

GOA Trial Site Report

Phosphorus carryover after a crop failure and the implications for phosphorus placement in the following wheat crop.

Grain Orana Alliance

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Trial code:	GONU02320-2
Season/year:	Autumn 2019-20
Location:	Condo Park, Condobolin
Trial partners:	Rob Neal
Trial establishment date:	17/10/2019

Keywords

GONU023, phosphorous, nutrition, Collwell P, drought, crop failure, carry over, residual nutrition, stratification, Condobolin

Key findings

- Phosphorous (P) applied during a drought was still available for the subsequent crop.
- The highest yields were obtained where 10 kg P/ha was applied in 2019 and a further 10 kg/P in 2020.
- The 2020 crops' ability access residual P was not influenced by sowing over or between the previous year's fertilizer rows in 2020, a relatively wet season.

Background

During the 2017-19 drought, many farmers faced reduced incomes and sought ways to reduce costs. With this parameter, can P rates be reduced, particularly where P has been applied in a previous failed crop? The location and availability of the P in the soil profile needs to be considered, specifically where it is banded and in a controlled traffic system.

P is relatively immobile in the soil and its placement in a failed crop situation and the positioning of the seed in the following year could influence its availability.

There has been some research into P placement in cereals, suggesting placement is more of an issue in dry seasons than wet seasons. However, there is no research into P placement following a crop failure, or how this might influence the P rate applied in the following season. If the P has been banded with the

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seed, sowing over the previous year's rows might displace the P in a tyned sowing situation, while sowing between the rows might limit access to the P in dry seasons, particularly if it's a dry start.

The primary aim of this trial is to investigate interactions between seed placement and P uptake following a crop failure in the previous year. The secondary consideration will be looking at the availability of P from one season to the next.

Aims

To investigate if there is a yield response to seed placement in year 2 when placing the seed on top on the previous year's band of P fertiliser in a failed crop scenario in a knife point press wheel system in wheat.

Methodology

Trial Design	
Type	Small plot (~12 m x 2 m)
Design	Randomized split plot
Replications	3
Analysis	ASREML
Confidence interval	95%

Site Selection: This site selected should have been P responsive. Soil testing (Table 1) showed the topsoil with critically low levels of Colwell P and levels below detection deeper in the profile.

Table 1: Soil P levels

Location	Assay	Unit	0-10 cm	10-30 cm	30-60 cm	60-90 cm
Condobolin	Phosphorus (Colwell)	mg/kg	17	<5	-	-
Condobolin	Phosphorus (BSES)	mg/kg	22	<5	-	-
Condobolin	Phosphorus Buffer Index (PBI)		63	91	-	-

Table 2: Condobolin rainfall (2019 and 2020 versus long term average (LTA)).

Condobolin rainfall													
Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL
2019	13	38	15	0	16	16	19	6	4	2	12	5	146
2020	17	113	109	124	7	43	46	59	48	36	40	27	669
LTA	49	43	43	32	35	33	36	34	32	48	44	40	469

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Treatments

Drought year, 2019: Year 1 (Y1)

MAP applied on 2/10/2019 due to drought conditions (Table 3):

- Two P rates: 0 and 10 kg/ha
- Crop not sown and P drilled in October using plot seeder.
- P applied as MAP fertiliser

Subsequent year, 2020: Year 2 (Y2)

MAP applied at sowing:

- Two P rates: 0 and 10 kg/ha.
- Two positions, on the row and mid row (to the previous year's fertiliser application).
- P applied as MAP fertiliser
- urea was applied at 90 kg/ha at sowing, and a further 200 kg/ha UAN in August.

Table 1. Treatment list, note that seed and P fertiliser were sown together in 2020.

Phosphorous rate (kg/ha)		Seed placement in year 2
2019	2020	
0	0	control
0	10	on row
0	10	mid row
10	0	on row
10	0	mid row
10	10	on row
10	10	mid row

Results

Yield:

There was a p response of close to 1t/ha from the application of phosphorous. There was no difference between the placement of the fertiliser in the year it was applied. Applying 10 kg/ha on the row in 2020 was better than applying 10kg/ha in 2019 regardless of placement (Figure 1).

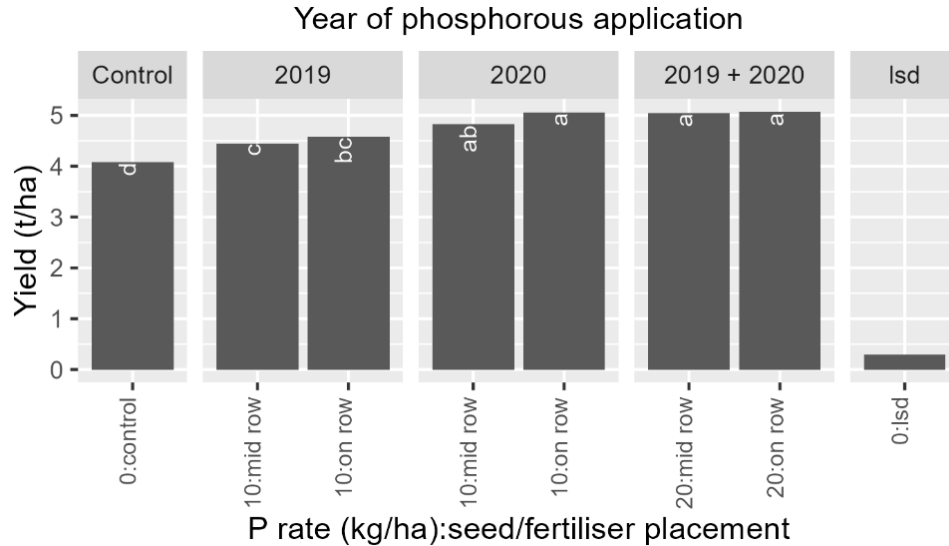


Figure 1. Wheat yield (t/ha) in 2020 by P rate (kg/ha) applied in 2019 2020 and placement. Treatments with the same letter are not significantly different.

Protein: Application of 10 kg/ha P to the mid row in either 2019 or 2020 had a higher protein than the control. There were no differences between the placements when applied at the same rate at the same time.

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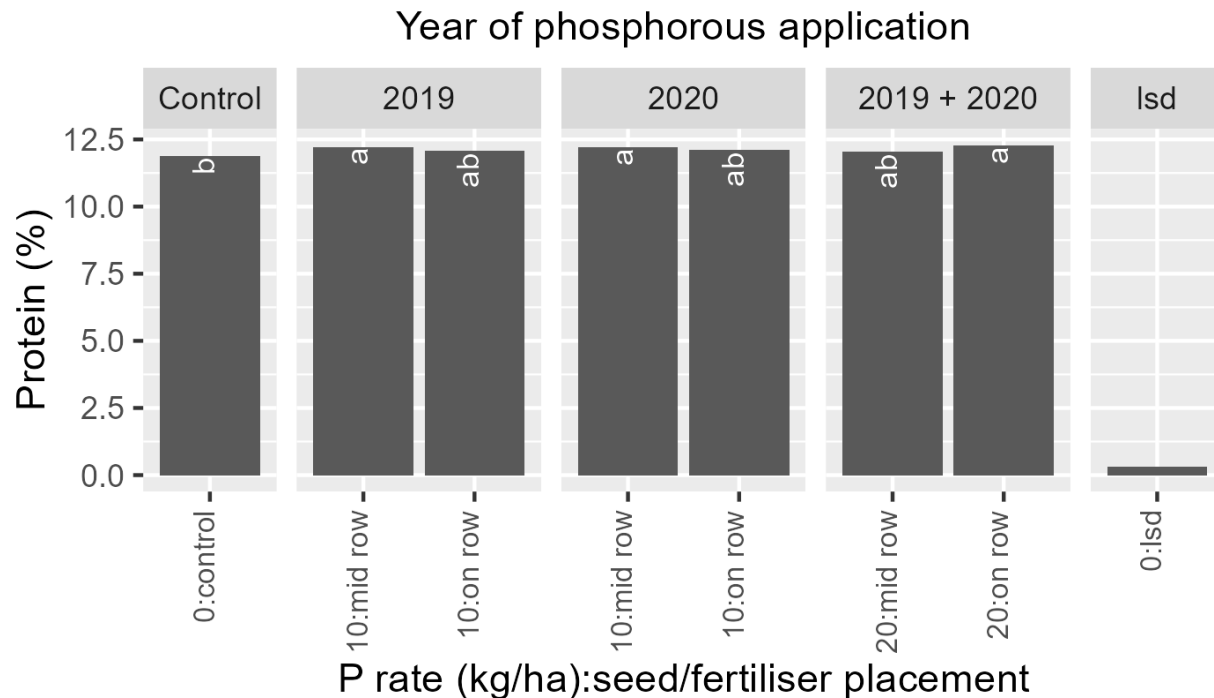


Figure 2. Wheat protein (%) in 2020 by P rate (kg/ha) applied in 2019 and 2020 and placement. Treatments with the same letter are not significantly different.

Discussion

Wheat yields in 2020 were high. The average site yield was 4.2 t/ha (Figure 1) and average protein was 10.6% (Figure 2).

As conditions were too dry in 2019 to establish a crop, treatments were applied to the site in October without the seed.

Prior to sowing in 2020, the grower reported that the site was flooded by local runoff on several occasions and may have been underwater for some time (1-2 days). This may have affected P availability and the nitrogen (N) component of the MAP.

This site had very low background levels of P, with Colwell P of 17 ppm in the top 0-10 cm of soil and the site was very P responsive. There was a >1/t/ha difference between the highest yielding treatment (10 kg P/ha in both 2019 and 2020 placed on-row) and the untreated.

Placing seed away from the P applied in the drought year did not reduce yields (Figure 1). This does demonstrate that wheat can forage for P in the interrows (in what was a wet season). Clearly the 2020 crop was able to access P applied during the 2019 drought, however 10 kg P/ha was yield limiting. There was benefit topping up the P, as the highest yields were obtained where 10 kg P/ha was applied in 2019 and a further 10 kg/ha in 2020. If no P was applied during the drought, then 10 kg/ha P applied in the post drought year yielded as good as 10 applied in both years. This may suggest that a lower amount may have been sufficient in 2020, i.e. 5 kg P/ha.

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There was little impact on screenings, protein or test weight.

Conclusions

- The crops' ability access residual P was not influenced by sowing over the old rows established in 2019 or between the old rows in the relatively wet season of 2020.
- Phosphorous applied during a drought was still available for the subsequent even after flooding events.
- Topping up P in the subsequent crop did improve yields, however, could be fine-tuned.

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Appendix

Results

Table 2: Trial results 2020

Phosphorous rates		Seed Placement								
2019	2020		Yield		Test weight		Protein		Screenings	
(kg/ha)			(t/ha)		(kg/hl)		(%)		(%)	
0	0	control	4.1	d	76.6	ab	11.9	b	6.0	a
	10	mid row	4.8	ab	76.2	ab	12.2	a	5.4	ab
		on row	5.1	a	77.4	a	12.1	ab	4.9	b
10	0	mid row	4.4	c	76.0	b	12.2	a	5.8	ab
		on row	4.6	bc	76.3	ab	12.1	ab	5.3	ab
	10	mid row	5.0	a	76.8	ab	12.0	ab	5.7	ab
		on row	5.1	a	76.9	ab	12.3	a	4.8	b
lsd	lsd	lsd	0.3		1.4		0.3		1.0	