

Soil nitrogen and phosphorus were greater in overlapping areas of fields in Alberta, Saskatchewan, Manitoba, and Ontario

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Introduction

Shapes of agricultural fields and obstacles within fields will determine driving patterns for farm operations such as seeding, fertilization, and harvesting. Overlap of seed, fertilizer, and pesticide applications increase with smaller field size and when fields are irregularly shaped, and the amount of overlap depends on size of the farm implement, obstacles in the field, field shape, and field size (Shockley et al. 2012). The objective of the current work was to quantify the amount of nutrient buildup in areas of agricultural fields that experience overlap from driving patterns of farm equipment relative to adjacent non-overlap areas.

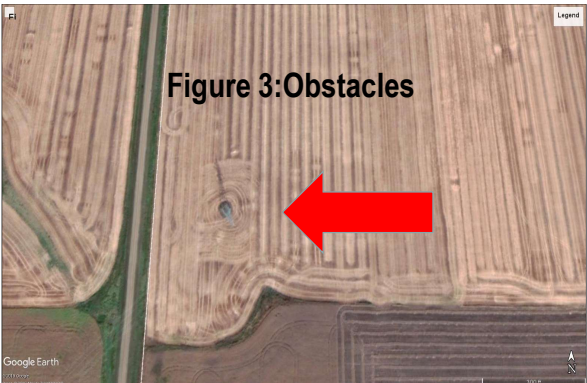
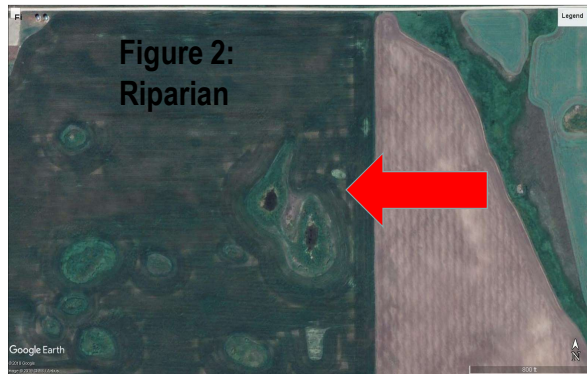
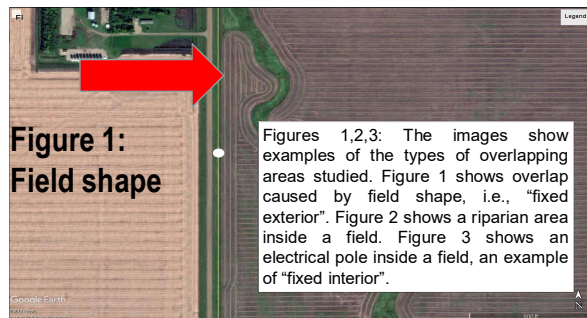
Material & methods

Soil samples were taken on 118 fields of 68 farms in total; 9 farms in Alberta, 33 in Saskatchewan, 18 in Manitoba, and 8 in Ontario, Canada. There were 90 samples taken in 2011, 552 in 2012, and 390 in 2013 for a total of 1032 over three depths (0-15, 15-30, and 30-60 cm) from 344 soil cores. Soil samples were taken in paired clusters in autumn after harvest. The first cluster was in 'overlap' locations where obstacles forced the producer to drive twice over the same area each seeding pass, compared to the second cluster where there were no obstacles present ('no overlap'). Paired treatment comparisons were done separately for each depth using Student's t-Tests in R (R Core Team 2019) at $P < 0.05$.

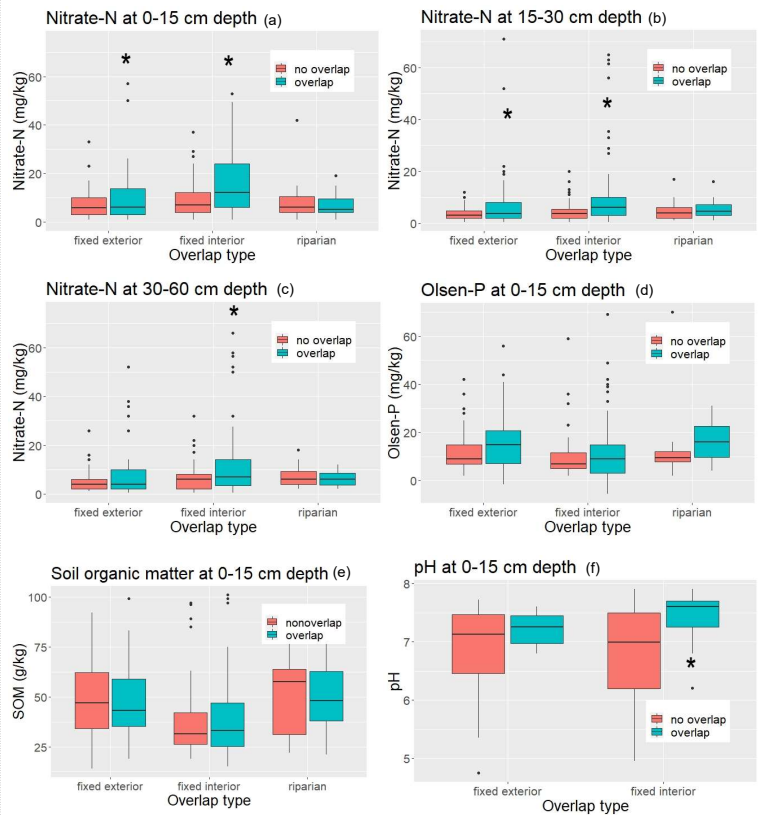
Results & discussion

Mean nitrate-N, Olsen-P, soil organic matter content (SOM), and pH values by depth for overlap versus non-overlap areas (Table 1), number of samples (n) and significance of t-tests ($* P < 0.05$) comparing overlap to non-overlap areas at all sites. Standard errors are shown in parentheses. Nitrate-N at 0-15, 15-30, and 30-60 cm depth (a,b,c), Olsen-P at 0-15 cm depth (d), soil organic matter content at 0-15 cm depth (e) and pH at 0-15 cm depth (f) by overlap type (Crittenden et al. 2020).

Depth (cm)	n	Nitrate-N (mg kg ⁻¹)		n	Olsen-P (mg kg ⁻¹)		n	SOM (g kg ⁻¹)		n	pH	
		No overlap	Overlap		No overlap	Overlap		No overlap	Overlap		No overlap	Overlap
0-15	344	9.0 (0.8)	14.4* (1.2)	298	11.1 (0.9)	14.1* (0.9)	344	42.8 (1.4)	42.5 (1.4)	124	6.82 (0.65)	7.30* (1.59)
		4.3 (0.3)	8.6* (0.9)		--	--		214	24.4 (1.3)		25.1 (1.2)	38
15-30	344	5.9 (0.4)	14.3* (2.5)	--	--	--	214	16.0 (1.0)	16.9 (1.1)	38	7.74 (1.78)	7.65 (1.76)
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Figures 1,2,3: The images show examples of the types of overlapping areas studied. Figure 1 shows overlap caused by field shape, i.e., "fixed exterior". Figure 2 shows a riparian area inside a field. Figure 3 shows an electrical pole inside a field, an example of "fixed interior".



Conclusion

These data show that nitrogen and phosphorus are present in greater amounts in areas of arable fields in the Canadian Prairie region and Ontario where, due to field configuration, driving patterns overlap (Table 1). Producers, consultants, and researchers should avoid sampling in overlap areas since they do not represent typical field conditions. Greater care must be taken in overlapping areas of arable fields to fully reach yield potential by maximizing NUE through fertilization and minimizing losses to the environment which should lessen production costs.

References

S.J.Crittenden, J.Fitzmaurice, M.Lewis, K.Reid, and B.Irvine. Soil nitrogen and phosphorus were greater in overlapping areas of fields in Alberta, Saskatchewan, Manitoba, and Ontario. *Canadian Journal of Soil Science*. 0(0): 1-4. <https://doi.org/10.1139/cjss-2020-0052>
 Shockley, J., Dillon, C.R., Stombaugh, T., and Shearer, S. 2012. Whole farm analysis of automatic section control for agricultural machinery. *Precision Agric.* 13: 411-420.