

# Evaluation of Phosphorus and Potassium Rates on Soybean as a Tool to increase Yield and Protein

**Cooperator:** Ron Peterson

**Variety:** Legend 009

**Planting date:** May 12, 2003

**Harvest date:** September 26, 2003

**Soil Test Results:** 0-6" depth  
 Olsen P - 8ppm  
 Potassium - 115ppm  
 Organic matter - 35%  
 pH - 8.2  
 Carbonates - 6.3%  
 Soluble salts - 0.47mmhos/cm

## Purpose of study

New soybean cultivars with higher yield potentials have been developed for the region over the past ten years and this prompted the idea to conduct a phosphorus and potassium rate study to determine if the phosphorus and potassium nutritional needs of the crop were still being met from lower testing soils. Last years research showed significant increases in yield and protein with the addition of  $P_2O_5$  on lower testing soils.

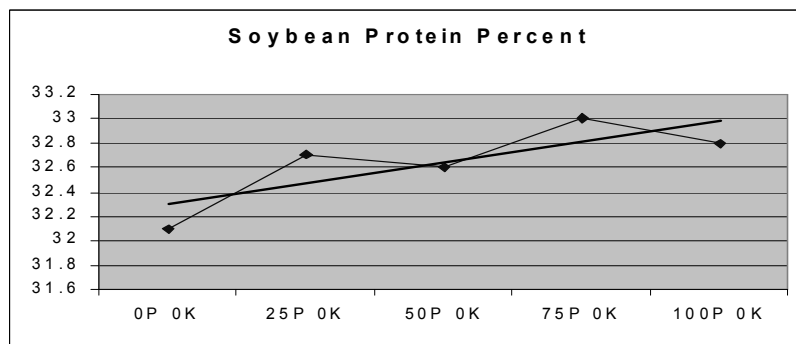
## Results

The treatment with 50  $P_2O_5$  100  $K_2O_5$  was the only treatment significantly different from the 0  $P_2O_5$  0  $K_2O$  treatment with respect to yield. There was no significant difference in protein percent or oil percent when compared to the 0  $P_2O_5$  0  $K_2O$  treatments. Protein percent increased in a linear relationship with phosphorus rate from 32.1% with no added phosphorus to 32.8% with 100 pounds of  $P_2O_5$  added. This trend in protein increase was not statistically significant. There was about a 2 bushel increase in soybean yield over phosphorus rates when 100 pounds of  $K_2O$  was added to the soil however this increase was not statistically significant.

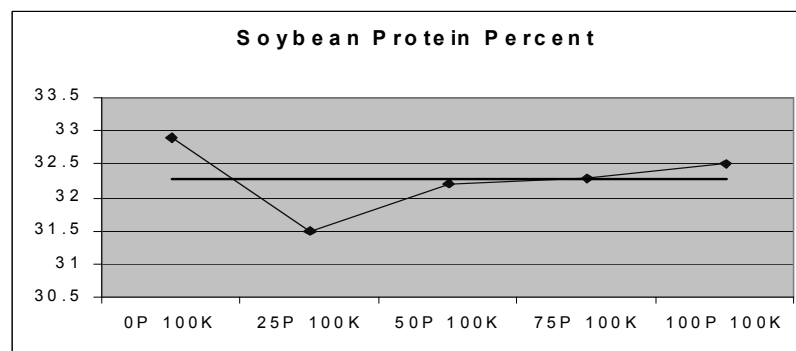
*Table 2. Treatment means for Yield, Protein% and Oil%*

Treatment $P_2O_5$ & $K_2O$ Rates	Yield bu/a	Protein %	Oil %
0 - 0	49.1	32.1	18.9
25 - 0	48.9	32.7	18.8
50 - 0	50.7	32.6	18.6
75 - 0	50.6	33.0	18.2
100 - 0	48.3	32.8	18.0
0 - 100	51.0	32.9	18.2
25 - 100	52.2	31.5	18.7
50 - 100	53.6	32.2	18.5
75 - 100	51.7	32.3	19.0
100 - 100	52.8	32.5	18.4
<b>Significance</b>		<b>N.S.</b>	
<b>LSD (.05)</b>	<b>4.1</b>	<b>1.6</b>	<b>0.6</b>

*Soybean protein percent with 0  $K_2O$  and 0 to 100  $P_2O_5$  rates*



*Soybean protein percent with 0  $K_2O$  and 0 to 100  $P_2O_5$  rates.*



# Evaluation of Phosphorus Application Rates and Methods to Increase Yield and Protein of Soybean

**Cooperator:** Gerald Nordick Farm - Rothsay

**Variety:** 90B53RR

**Planting date:** May 23, 2003

**Harvest date:** October 8, 2003

**Soil Test Results:** 0-6" depth  
 Olsen P - 7ppm  
 Potassium - 130ppm  
 Organic matter - 3.1%  
 pH - 7.9  
 Carbonates - 0.7%  
 Soluble salts - 0.32mmho/cm

## Purpose of study:

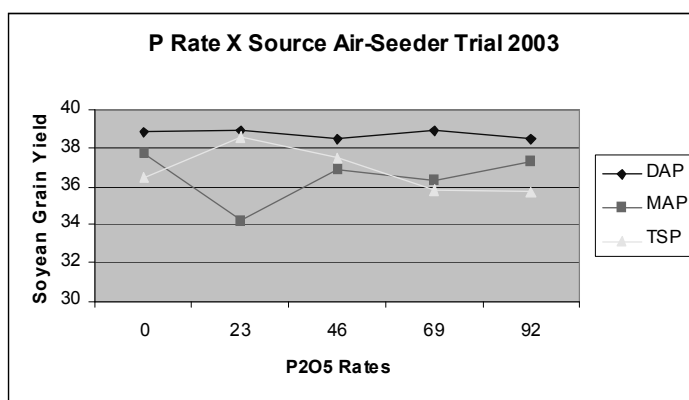
Many soybean growers have switched to using an air-seeder to plant their soybean crop. A question on how much fertilizer can safely be applied with an air-seeder at planting time is unclear. A phosphorus application method experiment was conducted to determine if phosphorus can safely be applied with an air-seeder at planting time to reduce input costs associated with broadcast application and incorporation prior to planting. This trial was designed to investigate three different fertilizer materials ((DAP) diammonium phosphate, (MAP) monoammonium phosphate and (TSP) triple super phosphate) applied at five rates at planting time. Nitrogen was broadcast to appropriate plots to equalize the total amount on nitrogen added to each plot from each source.

## Results:

There were no significant differences with respect to grain yield. Protein concentration was significant at the  $p=0.10$  level when averaged across sources. There were no significant differences in protein concentration between sources. There was a linear trend to increase protein concentration with increased  $P_2O_5$  application rate equaling a 1% increase. There were no significant differences with respect to population. There was a linear trend to decrease oil concentration with increased  $P_2O_5$  application rate equaling a 1/2% oil concentration decrease. Oil concentration decrease was significant at the  $p=0.10$  level when averaged across sources. There were no significant differences in oil concentration between sources. Environmental conditions were not normal at this site with 15 inches of rain recorded early in the growing season.

## Soybean grain yield of phosphorus sources and rates.

Source	P <sub>2</sub> O <sub>5</sub> Rate					Mean
	0	23	46	69	92	
DAP	38.8	38.9	38.5	38.9	38.5	38.7
MAP	37.7	34.2	36.9	36.3	37.3	36.6
TSP	36.5	38.6	37.5	35.8	35.7	36.8



## Soybean populations at phosphorus sources and rates.

Source	P <sub>2</sub> O <sub>5</sub> Rate					Mean
	0	23	46	69	92	
DAP	94380	107448	103818	104544	92202	100478
MAP	88572	94380	100188	98010	104544	97138
TSP	100914	102366	84216	105996	87120	96122

# Evaluation of Phosphorus Rates on Soybean as a Tool to Increase Yield and Protein

Cooperators: Doug Nelson, Roger & David Black,  
Gerald Nordick  
 Collaborators: George Rehm  
 Nearest town: Ada, Rindal, Rothsay  
 Variety: Traill, Mycogen 5007, Pioneer 90B53RR  
 Planted: May 27, June 10, May 23  
 Harvested: Oct. 13, Oct. 8, Oct. 8

### Purpose of study:

New soybean cultivars with higher yield potentials have been developed for the region over the past ten years and this prompted the idea to conduct a phosphorus rate study to determine if the phosphorus nutritional needs of the crop were still being met from residual phosphorus in the soil. Last years research showed significant increases in yield and protein with the addition of P2O5 on lower testing soils.

### Ada Site: Soil Test

Olsen P	10ppm
Potassium	156ppm
Organic matter	4.7%
pH	8.3
Carbonates	10.1%
Soluble salts	0.54mmho/cm

### Treatment means for Yield, Protein% and Oil%.

P2O5 Rate Lb/A	Yield Bu/A	Protein %	Oil %
0	24.3	35.5	18.8
20	22.8	35.5	18.8
40	24.2	35.7	18.8
60	24.5	35.9	18.9
80	21.6	35.5	18.8
100	24.1	35.5	18.9
Significance	N.S.	N.S.	N.S.

**Results:** There was no significant difference in yield, protein percent or oil percent at this location in 2003.

### Rindal Site: Soil Test

Olsen P	8ppm
Potassium	92ppm
Organic matter	4.2%
pH	8.0
Carbonates	5.1%
Soluble salts	0.35mmho/cm

### Treatment means for Yield, Protein% and Oil%.

P rate Lb P2O5/A	Yield Bu/A	Protein %	Oil %
0	40.4	31.3	19.4
20	39.3	31.6	19.1
40	39.8	32.0	19.0
60	42.6	31.7	19.2
80	40.8	32.6	19.0
100	40.8	31.1	19.5
Significance	N.S.	N.S.	N.S.

**Results:** There was no significant difference measured on soybean yield. There was a 1.3% increase in protein percent however it was not statistically significant.

### Rothsay Site: Soil Test

Olsen P	7ppm
Potassium	130ppm
Organic matter	3.1%
pH	7.9
Carbonates	0.7%

### Treatment Means for Yield, Protein% and Oil%.

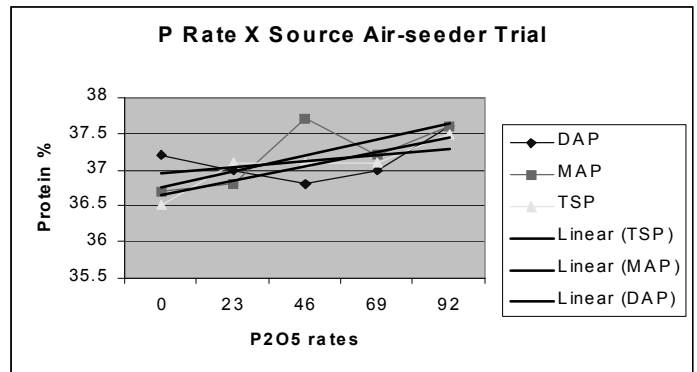
P rate Lb P2O5/A	Yield Bu/A	Protein %	Oil %
0	25.3	37.1	18.2
20	27.7	36.4	18.6
40	25.6	36.9	18.4
60	25.5	37.0	18.4
80	29.3	36.7	18.7
100	25.3	37.3	18.2
Significance	N.S.	N.S.	N.S.
LSD(.05%)	7.0	1.4	1.1

**Results:** There were no significant differences for soybean yield, protein concentration or oil concentration at this site in 2003. Fifteen inches of rain was received at this site early in the growing season which reduced yields significantly.

# Evaluation of Phosphorus Application — (continued)

*Soybean protein concentration at phosphorus sources and rates.*

Source	P <sub>2</sub> O <sub>5</sub> Rate					Mean
	0	23	46	69	92	
DAP	37.2	37.0	36.8	37.0	37.6	37.1
MAP	36.7	36.8	37.7	37.2	37.6	37.2
TSP	36.5	37.1	37.1	37.1	37.5	37.1



*Soybean oil concentration at phosphorus sources and rates.*

Source	P <sub>2</sub> O <sub>5</sub> Rate					Mean
	0	23	46	69	92	
DAP	18.7	18.5	18.6	18.4	18.1	18.4
MAP	18.7	18.6	18.1	18.5	18.2	18.4
TSP	18.8	18.3	18.5	18.4	18.2	18.5

