ENHANCING ALFALFA YIELD AND YIELD COMPONENTS THROUGH BALANCED PHOSPHORUS AND POTASSIUM MANAGEMENT

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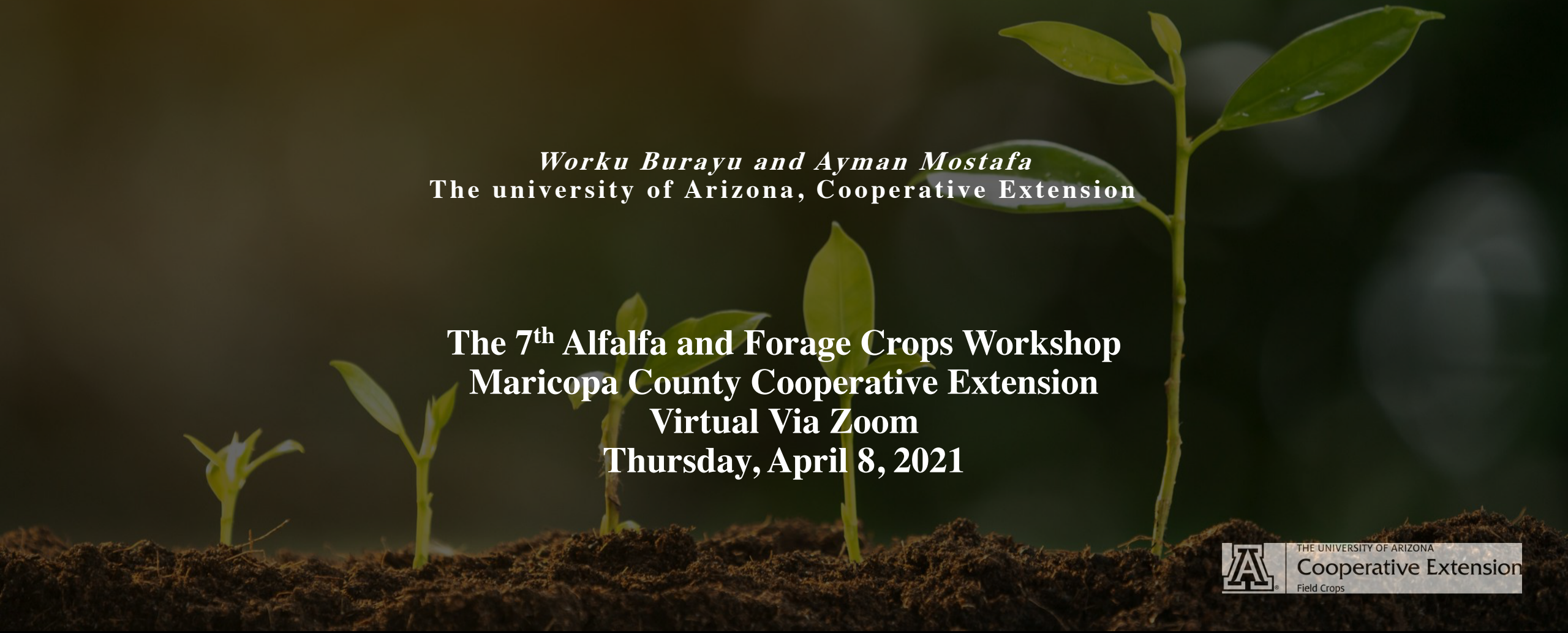
The 7th Alfalfa and Forage Crops Workshop
Maricopa County Cooperative Extension
Virtual Via Zoom
Thursday, April 8, 2021



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Indicators of Alfalfa Yield

Live plants per area
(15-8 newly stand; 4-5 established ft^2)

Stems per plant
(6-8; 4-7)

Number of stems per area
(50-60; 40-50 ft^2)

Mass per shoot (shoot weight)

Indicators of Alfalfa Yield (cont….)

Uniformity of the stand (Visual)

Plant height (26-30 inches)

Internode length

Node #

Trifoliate

These indicators help to answers the question should I maintain my alfalfa field?

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Balanced Fertilizers

- With intensive alfalfa production systems, growers increased inputs especially P fertilization rates to achieve higher yields,

- Research indicating the positive impacts of the interactions between P and K on the agronomic performance of alfalfa (Lissbrant et al. 2010),

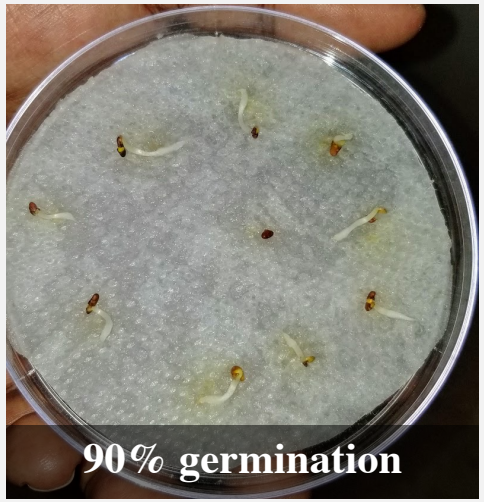
- There is little information in the low desert AZ on balanced PK fertilization effects on yield and yield components of alfalfa from areas where soil K is not limiting.

Objectives

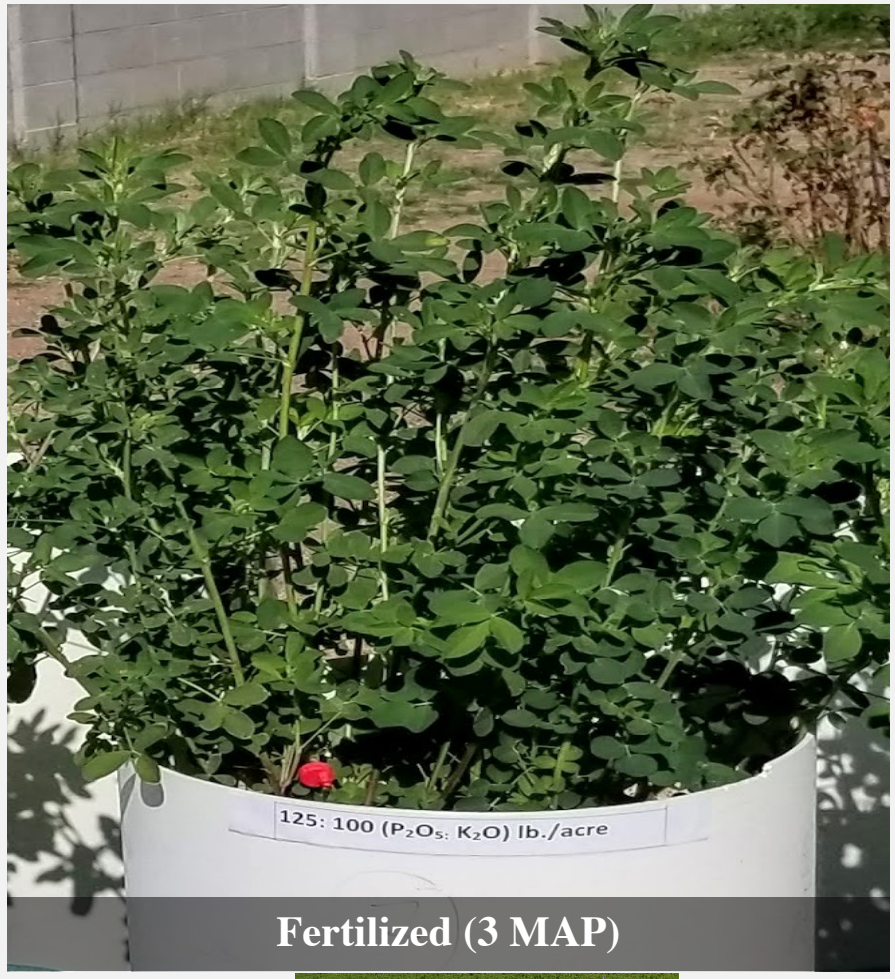
- To determine the impact of P and K nutrition on yield and yield components of alfalfa,
- To determine which yield components are associated with changes in alfalfa forage yield.

Methodologies

Results: Fertilizers Effect on Alfalfa


90% germination


A week after planting



Fertilized (3 MAP)


First cutting (4 months after planting (MAP))

Unfertilized (3 MAP)


Study at MAC

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Significance of P, K and their interaction on Alfalfa

Source	Yield	Plant/ft^2	Stems/plant	Stems/ft^2	Mass/stem	Height	Trifoliate	Node #	Internode length
P	***	ns	***	***	***	**	ns	ns	***
K	ns	ns	ns	ns	ns	ns	ns	ns	ns
PK	**	ns	**	**	*	**	ns	ns	**

*, **, *** refer to statistically significant at P < 0.05, P < 0.01 and P < 0.001; ns-no significant at the 0.05 probability level.

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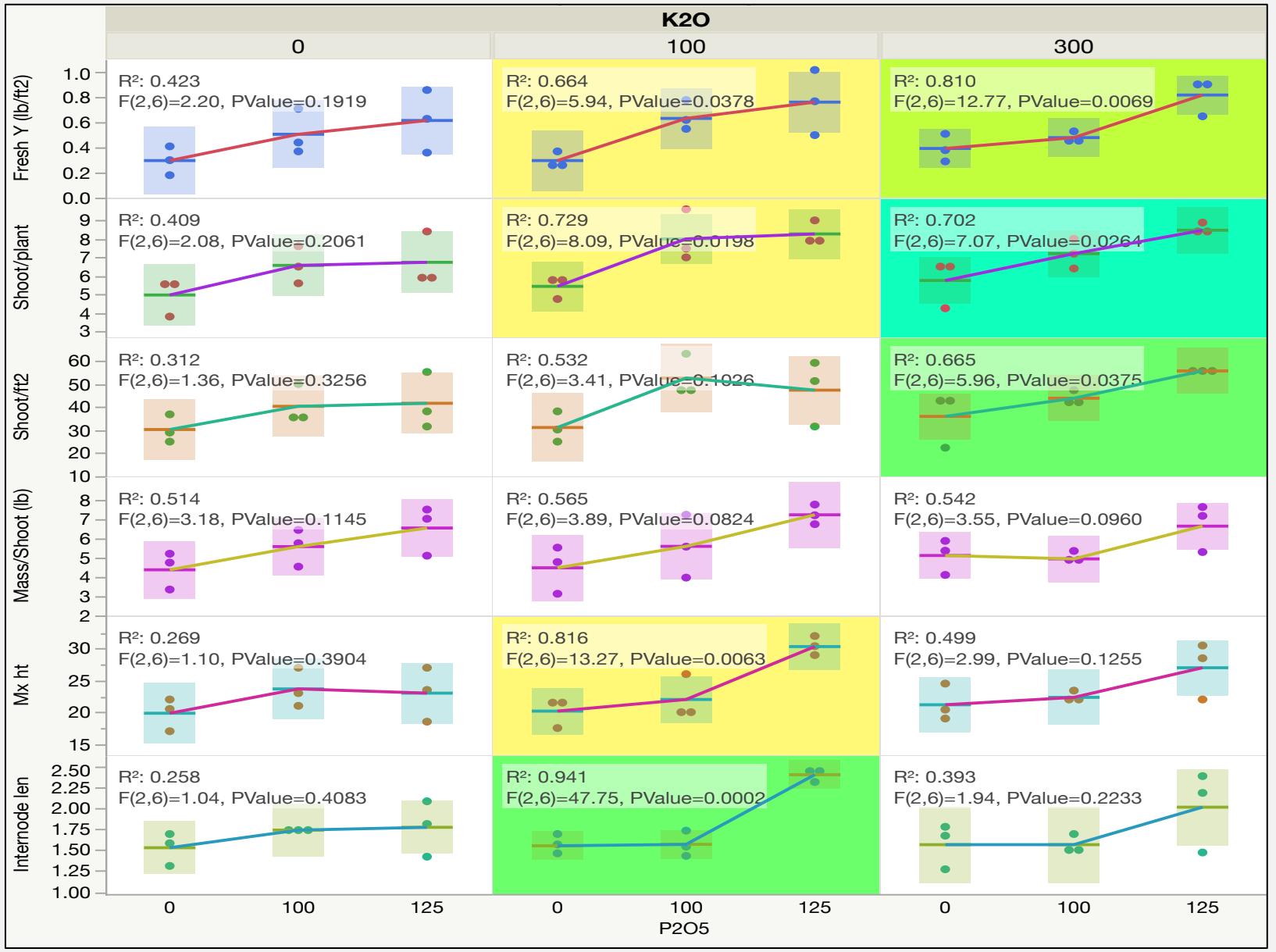
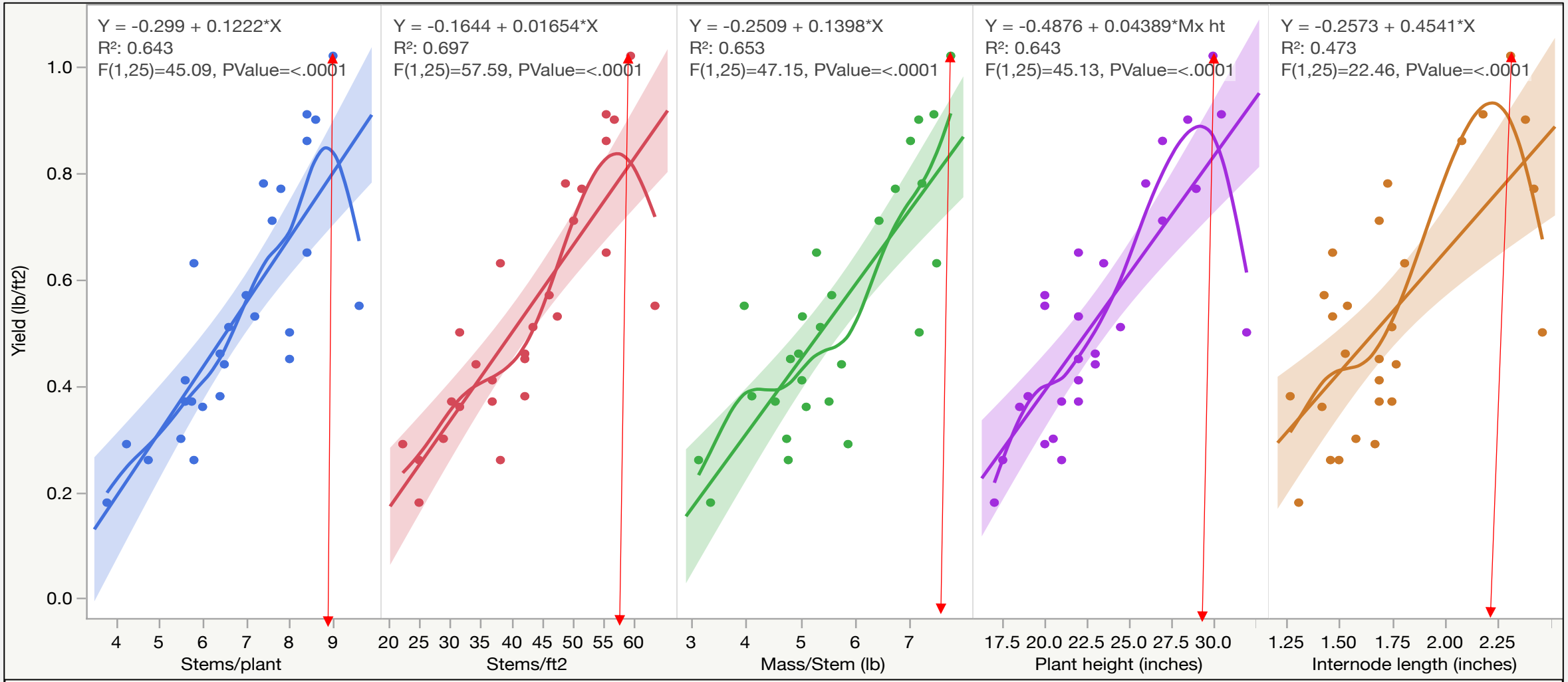
PK interaction effect on alfalfa yield and yield components



Alfalfa Yield Components Vs. Yield



Yield components Vs. Yield: Yield increases were due to higher number of stems per plant (r = 0.80***), stems/ft² (r = 0.83***), greater mass per shoot (r= 0.81***), plant height (r = 0.80***), and internode length (r = 0.69***). In the present findings, we estimated 9 stems/plant (9, 1.02, x, y), 59 shoots/ft² , 8 lb. /shoot (8, 1.02), the height of 29 inches (29, 1.02) and 2.2 inches internode length (2.2, 1.02) produced the highest yield.

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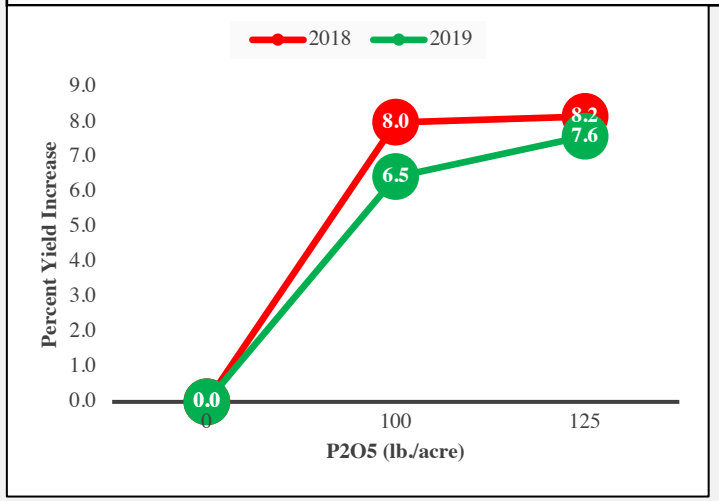
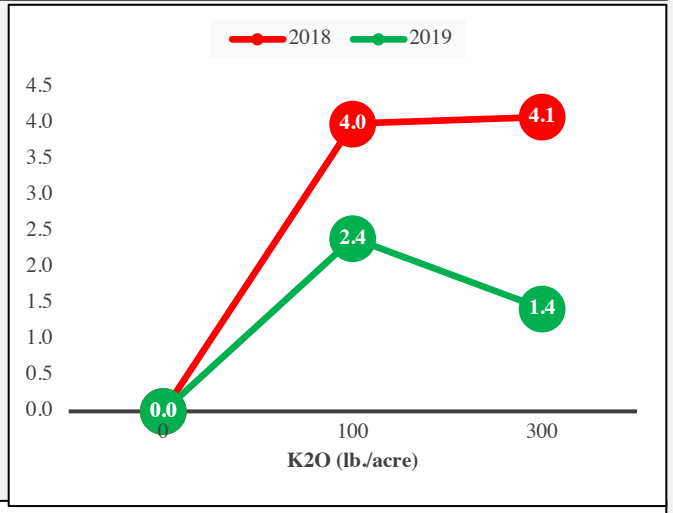
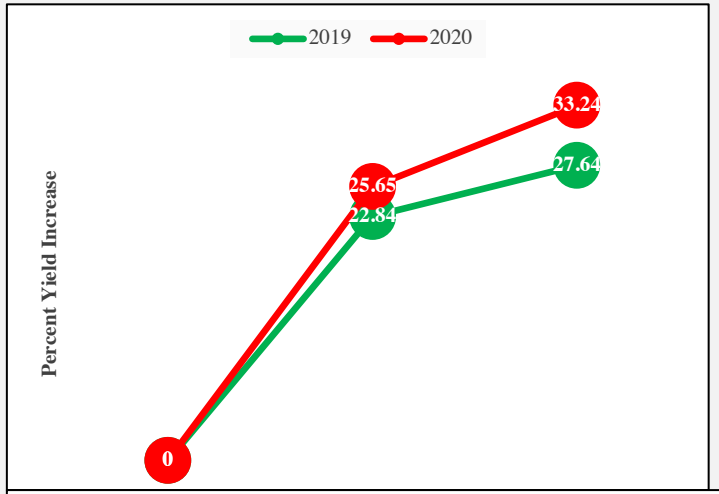
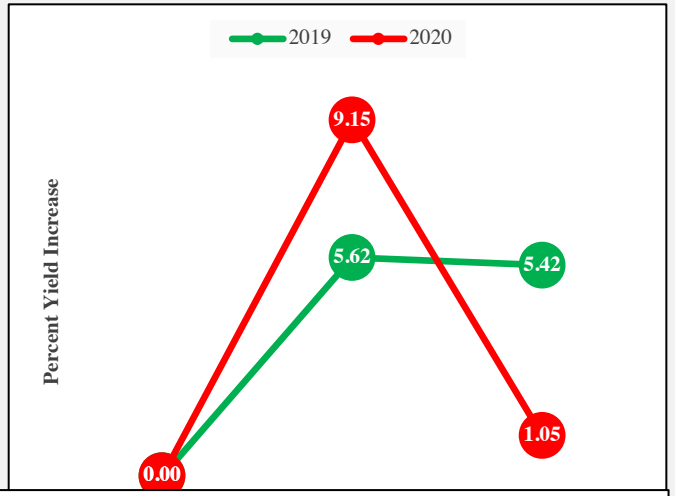
Individually P and K increased yield (MAC & Tube)





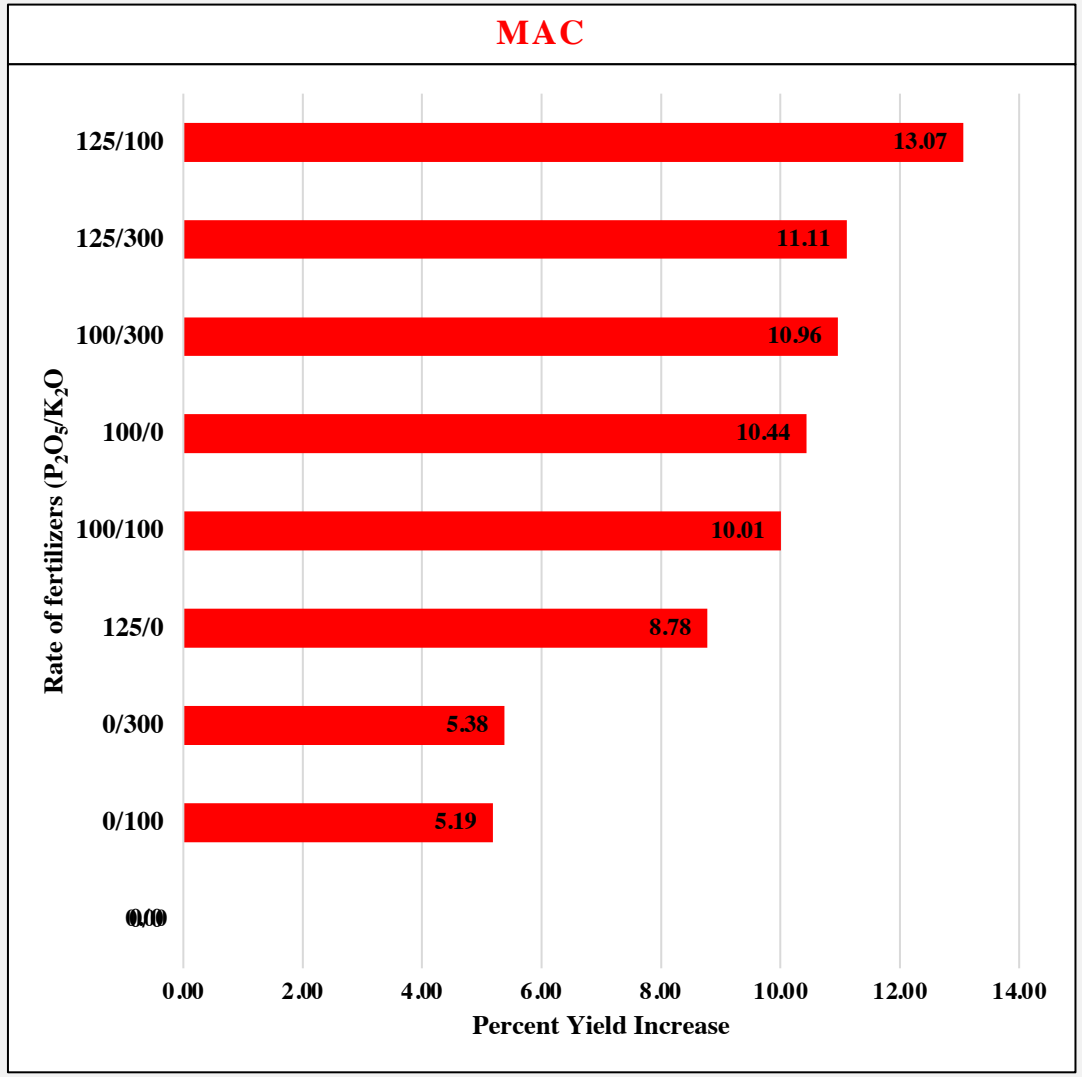
MAC

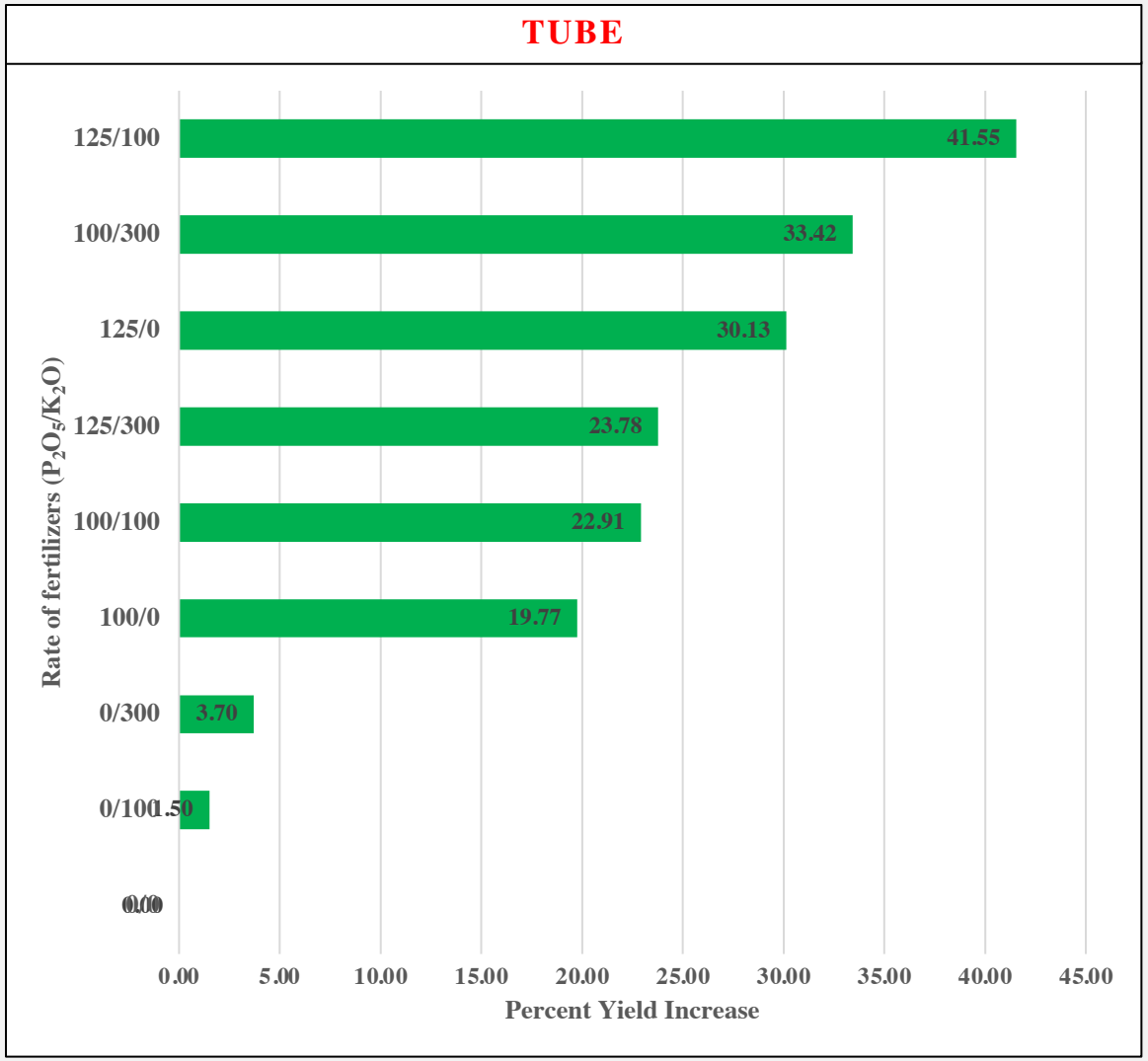




TUBE

Combination of P and K Increased Yield(average of two years)





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Balanced Fertility Synergetic Effect

Percent Yield Increase						
	MAC			TUBE		
Yield Advantage	2018	2019	Average	2019	2020	Average
PK over Unfertilized	14.77	12.35	13.50	34.80	35.83	35.32
PK over K alone	8.30	8.42	8.35	34.29	40.76	37.53
PK over P alone	3.60	6.21	4.95	9.92	11.29	10.61
{PK over (P+K)/2)}	5.92	**7.28**	6.60	22.11	**26.02**	24.07

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Nutrient amount removed and amount required to give maximum yields

Nutrient	Amount removed (lbs/ton)	Calculated amount removed at 15 t/A (lbs/acre)	Extractable nutrient (lbs/A)	Amount Required (lbs/A)	Amount Applied (based on 8.3 tons/acre) (lbs/A)
Sandy Clay Loam (MAC) at 15 T/A (Maximum Yield)					
P_2O_5	15	225	30	195	0, 100, 125
K_2O	60	900	771	129	0, 100, 300
Sandy Loam (Tube trial) at 17 T/A (Maximum Yield)					
P_2O_5	15	255	36	219	0, 100, 125
K_2O	60	1020	602	418	0, 100, 300

Balanced fertilizer application improved alfalfa yield. Maximum yield obtained at 125/100 (P_2O_5/K_2O) lb. $acre^{-1}$ yr^{-1} on both soil types.

Summary

- P & K interaction has significant and positive effect on yield and yield components of alfalfa,
- Balanced PK at 125 lbs a^{-1} P_2O_5 and 100 lbs a^{-1} K_2O produced the highest productivity,
- P has significant, while K has slight effect on yield individually,
- Highest single P or K fertilization alone did not result in **significantly** increased yield,
- A conservative approach to identifying fertilizer application rates may be more profitable.
- Additional research and detail economic analysis required.

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THANK YOU!!