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Variation of Seed Yield and Stem Number in Different Genotypes of Intermediate Wheatgrass

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ABSTRACT

Intermediate Wheatgrass is a popular perennial that is used for hay and forage. The reason this plant is so popular is because it can survive many types of conditions and is known to be less weedy than other crops. This plant has shown lots of progress in the past for producing a quality yield and you don't have to replant it every year. The Land Institute offered me an opportunity to work with this plant. The intermediate wheatgrass was planted in the spring of 2011 and threshed in the fall of 2011. I planted 210 plants in three different plots. Each plot had had 70 different genotypes in them. This means that there were three of each 70 different genotypes. In my research I compared the number of seeds in each genotype. To compare my plants I ran two way Anovas. The two-way Anova turned out not significant as was expected.

Keywords: *Intermediate Wheatgrass, perennials, Land institute, Thinopyrium intermedium*

INTRODUCTION

Annual grains are is a large and essential portion of the human diet. Two thirds of the world's cropland is dedicated to annuals. Annuals are known for their large seed size and yield. The down sides to annuals are soil erosion, contamination, nitrogen loss and cost. To control the weeds when growing annuals, tilling is one of the tools used. By using the tilling method it can cause bad soil erosion. Better management of annuals would reduce erosion in soil by 2.8 tons of acre per year. The other way to control weeds and disease is by using pesticides. (USDA-NRCS,2004a) Some say this is better because you're not using the tilling method to erode the ground, but it's just as bad. Using pesticides can harm animals and humans because it can get in the water way or can be digested straight into the body. To help the plants grow bigger and produce larger seed yield nitrogen is used as a fertilizer. The plant itself only soaks up about 30-50% of the applied nitrogen. This means that the rest of the nitrogen fertilizer is leaching. It is starting to pollute ground and surface waters, which again can harm animals and humans. The cost of annuals these days are getting really expensive to take care of and to purchase. All these problems are leading up to one thing and that is switching over to perennials.

Perennials reduce the need for herbicides and have been successful in the past. One perennial in particular has become popular, intermediate wheatgrass (IWG). There has been a growing interest in increasing the seed yield of IWG.

Intermediate wheatgrass (Thinopyrum intermedium) originated from Eurasia and is used in North America for hay and forage. (D.R. Dewey) This plant can survive all kinds of conditions and environments. It can tolerate flooding, droughts, ice, and many more inputs because it has a deep root system. In past researches, it has shown no tendencies to become weedy or invasive. (USDA-NRCS,2004a) Since this plant outcompetes most weeds, herbicides will not be needed. To help in place of fertilizers it is suggested that you pair them with legumes, such as alfalfa. IWG is profitable and easily processed. Although annual crops have better yields then perennials, the input cost for perennials are likely to be less. (Watt,1989)

There are good reasons of why the Land Institute (Salina, KS) chooses intermediate wheatgrass over other wheat grasses. IWG can provide multiple benefits such as reducing the need for herbicides and building soil organic matter. This wheatgrass is also well-matched with legumes, which is important because it helps reduce the need for any type of fertilizer. The last big reason is for human consumption or usage. It is profitable because there is little input cost which helps you make more money than you are spending on the crop. The crop is very edible and easy to process. Some bakers and cooks have experimented with it already and have liked the taste.

MATERIALS AND METHODS

The Land Institute received a grant from the NCRS to do research on Intermediate Wheatgrass. The Land Institute then granted me money to do a portion of the project for them. There are two other places they are doing research at in the United States. All of our supplies were supplied through them.

At the beginning there were 210 plants. In those 210 plants there are 70 different genotypes, three of each kind. I tagged all the plants and split them up into three different groups. The three different groups had one of each genotype in it. The plants were then planted in the same plot, but split into three sections. The plants were planted in the spring of 2011. I let the plants grow all summer long. Throughout the summer I had to weed the plants at least once a week. In the early fall, before the plants were ready to be threshed I measured the height of each plant. I also the counted the stems of each plant and put the data in a hand drawn table. All the stems of each plant would get bundled into one and labeled with their genotype number and plot A, B, or C. After collecting all the plants I had to thresh the seeds from each of the plants. I used a threshing box to do this. Once all the seeds were collected I weighed the seeds on a scale and picked a number of seeds to compare with for each plant.

After I get all the data collected, I am hoping to compare all my data to the two other plots in the United States. This will show what plot produced the larger yield and seed size.

RESULTS

Out of the 210 plants that were planted, I ended up collected data for 207. Somewhere between writing down the data and collecting the seeds I lost track of one genotype. My prediction was that the plant never grew, so I never wrote down the data. The data I wanted to compare is number of stems vs. number of seeds in each genotype. The first test I ran was a two-way Anova test comparing the number of seeds to each plant in each plot. After doing the Anova test I did a Holm-Sidak for comparison (Figure 1). The second test I ran was a two-way Anova test comparing the number of seeds of each plant in each plot. After doing that I did another Holm-Sidak for comparison (Figure 2). Then I ran another Anova to compare the number of stems vs number of seeds to each genotype and got a p value of <.001. (Figure 3)

Comparison	Diff of Means	Unadjusted P	Critical Level	Significant?
B vs. C	0.921	0 .0818	0.017	No
B vs. A	0.896	0.0863	0.025	No
A vs. C	0.0253	0.962	0.050	No

Figure 1:Holm-Sidak comparison of seed number in each plot.

Comparison	Diff of Means	Unadjusted P	Critical Level	Significant?
C vs. B	0.407	0.906	0.017	No
C vs. A	0.339	0.924	0.025	No
A vs. B	0.0684	0.984	0.050	No

Figure 2: Holm-sidak comparison of stem number in each plot.

Source of Variation	DF	SS	MS	F	P
Col 2	2	29.400	14.700	2.646	0.074
Col 4	42	992.040	23.620	4.251	<0.001
Residual	162	900.076	5.556		
Total	206	2020.415	9.808		

Table 1: Two-way anova comparison of number of stems vs. number of seeds in each genotype.

DISCUSSION

My main objective was to find a correlation between genetic and environmental effects on seed yield. Because my plot was pretty much the same environment there was not a significant correlation between the environmental effects compared to seed yield. If my data would have been compared to a different environment then I would have found some comparison. When finding at correlation between seed number and stem number in each genotype I figured there would be a significant correlation. Because I did not get the data from the other two locations I was not able to compare my data with theirs.

When running the test I did find correlation between the two. The Land Institute will be able to decide which genotypes produced the highest yield and use more of those genotypes in the next planting.

The errors that were possibly made in this could have been many different things. Starting with taking care of the plants in the summer, when weeding the plants I pulled up a couple of plants on accident causing them to have no data. When collecting the seeds I might have lost a few through the traveling and threshing. Other errors deal with counting stem and seeds. Counting the seeds was a tedious process sometimes having to double check.

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