



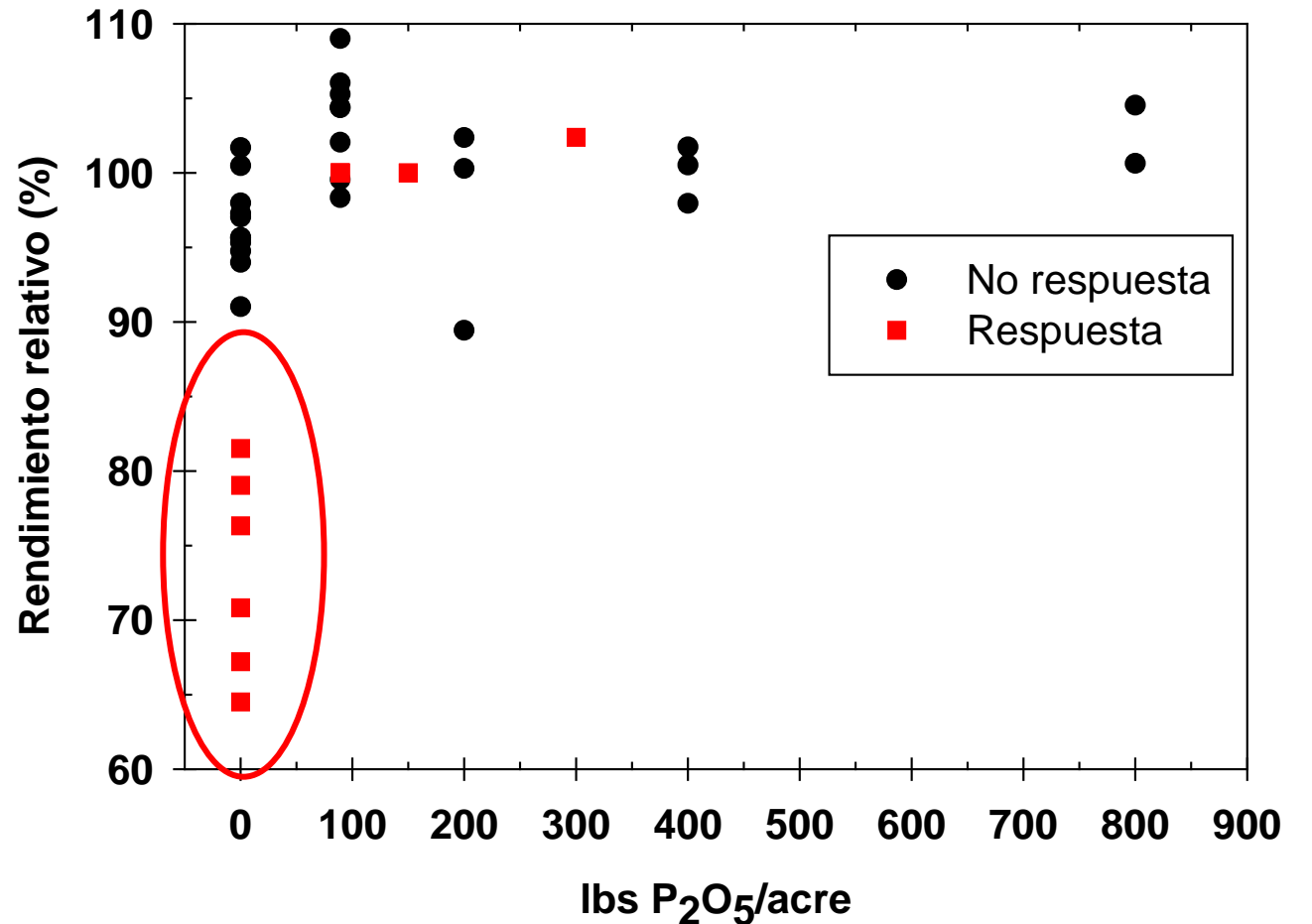
***Brachiaria decumbens* response to fertilizer-P in an Ultisol**

**Improved tropical forage fertilizer-P calibration
FRST Project; UPRM-AES SP-464**

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Forage response to fertilizer-P

- 17 trials conducted from 1964 to 1983
- Soil test P not reported
- Relative yield without fertilizer-P ranged from 65 to 102%
- + response to fertilizer-P in six trials





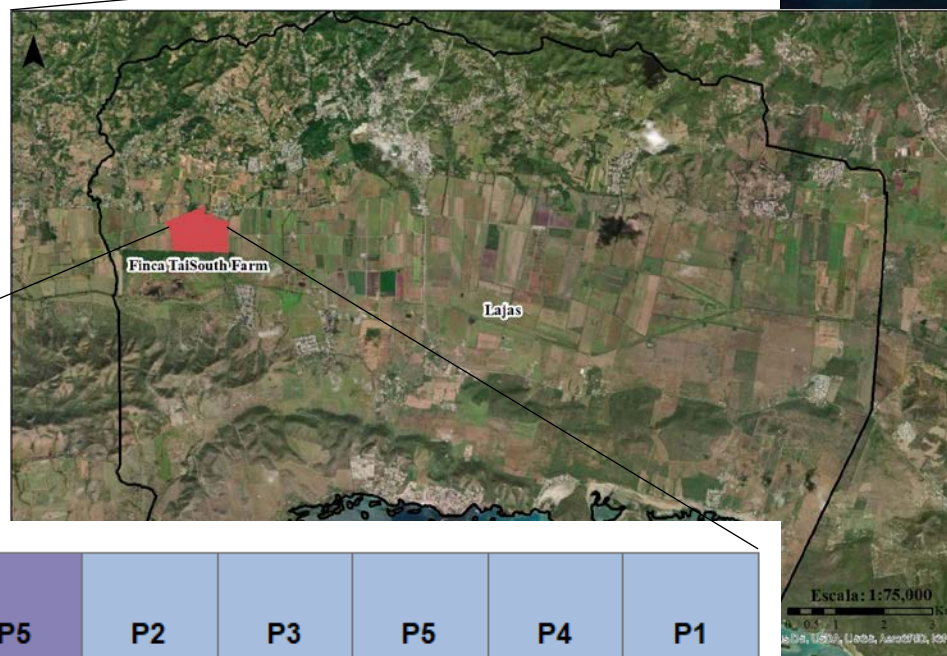
Objective

- Evaluate *B. decumbens* response to fertilizer-P in soil with Low soil test P

Location and experimental design



Lat. 18.024533;
Long -67.094095



P3 20	P1 19	P4 18	P2 17	P5 16	P2 10	P3 9	P5 8	P4 7	P1 6
P4 15	P2 14	P1 13	P5 12	P3 11	P1 5	P2 4	P4 3	P5 2	P3 1

Fertilizer-P levels

Treatment	kg P ₂ O ₅ /ha
P1	0
P2	60
P3	120
P4	180
P5	240

Materials and Methods

- Palmarejo series (Fine, mixed, semiactive, isohyperthermic Typic Haplustults)
- Fertilizer-P split-applied at 0 and 4 months
- Complementary fertilization (kg/ha) of 300 N, 300 K₂O, 25 micronutrient mix split-applied at 0 and 4.5 months

- Forage yield quantified at 45- to 50-d intervals, 8 harvests
- Leaf P concentration and P uptake

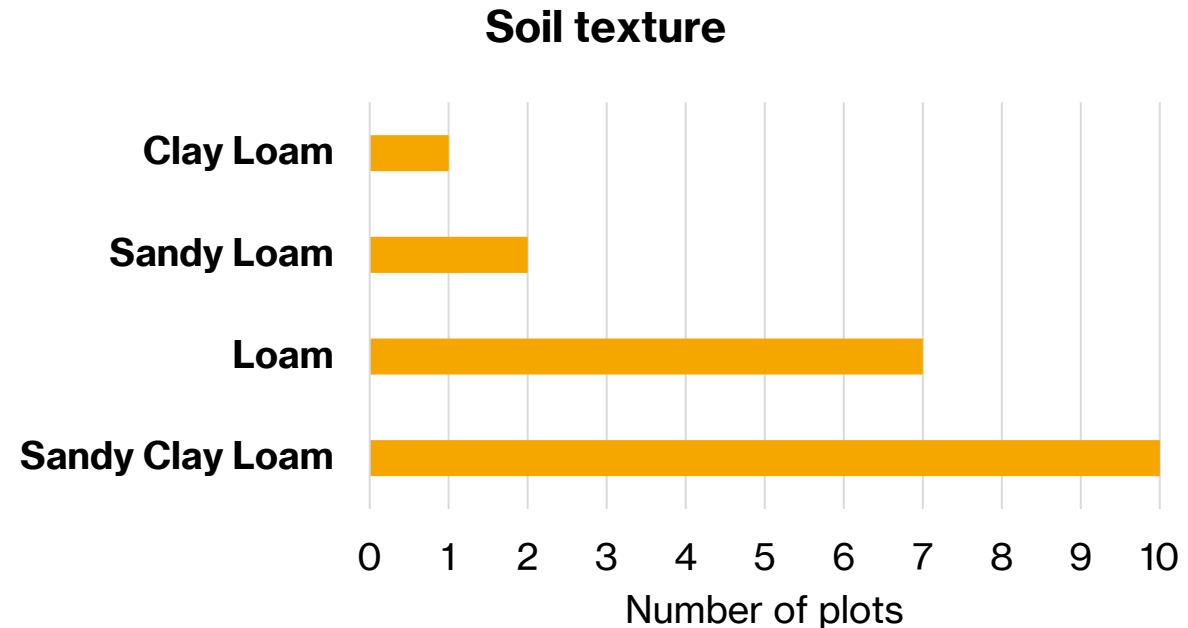
Soil testing

- 0 to 15 and 15 to 30 cm prior to experiment initiation
- 0 to 15 cm after one year
- Soils air-dry, sieved (2-mm)
- Diagnostic Test in VAS Laboratories (AgSource; Lincoln, NE) - <https://agsource.com/soil-testing/>

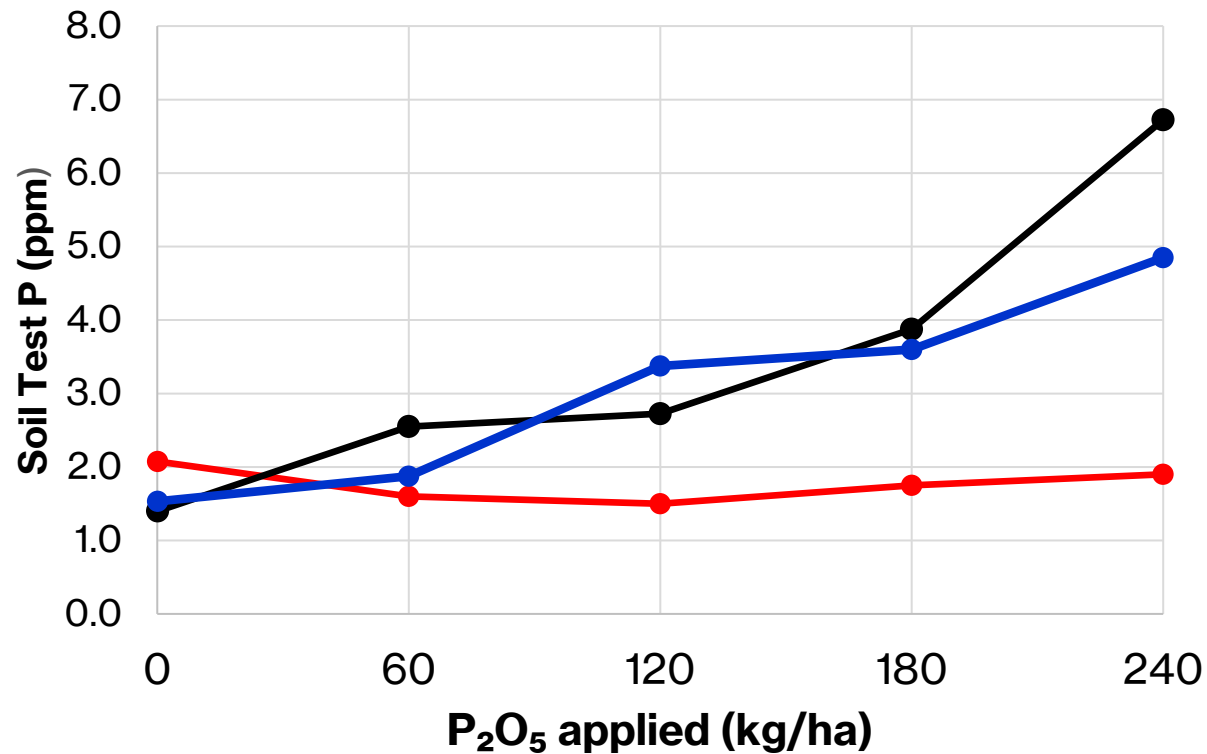
Soil fertility status

Depth	pH	MOS	Mehlich 3	Bray 1	Ca	Mg	K	Na	CEC (estimated)	Fe	Mn	Zn	Cu
cm		%	-----ppm-----		-----cmol _c /kg-----				-----mg/kg-----				
0 - 15	5.7	3.8	4.3	1.8	7.8	2.9	0.10	0.1	16.5	50.9	5.1	0.8	3.8
15 - 30	6.0	3.0	2.2	1.1	9.4	2.9	0.1	0.3	17.5	34.6	3.6	0.5	4.4

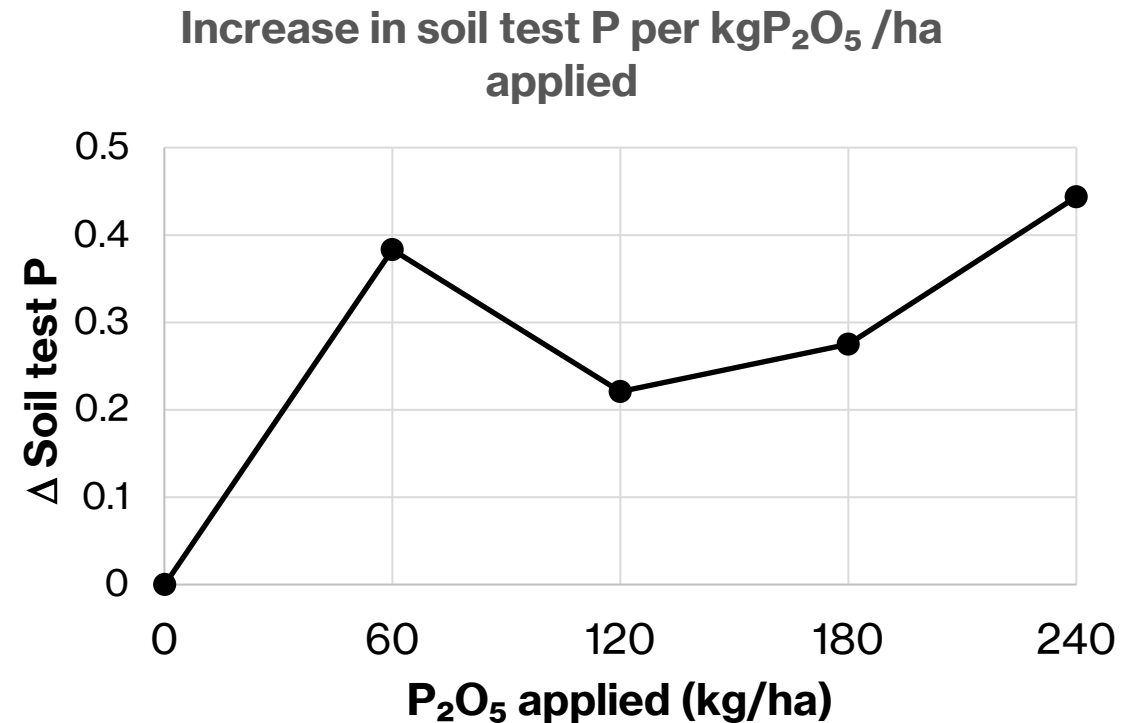
Initial soil test P (Bray1) concentration ranging from 1.2 to 1.6 mg P/kg (Low category)



Change in soil test P with fertilizer-P application



● Bray1STP Initial ● Bray1STP Midterm
● Bray1STP Final



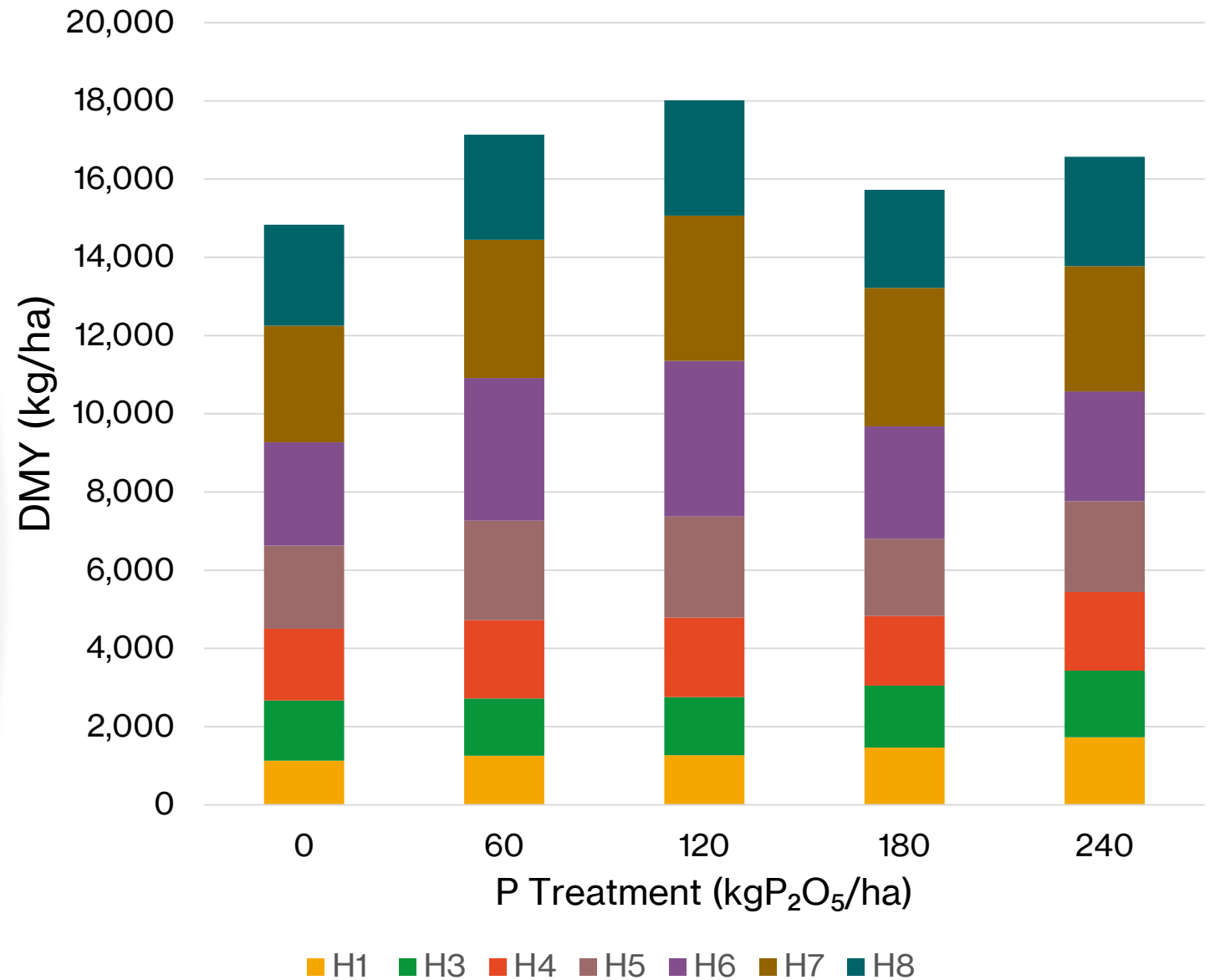
0.33 mg/kg per kg of P₂O₅/ha applied

Cumulative dry matter yield

Treatment	Dry Matter Yield
kgP ₂ O ₅ /ha-yr	kg/ha-yr
0	16,347 b
60	18,823 a
120	19,807 a
180	17,462 b
240	18,359 ab

} 18,550 kg/ha

+ 13% yield increase with fertilization of 60 kg P₂O₅/ha



* Data from block A were excluded from the statistical analysis since the block behaved atypically throughout the experiment.

Forage P concentration and extraction

Fertilizer-P applied	Forage P concentration	Forage P extraction	P balance
kg P/ha	g P/kg	-----kg P/ha-----	
0	1.68	82.7	-27
26	2.17	117	-14
52	2.38	137	+5.3
78	2.70	126	+32
104	2.83	140	+53

$$P_{\text{balance}} = 0.789 (\text{Fertilizer-P applied}) - 31.5; r^2 = 0.99$$

Conclusions

- Ultisol with soil test < 2 mg P/kg (Bray1)
- Forage DM yield response to fertilizer P at 60 kg P₂O₅/ha
- Possibly water was a limiting factor
- Δ STP of 0.33 mg/kg per kg of P₂O₅/ha applied
- Fertilizer P application of 40 kg P/ha yields net zero P balance
- Economic benefit is questionable



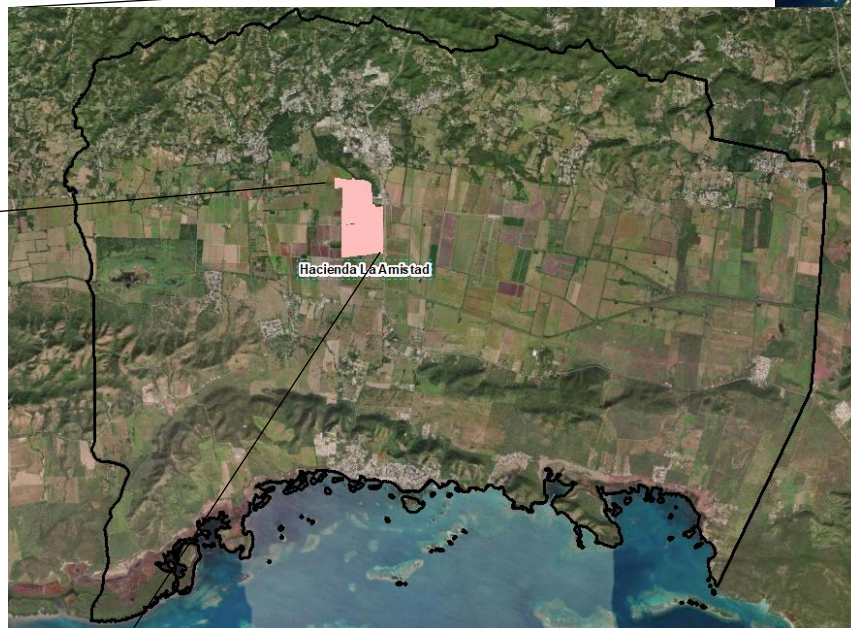
Additional on-going work



Tropical forage response to fertilizer-P in Vertisol



Location and Experimental Design



5	4	3	2	1
10	9	8	7	6
15	14	13	12	11
20	19	18	17	16

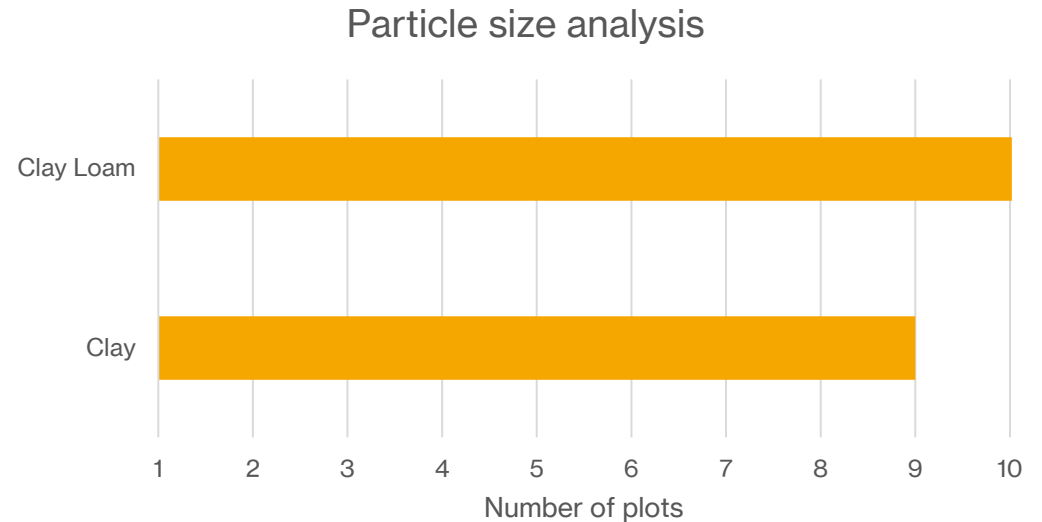
Treatment	kg P/ha
P1	0
P2	30
P3	60
P4	90
P5	120

Soil fertility status

Depth	pH	MOS	Bray 1	Ca	Mg	K	Na	Sum Bases (CEC)	CEC (estimated)	Fe	Mn	Zn	Cu
cm		%	mg/kg	-----cmolc/kg-----				-----mg/kg-----					
0 - 15	6.8	5.4	2.2 (1.38)	31.5	15.8	0.30	0.5	48.0	14.8	32	33.1	0.6	6.1
15 - 30	7.24	4.4	2.11 (6.62)	32.14	17.22	0.24	0.72	50.33	50.33	0.48	21.29	5.57	0.45

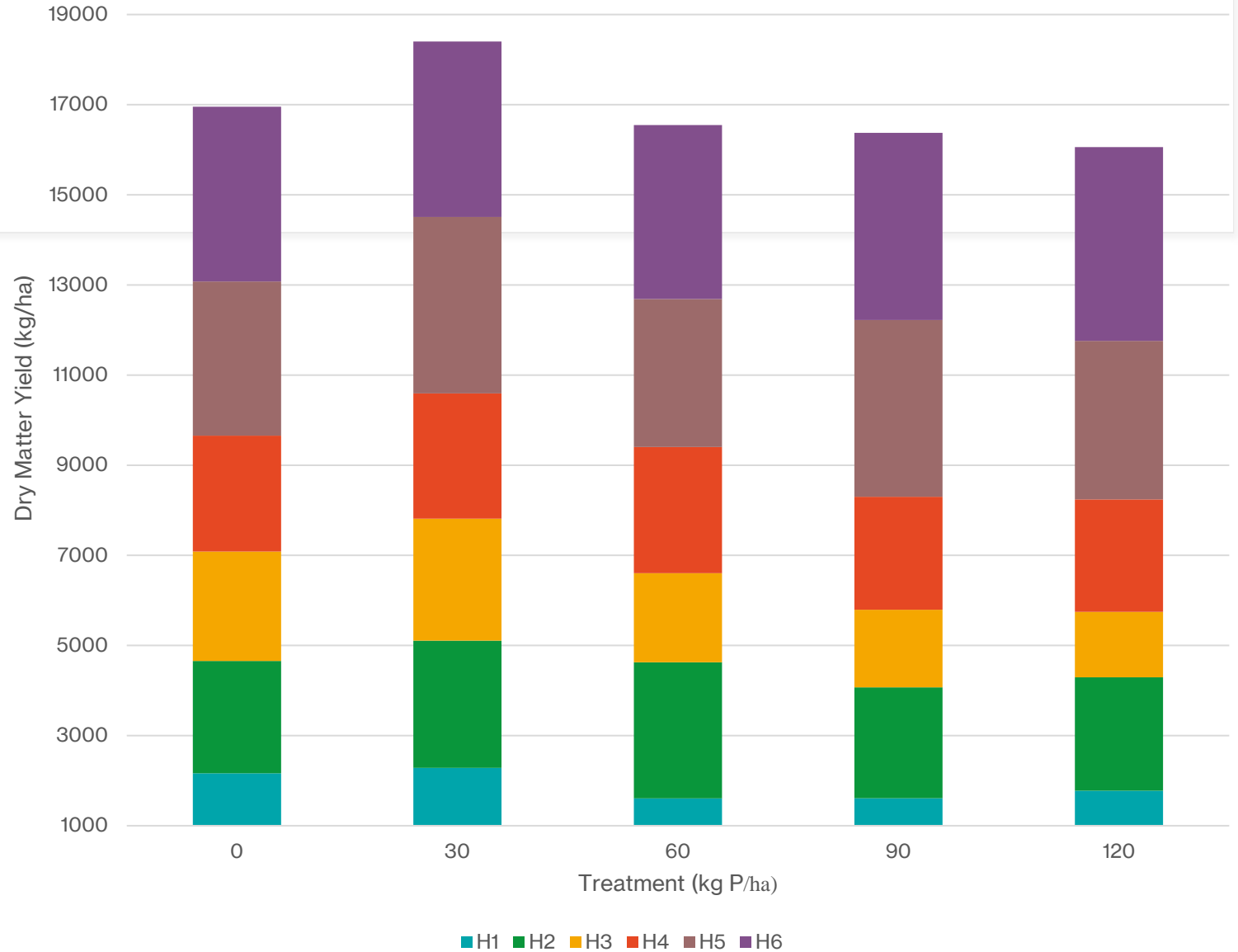
*Standard Deviation (SD) in parenthesis

Initial soil test P (Bray1) concentration ranging from 1.3 to 3.7 mg P/kg (Low category)



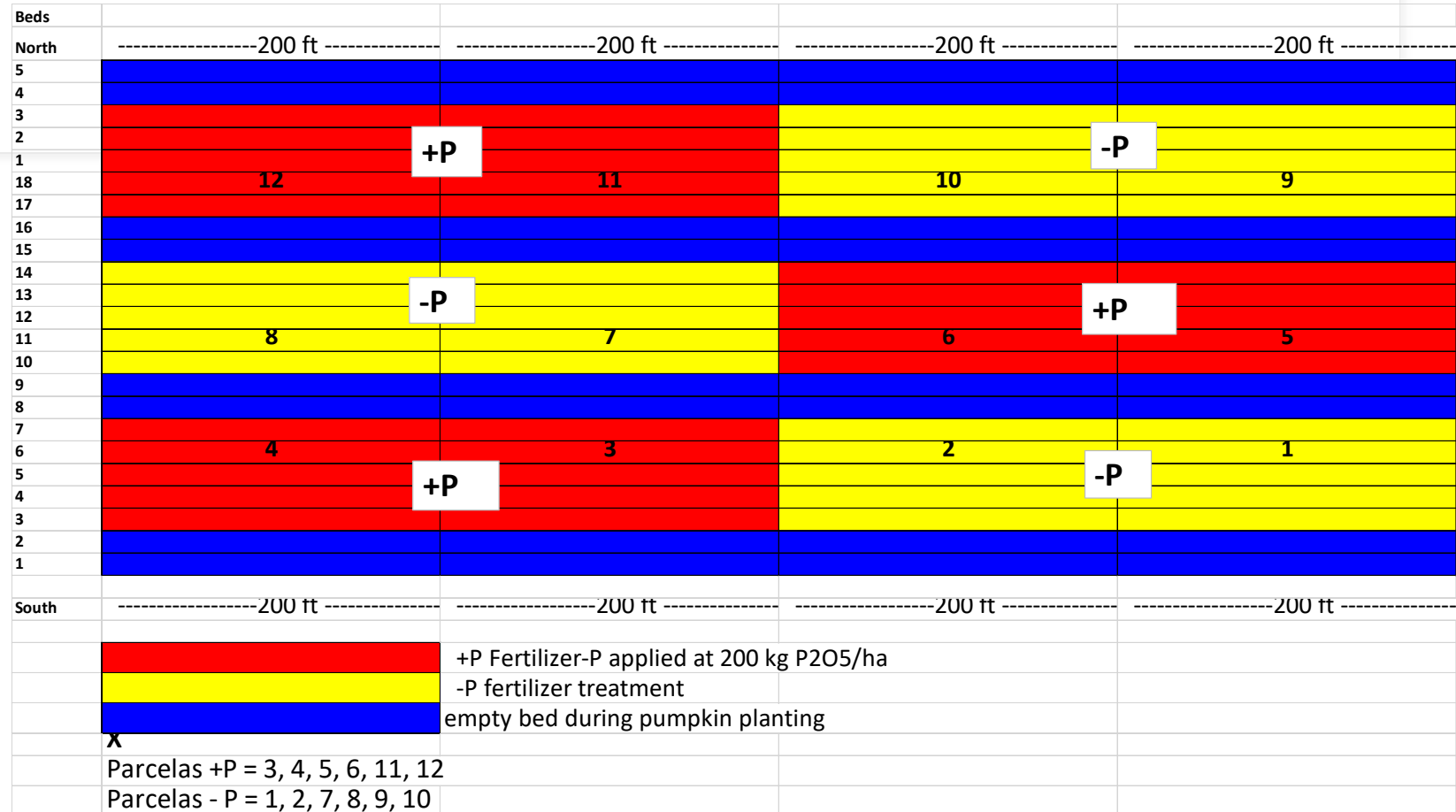
Cummulative dry matter yield per harvest

- There were not significant differences between treatments (LSD Fischer, $p > 0.05$)
- There were significant differences between harvests (LSD Fischer, $p < 0.01$)



P correlation experiments with horticultural crops

- 3-yr Hatch project
- Assess initial soil test P
- Two treatments:
 - +P fertilizer at 200 kg P_2O_5 /ha
 - - P fertilizer treatment
- Quantify crop yields
- Relate crop yield to initial soil test P



Depth	pH	MOS	Olsen P	Ca	Mg	K	Na	Sum Bases (CEC)	CEC (estimated)	Fe	Mn	Zn	Cu
cm		%	mg/kg	-----cmolc/kg-----				-----mg/kg-----					
0 - 15	7.8 (0.11)	2.1 (0.19)	21.3 (4.08)	12.5 (1.44)	12.6 (0.60)	0.8 (0.12)	0.3 (0.04)	26.2 (1.51)	26.2 (1.52)	7.1 (1.37)	3.6 (0.93)	0.6 (0.11)	2.0 (0.33)



- Monitoring of electrical conductivity and pH in water during fertigation