

# Bourgault Agronomy Trials

## 2015

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## Fertilizer Placement Comparison (FPC) Trial

### *Phosphorus with Canola*

#### **Introduction:**

The purpose of testing Phosphorus (P) placements is to provide producers with a safe method to apply removal rates of P in a one-pass seeding operation. Many soils in the Great Northern Plains are deficient in P because applied fertilizer has not matched the removal rates of the increased yield of today's crops. This is largely due to the fact that P fertilizer is essentially immobile in the soil and is best placed with the seed for a "pop-up" effect and increased early root development. Seed safety guidelines have been established because in some conditions too much P fertilizer in the granular form placed with the seed can cause issues due to a salt effect. Producers are placing safe rates with the seed, but typically these rates do not match removal rates of the crops.

Phosphorus fertilizer has not been of the greatest importance to producers because there is not always an instant and visible yield increase in the year of application. Phosphorus deficiency is known as the 'hidden hunger' because the producer does not see a distinct plant symptom that shows the plant is deficient. The symptoms can be identified easier when grown next to plants that are not deficient, like in strip trials, which display the delayed and stunted growth of the deficient plants.

The Agronomy team at Bourgault Industries explored different placement options in canola, including high rates seed placed and a split application where starter P is placed with the seed and the bulk of the P fertilizer is placed in the band with the rest of the fertilizer. A triple shoot concept was also explored where the seed is placed by itself, the P in a band slightly down and away, and the rest of the fertilizer in the mid-row band. The trials were located near St. Brieux, SK.

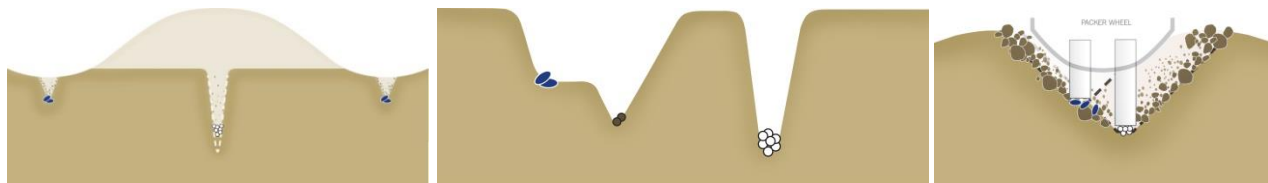
#### **Trial Design:**

- 500' by 30' strip trials
- Treatments replicated 3 times in a Complete Randomized Block Design
- Yield taken via weigh wagon
- Plant counts taken in 3 places per treatment and averaged
- Statistical analysis
  - Based on a 90% Level Of Confidence (LOC)
  - Least Significant Difference (LSD) indicates the smallest amount between treatments that would indicated a significant difference
  - Letters describe if one treatment is the same as the other. Ex. Treatments depicted as 'A' are the same other treats with 'A' in them.
    - Ie 'A' is statistically the same as 'AB'
    - Ie 'A' is not statistically the same as 'B'
- Target yield was 60bu/acre
  - Phosphorus replacement rate is 55lbs of P/acre (60bu x .91lb/bu removal rate)

**Seeding equipment used:**

- All plots were seeded with the same air tank and tractor
- Bourgault L7550 Airseeder
  - 5 Tanks all capable of metering
  - Capable of 3 airways to accommodate triple shoot for dry products
- Three separate seeding tools were used

Bourgault 3320	Bourgault 3720	Dual Knife
10" Spacing	10" Spacing	12" Spacing
¾" opener	Disc Wing Scraper	½" dual knife
MRB Equip	MRB Equip	Side-Band



- In the case of the 3720, the MRBs could also be locked up. In this case, the fertilizer blend was placed down the Disc portion of the Disc Wing Scraper



**Field Background:**

- Field Soil Analysis – 24" depth for nutrients; 6" depth for O.M and pH

N	P	K	S	O.M.	pH
17lbs	28lbs	288lbs	29lbs	3.5%	6.9

- Previous Crop was Oats
- Soil type
  - Waitville-Whitewood
  - Dark Gray wooded soil formed on loamy glacial till; loam surface texture
  - Nearly level topography but contains moderate amount of stones

### Rain Activity:

- Soil moisture at time of seeding was very good but did not receive significant rain until later in the growing season

Month	Monthly Percip. (mm)	Average Percip. (mm)
May	6.5	47
June	55.2	70
July	149.8	77
August	57.4	33
September	70.0	34

\* Info taken from Farmzone.com - Melfort location 2015

\* Average based on past 30 years

### Trial Details:

- Seeded May 19, 2015
- Variety – Dekalb 74-44
  - TKW 5.4g seeded 5 lbs/acre
- Fertilizer – 140-0-20-30 as a blend
  - Urea (46-0-0), Potash (0-0-60), Tiger 50 (11-0-0-50)

### Harvest:

- Swathing took place in the week of August 24<sup>th</sup>
  - Cutting was done on Monday, Wednesday, and Friday based on maturity
- All trials harvested on Sept. 12<sup>th</sup>
- Results were corrected to 10% moisture and 0% dockage according to the samples taken from every strip. Grading was done at the local elevator

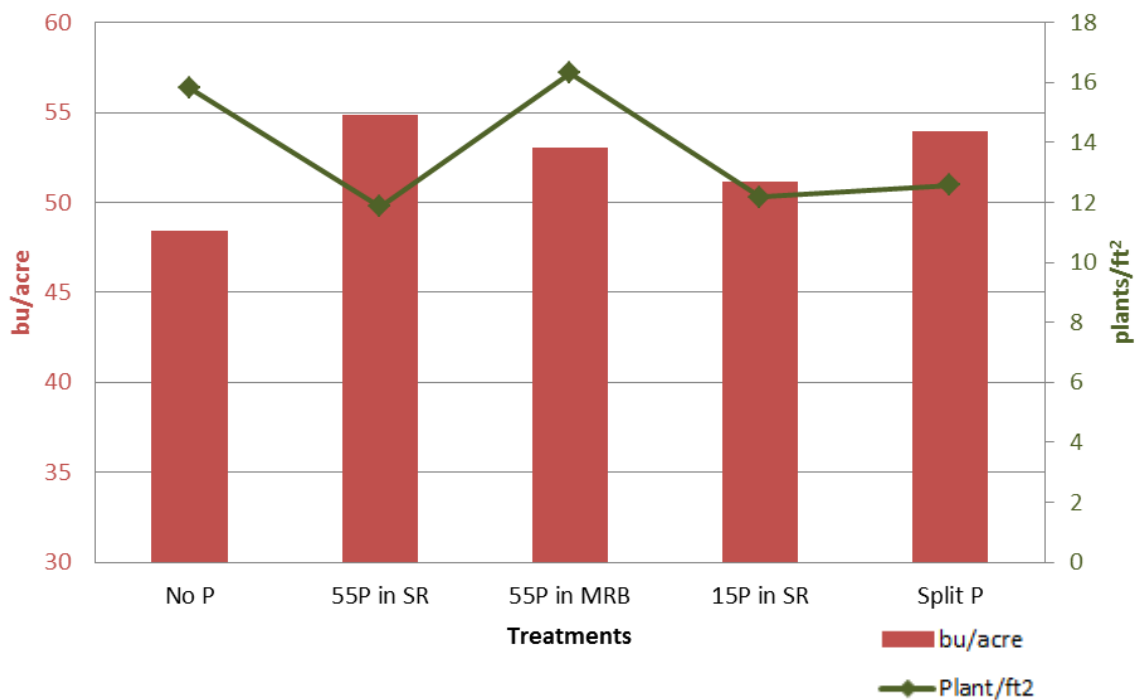
### Treatments:

- All treatments received the fertilizer blend of 140-0-20-30 in the band according to the drill used
- Phosphorus was the only nutrient that adjusted in placement and/or in rate
- Index
  - **P** – Actual lbs of P<sub>2</sub>O<sub>5</sub>
  - **SR** – Seed Row (either 55lbs of P or 15lbs of P)
  - **MRB** – Mid-Row Band (either 55lbs of P or 40lbs of P when doing a Split)
  - **SB** – Side-band (either 55lbs of P or 40lbs of P when doing a Split)
  - **DISC** – Disc Trench of the Disc Wing Scraper (55lbs of P)
  - **Split** – Indicates 15lbs of P was placed in the SR and the other 40lbs of P was placed in the band with the NKS fertilizer

## Results

**Bourgault 3320:**

### Phosphorus - Canola - 3320



Sig. Difference	No P	55P in SR	55P in MRB	15P in SR	Split P	LSD
Yield	A	B	AB	AB	B	5.29
Plant Count	B	A	B	A	A	2.76

Notes:

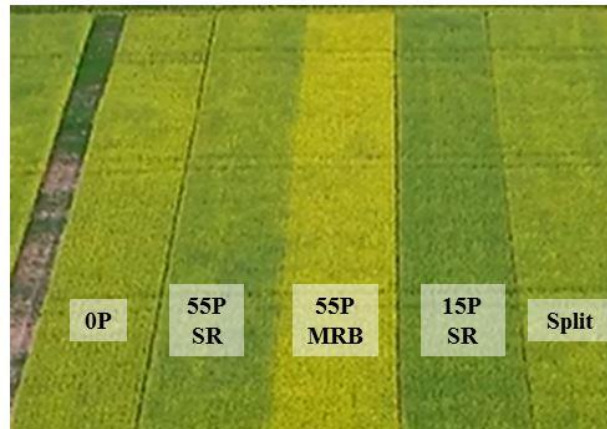
- At a 90% LOC, there was significant differences in yield and plant stands in this trial
- The treatment with no P and with all the P in the MRBs looked identical for the first 6 weeks but after this point, the treatment with the P in the MRBs looked stronger and continued to flower longer

July 8, 2015



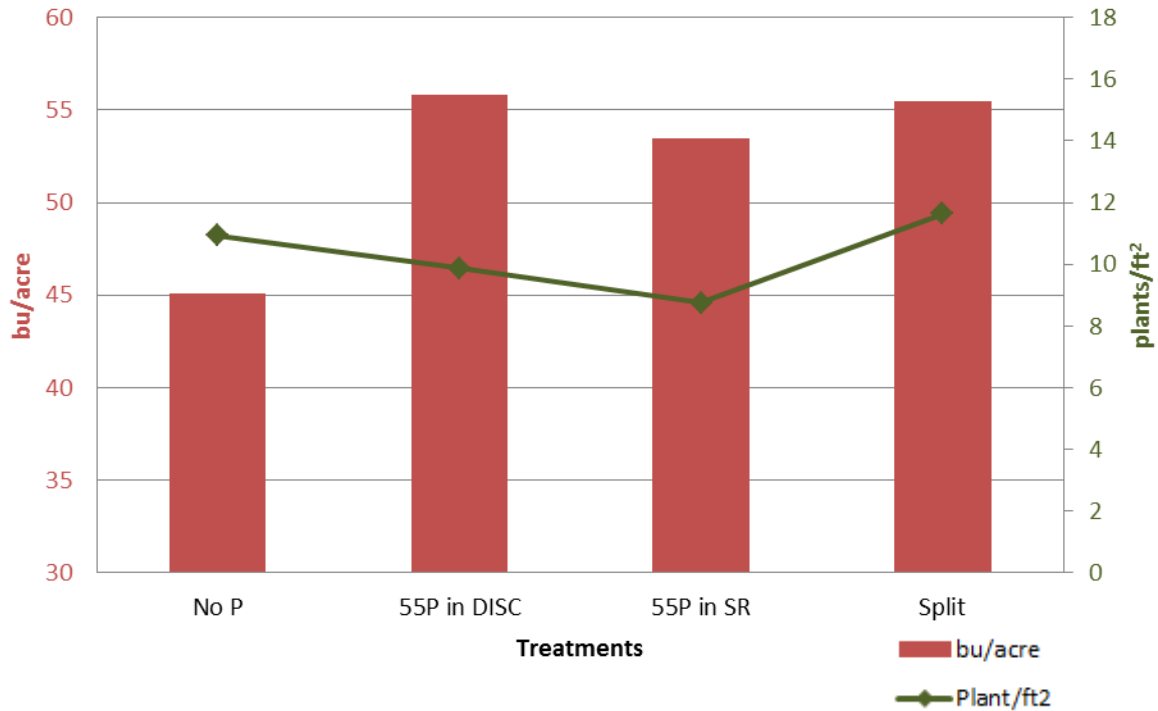
Split: 15P SR  
+ 40P MRB

July 20, 2015



Bourgault 3720 with MRBs:

### Phosphorus - Canola - 3720 with MRBs

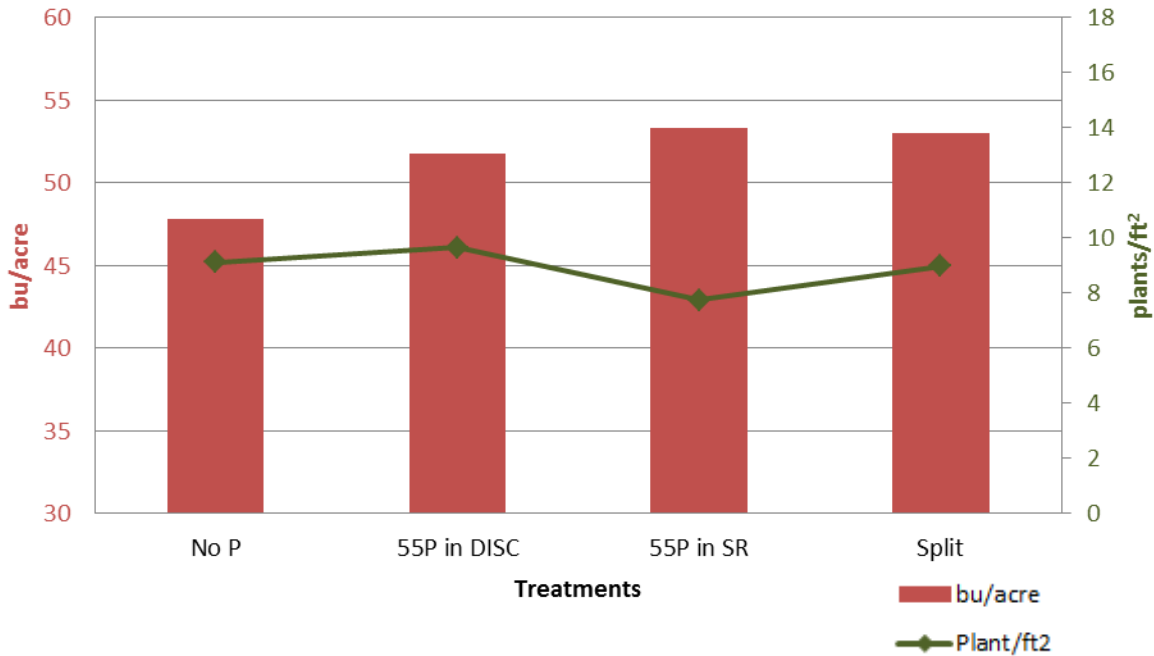


Sig. Difference	No P	55P in DISC	55P in SR	Split P	LSD
Yield	A	B	B	B	3.33
Plant Count	AB	AB	A	B	2.26

- At a 90% LOC, there was significant differences in yield and plant stands in this trial
- The treatment '55P in Disc' was our triple shoot trial

Bourgault 3720 Disc Wing Scraper with MRBs locked up:

## Phosphorus - Canola - 3720 Disc Wing Scraper (MRBs locked up)



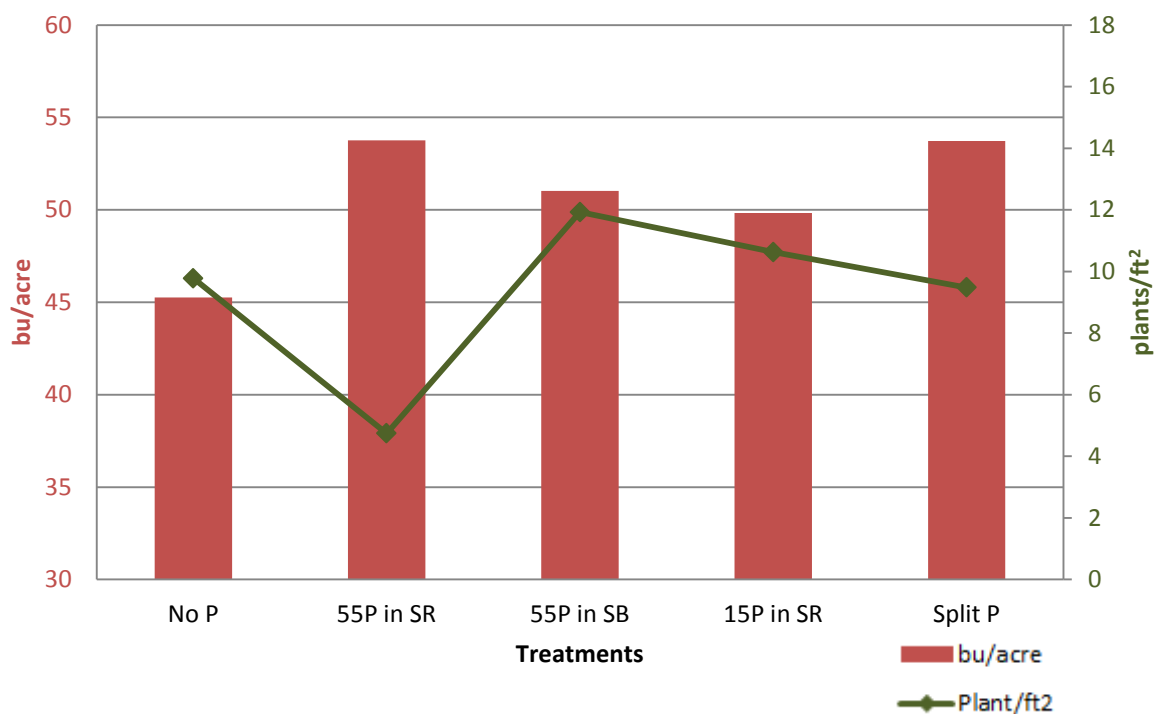
Sig. Difference	No P	55P in DISC	55P in SR	Split P	LSD
<b>Yield</b>	A	B	B	B	2.40
<b>Plant Count</b>	AB	B	A	AB	1.71

- At a 90% LOC, there was significant differences in yield and plant stands in this trial
- There was a delay in maturity when all of the P was placed in the nitrogen band with maturity coming in very similar to the no P treatment



Dual Knife:

## Phosphorus - Canola - Dual Knife



Sig. Difference	No P	55P in SR	55P in SB	15P in SR	Split P	LSD
Yield	A	C	B	B	C	2.90
Plant Count	B	A	C	BC	B	1.93

- At a 90% LOC, there was significant differences in yield and plant stands in this trial
- The plant stand was visually reduced when all of the P was placed in the seed row
- The maturity was delayed in the treatments when all of the P was placed with the seed as well as when all of the P was placed together with the band

## **Discussion:**

This year we saw a slight bump in yield when we applied replacement rates of phosphorus to the canola. Depending on the cost of 11-52-0, this may not have been economical in one year. However, phosphorus application has been known to show up for years to come after application. The strips will be monitored for visual differences in 2016 with the barley crop that will be planted on the field.

The 10" machines did not have a large effect on plant stands when compared to the dual knife machine on 12" spacing when high amounts of P was placed in with the seed. The salt effect associated with high phosphorus rates may have been mitigated with the excellent soil moisture present at the time of seeding. Overall, plant stand did not seem to have an effect on yield this year. Placing 55lbs of P in the seed row is risky and not recommended.

When all of the P was placed in the band with the rest of the fertilizer, whether it is in the SB or the MRB, the maturity was delayed. In the case of the SB, this may have been a result of the young roots not being able to access the P early as there was a high concentration of nitrogen in the general area of the P. The roots were able to access the P once the N band diluted. When P was placed entirely in the MRBs, early season P uptake and overall maturity was delayed. This was a result of a hot band situation along with the distance of the MRB band relative to the seed. However, there was evidence showing that P was taken up from the MRB later in the season.

The triple shoot system did not seem to increase yield or plant stand when compared to the split application of placing a small amount of P in the SR and the rest in the MRB. The cost of the additional air kit and time associated with monitoring for plugging was not offset by an increase in yield.

The split application treatment in all three seeding units had equal to the highest yields, with the maturity coming in average. The plant stand was not affected by the split application in any circumstance as the P placed with the seed was well within the recommended safe rates.

This trial will be continued in 2016.



APPENDIX – Harvest Data and Statistical Analysis

3320

Yield

Block	No P	55P in SR	55P in MRB	15P in SR	Split P
1	45.2	52.9	49.9	48.7	56.4
2	54.0	56.6	58.0	54.7	50.8
3	46.0	55.1	51.3	50.1	54.6
Average	48.4	54.9	53.1	51.2	53.9

Anova: Single Factor							
SUMMARY							
	Groups	Count	Sum	Average	Variance		
A	No P	3	145.2	48.4	23.68		
B	55P in SR	3	164.6	54.86667	3.463333		
AB	55P in MRB	3	159.2	53.06667	18.74333		
AB	15P in SR	3	153.5	51.16667	9.853333		
B	Split P	3	161.8	53.93333	8.173333		
ANOVA							
	Source of Variation	SS	df	MS	F	P-value	F crit
	Between Groups	79.01067	4	19.75267	1.54527	0.262332	2.605336
	Within Groups	127.8267	10	12.78267			
	Total	206.8373	14				
	LSD	5.29					
	T Crit	1.81					

Plants/ft<sup>2</sup>

Plants/ft <sup>2</sup>							Anova: Single Factor							
Block	No P	55P in SR	55P in MRB	15P in SR	Split P		SUMMARY							
							Groups	Count	Sum	Average	Variance			
1	18.0	10.4	15.6	14.0	15.6		B	No P	9	142.4	15.82222	33.88444		
	21.2	9.6	15.6	11.2	11.2		A	55P in SR	9	106.8	11.86667	6.12		
	23.2	13.2	16.4	11.6	11.6		B	55P in MRB	9	146.8	16.31111	6.311111		
2	11.6	13.2	13.6	13.2	9.2		A	15P in SR	9	109.6	12.17778	8.164444		
	11.2	16.0	20.0	12.8	12.4		A	Split P	9	113.2	12.57778	6.004444		
	6.4	14.8	19.2	12.8	14.8									
3	20.8	9.6	12.4	17.2	10.8									
	11.2	10.4	15.6	6.8	16.4									
	18.8	9.6	18.4	10.0	11.2									
Average	15.8	11.9	16.3	12.2	12.6		ANOVA							
							Source of Variation	SS	df	MS	F	P-value	F crit	
							Between Groups	164.2169	4	41.05422	3.393784	0.017578	2.09095	
							Within Groups	483.8756	40	12.09689				
							Total	648.0924	44					
							LSD	2.76						
							T Crit	1.68						



### 3720 with MRBs

Yield (bu/acre)

bu/acre	No P	55P in DISC	55P in SR	Split
1	41.5	55.9	52.4	56.2
2	44.7	56.8	55.1	56.3
3	49.0	54.8	52.8	53.9
Average	<b>45.1</b>	<b>55.8</b>	<b>53.4</b>	<b>55.5</b>

Anova: Single Factor							
SUMMARY							
	Groups	Count	Sum	Average	Variance		
A	No P	3	135.2	45.06667	14.16333		
B	55P in DT	3	167.5	55.83333	1.003333		
B	55P in SR	3	160.3	53.43333	2.123333		
B	Split	3	166.4	55.46667	1.843333		
ANOVA							
	Source of Variation	SS	df	MS	F	P-value	F crit
	Between Groups	228.0833	3	76.02778	15.89431	0.000986	2.923796
	Within Groups	38.26667	8	4.783333			
	Total	266.35	11				
	LSD	3.33					
	T Crit	1.86					

Plants/ ft<sup>2</sup>

Plant/ft <sup>2</sup>	No P	55P in DISC	55P in SR	Split	Anova: Single Factor							
1	11.6	6.0	10.8	13.2								
	8.4	10.4	10.0	14.0								
	5.2	10.4	6.4	9.2								
2	8.8	9.2	13.2	12.8	AB	No P	9	98.4	10.93333	17.32		
	18.0	10.4	6.8	14.8	AB	55P in DT	9	88.8	9.866667	3.68		
	14.8	9.2	8.0	9.6	A	55P in SR	9	78.8	8.755556	6.737778		
3	6.8	12.8	8.4	11.6	B	Split	9	104.8	11.64444	4.617778		
	10.4	11.6	4.8	9.2								
	14.4	8.8	10.4	10.4								
Average	<b>10.9</b>	<b>9.9</b>	<b>8.8</b>	<b>11.6</b>	ANOVA							
	Source of Variation	SS	df	MS	F	P-value	F crit					
	Between Groups	43.03556	3	14.34519	1.773443	0.172046	2.263453					
	Within Groups	258.8444	32	8.088889								
	Total	301.88	35									
	LSD	2.26										
	T Crit	1.69										



### 3720 without MRBs

Yield (bu/acre)

bu/acre	No P	55P in DISC	55P in SR	Split
1	47.2	54.0	53.3	53.7
2	48.9	52.5	52.6	53.6
3	47.4	48.8	54.0	51.6
Average	<b>47.8</b>	<b>51.8</b>	<b>53.3</b>	<b>53.0</b>

Anova: Single Factor							
SUMMARY							
	Groups	Count	Sum	Average	Variance		
A	No P	3	143.5	47.83333	0.863333		
B	55P in DT	3	155.3	51.76667	7.163333		
B	55P in SR	3	159.9	53.3	0.49		
B	Split	3	158.9	52.96667	1.403333		
ANOVA							
	Source of Variation	SS	df	MS	F	P-value	F crit
	Between Groups	56.70667	3	18.90222	7.621864	0.009884	2.923796
	Within Groups	19.84	8	2.48			
	Total	76.54667	11				
	LSD	2.40					
	T Crit	1.86					

Plants/ft<sup>2</sup>

Plant/ft <sup>2</sup>	No P	55P in DISC	55P in SR	Split	Anova: Single Factor							
					SUMMARY							
					Groups	Count	Sum	Average	Variance			
1	10.8	10.8	7.6	10.0	AB	No P	9	82	9.111111	9.031111		
	9.2	9.6	6.8	8.4	B	55P in DT	9	86.8	9.644444	3.257778		
	2.0	12.0	9.2	8.4	A	55P in SR	9	69.6	7.733333	1.8		
2	8.8	10.0	8.8	12.0	AB	Split	9	80.8	8.977778	4.324444		
	11.6	8.8	6.4	10.8								
	7.2	6.4	7.2	7.6								
3	11.2	12.0	10.0	10.0								
	10.4	8.8	6.0	4.8								
	10.8	8.4	7.6	8.8								
Average	<b>9.1</b>	<b>9.6</b>	<b>7.7</b>	<b>9.0</b>	ANOVA							
					Source of Variation	SS	df	MS	F	P-value	F crit	
					Between Groups	17.65333	3	5.884444	1.278301	0.298484	2.263453	
					Within Groups	147.3067	32	4.603333				
					Total	164.96	35					
					LSD	1.71						
					T Crit	1.69						



## Dual Knife

Yield (bu/acre)

bu/acre	No P	55P in SR	55P in SB	15P in SR	Split P
1	42.7	55.1	52.5	48.2	54.6
2	44.3	54.4	50.2	51.3	54.5
3	48.8	51.8	50.4	50.0	52.1
<b>Average</b>	<b>45.3</b>	<b>53.8</b>	<b>51.0</b>	<b>49.8</b>	<b>53.7</b>

Anova: Single Factor							
SUMMARY							
	Groups	Count	Sum	Average	Variance		
A	No P	3	135.8	45.26667	10.00333		
C	55P in SR	3	161.3	53.76667	3.023333		
B	55P in SB	3	153.1	51.03333	1.623333		
B	15P in SR	3	149.5	49.83333	2.423333		
C	Split P	3	161.2	53.73333	2.003333		
ANOVA							
	Source of Variation	SS	df	MS	F	P-value	F crit
	Between Groups	146.956	4	36.739	9.629303	0.001849	2.605336
	Within Groups	38.15333	10	3.815333			
	Total	185.1093	14				
	LSD	2.90					
	T Crit	1.81					

Plants/ft<sup>2</sup>

Plant/ft <sup>2</sup>	No P	55P in SR	55P in SB	15P in SR	Split P	Anova: Single Factor									
1	4.3	3.3	13.7	11.0	11.0										
	9.3	2.7	11.7	10.3	14.3										
	7.3	3.0	7.7	10.3	14.0										
2	10.7	6.7	12.7	9.0	6.3	B	No P	9	88	9.777778	8.833333				
	13.7	6.0	12.3	13.3	9.7	A	55P in SR	9	42.66667	4.740741	2.993827				
	11.0	7.7	14.0	7.0	7.3	C	55P in SB	9	107.3333	11.92593	4.521605				
3	12.0	4.0	12.3	10.7	7.0	BC	15P in SR	9	95.66667	10.62963	4.095679				
	12.3	5.0	9.3	10.3	7.3	B	Split P	9	85.33333	9.481481	9.114198				
	7.3	4.3	13.7	13.7	8.3										
<b>Average</b>	<b>9.8</b>	<b>4.7</b>	<b>11.9</b>	<b>10.6</b>	<b>9.5</b>										
ANOVA															
	Source of Variation	SS	df	MS	F	P-value	F crit								
	Between Groups	267.3975	4	66.84938	11.30793	3.12E-06	2.09095								
	Within Groups	236.4691	40	5.911728											
	Total	503.8667	44												
	LSD	1.93													
	T Crit	1.68													