



THE UNIVERSITY OF ARIZONA
Cooperative Extension
IPM & Urban Agriculture

Management of Alfalfa Nutrients & Pests in Alfalfa

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Agricultural Production Seminar
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Alfalfa: Importance & Issues

	AZ	USA
Harvested acres	260,000 (~1.6%)	16.6 millions
Production (Tons)	2.16 M (~13%)	52.6 millions
Average yield (tons/acre)	8.4	3.2
Value (at \$175 / ton)	\$451 M	\$9.2 billion



Low Desert Alfalfa: Importance & Issues

- Non-dormant varieties
- Multiple harvests per year
- High productivity
- Cutting cycle
- Alfalfa stand life
- Intensive production system
- Aging associated problems
- Require replacement
- Production continuity.
- 6 to 10 cuttings a year.
- Average of 8.4 tons/acre.
- 28 to 32 days schedule.
- > 3 years.
- Remove various resources.
- Yield, quality, autotoxicity.
- High establishment cost.

Importance of balanced fertilizer management

N – P – K

Objectives

- Determine the yield response of irrigated alfalfa to various blend of P and K fertilizers.
- Assess the effects of different P & K levels on soil and plant tissues.



Trials at Maricopa Ag Center (MAC)

- **Soil Analysis:**

- Texture: Sandy Clay loam
- K (ppm): 320
- Na (ppm): 250
- Olsen-P (ppm): 6.6
- Nitrate-N (ppm): 1.1
- pH: 8.2



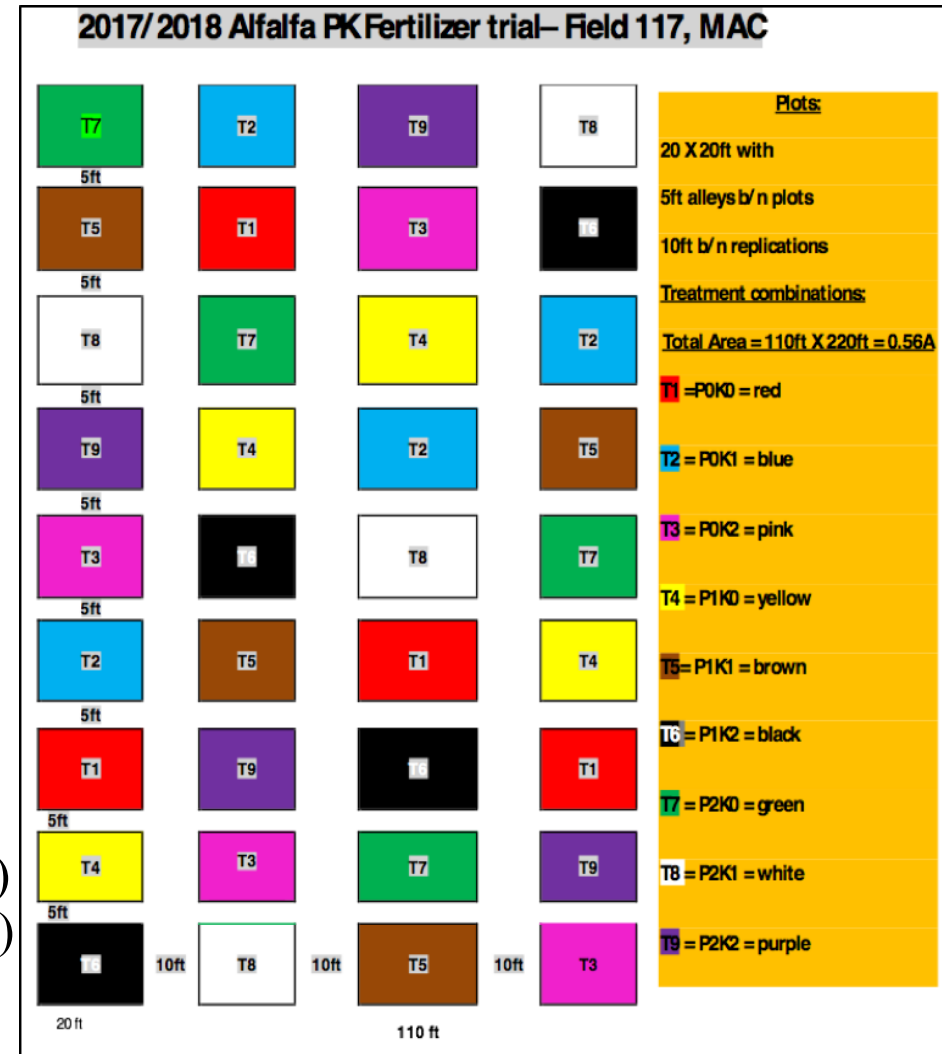
- **Sources of fertilizers:**

- MAP (11-52-0)
- KCL (0-0-60)

- **Rates (lb acre⁻¹)**

- MAP (0, 192, 240); P₂O₅ (0, 100, 125)
- KCL (0, 167, 500); K₂O (0, 100, 300)

- **Design:** Factorial in RCBD. Plot area = 400 ft², 5 ft b/n plots and 10 ft b/n replications.

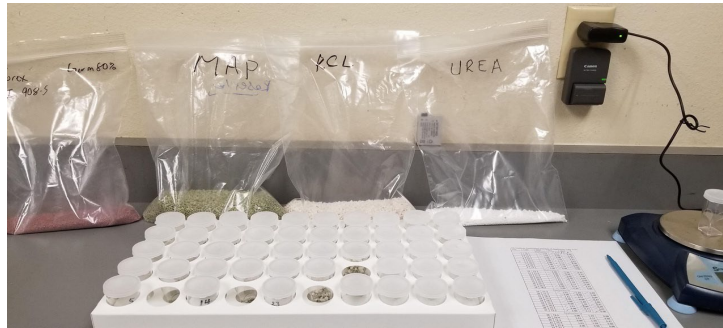
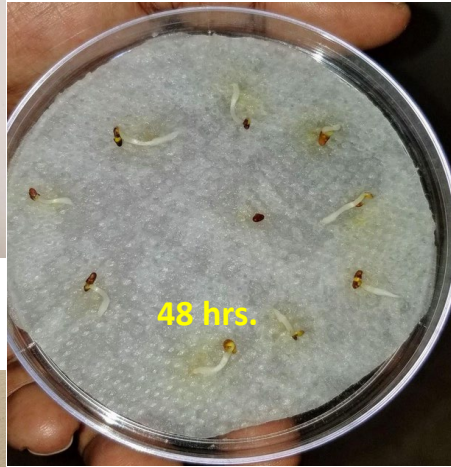
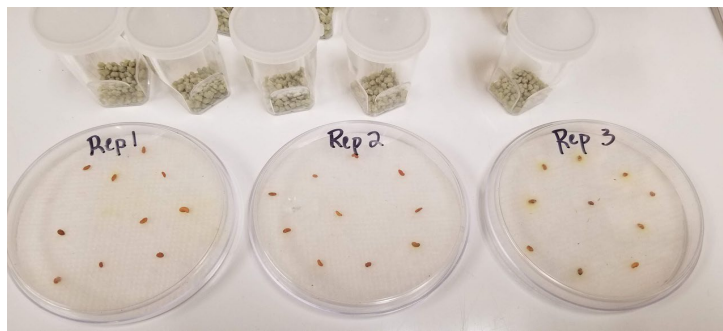


Trials at Maricopa Ag Center (MAC)

- **Fertilizers applied, November 2017**
- **Eight cuttings in 2018 and six in 2019**
- **Hay Yield adjusted to 12% moisture**
- **Soil samples at 6 inches depth collected**
- **Soil P & K determined**
- **A subsample of 48 shoots each plot**
- **Plant P & K concentration determined**

Tube Trials





Texture: Sandy loam (72% sand)
K (ppm): 250
Na (ppm): 210
Olsen-p (ppm): 7.8
Nitrate-N (ppm): 3.9
pH: 9.0



P fertilization VS hay yield at MAC Trial 2018

P ₂ O ₅ (MAP) [†]	January	March	April	May	June	July	August	September	Total
<u>Lbs. acre⁻¹</u>	Hay Yield, tons acre ⁻¹								
0 (0)	1.24B ^{††}	1.62B	1.94B	2.36B	2.69A	1.63B	2.15A	2.19B	15.82B
100 (192)	1.31B	1.85A	2.08A	2.49A	2.97A	1.93A	2.24A	2.33A	17.20A
125 (240)	1.46A	1.88A	2.10A	2.50A	2.88A	1.76AB	2.33A	2.31A	17.22A

P Fertilizer Increased Yield

- The benefit of phosphorus fertilizer was realized in all cuttings. No difference was detected between the rates of 100 (192) and 125 (240) lbs. acre⁻¹, after the first January cuttings.

[†] Sources of fertilizer: MAP-monoammonium phosphate (11-52-0).

^{††} Within a column, values followed by the same letters are not significantly different at 0.05 level of probability.

P Fertilization VS Hay Yield at MAC Trial 2019

P ₂ O ₅ (MAP) [†]	March	April	May	June	July	Aug	Total
<u>Lbs. acre⁻¹</u>	Hay Yield, tons ha ⁻¹						
0 (0)	1.51 ^{††}	2.22A	2.18A	1.85A	1.67B	1.54A	10.98B
100 (192)	1.74A	2.32A	2.30A	1.89A	1.88A	1.61A	11.74A
125 (240)	1.83A	2.36A	2.32A	1.89A	1.85A	1.64A	11.88A

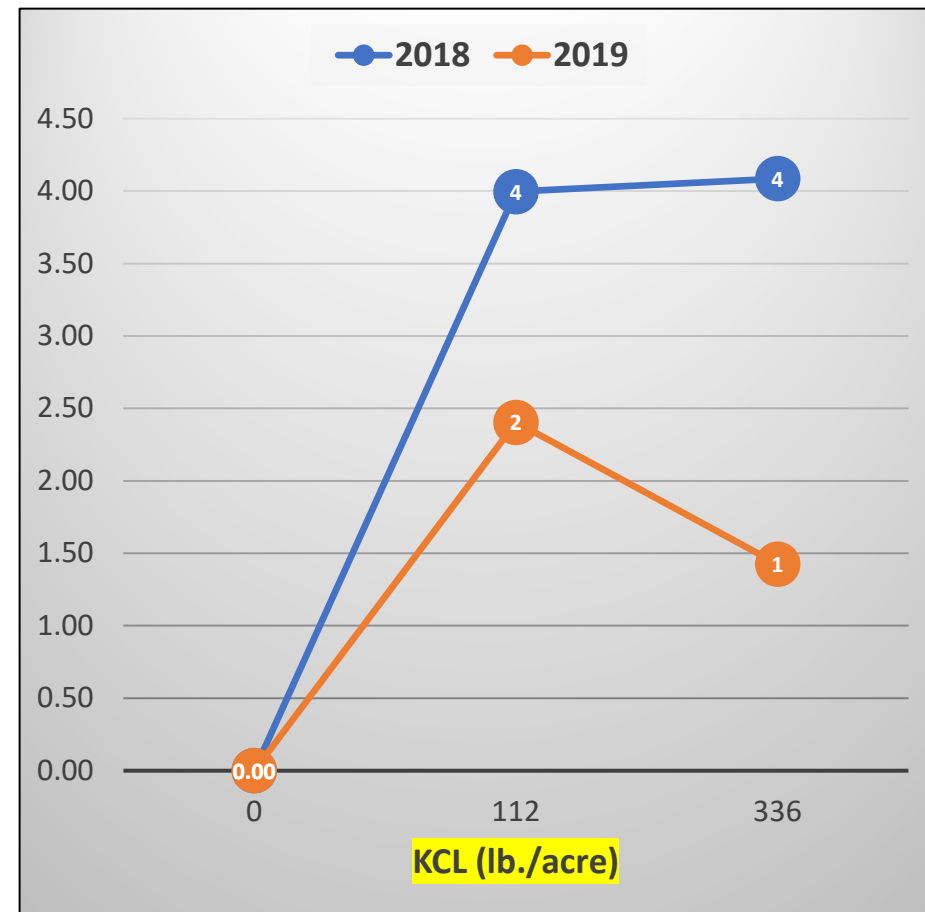
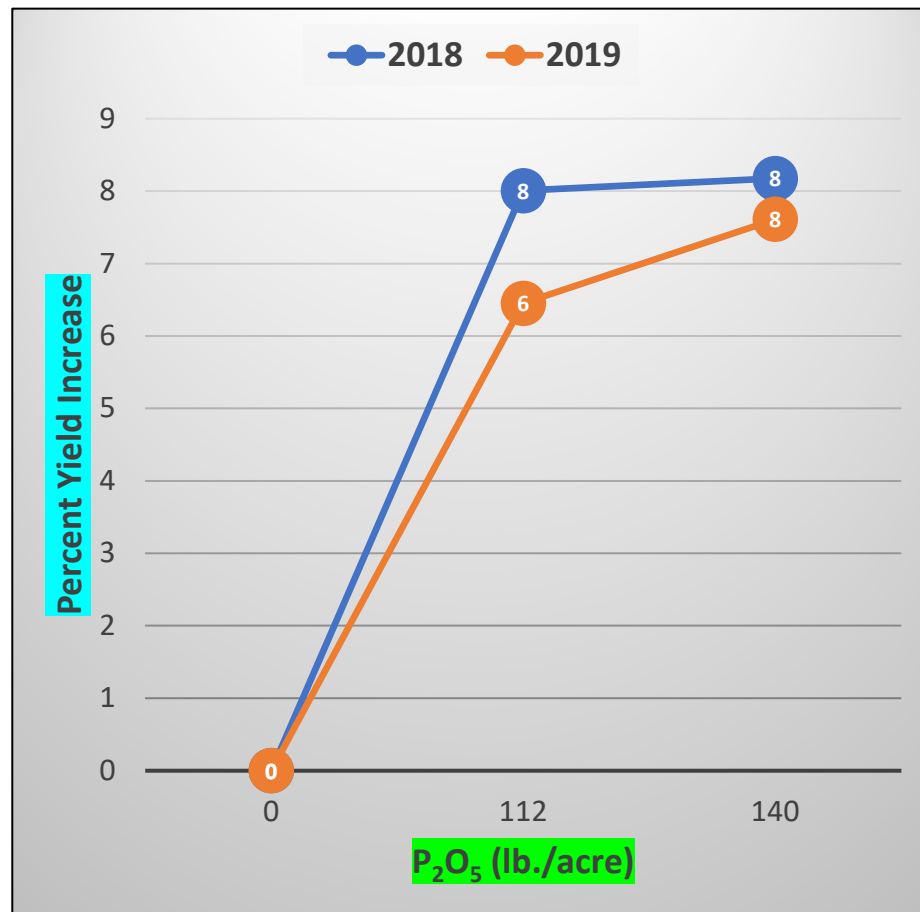
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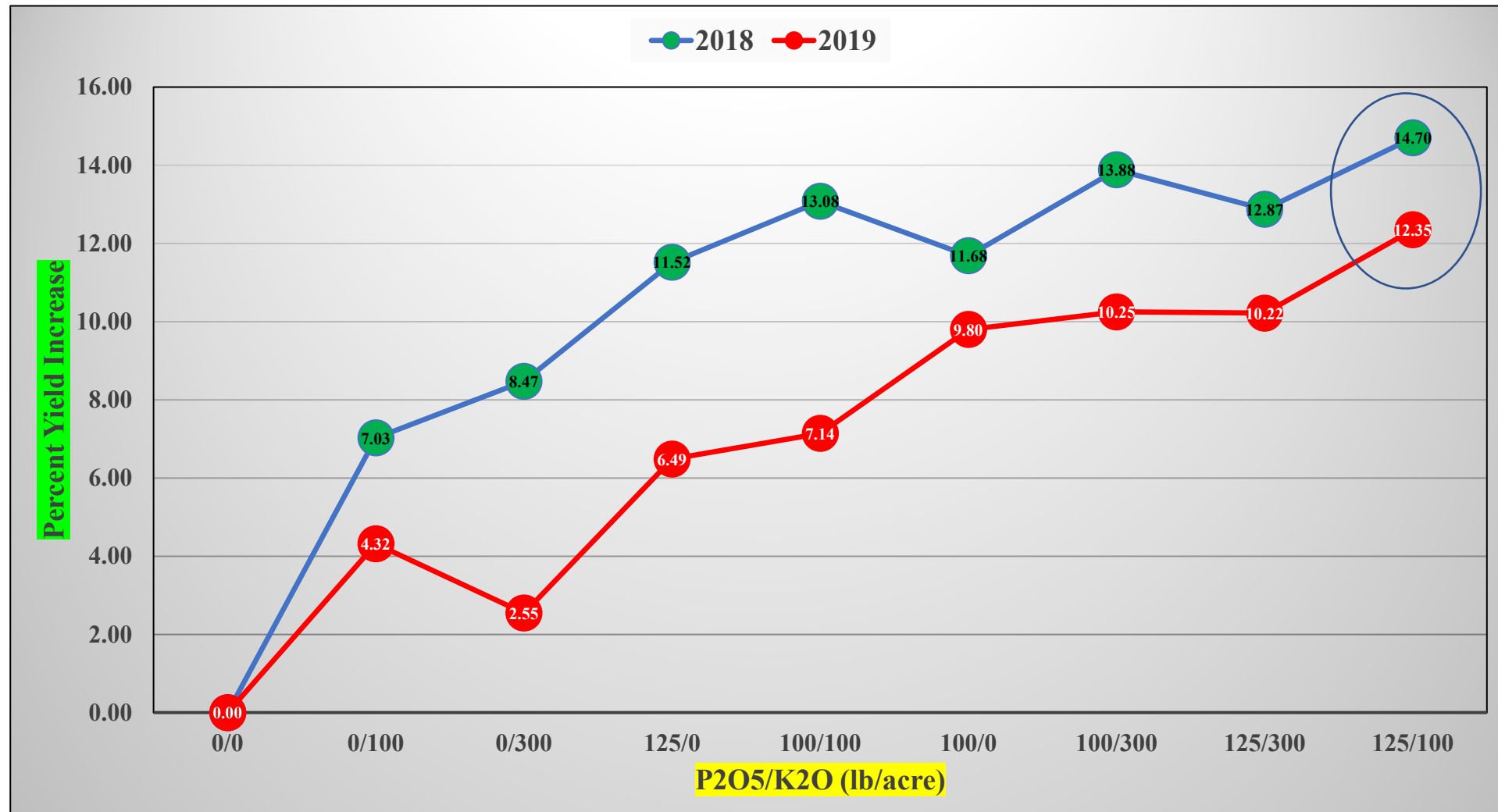
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Separate Impacts of P & K Fertilization on Yield at MAC Trials 2018 & 2019



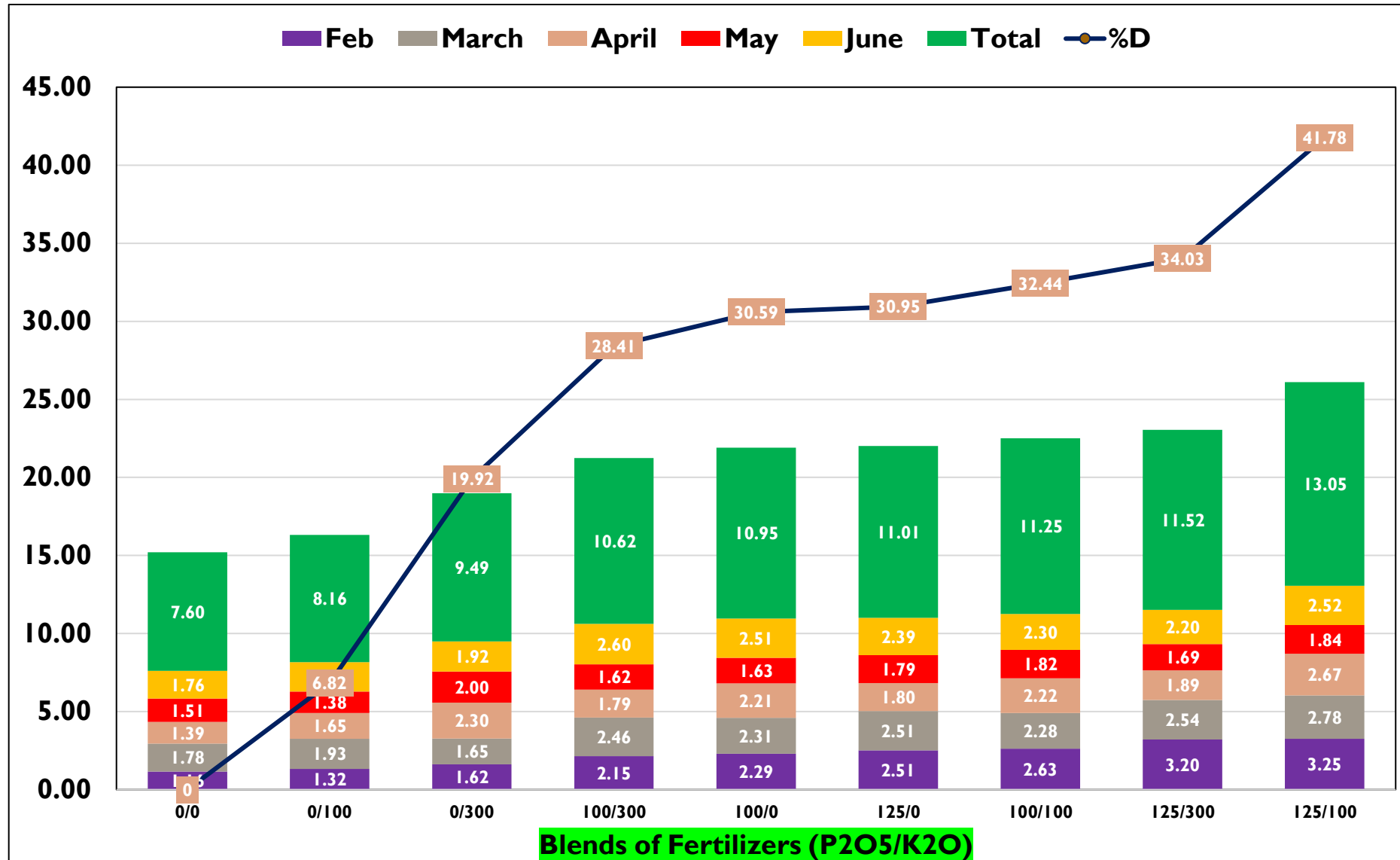
Combined Impacts of P & K Fertilization on Yield at MAC Trials 2018 & 2019



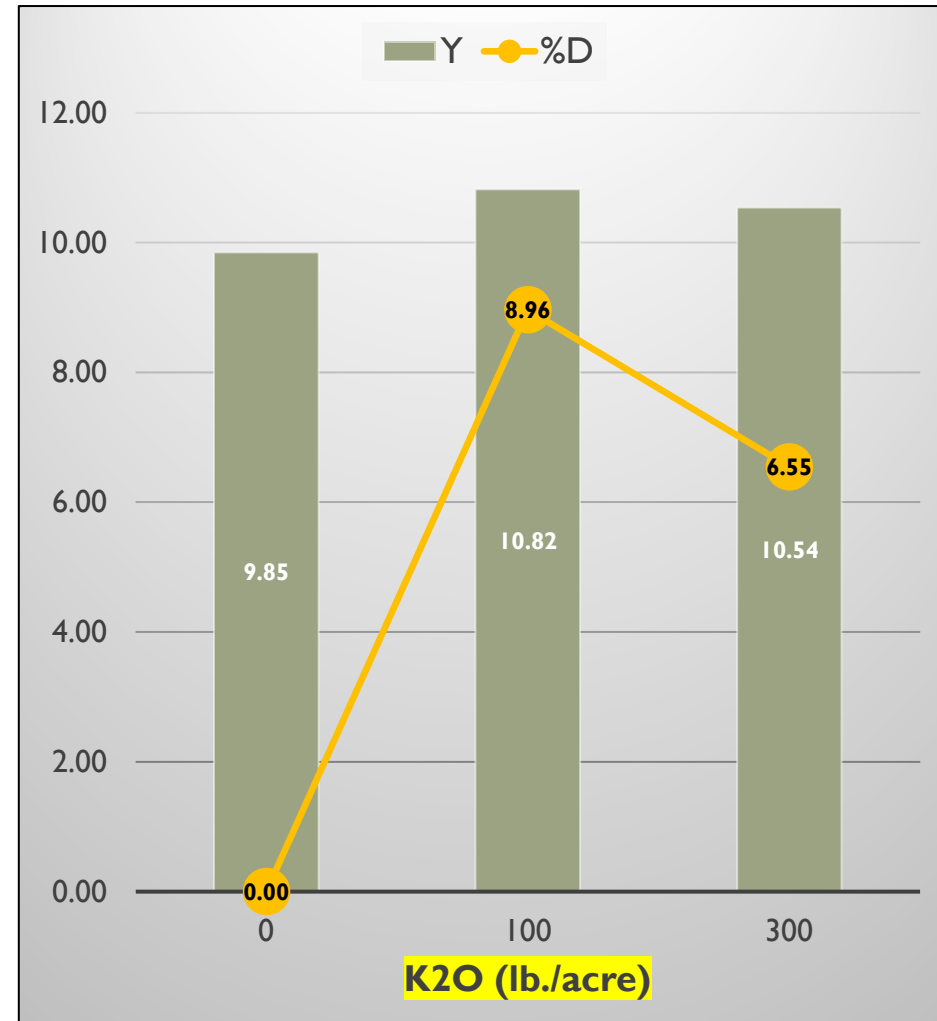
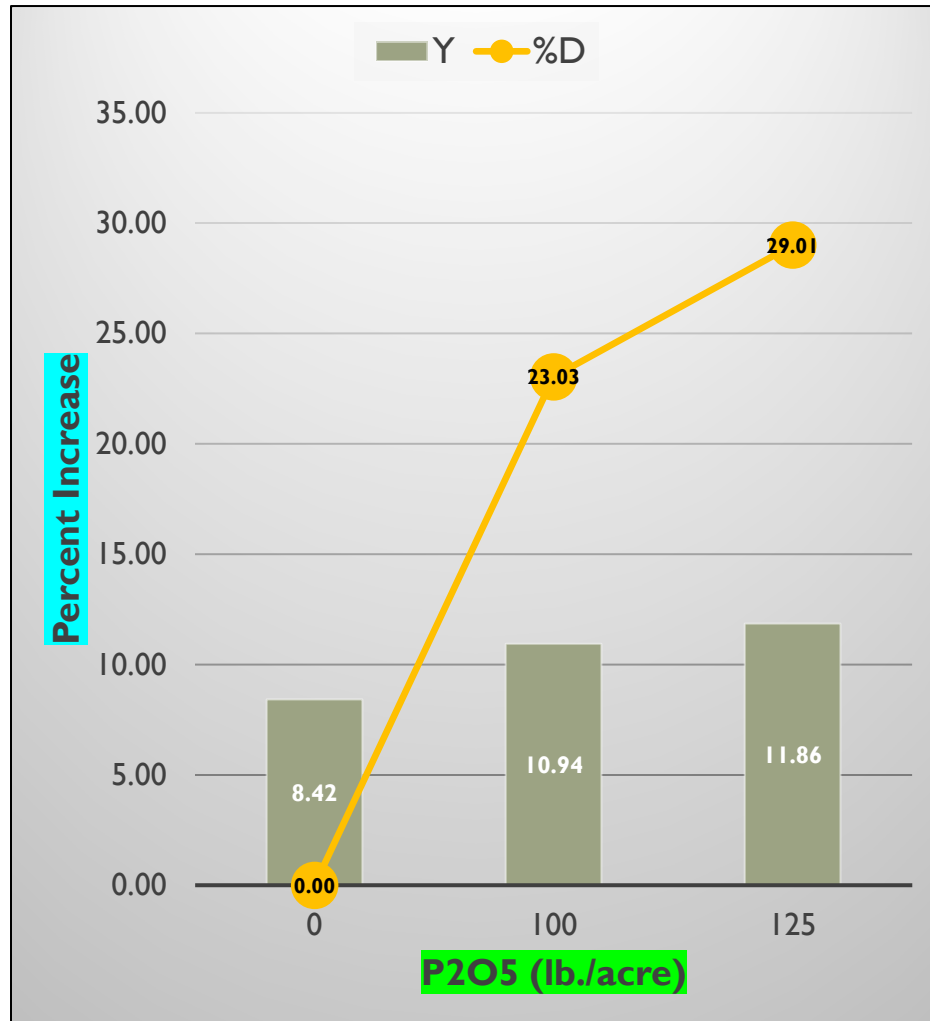
Synergetic Effects of P & K on Average Yield at MAC Trials

P ₂ O ₅ (lb. acre ⁻¹)	K ₂ O (lb. acre ⁻¹)	Yield (tons ac ⁻¹)	Response
0	0	12.86	--
0	100	13.66	0.80, tons ac ⁻¹
125	0	14.20	1.34, tons ac ⁻¹
 125	100	14.90	2.04, tons ac ⁻¹
Average (P + K)		13.94	1.08, tons ac ⁻¹
Difference {(PK- ave (P+K))}		0.96	6.44%
Yield Advantage of Interaction (PK) over Individual components			
Together (PK) over P alone		0.7 (4.70 %)	Synergetic effect of PK Interaction
Together (PK) over K alone		1.24 (8.32 %)	




Combined Impacts of P & K on Yield (5 cuts) Tube Trial 2019



Separate Impacts of P & K Fertilization on Yield at Tube Trial 2019



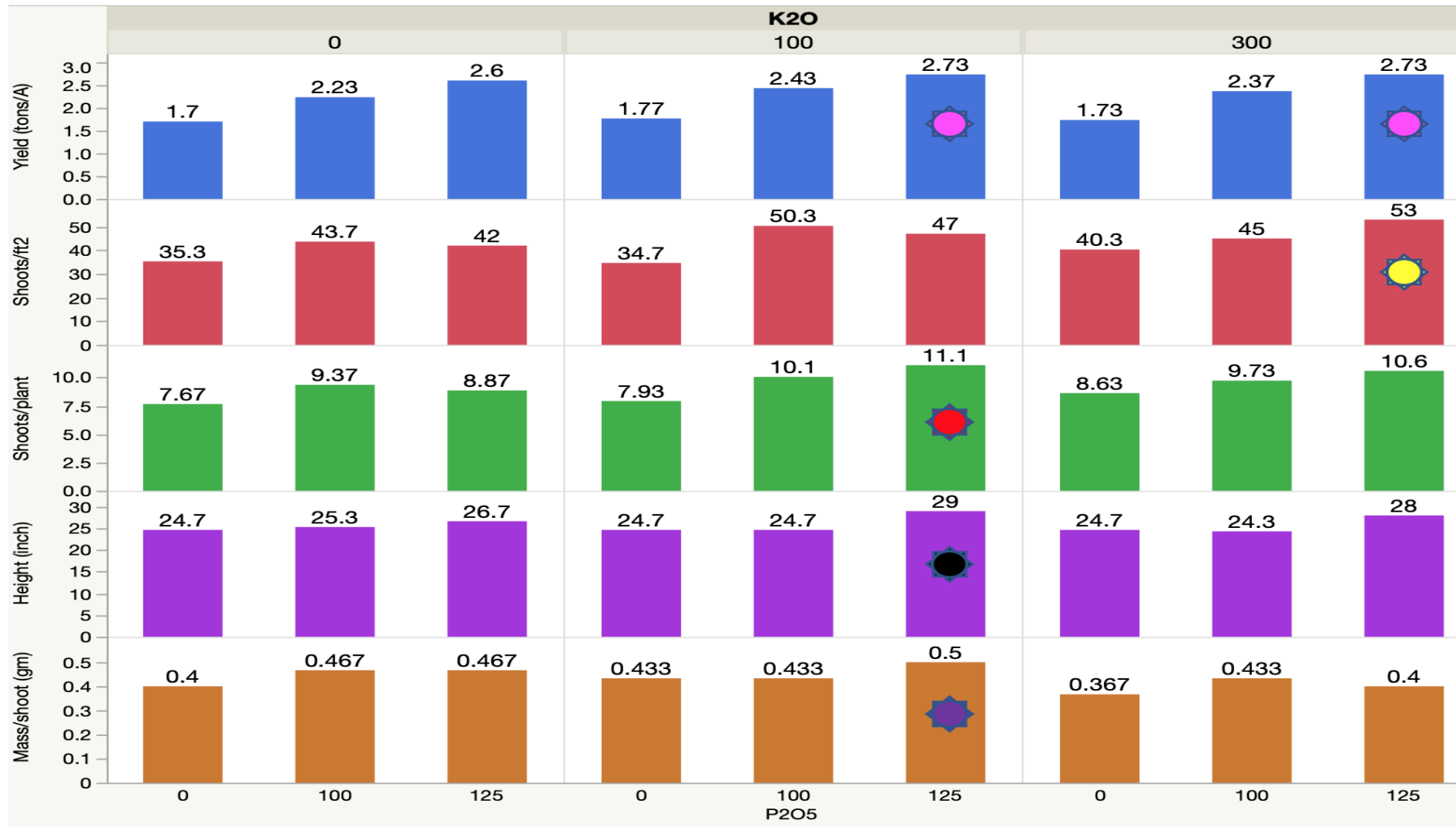
Synergetic Effects of P & K on Average Yield at **Tube Trial 2019**

P_2O_5 (lb. acre ⁻¹)	K_2O (lb. acre ⁻¹)	Yield (tons acre ⁻¹)	Response
0	0	7.60	--
0	100	8.16	0.56, tons ac ⁻¹
125	0	11.01	3.41, tons ac ⁻¹
 125	100	13.05	5.45, tons ac⁻¹
Average (P + K)		9.59	1.99, tons ac ⁻¹
Difference {(PK-ave(P+K))}		3.46	26.51%
Yield Advantage of Interaction (PK) over Individual components			
Together (PK) over P alone		2.04 (15.63 %)	Synergetic effect of PK Interaction
Together (PK) over K alone		4.89 (37.47 %)	

Impacts of P & K Fertilization on Yield at Tube Trial 2020

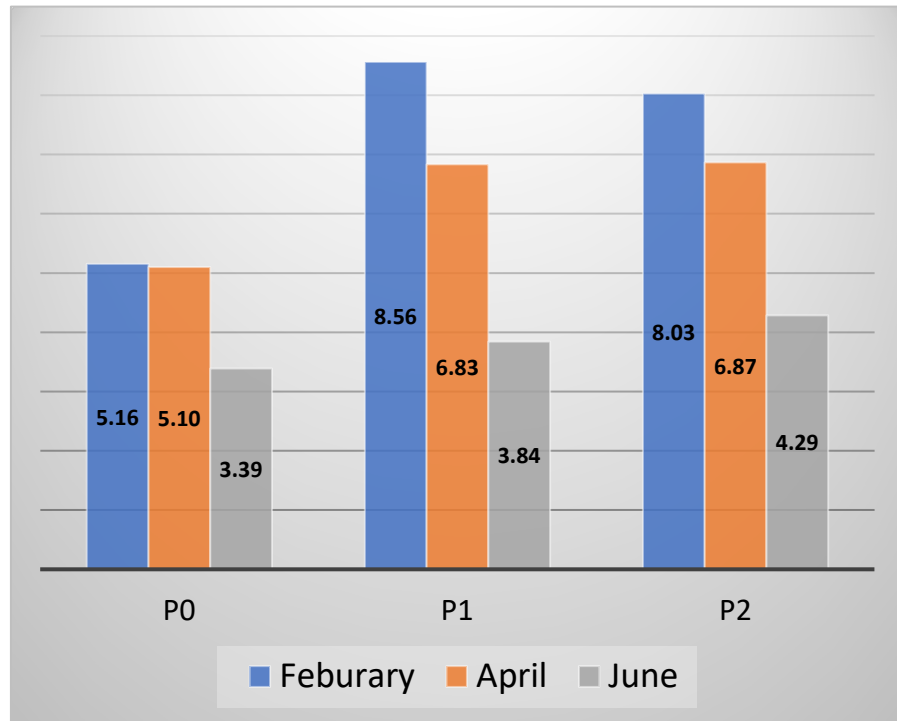


Balanced P and K Fertilizers Improved Alfalfa Yield and Yield Components at Tube Trial 2020

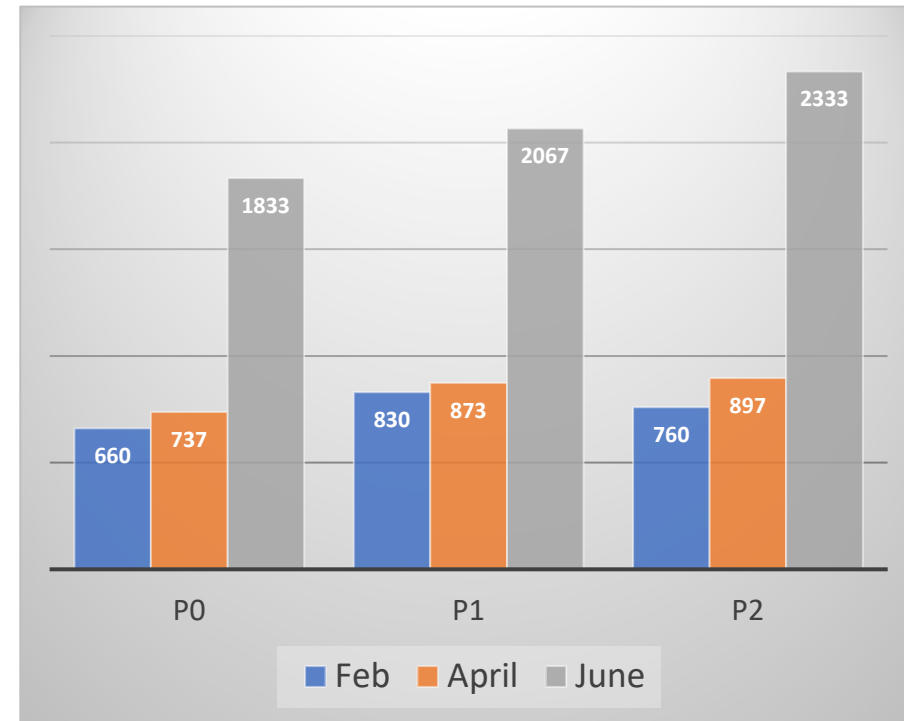


P Fertilizer Effect on Soil and Plant-P (Tube-2019)

- Olsen-P



- Plant Concentration (PO4-P)



Conclusions

- P has significant, while K has slight effect on yield individually,
- P & K interaction has synergetic effects on yield,
- Highest fertilizer application did not result in **significantly** increased yield,
- Balanced PK produced the highest productivity,
- With increasing fertilizer costs, a conservative approach to identifying fertilizer application rates may be more profitable.
- Additional research and detail economic analysis required.

Alfalfa Aphid Complex

- The pea aphid, *Acyrtosiphon pisum*



- The blue alfalfa aphid, *Acyrtosiphon kondoi*



Alfalfa Aphid Complex

- The spotted alfalfa aphid, *Therioaphis maculata*



- The cowpea aphid, *Aphis craccivora*



After 2012

Before 2012

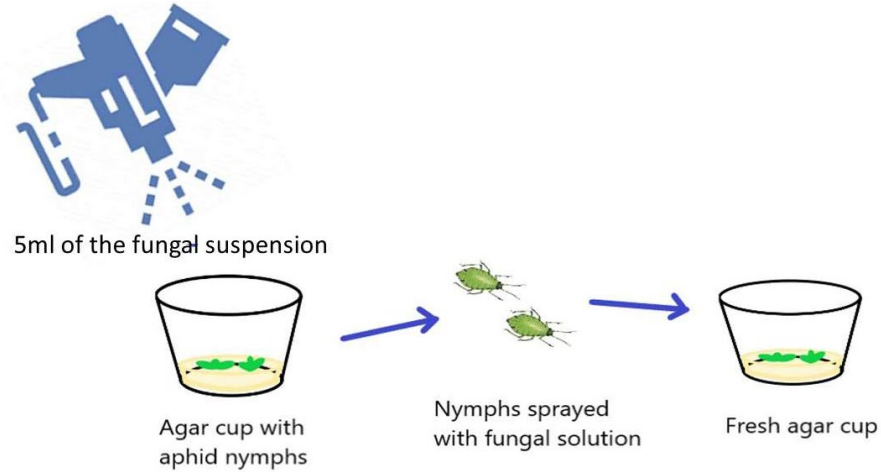




***Isaria sp* & *Zoophthora sp.*
Entomopathogenic Fungus**

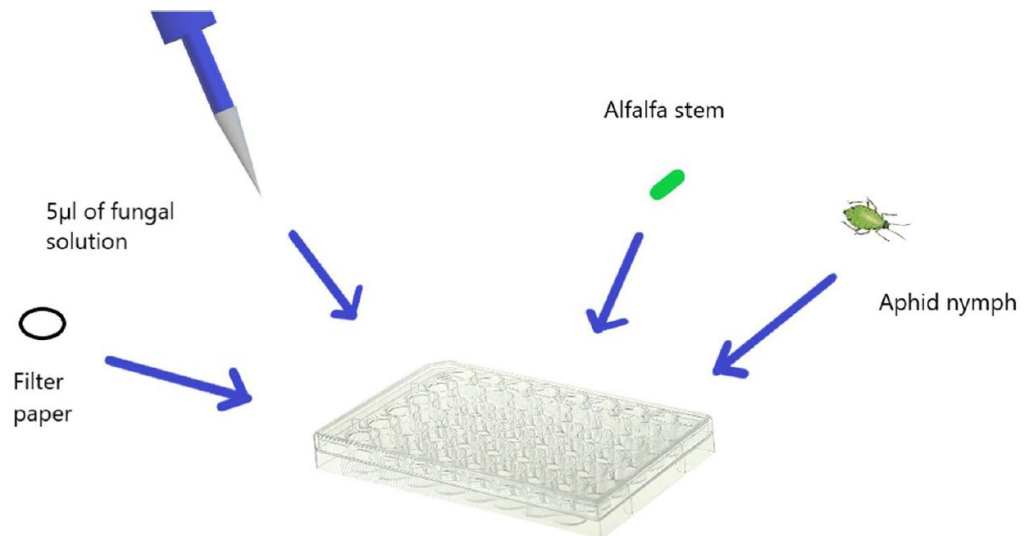


Effects of formulations of *Isaria fumosorosea* (If) & *Beauveria bassiana* (Bb) on blue alfalfa aphid (BAA)

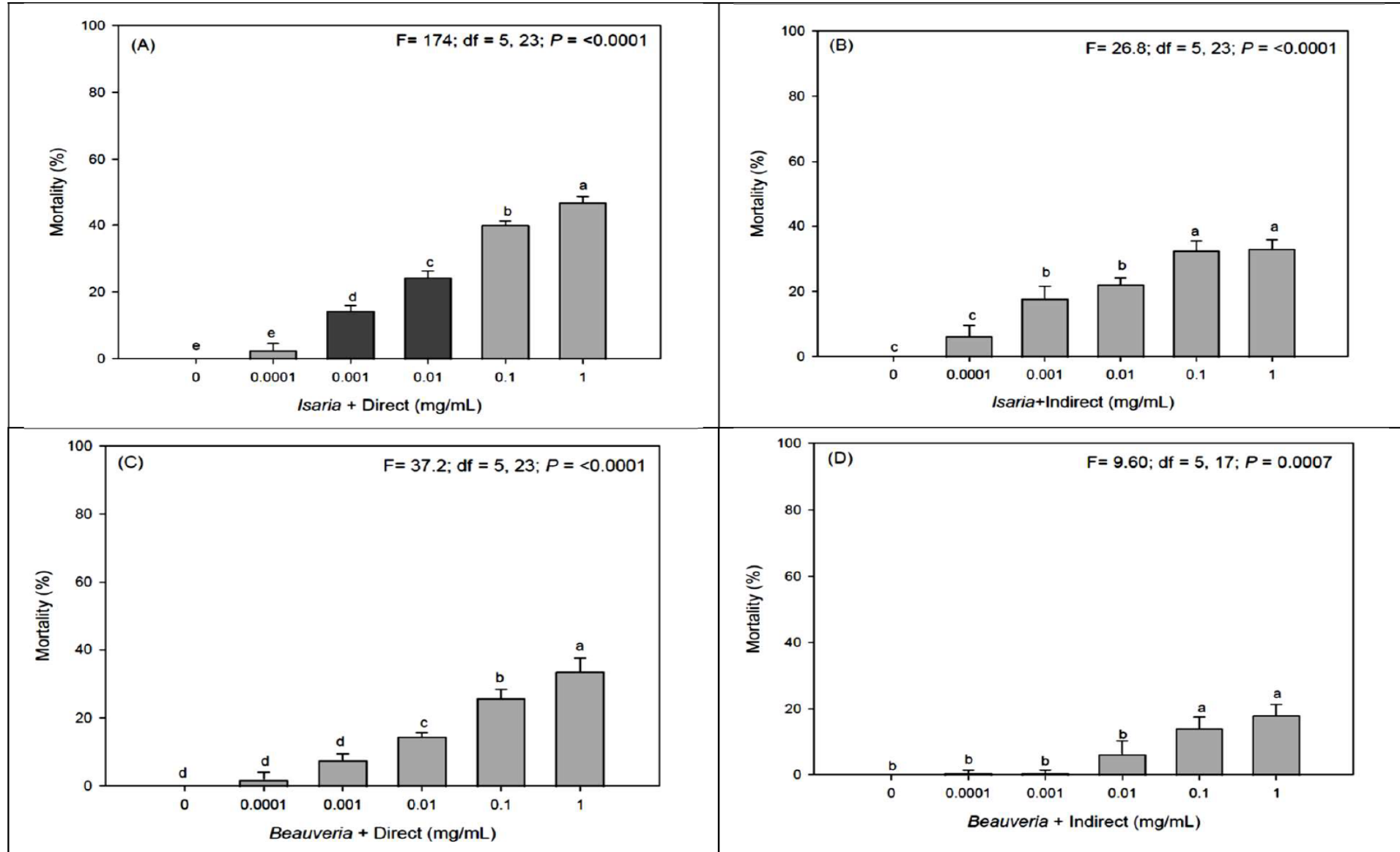


Setup for **direct (spray)** application method

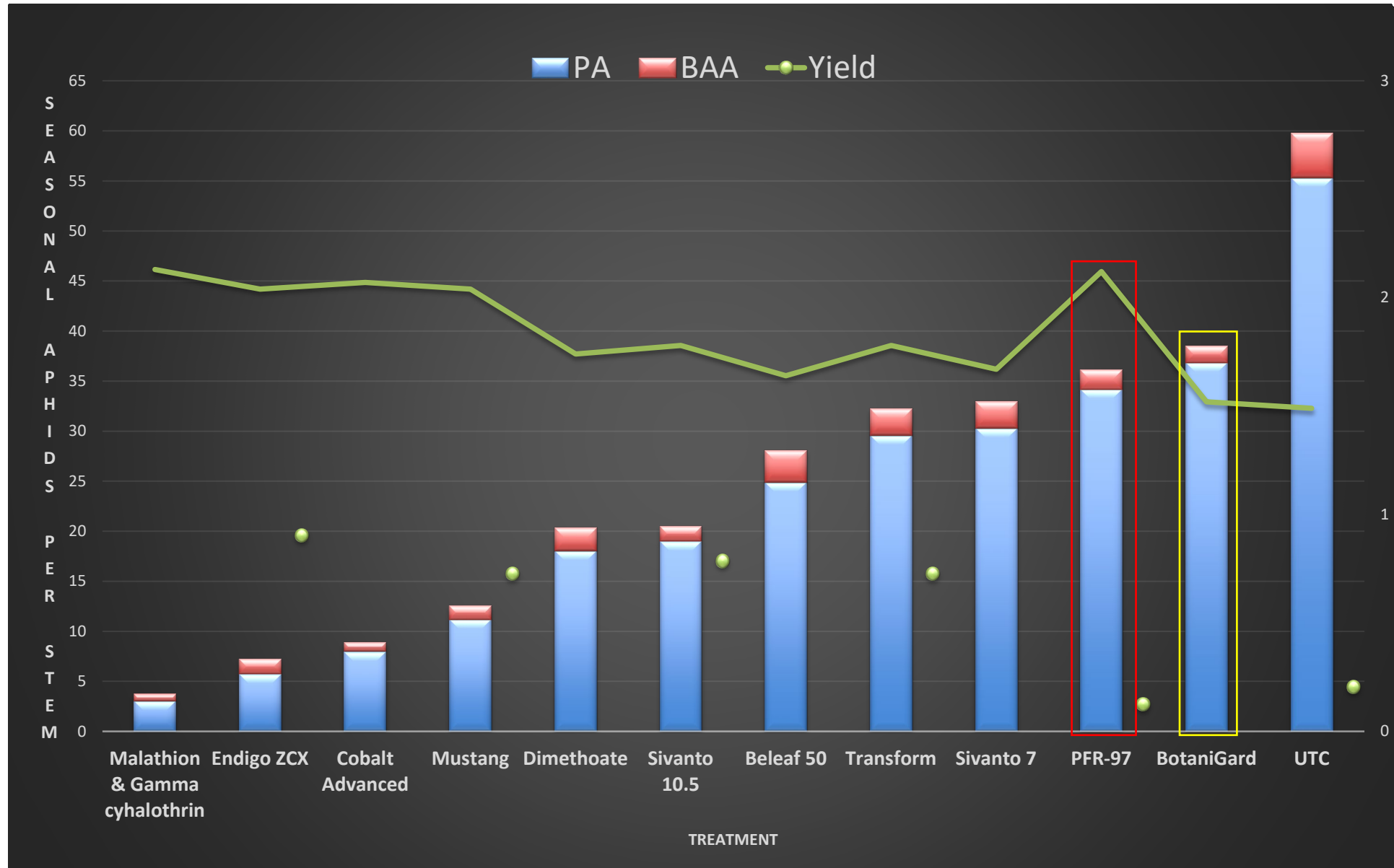
Setup for **indirect** inoculum application method



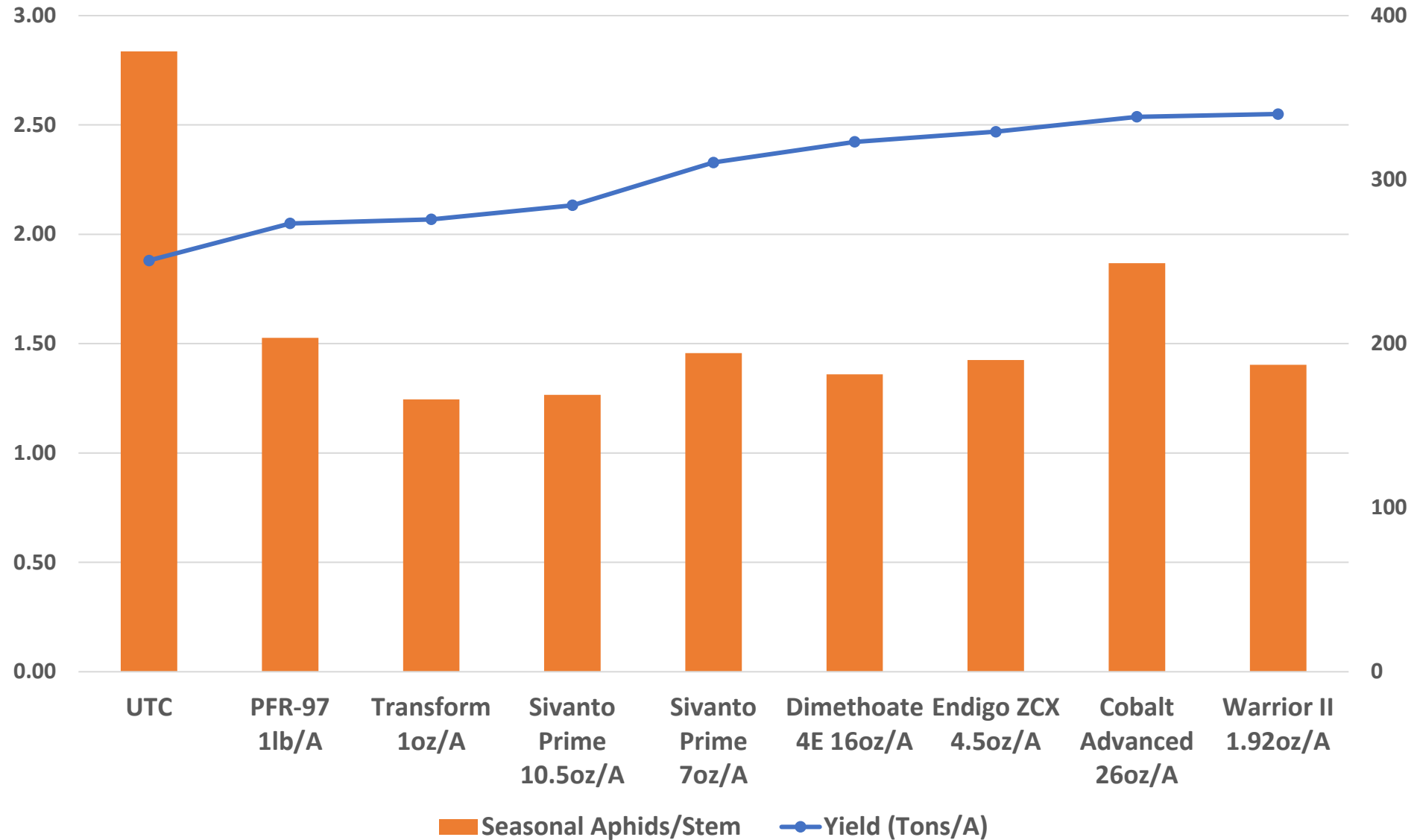
Mortality % of BAA exposed to different doses of (If) & (Bb) application methods after 5 days



Aphid Populations/Stem vs Yield (ton/A) for 2017 Study



Aphid Populations/Stem vs Yield (ton/A) for 2018 Study





IPM Continuum

Biologically-
based strategies

Biologically
Reliant

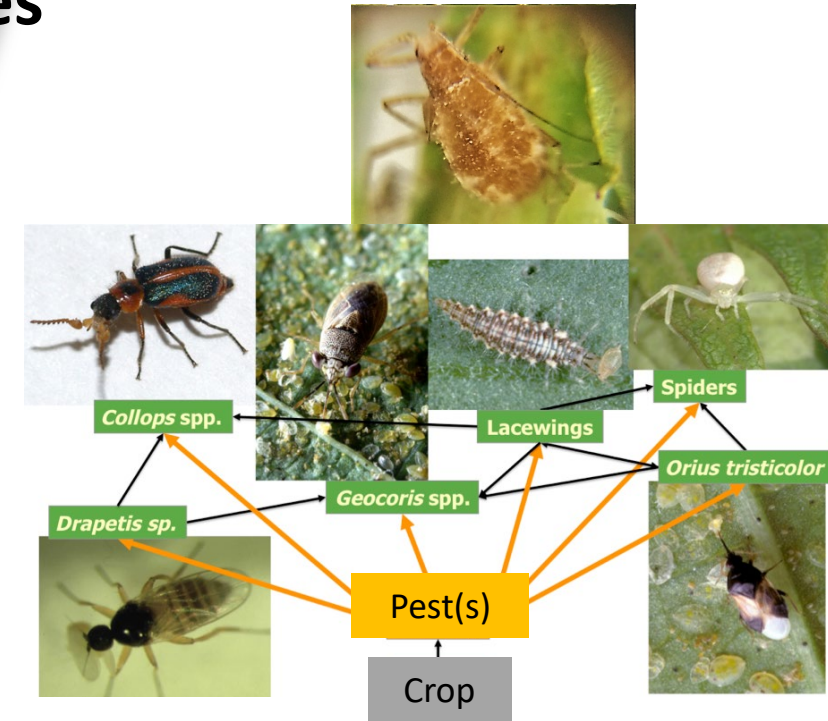
Prevention

Reduced risk
insecticides

Thresholds

Scouting

Chemically
Reliant





Thanks

