Alberta Agricultural Research Institute
On-Farm Demonstration Program
Report Template

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Project Number:	**99NE13**
Project Name:	**ESTABLISHING HIGHER AND MORE CONSISTENT YIELDS IN FIELD PEA PRODUCTION**
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☐ **Progress Report** ☐ **Interim Report** ☐ **Final Report X**

Year _____3_____ of ____3____ year project.
(1,2,3) (1^{st}, 2^{nd}, 3^{rd})

Key Results and Conclusions:

From 1999 to 2001, this research project demonstrated field pea final seed yield increases of 11.4 to 46% when a seeding rate target of 7 to 10 live plants/sqft was used. Economic analyses demonstrated increases in marginal returns of –$6.22 to +$43.40. As well, there were instances when target seeding rate used had no effect on yield. Over the same time period, this research project demonstrated that early herbicide applications (one or two weeks after crop emergence) resulted in final seed yield increases of 23 to 69% in one year while late herbicide applications (three weeks after crop emergence as compared to one or two weeks after crop emergence) resulted in a final seed yield increase of 11.4% in another year. Economic analyses demonstrated increases in marginal returns of $20.52 to $104.88. As in the case of target seeding rates, there were instances where herbicide application timing had no effect on final seed yield. This project was part of a much larger provincial initiative that has collected data on the yield effects of different target seeding rates and herbicide application timings over 22 sites years. This study, along with the overall provincial initiative, have provided strong evidence to support the recommendations that field pea growers use a seeding rate target of at least 7 live plants/sqft and that they apply herbicides as early as is appropriate, that is, when weed emergence has begun.

Background:

Field peas have become a well-established part of crop rotations employed by many Western Canadian farmers. Evidence of this is the growth of field pea acres to over two million across

the three prairie provinces in the 1997, 1998 and 1999 cropping seasons. The benefit of growing field peas such as their being a profitable cash crop and providing yield benefits for following crops has fueled this growth. At the same time, the problem of maintaining yield stability across sites and years has become apparent. For example, in Alberta from 1986 to 1997 average field pea yields (kg/ha) fluctuated by more than 30% (in both positive and negative directions) from year to year. Yield fluctuations of 10% or more occurred in seven of 11 occasions. During the same time period, average canola yields fluctuated to a maximum of 20% on a year to year basis with yearly fluctuations being less than 10% on eight of 11 occasions (Canada Grains Council, 1998). Dramatic year to year yield fluctuations result in an unreliable supply of product to the field pea trade which inhibits the growth and profitability of the industry. As well, such fluctuation has a dramatic impact on profitability on the farm and contributes to abandonment of the crop by new growers. To address this problem, producers are often advised to ensure plant stands of at least 75 plants/m^2 (7 plants/sqft) and to spray as early as possible (Frick 1997, Alberta Pulse Growers Commission 1993).

Many field pea growers are used to seeding cereal crops on a volume per acre basis and are not familiar with taking into account differences in seed size when determining seeding rates for field pea crops. Growers are also concerned about the high costs of field pea seed relative to the seed of other crops. Some have chosen to seed at lower than recommended rates. This has resulted in field pea crops with low plant stand densities that are expected to be less competitive with weeds, more susceptible to plant loss due to seeding diseases and, ultimately, lower yielding. The long standing recommendation of 7 plants/sqft (i.e. Biddle et al. 1989, Heath et al. 1991, Park and Miller 1992, Townley-Smith and Wright 1994, Park and Lopetinsky 1995) has already been mentioned. Recently, it has been recommended by some that the number be increased to 8 plants/sqft for black soil zones and decreased to 6 plants/sqft for brown soil zones (Lafond 1998). However, many agronomists in the field report that the plant stand densities that they encounter are closer to 4 or 5 plants/sqft.

Research by Harker et al. (1998) has provided critical evidence supporting the recommendation to apply herbicides as early as possible in the growing season. Harker's work has shown, over six site-years, that a delay in weed removal of two, three and four weeks after field pea emergence has resulted in yield losses of 7%, 12% and 26% respectively. Currently however, many agronomists in the field report that most field pea crops are sprayed three to four weeks after field pea emergence.

The production practice recommendations and research efforts discussed above have dramatically improved many growers' ability to produce higher and more consistent yields with their field peas. However, little information is available to field pea growers which help them determine which production practices are the most effective and cost-efficient in addressing their yield stability problems. Such information would be of great assistance to producers when planning their expenditures and activities for a cropping season. There is a need to research the comparative advantages of production practices in field peas and demonstrate these practices to growers.

Objectives:

1. To demonstrate to new and established field pea growers the following agronomic practices of field pea production:

   a) targeting field pea plant stand densities of 7 or 10 plants/sqft as opposed to 4 plants/sqft
   b) applying herbicides to field peas in-crop as early as possible as opposed to later applications or no herbicide application at all.

2. To demonstrate how these production practices affect the yield stability of field peas

3. To calculate the production economics of these agronomic practices.

Project Plan or Method Used:

From 1999 to 2001, the Battle River Research Group was contracted to conduct a yearly experiment using a randomized complete block design and a 3 X 5 factorial treatment structure. The treatments included targeting field pea plant populations using three different levels (4, 7 and 10 plants/sqft) and herbicide application timing using five different spraying dates (no spray, one week, two weeks, three weeks and four weeks after crop emergence). Crop emergence was defined as the point when rows of crop were first discernable in the plots. This experimental design was based on grower input and reaction to the results of the previous Intensive Pea Management project (FFF grant #98NE04).

The field sites were soil tested prior to seeding and fertilized accordingly. The experiment was direct seeded into wheat stubble using a Fabro plot drill. All plots were inoculated using a commercial granular product at the manufacturer's recommended rates. Field pea stand densities were determined after crop emergence to ensure adequate plant populations are present. A combination of imazamox and imazethapyr (Odyssey®) was used as the herbicide treatment. Measurements throughout the growing season included: plant stand density, plant heights, maturity and final grain yield.

Plots were harvested when seed moisture content is 20% or less. Seed was aerated until dry (> 16% seed moisture) immediately after harvest and then weighed for yield determinations. Further experimental detail is listed below:

Year 1999

Locations: 7 miles east of Camrose,AB, sw6-47-18 w4
Soil type: Black medium textured 6.5% OM, ph 5.8, slightly solonetzic
Seeding Date: May 6, 1999
Previous Crop: Wheat
Tillage: Minimum tillage
Cultivar: Carneval 1000 Kernel weight - 230 gms

Seeding Rate: 4 plants/sq foot -104 lbs/acre, 7 plants/sq foot-182 lbs/acre, 10 plants/sq foot-260 lbs/acre
Fertilizer/innoculant used: 25 lbs Phosphate (12-51-0) seed placed, granular innoculant in seed row
Herbicide application dates/ crop stage/weed stage: Odyssey 17 gms/acre, Spray 1 week after emergence - June 2 - (peas 2 node, wild oats 3 leaf), Spray 2 weeks after emergence - June 10 (peas 4 node, wild oats 4-5 Leaf), Spray 3 weeks after emergence- June 14 (peas 5-6 node, wild oats 6 leaf), Spray 4 weeks after emergence June 24 (peas 6-8 node, wild oats, 6 leaf to flag leaf)
Dessication - Sept 2, 1999 Roundup Fast Forward 1.2L/acre
Harvest Date - Sept 21 1999

Treatments and cost
Odyssey - $17.64/acre Carneval peas $10.20/bushel
104 lbs/acre (4 plants/sq ft) - $17.67/acre 182 lbs/acre (7 plants/sq ft) - $30.93/acre
260 lbs/acre (10 plants/sq ft) - $44.19/acre

Table 1: Weather Data courtesy of Alberta Agriculture Weather Summary.

Month	Mean Temp Degrees C	30 year Average	Total Precipitation (mm)	30 year average
April	5.4	3.8	26.2	20.2
May	8.8	10.8	47.2	45.5
June	13	14.8	12.2	82.7
July	14.3	16.7	83.4	84.9
August	15.8	15.8	46	67.6

Data collection site - Camrose airport, 6 miles from project site.

Year 2000

Location: 2 miles west and 3 north of Killam, se6-45-13 w4
Seeding Date: May 8, 2000
Previous Crop: Wheat
Tillage: direct-seeded
Cultivar: Carneval 1000 Kernel weight - 238 gms, 93% germination
Seeding Rate: 4 plants/sq foot -109 lbs/acre, 7 plants/sq foot-191 lbs/acre, 10 plants/sq foot-273 lbs/acre
Fertilizer/Inoculant used: 25 lbs Phosphate (12-51-0) and granular inoculant seed placed
Herbicide application dates/ crop stage/weed stage: Odyssey 17 gms/acre

Spray 1 week after emergence- May 31 (peas 2 node), Spray 2 weeks after emergence - June 7 (peas 4 node), Spray 4 weeks after emergence (peas 6 node) , spray 5 weeks after emergence (peas 8+ nodes)
Dessication - none
Harvest Date - Sept 14, 2000
Treatments and Costs
Odyssey - $17.64/acre Carneval seed peas $10.20/bushel
109 lbs/acre (4 plants/sq ft) - $18.53/acre 191 lbs/acre (7 plants/sq ft) - $32.47/acre
273 lbs/acre (10 plants/sq ft) - $46.41/acre

Table 2: 2000 Weather Data courtesy of Alberta Agriculture Weather Summary

Month	Mean Temp Degrees C	30 year Average	Total Precipitation (mm)	30 year Average
April	4.3	4.1	17	18.4
May	9.4	11.1	38	40.6
June	13.7	15.1	54.4	93.4
July	18	16.4	119.8	72.2
August	16.4	15.4	32.8	56.5

Data collection site - closest weather station, Sedgewick

Year 2001

Location: 1 mile west and 4.5 miles north of Killam, se6-45-13 w4
Seeding Date: May 3, 2001
Previous Crop: Wheat
Tillage: direct-seeded
Cultivar: Carneval 1000 Kernel weight - 238 gms, 89% germination
Seeding Rate: 4 plants/sq foot -109 lbs/acre, 7 plants/sq foot-190 lbs/acre, 10 plants/sq foot-272 lbs/acre
Fertilizer/Inoculant used: 25 lbs Phosphate (12-51-0) and granular inoculant seed placed
Herbicide application dates/ crop stage/weed stage: Odyssey 17 gms/acre
Spray 1 week after emergence- May 31 (peas 3 to 4 node), Spray 2 weeks after emergence - June 6 (peas 4 to 6 node), Spray 3 weeks after emergence – June 13 (peas 8 node) , spray 4 weeks after emergence June 19 (peas 10 to 12 nodes)
Dessication - none
Harvest Date - August 30, 2001
Treatments and Costs
Odyssey - $17.64/acre Carneval seed peas $10.20/bushel
109 lbs/acre (4 plants/sq ft) - $18.53/acre 190 lbs/acre (7 plants/sq ft) - $32.30/acre
272 lbs/acre (10 plants/sq ft) - $46.24/acre

Table 3: 2001 Weather Data courtesy of Alberta Agriculture Weather Summary

Month	30 year Average Temp Degrees C	Total Precipitation (mm)	30 year Average
May	11.1	25.6	40.6
June	15.1	117.7	93.4
July	16.4	67.6	72.2
August	15.4	Trace	56.5

Data collection site - closest weather station, Sedgewick

Data Collected & Analysis:

For statistical analysis, an analysis of variance (ANOVA) with P=0.05 was conducted on all yield data to determine main effects. Any interactions detected were further investigated using single degree of freedom orthogonal contrasts with P=0.05. An economic analysis to determine the contribution of treatment effects towards marginal returns was also done. Measurements besides yield that were taken throughout the growing season included plant stand densities, weed densities/species composition, plant harvest maturity timings and plant lodging ratings just prior to harvest. These measurements are currently being collated and analysed across 22 site years as part of a provincial initiative for use in a referred journal publication. Analyses based on yield are as follows:

Year 1999

Analysis of the data revealed main effects on yield for both plant stand density and herbicide timing with no interactions. Table 4 below summarizes the effects of different plant stand densities on yield. It should be noted that plots seeded with a target plant stand density of 7 plants/sqft had 31% more yield than plot seeded with a target plant stand density of 4 plants/sqft. In the case of 10 plants/sqft this increase was 46%.

Table 4: Field pea yield main effects resulting from the use of three different seeding rate targets.

Treatment Levels (plants/sqft)	YIELD 60 lb bu/acre	Significance Grouping* LSD = 4.75 60 lb bu/acre
10 plants/sq ft	54.8	A
7 plants/sq ft	49.0	B
4 plants/sq ft	37.5	C

C.V. = 15.81%

*Yields with the same letter are not significantly different.

Table 5 below summarizes the effects of different herbicide application timings on yield. It should be noted spraying at one week after crop emergence increased yield an average of 38% compared to spraying at two or three weeks after crop emergence. Compared to plots sprayed at four weeks after crop emergence, those sprayed at one week after crop emergence yielded 69% more. This increase became 108% in the case of plots receiving no herbicide application being compared to those that were sprayed one week after crop emergence.

Table 5: Field pea yield main effects resulting from the use of five different post-emergent herbicide application timings.

Treatment Levels (spray date)	YIELD 60 lb bu/acre	Significance Grouping* LSD = 6.14 60 lb bu/acre
One week after crop emergence	66.9	A
Two weeks after crop emergence	47.7	B
three weeks after crop emergence	49.3	B
four weeks after crop emergence	39.5	C
no herbicide application	32.2	D

C.V. = 15.81%

*Yields with the same letter are not significantly different.

Economic Analysis

Tables 6 and 7 model the potential benefits to a field pea grower of targeting higher plant stand densities or spraying earlier than at the fourth week after crop emergence. Using the yield increases found in this experiment, it is clearly profitable to target plant populations greater than 4 plants/sqft and to spray earlier than four weeks after crop emergence.

Table 6: Potential benefit for a grower who averages 40 bu/acre field pea yield with 4 plants/sqft of using 7 or 10 plants/sqft as a target plant population.

New Seeding Rate (plants/sqft)	Yield Increase (%)	Yield Increase (60 lb bu/acre)	Gross Return*	Increased Seed Costs**	Marginal Return***
10 plants/sq ft	46	18.4	$69.92	$26.52	$43.40
7 plants/sq ft	31	12.4	$47.12	$13.26	$33.86

*Gross returns - bu/acre X $3.80/bu

** Seed costs - calculated using $10.20/bushel

*** Marginal Returns = Gross Returns - Increased Seed Costs.

Table 7: Potential benefit for a grower who averages 40 bu/acre field pea yield with herbicide application at the fourth week after crop emergence of applying herbicides at one, two or three weeks after plant emergence.

New Herbicide Application Timing (spray date)	Yield Increase (%)	Yield Increase (60 lb bu/acre)	Gross Return*	Increased Spray Costs**	Marginal Return***
one week after plant emergence	69	27.6	$104.88	0	$104.88
two or three weeks after plant emergence****	23	9.2	$34.96	0	$34.96

*Gross returns - bu/acre X $3.80/bu

** Seed and spray costs - calculated using $10.20/bushel

*** Marginal Returns = Gross Returns - Increased spray costs.
**** Because these two timings were not found to be significantly different, an average value for Yield Increase (%) was used.

Year 2000

It is important to note that sparse weed populations were noted at the experimental site in 2000. Analysis of the data revealed main effects on yield for seeding rate. Table 8 below summarizes the effects of different seeding rates on yield. It should be noted that plots seeded with a target rate of 10 live plants/sqft had final seed yields that were 11.4% greater than plots seeded with a target rate of 4 live plants/sqft

Table 8: Field pea yield main effects resulting from the use of three different seeding rate targets.

Treatment Levels (plants/sqft)	Yield 60 lb bu/acre	Significance Grouping* LSD = 4.5 bu/acre
10 plants/sqft	55.6	A
7 plants/sqft	54.3	AB
4 plants/sqft	49.9	B

C.V. = 12.3%
.*Yields with the same letter are not significantly different.

Economic Analysis

Table 9 below models the potential benefits to a field pea grower of changing their practice of using a seeding rate target of 4 live plants/sqft for one of 10 live plants/sqft. In this case, given our assumptions, the grower stands to lose $6.22 per acre from using the higher seeding rate even though a yield increase of 11.4% or 5.7 bushels occurs. The relatively high cost of field pea seed requires that yield increases be relatively large in order to be profitable.

Table 9: Potential benefit for a grower who averages 40 bu/acre field pea yield using a target seeding rate of 10 live plants/sqft as opposed to 4 live plants/sqft.

New Seeding Rate (plants/sqft)	Yield Increase**** (%)	Yield Increase (60 lb bu/acre)	Gross Return*	Increased Seed Costs**	Marginal Return***
10 plants/sqft	11.4	5.7	$21.66	$27.88	-$6.22

*Gross returns - bu/acre X $3.80/bu
** Seed costs - calculated using $10.20/bushel
*** Marginal Returns = Gross Returns - Increased seed costs.

Year 2001

It is important to note that a severe hailstorm occurred at the experimental site on June 23rd of 2001. During this storm, 60 ml of precipitation fell and the nearby canola and field pea fields were written off by crop insurance adjusters. Damage to the experimental site was noted as very severe. Naturally, this event had a significant impact on the results found. Analysis of the data

revealed main effects on yield for herbicide application timing. Table 10 below summarizes the effects of different herbicide application timings on yield. It should be noted that plots sprayed at three weeks after crop emergence demonstrated final seed yields that were 13.6% greater yield than plots sprayed at one or two weeks after crop emergence and 25.8% greater than plots that received no herbicide at all. Plots sprayed at four weeks after crop emergence demonstrated final seed yields that were 21.7% greater than plots that received no herbicide at all. Plots sprayed at one or two weeks after crop emergence had final seed yields that did not differ from those of unsprayed plots.

Table 10: Field pea yield main effects resulting from the use of five different post-emergent herbicide application timings.

Treatment Levels (spray date)	YIELD 60 lb bu/acre	Significance Grouping* LSD = 2.6 60 lb bu/acre
one week after crop emergence	26.2	BC
two weeks after crop emergence	26.2	BC
three weeks after crop emergence	29.7	A
four weeks after crop emergence	28.8	AB
no herbicide application	23.6	C

C.V. = 11.87%

*Yields with the same letter are not significantly different.

Economic Analysis

Table 11 models the potential benefits to a field pea grower of spraying at the third week after crop emergence versus spraying at the first or second week after crop emergence. Using the yield increases found in this experiment, it was clearly profitable to spray later rather than earlier. However, it should be noted that the severe weather conditions that this experiment was carried out under are responsible for these results. It is unlikely that a grower could accurately predict the occurrence of such severe weather and then use late spraying as a management strategy.

Table 11: Potential benefit for a grower who averages 40 bu/acre field pea yield with herbicide application at the first or second week after crop emergence of applying herbicide at the third week after plant emergence.

New Herbicide Application Timing (spray date)	Yield Increase (%)	Yield Increase (60 lb bu/acre)	Gross Return*	Increased Spray Costs**	Marginal Return***
third week after plant emergence	13.6	5.4	$20.52	0	$20.52

*Gross returns - bu/acre X $3.80/bu

** Seed and spray costs - calculated using $10.20/bushel

*** Marginal Returns = Gross Returns - Increased spray costs.

Table 12 models the potential benefits to a field pea grower of spraying at the third or fourth week after crop emergence versus not spraying at all. Using the yield increases found in this experiment, it was clearly profitable to spray later rather than not at all. However, it should be noted that the severe weather conditions that this experiment was carried out under are responsible for these results. It should be noted that, although the experimental site was mown

down after the last herbicide application, the weed control these applications provided were still effective.

Table 12: Potential benefit for a grower who averages 40 bu/acre field pea yield with no herbicide application of applying herbicide at the third or fourth week after plant emergence.

New Herbicide Application Timing (spray date)	Yield Increase (%)	Yield Increase (60 lb bu/acre)	Gross Return*	Increased Spray Costs**	Marginal Return***
three or four weeks after plant emergence****	23.8	9.52	$36.18	$21.64	$14.54

*Gross returns - bu/acre X $3.80/bu
** Seed and spray costs - calculated using $10.20/bushel, $17.64 and $4.00 for herbicide and application costs, respectively.
*** Marginal Returns = Gross Returns - Increased spray costs.
**** Because these two timings were not found to be significantly different, an average value for Yield Increase (%) was used.

Discussion of Results:

The experimental treatments used were selected based on the expectation that they were likely to have large impacts on final yield. This expectation was based both on evidence from the scientific literature, as outlined previously, and on the input from growers and observations of their practices. Many agronomists in the field report that the targeting of field pea stand densities below those recommend as optimum (7 live plants/sqft) is a common strategy employed to lower costs. In 1999, we found that using a field pea stand density target of 7 live plants/sqft resulted in a yield increase of 31% as compared to using a target of 4 live plants/sqft. In the case of using a field pea stand density target of 10 live plants/sqft, this increase rose to 46%. When these results were used in our economic analysis model, marginal returns of $33.86 and $43.40 for 7 and 10 live plants/sqft, respectively, were noted. In 2000, we found that a seeding rate target of 10 live plants/sqft resulted in an 11.4% increase in final seed yield compared to a seeding rate target of 4 live plants/sqft. However, the increased cost of the higher seeding rate, given our assumptions, meant that our economic analysis model predicted a $6.22 loss in marginal return per acre. It should be noted that, given different assumptions in our economic model, this loss could be minimized or even turned into a profit . In 2001, no significant differences in yield were found between the seeding rate targets used.

Many agronomists in the field also report that herbicides are often applied to field pea stands at four weeks after crop emergence or even later either because of grower choice or because of an inability on the part of growers to apply products any earlier. In 1999, we found that applying herbicide at one week after crop emergence (wae) increased yield 38% as compared to applications at two or three weeks after crop emergence (wae). Compared to applications made at four wae, a one week wae timing increased yield by 69%. The resulting increases to marginal returns according to our economic model were $34.96 (one wae compared to two or three wae) and $104.88 (one wae compared to four wae). In 2000, no significant yield differences resulting from different herbicide application timings were found. Very low weed densities were noted. In 2001, a herbicide application at three wae increased yield 13.6% as compared to applications at one or two wae. According to our economic model, the corresponding increase in marginal return was $20.52. The occurrence of severe hail storm at a time just after the three and four wae

herbicide timings were applied is seen as responsible for the results found. The crop was completely mown down and then started to regrow making the three and four wae applications early herbicide timings relative to the growth stage of the crop. It should be noted that applying herbicide at three or four wae did increase yield 23.8% as compared to the unsprayed check and, according to our economic model, resulted in a marginal return of $14.54. This demonstrates that, even though adjusters wrote the site off, these later herbicide applications did provide some value in terms of protecting yield potential.

Conclusions:

Over the three years of this study it was found that certain production practices did have significant impacts on final seed yield and profitability. In 1999, this project demonstrated that use of 7 live plants/sqft as a seeding rate resulting in a 31% increase in final seed yield as compared to 4 live plants/sqft. The increase in marginal return was found to be $33.86. In 2000, this project demonstrated that used of 10 live plants/sqft increased yield 11.4% as compared to 4 live plants/sqft. However, it was also shown that the increase seed costs due to the use of the higher seeding rate actually caused a loss in marginal return per acre. As with all economic models though, the assumptions are critical. If a lower seed cost (which is likely on many farming operations due to the use of "brown bag" seed) or a higher price per bushel for final seed yield had been used in the model, the use of the higher seeding rate in 2000 would have been shown as profitable. Assumptions for the economic analysis model used in this discussion were purposely held constant over the years of the study. In 2001, no differences in final seed yield due to different plant stand density targets were found. This is not unusual when one considers that is unlikely that any production practice is going to work every single time it is employed. As has been noted earlier, this study was part of a much large provincially based initiative. In this larger study, the seeding rates used in this experiment have been examined over 22 site years. At 9 sites or 41% of the time, using a seeding rate target of 7 live plants/sqft has produced an average yield increase of 27% as compared to using a seeding rate target of 4 live plants/sqft. It should be noted that in the overall provincial initiative, there have been cases where 10 live plants/sqft has proven to result in the greatest final seed yield increases. However, the frequency of such occurrences is less than the frequency of situations where 7 live plants/sq/ft has shown to result in the greatest final seed yield increases or where 7 and 10 live plant/sqft targets did not differ in their effects on yield. All of this is good evidence that seeding rate is a major factor in optimizing and stabilizing field pea yield. A seeding rate target of 7 live plants/sqft is a reliably optimum seeding rate level. It was stated earlier that field pea final seed yield increases have to be relatively large to cover the cost of using higher field pea seeding rates. We have ample evidence to show that these yield increases are sufficiently large.

Herbicide application timing had no effect on final seed yield in year 2000 of this study. In 1999, seed yield was increased 69% by spraying at one wae and 23% by spraying at two or three wae as compared to spraying at four wae. Increases to marginal return were $104.88 and $34.96, respectively. In 2001 a herbicide application at three wae increased yield 13.6% as compared to applications at one or two wae. The increase in marginal return was $20.52. The occurrence of severe hail storm at a time just after the three and four wae herbicide timings were applied is seen as responsible for these results which are very contrary to that found in the literature. It must be remembered that the crop was completely mown down and then started to regrow making the three and four wae applications early herbicide timings relative to the growth stage

of the crop. It should be noted that applying herbicide at three or four wae did increase yield 23.8% as compared to the unsprayed check and resulted in a marginal return increase of $14.54. This demonstrates that, even though adjusters wrote the site off, these later herbicide applications did provide some value in terms of protecting yield potential. What was really measured in 2001 was the benefit of early herbicide applications once the effect of the hailstorm on the growth pattern of the field pea crop is understood. In the overall provincial initiative that this study is part of, the question of herbicide application timing has been explored over 19 site years. At 9 of 19 sites or 47% of the time, spraying early (one to two wae) has produced an average 48% increase in final seed yield as compared to spraying late (four wae). There is clear evidence that herbicide application timing is a major factor in optimising and stabilizing field pea yield.

Extension Activities:

1. BRRG held its annual summer tour in the Killam area over the years of this study and invited the project co-ordinator out each year to discuss the work..
2. Industry agronomists toured the plots over the growing season, while an unknown number of growers and industry agronomists took advantage of self-guided tour opportunities.
3. The results of this research were presented at APG Zone 5 Annual Meetings over the years of the study and will be presented at numerous extension events in the future.
4. Results have been and will be presented at poster and oral sessions at research conferences. Examples of past engagements include: North American Pulse Improvement Association (poster 1999, oral 2001), Alberta Pulse Growers Provincial Annual Meeting (oral 2000), Farmtech 2000 (poster 2000), Northeat Industry Agronomist Update (oral 1999 and 2000).
5. Results and conclusions from this study have been included in mailouts to industry agronomists, newscolumns and interviews to the Ag Media and in radio reports.
6. The results of this study will be included in an article for a referred scientific journal currently being pulled together by a provincial team.
7. APG – Pulse Crop News is creating a special research supplement to Pulse Crop News which will include the results of this project.
8. BRRG will include the results and conclusions of this project in its annual report just as it has over the years of the study.

Recommendations/Acknowledgments:

It is recommended that field pea growers use a seeding rate target of at least 7 live plants/sqft and that, if they choose to apply herbicides, they apply them as early as is appropriate, that is when weed emergence begins. At this time, the field peas are also less susceptible to chemical injury. There is good evidence so far to support these recommendations.

Zone 5 APG wishes to express its appreciation to numerous agencies and individuals who have contributed in many ways to the success of this project:

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4. Partners – ASB's, ag. supply companies
5. Summer Technicians – Rhonda Ovenden, Penny Soden, Kristina Fraser

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