21	Accession	2	3567.407844	5.70	0.1492	Step2ResRate4
22	Error	2	625.688767	_	_	Step2ResRate4
23	Run*Accession	2	625.688767	2.04	0.1448	Step2ResRate4
24	Error: MS(Error)	35	5360.208333	_	_	Step2ResRate4
25	Run	1	126.698675	0.54	0.5358	Step2ResRate5
26	Error	2.0438	475.147334	_	_	Step2ResRate5
27	Accession	2	103.443339	0.22	0.8211	Step2ResRate5
28	Error	2	474.691079	_	_	Step2ResRate5
29	Run*Accession	2	474.691079	2.94	0.0672	Step2ResRate5
30	Error: MS(Error)	32	2582.440476	_	_	Step2ResRate5
31	Run	1	40.705817	3.93	0.1792	Step2ResRate6
32	Error	2.1108	21.870297	_	_	Step2ResRate6
33	Accession	2	20.716441	1.00	0.5000	Step2ResRate6
34	Error	2	20.716441	_	_	Step2ResRate6
35	Run*Accession	2	20.716441	0.99	0.3830	Step2ResRate6
36	Error: MS(Error)	31	324.305556	_	_	Step2ResRate6
37	Run	1	16.717105	6.52	0.1086	Step2ResRate7
38	Error	2.3094	5.923461	_	_	Step2ResRate7
39	Accession	2	4.928257	1.00	0.5000	Step2ResRate7
40	Error	2	4.928257	_	_	Step2ResRate7
41	Run*Accession	2	4.928257	0.44	0.6508	Step2ResRate7
42	Error: MS(Error)	33	186.875000	_	_	Step2ResRate7
43	Run	1	160.158208	0.46	0.5642	Step2F1Rate1
44	Error	2.1411	748.376060	_	_	Step2F1Rate1
45	Accession	2	41.945939	0.06	0.9447	Step2F1Rate1
46	Error	2	715.918542	_	_	Step2F1Rate1
47	Run*Accession	2	715.918542	1.72	0.1949	Step2F1Rate1
48	Error: MS(Error)	33	6870.982143	_	_	Step2F1Rate1
49	Run	1	279.769737	3.24	0.1982	Step2F1Rate2

Cleth Visual - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error	2.2757	196.621427	_	_	Step2F1Rate2
51	Accession	2	88.591610	0.52	0.6596	Step2F1Rate2
52	Error	2	171.639555	_	_	Step2F1Rate2
53	Run*Accession	2	171.639555	0.89	0.4191	Step2F1Rate2
54	Error: MS(Error)	33	3171.875000	_	_	Step2F1Rate2
55	Run	1	15.800070	0.14	0.7425	Step2F1Rate3
56	Error	2.2881	263.361366	_	_	Step2F1Rate3
57	Accession	2	274.232456	1.23	0.4482	Step2F1Rate3
58	Error	2	222.752193	_	_	Step2F1Rate3
59	Run*Accession	2	222.752193	0.50	0.6087	Step2F1Rate3
60	Error: MS(Error)	33	7292.708333	_	_	Step2F1Rate3
61	Run	1	206.663152	0.56	0.5298	Step2F1Rate4
62	Error	2.0674	761.758296	_	_	Step2F1Rate4
63	Accession	2	216.879650	0.29	0.7767	Step2F1Rate4
64	Error	2	754.379650	_	_	Step2F1Rate4
65	Run*Accession	2	754.379650	2.44	0.1022	Step2F1Rate4
66	Error: MS(Error)	34	5254.107143	_	_	Step2F1Rate4
67	Run	1	0.284282	0.00	0.9576	Step2F1Rate5
68	Error	2.0902	166.319588	_	_	Step2F1Rate5
69	Accession	2	18.523960	0.12	0.8966	Step2F1Rate5
70	Error	2	160.657776	_	_	Step2F1Rate5
71	Run*Accession	2	160.657776	1.44	0.2528	Step2F1Rate5
72	Error: MS(Error)	32	1790.178571	_	_	Step2F1Rate5
73	Run	1	107.776881	2.33	0.2508	Step2F1Rate6
74	Error	2.2917	105.969954	_	_	Step2F1Rate6
75	Accession	2	93.838051	1.00	0.5000	Step2F1Rate6
76	Error	2	93.838051	_	_	Step2F1Rate6
77	Run*Accession	2	93.838051	1.22	0.3083	Step2F1Rate6
78	Error: MS(Error)	31	1189.732143	_	_	Step2F1Rate6
79	Run	1	197.044335	1.79	0.2993	Step2F1Rate7
80	Error	2.2646	249.073287	_	_	Step2F1Rate7
81	Accession	2	217.625755	1.00	0.5000	Step2F1Rate7
82	Error	2	217.625755	_	_	Step2F1Rate7
83	Run*Accession	2	217.625755	0.82	0.4480	Step2F1Rate7
84	Error: MS(Error)	32	4228.571429	_	_	Step2F1Rate7

Cleth Visual - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	120.416667	0.47	0.5034	Step2bSusRate1
2	Error: MS(Error)	14	3573.333333	_	_	Step2bSusRate1
3	Run	1	16.470588	0.04	0.8433	Step2bSusRate2
4	Error: MS(Error)	15	6110.000000	_	_	Step2bSusRate2
5	Run	1	150.416667	0.63	0.4407	Step2bSusRate3
6	Error: MS(Error)	14	3343.333333	_	_	Step2bSusRate3
7	Run	1	411.764706	4.41	0.0530	Step2bSusRate4
8	Error: MS(Error)	15	1400.000000	_	_	Step2bSusRate4
9	Run	1	16.470588	0.69	0.4204	Step2bSusRate5
10	Error: MS(Error)	15	360.000000	_	_	Step2bSusRate5
11	Run	1	0	.	.	Step2bSusRate6
12	Error: MS(Error)	14	0	_	_	Step2bSusRate6
13	Run	1	18.907563	1.47	0.2440	Step2bSusRate7
14	Error: MS(Error)	15	192.857143	_	_	Step2bSusRate7

Cleth Visual - Step 3: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	348.810285	9.14	0.0040	Step3ALLRate1
2	Error	49.552	1892.041312	_	_	Step3ALLRate1
3	Type	2	15119	1129.65	0.0009	Step3ALLRate1
4	Error: MS(Run*Type)	2	13.384149	_	_	Step3ALLRate1
5	Run*Type	2	13.384149	0.02	0.9760	Step3ALLRate1
6	Error: MS(Error)	87	23950	_	_	Step3ALLRate1
7	Run	1	13.598639	0.09	0.7938	Step3ALLRate2
8	Error	2.3749	378.399480	_	_	Step3ALLRate2
9	Type	2	4752.539387	14.71	0.0636	Step3ALLRate2
10	Error: MS(Run*Type)	2	322.995587	_	_	Step3ALLRate2
11	Run*Type	2	322.995587	1.16	0.3168	Step3ALLRate2
12	Error: MS(Error)	88	12202	_	_	Step3ALLRate2
13	Run	1	3.819774	0.02	0.8991	Step3ALLRate3
14	Error	2.5444	497.018853	_	_	Step3ALLRate3
15	Type	2	6361.778181	16.11	0.0585	Step3ALLRate3
16	Error: MS(Run*Type)	2	394.939058	_	_	Step3ALLRate3
17	Run*Type	2	394.939058	1.10	0.3386	Step3ALLRate3
18	Error: MS(Error)	89	16033	_	_	Step3ALLRate3
19	Run	1	905.546699	10.14	0.0436	Step3ALLRate4
20	Error	3.3052	295.132180	_	_	Step3ALLRate4
21	Type	2	2233.766738	14.39	0.0650	Step3ALLRate4
22	Error: MS(Run*Type)	2	155.266775	_	_	Step3ALLRate4
23	Run*Type	2	155.266775	0.41	0.6623	Step3ALLRate4
24	Error: MS(Error)	92	17254	_	_	Step3ALLRate4
25	Run	1	0.390775	0.01	0.9436	Step3ALLRate5
26	Error	2.42	154.328090	_	_	Step3ALLRate5
27	Type	2	570.468275	4.47	0.1829	Step3ALLRate5
28	Error: MS(Run*Type)	2	127.654178	_	_	Step3ALLRate5
29	Run*Type	2	127.654178	1.01	0.3687	Step3ALLRate5
30	Error: MS(Error)	87	5501.184211	_	_	Step3ALLRate5
31	Run	1	93.426482	2.81	0.2193	Step3ALLRate6
32	Error	2.2963	76.293577	_	_	Step3ALLRate6
33	Type	2	69.433978	1.00	0.5000	Step3ALLRate6
34	Error: MS(Run*Type)	2	69.433978	_	_	Step3ALLRate6
35	Run*Type	2	69.433978	1.67	0.1940	Step3ALLRate6
36	Error: MS(Error)	84	1743.611111	_	_	Step3ALLRate6
37	Run	1	172.420728	3.47	0.1773	Step3ALLRate7
38	Error	2.5065	124.570636	_	_	Step3ALLRate7
39	Type	2	97.862620	1.00	0.5000	Step3ALLRate7
40	Error: MS(Run*Type)	2	97.862620	_	_	Step3ALLRate7
41	Run*Type	2	97.862620	0.86	0.4286	Step3ALLRate7
42	Error: MS(Error)	88	5033.892496	_	_	Step3ALLRate7

Cleth Weight - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	3737.503642	6.32	0.1277	Step1ResRate1
2	Error	2.0119	1190.240876	_	_	Step1ResRate1
3	Accession	2	140.876312	0.16	0.8754	Step1ResRate1
4	Error	0.8088	361.380063	_	_	Step1ResRate1
5	Run*Accession	2	1185.991982	1.78	0.2390	Step1ResRate1
6	Error	6.8707	2294.492244	_	_	Step1ResRate1
7	Plant(Accession)	7	1045.124092	0.45	0.8383	Step1ResRate1
8	Error	4.7939	1605.115072	_	_	Step1ResRate1
9	Run*Plant(Accession)	6	2005.599433	1.01	0.4441	Step1ResRate1
10	Error: MS(Error)	20	6591.369167	_	_	Step1ResRate1
11	Run	1	214.632295	1.27	0.3760	Step1ResRate2
12	Error	2.0035	337.556703	_	_	Step1ResRate2
13	Accession	2	519.127891	1.34	0.4463	Step1ResRate2
14	Error	1.7174	332.998000	_	_	Step1ResRate2
15	Run*Accession	2	337.454665	3.30	0.0913	Step1ResRate2
16	Error	7.8158	399.367046	_	_	Step1ResRate2
17	Plant(Accession)	7	316.306515	1.28	0.4723	Step1ResRate2
18	Error	2.6799	94.765321	_	_	Step1ResRate2
19	Run*Plant(Accession)	5	219.546441	0.32	0.8960	Step1ResRate2
20	Error: MS(Error)	21	2891.545833	_	_	Step1ResRate2
21	Run	1	107.913285	0.52	0.5455	Step1ResRate3
22	Error	2.0177	419.517998	_	_	Step1ResRate3
23	Accession	2	192.303655	0.35	0.7317	Step1ResRate3
24	Error	2.5482	692.190015	_	_	Step1ResRate3
25	Run*Accession	2	419.539805	4.88	0.0417	Step1ResRate3
26	Error	7.9192	340.653339	_	_	Step1ResRate3
27	Plant(Accession)	7	583.465787	2.21	0.2234	Step1ResRate3
28	Error	4.2277	159.544571	_	_	Step1ResRate3
29	Run*Plant(Accession)	6	243.952952	0.59	0.7374	Step1ResRate3
30	Error: MS(Error)	21	1456.365833	_	_	Step1ResRate3
31	Run	1	355.442907	1.38	0.3582	Step1ResRate4
32	Error	2.0434	524.429990	_	_	Step1ResRate4
33	Accession	2	697.006913	1.04	0.4612	Step1ResRate4
34	Error	2.7763	933.996292	_	_	Step1ResRate4
35	Run*Accession	2	515.595252	8.87	0.0013	Step1ResRate4
36	Error	24.325	706.959335	_	_	Step1ResRate4
37	Plant(Accession)	7	458.572871	-14.38	.	Step1ResRate4
38	Error	0.4748	-2.163518	_	_	Step1ResRate4
39	Run*Plant(Accession)	6	72.438834	0.07	0.9986	Step1ResRate4
40	Error: MS(Error)	22	3994.975833	_	_	Step1ResRate4
41	Run	1	581.424084	3.05	0.2201	Step1ResRate5
42	Error	2.0482	390.889096	_	_	Step1ResRate5
43	Accession	2	17.696099	0.04	0.9592	Step1ResRate5
44	Error	1.9839	413.100885	_	_	Step1ResRate5
45	Run*Accession	2	387.546318	2.59	0.1741	Step1ResRate5
46	Error	4.7197	353.114366	_	_	Step1ResRate5
47	Plant(Accession)	7	609.758503	1.16	0.4532	Step1ResRate5
48	Error	4.7505	355.484383	_	_	Step1ResRate5
49	Run*Plant(Accession)	5	374.735463	0.94	0.4788	Step1ResRate5

Cleth Weight - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error: MS(Error)	18	1434.740000	_	_	Step1ResRate5
51	Run	1	1154.104553	6.64	0.1264	Step1ResRate6
52	Error	1.9512	338.962365	_	_	Step1ResRate6
53	Accession	2	453.091664	4.17	0.8702	Step1ResRate6
54	Error	0.0554	3.007686	_	_	Step1ResRate6
55	Run*Accession	2	357.538822	0.66	0.5701	Step1ResRate6
56	Error	3.6995	1007.299956	_	_	Step1ResRate6
57	Plant(Accession)	7	1213.494206	0.62	0.7265	Step1ResRate6
58	Error	3.5625	991.681139	_	_	Step1ResRate6
59	Run*Plant(Accession)	4	1043.023611	2.07	0.1215	Step1ResRate6
60	Error: MS(Error)	21	2649.493333	_	_	Step1ResRate6
61	Run	1	405.938101	2.93	0.2276	Step1ResRate7
62	Error	2.0272	281.213422	_	_	Step1ResRate7
63	Accession	2	261.401789	0.90	0.5560	Step1ResRate7
64	Error	1.4551	210.667682	_	_	Step1ResRate7
65	Run*Accession	2	280.265142	1.94	0.2413	Step1ResRate7
66	Error	4.7839	345.254659	_	_	Step1ResRate7
67	Plant(Accession)	7	485.828613	0.95	0.5528	Step1ResRate7
68	Error	4.0074	291.521991	_	_	Step1ResRate7
69	Run*Plant(Accession)	5	360.170581	1.08	0.3988	Step1ResRate7
70	Error: MS(Error)	20	1328.060833	_	_	Step1ResRate7

Cleth Weight - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	3142.162932	16.19	0.0478	Step2ResRate1
2	Error	2.209	428.765061	_	_	Step2ResRate1
3	Accession	2	70.740650	0.19	0.8439	Step2ResRate1
4	Error	2	382.297309	_	_	Step2ResRate1
5	Run*Accession	2	382.297309	0.69	0.5101	Step2ResRate1
6	Error: MS(Error)	33	9180.500722	_	_	Step2ResRate1
7	Run	1	332.034909	1.32	0.3664	Step2ResRate2
8	Error	2.0567	516.551871	_	_	Step2ResRate2
9	Accession	2	526.457049	1.03	0.4934	Step2ResRate2
10	Error	2	512.719270	_	_	Step2ResRate2
11	Run*Accession	2	512.719270	2.49	0.0982	Step2ResRate2
12	Error: MS(Error)	33	3395.127056	_	_	Step2ResRate2
13	Run	1	232.934730	1.05	0.4106	Step2ResRate3
14	Error	2.0481	453.138433	_	_	Step2ResRate3
15	Accession	2	97.110483	0.21	0.8241	Step2ResRate3
16	Error	2	454.860808	_	_	Step2ResRate3
17	Run*Accession	2	454.860808	3.36	0.0464	Step2ResRate3
18	Error: MS(Error)	34	2298.015833	_	_	Step2ResRate3
19	Run	1	682.778190	2.76	0.2329	Step2ResRate4
20	Error	2.093	517.320395	_	_	Step2ResRate4
21	Accession	2	683.868162	1.35	0.4247	Step2ResRate4
22	Error	2	504.852104	_	_	Step2ResRate4
23	Run*Accession	2	504.852104	1.95	0.1579	Step2ResRate4
24	Error: MS(Error)	35	4538.018083	_	_	Step2ResRate4
25	Run	1	811.994465	2.13	0.2794	Step2ResRate5
26	Error	2.0414	778.031039	_	_	Step2ResRate5
27	Accession	2	20.556442	0.03	0.9748	Step2ResRate5
28	Error	2	793.842784	_	_	Step2ResRate5
29	Run*Accession	2	793.842784	5.07	0.0127	Step2ResRate5
30	Error: MS(Error)	30	2350.553512	_	_	Step2ResRate5
31	Run	1	1220.065461	29.15	0.0200	Step2ResRate6
32	Error	2.4771	103.671414	_	_	Step2ResRate6
33	Accession	2	281.686507	3.64	0.2154	Step2ResRate6
34	Error	2	77.339691	_	_	Step2ResRate6
35	Run*Accession	2	77.339691	0.25	0.7778	Step2ResRate6
36	Error: MS(Error)	32	4885.572032	_	_	Step2ResRate6
37	Run	1	405.416952	7.11	0.1088	Step2ResRate7
38	Error	2.1376	121.928203	_	_	Step2ResRate7
39	Accession	2	262.200166	2.31	0.3021	Step2ResRate7
40	Error	2	113.510711	_	_	Step2ResRate7
41	Run*Accession	2	113.510711	0.85	0.4378	Step2ResRate7
42	Error: MS(Error)	32	2142.248143	_	_	Step2ResRate7
43	Run	1	626.908885	10.40	0.0729	Step2F1Rate1
44	Error	2.2287	134.385278	_	_	Step2F1Rate1
45	Accession	2	24.013415	0.20	0.8345	Step2F1Rate1
46	Error	2	121.047490	_	_	Step2F1Rate1
47	Run*Accession	2	121.047490	1.07	0.3543	Step2F1Rate1
48	Error: MS(Error)	33	1864.783571	_	_	Step2F1Rate1
49	Run	1	10.861667	0.19	0.6983	Step2F1Rate2

Cleth Weight - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error	2.3311	131.646826	_	_	Step2F1Rate2
51	Accession	2	142.289521	1.28	0.4379	Step2F1Rate2
52	Error	2	110.843459	_	_	Step2F1Rate2
53	Run*Accession	2	110.843459	0.75	0.4812	Step2F1Rate2
54	Error: MS(Error)	33	2445.615000	_	_	Step2F1Rate2
55	Run	1	1.517049	0.04	0.8576	Step2F1Rate3
56	Error	2.2787	85.992500	_	_	Step2F1Rate3
57	Accession	2	185.668398	2.47	0.2885	Step2F1Rate3
58	Error	2	75.296165	_	_	Step2F1Rate3
59	Run*Accession	2	75.296165	0.96	0.3921	Step2F1Rate3
60	Error: MS(Error)	34	1329.991508	_	_	Step2F1Rate3
61	Run	1	51.331987	1.30	0.3476	Step2F1Rate4
62	Error	2.6338	104.190079	_	_	Step2F1Rate4
63	Accession	2	74.266893	0.98	0.5056	Step2F1Rate4
64	Error	2	75.953942	_	_	Step2F1Rate4
65	Run*Accession	2	75.953942	0.69	0.5085	Step2F1Rate4
66	Error: MS(Error)	33	1815.442917	_	_	Step2F1Rate4
67	Run	1	0.788051	0.14	0.7197	Step2F1Rate5
68	Error	5.0515	27.624408	_	_	Step2F1Rate5
69	Accession	2	176.931194	25.02	0.0384	Step2F1Rate5
70	Error	2	7.070577	_	_	Step2F1Rate5
71	Run*Accession	2	7.070577	0.07	0.9365	Step2F1Rate5
72	Error: MS(Error)	30	1612.861429	_	_	Step2F1Rate5
73	Run	1	42.462621	2.46	0.2117	Step2F1Rate6
74	Error	3.1023	53.507172	_	_	Step2F1Rate6
75	Accession	2	74.528958	2.47	0.2885	Step2F1Rate6
76	Error	2	30.220189	_	_	Step2F1Rate6
77	Run*Accession	2	30.220189	0.38	0.6896	Step2F1Rate6
78	Error: MS(Error)	32	1286.127817	_	_	Step2F1Rate6
79	Run	1	8.979267	2.27	0.1988	Step2F1Rate7
80	Error	4.5044	17.846521	_	_	Step2F1Rate7
81	Accession	2	78.408106	14.23	0.0657	Step2F1Rate7
82	Error	2	5.510530	_	_	Step2F1Rate7
83	Run*Accession	2	5.510530	0.10	0.9036	Step2F1Rate7
84	Error: MS(Error)	32	866.718333	_	_	Step2F1Rate7

Cleth Weight - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	0.294000	0.02	0.8915	Step2bSusRate1
2	Error: MS(Error)	14	213.356000	_	_	Step2bSusRate1
3	Run	1	52.521008	0.76	0.3970	Step2bSusRate2
4	Error: MS(Error)	15	1036.094286	_	_	Step2bSusRate2
5	Run	1	3.082667	0.06	0.8152	Step2bSusRate3
6	Error: MS(Error)	14	760.697333	_	_	Step2bSusRate3
7	Run	1	25.938375	0.69	0.4189	Step2bSusRate4
8	Error: MS(Error)	14	523.551000	_	_	Step2bSusRate4
9	Run	1	0.546429	0.02	0.8874	Step2bSusRate5
10	Error: MS(Error)	15	395.033571	_	_	Step2bSusRate5
11	Run	1	0.272269	0.01	0.9251	Step2bSusRate6
12	Error: MS(Error)	15	447.197143	_	_	Step2bSusRate6
13	Run	1	1.536000	0.05	0.8222	Step2bSusRate7
14	Error: MS(Error)	14	410.264000	_	_	Step2bSusRate7

Cleth Weight - Step 3: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	1712.634699	2.82	0.2287	Step3ALLRate1
2	Error	2.111	1283.382325	_	_	Step3ALLRate1
3	Type	2	2792.152525	2.08	0.3251	Step3ALLRate1
4	Error: MS(Run*Type)	2	1345.062873	_	_	Step3ALLRate1
5	Run*Type	2	1345.062873	4.99	0.0089	Step3ALLRate1
6	Error: MS(Error)	88	11872	_	_	Step3ALLRate1
7	Run	1	337.398614	5.24	0.1164	Step3ALLRate2
8	Error	2.6795	172.371704	_	_	Step3ALLRate2
9	Type	2	221.631805	1.80	0.3571	Step3ALLRate2
10	Error: MS(Run*Type)	2	123.101158	_	_	Step3ALLRate2
11	Run*Type	2	123.101158	0.68	0.5077	Step3ALLRate2
12	Error: MS(Error)	89	8019.511976	_	_	Step3ALLRate2
13	Run	1	26.182043	0.35	0.6064	Step3ALLRate3
14	Error	2.4464	185.351172	_	_	Step3ALLRate3
15	Type	2	194.404592	1.24	0.4466	Step3ALLRate3
16	Error: MS(Run*Type)	2	156.898611	_	_	Step3ALLRate3
17	Run*Type	2	156.898611	1.37	0.2595	Step3ALLRate3
18	Error: MS(Error)	90	5155.747459	_	_	Step3ALLRate3
19	Run	1	254.242083	2.92	0.1981	Step3ALLRate4
20	Error	2.6472	230.577780	_	_	Step3ALLRate4
21	Type	2	390.209731	2.25	0.3076	Step3ALLRate4
22	Error: MS(Run*Type)	2	173.342905	_	_	Step3ALLRate4
23	Run*Type	2	173.342905	0.96	0.3860	Step3ALLRate4
24	Error: MS(Error)	90	8107.151967	_	_	Step3ALLRate4
25	Run	1	203.048276	0.73	0.4789	Step3ALLRate5
26	Error	2.0765	574.215150	_	_	Step3ALLRate5
27	Type	2	578.951024	0.98	0.5046	Step3ALLRate5
28	Error: MS(Run*Type)	2	589.692212	_	_	Step3ALLRate5
29	Run*Type	2	589.692212	4.56	0.0132	Step3ALLRate5
30	Error: MS(Error)	83	5365.907441	_	_	Step3ALLRate5
31	Run	1	385.567084	1.72	0.3130	Step3ALLRate6
32	Error	2.1375	479.711810	_	_	Step3ALLRate6
33	Type	2	216.116002	0.45	0.6884	Step3ALLRate6
34	Error: MS(Run*Type)	2	477.376002	_	_	Step3ALLRate6
35	Run*Type	2	477.376002	2.94	0.0580	Step3ALLRate6
36	Error: MS(Error)	87	7056.678761	_	_	Step3ALLRate6
37	Run	1	100.853164	1.06	0.4009	Step3ALLRate7
38	Error	2.2302	211.300178	_	_	Step3ALLRate7
39	Type	2	10.686271	0.05	0.9498	Step3ALLRate7
40	Error: MS(Run*Type)	2	202.221118	_	_	Step3ALLRate7
41	Run*Type	2	202.221118	2.27	0.1098	Step3ALLRate7
42	Error: MS(Error)	86	3836.526734	_	_	Step3ALLRate7

Seth Visual - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	101.072607	1.57	0.3298	Step1ResRate1
2	Error	2.1375	137.538770	_	_	Step1ResRate1
3	Accession	2	35.021768	0.19	0.8381	Step1ResRate1
4	Error	3.2651	306.617099	_	_	Step1ResRate1
5	Run*Accession	2	130.391251	10.84	0.0147	Step1ResRate1
6	Error	5.0721	30.499126	_	_	Step1ResRate1
7	Plant(Accession)	7	165.315699	4.85	0.1010	Step1ResRate1
8	Error	3.2131	15.637058	_	_	Step1ResRate1
9	Run*Plant(Accession)	3	14.155983	0.10	0.9577	Step1ResRate1
10	Error: MS(Error)	13	604.166667	_	_	Step1ResRate1
11	Run	1	315.530303	5.75	0.1304	Step1ResRate2
12	Error	2.1393	117.322727	_	_	Step1ResRate2
13	Accession	2	208.165363	1.47	0.4511	Step1ResRate2
14	Error	1.4214	100.778316	_	_	Step1ResRate2
15	Run*Accession	2	107.567070	0.96	0.4714	Step1ResRate2
16	Error	3.1721	177.323043	_	_	Step1ResRate2
17	Plant(Accession)	7	495.241152	1.27	0.4584	Step1ResRate2
18	Error	3.1039	172.955181	_	_	Step1ResRate2
19	Run*Plant(Accession)	4	231.143162	0.72	0.5927	Step1ResRate2
20	Error: MS(Error)	13	1041.666667	_	_	Step1ResRate2
21	Run	1	522.075021	12.24	0.0649	Step1ResRate3
22	Error	2.1655	92.337226	_	_	Step1ResRate3
23	Accession	2	54.330908	0.32	0.7484	Step1ResRate3
24	Error	2.9654	251.717707	_	_	Step1ResRate3
25	Run*Accession	2	79.386982	2.31	0.4186	Step1ResRate3
26	Error	1.0173	17.482414	_	_	Step1ResRate3
27	Plant(Accession)	6	301.285461	3.64	0.5106	Step1ResRate3
28	Error	0.5677	7.825168	_	_	Step1ResRate3
29	Run*Plant(Accession)	3	75.320513	0.32	0.8073	Step1ResRate3
30	Error: MS(Error)	12	927.083333	_	_	Step1ResRate3
31	Run	1	820.078539	1.50	0.3447	Step1ResRate4
32	Error	2.0103	1098.650067	_	_	Step1ResRate4
33	Accession	2	616.602148	0.30	0.7574	Step1ResRate4
34	Error	4.3794	4556.467699	_	_	Step1ResRate4
35	Run*Accession	2	1085.568557	4.33	0.1227	Step1ResRate4
36	Error	3.2115	402.975596	_	_	Step1ResRate4
37	Plant(Accession)	7	3781.472291	4.41	0.1279	Step1ResRate4
38	Error	2.9479	361.305414	_	_	Step1ResRate4
39	Run*Plant(Accession)	4	532.632576	0.46	0.7615	Step1ResRate4
40	Error: MS(Error)	12	3447.916667	_	_	Step1ResRate4
41	Run	1	122.324159	0.39	0.5959	Step1ResRate5
42	Error	1.9519	606.842245	_	_	Step1ResRate5
43	Accession	2	103.808570	0.14	0.8802	Step1ResRate5
44	Error	1.1621	422.612553	_	_	Step1ResRate5
45	Run*Accession	2	613.765337	2.09	0.2894	Step1ResRate5
46	Error	2.5702	377.849690	_	_	Step1ResRate5
47	Plant(Accession)	7	992.738095	0.96	0.5959	Step1ResRate5
48	Error	2.0279	298.423730	_	_	Step1ResRate5
49	Run*Plant(Accession)	3	440.773810	1.01	0.4260	Step1ResRate5

Seth Visual - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error: MS(Error)	11	1604.166667	_	_	Step1ResRate5
51	Run	1	101.828761	0.44	0.5825	Step1ResRate6
52	Error	1.8099	421.263514	_	_	Step1ResRate6
53	Accession	2	603.188489	1.12	0.5612	Step1ResRate6
54	Error	0.9645	260.794595	_	_	Step1ResRate6
55	Run*Accession	2	474.242424	1.27	0.4021	Step1ResRate6
56	Error	2.8674	534.089043	_	_	Step1ResRate6
57	Plant(Accession)	7	1599.674519	1.19	0.4914	Step1ResRate6
58	Error	2.8385	544.269211	_	_	Step1ResRate6
59	Run*Plant(Accession)	3	496.153846	5.92	0.0102	Step1ResRate6
60	Error: MS(Error)	12	335.416667	_	_	Step1ResRate6
61	Run	1	841.666667	64.20	<.0001	Step1ResRate7
62	Error	11.761	154.178979	_	_	Step1ResRate7
63	Accession	2	269.562709	0.62	0.5704	Step1ResRate7
64	Error	5.6484	1225.735421	_	_	Step1ResRate7
65	Run*Accession	2	8.117683	0.24	0.7918	Step1ResRate7
66	Error	7.0477	118.510576	_	_	Step1ResRate7
67	Plant(Accession)	6	1237.130995	16.92	0.0096	Step1ResRate7
68	Error	3.8267	46.640206	_	_	Step1ResRate7
69	Run*Plant(Accession)	3	32.532051	0.05	0.9830	Step1ResRate7
70	Error: MS(Error)	12	2441.666667	_	_	Step1ResRate7

Seth Visual - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	144.195275	1.38	0.3545	Step2ResRate1
2	Error	2.1417	224.173040	_	_	Step2ResRate1
3	Accession	2	69.438296	0.31	0.7648	Step2ResRate1
4	Error	2	225.776325	_	_	Step2ResRate1
5	Run*Accession	2	225.776325	3.33	0.0537	Step2ResRate1
6	Error: MS(Error)	23	779.761905	_	_	Step2ResRate1
7	Run	1	474.078675	13.41	0.0451	Step2ResRate2
8	Error	2.5805	91.252643	_	_	Step2ResRate2
9	Accession	2	293.339768	4.43	0.1841	Step2ResRate2
10	Error	2	66.184041	_	_	Step2ResRate2
11	Run*Accession	2	66.184041	0.47	0.6328	Step2ResRate2
12	Error: MS(Error)	24	1702.976190	_	_	Step2ResRate2
13	Run	1	885.536398	15.32	0.0521	Step2ResRate3
14	Error	2.168	125.301040	_	_	Step2ResRate3
15	Accession	2	78.223594	0.68	0.5957	Step2ResRate3
16	Error	2	115.260631	_	_	Step2ResRate3
17	Run*Accession	2	115.260631	0.93	0.4110	Step2ResRate3
18	Error: MS(Error)	21	1304.166667	_	_	Step2ResRate3
19	Run	1	675.008549	1.12	0.3976	Step2ResRate4
20	Error	2.0735	1250.236685	_	_	Step2ResRate4
21	Accession	2	396.889450	0.32	0.7549	Step2ResRate4
22	Error	2	1222.477184	_	_	Step2ResRate4
23	Run*Accession	2	1222.477184	1.77	0.1933	Step2ResRate4
24	Error: MS(Error)	23	7956.607143	_	_	Step2ResRate4
25	Run	1	125.973064	0.37	0.6024	Step2ResRate5
26	Error	2.0704	702.248685	_	_	Step2ResRate5
27	Accession	2	142.270124	0.21	0.8297	Step2ResRate5
28	Error	2	693.316149	_	_	Step2ResRate5
29	Run*Accession	2	693.316149	2.28	0.1267	Step2ResRate5
30	Error: MS(Error)	21	3188.273810	_	_	Step2ResRate5
31	Run	1	499.499563	1.50	0.3425	Step2ResRate6
32	Error	2.0563	685.012663	_	_	Step2ResRate6
33	Accession	2	154.251659	0.22	0.8165	Step2ResRate6
34	Error	2	686.199499	_	_	Step2ResRate6
35	Run*Accession	2	686.199499	3.17	0.0617	Step2ResRate6
36	Error: MS(Error)	22	2381.190476	_	_	Step2ResRate6
37	Run	1	959.557264	25.22	0.0031	Step2ResRate7
38	Error	5.4685	208.077488	_	_	Step2ResRate7
39	Accession	2	371.392600	7.53	0.1172	Step2ResRate7
40	Error	2	49.295992	_	_	Step2ResRate7
41	Run*Accession	2	49.295992	0.14	0.8720	Step2ResRate7
42	Error: MS(Error)	21	3755.714286	_	_	Step2ResRate7
43	Run	1	827.734559	15.34	0.0377	Step2F1Rate1
44	Error	2.6202	141.393995	_	_	Step2F1Rate1
45	Accession	2	37.202381	0.35	0.7401	Step2F1Rate1
46	Error	2	105.952381	_	_	Step2F1Rate1
47	Run*Accession	2	105.952381	0.86	0.4350	Step2F1Rate1
48	Error: MS(Error)	30	1856.845238	_	_	Step2F1Rate1
49	Run	1	226.927000	0.20	0.7004	Step2F1Rate2

Seth Visual - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error	2.0578	2387.234047	_	_	Step2F1Rate2
51	Accession	2	646.102180	0.27	0.7873	Step2F1Rate2
52	Error	2	2391.580351	_	_	Step2F1Rate2
53	Run*Accession	2	2391.580351	3.17	0.0557	Step2F1Rate2
54	Error: MS(Error)	31	11677	_	_	Step2F1Rate2
55	Run	1	2250.125313	8.99	0.0859	Step2F1Rate3
56	Error	2.1839	546.572429	_	_	Step2F1Rate3
57	Accession	2	108.255871	0.21	0.8242	Step2F1Rate3
58	Error	2	507.570939	_	_	Step2F1Rate3
59	Run*Accession	2	507.570939	1.33	0.2794	Step2F1Rate3
60	Error: MS(Error)	33	6317.857143	_	_	Step2F1Rate3
61	Run	1	2526.817043	35.28	0.0127	Step2F1Rate4
62	Error	2.7068	193.859139	_	_	Step2F1Rate4
63	Accession	2	574.204990	4.40	0.1850	Step2F1Rate4
64	Error	2	130.369374	_	_	Step2F1Rate4
65	Run*Accession	2	130.369374	0.36	0.6981	Step2F1Rate4
66	Error: MS(Error)	33	5921.428571	_	_	Step2F1Rate4
67	Run	1	1448.151629	5.66	0.1249	Step2F1Rate5
68	Error	2.2811	584.112269	_	_	Step2F1Rate5
69	Accession	2	383.427104	0.75	0.5699	Step2F1Rate5
70	Error	2	508.084638	_	_	Step2F1Rate5
71	Run*Accession	2	508.084638	0.88	0.4258	Step2F1Rate5
72	Error: MS(Error)	33	9567.857143	_	_	Step2F1Rate5
73	Run	1	1118.115347	12.26	0.0435	Step2F1Rate6
74	Error	2.8178	257.078553	_	_	Step2F1Rate6
75	Accession	2	1449.180048	8.62	0.1040	Step2F1Rate6
76	Error	2	168.182064	_	_	Step2F1Rate6
77	Run*Accession	2	168.182064	0.51	0.6077	Step2F1Rate6
78	Error: MS(Error)	32	5318.303571	_	_	Step2F1Rate6
79	Run	1	3105.375000	27.84	0.0224	Step2F1Rate7
80	Error	2.418	269.688111	_	_	Step2F1Rate7
81	Accession	2	564.535985	2.65	0.2743	Step2F1Rate7
82	Error	2	213.399621	_	_	Step2F1Rate7
83	Run*Accession	2	213.399621	0.52	0.5980	Step2F1Rate7
84	Error: MS(Error)	32	6534.375000	_	_	Step2F1Rate7

Seth Visual - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	485.378151	4.69	0.0469	Step2bSusRate1
2	Error: MS(Error)	15	1552.857143	_	_	Step2bSusRate1
3	Run	1	1398.403361	6.00	0.0271	Step2bSusRate2
4	Error: MS(Error)	15	3495.714286	_	_	Step2bSusRate2
5	Run	1	1983.750000	11.06	0.0050	Step2bSusRate3
6	Error: MS(Error)	14	2510.000000	_	_	Step2bSusRate3
7	Run	1	3130.168067	11.24	0.0044	Step2bSusRate4
8	Error: MS(Error)	15	4175.714286	_	_	Step2bSusRate4
9	Run	1	97.142857	0.47	0.5036	Step2bSusRate5
10	Error: MS(Error)	15	3102.857143	_	_	Step2bSusRate5
11	Run	1	355.042017	3.28	0.0900	Step2bSusRate6
12	Error: MS(Error)	15	1621.428571	_	_	Step2bSusRate6
13	Run	1	0	.	.	Step2bSusRate7
14	Error: MS(Error)	15	0	_	_	Step2bSusRate7

Seth Visual - Step 3: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	18.290323	0.03	0.8754	Step3ALLRate1
2	Error	2.0252	1177.868800	_	_	Step3ALLRate1
3	Type	2	786.623351	0.64	0.6099	Step3ALLRate1
4	Error: MS(Run*Type)	2	1229.743805	_	_	Step3ALLRate1
5	Run*Type	2	1229.743805	10.16	0.0001	Step3ALLRate1
6	Error: MS(Error)	76	4598.571429	_	_	Step3ALLRate1
7	Run	1	72.520232	0.07	0.8096	Step3ALLRate2
8	Error	2.0705	2013.142564	_	_	Step3ALLRate2
9	Type	2	3554.141399	1.74	0.3650	Step3ALLRate2
10	Error: MS(Run*Type)	2	2043.160674	_	_	Step3ALLRate2
11	Run*Type	2	2043.160674	3.95	0.0232	Step3ALLRate2
12	Error: MS(Error)	78	20168	_	_	Step3ALLRate2
13	Run	1	14.991221	0.01	0.9364	Step3ALLRate3
14	Error	2.0251	3748.372040	_	_	Step3ALLRate3
15	Type	2	9325.944499	2.33	0.3001	Step3ALLRate3
16	Error: MS(Run*Type)	2	3999.660575	_	_	Step3ALLRate3
17	Run*Type	2	3999.660575	13.92	<.0001	Step3ALLRate3
18	Error: MS(Error)	76	10920	_	_	Step3ALLRate3
19	Run	1	6588.354304	18.43	0.0419	Step3ALLRate4
20	Error	2.2108	790.235049	_	_	Step3ALLRate4
21	Type	2	7490.139806	10.26	0.0888	Step3ALLRate4
22	Error: MS(Run*Type)	2	729.682371	_	_	Step3ALLRate4
23	Run*Type	2	729.682371	1.42	0.2470	Step3ALLRate4
24	Error: MS(Error)	79	20250	_	_	Step3ALLRate4
25	Run	1	422.431371	0.56	0.5300	Step3ALLRate5
26	Error	2.0785	1570.283193	_	_	Step3ALLRate5
27	Type	2	10626	6.72	0.1296	Step3ALLRate5
28	Error: MS(Run*Type)	2	1581.695864	_	_	Step3ALLRate5
29	Run*Type	2	1581.695864	3.45	0.0366	Step3ALLRate5
30	Error: MS(Error)	77	17629	_	_	Step3ALLRate5
31	Run	1	1901.454086	21.34	0.0279	Step3ALLRate6
32	Error	2.511	223.708540	_	_	Step3ALLRate6
33	Type	2	10678	62.95	0.0156	Step3ALLRate6
34	Error: MS(Run*Type)	2	169.615257	_	_	Step3ALLRate6
35	Run*Type	2	169.615257	0.55	0.5771	Step3ALLRate6
36	Error: MS(Error)	77	11793	_	_	Step3ALLRate6
37	Run	1	2103.474790	4.19	0.1726	Step3ALLRate7
38	Error	2.0745	1040.983724	_	_	Step3ALLRate7
39	Type	2	5599.632314	5.34	0.1577	Step3ALLRate7
40	Error: MS(Run*Type)	2	1048.332939	_	_	Step3ALLRate7
41	Run*Type	2	1048.332939	3.46	0.0365	Step3ALLRate7
42	Error: MS(Error)	76	11516	_	_	Step3ALLRate7

Seth Weight - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	346.382874	0.22	0.6862	Step1ResRate1
2	Error	2.0588	3292.509140	_	_	Step1ResRate1
3	Accession	2	1758.128535	0.36	0.7301	Step1ResRate1
4	Error	2.2539	5460.289437	_	_	Step1ResRate1
5	Run*Accession	2	3254.986234	2.38	0.2338	Step1ResRate1
6	Error	3.1696	2167.468040	_	_	Step1ResRate1
7	Plant(Accession)	7	8668.802177	1.83	0.3709	Step1ResRate1
8	Error	2.3677	1603.126764	_	_	Step1ResRate1
9	Run*Plant(Accession)	3	2047.804444	0.93	0.4521	Step1ResRate1
10	Error: MS(Error)	13	9498.778333	_	_	Step1ResRate1
11	Run	1	984.492870	5.78	0.0917	Step1ResRate2
12	Error	3.1377	534.138780	_	_	Step1ResRate2
13	Accession	2	6776.275907	3.78	0.1395	Step1ResRate2
14	Error	3.3239	2983.267179	_	_	Step1ResRate2
15	Run*Accession	2	272.851330	0.39	0.7098	Step1ResRate2
16	Error	2.4846	858.903668	_	_	Step1ResRate2
17	Plant(Accession)	7	7427.571921	3.79	0.3124	Step1ResRate2
18	Error	1.3261	371.605402	_	_	Step1ResRate2
19	Run*Plant(Accession)	4	1608.136432	0.38	0.8221	Step1ResRate2
20	Error: MS(Error)	14	14979	_	_	Step1ResRate2
21	Run	1	136.498953	0.53	0.5045	Step1ResRate3
22	Error	4.2262	1086.411020	_	_	Step1ResRate3
23	Accession	2	391.765730	0.36	0.7624	Step1ResRate3
24	Error	0.986	534.000979	_	_	Step1ResRate3
25	Run*Accession	2	296.867160	1.26	0.8522	Step1ResRate3
26	Error	0.0971	11.426189	_	_	Step1ResRate3
27	Plant(Accession)	6	2492.801833	2.20	0.6958	Step1ResRate3
28	Error	0.2976	56.294601	_	_	Step1ResRate3
29	Run*Plant(Accession)	3	1309.881821	0.36	0.7855	Step1ResRate3
30	Error: MS(Error)	14	17166	_	_	Step1ResRate3
31	Run	1	5727.969833	15.44	0.0559	Step1ResRate4
32	Error	2.0699	767.738696	_	_	Step1ResRate4
33	Accession	2	111.311132	0.10	0.9100	Step1ResRate4
34	Error	2.7421	1563.896242	_	_	Step1ResRate4
35	Run*Accession	2	730.665803	2.60	0.2270	Step1ResRate4
36	Error	2.8647	402.451648	_	_	Step1ResRate4
37	Plant(Accession)	7	1885.285601	2.47	0.3966	Step1ResRate4
38	Error	1.3406	146.476861	_	_	Step1ResRate4
39	Run*Plant(Accession)	4	624.136917	0.38	0.8209	Step1ResRate4
40	Error: MS(Error)	14	5786.584167	_	_	Step1ResRate4
41	Run	1	252.797621	13.64	0.0471	Step1ResRate5
42	Error	2.4808	45.966029	_	_	Step1ResRate5
43	Accession	2	111.516024	30.48	0.9825	Step1ResRate5
44	Error	0.0036	0.006651	_	_	Step1ResRate5
45	Run*Accession	2	33.494031	0.50	0.6522	Step1ResRate5
46	Error	2.8859	97.147213	_	_	Step1ResRate5
47	Plant(Accession)	7	123.712051	0.59	0.7483	Step1ResRate5
48	Error	1.9057	56.815489	_	_	Step1ResRate5
49	Run*Plant(Accession)	4	147.571766	0.45	0.7731	Step1ResRate5

Seth Weight - Step 1: Run*Specific(Group) ANOVA for Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error: MS(Error)	13	1073.999167	_	_	Step1ResRate5
51	Run	1	841.187389	1.97	0.2946	Step1ResRate6
52	Error	2.0162	860.837462	_	_	Step1ResRate6
53	Accession	2	59.229588	0.04	0.9583	Step1ResRate6
54	Error	3.6266	2489.585326	_	_	Step1ResRate6
55	Run*Accession	2	863.123208	5.49	0.0891	Step1ResRate6
56	Error	3.3039	259.878885	_	_	Step1ResRate6
57	Plant(Accession)	6	1699.732064	3.60	0.1463	Step1ResRate6
58	Error	3.273	257.279193	_	_	Step1ResRate6
59	Run*Plant(Accession)	4	318.832393	0.87	0.5123	Step1ResRate6
60	Error: MS(Error)	12	1105.763333	_	_	Step1ResRate6
61	Run	1	661.166039	4.41	0.1643	Step1ResRate7
62	Error	2.1042	315.759007	_	_	Step1ResRate7
63	Accession	2	163.060963	0.33	0.7437	Step1ResRate7
64	Error	2.9159	724.086691	_	_	Step1ResRate7
65	Run*Accession	2	295.376838	1.80	0.3054	Step1ResRate7
66	Error	3.0127	246.596732	_	_	Step1ResRate7
67	Plant(Accession)	6	1011.529813	2.23	0.3232	Step1ResRate7
68	Error	2.2203	167.925868	_	_	Step1ResRate7
69	Run*Plant(Accession)	4	351.383689	0.51	0.7306	Step1ResRate7
70	Error: MS(Error)	12	2072.286667	_	_	Step1ResRate7

Seth Weight - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	12.661144	0.00	0.9581	Step2ResRate1
2	Error	2.0982	7648.463945	_	_	Step2ResRate1
3	Accession	2	4646.903989	0.58	0.6309	Step2ResRate1
4	Error	2	7944.242081	_	_	Step2ResRate1
5	Run*Accession	2	7944.242081	4.78	0.0183	Step2ResRate1
6	Error: MS(Error)	23	19100	_	_	Step2ResRate1
7	Run	1	414.859182	0.90	0.4211	Step2ResRate2
8	Error	2.6504	1221.858683	_	_	Step2ResRate2
9	Accession	2	6159.431756	7.20	0.1219	Step2ResRate2
10	Error	2	854.908199	_	_	Step2ResRate2
11	Run*Accession	2	854.908199	0.45	0.6433	Step2ResRate2
12	Error: MS(Error)	25	23799	_	_	Step2ResRate2
13	Run	1	792.593802	1.58	0.3247	Step2ResRate3
14	Error	2.2112	1106.073815	_	_	Step2ResRate3
15	Accession	2	419.197480	0.43	0.7000	Step2ResRate3
16	Error	2	978.105592	_	_	Step2ResRate3
17	Run*Accession	2	978.105592	0.54	0.5872	Step2ResRate3
18	Error: MS(Error)	23	20642	_	_	Step2ResRate3
19	Run	1	7423.390758	17.41	0.0472	Step2ResRate4
20	Error	2.1356	910.650000	_	_	Step2ResRate4
21	Accession	2	42.030555	0.05	0.9534	Step2ResRate4
22	Error	2	859.981431	_	_	Step2ResRate4
23	Run*Accession	2	859.981431	1.26	0.3011	Step2ResRate4
24	Error: MS(Error)	25	8531.751429	_	_	Step2ResRate4
25	Run	1	353.645227	5.33	0.1359	Step2ResRate5
26	Error	2.1978	145.951246	_	_	Step2ResRate5
27	Accession	2	229.267065	1.71	0.3692	Step2ResRate5
28	Error	2	134.183112	_	_	Step2ResRate5
29	Run*Accession	2	134.183112	1.22	0.3120	Step2ResRate5
30	Error: MS(Error)	24	1316.443452	_	_	Step2ResRate5
31	Run	1	665.146311	2.61	0.2409	Step2ResRate6
32	Error	2.1109	537.396917	_	_	Step2ResRate6
33	Accession	2	31.899849	0.06	0.9422	Step2ResRate6
34	Error	2	520.449170	_	_	Step2ResRate6
35	Run*Accession	2	520.449170	1.83	0.1838	Step2ResRate6
36	Error: MS(Error)	22	3126.278119	_	_	Step2ResRate6
37	Run	1	873.766345	5.60	0.1311	Step2ResRate7
38	Error	2.182	340.565142	_	_	Step2ResRate7
39	Accession	2	116.423897	0.37	0.7283	Step2ResRate7
40	Error	2	312.097051	_	_	Step2ResRate7
41	Run*Accession	2	312.097051	0.99	0.3858	Step2ResRate7
42	Error: MS(Error)	22	3450.868238	_	_	Step2ResRate7
43	Run	1	56.099852	0.07	0.8120	Step2F1Rate1
44	Error	2.567	2077.527214	_	_	Step2F1Rate1
45	Accession	2	1138.558973	0.70	0.5873	Step2F1Rate1
46	Error	2	1620.156079	_	_	Step2F1Rate1
47	Run*Accession	2	1620.156079	1.01	0.3766	Step2F1Rate1
48	Error: MS(Error)	31	24914	_	_	Step2F1Rate1
49	Run	1	22.650105	0.02	0.8970	Step2F1Rate2

Seth Weight - Step 2: Run*Group ANOVA for F1 and Res

Obs	Source	DF	SS	FValue	ProbF	TypeRate
50	Error	2.0273	2149.670768	_	_	Step2F1Rate2
51	Accession	2	103.865308	0.05	0.9541	Step2F1Rate2
52	Error	2	2159.731550	_	_	Step2F1Rate2
53	Run*Accession	2	2159.731550	3.72	0.0356	Step2F1Rate2
54	Error: MS(Error)	31	8992.293964	_	_	Step2F1Rate2
55	Run	1	289.564524	0.96	0.4117	Step2F1Rate3
56	Error	2.5543	774.433859	_	_	Step2F1Rate3
57	Accession	2	2571.963927	4.53	0.1810	Step2F1Rate3
58	Error	2	568.292420	_	_	Step2F1Rate3
59	Run*Accession	2	568.292420	0.46	0.6373	Step2F1Rate3
60	Error: MS(Error)	33	20533	_	_	Step2F1Rate3
61	Run	1	1886.755769	7.00	0.1077	Step2F1Rate4
62	Error	2.1865	589.607882	_	_	Step2F1Rate4
63	Accession	2	624.854941	1.11	0.4748	Step2F1Rate4
64	Error	2	564.909921	_	_	Step2F1Rate4
65	Run*Accession	2	564.909921	2.09	0.1406	Step2F1Rate4
66	Error: MS(Error)	32	4331.168988	_	_	Step2F1Rate4
67	Run	1	6.196738	0.47	0.5420	Step2F1Rate5
68	Error	2.9417	38.553170	_	_	Step2F1Rate5
69	Accession	2	253.288716	10.80	0.0847	Step2F1Rate5
70	Error	2	23.443471	_	_	Step2F1Rate5
71	Run*Accession	2	23.443471	0.40	0.6722	Step2F1Rate5
72	Error: MS(Error)	31	903.163810	_	_	Step2F1Rate5
73	Run	1	3.239359	0.11	0.7625	Step2F1Rate6
74	Error	2.602	74.892743	_	_	Step2F1Rate6
75	Accession	2	27.367320	0.50	0.6687	Step2F1Rate6
76	Error	2	55.241866	_	_	Step2F1Rate6
77	Run*Accession	2	55.241866	0.67	0.5167	Step2F1Rate6
78	Error: MS(Error)	32	1311.197560	_	_	Step2F1Rate6
79	Run	1	34.366629	0.51	0.5465	Step2F1Rate7
80	Error	2.132	144.688188	_	_	Step2F1Rate7
81	Accession	2	106.363697	0.77	0.5655	Step2F1Rate7
82	Error	2	138.410795	_	_	Step2F1Rate7
83	Run*Accession	2	138.410795	1.63	0.2123	Step2F1Rate7
84	Error: MS(Error)	32	1360.908036	_	_	Step2F1Rate7

Seth Weight - Step 2b: Run ANOVA for ATx623 (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	3660.492782	6.31	0.0240	Step2bSusRate1
2	Error: MS(Error)	15	8704.429571	_	_	Step2bSusRate1
3	Run	1	7958.311563	13.22	0.0024	Step2bSusRate2
4	Error: MS(Error)	15	9032.553143	_	_	Step2bSusRate2
5	Run	1	953.610667	10.87	0.0053	Step2bSusRate3
6	Error: MS(Error)	14	1227.829333	_	_	Step2bSusRate3
7	Run	1	167.560333	3.15	0.0995	Step2bSusRate4
8	Error: MS(Error)	13	692.273000	_	_	Step2bSusRate4
9	Run	1	42.883034	2.27	0.1529	Step2bSusRate5
10	Error: MS(Error)	15	283.738143	_	_	Step2bSusRate5
11	Run	1	41.080008	1.43	0.2497	Step2bSusRate6
12	Error: MS(Error)	15	429.635286	_	_	Step2bSusRate6
13	Run	1	8.252782	0.23	0.6384	Step2bSusRate7
14	Error: MS(Error)	15	538.049571	_	_	Step2bSusRate7

Seth Weight - Step 3: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	3310.556829	2.10	0.2763	Step3ALLRate1
2	Error	2.1463	3384.360232	_	_	Step3ALLRate1
3	Type	2	19995	6.16	0.1397	Step3ALLRate1
4	Error: MS(Run*Type)	2	3247.913591	_	_	Step3ALLRate1
5	Run*Type	2	3247.913591	1.86	0.1624	Step3ALLRate1
6	Error: MS(Error)	77	67186	_	_	Step3ALLRate1
7	Run	1	5132.829782	1.79	0.3098	Step3ALLRate2
8	Error	2.0622	5928.190257	_	_	Step3ALLRate2
9	Type	2	22686	3.74	0.2110	Step3ALLRate2
10	Error: MS(Run*Type)	2	6068.190436	_	_	Step3ALLRate2
11	Run*Type	2	6068.190436	4.65	0.0124	Step3ALLRate2
12	Error: MS(Error)	79	51575	_	_	Step3ALLRate2
13	Run	1	2350.457538	10.37	0.0416	Step3ALLRate3
14	Error	3.3478	758.941198	_	_	Step3ALLRate3
15	Type	2	24870	64.95	0.0152	Step3ALLRate3
16	Error: MS(Run*Type)	2	382.933478	_	_	Step3ALLRate3
17	Run*Type	2	382.933478	0.32	0.7284	Step3ALLRate3
18	Error: MS(Error)	78	46932	_	_	Step3ALLRate3
19	Run	1	6777.580872	6.54	0.1193	Step3ALLRate4
20	Error	2.0937	2168.814553	_	_	Step3ALLRate4
21	Type	2	7249.646306	3.16	0.2403	Step3ALLRate4
22	Error: MS(Run*Type)	2	2293.419533	_	_	Step3ALLRate4
23	Run*Type	2	2293.419533	5.73	0.0048	Step3ALLRate4
24	Error: MS(Error)	78	15619	_	_	Step3ALLRate4
25	Run	1	327.714942	3.74	0.1855	Step3ALLRate5
26	Error	2.1219	186.006058	_	_	Step3ALLRate5
27	Type	2	71.783742	0.39	0.7171	Step3ALLRate5
28	Error: MS(Run*Type)	2	181.963742	_	_	Step3ALLRate5
29	Run*Type	2	181.963742	2.30	0.1071	Step3ALLRate5
30	Error: MS(Error)	78	3086.434008	_	_	Step3ALLRate5
31	Run	1	332.383236	1.24	0.3779	Step3ALLRate6
32	Error	2.0687	554.077988	_	_	Step3ALLRate6
33	Type	2	217.396619	0.39	0.7210	Step3ALLRate6
34	Error: MS(Run*Type)	2	561.915899	_	_	Step3ALLRate6
35	Run*Type	2	561.915899	3.92	0.0238	Step3ALLRate6
36	Error: MS(Error)	77	5512.292611	_	_	Step3ALLRate6
37	Run	1	374.902981	2.92	0.2202	Step3ALLRate7
38	Error	2.1588	276.876985	_	_	Step3ALLRate7
39	Type	2	485.439119	1.85	0.3514	Step3ALLRate7
40	Error: MS(Run*Type)	2	263.055380	_	_	Step3ALLRate7
41	Run*Type	2	263.055380	1.68	0.1930	Step3ALLRate7
42	Error: MS(Error)	77	6026.307291	_	_	Step3ALLRate7

Seth Visual - Step 3b: Run*Type ANOVA for Everything Except SusR2

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	2	487.142857	3.75	0.0329	Step3bRate1
2	Error	37	2402.857143	_	_	Step3bRate1
3	Corrected Total	39	2890.000000	_	_	Step3bRate1
4	Model	2	603.789391	1.65	0.2052	Step3bRate2
5	Error	37	6756.210609	_	_	Step3bRate2
6	Corrected Total	39	7360.000000	_	_	Step3bRate2
7	Model	2	909.386447	3.69	0.0347	Step3bRate3
8	Error	36	4430.357143	_	_	Step3bRate3
9	Corrected Total	38	5339.743590	_	_	Step3bRate3
10	Model	2	1627.101290	3.41	0.0435	Step3bRate4
11	Error	38	9071.679198	_	_	Step3bRate4
12	Corrected Total	40	10698.780488	_	_	Step3bRate4
13	Model	2	5152.149605	7.10	0.0025	Step3bRate5
14	Error	36	13064.517062	_	_	Step3bRate5
15	Corrected Total	38	18216.666667	_	_	Step3bRate5
16	Model	2	4839.300977	13.42	<.0001	Step3bRate6
17	Error	36	6491.468254	_	_	Step3bRate6
18	Corrected Total	38	11330.769231	_	_	Step3bRate6
19	Model	2	4255.116959	11.21	0.0002	Step3bRate7
20	Error	35	6640.277778	_	_	Step3bRate7
21	Corrected Total	37	10895.394737	_	_	Step3bRate7

Seth Visual - Step 3c: Type ANOVA for Everything at Run 1

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	2	1768.571429	15.71	<.0001	Step3cRate1
2	Error	39	2195.714286	_	_	Step3cRate1
3	Corrected Total	41	3964.285714	_	_	Step3cRate1
4	Model	2	5452.207792	8.33	0.0009	Step3cRate2
5	Error	41	13411.428571	_	_	Step3cRate2
6	Corrected Total	43	18863.636364	_	_	Step3cRate2
7	Model	2	15387.906977	47.42	<.0001	Step3cRate3
8	Error	40	6490.000000	_	_	Step3cRate3
9	Corrected Total	42	21877.906977	_	_	Step3cRate3
10	Model	2	7226.688312	13.25	<.0001	Step3cRate4
11	Error	41	11177.857143	_	_	Step3cRate4
12	Corrected Total	43	18404.545455	_	_	Step3cRate4
13	Model	2	7249.529221	32.56	<.0001	Step3cRate5
14	Error	41	4564.107143	_	_	Step3cRate5
15	Corrected Total	43	11813.636364	_	_	Step3cRate5
16	Model	2	6112.207792	23.64	<.0001	Step3cRate6
17	Error	41	5301.428571	_	_	Step3cRate6
18	Corrected Total	43	11413.636364	_	_	Step3cRate6
19	Model	2	1949.074675	8.20	0.0010	Step3cRate7
20	Error	41	4875.357143	_	_	Step3cRate7
21	Corrected Total	43	6824.431818	_	_	Step3cRate7

Seth Visual - Step 3d: Type ANOVA for Resistant and F1 at Run 1

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	1	440.000000	6.79	0.0140	Step3dRate1
2	Error	31	2010.000000	_	_	Step3dRate1
3	Corrected Total	32	2450.000000	_	_	Step3dRate1
4	Model	1	602.230949	3.08	0.0894	Step3dRate2
5	Error	31	6070.496324	_	_	Step3dRate2
6	Corrected Total	32	6672.727273	_	_	Step3dRate2
7	Model	1	543.885281	6.80	0.0139	Step3dRate3
8	Error	31	2480.357143	_	_	Step3dRate3
9	Corrected Total	32	3024.242424	_	_	Step3dRate3
10	Model	1	88.299794	0.35	0.5561	Step3dRate4
11	Error	32	7985.964912	_	_	Step3dRate4
12	Corrected Total	33	8074.264706	_	_	Step3dRate4
13	Model	1	315.840081	0.82	0.3717	Step3dRate5
14	Error	30	11521.659919	_	_	Step3dRate5
15	Corrected Total	31	11837.500000	_	_	Step3dRate5
16	Model	1	10.429067	0.06	0.8016	Step3dRate6
17	Error	30	4870.039683	_	_	Step3dRate6
18	Corrected Total	31	4880.468750	_	_	Step3dRate6
19	Model	1	308.109319	1.35	0.2555	Step3dRate7
20	Error	29	6640.277778	_	_	Step3dRate7
21	Corrected Total	30	6948.387097	_	_	Step3dRate7

Seth Visual - Step 3e: Type ANOVA for Resistant and F1 at Run 2

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	1	11.160714	0.32	0.5739	Step3eRate1
2	Error	30	1035.714286	_	_	Step3eRate1
3	Corrected Total	31	1046.875000	_	_	Step3eRate1
4	Model	1	1301.512605	3.93	0.0561	Step3eRate2
5	Error	32	10601.428571	_	_	Step3eRate2
6	Corrected Total	33	11902.941176	_	_	Step3eRate2
7	Model	1	283.636364	1.48	0.2325	Step3eRate3
8	Error	31	5930.000000	_	_	Step3eRate3
9	Corrected Total	32	6213.636364	_	_	Step3eRate3
10	Model	1	859.201681	3.40	0.0745	Step3eRate4
11	Error	32	8087.857143	_	_	Step3eRate4
12	Corrected Total	33	8947.058824	_	_	Step3eRate4
13	Model	1	1492.951681	15.90	0.0004	Step3eRate5
14	Error	32	3004.107143	_	_	Step3eRate5
15	Corrected Total	33	4497.058824	_	_	Step3eRate5
16	Model	1	454.453782	2.74	0.1074	Step3eRate6
17	Error	32	5301.428571	_	_	Step3eRate6
18	Corrected Total	33	5755.882353	_	_	Step3eRate6
19	Model	1	1243.025210	8.16	0.0075	Step3eRate7
20	Error	32	4875.357143	_	_	Step3eRate7
21	Corrected Total	33	6118.382353	_	_	Step3eRate7

Seth Weight - Step 3b: Run*Type ANOVA for Everything Except SusR2

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	2	5793.61843	2.17	0.1287	Step3bRate1
2	Error	37	49436.91757	_	_	Step3bRate1
3	Corrected Total	39	55230.53600	_	_	Step3bRate1
4	Model	2	5903.47996	2.79	0.0738	Step3bRate2
5	Error	38	40148.95126	_	_	Step3bRate2
6	Corrected Total	40	46052.43122	_	_	Step3bRate2
7	Model	2	11829.03454	7.44	0.0019	Step3bRate3
8	Error	38	30213.17570	_	_	Step3bRate3
9	Corrected Total	40	42042.21024	_	_	Step3bRate3
10	Model	2	8601.58546	13.31	<.0001	Step3bRate4
11	Error	37	11952.50429	_	_	Step3bRate4
12	Corrected Total	39	20554.08975	_	_	Step3bRate4
13	Model	2	115.48531	1.10	0.3439	Step3bRate5
14	Error	37	1944.37244	_	_	Step3bRate5
15	Corrected Total	39	2059.85775	_	_	Step3bRate5
16	Model	2	364.10669	1.55	0.2258	Step3bRate6
17	Error	36	4224.66254	_	_	Step3bRate6
18	Corrected Total	38	4588.76923	_	_	Step3bRate6
19	Model	2	724.17100	2.74	0.0773	Step3bRate7
20	Error	39	5161.04805	_	_	Step3bRate7
21	Corrected Total	41	5885.21905	_	_	Step3bRate7

Seth Weight - Step 3c: Type ANOVA for Everything at Run 1

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	2	19826.00045	22.34	<.0001	Step3cRate1
2	Error	40	17749.10141	_	_	Step3cRate1
3	Corrected Total	42	37575.10186	_	_	Step3cRate1
4	Model	2	25980.53736	46.61	<.0001	Step3cRate2
5	Error	41	11426.44150	_	_	Step3cRate2
6	Corrected Total	43	37406.97886	_	_	Step3cRate2
7	Model	2	14911.19816	17.84	<.0001	Step3cRate3
8	Error	40	16718.43300	_	_	Step3cRate3
9	Corrected Total	42	31629.63116	_	_	Step3cRate3
10	Model	2	778.56236	4.35	0.0193	Step3cRate4
11	Error	41	3666.82764	_	_	Step3cRate4
12	Corrected Total	43	4445.39000	_	_	Step3cRate4
13	Model	2	142.06638	2.55	0.0904	Step3cRate5
14	Error	41	1142.06157	_	_	Step3cRate5
15	Corrected Total	43	1284.12795	_	_	Step3cRate5
16	Model	2	423.70879	6.75	0.0029	Step3cRate6
17	Error	41	1287.63007	_	_	Step3cRate6
18	Corrected Total	43	1711.33886	_	_	Step3cRate6
19	Model	2	54.93978	1.21	0.3105	Step3cRate7
20	Error	38	865.25925	_	_	Step3cRate7
21	Corrected Total	40	920.19902	_	_	Step3cRate7

Seth Weight - Step 3d: Type ANOVA for Resistant and F1 at Run 1

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	1	2050.27282	1.45	0.2373	Step3dRate1
2	Error	31	43764.26900	_	_	Step3dRate1
3	Corrected Total	32	45814.54182	_	_	Step3dRate1
4	Model	1	4332.42471	4.18	0.0493	Step3dRate2
5	Error	32	33186.65412	_	_	Step3dRate2
6	Corrected Total	33	37519.07882	_	_	Step3dRate2
7	Model	1	5892.95663	6.56	0.0152	Step3dRate3
8	Error	33	29666.30737	_	_	Step3dRate3
9	Corrected Total	34	35559.26400	_	_	Step3dRate3
10	Model	1	6485.73514	18.51	0.0001	Step3dRate4
11	Error	33	11562.81229	_	_	Step3dRate4
12	Corrected Total	34	18048.54743	_	_	Step3dRate4
13	Model	1	65.57440	1.07	0.3085	Step3dRate5
14	Error	31	1896.47529	_	_	Step3dRate5
15	Corrected Total	32	1962.04970	_	_	Step3dRate5
16	Model	1	247.66050	1.87	0.1811	Step3dRate6
17	Error	30	3964.04825	_	_	Step3dRate6
18	Corrected Total	31	4211.70875	_	_	Step3dRate6
19	Model	1	434.12224	2.86	0.1001	Step3dRate7
20	Error	33	5003.73947	_	_	Step3dRate7
21	Corrected Total	34	5437.86171	_	_	Step3dRate7

Seth Weight - Step 3e: Type ANOVA for Resistant and F1 at Run 2

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	1	2.41837	0.01	0.9436	Step3eRate1
2	Error	31	14717.32041	_	_	Step3eRate1
3	Corrected Total	32	14719.73879	_	_	Step3eRate1
4	Model	1	1431.65832	4.90	0.0342	Step3eRate2
5	Error	32	9356.18550	_	_	Step3eRate2
6	Corrected Total	33	10787.84382	_	_	Step3eRate2
7	Model	1	2749.24315	5.31	0.0280	Step3eRate3
8	Error	31	16037.47200	_	_	Step3eRate3
9	Corrected Total	32	18786.71515	_	_	Step3eRate3
10	Model	1	746.25600	7.10	0.0120	Step3eRate4
11	Error	32	3364.24664	_	_	Step3eRate4
12	Corrected Total	33	4110.50265	_	_	Step3eRate4
13	Model	1	115.72061	4.09	0.0517	Step3eRate5
14	Error	32	906.22057	_	_	Step3eRate5
15	Corrected Total	33	1021.94118	_	_	Step3eRate5
16	Model	1	315.18034	9.02	0.0052	Step3eRate6
17	Error	32	1118.60907	_	_	Step3eRate6
18	Corrected Total	33	1433.78941	_	_	Step3eRate6
19	Model	1	0.17530	0.01	0.9191	Step3eRate7
20	Error	29	484.51825	_	_	Step3eRate7
21	Corrected Total	30	484.69355	_	_	Step3eRate7

Appendix B - Supplemental Information for Chapter 3

Appendix B1. Dose Response Data

Run	Type	Herbicide	SASrate	Rate	Dose	Rep	Dry	Control	Percent	Score
1	Tx623	Nicosulfuron	1	0.03125	1.81	7	0.381	0.613	62.2	90
1	Tx623	Nicosulfuron	1	0.03125	1.81	8	0.227	0.522	43.5	75
1	Tx623	Nicosulfuron	1	0.03125	1.81	9	0.247	0.732	33.7	85
1	Tx623	Nicosulfuron	1	0.03125	1.81	10	0.390	0.495	78.9	90
1	Tx623	Nicosulfuron	1	0.03125	1.81	11	0.118	0.469	25.2	70
1	Tx623	Nicosulfuron	1	0.03125	1.81	12	0.300	0.646	46.4	100
1	TW	Nicosulfuron	1	0.03125	1.81	1	0.594	0.565	105.2	100
1	TW	Nicosulfuron	1	0.03125	1.81	2	0.525	0.539	97.4	100
1	TW	Nicosulfuron	1	0.03125	1.81	3	0.644	0.541	119.1	95
1	TW	Nicosulfuron	1	0.03125	1.81	4	0.658	0.566	116.4	100
1	TW	Nicosulfuron	1	0.03125	1.81	5	0.537	0.583	92.1	100
1	TW	Nicosulfuron	1	0.03125	1.81	6	0.652	0.656	99.4	95
1	Tx623	Nicosulfuron	2	0.0625	2.17	7	0.130	0.613	21.2	80
1	Tx623	Nicosulfuron	2	0.0625	2.17	8	0.177	0.522	33.9	85
1	Tx623	Nicosulfuron	2	0.0625	2.17	9	0.250	0.732	34.2	75
1	Tx623	Nicosulfuron	2	0.0625	2.17	10	0.182	0.495	36.8	75
1	Tx623	Nicosulfuron	2	0.0625	2.17	11	0.276	0.469	58.9	60
1	Tx623	Nicosulfuron	2	0.0625	2.17	12	0.109	0.646	16.9	50
1	TW	Nicosulfuron	2	0.0625	2.17	1	0.684	0.565	121.2	100
1	TW	Nicosulfuron	2	0.0625	2.17	2	0.638	0.539	118.4	100
1	TW	Nicosulfuron	2	0.0625	2.17	3	0.743	0.541	137.5	100
1	TW	Nicosulfuron	2	0.0625	2.17	4	0.655	0.566	115.8	95
1	TW	Nicosulfuron	2	0.0625	2.17	5	0.536	0.583	91.9	95
1	TW	Nicosulfuron	2	0.0625	2.17	6	0.522	0.656	79.6	95
1	Tx623	Nicosulfuron	3	0.125	4.34	7	0.304	0.613	49.6	85
1	Tx623	Nicosulfuron	3	0.125	4.34	8	0.638	0.522	122.2	100
1	Tx623	Nicosulfuron	3	0.125	4.34	9	0.395	0.732	54.0	100
1	Tx623	Nicosulfuron	3	0.125	4.34	10	0.283	0.495	57.2	75
1	Tx623	Nicosulfuron	3	0.125	4.34	11	0.390	0.469	83.2	80
1	Tx623	Nicosulfuron	3	0.125	4.34	12	0.257	0.646	39.8	90
1	TW	Nicosulfuron	3	0.125	4.34	1	0.636	0.565	112.7	100
1	TW	Nicosulfuron	3	0.125	4.34	2	0.455	0.539	84.4	80
1	TW	Nicosulfuron	3	0.125	4.34	3	0.580	0.541	107.3	100
1	TW	Nicosulfuron	3	0.125	4.34	4	0.822	0.566	145.4	95
1	TW	Nicosulfuron	3	0.125	4.34	5	0.781	0.583	133.9	95
1	TW	Nicosulfuron	3	0.125	4.34	6	0.451	0.656	68.8	95
1	Tx623	Nicosulfuron	4	0.25	8.69	7	0.142	0.613	23.2	80
1	Tx623	Nicosulfuron	4	0.25	8.69	8	0.119	0.522	22.8	100
1	Tx623	Nicosulfuron	4	0.25	8.69	9	0.102	0.732	13.9	70
1	Tx623	Nicosulfuron	4	0.25	8.69	10	0.322	0.495	65.1	70
1	Tx623	Nicosulfuron	4	0.25	8.69	11	0.132	0.469	28.2	50
1	Tx623	Nicosulfuron	4	0.25	8.69	12	0.142	0.646	22.0	60
1	TW	Nicosulfuron	4	0.25	8.69	1	0.671	0.565	118.9	100
1	TW	Nicosulfuron	4	0.25	8.69	2	0.592	0.539	109.8	100
1	TW	Nicosulfuron	4	0.25	8.69	3	0.605	0.541	111.9	95
1	TW	Nicosulfuron	4	0.25	8.69	4	0.695	0.566	122.9	100
1	TW	Nicosulfuron	4	0.25	8.69	5	0.556	0.583	95.3	95
1	TW	Nicosulfuron	4	0.25	8.69	6	0.425	0.656	64.8	95
1	Tx623	Nicosulfuron	5	0.5	17.4	7	0.085	0.613	13.9	60
1	Tx623	Nicosulfuron	5	0.5	17.4	8	0.068	0.522	13.0	50
1	Tx623	Nicosulfuron	5	0.5	17.4	9	0.064	0.732	8.7	50
1	Tx623	Nicosulfuron	5	0.5	17.4	10	0.074	0.495	15.0	50
1	Tx623	Nicosulfuron	5	0.5	17.4	11	0.079	0.469	16.9	40
1	Tx623	Nicosulfuron	5	0.5	17.4	12	0.085	0.646	13.2	30

1	TW	Nicosulfuron	5	0.5	17.4	1	0.686	0.565	121.5	100
1	TW	Nicosulfuron	5	0.5	17.4	2	0.712	0.539	132.1	100
1	TW	Nicosulfuron	5	0.5	17.4	3	0.629	0.541	116.4	100
1	TW	Nicosulfuron	5	0.5	17.4	4	0.620	0.566	109.6	100
1	TW	Nicosulfuron	5	0.5	17.4	5	0.535	0.583	91.7	95
1	TW	Nicosulfuron	5	0.5	17.4	6	0.538	0.656	82.0	95
1	Tx623	Nicosulfuron	6	1	34.7	7	0.080	0.613	13.1	30
1	Tx623	Nicosulfuron	6	1	34.7	8	0.071	0.522	13.6	40
1	Tx623	Nicosulfuron	6	1	34.7	9	0.036	0.732	4.9	10
1	Tx623	Nicosulfuron	6	1	34.7	10	0.077	0.495	15.6	30
1	Tx623	Nicosulfuron	6	1	34.7	11	0.082	0.469	17.5	20
1	Tx623	Nicosulfuron	6	1	34.7	12	0.059	0.646	9.1	25
1	TW	Nicosulfuron	6	1	34.7	1	0.615	0.565	108.9	100
1	TW	Nicosulfuron	6	1	34.7	2	0.527	0.539	97.8	100
1	TW	Nicosulfuron	6	1	34.7	3	0.345	0.541	63.8	100
1	TW	Nicosulfuron	6	1	34.7	4	0.619	0.566	109.5	100
1	TW	Nicosulfuron	6	1	34.7	5	0.681	0.583	116.7	100
1	TW	Nicosulfuron	6	1	34.7	6	0.630	0.656	96.0	95
1	Tx623	Nicosulfuron	7	2	69.5	7	0.081	0.613	13.2	30
1	Tx623	Nicosulfuron	7	2	69.5	8	0.091	0.522	17.4	10
1	Tx623	Nicosulfuron	7	2	69.5	9	0.103	0.732	14.1	20
1	Tx623	Nicosulfuron	7	2	69.5	10	0.046	0.495	9.3	0
1	Tx623	Nicosulfuron	7	2	69.5	11	0.041	0.469	8.8	20
1	Tx623	Nicosulfuron	7	2	69.5	12	0.096	0.646	14.9	25
1	TW	Nicosulfuron	7	2	69.5	1	0.679	0.565	120.3	100
1	TW	Nicosulfuron	7	2	69.5	2	0.552	0.539	102.4	100
1	TW	Nicosulfuron	7	2	69.5	3	0.632	0.541	116.9	95
1	TW	Nicosulfuron	7	2	69.5	4	0.772	0.566	136.5	100
1	TW	Nicosulfuron	7	2	69.5	5	0.512	0.583	87.8	95
1	TW	Nicosulfuron	7	2	69.5	6	0.653	0.656	99.5	95
1	Tx623	Nicosulfuron	8	4	139	7	0.076	0.613	12.4	20
1	Tx623	Nicosulfuron	8	4	139	8	0.093	0.522	17.8	0
1	Tx623	Nicosulfuron	8	4	139	9	0.079	0.732	10.8	5
1	Tx623	Nicosulfuron	8	4	139	10	0.063	0.495	12.7	5
1	Tx623	Nicosulfuron	8	4	139	11	0.096	0.469	20.5	10
1	Tx623	Nicosulfuron	8	4	139	12	0.050	0.646	7.7	20
1	TW	Nicosulfuron	8	4	139	1	0.698	0.565	123.6	100
1	TW	Nicosulfuron	8	4	139	2	0.418	0.539	77.6	100
1	TW	Nicosulfuron	8	4	139	3	0.548	0.541	101.4	100
1	TW	Nicosulfuron	8	4	139	4	0.475	0.566	84.0	100
1	TW	Nicosulfuron	8	4	139	5	0.632	0.583	108.3	100
1	TW	Nicosulfuron	8	4	139	6	0.553	0.656	84.3	90
1	Tx623	Nicosulfuron	9	8	278	7	0.084	0.613	13.7	10
1	Tx623	Nicosulfuron	9	8	278	8	0.060	0.522	11.5	0
1	Tx623	Nicosulfuron	9	8	278	9	0.089	0.732	12.2	5
1	Tx623	Nicosulfuron	9	8	278	10	0.088	0.495	17.8	5
1	Tx623	Nicosulfuron	9	8	278	11	0.052	0.469	11.1	5
1	Tx623	Nicosulfuron	9	8	278	12	0.076	0.646	11.8	15
1	TW	Nicosulfuron	9	8	278	1	0.679	0.565	120.3	100
1	TW	Nicosulfuron	9	8	278	2	0.648	0.539	120.2	95
1	TW	Nicosulfuron	9	8	278	3	0.514	0.541	95.1	90
1	TW	Nicosulfuron	9	8	278	4	0.765	0.566	135.3	100
1	TW	Nicosulfuron	9	8	278	5	0.759	0.583	130.1	100
1	TW	Nicosulfuron	9	8	278	6	0.657	0.656	100.2	95
1	Tx623	Imazapyr	1	0.03125	0.701	7	0.527	0.613	86.0	95
1	Tx623	Imazapyr	1	0.03125	0.701	8	0.382	0.522	73.2	80
1	Tx623	Imazapyr	1	0.03125	0.701	9	0.563	0.732	76.9	100
1	Tx623	Imazapyr	1	0.03125	0.701	10	0.457	0.495	92.4	100
1	Tx623	Imazapyr	1	0.03125	0.701	11	0.651	0.469	139.0	100
1	Tx623	Imazapyr	1	0.03125	0.701	12	0.583	0.646	90.2	100
1	TW	Imazapyr	1	0.03125	0.701	1	0.650	0.565	115.1	100
1	TW	Imazapyr	1	0.03125	0.701	2	0.689	0.539	127.8	100

1	TW	Imazapyr	1	0.03125	0.701	3	0.455	0.541	84.2	100
1	TW	Imazapyr	1	0.03125	0.701	4	0.715	0.566	126.4	100
1	TW	Imazapyr	1	0.03125	0.701	5	0.691	0.583	118.5	100
1	TW	Imazapyr	1	0.03125	0.701	6	0.540	0.656	82.3	100
1	Tx623	Imazapyr	2	0.0625	1.40	7	0.715	0.613	116.7	95
1	Tx623	Imazapyr	2	0.0625	1.40	8	0.404	0.522	77.4	80
1	Tx623	Imazapyr	2	0.0625	1.40	9	0.499	0.732	68.2	100
1	Tx623	Imazapyr	2	0.0625	1.40	10	0.584	0.495	118.1	100
1	Tx623	Imazapyr	2	0.0625	1.40	11	0.588	0.469	125.5	100
1	Tx623	Imazapyr	2	0.0625	1.40	12	0.705	0.646	109.1	100
1	TW	Imazapyr	2	0.0625	1.40	1	0.587	0.565	104.0	100
1	TW	Imazapyr	2	0.0625	1.40	2	0.619	0.539	114.8	100
1	TW	Imazapyr	2	0.0625	1.40	3	0.662	0.541	122.5	95
1	TW	Imazapyr	2	0.0625	1.40	4	0.889	0.566	157.2	100
1	TW	Imazapyr	2	0.0625	1.40	5	0.517	0.583	88.6	100
1	TW	Imazapyr	2	0.0625	1.40	6	0.517	0.656	78.8	100
1	Tx623	Imazapyr	3	0.125	2.80	7	0.428	0.613	69.9	95
1	Tx623	Imazapyr	3	0.125	2.80	8	0.592	0.522	113.4	85
1	Tx623	Imazapyr	3	0.125	2.80	9	0.642	0.732	87.7	100
1	Tx623	Imazapyr	3	0.125	2.80	10	0.518	0.495	104.8	80
1	Tx623	Imazapyr	3	0.125	2.80	11	0.406	0.469	86.7	100
1	Tx623	Imazapyr	3	0.125	2.80	12	0.456	0.646	70.6	100
1	TW	Imazapyr	3	0.125	2.80	1	0.663	0.565	117.4	100
1	TW	Imazapyr	3	0.125	2.80	2	0.406	0.539	75.3	100
1	TW	Imazapyr	3	0.125	2.80	3	0.562	0.541	104.0	100
1	TW	Imazapyr	3	0.125	2.80	4	0.740	0.566	130.9	100
1	TW	Imazapyr	3	0.125	2.80	5	0.453	0.583	77.7	100
1	TW	Imazapyr	3	0.125	2.80	6	0.549	0.656	83.7	100
1	Tx623	Imazapyr	4	0.25	5.60	7	0.188	0.613	30.7	90
1	Tx623	Imazapyr	4	0.25	5.60	8	0.336	0.522	64.4	60
1	Tx623	Imazapyr	4	0.25	5.60	9	0.130	0.732	17.8	70
1	Tx623	Imazapyr	4	0.25	5.60	10	0.544	0.495	110.0	100
1	Tx623	Imazapyr	4	0.25	5.60	11	0.353	0.469	75.3	80
1	Tx623	Imazapyr	4	0.25	5.60	12	0.353	0.646	54.6	85
1	TW	Imazapyr	4	0.25	5.60	1	0.579	0.565	102.6	100
1	TW	Imazapyr	4	0.25	5.60	2	0.620	0.539	115.0	100
1	TW	Imazapyr	4	0.25	5.60	3	0.689	0.541	127.5	95
1	TW	Imazapyr	4	0.25	5.60	4	0.669	0.566	118.3	100
1	TW	Imazapyr	4	0.25	5.60	5	0.652	0.583	111.8	100
1	TW	Imazapyr	4	0.25	5.60	6	0.590	0.656	89.9	100
1	Tx623	Imazapyr	5	0.5	11.2	7	0.055	0.613	9.0	80
1	Tx623	Imazapyr	5	0.5	11.2	8	0.086	0.522	16.5	40
1	Tx623	Imazapyr	5	0.5	11.2	9	0.150	0.732	20.5	60
1	Tx623	Imazapyr	5	0.5	11.2	10	0.063	0.495	12.7	40
1	Tx623	Imazapyr	5	0.5	11.2	11	0.075	0.469	16.0	40
1	Tx623	Imazapyr	5	0.5	11.2	12	0.085	0.646	13.2	40
1	TW	Imazapyr	5	0.5	11.2	1	0.644	0.565	114.1	100
1	TW	Imazapyr	5	0.5	11.2	2	0.640	0.539	118.7	100
1	TW	Imazapyr	5	0.5	11.2	3	0.494	0.541	91.4	95
1	TW	Imazapyr	5	0.5	11.2	4	0.710	0.566	125.6	100
1	TW	Imazapyr	5	0.5	11.2	5	0.652	0.583	111.8	100
1	TW	Imazapyr	5	0.5	11.2	6	0.536	0.656	81.7	100
1	Tx623	Imazapyr	6	1	22.4	7	0.084	0.613	13.7	5
1	Tx623	Imazapyr	6	1	22.4	8	0.067	0.522	12.8	30
1	Tx623	Imazapyr	6	1	22.4	9	0.100	0.732	13.7	40
1	Tx623	Imazapyr	6	1	22.4	10	0.072	0.495	14.6	50
1	Tx623	Imazapyr	6	1	22.4	11	0.103	0.469	22.0	30
1	Tx623	Imazapyr	6	1	22.4	12	0.088	0.646	13.6	40
1	TW	Imazapyr	6	1	22.4	1	0.846	0.565	149.9	100
1	TW	Imazapyr	6	1	22.4	2	0.602	0.539	111.7	100
1	TW	Imazapyr	6	1	22.4	3	0.625	0.541	115.6	100
1	TW	Imazapyr	6	1	22.4	4	0.645	0.566	114.1	100

1	TW	Imazapyr	6	1	22.4	5	0.829	0.583	142.1	100
1	TW	Imazapyr	6	1	22.4	6	0.638	0.656	97.3	100
1	Tx623	Imazapyr	7	2	44.8	7	0.058	0.613	9.5	5
1	Tx623	Imazapyr	7	2	44.8	8	0.125	0.522	23.9	30
1	Tx623	Imazapyr	7	2	44.8	9	0.074	0.732	10.1	20
1	Tx623	Imazapyr	7	2	44.8	10	0.059	0.495	11.9	0
1	Tx623	Imazapyr	7	2	44.8	11	0.075	0.469	16.0	20
1	Tx623	Imazapyr	7	2	44.8	12	0.088	0.646	13.6	10
1	TW	Imazapyr	7	2	44.8	1	0.652	0.565	115.5	100
1	TW	Imazapyr	7	2	44.8	2	0.579	0.539	107.4	100
1	TW	Imazapyr	7	2	44.8	3	0.514	0.541	95.1	95
1	TW	Imazapyr	7	2	44.8	4	0.694	0.566	122.7	95
1	TW	Imazapyr	7	2	44.8	5	0.568	0.583	97.4	100
1	TW	Imazapyr	7	2	44.8	6	0.583	0.656	88.9	100
1	Tx623	Imazapyr	8	4	89.7	7	0.067	0.613	10.9	0
1	Tx623	Imazapyr	8	4	89.7	8	0.047	0.522	9.0	20
1	Tx623	Imazapyr	8	4	89.7	9	0.056	0.732	7.7	0
1	Tx623	Imazapyr	8	4	89.7	10	0.034	0.495	6.9	0
1	Tx623	Imazapyr	8	4	89.7	11	0.052	0.469	11.1	0
1	Tx623	Imazapyr	8	4	89.7	12	0.060	0.646	9.3	0
1	TW	Imazapyr	8	4	89.7	1	0.568	0.565	100.6	100
1	TW	Imazapyr	8	4	89.7	2	0.498	0.539	92.4	100
1	TW	Imazapyr	8	4	89.7	3	0.719	0.541	133.0	95
1	TW	Imazapyr	8	4	89.7	4	0.419	0.566	74.1	95
1	TW	Imazapyr	8	4	89.7	5	0.640	0.583	109.7	100
1	TW	Imazapyr	8	4	89.7	6	0.728	0.656	111.0	100
1	Tx623	Imazapyr	9	8	179	7	0.047	0.613	7.7	0
1	Tx623	Imazapyr	9	8	179	8	0.054	0.522	10.3	0
1	Tx623	Imazapyr	9	8	179	9	0.043	0.732	5.9	0
1	Tx623	Imazapyr	9	8	179	10	0.035	0.495	7.1	0
1	Tx623	Imazapyr	9	8	179	11	0.030	0.469	6.4	0
1	Tx623	Imazapyr	9	8	179	12	0.035	0.646	5.4	0
1	TW	Imazapyr	9	8	179	1	0.583	0.565	103.3	100
1	TW	Imazapyr	9	8	179	2	0.596	0.539	110.6	100
1	TW	Imazapyr	9	8	179	3	0.376	0.541	69.6	95
1	TW	Imazapyr	9	8	179	4	0.663	0.566	117.2	90
1	TW	Imazapyr	9	8	179	5	0.558	0.583	95.7	95
1	TW	Imazapyr	9	8	179	6	0.486	0.656	74.1	95
1	Tx623	Control	0	0	0	7	0.676	0.613	110.4	100
1	Tx623	Control	0	0	0	7	0.549	0.613	89.6	100
1	Tx623	Control	0	0	0	8	0.544	0.522	104.2	100
1	Tx623	Control	0	0	0	8	0.500	0.522	95.8	100
1	Tx623	Control	0	0	0	9	0.782	0.732	106.8	100
1	Tx623	Control	0	0	0	9	0.682	0.732	93.2	100
1	Tx623	Control	0	0	0	10	0.521	0.495	105.4	100
1	Tx623	Control	0	0	0	10	0.468	0.495	94.6	100
1	Tx623	Control	0	0	0	11	0.389	0.469	83.0	100
1	Tx623	Control	0	0	0	11	0.548	0.469	117.0	100
1	Tx623	Control	0	0	0	12	0.723	0.646	111.9	100
1	Tx623	Control	0	0	0	12	0.569	0.646	88.1	100
1	TW	Control	0	0	0	1	0.619	0.565	109.7	100
1	TW	Control	0	0	0	1	0.51	0.565	90.3	100
1	TW	Control	0	0	0	2	0.595	0.539	110.4	100
1	TW	Control	0	0	0	2	0.483	0.539	89.6	100
1	TW	Control	0	0	0	3	0.569	0.541	105.3	100
1	TW	Control	0	0	0	3	0.512	0.541	94.7	100
1	TW	Control	0	0	0	4	0.583	0.566	103.1	100
1	TW	Control	0	0	0	4	0.548	0.566	96.9	100
1	TW	Control	0	0	0	5	0.701	0.583	120.2	100
1	TW	Control	0	0	0	5	0.466	0.583	79.9	100
1	TW	Control	0	0	0	6	0.587	0.656	89.5	100
1	TW	Control	0	0	0	6	0.725	0.656	110.5	100

2	Tx623	Nicosulfuron	1	0.03125	1.81	7	0.242	0.669	36.2	90
2	Tx623	Nicosulfuron	1	0.03125	1.81	8	0.309	0.527	58.7	100
2	Tx623	Nicosulfuron	1	0.03125	1.81	9	0.315	0.661	47.7	100
2	Tx623	Nicosulfuron	1	0.03125	1.81	10	0.368	0.545	67.6	100
2	Tx623	Nicosulfuron	1	0.03125	1.81	11	0.514	0.702	73.2	100
2	Tx623	Nicosulfuron	1	0.03125	1.81	12	0.449	0.724	62.0	100
2	TW	Nicosulfuron	1	0.03125	1.81	1	0.654	0.520	125.9	100
2	TW	Nicosulfuron	1	0.03125	1.81	2	0.301	0.293	102.7	95
2	TW	Nicosulfuron	1	0.03125	1.81	3	0.301	0.391	77.0	100
2	TW	Nicosulfuron	1	0.03125	1.81	4	0.283	0.379	74.8	100
2	TW	Nicosulfuron	1	0.03125	1.81	5	0.319	0.334	95.5	100
2	TW	Nicosulfuron	1	0.03125	1.81	6	0.273	0.300	91.2	100
2	Tx623	Nicosulfuron	2	0.0625	2.17	7	.	0.669	.	80
2	Tx623	Nicosulfuron	2	0.0625	2.17	8	0.145	0.527	27.5	100
2	Tx623	Nicosulfuron	2	0.0625	2.17	9	0.16	0.661	24.2	60
2	Tx623	Nicosulfuron	2	0.0625	2.17	10	0.116	0.545	21.3	85
2	Tx623	Nicosulfuron	2	0.0625	2.17	11	0.258	0.702	36.8	85
2	Tx623	Nicosulfuron	2	0.0625	2.17	12	0.138	0.724	19.1	90
2	TW	Nicosulfuron	2	0.0625	2.17	1	0.319	0.520	61.4	100
2	TW	Nicosulfuron	2	0.0625	2.17	2	0.272	0.293	92.8	100
2	TW	Nicosulfuron	2	0.0625	2.17	3	0.193	0.391	49.4	100
2	TW	Nicosulfuron	2	0.0625	2.17	4	0.281	0.379	74.2	100
2	TW	Nicosulfuron	2	0.0625	2.17	5	0.421	0.334	126.0	100
2	TW	Nicosulfuron	2	0.0625	2.17	6	0.253	0.300	84.5	100
2	Tx623	Nicosulfuron	3	0.125	4.34	7	0.08	0.669	12.0	80
2	Tx623	Nicosulfuron	3	0.125	4.34	8	0.129	0.527	24.5	90
2	Tx623	Nicosulfuron	3	0.125	4.34	9	0.136	0.661	20.6	50
2	Tx623	Nicosulfuron	3	0.125	4.34	10	0.132	0.545	24.2	85
2	Tx623	Nicosulfuron	3	0.125	4.34	11	0.129	0.702	18.4	75
2	Tx623	Nicosulfuron	3	0.125	4.34	12	0.103	0.724	14.2	85
2	TW	Nicosulfuron	3	0.125	4.34	1	0.345	0.520	66.4	100
2	TW	Nicosulfuron	3	0.125	4.34	2	0.228	0.293	77.8	100
2	TW	Nicosulfuron	3	0.125	4.34	3	0.258	0.391	66.0	100
2	TW	Nicosulfuron	3	0.125	4.34	4	.	0.379	.	100
2	TW	Nicosulfuron	3	0.125	4.34	5	0.312	0.334	93.4	100
2	TW	Nicosulfuron	3	0.125	4.34	6	0.375	0.300	125.2	100
2	Tx623	Nicosulfuron	4	0.25	8.69	7	0.078	0.669	11.7	30
2	Tx623	Nicosulfuron	4	0.25	8.69	8	0.048	0.527	9.1	80
2	Tx623	Nicosulfuron	4	0.25	8.69	9	0.144	0.661	21.8	50
2	Tx623	Nicosulfuron	4	0.25	8.69	10	0.069	0.545	12.7	80
2	Tx623	Nicosulfuron	4	0.25	8.69	11	0.14	0.702	19.9	55
2	Tx623	Nicosulfuron	4	0.25	8.69	12	0.114	0.724	15.7	50
2	TW	Nicosulfuron	4	0.25	8.69	1	0.398	0.520	76.6	100
2	TW	Nicosulfuron	4	0.25	8.69	2	0.407	0.293	138.9	100
2	TW	Nicosulfuron	4	0.25	8.69	3	0.467	0.391	119.4	100
2	TW	Nicosulfuron	4	0.25	8.69	4	0.228	0.379	60.2	100
2	TW	Nicosulfuron	4	0.25	8.69	5	0.415	0.334	124.3	100
2	TW	Nicosulfuron	4	0.25	8.69	6	0.288	0.300	96.2	100
2	Tx623	Nicosulfuron	5	0.5	17.4	7	0.105	0.669	15.7	30
2	Tx623	Nicosulfuron	5	0.5	17.4	8	0.089	0.527	16.9	60
2	Tx623	Nicosulfuron	5	0.5	17.4	9	0.151	0.661	22.9	50
2	Tx623	Nicosulfuron	5	0.5	17.4	10	0.085	0.545	15.6	55
2	Tx623	Nicosulfuron	5	0.5	17.4	11	0.101	0.702	14.4	30
2	Tx623	Nicosulfuron	5	0.5	17.4	12	0.075	0.724	10.4	30
2	TW	Nicosulfuron	5	0.5	17.4	1	0.351	0.520	67.6	100
2	TW	Nicosulfuron	5	0.5	17.4	2	0.382	0.293	130.4	100
2	TW	Nicosulfuron	5	0.5	17.4	3	0.498	0.391	127.4	95
2	TW	Nicosulfuron	5	0.5	17.4	4	0.221	0.379	58.4	100
2	TW	Nicosulfuron	5	0.5	17.4	5	0.452	0.334	135.3	95
2	TW	Nicosulfuron	5	0.5	17.4	6	0.168	0.300	56.1	100
2	Tx623	Nicosulfuron	6	1	34.7	7	0.083	0.669	12.4	30
2	Tx623	Nicosulfuron	6	1	34.7	8	0.113	0.527	21.5	60

2	Tx623	Nicosulfuron	6	1	34.7	9	0.124	0.661	18.8	30
2	Tx623	Nicosulfuron	6	1	34.7	10	0.068	0.545	12.5	60
2	Tx623	Nicosulfuron	6	1	34.7	11	0.122	0.702	17.4	25
2	Tx623	Nicosulfuron	6	1	34.7	12	0.148	0.724	20.4	30
2	TW	Nicosulfuron	6	1	34.7	1	0.325	0.520	62.6	100
2	TW	Nicosulfuron	6	1	34.7	2	0.281	0.293	95.9	95
2	TW	Nicosulfuron	6	1	34.7	3	0.446	0.391	114.1	95
2	TW	Nicosulfuron	6	1	34.7	4	0.188	0.379	49.7	100
2	TW	Nicosulfuron	6	1	34.7	5	0.411	0.334	123.1	90
2	TW	Nicosulfuron	6	1	34.7	6	0.387	0.300	129.2	90
2	Tx623	Nicosulfuron	7	2	69.5	7	0.07	0.669	10.5	30
2	Tx623	Nicosulfuron	7	2	69.5	8	0.086	0.527	16.3	50
2	Tx623	Nicosulfuron	7	2	69.5	9	0.125	0.661	18.9	40
2	Tx623	Nicosulfuron	7	2	69.5	10	0.091	0.545	16.7	35
2	Tx623	Nicosulfuron	7	2	69.5	11	0.089	0.702	12.7	20
2	Tx623	Nicosulfuron	7	2	69.5	12	0.101	0.724	14.0	30
2	TW	Nicosulfuron	7	2	69.5	1	0.466	0.520	89.7	100
2	TW	Nicosulfuron	7	2	69.5	2	0.371	0.293	126.6	100
2	TW	Nicosulfuron	7	2	69.5	3	0.368	0.391	94.1	100
2	TW	Nicosulfuron	7	2	69.5	4	0.384	0.379	101.5	100
2	TW	Nicosulfuron	7	2	69.5	5	0.342	0.334	102.4	95
2	TW	Nicosulfuron	7	2	69.5	6	.	0.300	.	100
2	Tx623	Nicosulfuron	8	4	139	7	0.165	0.669	24.7	10
2	Tx623	Nicosulfuron	8	4	139	8	0.076	0.527	14.4	40
2	Tx623	Nicosulfuron	8	4	139	9	0.138	0.661	20.9	30
2	Tx623	Nicosulfuron	8	4	139	10	0.099	0.545	18.2	15
2	Tx623	Nicosulfuron	8	4	139	11	0.168	0.702	23.9	20
2	Tx623	Nicosulfuron	8	4	139	12	0.089	0.724	12.3	60
2	TW	Nicosulfuron	8	4	139	1	0.31	0.520	59.7	100
2	TW	Nicosulfuron	8	4	139	2	0.224	0.293	76.5	100
2	TW	Nicosulfuron	8	4	139	3	0.463	0.391	118.4	95
2	TW	Nicosulfuron	8	4	139	4	0.333	0.379	88.0	95
2	TW	Nicosulfuron	8	4	139	5	0.321	0.334	96.1	100
2	TW	Nicosulfuron	8	4	139	6	0.301	0.300	100.5	100
2	Tx623	Nicosulfuron	9	8	278	7	0.051	0.669	7.6	5
2	Tx623	Nicosulfuron	9	8	278	8	0.045	0.527	8.5	25
2	Tx623	Nicosulfuron	9	8	278	9	0.163	0.661	24.7	10
2	Tx623	Nicosulfuron	9	8	278	10	0.121	0.545	22.2	15
2	Tx623	Nicosulfuron	9	8	278	11	0.115	0.702	16.4	15
2	Tx623	Nicosulfuron	9	8	278	12	0.16	0.724	22.1	50
2	TW	Nicosulfuron	9	8	278	1	0.471	0.520	90.7	100
2	TW	Nicosulfuron	9	8	278	2	0.247	0.293	84.3	100
2	TW	Nicosulfuron	9	8	278	3	0.266	0.391	68.0	100
2	TW	Nicosulfuron	9	8	278	4	0.354	0.379	93.5	95
2	TW	Nicosulfuron	9	8	278	5	0.327	0.334	97.9	100
2	TW	Nicosulfuron	9	8	278	6	0.235	0.300	78.5	100
2	Tx623	Imazapyr	1	0.03125	0.701	7	0.601	0.669	89.9	100
2	Tx623	Imazapyr	1	0.03125	0.701	8	0.674	0.527	128.0	100
2	Tx623	Imazapyr	1	0.03125	0.701	9	0.871	0.661	131.9	100
2	Tx623	Imazapyr	1	0.03125	0.701	10	0.478	0.545	87.8	100
2	Tx623	Imazapyr	1	0.03125	0.701	11	0.447	0.702	63.7	100
2	Tx623	Imazapyr	1	0.03125	0.701	12	0.622	0.724	85.9	100
2	TW	Imazapyr	1	0.03125	0.701	1	0.421	0.520	81.0	100
2	TW	Imazapyr	1	0.03125	0.701	2	0.324	0.293	110.6	100
2	TW	Imazapyr	1	0.03125	0.701	3	0.484	0.391	123.8	100
2	TW	Imazapyr	1	0.03125	0.701	4	0.223	0.379	58.9	100
2	TW	Imazapyr	1	0.03125	0.701	5	0.353	0.334	105.7	100
2	TW	Imazapyr	1	0.03125	0.701	6	0.297	0.300	99.2	100
2	Tx623	Imazapyr	2	0.0625	1.40	7	0.672	0.669	100.5	100
2	Tx623	Imazapyr	2	0.0625	1.40	8	0.391	0.527	74.3	90
2	Tx623	Imazapyr	2	0.0625	1.40	9	0.501	0.661	75.9	90
2	Tx623	Imazapyr	2	0.0625	1.40	10	0.597	0.545	109.6	100

2	Tx623	Imazapyr	2	0.0625	1.40	11	0.314	0.702	44.7	90
2	Tx623	Imazapyr	2	0.0625	1.40	12	0.674	0.724	93.1	100
2	TW	Imazapyr	2	0.0625	1.40	1	0.331	0.520	63.7	100
2	TW	Imazapyr	2	0.0625	1.40	2	0.366	0.293	124.9	95
2	TW	Imazapyr	2	0.0625	1.40	3	0.295	0.391	75.4	100
2	TW	Imazapyr	2	0.0625	1.40	4	0.401	0.379	105.9	95
2	TW	Imazapyr	2	0.0625	1.40	5	0.363	0.334	108.7	100
2	TW	Imazapyr	2	0.0625	1.40	6	0.367	0.300	122.5	100
2	Tx623	Imazapyr	3	0.125	2.80	7	0.505	0.669	75.5	95
2	Tx623	Imazapyr	3	0.125	2.80	8	0.483	0.527	91.7	100
2	Tx623	Imazapyr	3	0.125	2.80	9	0.852	0.661	129.0	100
2	Tx623	Imazapyr	3	0.125	2.80	10	0.559	0.545	102.7	100
2	Tx623	Imazapyr	3	0.125	2.80	11	0.447	0.702	63.7	100
2	Tx623	Imazapyr	3	0.125	2.80	12	0.517	0.724	71.4	100
2	TW	Imazapyr	3	0.125	2.80	1	0.434	0.520	83.5	100
2	TW	Imazapyr	3	0.125	2.80	2	0.388	0.293	132.4	100
2	TW	Imazapyr	3	0.125	2.80	3	0.338	0.391	86.4	100
2	TW	Imazapyr	3	0.125	2.80	4	0.338	0.379	89.3	100
2	TW	Imazapyr	3	0.125	2.80	5	0.304	0.334	91.0	100
2	TW	Imazapyr	3	0.125	2.80	6	0.274	0.300	91.5	100
2	Tx623	Imazapyr	4	0.25	5.60	7	0.14	0.669	20.9	95
2	Tx623	Imazapyr	4	0.25	5.60	8	0.212	0.527	40.3	90
2	Tx623	Imazapyr	4	0.25	5.60	9	0.481	0.661	72.8	90
2	Tx623	Imazapyr	4	0.25	5.60	10	0.254	0.545	46.6	85
2	Tx623	Imazapyr	4	0.25	5.60	11	0.327	0.702	46.6	90
2	Tx623	Imazapyr	4	0.25	5.60	12	0.168	0.724	23.2	90
2	TW	Imazapyr	4	0.25	5.60	1	0.461	0.520	88.7	100
2	TW	Imazapyr	4	0.25	5.60	2	0.204	0.293	69.6	100
2	TW	Imazapyr	4	0.25	5.60	3	0.369	0.391	94.4	95
2	TW	Imazapyr	4	0.25	5.60	4	0.399	0.379	105.4	100
2	TW	Imazapyr	4	0.25	5.60	5	0.417	0.334	124.9	100
2	TW	Imazapyr	4	0.25	5.60	6	0.255	0.300	85.1	100
2	Tx623	Imazapyr	5	0.5	11.2	7	0.156	0.669	23.3	50
2	Tx623	Imazapyr	5	0.5	11.2	8	0.048	0.527	9.1	85
2	Tx623	Imazapyr	5	0.5	11.2	9	0.148	0.661	22.4	60
2	Tx623	Imazapyr	5	0.5	11.2	10	0.107	0.545	19.7	40
2	Tx623	Imazapyr	5	0.5	11.2	11	0.144	0.702	20.5	50
2	Tx623	Imazapyr	5	0.5	11.2	12	0.162	0.724	22.4	85
2	TW	Imazapyr	5	0.5	11.2	1	0.326	0.520	62.8	100
2	TW	Imazapyr	5	0.5	11.2	2	0.326	0.293	111.3	100
2	TW	Imazapyr	5	0.5	11.2	3	0.318	0.391	81.3	100
2	TW	Imazapyr	5	0.5	11.2	4	0.293	0.379	77.4	100
2	TW	Imazapyr	5	0.5	11.2	5	0.281	0.334	84.1	100
2	TW	Imazapyr	5	0.5	11.2	6	0.379	0.300	126.5	95
2	Tx623	Imazapyr	6	1	22.4	7	0.113	0.669	16.9	40
2	Tx623	Imazapyr	6	1	22.4	8	0.081	0.527	15.4	50
2	Tx623	Imazapyr	6	1	22.4	9	0.133	0.661	20.1	50
2	Tx623	Imazapyr	6	1	22.4	10	0.146	0.545	26.8	25
2	Tx623	Imazapyr	6	1	22.4	11	0.133	0.702	18.9	40
2	Tx623	Imazapyr	6	1	22.4	12	0.168	0.724	23.2	45
2	TW	Imazapyr	6	1	22.4	1	0.422	0.520	81.2	100
2	TW	Imazapyr	6	1	22.4	2	0.305	0.293	104.1	100
2	TW	Imazapyr	6	1	22.4	3	0.379	0.391	96.9	100
2	TW	Imazapyr	6	1	22.4	4	0.339	0.379	89.6	100
2	TW	Imazapyr	6	1	22.4	5	0.469	0.334	140.4	95
2	TW	Imazapyr	6	1	22.4	6	0.195	0.300	65.1	100
2	Tx623	Imazapyr	7	2	44.8	7	0.08	0.669	12.0	5
2	Tx623	Imazapyr	7	2	44.8	8	0.13	0.527	24.7	10
2	Tx623	Imazapyr	7	2	44.8	9	0.141	0.661	21.3	25
2	Tx623	Imazapyr	7	2	44.8	10	0.162	0.545	29.8	10
2	Tx623	Imazapyr	7	2	44.8	11	0.13	0.702	18.5	15
2	Tx623	Imazapyr	7	2	44.8	12	0.07	0.724	9.7	10

2	TW	Imazapyr	7	2	44.8	1	0.422	0.520	81.2	100
2	TW	Imazapyr	7	2	44.8	2	0.283	0.293	96.6	100
2	TW	Imazapyr	7	2	44.8	3	0.385	0.391	98.5	100
2	TW	Imazapyr	7	2	44.8	4	0.281	0.379	74.2	100
2	TW	Imazapyr	7	2	44.8	5	0.475	0.334	142.2	100
2	TW	Imazapyr	7	2	44.8	6	0.241	0.300	80.5	100
2	Tx623	Imazapyr	8	4	89.7	7	0.066	0.669	9.9	0
2	Tx623	Imazapyr	8	4	89.7	8	0.044	0.527	8.4	0
2	Tx623	Imazapyr	8	4	89.7	9	0.111	0.661	16.8	0
2	Tx623	Imazapyr	8	4	89.7	10	0.134	0.545	24.6	0
2	Tx623	Imazapyr	8	4	89.7	11	0.055	0.702	7.8	0
2	Tx623	Imazapyr	8	4	89.7	12	0.067	0.724	9.3	0
2	TW	Imazapyr	8	4	89.7	1	0.425	0.520	81.8	100
2	TW	Imazapyr	8	4	89.7	2	0.339	0.293	115.7	100
2	TW	Imazapyr	8	4	89.7	3	0.46	0.391	117.6	100
2	TW	Imazapyr	8	4	89.7	4	0.26	0.379	68.7	95
2	TW	Imazapyr	8	4	89.7	5	0.402	0.334	120.4	100
2	TW	Imazapyr	8	4	89.7	6	0.321	0.300	107.2	100
2	Tx623	Imazapyr	9	8	179	7	.	0.669	.	.
2	Tx623	Imazapyr	9	8	179	8	0.081	0.527	15.4	0
2	Tx623	Imazapyr	9	8	179	9	0.136	0.661	20.6	0
2	Tx623	Imazapyr	9	8	179	10	0.059	0.545	10.8	0
2	Tx623	Imazapyr	9	8	179	11	0.122	0.702	17.4	0
2	Tx623	Imazapyr	9	8	179	12	0.08	0.724	11.0	0
2	TW	Imazapyr	9	8	179	1	0.282	0.520	54.3	95
2	TW	Imazapyr	9	8	179	2	0.281	0.293	95.9	100
2	TW	Imazapyr	9	8	179	3	0.343	0.391	87.7	100
2	TW	Imazapyr	9	8	179	4	0.266	0.379	70.3	95
2	TW	Imazapyr	9	8	179	5	0.321	0.334	96.1	100
2	TW	Imazapyr	9	8	179	6	0.343	0.300	114.5	100
2	Tx623	Control	0	0	0	7	0.65	0.669	97.2	100
2	Tx623	Control	0	0	0	7	0.687	0.669	102.8	100
2	Tx623	Control	0	0	0	8	0.598	0.527	113.6	100
2	Tx623	Control	0	0	0	8	0.455	0.527	86.4	100
2	Tx623	Control	0	0	0	9	0.594	0.661	89.9	100
2	Tx623	Control	0	0	0	9	0.727	0.661	110.1	100
2	Tx623	Control	0	0	0	10	0.51	0.545	93.7	100
2	Tx623	Control	0	0	0	10	0.579	0.545	106.3	100
2	Tx623	Control	0	0	0	11	0.67	0.702	95.4	100
2	Tx623	Control	0	0	0	11	0.734	0.702	104.6	100
2	Tx623	Control	0	0	0	12	0.701	0.724	96.8	100
2	Tx623	Control	0	0	0	12	0.747	0.724	103.2	100
2	TW	Control	0	0	0	1	0.508	0.520	97.8	100
2	TW	Control	0	0	0	1	0.531	0.520	102.2	100
2	TW	Control	0	0	0	2	0.318	0.293	108.5	100
2	TW	Control	0	0	0	2	0.268	0.293	91.5	100
2	TW	Control	0	0	0	3	0.45	0.391	115.1	95
2	TW	Control	0	0	0	3	0.332	0.391	84.9	100
2	TW	Control	0	0	0	4	0.429	0.379	113.3	97.5
2	TW	Control	0	0	0	4	0.328	0.379	86.7	95
2	TW	Control	0	0	0	5	0.11	0.334	32.9	100
2	TW	Control	0	0	0	5	0.558	0.334	167.1	100
2	TW	Control	0	0	0	6	0.29	0.300	96.8	100
2	TW	Control	0	0	0	6	0.309	0.300	103.2	100

Appendix B2. High-Rate Dose Response Data

Table B-1. Resistant Genotype Response to High-Rate Dose Response

Herbicide	Rate†	Dose	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Mean	Mean
		g ha^{-1}	---------- Run 3 ----------									Overall
Control	0	0	100	100	100	100	100	100	100	100	100.0	100.0
Control	0	0	100	100	100	100	100	100	100	100	100.0	100.0
Control	0	0	100	100	100	100	100	100	100	100	100.0	100.0
Imazapyr	16	358	100	95	100	100	100	95	100	100	98.8	97.8
Imazapyr	32	717	100	95	100	90	100	100	100	95	97.5	98.4
Imazapyr	64	1434	95	100	100	100	100	95	100	100	98.8	98.8
Imazapyr	128	2867	95	100	95	95	100	100	95	95	96.9	96.6
Imazapyr	256	5734	95	95	90	95	90	85	85	85	90.0	92.5
Imazapyr	512	11469	85	80	95	70	95	90	80	85	85.0	88.1
Nicosulfuron	16	555	90	100	100	95	95	.	100	100	97.1	97.7
Nicosulfuron	32	1110	100	100	100	100	100	100	100	100	100.0	99.1
Nicosulfuron	64	2221	95	95	95	95	95	100	100	95	96.3	96.9
Nicosulfuron	128	4442	95	95	95	95	95	95	90	90	93.8	94.7
Nicosulfuron	256	8883	95	100	100	95	95	95	95	95	96.3	95.0
			---------- Run 4 ----------									
Control	0	0	100	100	100	100	100	100	100	100	100.0	-
Control	0	0	100	100	100	100	100	100	100	100	100.0	-
Control	0	0	100	100	100	100	100	100	100	100	100.0	-
Imazapyr	16	358	95	100	100	95	95	90	100	100	96.9	-
Imazapyr	32	717	100	100	100	100	100	100	100	95	99.4	-
Imazapyr	64	1434	95	95	100	100	100	100	100	100	98.8	-
Imazapyr	128	2867	90	100	95	100	100	95	90	100	96.3	-
Imazapyr	256	5734	95	95	95	95	95	95	95	95	95.0	-
Imazapyr	512	11469	90	95	90	95	90	90	85	95	91.3	-
Nicosulfuron	16	555	100	100	100	95	100	95	100	95	98.1	-
Nicosulfuron	32	1110	95	100	100	95	100	95	100	100	98.1	-
Nicosulfuron	64	2221	95	95	100	95	100	95	100	100	97.5	-
Nicosulfuron	128	4442	95	95	95	95	95	95	100	95	95.6	-
Nicosulfuron	256	8883	90	95	95	90	95	95	95	95	93.8	-

† Rate is a multiple of the use rate.

Appendix B3. SAS Code for Dose Response Analysis

```
options nodate pageno=1;
*ensure that the infile path and outpath is correct;
%let Infile_1="F:\ALS\AHASdata.txt";
%let Outpath=F:\ALS\;
*OK, now you are ready to submit!;
*Expected output:
     Listing: 8 tables with Run ANOVA        (StepA)
              4 tables with Run*Type ANOVA   (StepB)
              4 tables with Type ANOVA       (StepC&D)
     Export: 4 files for Sigma Plot
*The following should not need any attention;
%let Library=work.AHAS;
*Rates  0.03125, 0.0625, 0.125, 0.25, 0.5 , 1, 2, 4, 8 are fractions of use dose;
*SASrates refers to Rate0 to Rate9 as noted below;
*Note: The following let statements are not used in the program but remain listed here
for your edification;
%let Rate0=0; %let Rate1=0.03125; %let Rate2=0.0625; %let Rate3=0.125; %let
Rate4=0.25;
%let Rate5=0.5; %let Rate6=1; %let Rate7=2; %let Rate8=4; %let Rate9=8;
proc import datafile=&Infile_1 out=&Library dbms=TAB;
run;
%macro DataBreakout (Herb,Typ,Type);
%if &Herb=Nic %then %do;
data &Herb;    set AHAS;
   if herbicide= "Control" then herbicide="Nicosulfuron"; run;
data &Herb;    set &Herb;
   where herbicide= "Nicosulfuron"; run;
%end;
   %else %if &Herb=Imaz %then %do;
data &Herb;    set AHAS;
   if herbicide= "Control" then herbicide="Imazapyr"; run;
data &Herb;    set &Herb;
   where herbicide= "Imazapyr"; run;
%end;
   data &Herb&Typ;    set &Herb;
     where Type = "&Type"; run;
%do i=0 %to 9;
     data &Herb.Rate&i ;      set &Herb;
       where SASrate = &i; run;
     data &Herb&Typ.Rate&i ;      set &Herb&Typ;
       where SASrate = &i;run;
%end;
%mend DataBreakout;
%DataBreakout (Nic,Sus,Tx623)
%DataBreakout (Nic,Res,TW)
%DataBreakout (Imaz,Sus,Tx623)
%DataBreakout (Imaz,Res,TW);
*Starting GLM F-Tests;
ods listing close; *Step A: Run ANOVA for Tx623 and TW;
%macro TypeGLMtest (Herb,Typ, Responce, R, y);
%do i=1 %to 9;
%* "Testing &Typ at Rate &i";
Proc glm data= &Herb&Typ.Rate&i ;
   ods output RandomModelANOVA=Random&Herb&R&Typ.Rate&i;
   class run;
   model &y = run/SS3;
   random run/test;
run;
data Random&Herb&R&Typ.Rate&i (drop=Dependent HypothesisType Control MS Error);
```

```
   set Random&Herb&R&Typ.Rate&i;
   TypeRate = "&Typ.Rate&i";
run;
%end;
%mend TypeGLMtest;
%TypeGLMtest (Nic,Sus, Visual, V, Score)
%TypeGLMtest (Nic,Sus, Weight, W, Percent)
%TypeGLMtest (Nic,Res, Visual, V, Score)
%TypeGLMtest (Nic,Res, Weight, W, Percent)
%TypeGLMtest (Imaz,Sus, Visual, V, Score)
%TypeGLMtest (Imaz,Sus, Weight, W, Percent)
%TypeGLMtest (Imaz,Res, Visual, V, Score)
%TypeGLMtest (Imaz,Res, Weight, W, Percent);
ods output close; ods listing;
%macro GLMmerge (Step, Herb, Response, R, y);
title1 "Kellan Kershner: AHAS &Response &Herb Dataset";
%if &Step=StepA %then %do;
data &Step.Random&Herb&R;
set Random&Herb&R.SusRate1
       Random&Herb&R.SusRate2     Random&Herb&R.SusRate3
       Random&Herb&R.SusRate4     Random&Herb&R.SusRate5
       Random&Herb&R.SusRate6     Random&Herb&R.SusRate7
       Random&Herb&R.SusRate8     Random&Herb&R.SusRate9
    Random&Herb&R.ResRate1
       Random&Herb&R.ResRate2     Random&Herb&R.ResRate3
       Random&Herb&R.ResRate4     Random&Herb&R.ResRate5
       Random&Herb&R.ResRate6     Random&Herb&R.ResRate7
       Random&Herb&R.ResRate8     Random&Herb&R.ResRate9; run;
title2 "&Step : &Response Run ANOVA for Tx623 and TW (Note: No variability when all
are dead)";
%end; %else %if &Step=StepB %then %do;
data &Step.Random&Herb&R;
set Random&Herb&R.AllRate1
       Random&Herb&R.AllRate2     Random&Herb&R.AllRate3
       Random&Herb&R.AllRate4     Random&Herb&R.AllRate5
       Random&Herb&R.AllRate6     Random&Herb&R.AllRate7
       Random&Herb&R.AllRate8     Random&Herb&R.AllRate9; run;
title2 "&Step.: Run*Type ANOVA for Everything";
%end; %else %if &Step=StepC or &Step=StepD %then %do;
data &Step.Random&Herb&R;
set Random&Herb&R&Step.Rate1
       Random&Herb&R&Step.Rate2   Random&Herb&R&Step.Rate3
       Random&Herb&R&Step.Rate4   Random&Herb&R&Step.Rate5
       Random&Herb&R&Step.Rate6   Random&Herb&R&Step.Rate7
       Random&Herb&R&Step.Rate8   Random&Herb&R&Step.Rate9; run;
title2 "&Step.: Run*Type ANOVA for Single Run";
%end;
Proc Print data=&Step.Random&Herb&R; run;
%mend GLMmerge;
run;
%GLMmerge (StepA, Nic, Visual, V, Score)
%GLMmerge (StepA, Nic, Weight, W, Percent)
%GLMmerge (StepA, Imaz, Visual, V, Score)
%GLMmerge (StepA, Imaz, Weight, W, Percent);
ods listing close; *Step B: Run*Type ANOVA for Everything;
%macro OverallGLMtest (Herb,Typ, Responce, R, y);
%do i=1 %to 9;
   %* "Testing Everything at Rate &i";
   Proc glm data= &Herb.Rate&i ;
     ods output RandomModelANOVA=Random&Herb&R&Typ.Rate&i;
     class run Type;
     model &y = run Type run*Type/SS3;
     random run run*Type/test; run;
```

```
   data Random&Herb&R&Typ.Rate&i (drop=Dependent HypothesisType Control MS Error);
     set Random&Herb&R&Typ.Rate&i;
     TypeRate = "&Typ.Rate&i"; run;
%end;
%mend OverallGLMtest;
%OverallGLMtest (Nic, All, Visual, V, Score)
%OverallGLMtest (Nic, All, Weight, W, Percent)
%OverallGLMtest (Imaz, All, Visual, V, Score)
%OverallGLMtest (Imaz, All, Weight, W, Percent);
ods listing;
%GLMmerge (StepB, Nic, Visual, V, Score)
%GLMmerge (StepB, Nic, Weight, W, Percent)
%GLMmerge (StepB, Imaz, Visual, V, Score)
%GLMmerge (StepB, Imaz, Weight, W, Percent);
ods listing close;
*Staring LSmeans for exporting to SigmaPlot;
%macro TypeLSMeans (Herb, Responce, R, y);
%*Mixed LSMeans for Everything at Rate;
%do i=0 %to 9;
Proc mixed data= &Herb.Rate&i ;
   ods output LSMeans=LSMeans&Herb&R.Rate&i;
   class run Type;
   model &y = Type / ddfm=satterth;
   random run run*Type;
   lsmeans Type / cl; run;
data LSMeans&Herb&R.Rate&i;
   set LSMeans&Herb&R.Rate&i;
   Rate = input ("&i",best1.); run;
%end;
%mend TypeLSMeans;
%TypeLSMeans (Nic, Visual, V, Score)
%TypeLSMeans (Nic, Weight, W, Percent)
%TypeLSMeans (Imaz, Visual, V, Score)
%TypeLSMeans (Imaz, Weight, W, Percent);
%macro TypeLSMeansOut (Herb,Typ,Type,Responce,R,y);
data LSMeans&Herb&R;
  set LSMeans&Herb&R.Rate0      LSMeans&Herb&R.Rate1
        LSMeans&Herb&R.Rate2     LSMeans&Herb&R.Rate3
        LSMeans&Herb&R.Rate4     LSMeans&Herb&R.Rate5
      LSMeans&Herb&R.Rate6       LSMeans&Herb&R.Rate7
        LSMeans&Herb&R.Rate8     LSMeans&Herb&R.Rate9; run;
%*This creates LSMeans sets at each type level;
   data LSMeans&Herb&R&Typ (drop=Effect Rate Type Estimate StdErr DF tValue Probt
Alpha Lower Upper);
     set LSMeans&Herb&R;
     where Type = "&Type";
     Rate&R&Typ = Rate;
     LS&R&Typ = Estimate;
     SE&R&Typ = StdErr; run;
%mend TypeLSMeansOut;
%TypeLSMeansOut (Nic,Sus,Tx623,Visual,V,Score)
%TypeLSMeansOut (Nic,Res,TW,Visual,V,Score)
%TypeLSMeansOut (Nic,Sus,Tx623,Weight,W,Percent)
%TypeLSMeansOut (Nic,Res,TW,Weight,W,Percent)
%TypeLSMeansOut (Imaz,Sus,Tx623,Visual,V,Score)
%TypeLSMeansOut (Imaz,Res,TW,Visual,V,Score)
%TypeLSMeansOut (Imaz,Sus,Tx623,Weight,W,Percent)
%TypeLSMeansOut (Imaz,Res,TW,Weight,W,Percent);
%macro RateLSMeans (Herb,Typ,Type,Responce,R,y);
%*Mixed (LS)Means for Rates at Type;
Proc mixed data= &Herb&Typ ;
   ods output LSMeans=XMeans&Herb&R&Typ;
   class run SASrate;
```

```
   model &y = SASrate / ddfm=satterth;
   random run run*SASrate;
   lsmeans SASRate / cl; run;
data XMeans&Herb&R&Typ (drop= Effect DF tValue Probt Alpha Lower Upper);
   set XMeans&Herb&R&Typ;
   rename Estimate = Mean&R&Typ;
   rename StdErr = SEm&R&Typ; run;
proc sort data=XMeans&Herb&R&Typ;
   by SASrate; run;
data Xmeans&Herb&R&Typ (drop= SASrate);
   set Xmeans&Herb&R&Typ;
   Rate&R&Typ = SASrate; run;
%mend RateLSMeans;
%RateLSMeans (Nic,Sus,Tx623,Visual,V,Score)
%RateLSMeans (Nic,Res,TW,Visual,V,Score)
%RateLSMeans (Nic,Sus,Tx623,Weight,W,Percent)
%RateLSMeans (Nic,Res,TW,Weight,W,Percent)
%RateLSMeans (Imaz,Sus,Tx623,Visual,V,Score)
%RateLSMeans (Imaz,Res,TW,Visual,V,Score)
%RateLSMeans (Imaz,Sus,Tx623,Weight,W,Percent)
%RateLSMeans (Imaz,Res,TW,Weight,W,Percent);
%macro Match (Herb,Typ,Type,Responce,R,y);
data Match&Herb&R&Typ;
   merge LSMeans&Herb&R&Typ XMeans&Herb&R&Typ;
   by Rate&R&Typ; run;
data Match&Herb&R&Typ (drop= Mean&R&Typ SE&R&Typ SEM&R&Typ);
   set Match&Herb&R&Typ;
   Dif&R&Typ = LS&R&Typ - Mean&R&Typ;
   AbR&R&Typ = LS&R&Typ + SE&R&Typ;
   AbT&R&Typ = LS&R&Typ - SEM&R&Typ; run;
%mend Match;
%Match (Nic,Sus,Tx623,Visual,V,Score)
%Match (Nic,Res,TW,Visual,V,Score)
%Match (Nic,Sus,Tx623,Weight,W,Percent)
%Match (Nic,Res,TW,Weight,W,Percent)
%Match (Imaz,Sus,Tx623,Visual,V,Score)
%Match (Imaz,Res,TW,Visual,V,Score)
%Match (Imaz,Sus,Tx623,Weight,W,Percent)
%Match (Imaz,Res,TW,Weight,W,Percent);
%macro Export (Herb,R,Typ1,Typ2,Typ3,Typ4);
data SigmaDif&Herb&R;
   merge Match&Herb&R&Typ1
         Match&Herb&R&Typ2; run;
%if &Typ3=null %then %do; %end;
%else %if AAAA=AAAA %then %do;
data SigmaDif&Herb&R;
   merge SigmaDif&Herb&R
         Match&Herb&R&Typ3; run;
%end;
%if &Typ4=null %then %do; %end;
%else %if AAAA=AAAA %then %do;
data SigmaDif&Herb&R;
   merge SigmaDif&Herb&R
         Match&Herb&R&Typ4; run;
%end;
proc export data=SigmaDif&Herb&R
   outfile="&Outpath.Sigma&Herb&R..txt"
   dbms=dlm;
      delimiter=','; run;
%mend Export;
%Export (Nic,W,Res,Sus,null,null)
%Export (Imaz,V,Res,Sus,null,null);
/*The following are not invoked but are ready if wanted
```

```
%Export (Nic,V,Res,Sus,null,null)
%Export (Imaz,W,Res,Sus,null,null);*/
*Staring Secondary GLM Test;
%macro TypeGLMtestStepQ (Step,Herb,Response,R,y);
%if &Step=StepC %then %do i=1 %to 9;
title2 "GLM F-Test Step C: Testing Everything at Run 1";
   data &Herb&Step.Rate&i;
     set &Herb.Rate&i;
       if Run =2 then delete; run;
%end;
%if &Step=StepD %then %do i=1 %to 9;
title2 "GLM F-Test Step D: Testing Everything at Run 2";
data &Herb&Step.Rate&i;
     set &Herb.Rate&i;
       if Run =1 then delete; run;
%end;
%do i=1 %to 9;
Proc glm data= &Herb&Step.Rate&i;
   ods output OverallANOVA=Random&Herb&R&Step.Rate&i;
   class Type;
   model &y = Type/SS3;
run;
data Random&Herb&R&Step.Rate&i (drop=Dependent MS);
   set Random&Herb&R&Step.Rate&i;
   TypeRate = "&Step.Rate&i";
run;
%end;
%mend TypeGLMtestStepQ;
%TypeGLMtestStepQ (StepC, Nic, Visual, V, Score)
%TypeGLMtestStepQ (StepD, Nic, Visual, V, Score)
%TypeGLMtestStepQ (StepC, Imaz, Weight, W, Percent)
%TypeGLMtestStepQ (StepD, Imaz, Weight, W, Percent);
ods listing;
%GLMmerge (StepC, Nic, Visual, V, Score)
%GLMmerge (StepD, Nic, Visual, V, Score)
%GLMmerge (StepC, Imaz, Weight, W, Percent)
%GLMmerge (StepD, Imaz, Weight, W, Percent);
ods listing close;
*Starting ResR1, ResR2, SusR1, and SusR2 LSMeans out (aka Run);
%macro RunTypeData (Herb);
%*This Splits Typ into Run1 and Run2;
   data Run&Herb.ResR1;
     set &Herb.Res;
     where Run = 1;
     Type = "ResR1";run;
   data Run&Herb.ResR2;
     set &Herb.Res;
     where Run = 2;
     Type = "ResR2";run;
   data Run&Herb.SusR1;
     set &Herb.Sus;
     where Run = 1;
     Type = "SusR1";run;
   data Run&Herb.SusR2;
     set &Herb.Sus;
     where Run = 2;
     Type = "SusR2";run;
   data Run&Herb;
     set Run&Herb.SusR1 Run&Herb.SusR2 Run&Herb.ResR1 Run&Herb.ResR2;run;
   data SusHalfRun&Herb;
     set Run&Herb.SusR1 Run&Herb.SusR2 &Herb.Res;
     if Type="TW" then Type="Res";run;
   data SusHalfRun&Herb.SusR1;
```

```
        set Run&Herb.SusR1; run;
   data SusHalfRun&Herb.SusR2;
        set Run&Herb.SusR2;run;
   data SusHalfRun&Herb.Res;
        set &Herb.Res;run;
%do i=0 %to 9;
data Run&Herb.Rate&i;
   set Run&Herb;
   where SASrate = &i; run;
data SusHalfRun&Herb.Rate&i;
   set SusHalfRun&Herb;
   where SASrate = &i; run;
%end;
%mend RunTypeData;
%RunTypeData (Nic)
%RunTypeData (Imaz);
%macro RunTypeLSMeans (Herb, Responce, R, y);
%*Mixed LSMeans for Everything at Rate;
%do i=0 %to 9;
Proc mixed data= &Herb.Rate&i ;
   ods output LSMeans=LSMeans&Herb&R.Rate&i;
   class run Type;
   model &y = Type / ddfm=satterth;
   lsmeans Type / cl; run;
data LSMeans&Herb&R.Rate&i;
   set LSMeans&Herb&R.Rate&i;
   Rate = input ("&i",best1.); run;
%end;
%mend RunTypeLSMeans;
%RunTypeLSMeans (RunNic, Visual, V, Score)
%RunTypeLSMeans (RunNic, Weight, W, Percent)
%RunTypeLSMeans (RunImaz, Visual, V, Score)
%RunTypeLSMeans (RunImaz, Weight, W, Percent)
%TypeLSMeansOut (RunNic,SusR1,SusR1,Visual,V,Score)
%TypeLSMeansOut (RunNic,SusR2,SusR2,Visual,V,Score)
%TypeLSMeansOut (RunNic,ResR1,ResR1,Visual,V,Score)
%TypeLSMeansOut (RunNic,ResR2,ResR2,Visual,V,Score)
%TypeLSMeansOut (RunNic,SusR1,SusR1,Weight,W,Percent)
%TypeLSMeansOut (RunNic,SusR2,SusR2,Weight,W,Percent)
%TypeLSMeansOut (RunNic,ResR1,ResR1,Weight,W,Percent)
%TypeLSMeansOut (RunNic,ResR2,ResR2,Weight,W,Percent)
%TypeLSMeansOut (RunImaz,SusR1,SusR1,Visual,V,Score)
%TypeLSMeansOut (RunImaz,SusR2,SusR2,Visual,V,Score)
%TypeLSMeansOut (RunImaz,ResR1,ResR1,Visual,V,Score)
%TypeLSMeansOut (RunImaz,ResR2,ResR2,Visual,V,Score)
%TypeLSMeansOut (RunImaz,SusR1,SusR1,Weight,W,Percent)
%TypeLSMeansOut (RunImaz,SusR2,SusR2,Weight,W,Percent)
%TypeLSMeansOut (RunImaz,ResR1,ResR1,Weight,W,Percent)
%TypeLSMeansOut (RunImaz,ResR2,ResR2,Weight,W,Percent);
%macro RunRateLSMeans (Herb,Typ,Type,Responce,R,y);
%*Mixed (LS)Means for Rates at Type;
Proc mixed data= &Herb&Typ ;
   ods output LSMeans=XMeans&Herb&R&Typ;
   class SASrate;
   model &y = SASrate / ddfm=satterth;
   lsmeans SASRate / cl; run;
data XMeans&Herb&R&Typ (drop= Effect DF tValue Probt Alpha Lower Upper);
   set XMeans&Herb&R&Typ;
   rename Estimate = Mean&R&Typ;
   rename StdErr = SEm&R&Typ; run;
proc sort data=XMeans&Herb&R&Typ;
   by SASrate; run;
data Xmeans&Herb&R&Typ (drop= SASrate);
```

```
   set Xmeans&Herb&R&Typ;
   Rate&R&Typ = SASrate; run;
%mend RunRateLSMeans;
%RunRateLSMeans (RunNic,SusR1,Tx623,Visual,V,Score)
%RunRateLSMeans (RunNic,SusR2,Tx623,Visual,V,Score)
%RunRateLSMeans (RunNic,ResR1,TW,Visual,V,Score)
%RunRateLSMeans (RunNic,ResR2,TW,Visual,V,Score)
%RunRateLSMeans (RunNic,SusR1,Tx623,Weight,W,Percent)
%RunRateLSMeans (RunNic,SusR2,Tx623,Weight,W,Percent)
%RunRateLSMeans (RunNic,ResR1,TW,Weight,W,Percent)
%RunRateLSMeans (RunNic,ResR2,TW,Weight,W,Percent)
%RunRateLSMeans (RunImaz,SusR1,Tx623,Visual,V,Score)
%RunRateLSMeans (RunImaz,SusR2,Tx623,Visual,V,Score)
%RunRateLSMeans (RunImaz,ResR1,TW,Visual,V,Score)
%RunRateLSMeans (RunImaz,ResR2,TW,Visual,V,Score)
%RunRateLSMeans (RunImaz,SusR1,Tx623,Weight,W,Percent)
%RunRateLSMeans (RunImaz,SusR2,Tx623,Weight,W,Percent)
%RunRateLSMeans (RunImaz,ResR1,TW,Weight,W,Percent)
%RunRateLSMeans (RunImaz,ResR2,TW,Weight,W,Percent)
%Match (RunNic,SusR1,Tx623,Visual,V,Score)
%Match (RunNic,SusR2,Tx623,Visual,V,Score)
%Match (RunNic,ResR1,TW,Visual,V,Score)
%Match (RunNic,ResR2,TW,Visual,V,Score)
%Match (RunNic,SusR1,Tx623,Weight,W,Percent)
%Match (RunNic,SusR2,Tx623,Weight,W,Percent)
%Match (RunNic,ResR1,TW,Weight,W,Percent)
%Match (RunNic,ResR2,TW,Weight,W,Percent)
%Match (RunImaz,SusR1,Tx623,Visual,V,Score)
%Match (RunImaz,SusR2,Tx623,Visual,V,Score)
%Match (RunImaz,ResR1,TW,Visual,V,Score)
%Match (RunImaz,ResR2,TW,Visual,V,Score)
%Match (RunImaz,SusR1,Tx623,Weight,W,Percent)
%Match (RunImaz,SusR2,Tx623,Weight,W,Percent)
%Match (RunImaz,ResR1,TW,Weight,W,Percent)
%Match (RunImaz,ResR2,TW,Weight,W,Percent);
/*The following are not invoked but are ready if wanted
%Export (RunNic,W,ResR1,ResR2,SusR1,SusR2)
%Export (RunImaz,V,ResR1,ResR2,SusR1,SusR2)
%Export (RunImaz,W,ResR1,ResR2,SusR1,SusR2)*/
%Export (RunNic,V,ResR1,ResR2,SusR1,SusR2);
*Starting SusR1, SusR2, and Res (both) LSMeans out (aka SusHalfRun);
%TypeLSMeans (SusHalfRunImaz, Weight, W, Percent)
%TypeLSMeansOut (SusHalfRunImaz,SusR1,SusR1,Weight,W,Percent)
%TypeLSMeansOut (SusHalfRunImaz,SusR2,SusR2,Weight,W,Percent)
%TypeLSMeansOut (SusHalfRunImaz,Res,Res,Weight,W,Percent)
%RunRateLSMeans (SusHalfRunImaz,SusR1,Tx623,Weight,W,Percent)
%RunRateLSMeans (SusHalfRunImaz,SusR2,Tx623,Weight,W,Percent)
%RateLSMeans (SusHalfRunImaz,Res,TW,Weight,W,Percent)
%Match (SusHalfRunImaz,SusR1,Tx623,Weight,W,Percent)
%Match (SusHalfRunImaz,SusR2,Tx623,Weight,W,Percent)
%Match (SusHalfRunImaz,Res,TW,Weight,W,Percent);
%Export (SusHalfRunImaz,W,Res,SusR1,SusR2,null);
*Only ImazW is available as SusHalfRun without adding code (11 lines);
run; quit;
```

Appendix B4. SAS Output from Dose Response Analysis

StepA : Visual Run ANOVA for Tx623 and TW (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	533.333333	7.80	0.0190	SusRate1
2	Error: MS(Error)	10	683.333333	_	_	SusRate1
3	Run	1	468.750000	2.67	0.1332	SusRate2
4	Error: MS(Error)	10	1754.166667	_	_	SusRate2
5	Run	1	352.083333	2.24	0.1652	SusRate3
6	Error: MS(Error)	10	1570.833333	_	_	SusRate3
7	Run	1	602.083333	1.79	0.2110	SusRate4
8	Error: MS(Error)	10	3370.833333	_	_	SusRate4
9	Run	1	52.083333	0.34	0.5714	SusRate5
10	Error: MS(Error)	10	1520.833333	_	_	SusRate5
11	Run	1	533.333333	2.90	0.1196	SusRate6
12	Error: MS(Error)	10	1841.666667	_	_	SusRate6
13	Run	1	833.333333	7.52	0.0208	SusRate7
14	Error: MS(Error)	10	1108.333333	_	_	SusRate7
15	Run	1	1102.083333	5.32	0.0437	SusRate8
16	Error: MS(Error)	10	2070.833333	_	_	SusRate8
17	Run	1	533.333333	3.72	0.0826	SusRate9
18	Error: MS(Error)	10	1433.333333	_	_	SusRate9
19	Run	1	2.083333	0.38	0.5490	ResRate1
20	Error: MS(Error)	10	54.166667	_	_	ResRate1
21	Run	1	18.750000	5.00	0.0493	ResRate2
22	Error: MS(Error)	10	37.500000	_	_	ResRate2
23	Run	1	102.083333	3.77	0.0809	ResRate3
24	Error: MS(Error)	10	270.833333	_	_	ResRate3
25	Run	1	18.750000	5.00	0.0493	ResRate4
26	Error: MS(Error)	10	37.500000	_	_	ResRate4
27	Run	1	2.629536E-31	0.00	1.0000	ResRate5
28	Error: MS(Error)	10	66.666667	_	_	ResRate5
29	Run	1	52.083333	4.31	0.0646	ResRate6
30	Error: MS(Error)	10	120.833333	_	_	ResRate6
31	Run	1	8.333333	1.43	0.2596	ResRate7
32	Error: MS(Error)	10	58.333333	_	_	ResRate7
33	Run	1	2.629536E-31	0.00	1.0000	ResRate8
34	Error: MS(Error)	10	116.666667	_	_	ResRate8
35	Run	1	18.750000	1.80	0.2094	ResRate9
36	Error: MS(Error)	10	104.166667	_	_	ResRate9

StepA : Weight Run ANOVA for Tx623 and TW (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	256.687500	0.91	0.3628	SusRate1
2	Error: MS(Error)	10	2822.881667	_	_	SusRate1
3	Run	1	168.918818	1.19	0.3032	SusRate2
4	Error: MS(Error)	9	1275.003000	_	_	SusRate2
5	Run	1	7110.200833	14.98	0.0031	SusRate3
6	Error: MS(Error)	10	4746.701667	_	_	SusRate3
7	Run	1	592.207500	3.34	0.0977	SusRate4
8	Error: MS(Error)	10	1774.295000	_	_	SusRate4
9	Run	1	19.253333	1.61	0.2338	SusRate5
10	Error: MS(Error)	10	119.923333	_	_	SusRate5
11	Run	1	71.053333	3.91	0.0762	SusRate6
12	Error: MS(Error)	10	181.713333	_	_	SusRate6
13	Run	1	10.830000	1.06	0.3265	SusRate7
14	Error: MS(Error)	10	101.730000	_	_	SusRate7
15	Run	1	88.020833	3.72	0.0828	SusRate8
16	Error: MS(Error)	10	236.908333	_	_	SusRate8
17	Run	1	45.630000	1.50	0.2491	SusRate9
18	Error: MS(Error)	10	304.736667	_	_	SusRate9
19	Run	1	325.520833	1.39	0.2659	ResRate1
20	Error: MS(Error)	10	2343.741667	_	_	ResRate1
21	Run	1	2584.267500	4.43	0.0617	ResRate2
22	Error: MS(Error)	10	5839.001667	_	_	ResRate2
23	Run	1	1441.473000	1.96	0.1952	ResRate3
24	Error: MS(Error)	9	6624.887000	_	_	ResRate3
25	Run	1	5.333333	0.01	0.9315	ResRate4
26	Error: MS(Error)	10	6873.113333	_	_	ResRate4
27	Run	1	508.300833	0.55	0.4767	ResRate5
28	Error: MS(Error)	10	9299.221667	_	_	ResRate5
29	Run	1	27.300833	0.04	0.8494	ResRate6
30	Error: MS(Error)	10	7193.941667	_	_	ResRate6
31	Run	1	161.980121	0.63	0.4493	ResRate7
32	Error: MS(Error)	9	2330.445333	_	_	ResRate7
33	Run	1	133.333333	0.37	0.5574	ResRate8
34	Error: MS(Error)	10	3618.206667	_	_	ResRate8
35	Run	1	2954.740833	15.63	0.0027	ResRate9
36	Error: MS(Error)	10	1890.861667	_	_	ResRate9

StepA : Visual Run ANOVA for Tx623 and TW (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	52.083333	1.62	0.2314	SusRate1
2	Error: MS(Error)	10	320.833333	_	_	SusRate1
3	Run	1	2.083333	0.04	0.8376	SusRate2
4	Error: MS(Error)	10	470.833333	_	_	SusRate2
5	Run	1	102.083333	2.53	0.1431	SusRate3
6	Error: MS(Error)	10	404.166667	_	_	SusRate3
7	Run	1	252.083333	2.35	0.1560	SusRate4
8	Error: MS(Error)	10	1070.833333	_	_	SusRate4
9	Run	1	408.333333	1.26	0.2874	SusRate5
10	Error: MS(Error)	10	3233.333333	_	_	SusRate5
11	Run	1	252.083333	1.56	0.2408	SusRate6
12	Error: MS(Error)	10	1620.833333	_	_	SusRate6
13	Run	1	8.333333	0.10	0.7618	SusRate7
14	Error: MS(Error)	10	858.333333	_	_	SusRate7
15	Run	1	33.333333	1.00	0.3409	SusRate8
16	Error: MS(Error)	10	333.333333	_	_	SusRate8
17	Run	1	0	.	.	SusRate9
18	Error: MS(Error)	9	0	_	_	SusRate9
19	Run	1	0	.	.	ResRate1
20	Error: MS(Error)	10	0	_	_	ResRate1
21	Run	1	2.083333	0.38	0.5490	ResRate2
22	Error: MS(Error)	10	54.166667	_	_	ResRate2
23	Run	1	0	.	.	ResRate3
24	Error: MS(Error)	10	0	_	_	ResRate3
25	Run	1	6.573841E-32	0.00	1.0000	ResRate4
26	Error: MS(Error)	10	41.666667	_	_	ResRate4
27	Run	1	6.573841E-32	0.00	1.0000	ResRate5
28	Error: MS(Error)	10	41.666667	_	_	ResRate5
29	Run	1	2.083333	1.00	0.3409	ResRate6
30	Error: MS(Error)	10	20.833333	_	_	ResRate6
31	Run	1	8.333333	2.50	0.1449	ResRate7
32	Error: MS(Error)	10	33.333333	_	_	ResRate7
33	Run	1	2.083333	0.38	0.5490	ResRate8
34	Error: MS(Error)	10	54.166667	_	_	ResRate8
35	Run	1	18.750000	1.80	0.2094	ResRate9
36	Error: MS(Error)	10	104.166667	_	_	ResRate9

StepA : Weight Run ANOVA for Tx623 and TW (Note: No variability when all are dead)

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	72.520833	0.11	0.7427	SusRate1
2	Error: MS(Error)	10	6366.088333	_	_	SusRate1
3	Run	1	1138.800833	2.06	0.1819	SusRate2
4	Error: MS(Error)	10	5532.868333	_	_	SusRate2
5	Run	1	0.067500	0.00	0.9905	SusRate3
6	Error: MS(Error)	10	4482.295000	_	_	SusRate3
7	Run	1	873.813333	1.21	0.2966	SusRate4
8	Error: MS(Error)	10	7205.373333	_	_	SusRate4
9	Run	1	72.520833	3.33	0.0980	SusRate5
10	Error: MS(Error)	10	217.728333	_	_	SusRate5
11	Run	1	79.567500	5.39	0.0426	SusRate6
12	Error: MS(Error)	10	147.501667	_	_	SusRate6
13	Run	1	80.083333	1.86	0.2029	SusRate7
14	Error: MS(Error)	10	431.366667	_	_	SusRate7
15	Run	1	39.967500	1.71	0.2208	SusRate8
16	Error: MS(Error)	10	234.335000	_	_	SusRate8
17	Run	1	170.496485	17.78	0.0023	SusRate9
18	Error: MS(Error)	9	86.325333	_	_	SusRate9
19	Run	1	470.000833	0.98	0.3458	ResRate1
20	Error: MS(Error)	10	4801.608333	_	_	ResRate1
21	Run	1	349.920000	0.50	0.4965	ResRate2
22	Error: MS(Error)	10	7028.136667	_	_	ResRate2
23	Run	1	18.500833	0.04	0.8396	ResRate3
24	Error: MS(Error)	10	4289.381667	_	_	ResRate3
25	Run	1	784.083333	2.97	0.1157	ResRate4
26	Error: MS(Error)	10	2642.603333	_	_	ResRate4
27	Run	1	831.667500	1.96	0.1913	ResRate5
28	Error: MS(Error)	10	4232.581667	_	_	ResRate5
29	Run	1	1960.963333	3.73	0.0822	ResRate6
30	Error: MS(Error)	10	5253.996667	_	_	ResRate6
31	Run	1	241.203333	0.62	0.4508	ResRate7
32	Error: MS(Error)	10	3917.053333	_	_	ResRate7
33	Run	1	7.363333	0.02	0.8982	ResRate8
34	Error: MS(Error)	10	4274.433333	_	_	ResRate8
35	Run	1	222.740833	0.54	0.4808	ResRate9
36	Error: MS(Error)	10	4152.741667	_	_	ResRate9

StepB: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	301.041667	1.28	0.4603	AllRate1
2	Type	1	301.041667	1.28	0.4603	AllRate1
3	Error: MS(Run*Type)	1	234.375000	_	_	AllRate1
4	Run*Type	1	234.375000	6.36	0.0203	AllRate1
5	Error: MS(Error)	20	737.500000	_	_	AllRate1
6	Run	1	337.500000	2.25	0.3743	AllRate2
7	Type	1	2816.666667	18.78	0.1444	AllRate2
8	Error: MS(Run*Type)	1	150.000000	_	_	AllRate2
9	Run*Type	1	150.000000	1.67	0.2104	AllRate2
10	Error: MS(Error)	20	1791.666667	_	_	AllRate2
11	Run	1	37.500000	0.09	0.8145	AllRate3
12	Type	1	1204.166667	2.89	0.3385	AllRate3
13	Error: MS(Run*Type)	1	416.666667	_	_	AllRate3
14	Run*Type	1	416.666667	4.52	0.0460	AllRate3
15	Error: MS(Error)	20	1841.666667	_	_	AllRate3
16	Run	1	204.166667	0.49	0.6112	AllRate4
17	Type	1	7004.166667	16.81	0.1523	AllRate4
18	Error: MS(Run*Type)	1	416.666667	_	_	AllRate4
19	Run*Type	1	416.666667	2.44	0.1336	AllRate4
20	Error: MS(Error)	20	3408.333333	_	_	AllRate4
21	Run	1	26.041667	1.00	0.5000	AllRate5
22	Type	1	17334	665.64	0.0247	AllRate5
23	Error: MS(Run*Type)	1	26.041667	_	_	AllRate5
24	Run*Type	1	26.041667	0.33	0.5732	AllRate5
25	Error: MS(Error)	20	1587.500000	_	_	AllRate5
26	Run	1	126.041667	0.27	0.6928	AllRate6
27	Type	1	25026	54.48	0.0857	AllRate6
28	Error: MS(Run*Type)	1	459.375000	_	_	AllRate6
29	Run*Type	1	459.375000	4.68	0.0428	AllRate6
30	Error: MS(Error)	20	1962.500000	_	_	AllRate6
31	Run	1	504.166667	1.49	0.4365	AllRate7
32	Type	1	31538	93.44	0.0656	AllRate7
33	Error: MS(Run*Type)	1	337.500000	_	_	AllRate7
34	Run*Type	1	337.500000	5.79	0.0260	AllRate7
35	Error: MS(Error)	20	1166.666667	_	_	AllRate7
36	Run	1	551.041667	1.00	0.5000	AllRate8
37	Type	1	37209	67.53	0.0771	AllRate8
38	Error: MS(Run*Type)	1	551.041667	_	_	AllRate8
39	Run*Type	1	551.041667	5.04	0.0363	AllRate8
40	Error: MS(Error)	20	2187.500000	_	_	AllRate8
41	Run	1	376.041667	2.14	0.3820	AllRate9
42	Type	1	42926	243.84	0.0407	AllRate9
43	Error: MS(Run*Type)	1	176.041667	_	_	AllRate9
44	Run*Type	1	176.041667	2.29	0.1459	AllRate9
45	Error: MS(Error)	20	1537.500000	_	_	AllRate9

StepB: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	2.041667	0.00	0.9623	AllRate1
2	Type	1	13132	22.64	0.1319	AllRate1
3	Error: MS(Run*Type)	1	580.166667	_	_	AllRate1
4	Run*Type	1	580.166667	2.25	0.1496	AllRate1
5	Error: MS(Error)	20	5166.623333	_	_	AllRate1
6	Run	1	1979.040571	3.00	0.3332	AllRate2
7	Type	1	25151	38.16	0.1022	AllRate2
8	Error: MS(Run*Type)	1	659.129143	_	_	AllRate2
9	Run*Type	1	659.129143	1.76	0.2003	AllRate2
10	Error: MS(Error)	19	7114.004667	_	_	AllRate2
11	Run	1	7338.666730	7.78	0.2191	AllRate3
12	Type	1	16620	17.62	0.1489	AllRate3
13	Error: MS(Run*Type)	1	943.067683	_	_	AllRate3
14	Run*Type	1	943.067683	1.58	0.2246	AllRate3
15	Error: MS(Error)	19	11372	_	_	AllRate3
16	Run	1	354.970417	1.46	0.4398	AllRate4
17	Type	1	39455	162.65	0.0498	AllRate4
18	Error: MS(Run*Type)	1	242.570417	_	_	AllRate4
19	Run*Type	1	242.570417	0.56	0.4626	AllRate4
20	Error: MS(Error)	20	8647.408333	_	_	AllRate4
21	Run	1	164.850417	0.45	0.6224	AllRate5
22	Type	1	46104	127.11	0.0563	AllRate5
23	Error: MS(Run*Type)	1	362.703750	_	_	AllRate5
24	Run*Type	1	362.703750	0.77	0.3906	AllRate5
25	Error: MS(Error)	20	9419.145000	_	_	AllRate5
26	Run	1	5.133750	0.06	0.8533	AllRate6
27	Type	1	40879	438.52	0.0304	AllRate6
28	Error: MS(Run*Type)	1	93.220417	_	_	AllRate6
29	Run*Type	1	93.220417	0.25	0.6206	AllRate6
30	Error: MS(Error)	20	7375.655000	_	_	AllRate6
31	Run	1	48.167683	0.37	0.6539	AllRate7
32	Type	1	49225	373.37	0.0329	AllRate7
33	Error: MS(Run*Type)	1	131.840063	_	_	AllRate7
34	Run*Type	1	131.840063	1.03	0.3229	AllRate7
35	Error: MS(Error)	19	2432.175333	_	_	AllRate7
36	Run	1	2.343750	0.01	0.9344	AllRate8
37	Type	1	35428	161.76	0.0500	AllRate8
38	Error: MS(Run*Type)	1	219.010417	_	_	AllRate8
39	Run*Type	1	219.010417	1.14	0.2992	AllRate8
40	Error: MS(Error)	20	3855.115000	_	_	AllRate8
41	Run	1	1133.000417	0.61	0.5787	AllRate9
42	Type	1	44591	23.88	0.1285	AllRate9
43	Error: MS(Run*Type)	1	1867.370417	_	_	AllRate9
44	Run*Type	1	1867.370417	17.01	0.0005	AllRate9
45	Error: MS(Error)	20	2195.598333	_	_	AllRate9

StepB: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	26.041667	1.00	0.5000	AllRate1
2	Type	1	26.041667	1.00	0.5000	AllRate1
3	Error: MS(Run*Type)	1	26.041667	_	_	AllRate1
4	Run*Type	1	26.041667	1.62	0.2172	AllRate1
5	Error: MS(Error)	20	320.833333	_	_	AllRate1
6	Run	1	4.166667	1.98E30	<.0001	AllRate2
7	Type	1	66.666667	3.17E31	<.0001	AllRate2
8	Error: MS(Run*Type)	1	2.103629E-30	_	_	AllRate2
9	Run*Type	1	2.103629E-30	0.00	1.0000	AllRate2
10	Error: MS(Error)	20	525.000000	_	_	AllRate2
11	Run	1	51.041667	1.00	0.5000	AllRate3
12	Type	1	84.375000	1.65	0.4208	AllRate3
13	Error: MS(Run*Type)	1	51.041667	_	_	AllRate3
14	Run*Type	1	51.041667	2.53	0.1277	AllRate3
15	Error: MS(Error)	20	404.166667	_	_	AllRate3
16	Run	1	126.041667	1.00	0.5000	AllRate4
17	Type	1	1134.375000	9.00	0.2048	AllRate4
18	Error: MS(Run*Type)	1	126.041667	_	_	AllRate4
19	Run*Type	1	126.041667	2.27	0.1479	AllRate4
20	Error: MS(Error)	20	1112.500000	_	_	AllRate4
21	Run	1	204.166667	1.00	0.5000	AllRate5
22	Type	1	11267	55.18	0.0852	AllRate5
23	Error: MS(Run*Type)	1	204.166667	_	_	AllRate5
24	Run*Type	1	204.166667	1.25	0.2774	AllRate5
25	Error: MS(Error)	20	3275.000000	_	_	AllRate5
26	Run	1	104.166667	0.69	0.5577	AllRate6
27	Type	1	23438	156.25	0.0508	AllRate6
28	Error: MS(Run*Type)	1	150.000000	_	_	AllRate6
29	Run*Type	1	150.000000	1.83	0.1915	AllRate6
30	Error: MS(Error)	20	1641.666667	_	_	AllRate6
31	Run	1	0	0.00	1.0000	AllRate7
32	Type	1	44204	2652.25	0.0124	AllRate7
33	Error: MS(Run*Type)	1	16.666667	_	_	AllRate7
34	Run*Type	1	16.666667	0.37	0.5478	AllRate7
35	Error: MS(Error)	20	891.666667	_	_	AllRate7
36	Run	1	9.375000	0.36	0.6560	AllRate8
37	Type	1	56551	2171.56	0.0137	AllRate8
38	Error: MS(Run*Type)	1	26.041667	_	_	AllRate8
39	Run*Type	1	26.041667	1.34	0.2600	AllRate8
40	Error: MS(Error)	20	387.500000	_	_	AllRate8
41	Run	1	8.928571	1.00	0.5000	AllRate9
42	Type	1	53858	6032.11	0.0082	AllRate9
43	Error: MS(Run*Type)	1	8.928571	_	_	AllRate9
44	Run*Type	1	8.928571	1.63	0.2173	AllRate9
45	Error: MS(Error)	19	104.166667	_	_	AllRate9

StepB: Run*Type ANOVA for Everything

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Run	1	86.640000	0.19	0.7383	AllRate1
2	Type	1	327.081667	0.72	0.5526	AllRate1
3	Error: MS(Run*Type)	1	455.881667	_	_	AllRate1
4	Run*Type	1	455.881667	0.82	0.3770	AllRate1
5	Error: MS(Error)	20	11168	_	_	AllRate1
6	Run	1	1375.620417	12.16	0.1778	AllRate2
7	Type	1	986.883750	8.73	0.2078	AllRate2
8	Error: MS(Run*Type)	1	113.100417	_	_	AllRate2
9	Run*Type	1	113.100417	0.18	0.6758	AllRate2
10	Error: MS(Error)	20	12561	_	_	AllRate2
11	Run	1	8.166667	0.79	0.5384	AllRate3
12	Type	1	384.000000	36.92	0.1038	AllRate3
13	Error: MS(Run*Type)	1	10.401667	_	_	AllRate3
14	Run*Type	1	10.401667	0.02	0.8792	AllRate3
15	Error: MS(Error)	20	8771.676667	_	_	AllRate3
16	Run	1	1656.681667	1363.52	0.0172	AllRate4
17	Type	1	16538	13611.1	0.0055	AllRate4
18	Error: MS(Run*Type)	1	1.215000	_	_	AllRate4
19	Run*Type	1	1.215000	0.00	0.9609	AllRate4
20	Error: MS(Error)	20	9847.976667	_	_	AllRate4
21	Run	1	206.506667	0.30	0.6828	AllRate5
22	Type	1	40131	57.52	0.0835	AllRate5
23	Error: MS(Run*Type)	1	697.681667	_	_	AllRate5
24	Run*Type	1	697.681667	3.14	0.0918	AllRate5
25	Error: MS(Error)	20	4450.310000	_	_	AllRate5
26	Run	1	625.260417	0.44	0.6265	AllRate6
27	Type	1	50078	35.38	0.1060	AllRate6
28	Error: MS(Run*Type)	1	1415.270417	_	_	AllRate6
29	Run*Type	1	1415.270417	5.24	0.0331	AllRate6
30	Error: MS(Error)	20	5401.498333	_	_	AllRate6
31	Run	1	21.660000	0.07	0.8328	AllRate7
32	Type	1	41600	138.84	0.0539	AllRate7
33	Error: MS(Run*Type)	1	299.626667	_	_	AllRate7
34	Run*Type	1	299.626667	1.38	0.2542	AllRate7
35	Error: MS(Error)	20	4348.420000	_	_	AllRate7
36	Run	1	6.510417	0.16	0.7581	AllRate8
37	Type	1	50463	1236.21	0.0181	AllRate8
38	Error: MS(Run*Type)	1	40.820417	_	_	AllRate8
39	Run*Type	1	40.820417	0.18	0.6750	AllRate8
40	Error: MS(Error)	20	4508.768333	_	_	AllRate8
41	Run	1	0.720143	0.00	0.9727	AllRate9
42	Type	1	36287	93.04	0.0658	AllRate9
43	Error: MS(Run*Type)	1	390.029349	_	_	AllRate9
44	Run*Type	1	390.029349	1.75	0.2018	AllRate9
45	Error: MS(Error)	19	4239.067000	_	_	AllRate9

StepC: Run*Type ANOVA for Single Run

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	1	533.333333	8.42	0.0158	StepCRate1
2	Error	10	633.333333	_	_	StepCRate1
3	Corrected Total	11	1166.666667	_	_	StepCRate1
4	Model	1	2133.333333	23.49	0.0007	StepCRate2
5	Error	10	908.333333	_	_	StepCRate2
6	Corrected Total	11	3041.666667	_	_	StepCRate2
7	Model	1	102.083333	1.27	0.2862	StepCRate3
8	Error	10	804.166667	_	_	StepCRate3
9	Corrected Total	11	906.250000	_	_	StepCRate3
10	Model	1	2002.083333	13.16	0.0046	StepCRate4
11	Error	10	1520.833333	_	_	StepCRate4
12	Corrected Total	11	3522.916667	_	_	StepCRate4
13	Model	1	8008.333333	141.32	<.0001	StepCRate5
14	Error	10	566.666667	_	_	StepCRate5
15	Corrected Total	11	8575.000000	_	_	StepCRate5
16	Model	1	16133.333333	297.85	<.0001	StepCRate6
17	Error	10	541.666667	_	_	StepCRate6
18	Corrected Total	11	16675.000000	_	_	StepCRate6
19	Model	1	19200.000000	307.20	<.0001	StepCRate7
20	Error	10	625.000000	_	_	StepCRate7
21	Corrected Total	11	19825.000000	_	_	StepCRate7
22	Model	1	23408.333333	540.19	<.0001	StepCRate8
23	Error	10	433.333333	_	_	StepCRate8
24	Corrected Total	11	23841.666667	_	_	StepCRate8
25	Model	1	24300.000000	1121.54	<.0001	StepCRate9
26	Error	10	216.666667	_	_	StepCRate9
27	Corrected Total	11	24516.666667	_	_	StepCRate9

StepD: Run*Type ANOVA for Single Run

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	1	2.0833333	0.20	0.6643	StepDRate1
2	Error	10	104.1666667	_	_	StepDRate1
3	Corrected Total	11	106.2500000	_	_	StepDRate1
4	Model	1	833.3333333	9.43	0.0118	StepDRate2
5	Error	10	883.3333333	_	_	StepDRate2
6	Corrected Total	11	1716.6666667	_	_	StepDRate2
7	Model	1	1518.7500000	14.64	0.0033	StepDRate3
8	Error	10	1037.5000000	_	_	StepDRate3
9	Corrected Total	11	2556.2500000	_	_	StepDRate3
10	Model	1	5418.7500000	28.71	0.0003	StepDRate4
11	Error	10	1887.5000000	_	_	StepDRate4
12	Corrected Total	11	7306.2500000	_	_	StepDRate4
13	Model	1	9352.0833333	91.61	<.0001	StepDRate5
14	Error	10	1020.8333333	_	_	StepDRate5
15	Corrected Total	11	10372.916667	_	_	StepDRate5
16	Model	1	9352.0833333	65.82	<.0001	StepDRate6
17	Error	10	1420.8333333	_	_	StepDRate6
18	Corrected Total	11	10772.916667	_	_	StepDRate6
19	Model	1	12675.000000	234.00	<.0001	StepDRate7
20	Error	10	541.6666667	_	_	StepDRate7
21	Corrected Total	11	13216.666667	_	_	StepDRate7
22	Model	1	14352.083333	81.82	<.0001	StepDRate8
23	Error	10	1754.1666667	_	_	StepDRate8
24	Corrected Total	11	16106.250000	_	_	StepDRate8
25	Model	1	18802.083333	142.35	<.0001	StepDRate9
26	Error	10	1320.8333333	_	_	StepDRate9
27	Corrected Total	11	20122.916667	_	_	StepDRate9

StepC: Run*Type ANOVA for Single Run

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	1	777.630000	1.58	0.2380	StepCRate1
2	Error	10	4936.010000	_	_	StepCRate1
3	Corrected Total	11	5713.640000	_	_	StepCRate1
4	Model	1	215.900833	0.32	0.5826	StepCRate2
5	Error	10	6692.788333	_	_	StepCRate2
6	Corrected Total	11	6908.689167	_	_	StepCRate2
7	Model	1	260.400833	0.62	0.4483	StepCRate3
8	Error	10	4181.688333	_	_	StepCRate3
9	Corrected Total	11	4442.089167	_	_	StepCRate3
10	Model	1	8127.607500	12.96	0.0048	StepCRate4
11	Error	10	6271.115000	_	_	StepCRate4
12	Corrected Total	11	14398.722500	_	_	StepCRate4
13	Model	1	25705.763333	169.48	<.0001	StepCRate5
14	Error	10	1516.763333	_	_	StepCRate5
15	Corrected Total	11	27222.526667	_	_	StepCRate5
16	Model	1	34165.340833	165.77	<.0001	StepCRate6
17	Error	10	2061.001667	_	_	StepCRate6
18	Corrected Total	11	36226.342500	_	_	StepCRate6
19	Model	1	24480.333333	248.62	<.0001	StepCRate7
20	Error	10	984.653333	_	_	StepCRate7
21	Corrected Total	11	25464.986667	_	_	StepCRate7
22	Model	1	26686.900833	135.12	<.0001	StepCRate8
23	Error	10	1974.988333	_	_	StepCRate8
24	Corrected Total	11	28661.889167	_	_	StepCRate8
25	Model	1	23205.607500	121.95	<.0001	StepCRate9
26	Error	10	1902.921667	_	_	StepCRate9
27	Corrected Total	11	25108.529167	_	_	StepCRate9

StepD: Run*Type ANOVA for Single Run

Obs	Source	DF	SS	FValue	ProbF	TypeRate
1	Model	1	5.333333	0.01	0.9281	StepDRate1
2	Error	10	6231.686667	_	_	StepDRate1
3	Corrected Total	11	6237.020000	_	_	StepDRate1
4	Model	1	884.083333	1.51	0.2478	StepDRate2
5	Error	10	5868.216667	_	_	StepDRate2
6	Corrected Total	11	6752.300000	_	_	StepDRate2
7	Model	1	134.000833	0.29	0.6008	StepDRate3
8	Error	10	4589.988333	_	_	StepDRate3
9	Corrected Total	11	4723.989167	_	_	StepDRate3
10	Model	1	8411.107500	23.52	0.0007	StepDRate4
11	Error	10	3576.861667	_	_	StepDRate4
12	Corrected Total	11	11987.969167	_	_	StepDRate4
13	Model	1	15123.000000	51.55	<.0001	StepDRate5
14	Error	10	2933.546667	_	_	StepDRate5
15	Corrected Total	11	18056.546667	_	_	StepDRate5
16	Model	1	17328.000000	51.87	<.0001	StepDRate6
17	Error	10	3340.496667	_	_	StepDRate6
18	Corrected Total	11	20668.496667	_	_	StepDRate6
19	Model	1	17419.320000	51.79	<.0001	StepDRate7
20	Error	10	3363.766667	_	_	StepDRate7
21	Corrected Total	11	20783.086667	_	_	StepDRate7
22	Model	1	23816.430000	94.00	<.0001	StepDRate8
23	Error	10	2533.780000	_	_	StepDRate8
24	Corrected Total	11	26350.210000	_	_	StepDRate8
25	Model	1	13913.914667	53.60	<.0001	StepDRate9
26	Error	9	2336.145333	_	_	StepDRate9
27	Corrected Total	10	16250.060000	_	_	StepDRate9