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COMPARING BROADCAST AND CONVENTIONAL DRILL METHODS FOR SEEDING WINTER WHEAT

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ABSTRACT

Agricultural production drill and broadcast seeding are established methods for planting cereals. Broadcast seeding has higher risk due to several factors including poor seed to soil contact, poor fertilizer incorporation, poorly incorporated seed exposed to the elements, and lower yields. The University of Idaho conducted a study in 2016 and 2017 using irrigated winter wheat to determine if broadcasting winter wheat seed with fertilizer was as effective as drilling wheat seed. Results showed there was no statistical difference in yield found between the treatments in 2016 (*P*=0.49) or 2017 (*P*=0.15). Greater variability between replications was found within the broadcast treatment versus the drilled treatment for both years. Results do not warrant changing established drill seeding recommendations.

INTRODUCTION

Winter wheat and barley are major rotation crops in south central Idaho. Planting cereals with a drill is the recommended practice for best results (Herbek and Murdock, 2009). The best wheat stand establishment and yield are obtained by seeding with a grain drill as they offer more precision for seed placement and plant density (Herbek and Murdock, 2009; Larson and Watson, 2005). Producers are always looking for ways to do things faster with less input costs and broadcasting cereal seed mixed with a fertilizer application is an accepted practice and considered the most economical method to apply seed to large areas of land (USDA, 2009). The seed and fertilizer are mixed and applied using commercial fertilizer applicators which saves the cost of using a drill and possibly eliminating the need to purchase a drill. Once the application is completed, the seed and fertilizer are lightly incorporated using a roller-harrow or other shallow tillage tool to provide good seed to soil contact without burying the seed. The key to success with this method is to ensure the seed bed has been sufficiently prepared so the tillage tool can provide proper seed to soil contact and firmness to the seedbed (USDA, 2009). It is recommended to increase the seeding rate when using broadcast seeding compared to drilling (Herbek and Murdock, 2009; Larson and Watson, 2005; University of Idaho Extension, 2005).

Two opinions are considered when discussing broadcast seeding (Herbek and Murdock, 2009; Larson and Watson, 2005; University of Idaho Extension, 2005; USDA, 2009). The first opinion states the broadcast method is the most economical method to apply seed over a large area and despite challenges it can be worthwhile in some years (USDA, 2009; University of Idaho Extension, 2005). The second opinion states that the method can be unreliable due to random seed depth and emergence, non-unifiorm stands, increased chance for winter injury, increased seed costs and usually lower yeilds (Herbek and Murdock, 2009; Larson and Watson, 2005). One study in Canada did not recommend broadcast seeding as no successful substitute for drill seeding could be identified by the researchers (Collins and Fowler, 1992). Seedbed preparation was identified as the most critical component to success with the broadcast method (USDA, 2009). Rain or irrigation are necessary when broadcasting as seed can't be placed into soil moisture as with drilling (Collins and Fowler, 1992; University of Idaho, 2005).

The McGregor Company is a full-service agronomy business with a seed treatment facility located in Twin Falls, Idaho. Company representatives asked University of Idaho Extension to conduct a study comparing broadcast and conventional drill methods for seeding winter wheat to help them make seeding application recommendations to their growers. Though broadcasting seed is certainly not a new idea, the consultants wanted some data in irrigated production to back up their discussions with growers. Much of the research that has been conducted has been in dryland/rain-fed production. A two-year study was designed and conducted at the University of Idaho Kimberly Research and Extension Center farm located in Kimberly, Idaho. The farm consists of silt loam soils at approximately 3800 feet elevation.

METHODS

The study design was a randomized complete block with two treatments and four replications. In 2016 the plots were 20 feet x 158 feet and in 2017 plot size was 20 feet x 115 feet. The difference in length was due to field configuration each year. A five-foot strip was harvested from each plot using a Wintersteiger Delta plot combine with a 5-foot head. Harvest dates were July 29th in 2016 and August 16th in 2017. Irrigation was provided by a wheel-line sprinkler system.

At the beginning of the study the site was prepared using a moldboard plow, disk, and roller-harrow. Fertilizer amendments were determined using soil tests and based on Southern Idaho Fertilizer Guide: Irrigated Winter Wheat (Brown, 2001). Nitrogen (N) was applied to both treatments at a 1/2 rate (120 lbs./acre for 2016; 92 lbs./acre for 2017) and phosphorus (P) was applied at a full rate to both treatments (60 lbs./acre for 2016; 44 lbs./acre for 2017). The fertilizer for

the drilled treatment was applied prior to drilling and the fertilizer for the broadcast treatment was broadcast with the seed through an air fertilizer spreader. A 1/2 rate of N was used to prevent leaching excess N throughout the winter. No other fertilizer amendments were needed. After fertilizer was applied, the entire site was roller-harrowed. The second 1/2 rate of N was applied to both treatments in the spring just before elongation of the stem, approximately Feekes Stage 5. The application took place in 2016 but miscommunication prevented the spring application from taking place in 2017. By the time it was realized that N had not been applied, the plants were too mature to drive the applicator across. The lack of N in 2017 is evident in the final yield results in Table 1 and can also be seen in the yield distribution boxes placement on the y axis below in Figure 1.

The conventional drill plots were planted with an International (IH) model 510 10-foot drill with 6-inch spacings. The broadcast plots were planted with a Valmar model 500 air fertilizer spreader. The wheat variety for both study years was WB 1529 soft white winter wheat. Seeding rate was 125 lbs./acre for the conventionally drilled treatment and 140 lbs./acre for the broadcast treatment. The winter wheat plots were planted October 6th in both 2015 and 2016.

RESULTS

Statistical analysis was conducted using SAS© Proprietary Software 9.4 PROC GLM. The results of the study are shown in Table 1. The year effect was significant so further analyses were done by year. There was no statistical difference found between the treatments in 2016 (P=0.49) or 2017 (P=0.15). Least Significant Differnce (LSD) at the 0.05 level is larger than the difference between treatments in both years indicating the treatments are not different from one another in either year. The LSD in 2016 was 15.3 bu./acre and the difference between treatment averages was 3.75 bu./acre. In 2017 the LSD was 22 bu./acre and the differnce between treatment averages was 13.25 bu./acre.

Table 1. Broadcast versus conventional drill methods for seeding winter wheat. Differences in yield measured in bu./acre and test weight measured in lbs./bu. are not significant within year.

Year	Treatment	Average Yield (bu./acre)	Test Weight (lbs./bu.)
2016	Broadcast w/fertilizer	158	62
	Conventional drill	154	62
	P value	0.49	
	LSD (.05)	15.3	
	Difference between treatments	3.8	
2017	Broadcast w/fertilizer	85	63
	Conventional drill	71	63
	P value	0.15	
	LSD (.05)	22	
	Difference between treatments	13.3	

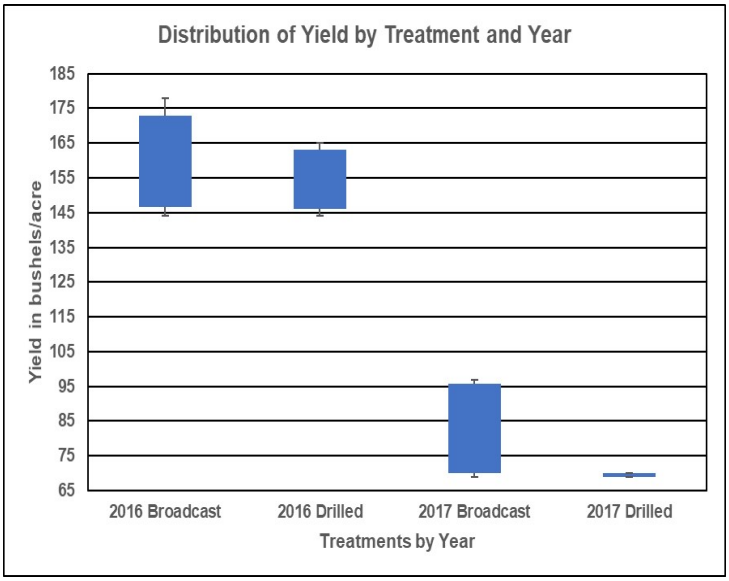

Figure 1. Distribution of yield between replications for each treatment by year, showing the variability between treatments. Distance between upper and lower whiskers represents the spread in bu./acre between the four replications in each treatment.

DISCUSSION

The data in this study indicates that planting winter wheat using the broadcast method with fertilizer is a viable practice. The success of the broadcast method was likely the result of good seedbed preparation with tillage, proper calibration of fertilizer and seeding equipment, and by increasing the seeding rate and paying attention to detail with the final roller-harrow pass to ensure the seed was covered but not buried. Averages of the individual treatment replications were used to develop the results for each treatment shown in Table 1. It is interesting to note that in both years, yield of the four replications of the drilled treatment exhibited less variability than the broadcast treatment. In 2016 the broadcast replications were separated by 34 lbs. versus 21 lbs. for the drilled replications. A similar situation was shown in 2017 as drilled treatment replications were within 1 lb. of each other while the broadcast replications were separated by 28 lbs. Figure 1 displays the distribution of yield boxes and graphically illustrates the variability within each treatment by year. Each box represents the spread between the highest and lowest yeilding replication within each treatment by year. By comparing the spread between the upper and lower whisker of each box it is easy to see that the broadcast treatment had the most variablilty between replications both years.

The study results show broadcast wheat yield is equal to drilled wheat yield but the variability within the treatment replications must be considered if an agronomist is making recommendations to growers. The most common seeding practice for cereals in southern Idaho is to prepare the field, fertilize, and then incorporate fertilizer and seed by pulling a roller-harrow and grain drill in tandem. The University of Idaho Extension recommendation is to use a drill when planting wheat as best germination and emergence occur at seeding depths of 1-1 ½ inches (Kephart and Stark, 1989; Robertson, et al., 2004). The broadcast method, though successful in this study, is the least desirable seeding method and prone to poor stand success if the seed bed is not prepared properly, is too dry, the seed is buried too deep, or too much is left on the soil surface. If a recommendation to use the broadcast method is made, the consultant must be certain the grower understands the process necessary for success and the risk of stand failure. A more thorough field size study would need to be conducted before standard drilling recommendations are changed.

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