

Project Title: Phosphorous Fertilizer for Pea, Lentil, and Chickpea – **2004 Progress Report.**

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Objectives:

- 1). Investigate fertilizer P response in pea, lentil, and chickpea in central and north central low P soils.
- 2). Investigate fertilizer P effects on spring type pea, lentil, and chickpea seedling vigor and seed quality.
- 3). Investigate Fertilizer P effects on winter type pea and lentil winter survival and seed and hay quality.

Materials and Methods:

In the spring of 2004, spring pea, lentil, and chickpea cultivars were planted at two locations at the Central Agricultural Research Center (CARC) near Moccasin and in a farmer's field near Cutbank, MT. Three varieties for each species were selected and direct-seeded (no-till) into spring wheat at four P fertilizer levels (0, 15, 30, and 45 lbs P₂O₅/acre). The phosphorus fertilizer source was triple super phosphate (0-45-0). At Cut Bank additional 30 lbs/acre KCl was applied. The fertilizers were applied with the seed at planting. The experiment had a randomized complete block design with four replications. Plots were planted with a no-till nursery planter at 12" row spaces. Plot size was 6ft x 25ft at Cut Bank and 5ft x 20ft at CARC. At Cut Bank, Spartan herbicide was applied preplant on the chickpea and pea area while Prowl herbicide was incorporated with a harrow on the lentil area. Grassy weeds in the plot area were treated with Poast. At CARC, preplanting Roundup was applied and Assure II was used to control grassy weeds. The experimental plots were harvested in July.

In the fall of 2003, two cultivars of winter pea and lentil were direct-seeded into winter cereal stubble at CARC. The fertilizer P levels and experimental design were the same as above. The winter pea and lentil were also planted in the spring 2004 at Cut Bank.

Project Results and Relevancy to Montana:

Both winter and spring type legumes produced good yields this year at the CARC site. However, the yields were low at the Cut Bank site due to drought. The chickpea trial was abandoned.

Accomplishments by Objective:

Objective 1: Results are shown in Table 1 and 2 for the CARC and the Cut Bank site, respectively. Phosphorous fertilizer did not affect the seed yield of pea, lentil, and chickpea at CARC and Cut Bank, but biomass yield of lentil increased with the addition of phosphorous fertilizer at the CARC site, but no difference was observed at the Cut Bank site. The biomass yield was 3365 to 4119 lbs/A for pea, 1639 to 2068 lbs/A for lentil, and 1996 to 2129 lbs/A for Chickpea at the CARC site. Mozart and Majoret produced more biomass than Delta, and Yuma and Chico had higher biomass yield than Myles. No difference was found among the lentil cultivars.

The seed yield of peas ranged from 2201 to 2295 lbs/A at CARC and from 1161 to 1256 lbs/A at Cut Bank; the seed yield of lentils ranged from 1257 to 1379 lbs/A at CARC and from 1195 to 1280 lbs/A at Cut Bank; Vantage and Richlea yielded higher than Brewer at CARC. The chickpeas yielded from 777 to 1215 lbs/A at the CARC site, and Myles has the highest yield of 1215 lbs/A, followed by Chico (1040 lbs/A) and Yuma (777 lbs/A), respectively.

Objective 2: No measurable difference in seedling vigor was found in the spring pea, chickpea, and lentil. Due to the page limit, the plant density and plant height data were not presented in this report. Those data will be included in the final report.

Objective 3: The yields of two winter pea and lentil cultivars are shown in Table 3 and 4 for CARC and Cut Bank, respectively. Phosphorus fertilizer did not significantly affect the biomass and seed yield of winter pea and lentil at both locations. Breeding line P706 produced higher biomass (5237 lbs/A) than line P726 (3938 lbs/A), however, the seed yield was higher for line P726 (2009 lbs/A) than line P706 (1791 lbs/A), indicating that P726 is suitable for seed production and P706 is suitable for forage production. The seed yield at Cut Bank was 1231 lbs/A for P726 and 1154 lbs/A for P706.

For winter lentil, however, both biomass and seed yield was higher for L010 than for L079 at the CARC site. The biomass yield was 2032 lbs/A for L010 and 1656 lbs/A for L079. The seed yield was 1554 and 1464 lbs/A for L010 at CARC and Cut Bank, respectively, and the seed yield for L079 was 1245 and 1335 lbs/A at CARC and Cut Bank.

There was no significant effect of P on seedling winter survival. Due to the page limit the winter survival data were not presented in this report. Those data will be included in the final report. Although the phosphorus fertilizer did not significantly increase biomass and seed yield of winter and spring legumes in this study, the data collected in this study are important to Montana growers. The selected cultivars of both winter and spring types of legumes were tested under extremely different weather conditions in 2003 and 2004, as well as in two different geological locations at Moccasin and Cut Bank, MT. Results indicate that pea and lentil adapt well to central Montana's environments.

Termination Date:

This project was originally planned to be finished in two years. The second year winter pea and lentil have been planted in the fall of 2004, which will be harvested in the summer of 2005. Therefore, the final report will be submitted in the winter of 2005. We acknowledge the funding support from the Montana Fertilizer Advisory Committee.

Table 1. Effect of phosphorus fertilizer on spring pea, lentil and chickpea biomass and seed yield Center, Moccasin, MT, 2004.

Chickpea			Lentil			Pea		
Treatment	Biomass	Seed Yield	Treatment	Biomass	Seed Yield	Treatment	Biomass	Seed Yield
Variety (lbs P ₂ O ₅ /A)	(lb/A)	(lb/A)	Variety (lbs P ₂ O ₅ /A)	(lb/A)	(lb/A)	Variety (lbs P ₂ O ₅ /A)	(lb/A)	(lb/A)
Yuma (0)	2252.1	770.7	Vantage (0)	1636.0	1341.2	Majoret (0)	3326.2	2165.9
Yuma (15)	2242.2	771.9	Vantage (15)	1785.1	1309.2	Majoret (15)	3725.5	2280.8
Yuma (30)	2320.8	772.6	Vantage (30)	1983.1	1467.4	Majoret (30)	3679.5	2346.0
Yuma (45)	2339.1	791.9	Vantage (45)	2504.7	1398.8	Majoret (45)	4759.3	2212.1
Myles (0)	1669.2	1175.6	Richlea (0)	1718.5	1280.3	Mozart (0)	3712.9	2199.6
Myles (15)	1661.2	1212.9	Richlea (15)	2180.6	1336.7	Mozart (15)	5439.1	2161.1
Myles (30)	1693.5	1277.5	Richlea (30)	1902.3	1411.9	Mozart (30)	4434.7	2137.1
Myles (45)	1813.3	1192.5	Richlea (45)	1950.8	1397.5	Mozart (45)	4730.3	2309.3
Chico (0)	2067.7	1002.6	Brewer (0)	1561.5	1192.2	Delta (0)	3056.4	2176.6
Chico (15)	2222.7	979.9	Brewer (15)	1878.3	1237.9	Delta (15)	3191.5	2279.9
Chico (30)	2000.2	1109.6	Brewer (30)	2126.7	1294.8	Delta (30)	3338.1	2369.2
Chico (45)	2234.9	1064.0	Brewer (45)	1749.0	1302.5	Delta (45)	2753.6	2353.9
Phosphorus Summary								
0	1996.3	982.9	0	1638.7 b†	1271.2	0	3365.2	2180.7
15	2042.0	988.3	15	1947.9 ab	1294.6	15	4118.7	2240.6
30	2004.8	1053.2	30	2004.0 a	1391.4	30	3817.4	2284.1
45	2129.1	1016.1	45	2068.2 a	1366.3	45	4081.1	2291.8
P-value	0.63	0.67	P-value	0.03	0.11	P-value	0.29	0.27
LSD (0.05)	214.4	118.9	LSD (0.05)	312.4	103.4	LSD (0.05)	872.2	125.4
Variety Summary								
Yuma	2288.5 a	776.8 c	Vantage	1977.2	1379.1 a	Majoret	3872.6 a	2251.2
Myles	1709.3 b	1214.6 a	Richlea	1938.1	1356.6 a	Mozart	4579.2 a	2201.8
Chico	2131.4 a	1039.9 b	Brewer	1828.9	1256.9 b	Delta	3084.9 b	2294.9
P-value	0.0001	0.0001	P-value	0.48	0.03	P-value	0.001	0.23
LSD (0.05)	182.9	103.0	LSD (0.05)	270.6	89.5	LSD (0.05)	755.3	108.6
Interaction Summary								
P-value	0.95	0.97	P-value	0.09	0.99	P-value	0.40	0.42
Interaction	NS	NS	Interaction	NS	NS	Interaction	NS	NS

†Data following the same letter in the same column indicate not significantly different according to Fisher's protected LSD(0.05).

Table 2. Effect of phosphorus fertilizer on spring chickpea, lentil and pea seed yield at Cut Bank, MT, 2004.

Chickpea*		Lentil*		Pea*	
Treatment	Seed Yield	Treatment	Seed Yield	Treatment	Seed Yield
Variety (lbs P ₂ O ₅ /A)	(lb/A)	Variety (lbs P ₂ O ₅ /A)	(lb/A)	Variety (lbs P ₂ O ₅ /A)	(lb/A)
Yuma (0)	-	Vantage (0)	1250.5	Majoret (0)	1220.3
Yuma (15)	-	Vantage (15)	1206.0	Majoret (15)	1301.0
Yuma (30)	-	Vantage (30)	1188.5	Majoret (30)	1233.8
Yuma (45)	-	Vantage (45)	1250.5	Majoret (45)	1183.5
Myles (0)	-	Richlea (0)	1120.5	Mozart (0)	1122.8
Myles (15)	-	Richlea (15)	1245.5	Mozart (15)	1182.7
Myles (30)	-	Richlea (30)	1173.8	Mozart (30)	1147.0
Myles (45)	-	Richlea (45)	1238.8	Mozart (45)	1139.5
Chico (0)	-	Brewer (0)	1297.5	Delta (0)	1273.8
Chico (15)	-	Brewer (15)	1307.8	Delta (15)	1177.3
Chico (30)	-	Brewer (30)	1273.3	Delta (30)	1253.0
Chico (45)	-	Brewer (45)	1240.8	Delta (45)	1362.8
Phosphorus Summary					
0	-	0	1222.8	0	1205.6
15	-	15	1253.1	15	1210.9
30	-	30	1211.8	30	1211.3
45	-	45	1243.2	45	1228.6
P-value	-	P-value	0.89	P-value	0.98
LSD (0.05)	-	LSD (0.05)	111.0	LSD (0.05)	126.9
Variety Summary					
Yuma	-	Vantage	1223.8	Majoret	1234.9
Myles	-	Richlea	1194.6	Mozart	1161.1
Chico	-	Brewer	1279.8	Delta	1256.3
P-value	-	P-value	0.23	P-value	0.22
LSD (0.05)	-	LSD (0.05)	96.1	LSD (0.05)	109.9
Interaction Summary					
P-value	-	P-value	0.85	P-value	0.43
Interaction	-	Interaction	NS	Interaction	NS

*Due to drought, the crops were short. Yield data in this table were estimated from small samples cut from 1m x 1m area. The chickpea plots were not harvested.

Table 3. Effect of phosphorus fertilizer on winter pea and lentil biomass and seed yield at the Central Ag. Research Center, Moccasin, MT, 2004.

Pea			Lentil		
Treatment	Biomass	Seed Yield	Treatment	Biomass	Seed Yield
Variety (lbs P ₂ O ₅ /A)	(lb/A)	(lb/A)	Variety (lbs P ₂ O ₅ /A)	(lb/A)	(lb/A)
P706 (0)	4993.0	1822.0	L079 (0)	1476.9	1289.0
P706 (15)	5263.8	1776.0	L079 (15)	1917.5	1225.8
P706 (30)	5333.6	1789.3	L079 (30)	1709.5	1306.8
P706 (45)	5357.6	1777.2	L079 (45)	1519.1	1157.4
P726 (0)	3623.4	1989.7	L010 (0)	1986.9	1483.8
P726 (15)	3915.0	2155.4	L010 (15)	2117.1	1637.6
P726 (30)	4000.0	1983.9	L010 (30)	2026.8	1557.5
P726 (45)	4215.0	1905.2	L010 (45)	1997.8	1537.7
Phosphorus Summary					
0	4308.2	1905.9	0	1731.9	1386.4
15	4678.8	1965.7	15	2017.3	1431.7
30	4739.4	1886.6	30	1868.1	1432.1
45	4624.3	1841.2	45	1758.5	1347.5
P-value	0.56	0.81	P-value	0.65	0.79
LSD (0.05)	662.0	265.5	LSD (0.05)	504.5	199.8
Variety Summary					
P706	5236.9 a†	1791.1 b	L079	1655.7 b	1244.7 b
P726	3938.3 b	2008.5 a	L010	2032.1 a	1554.2 a
P-value	0.0001	0.02	P-value	0.04	0.0001
LSD (0.05)	468.2	187.7	LSD (0.05)	356.7	141.2
Interaction Summary					
P-value	0.94	0.79	P-value	0.92	0.66
Interaction	NS	NS	Interaction	NS	NS

†Data following the same letter in the same column indicate not significantly different according to Fisher's protected LSD(0.05)

Table 4. Effect of phosphorus fertilizer on winter pea and lentil seed yield at Cut Bank, MT, 2004.

Winter Pea*		Winter Lentil*	
Treatment	Seed Yield	Treatment	Seed Yield
Variety (lbs P ₂ O ₅ /A)	(lb/A)	Variety (lbs P ₂ O ₅ /A)	(lb/A)
P706 (0)	1159.0	L079 (0)	1280.0
P706 (15)	1130.5	L079 (15)	1365.0
P706 (30)	1192.8	L079 (30)	1338.0
P706 (45)	1133.5	L079 (45)	1358.0
P726 (0)	1293.0	L010 (0)	1533.3
P726 (15)	1214.0	L010 (15)	1414.3
P726 (30)	1164.3	L010 (30)	1527.0
P726 (45)	1254.0	L010 (45)	1380.5
Phosphorus Summary			
0	1226.0	0	1406.6
15	1172.3	15	1389.6
30	1178.5	30	1432.5
45	1193.8	45	1369.3
P-value	0.89	P-value	0.93
LSD (0.05)	148.9	LSD (0.05)	200.8
Variety Summary			
P706	1153.9	L079	1335.3
P726	1231.3	L010	1463.8
P-value	0.16	P-value	0.08
LSD (0.05)	105.4	LSD (0.05)	142.0
Interaction Summary			
P-value	0.70	P-value	0.61
Interaction	NS	Interaction	NS

*Due to drought, the crops were short. Yield data in this table were estimated from small samples cut from 1m x 1m area.