Influence of Planting Date on Canola and Crambe Production

K.R. McKay, A.A. Schneiter, B.L. Johnson, B.K. Hanson, and B.G. Schatz

Increased interest in alternative sources of oil for edible and industrial uses have stimulated interest in the production of new oilseed crops. Spring sown canola (*Brassica napus* L. and *Brassica campestris* L.) and crambe (*Crambe abyssinica* Hochst) have excellent potential to expand the diversity of agricultural crops available to North Dakota producers. The three species are cool season oilseed crops that are adapted to this area. "Canola" is a tradename for varieties of rapeseed from which the oil can be used for human consumption, while crambe oil is used for industrial purposes.

Two types of spring sown canola, Argentine type (*Brassica napus*) and Polish type (*Brassica campestris*), are commercially grown. Argentine varieties are typically higher yielding, taller, later maturing and a have higher oil content than Polish varieties. Canola varieties of both types that have oil with less than 2 percent erucic acid and meal with less than 3 milligrams per gram glucosinolate have been approved by the U.S. Food and Drug Administration for human consumption. Canola varieties with higher than 2 percent erucic acid are considered as high erucic rapeseed varieties.

Crambe is an oilseed crop that may provide alternative oil sources for industry. Lessman and Anderson (5) indicate that crambe oil is one of the highest known sources of erucic acid. Crambe varieties are considered to be more drought tolerant and have a higher yield potential than high erucic rapeseed in North Dakota, but typically have a lower oil content.

Date of planting is an important management factor in the production of all crops, especially in regions where the growing season is short. The response of canola and crambe to planting date will be influenced by environmental conditions during the growing season.

Thurling and Vijendra Das (7) suggested that an optimal planting date for canola should ensure adequate vegetative development, optimal flowering time and allow grain development to be completed prior to the onset of severe drought stress. Gross (2) reported that seed yields in southern Manitoba were highest for both types of canola/rapeseed when planted near May 8. Earlier plantings resulted in frost damage to seedlings and later plantings resulted in decreased yields. Kondra (4) reported that in central Alberta an optimal planting time for Torch, a Polish type variety, was May 15 while a May 3 planting time was optimal for Midas, an Argentine type variety. Studies by Gross and Steffanson (3) and Christensen et al. (1) reported that oil content was highest in early plantings of canola.

Planting date had no effect on crambe yields or oil content in Georgia {Massey and Jellum (6)}. White and Higgins (8) reported similar results in Wyoming and Oregon; however, they reported that in Nebraska and Montana yield and oil content decreased with delayed planting dates.

The objective of this study was to determine the influence of planting date in North Dakota on yield and agronomic response of several varieties of canola and one variety of crambe.

MATERIALS AND METHODS

Studies were conducted at Prosper, Carrington, and Langdon during the 1989 and 1990 growing seasons. Varieties, their relative maturity, and seeding rates from these studies are listed in Table 1. All locations were planted at approximately 15 day intervals beginning May 1 and ending June 15 (Table 2). The Carrington location was abandoned in 1990 due to poor stand establishment after the first date of planting. An early planting was made on April 23 at Prosper in 1990 to evaluate seed yield and other agronomic characters. Trials at Prosper, which is located 16 miles northwest of Fargo, consisted of six rows spaced 12 inches apart and approximately 25 feet long. Trials at

Table 1. Agronomic characteristics of three canola varieties and one crambe variety evaluated for response to planting date at Prosper, Carrington, and Langdon, N.D.

Variety	Type	Relative maturity (days)	Seeding rate (lb/ac)
Westar	Argentine	90- 95	7
Topas	Argentine	95-100	7
Tobin	Polish	80- 85	6
Meyer	Crambe	90- 95	25

McKay is area agronomy specialist, NDSU Extension Service. Schneiter is professor and Johnson is research technician, Department of Crop and Weed Sciences; Hanson is associate agronomist, Langdon Research Center, and Schatz is associate agronomist, Carrington Research Extension Center respectively.

Table 2. Planting dates at Prosper, Carrington, and Langdon, N.D. during the 1989 and 1990 growing seasons.

Planting Date	Location		
	Prosper	Carrington	Langdon
		1989	
1	May 1	May 5	May 8
2	May 15	May 15	May 15
3	May 31	May 31	May 31
4	June 15	June 15	June 15
		1990	
	April 23*		
1	May 2	May 4	May 4
2	May 15	May 16	May 15
3	May 31	May 30	May 30
4	June 14	June 14	June 12

* Not used in the statistical analysis.

Table 3. Mean seed yield (lb/A) of three canola varieties seeded at four dates of planting at five environments.

Environment	Planting date				
	April 23*	May 4	May 15	May 31	June 15
Prosper 1989		245	327	168	118
Langdon 1989		1632	1180	596	82
Carrington 1989		714	643	388	282
Prosper 1990	2666	2118	2131	1156	1137
Langdon 1990		2290	2113	2145	1400
Avg.		1400	1279	891	538
LSD (0.05) Date = 205					

* Not included in the statistical analysis.
[1]Only varieties Westar and Tobin matured.
[2]Only the variety Tobin matured.

Carrington and Langdon consisted of four rows spaced 12 inches apart 25 and 16 feet long, respectively. Soil fertility was determined at all locations and N, P, and K were applied for a 2000 pound per acre yield goal. Chemical weed control at all locations consisted of a pre-plant incorporation of trifluralin supplemented by hand weeding when necessary. Flea beetles on canola were controlled with insecticides at all locations when necessary. Weather data was collected at all locations.

The trials at each location were replicated four times. Results from all locations were combined for analysis. The three canola varieties were analyzed separately from the crambe variety. All four planting dates were analyzed for seed yield. Only the first three dates were utilized in analyzing the other characters due to the large number of missing values in the fourth date of planting in 1989.

RESULTS AND DISCUSSION

Canola

Planting date had a significant influence on canola yield. Averaged across all environments yield decreased when the crop was planted after May 15 (Table 3). These results agree with those of Gross (2), who reported lower canola/rapeseed yields with delayed plantings. The decrease in yield with late plantings was the result of heat and/or moisture stress which decreased the number of pods per plant. Heat and moisture stress throughout all stages of growth at Prosper in 1989 resulted in low seed yields in plots of all planting dates. Adequate soil moisture and cooler temperatures early in the 1990 growing season resulted in higher seed yields. Seed yields at Langdon were consistently higher than at either Prosper or Carrington during both growing seasons due to cooler temperatures.

Argentine varieties, Westar and Topas, had generally higher seed yield than the Polish variety, Tobin, especially with the early planting dates (Figure 1). The mid-June 1989 plantings of Argentine type varieties Westar and Topas, at Langdon and Carrington and Topas at Prosper did not mature due to heat and moisture stress prior to flowering. The Polish variety Tobin matured regardless of planting date and environment, although low yields were observed from the fourth planting date at all environments in 1989.

Results suggest that canola is very susceptible to heat and drought stress and producers should plant early. Early plantings of canola at Prosper in 1990 were subjected to freezing temperatures as low as 22° F. These temperatures did not appear to damage seedlings or reduce seed yield.

A decrease in the number of days to first flower was observed in all varieties as planting date was delayed (Table 4). This was expected, as the early planted canola flowered during cooler temperatures. This prolonged the flowering period. The decrease in days to first flower reduced the number of days to physiological maturity as planting date was delayed (Table 4). Canola varieties planted in late May had a significantly lower oil

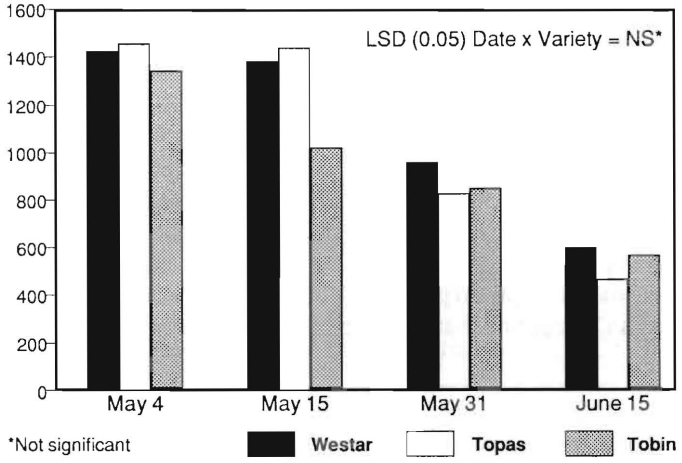

Figure 1. Seed yield of three canola varieties seeded at four dates of planting combined across five environments.

Table 4. Days from planting to first flower and days from planting to physiological maturity of three canola varieties from three planting dates combined across environments.

Planting Date	Variety	Days to first flower	Days to phys. maturity
May 4	Westar	52	89
	Topas	56	94
	Tobin	44	81
May 15	Westar	48	85
	Topas	49	89
	Tobin	40	76
May 31	Westar	41	79
	Topas	45	84
	Tobin	32	68
LSD (0.05) Date =		4	5
Variety =		1	2

Table 5. Average oil content (%) of three canola varieties at three planting dates grown at five environments.

	Planting date			
Environment	April 23*	May 4	May 15	May 31
Prosper 1989		34.9	35.6	34.4
Langdon 1989		39.8	39.2	37.8
Carrington 1989		40.3	40.4	38.4
Prosper 1990	40.4	39.8	39.9	39.7
Langdon 1990		41.6	40.5	40.4
Avg.		39.4	39.2	38.2
LSD (0.05) Date =		0.7		

*Not included in statistical analysis.

content than seed from earlier planting dates (Table 5). Canola seed typically contains 40 percent oil in the seed. Due to heat and drought stress during seed development, low levels of seed oil were observed in plots at all planting dates at Prosper in 1989. The Polish variety Tobin had significantly lower oil content than either of the Argentine varieties, Westar and Topas.

Table 6. Seed yield (lb/A) of Meyer crambe at four dates of planting grown at five environments.

	Planting date				
Environment	April 23*	May 4	May 15	May 31	June 15
Prosper 1989		354	441	751	1619
Langdon 1989		2107	1951	270	0
Carrington 1989		1093	907	942	897
Prosper 1990	3555	3132	2753	1731	1811
Langdon 1990		3272	3326	2870	2487
Avg.		1992	1880	1313	1363
LSD (0.05) Date =	418				

* Not included in the statistical analysis.

CRAMBE

Averaged across locations, crambe yields were consistently higher with early planting dates (Table 6). An exception was Prosper in 1989 where above normal rainfall in August resulted in prolonging the flowering period in the plots of the mid-June planting date. This resulted in higher seed yields (Table 6). Due to the heat and drought stress in 1989, Meyer crambe did not produce seed when planted in mid June at Langdon. Adequate soil moisture and cooler temperatures early in the 1990 growing season resulted in more normal plant growth and higher seed yields. Moisture stress late in the 1990 growing season reduced crambe seed yield in the plots of the late-May and mid-June plantings at both Prosper and Langdon. Crambe seedlings from early plantings were subjected to freezing temperatures as low as 22° F. These temperatures did not appear to damage seedlings or reduce seed yield.

Days to first flower and physiological maturity decreased with each successive delay in planting (Table 7). A general decrease in oil content was also observed with delayed plantings (Table 8). Heat and drought stress conditions at Langdon in 1989 decreased oil content as planting date was delayed beyond May 4. At Prosper, however, the last planting date produced the highest level of oil. Oil contents were consistently higher in 1990 than in 1989 due to more favorable environmental conditions.

Table 7. Days from planting to first flower and days from planting to physiological maturity of Meyer crambe at three planting dates combined across five environments.

Planting Date	Days to first flower	Days to phys. maturity
May 4	54	90
May 15	48	85
May 31	43	80
LSD (0.05) Date =	5	5

Table 8. Average oil content (%) of Meyer crambe at three planting dates grown at five environments.

	Planting date			
Environment	April 23*	May 4	May 15	May 31
Prosper 1989		24.0	23.6	25.2
Langdon 1989		28.1	25.2	17.3
Carrington 1989		29.4	30.5	28.0
Prosper 1990	31.8	31.2	29.4	31.4
Langdon 1990		32.1	32.7	31.7
Avg.		29.0	28.3	26.7
LSD (0.05) Date =	1.0			

* Not included in the statistical analysis.

SUMMARY

The optimum time to plant canola and crambe is early in the growing season. Early plantings may help avoid the hot and dry conditions that often occur late in the growing season. These conditions can drastically reduce the yield potential. Producers should plant canola and crambe in early May or no later than May 15 to avoid a decrease in seed yield and oil content. Canola is more susceptible to heat and drought stress than crambe. Crambe also has a higher yield potential than canola. Both crops are well adapted for production in North Dakota, especially if sown between May 1 and May 15.

REFERENCES

1. Christensen, J.V., W.G. Hegge, R.M DePauw, A.M.F. Henning, J.S. McKenzie, B. Siemens, and J.B. Thomas. 1985. Effect of seeding date, nitrogen and phosphate fertilizer on growth, yield and quality of rapeseed in northwest Alberta. Can. J Plt. Sci. 65:275-284.
2. Gross, A.J. 1962. Effect of date of planting on yield, plant height, flowering, and maturity of rape and turnip rape. Agron. J. 56:76-78.
3. Gross, A.J., and B.R. Stefansson. 1966. Effect of planting date on protein, oil content, fatty acid content of rapeseed and turnip rape. Can. J. Plt. Sci. 46:389-395.
4. Kondra, Z.P. 1977b. Effect of date of planting on rapeseed. Can. J. Plt. Sci. 57:607-609.
5. Lessman, K.J., and W.P. Anderson. 1981. Crambe. Monogr. Amer. Oil Chem. Soc. Champaign, Ill. p.223-246.
6. Massey, J.H., and M.D. Jellum. 1973. Effects of spring planting date and row spacing on the agronomic characteristics and chemical composition of crambe. Agron. J. 65:299-300.
7. Thurling N., and L.D. Vijendra Das. 1979. The relationship between pre-anthesis development and seed yield of spring rape(Brassica napus). Aust. J. Agric. Res.31:25-36.
8. White, G.A., and J.J. Higgins. 1966. Culture of crambe...A new industrial oilseed crop. Production Research Report No. 95, U.S.D.A.