

XVIII OPTIMIZING CANOLA PRODUCTION TRIAL

Objective: Measure the individual and combined effects of varying levels of fertilization and crop protection on canola yield, quality and profitability.

Background: Research in the past has focused on a single component of canola production, be that a product or a management decision. While this allows the researcher to isolate the benefit of that single component, it is clear that benefits determined in this way cannot simply be added together to determine the overall benefit in a cropping system. Several small plot research trials are being conducted by a team of researchers, headed by Dr. Don Flaten at the University of Manitoba in Winnipeg, MB. The purpose of these experiments is to focus on the combined effects of varying levels of fertilization, crop protection and genetics, to determine how the choice of a certain level of one (e.g., genetics) affects the profitability of different levels of the others (e.g., fertility, crop protection levels).

While University of Manitoba experiments focused on three general “packages” of inputs including fertilization, crop protection and genetic yield potential, the trials at the Canola Production Centres focused only on the interaction between fertilization and crop protection levels. This allowed the trials to be conducted in the larger field scale format commonly used at the Canola Production Centre sites.

Methodology: The optimizing canola production trial consisted of six treatments in a RCB design, using InVigor 2663.

1. Medium level of crop protection, low level of fertilization
2. Medium level of crop protection, medium level of fertilization
3. Medium level of crop protection, high level of fertilization
4. High level of crop protection, low level of fertilization
5. High level of crop protection, medium level of fertilization
6. High level of crop protection, high level of fertilization

Low level of fertilization = no fertilizer applied

Medium level of fertilization = fertilizer applied to 35 bu/ac target yield

- Micronutrients were foliar applied (if deficient)
- Macronutrients were soil applied

High level of fertilization = fertilizer applied to 50 bu/ac target yield

- Micronutrients were foliar applied (if marginal)
- Macronutrients were soil applied

Medium level of crop protection = Foundation Lite seed treatment, one application of Liberty (1.35 L/ac) at the appropriate crop and weed stage. No foliar fungicide was applied. Foliar insecticides were applied as per appropriate thresholds at the low rate.

High level of crop protection = Helix Xtra seed treatment, two applications of Liberty (1.35 L/ac @ 2 leaf stage and 1.08 L/ac @ 4 to 6-leaf stage). Select (0.025 L/ac) was applied along with the first application of Liberty if grassy weed pressure was high. Fungicide was applied for sclerotinia (Ronilan EG @ 0.4 kg/ac) if required. Foliar insecticides were applied as per appropriate thresholds at the high rate.

Western Canadian Summary:

CPC Location	Selkirk, MB		Yorkton, SK		Nipawin, SK		Beiseker, AB		Lethbridge (Irr), AB		Rycroft, AB		Thief River Falls, MN	
	NYD	CMD	NYD	CMD	NYD	CMD	NYD	CMD	NYD	CMD	NYD	CMD	NYD	CMD*
OPTIMIZING CANOLA PRODUCTION TRIAL														
Medium Level of Pest Control														
Low fertility	20.8	122	15.5	70	13.7	104	21.5	113	35.4	233	11.4	29	28.5	84
Medium fertility	30.9	191	23.3	74	21.2	111	25.4	112	53.8	359	24.7	70	30.6	72
High fertility	35.5	218	25.0	62	24.5	92	21.4	65	56.1	360	23.5	42	31.9	67
High Level of Pest Control														
Low fertility	21.5	98	18.0	37	15.8	49	19.8	91	27.3	166	14.2	47	26.7	31
Medium fertility	30.1	154	23.9	68	23.8	92	23.6	90	54.4	370	29.9	91	33.6	45
High fertility	36.0	193	29.5	99	28.2	102	24.5	86	59.6	397	30.1	72	31.8	24
LSD	1.15		2.50		1.90		2.72		7.39		3.80		2.39	
CV %	3.2		7.6		7.2		8.1		10.5		11.5		6.3	

Note: NYD - Net Yield Data (bu/ac), CMD - Contribution Margin Data (\$/ac)

* Note: Thief River Falls Contribution Margins are in US\$

Discussion:

Yield responses to additional levels of fertility were greater under high levels of pest control at most sites. This may have been attributed to the fact that pest control was no longer a limiting factor for yield. With the adverse environmental conditions and lack of disease pressure experienced this season at most locations, the best returns were obtained under a medium level of pest control and medium fertility level. Potential benefits in yield and economic return from higher levels of fertility and pest control were not obtained due to these environmental factors. The law of diminishing returns, the level of crop inputs, crop price and how much risk is involved all play a role in determining what inputs to use when.

SELKIRK

Methodology:

All of the fertilizer in each of the treatments was banded at a depth of 2" using the hoe press drill prior to seeding. No fertilizer was applied to the low fertility treatments, but they were tilled at 2" with the drill in order to maintain consistency of the seedbed with the other treatments. The actual nutrient rates applied to the medium fertility treatments were 41-23-0-9 lb/ac of N-P₂O₅-K-SO₄. The actual nutrient rates applied to the high fertility treatments were 70-38-0-15 lb/ac of N-P₂O₅-K-SO₄. The trial was seeded at a depth of ¾" into excellent moisture on May 22. Wet weather delayed herbicide applications until the 5 to 6-leaf stage of

the canola. Therefore, a single Liberty (1.35 L/ac) and Select (0.025 L/ac) tank mix application was substituted for the two Liberty applications on the high level of pest control treatments. The medium level of pest control received only a single application of Liberty (1.35 L/ac). The fungicide Ronilan EG was applied to the high level of pest control treatments at a rate of 0.35 kg/ac on July 11.

Observations:

Emergence was very good for all treatments. The treatments with lower fertility levels showed various symptoms of stress throughout the season, including slower canopy closure, shorter stature and reduced branching. The high fertility treatments averaged about 30 cm (1 ft) taller than the low fertility treatments at maturity. Some flea beetle damage was observed in the medium pest control treatments, but it never exceeded threshold levels. Weed control was good for all treatments. Over 60 mm of rain in the first week of July contributed to high humidity levels at early flowering that may have been conducive to sclerotinia infection, but conditions turned drier throughout the rest of July. No significant levels of sclerotinia were observed in the medium level of pest control treatments at swathing.

Results:

OPTIMIZING CANOLA PRODUCTION TRIAL					
Selkirk, MB					
Treatment	Yield (bu/ac)	Contribution Margin (\$/ac)	Oil (%)	Growing Degree Days	Days To Maturity
Medium Level of Pest Control					
Low Fertility	20.8	122.05	47.0	1115	86
Medium Fertility	30.9	191.43	47.0	1103	85
High Fertility	35.5	218.06	46.8	1115	86
High Level of Pest Control					
Low Fertility	21.5	98.51	47.1	1115	86
Medium Fertility	30.1	154.39	47.1	1103	85
High Fertility	36.0	192.72	47.2	1103	85
LSD	1.15		0.50		
CV%	3.2		0.9		

Discussion:

Increasing fertility level dramatically improved yields for both levels of pest control, and these gains were sufficient to improve contribution margins in spite of the increased fertilizer costs. The low to moderate levels of pests at this location resulted in no significant yield gains from increasing the level of pest control, for each fertility level. As a result, contribution margins were reduced at the high level of pest control for each fertility level, due mainly to higher input costs. Oil content, maturity and grade were not significantly impacted by the treatments.

YORKTON

Methodology:

This trial was seeded on May 9. Liquid fertilizer blends of 64-0-0-16 (actual) and 112-0-0-30 (actual) were banded prior to seeding the medium fertility and high fertility treatments, respectively. A seed placed blend of 7-30-10-0 (actual) was applied at time of seeding to these treatments. No fertilizer was applied for low fertility treatments. Medium pest control treatments included Foundation Lite treated InVigor 2663 and one application of Liberty at 1.35 L/ac. High pest control treatments included InVigor 2663 treated with Helix Xtra, and two applications of Liberty at 1.35 L/ac (2 to 3-leaf stage of the crop) and 1.08 L/ac (5 to 6-leaf stage of the crop). Ronilan EG (0.35 kg/ac) was applied to the high pest control treatments at 40% bloom.

Observations:

Cool and dry growing conditions resulted in slow and uneven emergence. Flea beetle pressure was high (5 to 7 flea beetles/plant) to extreme (11 to 14 flea beetles/plant) in many areas of the trial during early plant development. Leaf damage reached action thresholds (25 % leaf area damage) for spraying in medium pest control treatments within five days of emergence. Sevin XLR was applied to those treatments on May 29. The insecticide worked well in terms of contact control on actively feeding flea beetles. By June 5 (13 days after emergence), the medium pest control treatments had again reached or exceeded the action threshold for spraying, which resulted in an application of Matador. The high pest control treatments also reached action thresholds at this time and it was also sprayed with Matador. Flea beetle damage in the medium pest control treatments resulted in very high plant mortality (90%). Therefore, these treatments were re-seeded on June 7.

Weed control in all treatments was generally very good. Petal test kit results showed a low level of infection (32%) four days prior to the fungicide application on high pest control treatments.

Results:

OPTIMIZING CANOLA PRODUCTION TRIAL					
Yorkton, SK					
Treatment	Yield (bu/ac)	Contribution Margin (\$/ac)	Oil (%)	Growing Degree Days	Days To Maturity
Medium Level of Pest Control					
Low Fertility	15.5	61.79	47.7	1017	83
Medium Fertility	23.3	73.69	46.7	1054	86
High Fertility	25.0	70.17	45.2	1094	90
High Level of Pest Control					
Low Fertility	18.0	38.51	47.8	905	88
Medium Fertility	23.9	67.55	47.1	974	93
High Fertility	29.5	99.13	44.6	1021	97
LSD	2.50		1.05		
CV%	7.6		1.5		

Discussion:

Yields significantly increased with increasing fertility for the high level of pest control treatments. Higher levels of pest management also significantly improved yields for the high levels of fertility.

Contribution margins were a reflection of yield, fertilizer costs and pest control costs. Re-seeding and additional seed costs were also factored into medium level of pest control contribution margins. Increasing fertility improved economic returns at the high level of pest control. However, increased costs of applied fertilizer in medium pest control levels were not offset by yield increases.

Results also indicate that increased rates of applied fertilizer had a negative impact on oil content. This is a commonly observed response to increased fertility.

NIPAWIN

Methodology:

This trial was seeded on May 17. Liquid fertilizer blends of 64-19-8-15 (actual) and 120-35-14-28 (actual) were side-banded for medium fertility and high fertility treatments respectively. Medium pest control treatments included Foundation Lite treated InVigor 2663 and one application of Liberty (1.35 L/ac). High pest control treatments included InVigor 2663 treated with Helix Xtra, and two applications of Liberty at 1.35 L/ac (2 to 3-leaf stage of the crop) and 1.08 L/ac (5 to 6-leaf stage of the crop). No fungicide was applied to high pest control treatments due to drought conditions.

Observations:

Cool conditions combined with heavy trash resulted in slow and uneven emergence. High pest control treatments had a 25% higher plant population at the 4 to 5-leaf stage than the medium pest control treatments. Flea beetle pressure was very low in all treatments. Weed pressure was similar throughout all treatments. The high fertility treatments in both levels of pest control were the first to reach 100% ground cover at 27 days after emergence. Insect and disease pressure was generally low. However, lygus bug counts were near threshold levels by mid July, but no treatments were sprayed. Low fertility treatments were first to flower. The level of pest control had little impact on length of flowering, pod filling, ripening and harvestability ratings.

Results:

OPTIMIZING CANOLA PRODUCTION TRIAL					
Nipawin, SK					
Treatment	Yield (bu/ac)	Contribution Margin (\$/ac)	Oil (%)	Growing Degree Days	Days To Maturity
Medium Level of Pest Control					
Low Fertility	13.7	104.02	45.1	1075	94
Medium Fertility	21.2	110.77	43.8	1126	98
High Fertility	24.5	92.37	42.0	1202	103
High Level of Pest Control					
Low Fertility	15.8	48.93	45.5	1075	94
Medium Fertility	23.8	91.99	44.4	1126	98
High Fertility	28.2	102.39	42.3	1202	103
LSD	1.90		0.43		
CV%	7.2		1.0		

Discussion: Yields significantly increased with increasing fertility for both levels of pest control. Higher levels of pest management also significantly improved yields for each level of fertility.

Contribution margins were a reflection of yield, fertilizer costs and pest control costs. Increased fertility increased economic returns with high levels of pest control. However, medium levels of pest control limited the economic benefits of the high fertility level.

Results also indicate that increased rates of applied fertilizer had a negative impact on oil content. This is a commonly observed response to increased fertility.

BEISEKER

Methodology: Prior to seeding, 46-0-0 fertilizer was applied at a rate of 60 lb/ac (actual N) to meet a target yield of 35 bu/ac and 90 lb/ac (actual N) to meet a target yield of 50 bu/ac. A blend of 6-21-10-10 (actual) was seed-placed for both treatments.

Observations: Emergence was even and rapid among all treatments. Weed control in the medium and high crop protection treatments was excellent. No subsequent applications of herbicide were required. The low fertility treatments exhibited symptoms of nitrogen deficiency. Plants were spindly, short and did not compete well. Weeds were visible in the low fertility treatments at the end of the season. The low fertility treatments were the first to flower and the first to mature. Swaths were light and

had little stubble to anchor them. These swaths were flipped at combining.

Results:

OPTIMIZING CANOLA PRODUCTION TRIAL					
Beiseker, AB					
Treatment	Yield (bu/ac)	Contribution Margin (\$/ac)	Oil (%)	Growing Degree Days	Days To Maturity
Medium Level of Pest Control					
Low Fertility	21.5	113.20	42.0	1038	98
Medium Fertility	25.4	111.80	42.4	1078	103
High Fertility	21.4	65.43	41.6	1094	105
High Level of Pest Control					
Low Fertility	19.8	90.61	42.0	1038	98
Medium Fertility	23.6	90.09	41.7	1078	103
High Fertility	24.5	86.02	42.6	1094	105
LSD	2.72		1.49		
CV%	8.1		2.4		

Discussion: Yield differences of more than 2.72 bu/ac are significant. Due to minimal pest pressures on the crop, the economic return on investment using the high pest control scenario was lower. The medium level of pest control gave the best economic return with low and medium fertility. There were no significant differences in oil content.

LETHBRIDGE (IRRIGATION)

Methodology: Prior to seeding, 46-0-0 fertilizer was applied at a rate of 41 lb/ac (actual N) to meet a target yield of 35 bu/ac and 90 lb/ac (actual N) to meet a target yield of 50 bu/ac. A blend of 15-40-10-10 (actual) was seed-placed to meet the target of 50 bu/ac and a blend of 12-31-7-7 (actual) was seed-placed to meet the 35 bu/ac target yield.

Observations: Emergence was even and rapid among all treatments. Flea beetle damage reached the action threshold (25% leaf area damage) in all the medium pest control treatments. These treatments were sprayed using a low rate of Decis 5EC (0.04 L/ac). No flea beetle damage was observed in the high pest control treatments. Weed control in the medium and high pest control treatments was excellent and no follow-up applications of herbicide were required. The low fertility treatments exhibited symptoms of nitrogen deficiency. Plants were spindly, short and did not compete well. Weeds were visible in the low fertility treatments at the end of the season. The low fertility treatments were

the first to flower and the first to mature. Swaths were light and had little stubble to anchor them. These swaths were flipped at combining.

Results:

OPTIMIZING CANOLA PRODUCTION TRIAL					
Lethbridge (Irrigation), AB					
Treatment	Yield (bu/ac)	Contribution Margin (\$/ac)	Oil (%)	Growing Degree Days	Days To Maturity
Medium Level of Pest Control					
Low Fertility	35.4	233.25	45.3	1126	99
Medium Fertility	53.8	358.78	44.9	1155	102
High Fertility	56.1	359.59	45.0	1179	104
High Level of Pest Control					
Low Fertility	27.3	165.94	44.9	1126	99
Medium Fertility	54.4	369.77	45.2	1155	102
High Fertility	59.6	396.69	45.0	1179	104
LSD	7.39		0.90		
CV%	10.5		1.4		

Discussion: The low fertility (high and medium level of pest control) yielded significantly lower than the other treatments. The low fertility, medium pest control treatment yielded significantly higher than the low fertility, high level of pest control treatment. The highest yield and contribution margin was obtained from the high fertility, high pest control treatment. There were no significant differences in oil content.

RYCROFT

Methodology: All of the fertilizer in each of the treatments was banded at a depth of 2” using the hoe press drill prior to seeding. No fertilizer was applied to the low fertility treatments, but they were tilled at 2” with the drill in order to maintain consistency of the seedbed with the other treatments. The actual nutrient rates applied to the medium fertility treatments were 70-30-15-15 lb/ac of N-P₂O₅-K-SO₄. The actual nutrient rates applied to the high fertility treatments were 135-30-15-15 lb/ac of N-P₂O₅-K-SO₄. Seeding took place on May 30.

Observations: Due to the high amount of fertilizer that needed to be applied, it required two passes with the drill and a third pass to seed. This resulted in lower soil moisture at the time of seeding. The treatments with the high rate of fertilizer were more mature than the other treatments. The weed populations were also higher in the treatments with the high rate of fertilizer. The swaths were not able to cure properly due to cool and wet weather prior to combining.

Results:

OPTIMIZING CANOLA PRODUCTION TRIAL						
Rycroft, AB						
System	Yield (bu/ac)	Contribution Margin (\$/ac)	Oil (%)	Growing Degree Days	Days To Maturity	Grade
<i>Medium Level of Pest Control</i>						
Low Fertility	11.4	28.82	46.7	1060	111	3b
Medium Fertility	24.7	70.19	45.6	1053	109	sample
High Fertility	23.5	42.17	45.7	1045	107	sample
<i>High Level of Pest Control</i>						
Low Fertility	14.2	46.59	46.9	1060	111	3a
Medium Fertility	29.9	90.96	45.8	1053	109	sample
High Fertility	30.1	71.97	44.7	1045	107	sample
LSD	3.80					
CV%	11.5					

Discussion:

The low fertility treatments were significantly lower yielding than all other treatments in both levels of pest control. Contribution margins were a reflection of yield, fertilizer costs and pest control costs.

An early August frost caused a greater amount of plant tissue damage on the low fertility plots that were more advanced in flowering (50% bloom) than the other treatments (30% bloom). Differences in grade may be attributed to a larger amount of seeds in the low fertility treatments that were mature when August frosts occurred. Although days to maturity varied by four days between the low and high fertility treatments, the growing degree-days only varied by 15 GDD's indicating very cool conditions during plant maturation. This factor inflates the actual difference in days to maturity.