Large-Scale Plots Examine Seeding Rate Effects on Wheat Yield

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Irrigated winter wheat is grown as a rotational crop following potatoes in the Columbia Basin region of Oregon and Washington. As a rotational crop, it is desirable to minimize inputs and maximize yield. Seeding rate studies have been made under dryland production in the Pacific Northwest. Donaldson et al. (2001) reported that with above average precipitation grain yield was not decreased by low sowing rate in August. Grain yields were reduced by low seeding rates in combination with later seeding dates in September and October. Few studies have assessed the impact of seeding rate in irrigated wheat. Bohle et al. (1998) did a seeding rate by variety study on irrigated wheat in central Oregon, using small-scale research plots.

The study reported here was undertaken to determine the optimum seeding rate using replicated large-scale plots and normal production size farm equipment. The study was on an irrigated farm using center pivot irrigation. As Barao, S.M. (1992) said, "Instruction and demonstration of new technology within the controlled setting of a university research farm may not encourage farmers to adopt the technology for their farms, which have distinct and different resources." Information generated allows for better agronomic decision-making validated under normal growing conditions.

Three year study examines optimum seeding rates

A three-year study during the 1999 to 2000, 2000 to 2001, and 2001 to 2002 growing seasons was conducted near Echo, Oregon. The soil is a Shano very fine sandy loam (Coarse-silty, mixed, superactive, mesic Xeric Haplocambids). Average precipitation at the site was 6 to 10 inches annually.

Registered 'Stephens' soft white winter wheat was planted with a John Deere 730 air drill at rates of 40, 60, and 80 lb seed/acre in 1999 and 40, 60, 80 and 100 lb seed/acre in 2000 and 2001. A completely randomized experimental design was used, with five replications in 1999-2000, three replications in 2000-01 and four replications in 2001-02. Each year the plots were located on different fields. Individual plot size was 30 ft x approximately 2500 ft, or about 2 acres.

Plots were prepared each fall following harvest of potatoes. Land preparations were disking and packing with a 20' Sunflower disk and Smizzer packer. The fields were then irrigated prior to seeding. Plot locations changed to a different field each year on the same farming operation within a five-mile distance of the other sites.

The trial was irrigated by center pivot irrigation. Fertilizer was applied at planting with the drill, in early spring with a JD Air cart with air booms, and in late spring as liquid fertilizer through the center pivot. In 2000, 197 lb N and 102 lb S/a were applied. In 2001, 52 lb N and 17 lb S/a were applied. In 2002, 88 lb N and 97 lb S/a were applied.

Borate FB/Granubor 15% was applied at 6.9 lb/a at planting in years 2000 and 2002. Broadleaf weeds were controlled during the growing season with bromoxynil (MCPA) and thifensulfuron with tribenuron (Harmony Extra) applied at 0.12 gal/a and 0.5 oz/a, respectively in mid-March to April.

Grain was harvested with the cooperator's International Harvester combine. Yield data were collected with the combine's yield monitor.

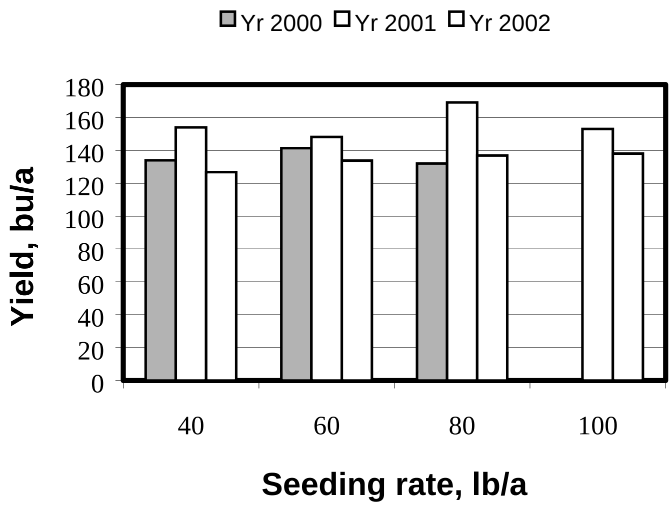

Figure 1. Grain yield as influenced by seeding rate in three growing seasons

Yields effected by season, not rates

Grain yields were affected by growing seasons but not by seeding rates (Fig. 1). The mean grain yield of 156 bu/acre measured in 2001 was significantly greater (LSD $_{@\ 10\%}$ = 8 bu/a) than mean yields of 138 and 134 bu/acre measured in 2000 and 2002. Three-year average grain yields were 137, 140, 143 and 144 bu/acre at seeding rates of 40, 60, 80 and 100 lb seed/acre, but differences among seeding rates were not statistically significant (Fig. 2).

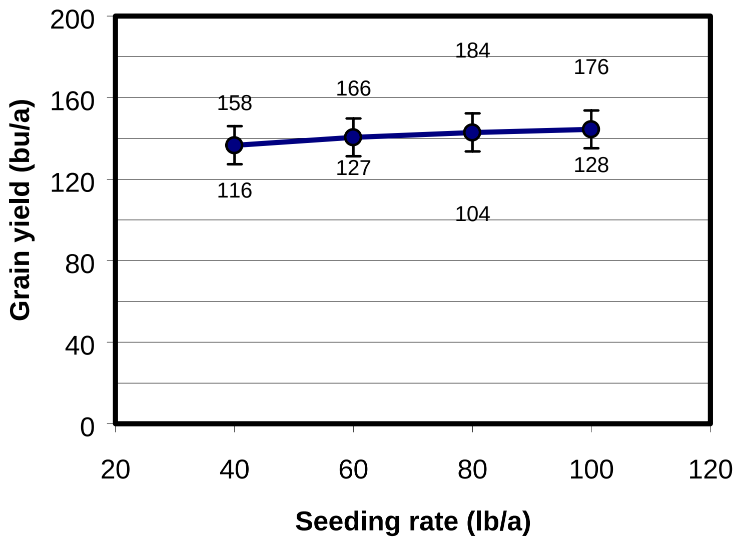

Figure 2. Three-year average grain yield as affected by seeding rate. Numbers below and above points are minimum and maximum grain yields at each seeding rate. Error bars around points represent Least Significant Difference (LSD) required for statistical significance at the 10% probability level.

These results are similar to those from a one-year, small-plot irrigated trial reported by Bohle et al. (1998). These investigators measured the highest yield (155 bu/acre) of 'Stephens' at a seeding rate of 16 seeds/ft^2 (83 lb seed/acre) but there were no statistically significant differences in yield between 8 and 20 seeds/ft^2 (41 and 104 lb seed/acre). Despite the lack of statistically significant differences, the trend toward increased yield with higher seeding rates suggests that growers may want to use intermediate seeding rates of 60 to 80 lb seed/acre (12 to 16 seeds/ft^2) to minimize risk of yield reduction. Yield data provided no justification for planting more than 16 seeds/ft^2.

Optimal winter wheat seeding rates reported from other regions have looked at combinations of seeding rate, seeding dates, and row spacing. A large-scale plot study in Ohio showed no differences in yield from seeding rates of 90, 120 and 150 lb/a (Miller, 1998) while a study in the northern Great Plains (Lafond and Gan, 1999) found optimum seeding rates of about 90 to 120 lb/a in six out of eight years. In low precipitation areas of Washington, grain yield was not decreased by low (6 seeds/ft^2) seeding rates in August, but was reduced compared with medium (12 seeds/ft^2) and high (18 seeds/ft^2) seeding rates in September and October. Yet, the high rate in either September or October had no advantage for grain yield. (Donaldson et al., 2001.)

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