Canola Production: Agronomic issues, Concerns and Research - USA

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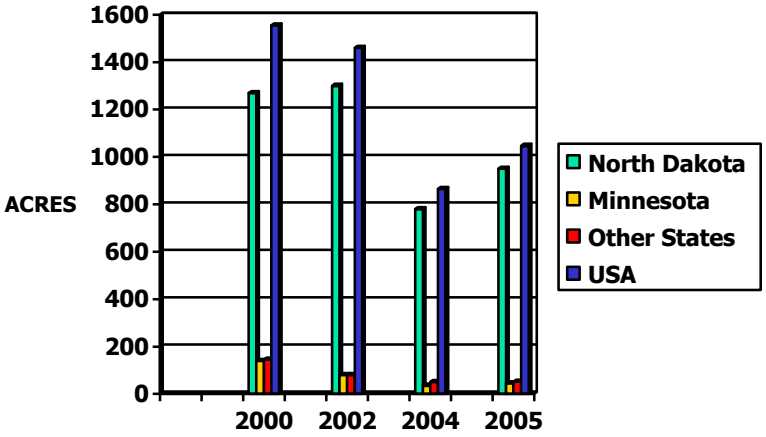
Introduction:
Acreage of canola in the USA has been slightly reduced in the past several years. The highest canola acreage was reported in 2000 with approximately 1.55 million acres (0.62 million Ha) planted nationwide. North Dakota has continued to be the leading state in the production of canola with nearly 90% or more of the canola planted each year. (See Figure 1.)

Figure 1. Canola Acreage in USA.



Adaptation: Canola is grown in a number of states in the USA with the majority of it being produced in the northern Great Plains states of North Dakota, northwest Minnesota, eastern Montana and northern South Dakota. Other regions that have limited acreage of canola include the Pacific Northwest including eastern Washington and Idaho, Kansas, Georgia, Michigan, Wisconsin and Indiana.

In North Dakota, acreage of canola has increased over 800% from 1994 to 2005. Highest acreage reported was in 2002 with 1.3 million acres planted. Average production yields of canola in the USA are approximately 1400 pounds per acre and can be slightly higher or lower depending on the year and the growing conditions.

Agronomic production studies include the following:

- Cultivar and variety evaluations
- Dormant seeding and coated seed evaluations
- Canola performance based on planting depths, rates and dates
- Effects of low initial plant stands or populations on canola yield performance
- Bin run source seeding studies and performance
- Winter canola and rapeseed cultivar evaluations in North Dakota, Kansas and Idaho
- Impacts of preceding crops on incidence of diseases and pest problems
- Canola breeding and Cultivar development

Many of these projects are ongoing and continue to present time.

Sclerotinia and National Initiative in the USA:

The goal of the National Sclerotinia Initiative is to conduct a coordinated research strategy to minimize the devastating effects of *Sclerotinia* (white mold) on soybeans, **canola**, sunflowers, dry edible beans, and the pulse crop group consisting of dry peas, lentils, and chickpeas. Sclerotinia is a serious fungal disease that affects most broad leaf plants, including canola. It has proven very difficult to control or minimize. The fungus generates hard, black bodies called sclerotinia that can remain in the soil for many years. Under the right weather conditions, the sclerotinia produce spores that spread for miles and can infect a susceptible crop. The Initiative began when Congress awarded $960,000 in fiscal year FY2002, and $1.45 million in FY2003. Scientists from 16 states have competed for funding in the first four years of the program, submitting 146 projects that totaled over $8.7 million in requests. Review and funding decisions have been and continue to be established via committees. Twenty projects were funded in FY2002, 23 projects were funded in FY2003, and 34 projects were funded in FY2004. The committees are once again awarding projects in FY2005 according to funding received and priorities. In FY 2005, $1,429,983 was appropriated and for FY 2006
$2.8 million is being requested to continue and sustain the research.
Among the projects that involve canola in the Sclerotinia National Initiative are:

- Identification of canola cultivars with improved tolerance to white mold.
- Determination of effective fungicides for management of Sclerotinia
- Identification and evaluation of a biological control agent that shows promise in managing white mold in various crops.
- The establishment of a comprehensive Sclerotinia Initiative website to serve the needs of the agricultural community and to provide educational information to the general public.

Blackleg Disease Issues in USA:

Blackleg, caused by *Leptosphaeria maculans* is reemerging as a serious disease in the northern Great Plains canola production region. Short crop rotations and the development of more aggressive strains of the pathogen may partially be the cause of the recent increase in the observation of Blackleg in canola. In 1991 this disease was first detected in North Dakota. The predominant strains of *L. maculans* in North Dakota are PG1 and PG2. In a survey in 2003 the first isolates of the more aggressive strains of PG3 and PG4 were identified. Our current grown cultivars were not tolerant or resistant to the new strains. Because of this recent reemergence of a more virulent disease strains, research was again initiated in 2004 to: a) establish a blackleg nursery in North Dakota for screening cultivars and experimental lines for resistance; b) evaluate northern canola cultivars and experimental lines for blackleg resistance against highly aggressive

and variable *L. maculans* populations at the University of Georgia blackleg nurseries; and c) evaluate fungicides for management and control of blackleg. The preferred method is to have highly resistant cultivars available for growers to utilize. This research in blackleg disease management is ongoing and will continue in 2005 and into 2006 and later.

Soil fertility and soil nutrient issues:
Both nitrogen and sulfur are key nutrients required by canola for high yields and a quality product. Canola requires nearly twice the amount of sulfur as does a crop of wheat.
Nitrogen recommendations are based on the following formula:

NR = (YG X 0.05) - STN - PCC

where NR = supplemental nitrogen recommended

YG = yield goal in lb/A

STN = soil nitrate-N 0-24 inches

PCC = previous crop credit if legumes were grown the previous season.

Nitrogen recommendations at selected yield goals are shown in Table 1. Yield goals should be conservative, based on a five year average and not on a potential optimistic yield such as what a wheat grower might do. Ammonium sources of N may be fall applied on most North Dakota soils, except on sandy loam textures or coarser, or where flooding is expected in the spring. Spring application may be made pre-plant or at planting. Canola is very sensitive to fertilizer salts. No more than 5 lb/A of N is recommended with the seed in 12 inch row spacing for medium textured soils, but the rate can be increased proportionally with narrow row spacing or increase in seed spread.

Phosphorus (P) and Potassium (K) recommendations:
Canola is a good scavenger of P and a row-starter fertilizer rate of 20-30 lb P_2O_5/A is sufficient for most soil test levels. On light soils where no nitrogen is recommended, 11-52-0 (MAP) would be a better seed-placed choice of phosphate, since its nitrogen component is not as likely to injure seed as 18-46-0 (DAP). K, if needed, may be added to row starter if final N + K_2O is below maximum allowable rate. Broadcast application of P and K is acceptable. However, a small amount of P as a row starter is recommended in addition to any broadcast.

Table 1. N, P and K recommendations for canola.

Yield Goal*	Soil N + supplemental N	Olsen-P, ppm					Soil test K, ppm.				
		VL	L	M	H	VH	VL	L	M	H	VH
		0-3	4-7	8-11	12-15	16+	0-40	41-80	81-120	121-160	160+
lb/A	lb/A at 0-2 ft.	lb P_2O_5/A					lb K_2O/A				
1000	65	35	25	15	0	0	50	35	20	0	0
1500	100	50	35	20	10	0	70	50	30	10	0
2000	130	65	45	30	10	0	95	70	40	15	0

2500	165	80	60	35	15	0	120	85	50	15	0

*Be conservative on yield goals to avoid lodging and low oil content.

Research conducted in the 2003 and 2004 cropping seasons appears to suggest that the hybrid canola's appear to respond to increased yields with less N required than the open-pollinated types of canola (Table 2). This was true in both low yielding environments (dry environments) and in high yield environments (high moisture environments). It should be noted that there is more N mineralization in the wet environments. This research needs to be continued for several more years before change is made in N recommendations based on the two types of canola being grown.

Table 2.

Canola Yield Goal and Nitrogen Required by Yield Environment 8 locations, ND, 2003-2004					
Canola Yield Goal	Current NDSU recommendation	Open Pollinated	Hybrid	Open Pollinated	Hybrid
	All varieties and environments	Low Yield Environment < 1800 lb/a Potential		High Yield Environment > 1800 lb/a Potential	
Lb/a	----------Total Lb N/acre----------				
1000	65	51	41		
1500	98	92	77		
2000	130	136	118	74	65
2500	163			110	97
3000	195			150	132

Source – John Lukach, NDSU Langdon Research/Extension Center.
Total lb N/acre includes Soil Test and applied N from all sources applied
High yield environment has much higher N mineralization due to favorable soil moisture during summer

Canola has a special requirement for sulfur. The consequences of low soil S levels are very serious in canola production. Spectacular yield increases due to sulfur application have been demonstrated in North Dakota. A composite soil test for sulfur may not represent sulfur fertility variation across the field. The current S soil test tends to overestimate available sulfate-S and field variability is huge. Growers should consider applying 20-30 lb S per acre regardless of soil test level. Research in North Dakota suggests canola growers should use a sulfate or thiosulfate form of sulfur. Elemental sulfur forms have not performed well in regional trials. In addition, there have been no canola yield responses to any other micronutrient in North Dakota.

Control of Volunteer Canola in cropping systems-

Currently in USA approximately 70% or more of the canola acreage is planted with GM canola cultivars. Both the Roundup (Glyphosate) resistant and Liberty (Glufosinate) resistant types of canola are being utilized. Clearfield (Imidazolinone) resistant canola which is a none GM and conventional canola are also being planted. Canola can volunteer for several years following a canola crop. These volunteers will compete with the succeeding crop and may affect yield depending on the volunteer density. Steps should be taken during the swathing and combining operations to minimize canola seed losses. Following canola harvest, seeds that remain on or

near the soil surface may germinate in the fall and be killed by frost. Avoid deep tillage that will deposit canola seeds several inches deep into the soil where they are less likely to germinate and where secondary dormancy is more likely to be induced. If possible, allow time in the spring for canola volunteers to germinate before a tillage operation and then seed the new crop as soon as possible following the tillage operation. Canola volunteers that emerge before or with the crop may be very large by the time the post emergence herbicide application is made. Canola volunteers can become much more difficult to control with herbicides once they reach the 6-leaf to bolting stage. There are some herbicides that provide excellent control of small volunteers, but provide poor control of bolting canola. Canola volunteers will be best controlled when applied by the 5-leaf stage. There are numerous selective herbicides that can be used and are labeled for use in cereal crops, soybean, corn and pulse crops that will control volunteer canola. However, to control the volunteers on a timely basis, plus the extra costs of herbicide and application can and does reduce the economic gains of crops that follow canola in rotations.

Insect pests and control management:
The most serious insect pests in canola include the Crucifer flea beetle (*Phyllothreta cruciferae*), Diamondback Moth (*Plutella xylostella*) and Bertha Armyworm (*Mamestra configurata*). The flea beetle is by far the most widespread and presents the greatest management and control problem for producers. Currently, the most effective control measure for flea beetle is the use of insecticides. The seedling stage is the critical period, and insecticides need to be applied as a seed treatment prior to planting or a foliar application to protect the crop from flea beetle damage. If growers use treated canola seed, the seedlings should be protected from flea beetle feeding for most of the susceptible seedling stage. Seed treatments usually provide at least 3 weeks of protection or 2 weeks after canola emergence in the field. If the seed treatment did not provide adequate protection or was not used, an application of a foliar insecticide may be necessary. Foliar applications are recommended when 25% defoliation occurs on the cotyledons and true leaves (Economic Threshold Level). When flea beetle populations are high, more than one application may be required due to the short residual of insecticides labeled for flea beetle control, and with the threat of re-infestation from surrounding areas. Foliar applications must be applied quickly for effective control. One of the problems growers' cope with is being able to cover large numbers of acres quickly when feeding pressure is high. Canola rapidly growing can usually compensate for flea beetle feeding injury once plants reach the 4-6 true leaf stage.

Insect research in Canola:

- Efficacy of Registered and Experimental Insecticides (seed treatments and foliar) for Control of the Crucifer Flea Beetle in Canola.
- Pest Management of the Crucifer Flea Beetle in Canola: Optimizing Yields through Insecticide Strategies and Planting Dates, and Forecasting Spring Flea Beetles Populations
- Reducing Insecticide Inputs for Control of the Crucifer Flea Beetle in Different Canola Varieties
- Control of Crucifer Flea Beetle in Canola through Insecticide Strategies and Canola Varieties
- Canola Insect Trap Network for Monitoring Diamondback Moth and Bertha Armyworm
- Canola Survey for Diseases and Flea Beetles

Canola Information Sources:

North Dakota State University

Oilseeds and Row Crops:
http://www.ag.ndsu.nodak.edu/plantsci/rowcrops/main.htm

North Dakota State University Extension
Procrop: http://www.ag.ndsu.nodak.edu/aginfo/procrop/procrop.htm

Sclerotinia Risk in Canola Forecast Program
http://www.ag.ndsu.nodak.edu/aginfo/sclerotinia/sclerotinia.htm

Canola Insects Information
http://www.ag.ndsu.nodak.edu/aginfo/entomology/entupdates/index.htm#Cano

Canola Organizations

Northern Canola Growers Association
2718 Gateway Avenue #301, Bismarck, ND 58503
Tele: 701-223-4124
Web address: www.northerncanola.com

Minnesota Canola Council
1306 West County Road F., #109
St. Paul, MN 55122
Tele: 651-638-9883
E-mail: mncanola@aol.com

U. S. Canola Association
600 Pennsylvania Ave. SE., Suite 320
Washington, DC 20003
Tele: 202-969-8113
Web address: www.uscanola.com