WASHINGTON STATE UNIVERSITY EXTENSION

Economics of Alfalfa Fertilization Under Inflated Hay and Fertilizer Prices

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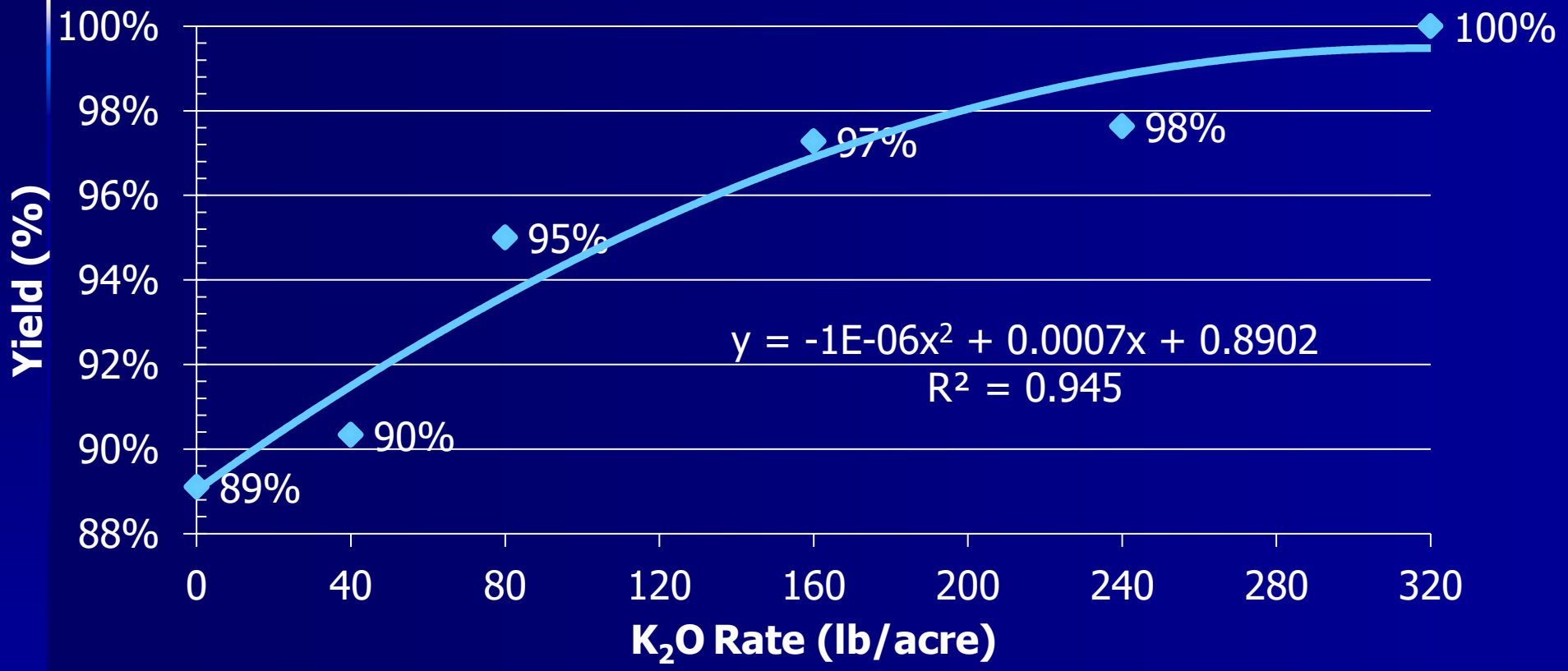
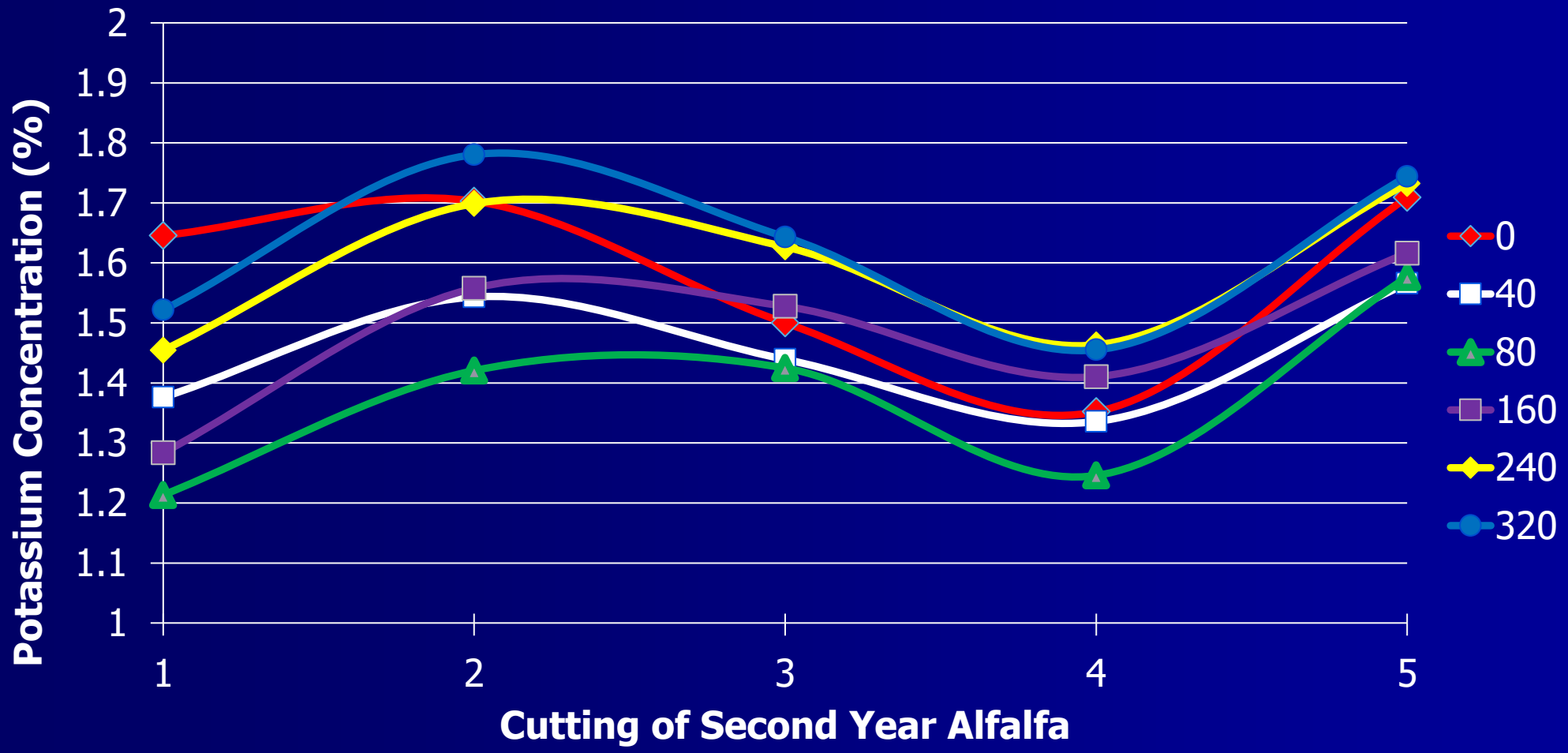
Potassium Study and Interpretation

2019 – 2020 Total Yield of Alfalfa as Influenced by Potassium Rate



Beginning K soil test levels was 86 & 79 ppm in 2019 and 2020, respectively.

2019 Tissue K Concentration at Harvest by Cutting and Rate After Spring Applications of K_2O (lb/acre)



Drop in Potassium Chloride (0-0-60) Rate Based on Hay and Fertilizer Price In Alfalfa

Fertilizer Price Of KCl^- (0-0-60)	Hay Price $150 per Ton	Hay Price $225 per Ton	Hay Price $300 per Ton
	Optimum Fertilizer Rate lbs K_2O/acre / (Percentage of Base Price Application)		
Base Price $ 446/Ton of KCl^- (0-0-60), $0.37 lb K_2O	204/(100%)	246/(100%)	265/(100%)
122% increase in Fert. Price $990/Ton, $0.83 lb K_2O	44/(22%)	144/(59%)	191/(72%)
244% Increase in Fert. Price $1534/Ton, $1.28 lb K_2O	0/(0%)	43/(17%)	116/(44%)

Inflation Correction Factor for K_2O Fertilizer Rates Based on Hay and Fertilizer Price In Alfalfa

Fertilizer Price Of KCl^- (0-0-60)	Hay Price $150 per Ton	Hay Price $225 per Ton	Hay Price $300 per Ton
Base Price $ 446/Ton of KCl^- (0-0-60), $0.37 lb K_2O	1.00	1.21	1.30
122% increase in Fert. Price $990/Ton, $0.83 lb K_2O	0.22	0.71	0.94
244% Increase in Fert. Price $1534/Ton, $1.28 lb K_2O	0.00	0.21	0.57

How much K_2O are we hauling off our fields?

K_2O Rate (lb/a)	2018 K_2O Rem-oved (lb/a)	2019 K_2O Rem-oved (lb/a)	2020 K_2O Rem-oved (lb/a)	2021 K_2O Rem oved (lb/a)	0-1′ Drop in K Test (ppm)	1-2′ Drop in K Test (ppm)	2-3′ Drop in K Test (ppm)
0	196.1	458.3	216	201.5	35	18	14
40	212.1	431.5	197	189.8	28	15	8
80	213.5	450.8	189	191.2	12	11	5
160	239.3	525.6	215	212.7	33	17	-3
240	308.4	567.2	239	236.8	33	14	23
320	300.2	616.1	250	259.5	3	19	6

K_2O Rate	Spring Soil Test K 2018	Spring Soil Test K 2019	Spring Soil Test K 2020	Fall Soil Test K 2021	Spring Soil Test K 2022	Reduction from Start (ppm)
(lb/a)	----------ppm----------					Sp. 18-Sp. 21
0	106.8	90.5	79.0	51.5	71.6	**35**
40	104.3	85.8	69.0	58.5	76.3	**28**
80	87.0	82.3	82.8	47.8	74.6	**12**
160	106.0	88.0	83.0	52.3	73.25	**33**
240	106.3	85.0	83.5	64.0	73.5	**33**
320	92.8	84.8	78.3	62.3	89.75	**3**

Change is Soil Test K Levels in one foot sample from Spring 2018 to 2022

K_2O Rate	Spring Soil Test K 2018	Spring Soil Test K 2019	Spring Soil Test K 2020	Fall Soil Test K 2021	Spring Soil Test K 2022	Reduction from Start (ppm)
(lb/a)	----------ppm----------					Sp. 18-Sp. 22
0	106.8	90.5	79.0	51.5	71.7	35.1
40	104.3	85.8	69.0	58.5	76.3	28.0
80	87.0	82.3	82.8	47.8	74.6	12.4
160	106.0	88.0	83.0	52.3	73.3	32.7
240	106.3	85.0	83.5	64.0	73.5	32.8
320	92.8	84.8	78.3	62.3	89.8	3.0

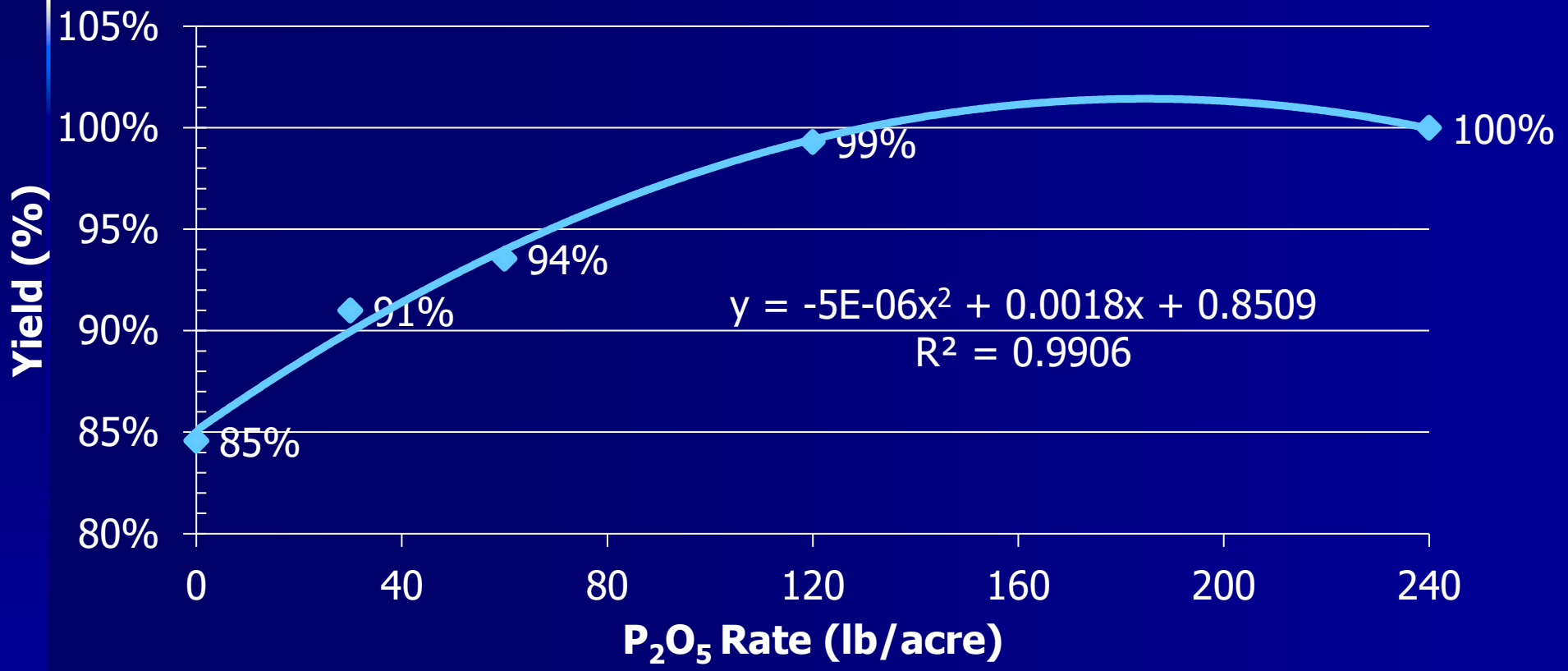
Goal to put back what we took off as potassium or maximize yield

- Over 4 years we pulled off 356 lbs/acre/year of K_2O
- Year two was the highest at 616 lbs/acre of K_2O
- Assuming current $300/ton hay price

Goal	Fertilizer Price (0-0-60)		
	$446/ton of Fert. ($0.37/lb of P_2O_5)	$990/ton of Fert. ($0.83/lb of P_2O_5)	$1,534/ton of Fert. ($1.27/lb of P_2O_5)
Optimizing Annual Profit K Rate	265 lbs/acre/yr	191 lbs/acre/yr	116 lbs/acre/yr
Total K Replacement Rate or Maximizing Yield	356 lbs/acre/yr	356 lbs/acre/yr	356 lbs/acre/yr
Increased Fert. Cost $/acre	$34/acre/yr	$137/acre/yr	$307/acre/yr

Phosphorus Study and Interpretation

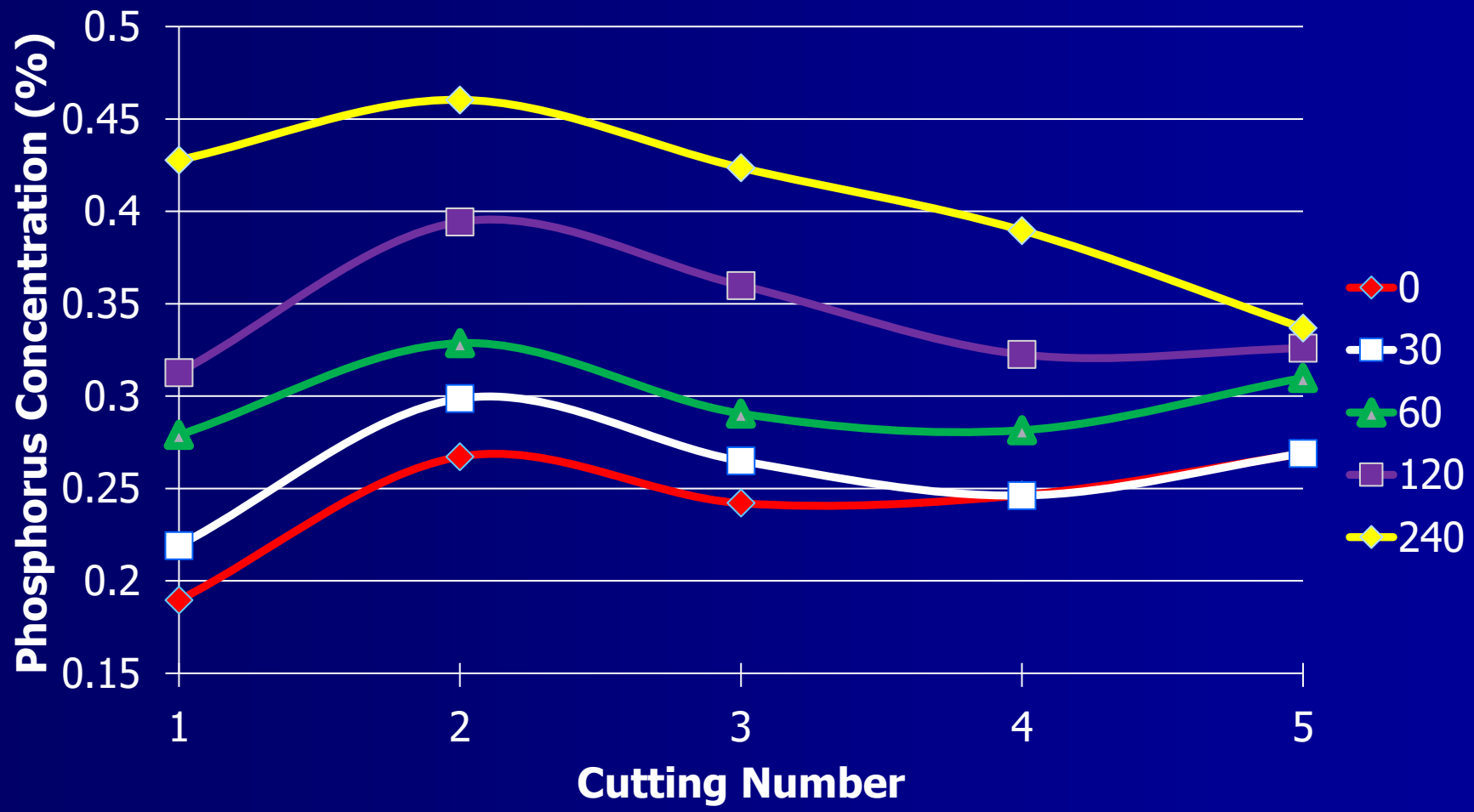
2019 – 2020 Total Yield of Alfalfa as Influenced by Phosphorus Rate



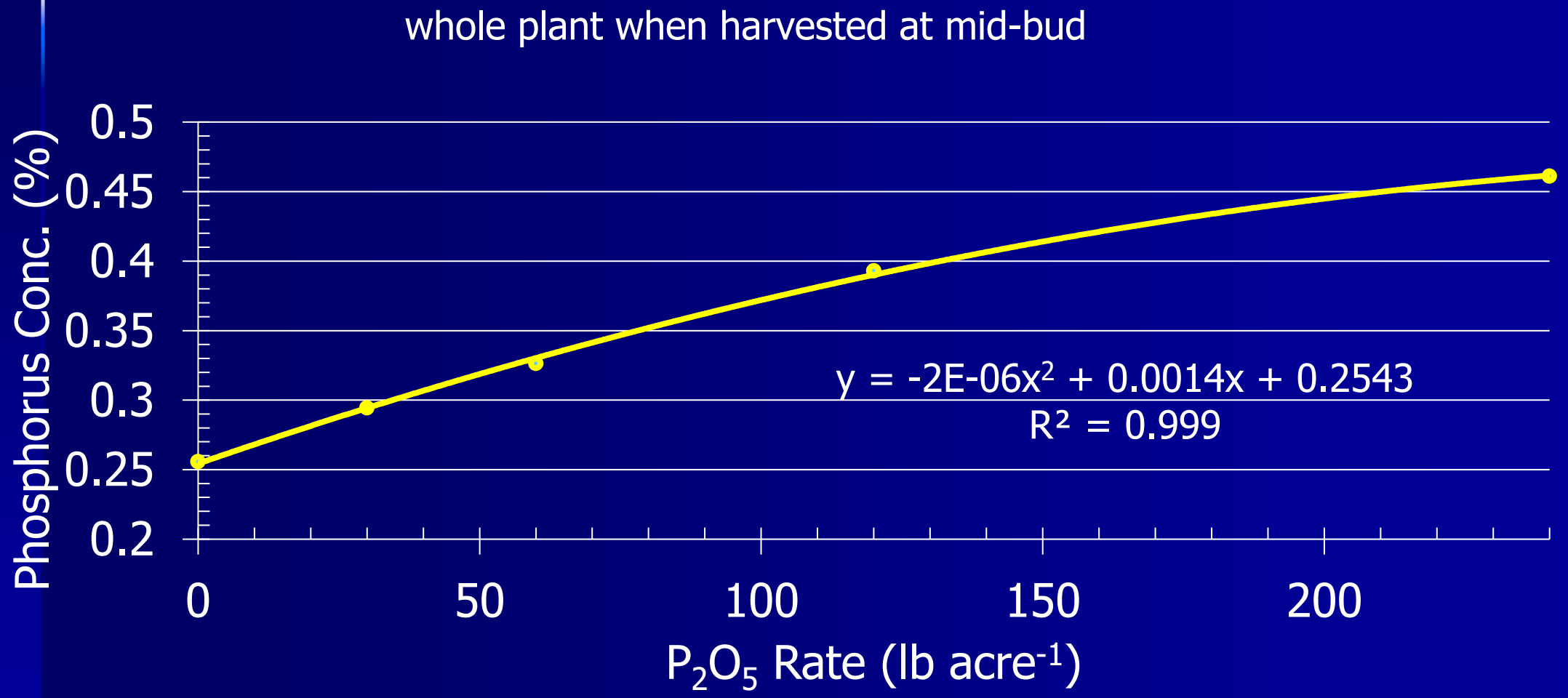
Beginning P soil test level was 6.7 and 5.7 ppm in 2019 and 2020, respectively.

2019 Tissue P Concentration at Harvest by Cutting and Rate

(whole plant when harvested at mid-bud)



2nd & 3rd Year Alfalfa Tissue Conc. At 2nd Cut as Influenced by Phosphorus Rate



Optimal 11-52-0 Rate Based on Hay and Fertilizer Price In Alfalfa and Opt. P (%) of 2nd Cut @mid-bud stage alfalfa

Fertilizer Price Of MAP (11-52-0)	Hay Price $150 per Ton	Hay Price $225 per Ton	Hay Price $300 per Ton
	Opt. Fert. Rate / Percent of Base App./ Opt. P Conc. (lbs P_2O_5/acre / % of Base App. / % P)		
Base Price $ 560/Ton of MAP ($0.54 lb P_2O_5)	146/(100%)/0.41	159/(100%)/0.42	166/(100%)/0.43
95% increase in Fert. Price $1090/Ton ($1.04 lb P_2O_5)	107/(73%)/0.38	134/(84%)/0.40	147/(89%)/0.41
189% Increase in Fert. Price $1620/Ton ($1.56 lb P_2O_5)	69/(47%)/0.34	109/(69%)/0.38	129/(78%)/0.40

Inflation Correction Factor for P Fertilizer Rates Based on Hay and Fertilizer Price In Alfalfa

Fertilizer Price Of MAP (11-52-0)	Hay Price $150 per Ton	Hay Price $225 per Ton	Hay Price $300 per Ton
Base Price $ 560/Ton of MAP ($0.54 lb P_2O_5)	1.00	1.09	1.14
95% increase in Fert. Price $1090/Ton ($1.04 lb P_2O_5)	0.73	0.92	1.01
189% Increase in Fert. Price $1620/Ton ($1.56 lb P_2O_5)	0.47	0.75	0.88

Change is Soil Test P Levels (Olson P) and Total Removed from 2017 to 2019

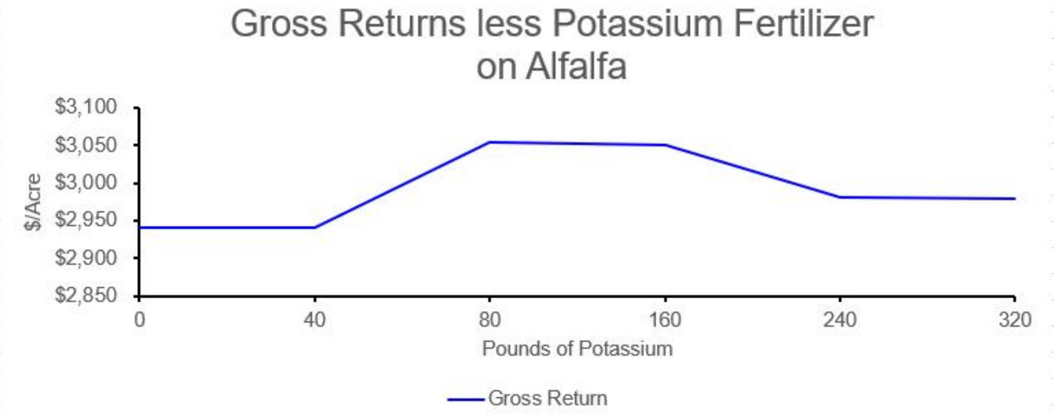
P_2O_5 Rate Applied	Total # of P_2O_5 Removed	Fall Soil Test P 2017	Fall Soil Test P 2018	Fall Soil Test P 2019	Fall Soil Test P 2020	Fall Soil Test P 2021
lb P_2O_5 a^{-1}	lb P_2O_5 a^{-1}	ppm P	ppm P	ppm P	ppm P	ppm P
0	228	8.4	4.5	4.3	5.50	5.25
30	265	8.6	6.0	5.8	4.75	7.5
60	293	7.9	5.5	4.0	3.25	5.25
120	**382**	**7.6**	**7.8**	**6.3**	**6.00**	**8.5**
240	455	9.1	9.7	8.3	7.50	12.25

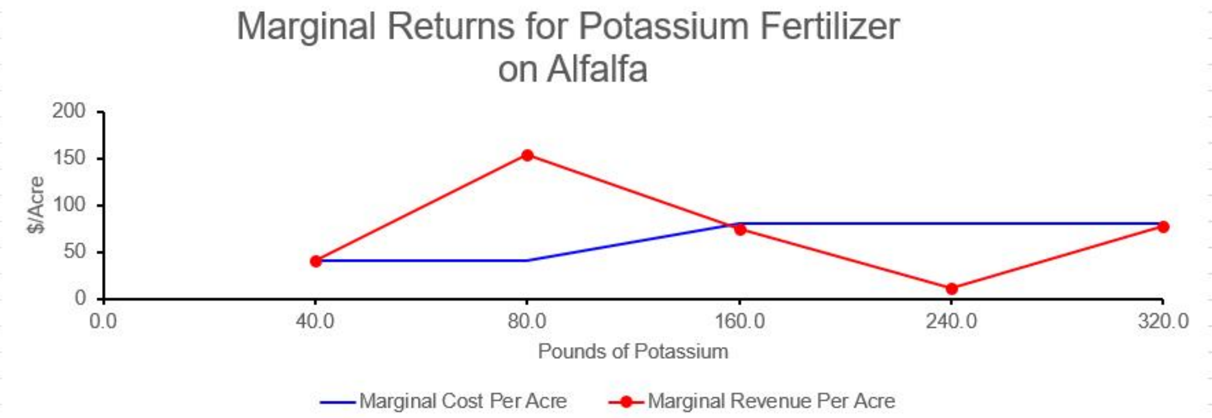
2nd Cut Harvest P Conc. (%)	Lbs of P_2O_5 to reach this from previous 1 %	Amount of P_2O_5 required to reach Optimum %	Dollars lost $acre^{-1}$ $year^{-1}$ for misapplying P when P is \$0.54 lb of P_2O_5 and Alfalfa is \$150 ton^{-1}	Dollars lost $acre^{-1}$ $year^{-1}$ for misapplying P when P is \$1.04 lb of P_2O_5 and Alfalfa is \$300 ton^{-1}
0.27	8	133	119	251
0.29	8	118	94	199
0.31	8	102	71	149
0.33	8	85	49	105
0.35	9	67	31	66
0.37	10	47	15	33
0.39	11	25	4	10
0.41	13	0	0	0
0.43	16	-29	5	10
0.45	20	-65	27	54

Sheet View | Workbook Views | Show | Zoom | Window | Macros

G3 =F3/100

		% of Max Yield	Yield Per Acre	Gross Return	Yield Change	Gross Revenue Per Ac	Marginal Revenue Per Acre		Marginal Cost Per Acre	Fertilizer Cost Per Acre	Fertilizer (Lbs. per Acre)
Yield Goal Per Ac	**11**	89%	9.80	$ 2,940.61		$ 2,940.61				$ -	0
Starting P (PPM)	**75-100 ppm K**	90%	9.94	$ 2,941.12	0.14	$ 2,981.12	$ 40.51	>	$ 40.00	$ 40.00	40
Hay Price	**300**	95%	10.45	$ 3,055.14	0.51	$ 3,135.14	$ 154.03	>	$ 40.00	$ 80.00	80
$/Lb. P	**1**	97%	10.70	$ 3,050.24	0.25	$ 3,210.24	$ 75.10	<	$ 80.00	$ 160.00	160
		98%	10.74	$ 2,981.92	0.04	$ 3,221.92	$ 11.68	<	$ 80.00	$ 240.00	240
		100%	11.00	$ 2,980.00	0.26	$ 3,300.00	$ 78.08	<	$ 80.00	$ 320.00	320



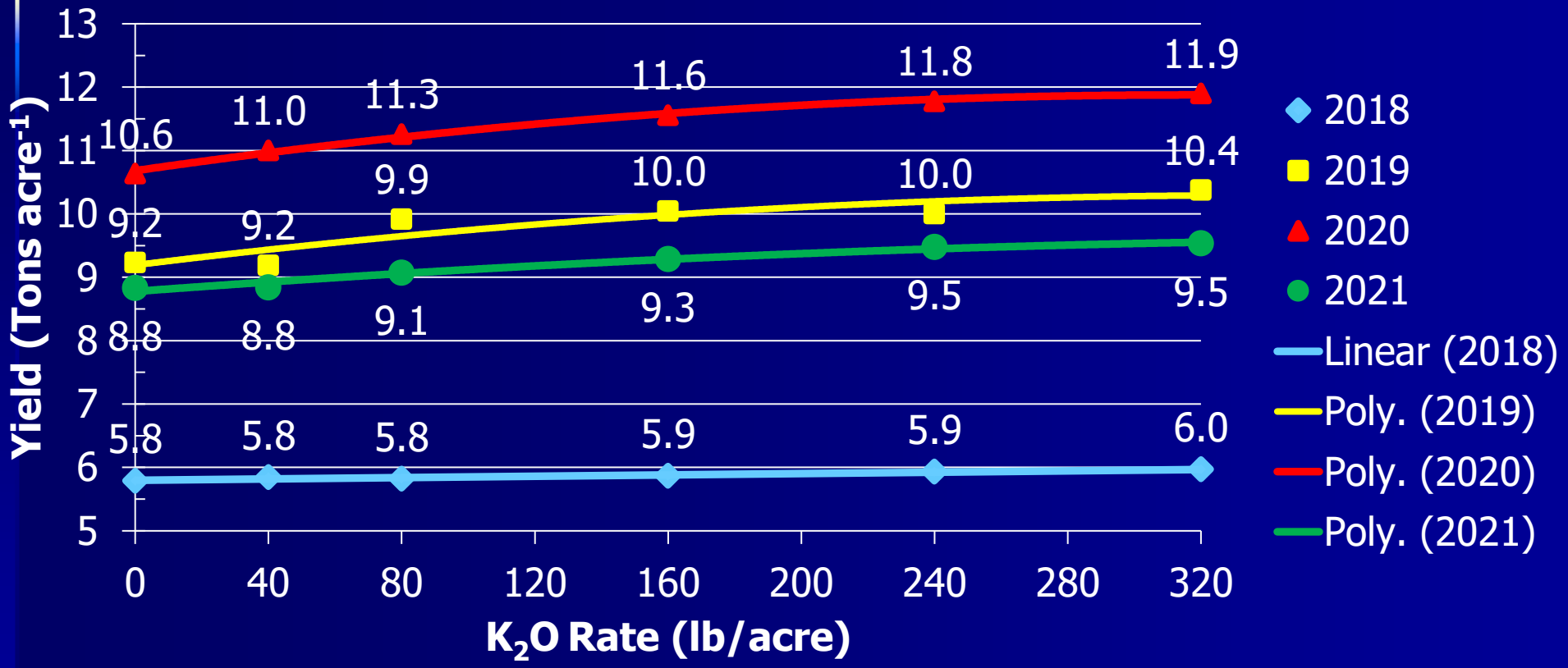


Intro | Phosphorus | Po Plot Area

This research was funded by:

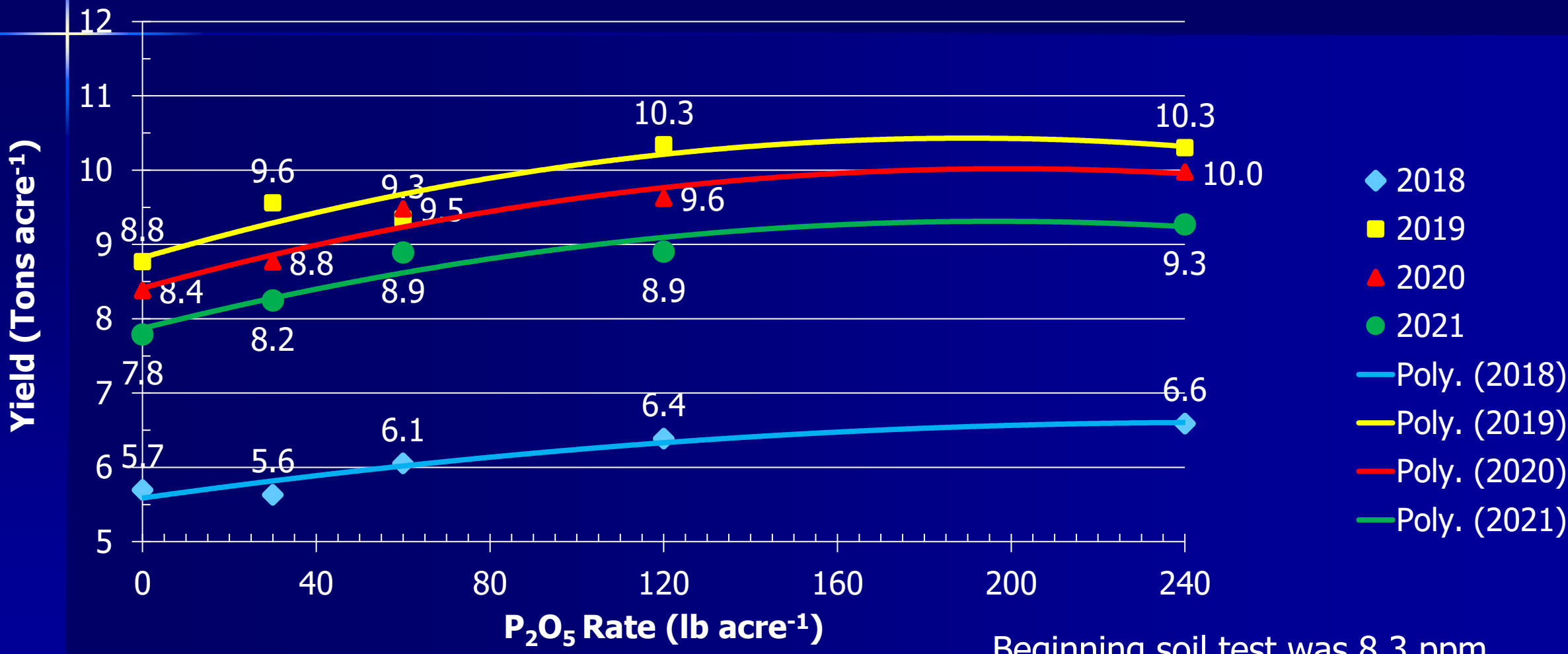

Questions?

2018 – 2021 Total Yield of Alfalfa as Influenced by Potassium Rate



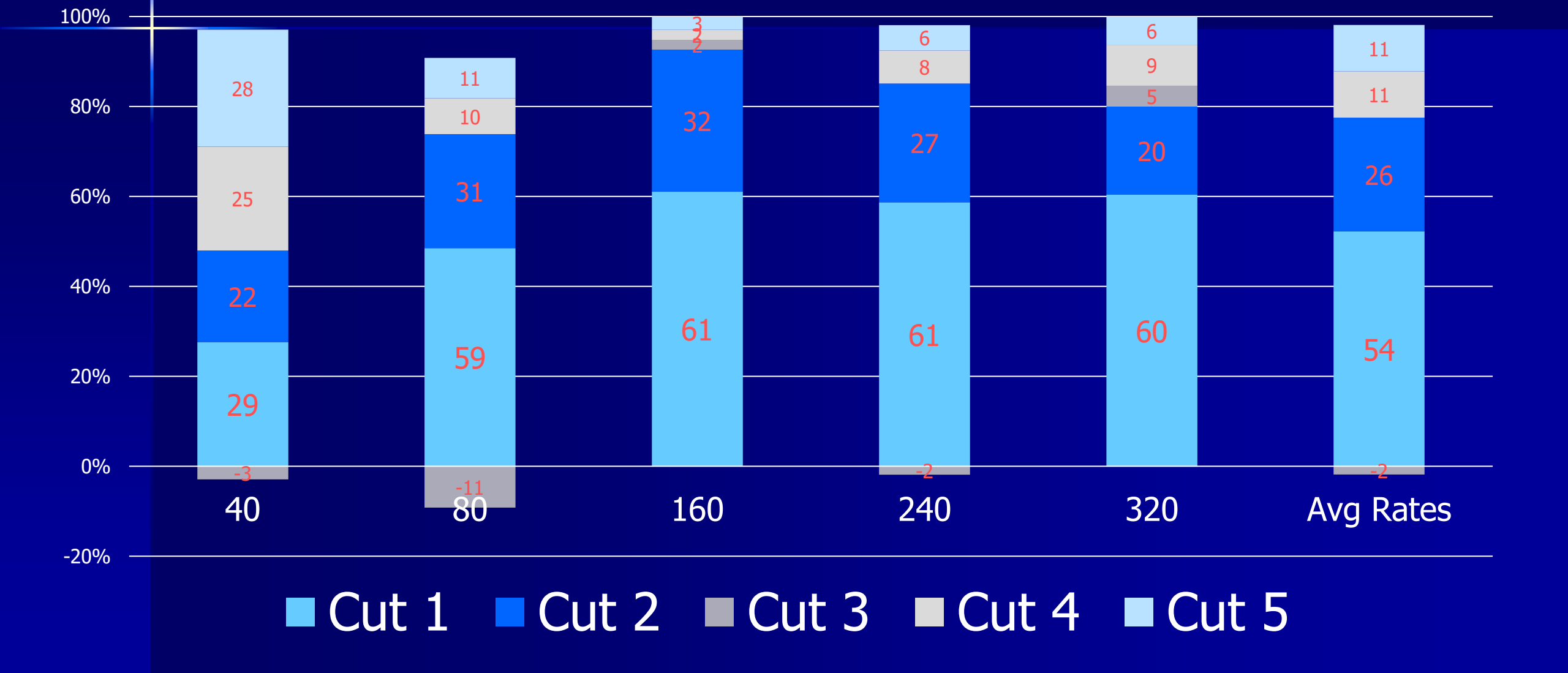
Beginning soil test level was 101 ppm K

2018 – 2021 Yield of Alfalfa as Influenced by Phosphorus Rate



Beginning soil test was 8.3 ppm

% of Increase In Yield Over the Control As Influenced by Cutting and Potassium Rate



Percent of K Uptake by Cutting and Potassium Rate in 2019