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INFLUENCE OF TOPPING RAPESEED ON YIELD COMPONENTS AND OTHER AGRONOMIC CHARACTERS UNDER VARYING DATES OF PLANTING

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Abstract

The effects of different planting dates were studied to determine the influence of topping at different growth stages on yield components, seed weight, seed yield and other agronomic characters. The time of topping had a significant effect on initial flowering and maturity periods. More days were required for initial flowering and maturity for the ratooned crop topped at first flower followed by the bud and pre-bud stage except where the secondary branches were removed, which appeared to be almost similar to the controls. Topping, however, had a negative effect on yield components. Removal of secondary branches had minimum effect on yield components and produced yield per plant and plot very close to the controls whereas, topping response was clearly evident on seed weight.

Introduction

Final seed yield is determined by a number of contributing factors including number of pods, number of seed per pod and individual seed weight. Appreciable losses of flowers and pods occur throughout plant development (Mendham *et al.*, 1981). These losses have been attributed to limited supplies of assimilates at critical stages of development caused by the reflection of light at flowering and mutual shading throughout pod and seed development (Mendham *et al.*, 1981).

Labana *et al.*, (1987) reported that defoliation upto 14 days before anthesis led to reduced number of flowers per plant, plant height, number of branches, seeds per pod, seed size, seed yield, oil and protein yield. Evans (1984) also indicated that reducing the size of the leaf canopy during the vegetative phase of growth limits the amount of assimilates available for developing stem and root and the assimilates available for developing stem and root and the assimilates stored in these organs have an important role in determining the yield potential of oilseed rape. The number of seeds per pod is one of the important yield components of rapeseed. Under natural light, the number of seeds per pod determines the seed yield (Inanaga *et al.*, 1986).

The present study was undertaken to determine the effect of topping rapeseed (*Brassica napus* L.) at different growth stages, on seed yield components, seed weight, seed yield and other agronomic characters.

Materials and Methods

Three field trials were planted on three different time periods under rainfed conditions in Saskatoon, Canada in 1990. *Brassica napus*, rapeseed, cv. Wester was used

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Table 1. Meteorological data for the sites under study during 1990 at Saskatoon, Canada.

Month	May	June	July	August	Total
Precipitation (mm)	27.6	59.8	75.9	6.3	170
Mean temp. (^{o}C)					
Max	17.3	24.2	23.2	24.7	
Min	5.0	10.4	12.0	11.3	
Mean	11.2	17.3	17.6	18.0	

in all trials. Fartilizer rate 22 N and 100 P kg/ha was used for first planting date whereas 50 N and 100 P kg/ha were applied for the second and third planting according to the fertility level of the field. Half of the fertilizer was broadcast and incorporated, whereas the other half was applied with the seed. Trials were laid out in a randomized complete block design with 5 replications.

For all seeding, an Oyord plot drill equipped with six openers spaced 30 cm apart, at a depth of 2-3 cm was used with seeding rate 6 kg/ha. Seeding was carried out under three different dates commencing from May 11, 29 and June 14, 1990. Meteorological data are reported in Table 1.

The topping treatments used in the experiments were as follows:

1. control (no topping);
2. at pre-bud stage, topping of 2/3 as the plant was elongating having just completed the resette stage;
3. at bud stage, topping as for T2 above;
4. at first flower, topping as for T2;
5. secondary branches were removed at first flower appearance.

Ten plants were selected in series randomly from central rows in each topping treatments including control plots of each experiment for the determination of yield components, and four central rows in each plot were harvested for seed yield. Measurements were made on number of branches, pods, number of seeds, plant height, dry weight, seed per plant, 1000 seed weight and seed yield. Data collected were subjected to statistical analysis using the analysis of variance (Steel & Torrie, 1980).

Results and Discussion

Effect of time of topping on crop development: Initial flowering and maturity responded differently to topping in the trials conducted under three planting periods. More days for flowering and maturity were required when the crop was topped at first flower stage followed by bud and pre-bud stage (Table 2). Evans & Abdel (1983), reported that defoliation influenced both the time and duration of flowering. On average, topping delayed the flowering by 4, 8 and 12 days and maturity by 2,3 and 8 days of the ratooned crop, topped at pre-bud, bud and first flower stage, respectively (Table 2). As the planting time was delayed the flowering and maturity period were reduced.

Table 2. Effect of topping period on initial flowering and maturity of crop sown at three dates under rainfed conditions.

Ratooning	Days to initial flowering			Days to maturity		
Treatment	May 11	May 29	June 14	May 11	May 29	June 14
Check	63	48	41	89	83	77
Prebud	66	53	44	96	84	79
Bud	71	57	*	97	86	*
First F1	75	61	*	101	87	*
Sec. Br.	63	48	41	89	83	78
LSD (0.05)	1	1	1	1	1	1

* No plant development after topping.

This reduction of the topped crop could be due to the short growing season and prevalent high temperature at critical stages of plant development (Table 1).

Effect of time of topping on the yield components: Topping showed quite different behaviour on yield components. Trials sown on May 11 and June 14, 1990 did not produce more branches pods and height per plant due to the dense plant stand (142 plants/m2 and 184 plant/m2), However, in both cases the trend for increease in dry weight number of seeds and seed yield per plant in removing secondary branches appeared the same but these components were reduced by later planting as compared to former data of planting (Table 3 ac). Since no regrowth took place in the trial sown on June 14, 1990 after topping the crop at bud or at first flower stage, no record on the yield component were obtained. It was observed from this late planted trial that as the planting period was delayed, the yield components and seed yield comparatively reduced than the early planting (Table 3c). This observation is in agreement with the finding of Scarisbrick et al., (1981) that delayed seeding reduces seed yield in rapeseed.

In a trial, sown on May 29, 1990, all the topping treatments, including the check, produced significantly more branches ranging 3-3.8 branches/plant than the secondary branches removal treatment because the crop stand was not dense (74 plants/m^2), since it was sown in 30 cm row spacing. Response to number of pods, seeds and seed yield per plant appeared great in control and removing the secondary branches at first flower stage (Table 3b). Height dry weight and seed yield per plant did not differ significantly between the check plot and when the secondary branches were removed. (Table 3b). These findings agree with that of Tayo & Morgan (1975) who found that this effect is probably achieved by making more carbon assimilate available to the upper inflorescences at times when important yield components (pods and seed numbers) are being determined.

McGregor (1981) studied the effects of bud, flower or pod removal from rapeseed or related species and found that considerable recovery is possible if the treatment is applied nearly in flowering. Williams & Free (1979) also found that late removal of

Table 3. Effect of topping period on the yield components of crop sown on May 11, 29 and June 14, 1990 under rainfed conditions.

Ratooning Treatment	Br/pl	Pods/pl	Ht/pl (cm)	Dry wt/pl (g)	Seeds/pl	Yield/pl (g)
a) May 11, 1990						
Check	1.6	13.8	51.0	3.8	234	0.79
Prebud	1.4	8.2	48.6	1.9	75	0.21
Bud	1.4	7.0	47.0	1.5	84	0.23
First FI.	3.0	10.2	60.6	3.0	65	0.17
Sec. Br.	1.0	16.2	57.6	5.0	286	1.06
LSD (0.05)	0.4	4.2	6.6	1.5	94	0.31
b) May 29, 1990						
Check	3.8	27.6	61.2	6.1	430	1.41
Prebud	3.1	12.3	43.0	2.8	120	0.31
Bud	3.0	4.1	42.9	2.4	39	0.10
First FI.	3.7	13.8	53.9	4.9	141	0.27
Sec. Br.	1.7	17.7	62.5	6.0	300	1.20
LSD (0.05)	1.1	5.3	5.8	1.2	87	0.33
c) June 14, 1990						
Check	1.6	10.2	60.6	1.8	54.8	0.15
Prebud	1.2	6.2	49.0	1.0	21.6	0.05
Bud	*	*	*	*	*	*
First FI.	*	*	*	*	*	*
Sec. Br.	1.2	10.0	63.2	2.0	51.6	0.15
LSD (0.05)	ns	2.9	4.7	0.9	ns	ns

Br = Branches, Pl = Plant, Ht = Height, Wt = Weight.

* No plant development after topping, so no data recorded.

buds or pods sometimes caused greater yield loss than early removal and late pod removal resulted in more immature pods at harvest. In *B. campestris*, Freyman *et al.*, (1973) found that defoliation during late anthesis reduced seed yield and that leaves of both *B. napus* and *B. campestris* were exporting labelled assimilates to the seed during the late anthesis period. Mendham *et al.*, (1981) found that reduced plant density resulted in increased produce in an altered plant with increased branching whereas Bowerman & Roger-Lewis (1980) reported that population densities from 38 to 182 plants per m^2 gave similar yields by adjusting secondary branching showing that rapeseed plants can compensate for low or high plant populations.

Effect of time of topping on seed weight and seed yield: The check and the secondary branches removal treatments produced heavier seed weights and seed yield than the

Table 4. Effect of topping period on 1000-seed weight (g) and seed yield under barani (rainfed) conditions crop sown at three dates.

Ratooning	1000-seed weight (g)			Seed yield (kg/ha)		
Treatment	May 11	May 29	June 14	May 11	May 29	June 14
Check	4.04	3.20	2.28	951	746	199
Prebud	3.41	3.03	1.86	248	217	83
Bud	3.20	2.64	*	326	84	*
First Fl.	3.00	2.73	*	114	180	*
Sec. Br.	4.21	4.30	2.33	1180	744	236
LSD (0.05)	0.39	0.37	0.40	242	139	139

* No plant development after topping, so no data recorded.

other treatments, but the seed weight was greatly reduced as the planting was delayed i.e., June, 29 which could be the result of high temperature at later stage of the crop development.

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