2020 Michigan Wheat Field Day

Precision Planting in Winter Wheat

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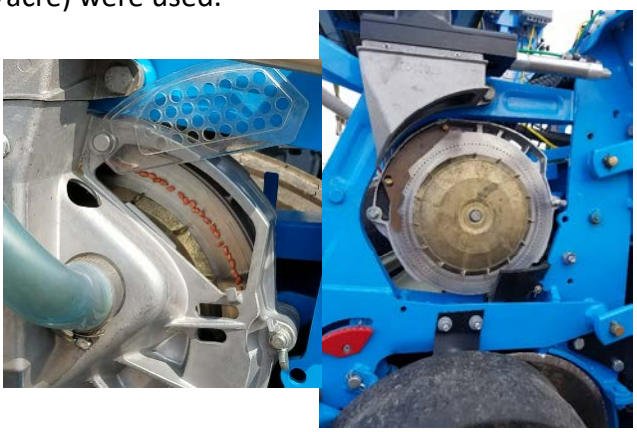
Problem Statement:
Conventional seed drills currently used to plant wheat can result in non-uniform seeding depth and plant-to-plant spacing. This may cause poor germination, reduced crown root development, and decreased tillering ability, which may lead to reduced yield potential.

Research Questions:

1. Will uniform planting depth and plant-to-plant spacing resulting from more precise placement of seeds from the use of a precision planter lead to reduced plant competition, improve plant health, and higher yield potential compared to the conventional seed drill?
2. Can wheat seeding rates be reduced without impacting grain yield?
3. What impacts will narrow and wide row spacing have on wheat grain yield compared to traditional 7.5" row spacing?

Methods:
In 2018 and 2019, research plots were planted at MSU Mason farm and Saginaw Valley Research and Extension Center (SVREC) using a precision planter with four row spacings (5", 7.5", 10", and 15") and a seed drill at 7.5" spacing. Four seeding rates (0.5, 1.0, 1.5, and 2 million seeds/acre) were used.



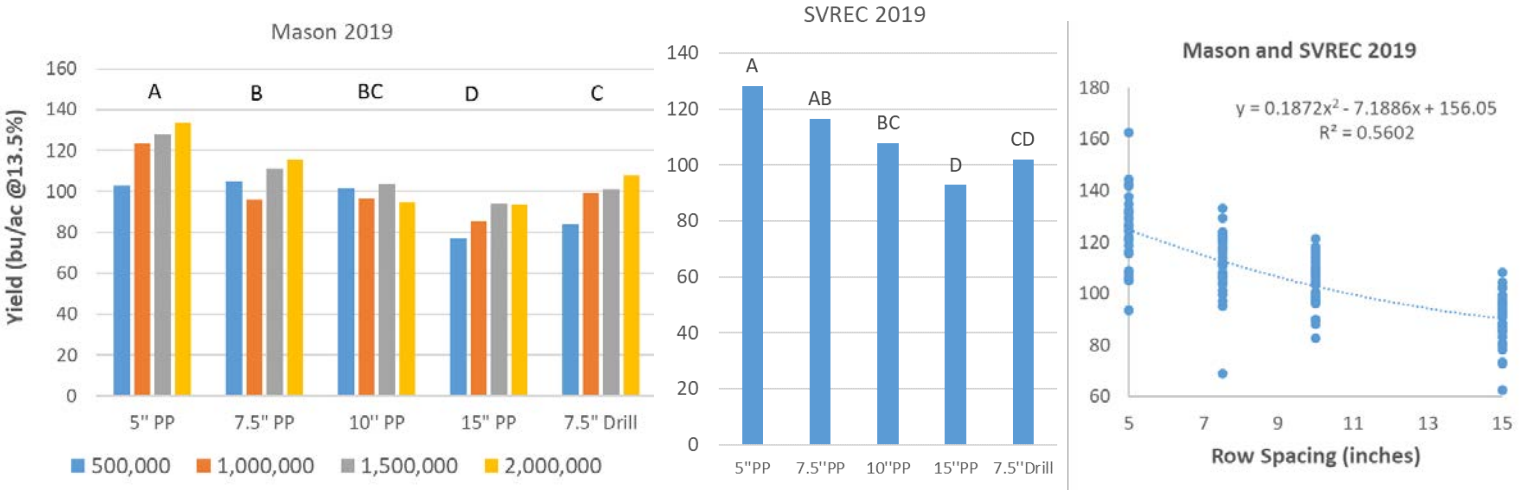
Conventional drill with rotating gear that "spills" seed into the drop tube (left panel), Precision planter with vacuum that picks up individual seeds and drops one seed at a time down the drop tube (right panel)

2019 Results- Planter vs Drill:

- Precision planting reduced the variability in seeding depth by 59% compared to the seed drill at Mason.
- Variability in plant-to-plant spacing was reduced by 17% in plots planted with precision planter.
- Reduction in variability in seeding depth as well as seed spacing using precision planter (i.e. uniform spatial distribution of seeds) can lead to uniform tiller growth and development, improved plant health; potentially leading to increased efficacy in management decisions (e.g. fungicide application).
- Stand establishment was also improved by 24% using precision planter (>70% stand) compared to seed drill (<60% stand).
- Overall, precision planted plots (107 bu/ac) showed 9% yield improvement over plots planted with a seed drill (98 bu/ac) at Mason. Yield increase of 15% (117 vs 102 bu/ac) was observed at SVREC.

Results- Row spacing and seeding rate

- Canopy closure was achieved fastest in narrow rows (5'') but was delayed in wider rows (15'') across all seeding rates. Faster canopy closure with narrow rows could also help with weed control and soil moisture conservation.
- Planting wheat in narrow rows led to higher yield. Based on first year data from 2 locations, decreasing row spacing to 5" increased yield by an average of 12 bu/acre compared to the conventional 7.5" row spacing using precision planter. Yield potential was lowest in 15'' row spacing.
- Based on 2019 and 2018 preliminary study, seeding rates of 1.3 – 1.5 m seeds/acre did not change canopy closure rate compared to higher rates even under delayed planting conditions, indicating the potential to reduce seeding rates without compromising wheat yield.
- Increase in seeding rate up to 1.3 -1.5 m seed/ac resulted in increased yields (except SVREC 2019). Seeding rate >1.5 m/ac did not increase yield even under delayed planting conditions, so there was no return on investment associated with higher seed rates. As seeding rate is reduced, competition between plants is reduced and each plant can produce more effective tillers that attribute to yield.
- Reduced harvest index (proportion of grains in total above ground biomass) was observed at both low (0.5 m) and high (2.0 m) seeding rates, indicating reduced grain yield potential under low/high rates.
- Narrow rows responded more favorably to increase in seeding rate compared to wider row spacings at one of the two locations in 2019. Wider rows benefit the least from increase in seeding rate.
- Yield under narrow rows (5'') at campus location (Ingham county) averaged across 1.0-2.0 m seeds/ac was 128 bu/ac compared to county's average 2019 yield of 72.5 bu/ac, indicating the potential of precision planting and narrow row spacing in increasing wheat yield potential.



Impact of row spacing and seeding rate on grain yield at Mason 2019 (left) and SVREC (middle); increase in yield potential with narrow row spacing for Mason and SVREC 2019 (right). PP- Precision Planter.

Take Home Messages:

- Improved seed placement at planting time (i.e. uniform seeding depth and seed-to-seed spacing) can lead to increase in crop uniformity during the growing season and improved yield potential.
- Potential for reduction in seeding rate (<1.5 m seeds/ac) without limiting yield while reducing input costs.
- Narrow row spacing, either alone or in combination with precision planting, can lead to increase in wheat yield potential.
- Optimize current planter configuration to plant in narrow rows OR invest in new planting technology to be used for multiple crops.