Kidman Springs Phosphorus Supplementation Project



NT DPIR – Tim Schatz



Northern Territory Government

What is a good return on an investment?



Large areas of northern Australia are Phosphorus (P) deficient.

Map of P status of land in northern Australia (McCosker and Winks (1994). Red = Acute & deficient.



McCosker and Winks (1994) estimated that only around 20% of land in northern Australia would provide cattle with a diet that is adequate in P.

There are a number of reasons but first

A brief review of work on P supplementation in northern Australia may be helpful

There is a long history of P research in northern Australia.

....and some of excellent publications.





Many studies have found significant improvements in growth

- 89 kg over 8 months at Charters Towers, Qld (Turner et al. 1935)
- 65 kg over a year near Katherine, NT (Winter et al. 1990)
- Numerous examples in reviews by Winks (1990), Miller et al. (1990), Dixon and Coates (2012)

However it is a different story with reproduction

Winks (1990) review

- Reported improvements in pregnancy rates in Africa and America (of 16-40%)
- However: "Under Australian conditions, despite studies from Grafton to the Barkly Tableland, few studies have shown any significant benefit".

Dixon and Coates (2012) review stated that there has been little research in the last 20 years to add to the Winks (1990) review.

- Hart and Michell (1965) Barkly (NT): found P supplementation (by water medication) increased pregnancy rates in lactating cows by 19% but the difference was <u>not significant due to low numbers</u> in the control treatment (n=29).
- Holroyd et al. (1977) Swans Lagoon (Qld): found molasses based P supplements significantly
 increased pregnancy rates in lactating cows at the 2nd and 3rd but not the 4th matings. However
 the benefits of P supp. were confounded with the benefits from molasses (extra energy) and did not
 differ from just supplementing with molasses and urea in the dry season. (n=20 per treatment).
- Miller *et al.* (1996 and 1998) Springmount (Nth Qld): found improvements in body condition score, milk production and calf growth from P supplementation, but <u>did not report on pregnancy rates</u>.

This is doesn't mean that there isn't a benefit, but just that it hasn't been documented in scientific studies. Many producers know there is a benefit!





Currently there are no published scientific studies showing that dry lick P supplementation increases pregnancy rates in northern Australia (Winks 1990, Dixon et al. 2012).

This may be a reason why adoption of P supplementation is so low.

We know from sales figures that adoption of P supplementation is much lower than expected for the amount of P deficient country.

Niethe (2011) estimated that 90% of cattle in acutely P deficient regions of Australia are not being supplemented with P over the wet season.

Beef advisors have had to rely on estimates and assumptions when predicting returns from P supplementation...... it seems that this has not been convincing enough for many producers.

The current low adoption indicates that many producers are not convinced that they will get a return on investment from P supplementation.

The Kidman Springs P trial aims to investigate the effects of P supplementation and provide information on the cost:benefit.





Victoria River Research Station (VRRS) aka "Kidman Springs"

- 250 km SW Katherine
- Native pastures
- 750 mm rainfall (Nov-Apr)



Method

- In June 2014, 179 Brahman weaner heifers were randomly allocated (stratified for weight) to either a +P or -P treatment.

- Treatments were managed in exactly the same way except that their supplement (mineral loose lick) either contained P (+P) or did not (-P).

- The treatments grazed separately in neighbouring paddocks that were acutely P deficient (Avg. Colwell soil P of 2.5 and 3.1 mg P/kg). The treatments swap paddocks each year.



Supplement content

	Dry sea	Dry season		Wet season	
	P+	P-	P+	P-	
Ridley Biofos MCP	25%		42.5%		
Salt	40%	65%	50%	73.5%	
Ammonium sulphate					
(Gran Am)	10%	10%	7.5%	7.5%	
Urea	25%	25%			
Limestone				17.5%	
	(5.25% P)		(9% P)		

Basically the licks were similar except that salt was substituted for P in the P-licks (and a bit of limestone in the wet season – to make the Ca:P ratio the same in both licks).

Average <u>cost per head per year</u> of P+ lick Wet: 66 g/day for 165 days @ \$960/t = \$10.51 Dry: 125 g/day for 200 days @ \$930/t = \$23.24

RIDLEY

\$33.75

- Supplement sponsorship

+P grew 34 kg more over the first wet season (+P = 102 kg, -P = 68 kg) +P grew another 33 kg more during maiden mating so that at the post mating preg test on 24/5/16 was 66 kg heavier

- Pregnancy rate was 10% higher in +P (70% v 60%) NS (P=0.18).
 This difference was less than expected from the difference in pre-mating Wt.
- Ovarian ultrasound scanning on 21/6/16 found that 23% more heifers were pregnant or cycling (had a CL) in +P (87% vs 64%; P<0.001). If all cycling heifers had become pregnant then there would have been a statistically significant difference in pregnancy rates between treatments.

Large differences in 1st lactation heifer results

	P+	P-	Difference
Average weight (kg)	382	262	120 kg *
Average P8 fat depth (mm)	3.9	0.1	3.8 mm *
Calf loss (%)	20.6	20.4	0.2% ^{NS}
Re-conception rate (%)	30	5	25% *
Average weaner weight (kg)	173	139	34 kg *
Total weight of weaners (kg)	8,616	5,544	3,072 kg *
Overall mortality rate to 3.5 y.o	1%	8%	7% *

P- mortality = 28% if include animals removed for welfare at WR1

+P 1st lactation heifer pregnancy rate = 30%

- P 1st lactation heifer pregnancy rate = 5%

Preliminary economic comparison to WR1 2017 – *Disclaimer: I am not an economist and this is a very basic comparison*

The total weight of calves weaned was 3,072 kg higher in +P (value @\$3.50/kg = \$10,751) P+ = 50 x 173 kg = 8,650 kg P- = 40 x 139 kg = 5,560 kg

This is just comparing the extra weight of weaners to the extra supplement consumed. It doesn't take into account the higher mortality rate and heavier weight of empty cull heifers sold (+66kg). We will do a proper economic comparison in future.

P+

Photos from March 2018

P-

51 cows to calve over the 2017/8 wet season

38 cows to calve over the 2017/8 wet season

Obvious difference in body condition

Calf loss was 16% in P+ and 21% in P-

WR1 2018 data – cows with opportunity to wean a 2nd calf

Note only 2 P- cows re-conceived after 1st calving (and 1 lost its calf)..... so all except 1 cow in P- was rearing it's 1st calf (they either lost their 1st calf and re-conceived or got pregnant for the first time as a 3 y.o).

	Dry Cow	Wet Cow	Dry Cow	Wet Cow
	Preg %	Preg %	Avg Wt	Avg Wt
_	92%	20%		
-P	(n=50)	(n=30)	424.3 kg	357.3
. D	96%	57%		
+P	(n=48)	(n=42)	493.3 kg	426.2 kg
		270/		
Diff +P vs -P	4%	5/%	69.0 kg	68.9 kg

Pregnancy rate in lactating cows was 37% higher in +P Average weight of +P cows was 69 kg heavier Now have 90 cows in +P and 80 in -P

Wet cows at WR1 in May 2018

	P+	P-	Difference
Number of pregnant cows at WR2 2017	51	38	
Calf loss (%)	16%	21%	5%
Number of calves weaned	43	30	13
Avg weaner weight (kg)	185	172	13.4 kg
Total weight of calves weaned (kg)	7,951	5,145	2,806 kg

2.8 tonnes more calves weaned from P+ in 2018 @ \$3/kg = \$8,418

Updated assessment of profit to WR1 2018 (P+ vs P- in the dry season only)

Extra calf production from +P treatment:

	Total weight of	Price	Extra \$ per	Extra \$ per heifer
	extra calves (kg)	(\$/kg)	treatment	originally allocated
2017	3,072	\$3.50	\$10,751	\$110.18
2018	2,806	\$3.00	\$8,417	\$86.71
Total	5,878		\$19,169	\$197.59

Extra cost of +P treatment (excluding labour):

- per treatment = \$5,529

- per heifer originally allocated = \$60.76

Return on investment:

- per treatment = \$19,169 / \$5,529 = 347%
- per heifer allocated = \$197.59 / \$60.76 = 325%

This is just comparing the extra weight of weaners to the extra supplement consumed. It doesn't take into account the greater value of cull cows in future (lower mortality and heavier weight +69 kg). Eg. 7 extra females have died in P-. If they are valued at \$1,000 per cow (Avg Wt = 460 kg) then the RoI = 473%.

Estimated return by WR1 2019

Extra calf production from +P treatment:

Estimated from the number of pregnancies in 2018 and using the same calf loss rates, weaning weights and prices as 2017.

	Total Wt. of extra calves (kg)	Price (\$/kg)	Value (\$) per treatment	Value (\$) per heifer allocated
2017	3,072	\$3.50	\$10,751	\$110.18
2018	2,806	\$3.00	\$8,417	\$86.71
2019	3,878	\$3.00	\$11,633	\$119.93
Total	5,878		\$30,803	\$317.52

Extra cost of +P treatment (excluding labour): Assuming the same supplement intake as during 2017/18.

- per treatment = \$7,195
- per heifer originally allocated = \$79.06

Return on investment:

- per treatment = \$30,803 / \$7,195 = 428%

- per heifer allocated = \$317.52 / \$79.06 = 402%

Again this is just comparing the extra weight of weaners to the extra supplement consumed.

It takes a while to see a return on investment from supplementing females, but once they start producing calves the returns are very good!

Note – These figures are a very basic economic comparison. A proper economic evaluation will be conducted in future.

Preliminary economic modelling has found that appropriately feeding P supplements on an acutely P deficient property in the Katherine region at least doubles the profit produced by the property (Fred Chudleigh *pers. comm.*)

Increased adoption of P supplementation by producers in P deficient country could significantly improve production of the northern cattle industry.

However, increased demand may result in a shortage of supply if producers don't plan ahead. Good idea to order 2 months before you need it.

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Kidman Springs staff

Comparing P+ to P- in DS only	By 2017	By 2018	By 2019
Extra cost of supplement per head	\$42.18	\$60.76	\$79.06
Extra value of weaners per head	\$110.88	\$197.59	\$317.52
Profit per head	\$68.70	\$136.84	\$238.46
Return on investment	263%	325%	402%

	P+	P- DS only	Difference
Avg cost of lick per head/year	\$33.75	\$18.82	\$14.93