



## Phosphorus management for Saskatchewan soybeans

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Seed-placed rates of up to 35 lbs.  $P_2O_5$  per acre (40 kg  $P_2O_5$ /ha) were safe across a wide range of conditions. However, seedrow safety was hard to predict, so sideband is still the preferred method for high P application rates. When soil test P levels were below 15 ppm Olsen P, yield was 11 to 22% higher with an increase of 6 to 13 bushels per acre (415-876 kg/ha).

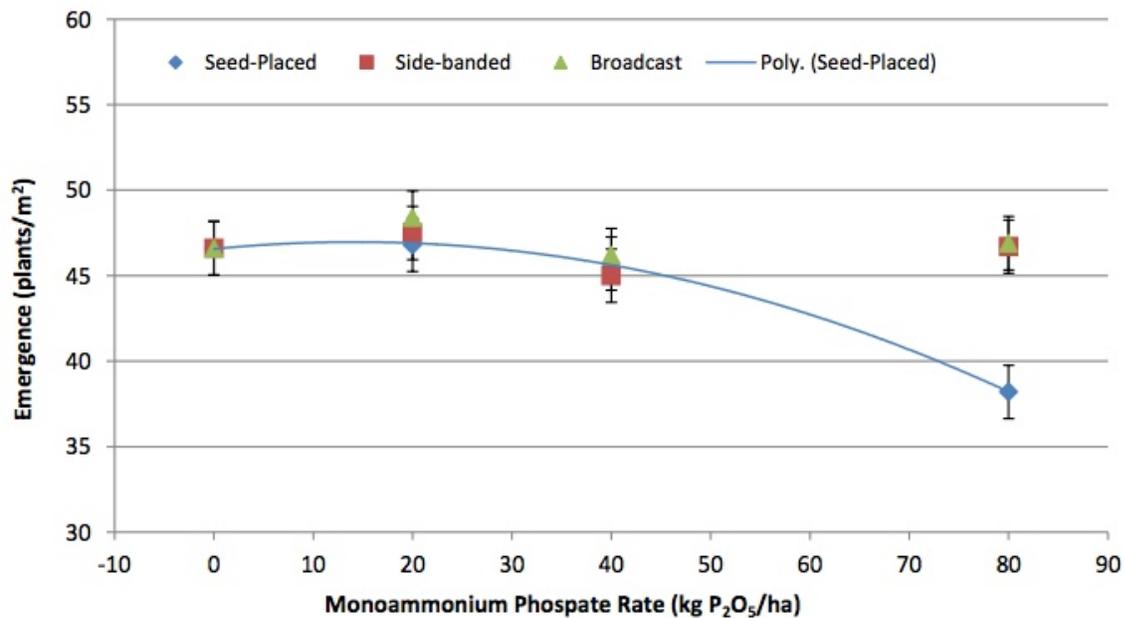
The Indian Head Agricultural Research Foundation led a three-year study at four Saskatchewan locations from 2015 through 2017. The locations were Indian Head, Melfort, Scott and Outlook. The research evaluated seedrow safety of monoammonium phosphate (MAP), response of soybean to P fertilizer, and P removal at harvest by soybean.

Three P fertilizer rates of 20, 40, and 80 lbs.  $P_2O_5$ /acre (22, 45 and 90 kg  $P_2O_5$ /ha) were compared, along with a control with no P fertilizer. The three placement methods were seed-placed, side-banded and pre-seed broadcast. Row spacing was 10 to 12 inches at 11 of 12 sites (one site at 7.6 inches; 19 cm) and seedbed utilization ranged from 5 to 10%. Soybean seed was double inoculated.

### Safe seed-placed P rates established

High rates of seed-placed P reduced plant stands at 50% of the sites. The highest rate of seed-placed P at 80 lbs.  $P_2O_5$ /ha reduced plant stands by 18% compared to side-banded or broadcast placement when averaged across all sites. However, with seeding rates of 5.5 seeds per square foot (55 seeds/m<sup>2</sup>; 220,000 seeds/ac), plant populations only fell below critical thresholds of 2.5 plants per square foot (25 plants/m<sup>2</sup>) in one treatment at one site. Seed-placed rates of up to 40 lbs.  $P_2O_5$ /ha were found to be safe across a wide range of conditions.

### Phosphorus placement and rate effects on soybean emergence across 12 site-years



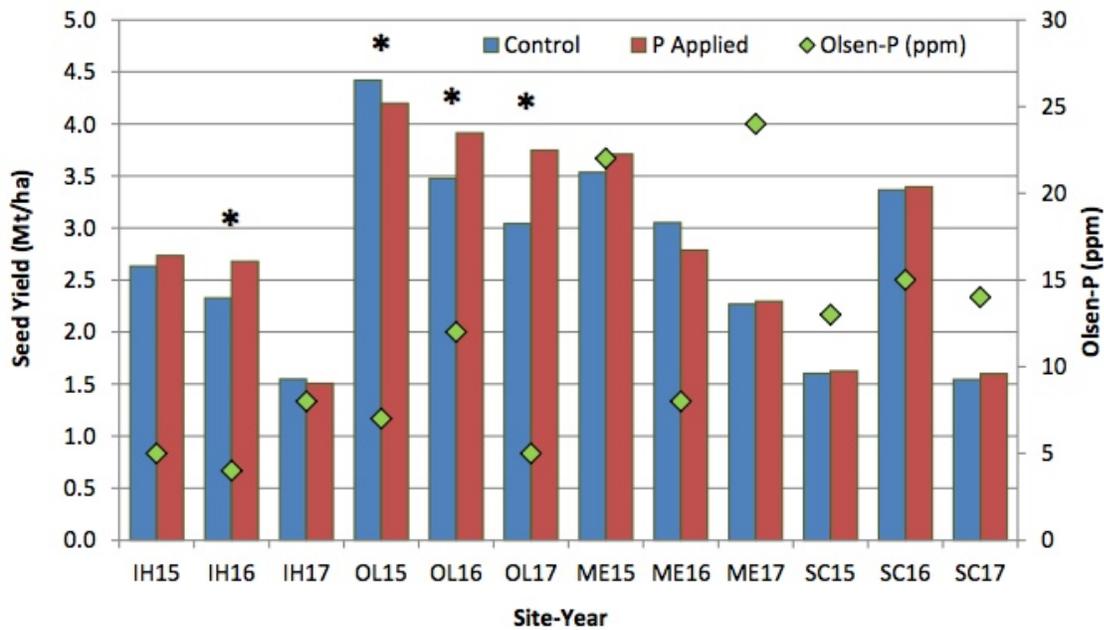
Source: Holzapfel et al. 2017

The researchers felt that, based on these results, the current recommendation of no more than 9 to 18 lbs.  $P_2O_5$ /acre (10-20 kg  $P_2O_5$ /ha) may be more conservative than necessary. However, the conditions when plant stands were impacted were hard to predict. Additionally, soybean response to seed-placed P was never better than side-banded or broadcast P. For these reasons, side-banding is still the preferred method for applying P, especially at high rates. Broadcast P was not considered an ideal option from either a fertilizer efficiency or environmental perspective.

### Six per cent higher yield with P fertilizer

When soil test P levels were below 15 ppm Olsen P test, positive yield responses were observed. For the three P responsive sites, the benefit was 11 to 22% or 6 to 13 bushels per acre (415–876 kg/ha). Averaged across all site-years, yields were 2.5 bu./ac (167 kg/ha) higher with optimal P management. The Outlook 2015 site had a negative response to P application.

Overall soybean yield response to P fertilization relative to soil test residual P levels



Site-years with a significant ( $P \leq 0.05$ ) control versus fertilizer contrast comparison are denoted by an asterisk. Source: Holzapfel et al. 2017.

The appropriate rate of P fertilizer varied by site and yield potential. Using the sufficiency approach, the goal is to replace P exports in the seed with P inputs as fertilizer over the long term. Phosphorus exports varied widely with 14 to 51 lbs.  $P_2O_5$ /acre (16 to 58 kg  $P_2O_5$ /ha) removed in the seed across the sites, with an overall mean of 35 lbs.  $P_2O_5$ /acre (39 kg  $P_2O_5$ /ha). Using the sufficiency approach, these P removals would be balanced with P fertilization.

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Holzapfel, C., Hnatowich, G., Pratchler, J., Weber, J., and Flaten, D. Developing Phosphorus Management Recommendations for Soybeans in Saskatchewan. Final Report.

<https://iharf.ca/wp-content/uploads/2018/04/P-recommendations-for-Soybean-in-Saskatchewan-Final-Report.pdf>