Pak.J.Bot., 25(2): 127-133, 1993.

RELATIVE EFFECT OF WEEDS ON TOPPING AND RATOONING RAPESEED (*BRASSICA NAPUS* L.)

RAHMAT ULLAH KHAN, H. HENNING MUENDEL[1] AND M. FAYYAZ CHAUDHRY[2]

Arid Zone Research Substation, Agriculture Research Institute, Dara Ismail Khan, Pakistan.

Abstract

Experiments were conducted with Westar rapeseed (*Brassica napus* L.) to determine the effect of weeds at different growth stages on topping dry matter and seed yield of ratooned crop. Dry matter yield of weed-free plots was greater than that of weedy plot; this was most pronounced with topping at the bud stage and at first flower. At the earlier topping stages, the crop dry matter was more than that of the oats, indicating greater early season growth of the rapeseed than of the oats. Early topping between pre-bud and bud stage allowed competition from the weeds for the longest period of time and resulted in the lowest seed yield and highest weed dry matter as compared to crop topped late at first flower (3/4 plant cut) or removal of secondary branches, even lowest in the check plots (un-topped). The removal of secondary branches produced highest seed yield over all treatments including check plots under both weedy and weed-free conditions but was worst for topping dry matter.

Introduction

In Pakistan, rapeseed/mustard has several uses. The seed is commonly used as an oilseed. However, during early growth stages, while the crop is fresh and green, the top growth is frequently removed by topping and used or sold for fodder. Furthermore, at the bud stage, the tender shoots are frequently used as a culinary specially for people, known locally as 'saag' (Khan *et al.*, 1987).

Raut & Ali (1986) report partial defoliation and detopping of mustard for feeding the leaves and top growth to lambs in India. Harper & Compton (1980) indicated that brassica crops, used as a forage for autumn grazing, provided an acceptable feed of high nutritive value compared to conserved grass and at a relatively low cost.

In India defoliation of 50% of the lower leaves of mustard, partial detopping of 50% top growth 45 and 60 days after sowing, or compelte detopping to ground level at 45 days after sowing, all considerably decreased seed yield (Raut & Ali 1986). However, the returns from yield of fresh fodder completely compensated for the loss of seed yield in the defoliation and partial detopping treatments. Plants with more than 60% of pods or buds removed resulted in reduced yield in U.K., (Williams & Free 1979). Early pod or bud removal sometimes caused less yield losses than did late removal.

Defoliation upto 14 days before anthesis led to reduced number of flowers per plant, plant height, branch numbers, seeds per pod, seed size, seed yield, oil and protein yield (Labana *et al.*, 1987). One of the major factors that greatly reduces yield in oil seed is infestation with weeds where from 18 to 76% has been reported (Rao 1987). According to Lutman (1984) and Ward & Askew (1984), volunteer cereals are particularly competitive with repeseed plants.

[1]Research Scientist, Agriculture Canada Research Station, P.O.Box 300 Main, Lethbridge, AB T1J 4B1 Canada.
[2]Assistant Professor, Biology Deptt., Quaid-i-Azam University, Islamabad, Pakistan.

Table 1. Weed population density and their dry weight at crop maturity topped at several stages during 1988-89 and 1989-90 (rainfed conditions).

Ratooning Treatment	Weed density/m^2		Weed dry weight/m^2 (g)	
	A. sativa	*M. indica*	*A. sativa*	*M. indica*
		1988-89		
Check	37	13	180.9	25.2
Prebud	122	12	839.1	42.1
Bud	117	39	544.2	72.3
First F1.	58	21	292.1	24.4
Sec. Br.	78	14	375.7	25.6
LSD (0.05)	52	NS	272.7	NS
		1989-90		
Check	75	42	193.3	10.3
Prebud	137	60	360.8	14.8
Bud	140	68	327.0	16.6
First F1.	144	40	321.2	9.8
Sec. Br.	67	29	160.6	7.1
LSD (0.05)	24	12	30.2	3.1

The present study was undertaken to determine the effect of weeds at different growth stages, on green and dry tops and seed yield of the ratooned crop of rapeseed (*Brossica napus* L.) as compared to check (un-topped crop).

Materials and Methods

Field trials were established at the National Agricultural Research Centre (NARC), Islamabad on October 15, 1988 (rainfed) and October 15 and 18, 1989 (rainfed and irrigated). *B. napus* rapeseed cv. Westar with a seeding rate of 4 kg/ha was used. The trial fields were cultivated with a sweep-tyned cultivator to a depth of 10-15 cm. Ninety kg/ha of N and 30 kg/ha of P were applied, using a modified Naeem *rabi* drill (Naeem & Co., Faisalabad, Pakistan) with fertilizer attachment, in bands 12-15 cm deep in rows 22 cm apart perpendicular to the direction of seedling. The fertilizer was a blend of urea (46-0-0) and diammonium phosphate (18-46-0). Final preparation of the seedbed was accomplished by harrowing twice with a diamond harrow, followed by a wooden plank. Trials were laid out in a split-plot design with five replications, with the main plots being weed condition (weedy or weed free) and sub-plot being the topping treatments during both the years respectively.

For all seeding an Oyord plot drill equipped with six openers spaced 30 cm apart, at a depth of 2-3 cm. was used. Just prior to seeding, the irrigated trial received an irrigation of approximately 75 mm whereas the rainfed trial received 33 and 17 mm rain prior to planting in October in 1988 and 1989 both the years respectively. The ratooning treatments were as follows:

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

Topping for fodder and seed yield from ratooned crop was carried out on the four central rows in each plot. Weeds assessment were made at the time of topping and again one week to ten days prior to seed harvest, two 1 m quadrats were placed in central areas of each plot at random, and the major weed species and their dry weights in this area determined by counting, oven drying and weighing. This timing of weed competition determining weed populations permitted an assessment of maximum competition provided by the weeds to the crop on the impact on dry weights at topping and seed yields at maturity, respectively. At maturity, avoiding border rows, the plots were hand harvested by sickle and allowed to dry in the field. Seed yield was determined by weighing seed of each plot. Data were subjected to the analysis of variance (ANOVA) and LSD calculated for comparisons among means (Steel & Torrie, 1980).

Results and Discussion

Weeds and topping dry matter and seed yield: The three trials, which had effective weedy and weed-free treatment comparisons, were 1988-89 rainfed and 1989-90 rainfed and irrigated. The heaviest weed infestation occurred in the 1988-89 rainfed trial, in which volunteer oats (*A. sativa*) was the dominant species (Fig.1).

Dry matter yield of weed-free plots was greater than that of weedy plots, this was most pronounced with topping at the bud stage and at first flower. At the earlier topping stages, the crop dry matter was more than that of the oats, indicating greater early-season growth of the rapeseed than that of oats. With topping at first flower, the dry matter of

Table 2. Weed population density and their dry weight at crop maturity topped at several stages during 1989-90 (Irrigated conditions).

Ratooning Treatment	Weed density/m^2			Weed dry weight/m^2 (g)		
	Cynd a	Sorg b	Fum c	Cynd a	Sorg b	Fum c
Check	9	37	10	9.5	5.2	4.9
Prebud	11	31	8	11.7	7.5	8.5
Bud	13	23	9	14.7	10.5	6.7
First. Fl.	10	39	7	11.6	9.6	7.4
Sec. Br.	8	24	8	7.6	6.6	5.5
LSD (0.05)	3	10	NS	2.9	2.1	3.5

* *Cynodon dactylon*, ** *Sorghum halepense*, *** *Fumaria indica*

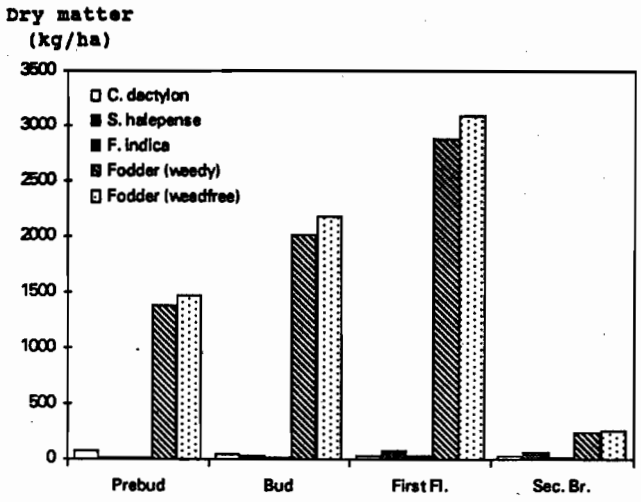

Fig.1. Dry matter yield of weedy and weed free rapeseed and dominant weeds at several topping stages. Location: Islamabad (Rainfed), 1988-89.

oats exceeded the dry matter of the toppings in the weedy treatment (Fig.1). The effect of the topping treatments on topping dry matter yield was greater than that of weed competition *per se* (Fig.1).

In the 1989-90 rainfed trial with weeds, oats also dominated the *Melilotus indica* (Fig.2). Rapeseed dry matter yield was greatest at bud stage and at first flowering, followed by topping at the pre-bud stage. In all cases the weed-free plots produced greater rapeseed dry matter than the weedy plots. In the 1989-90 irrigated trial, weed growth was weak, but the three dominant species identified were: *Cynodon dactylon*, *Sorghum halepense* and *Fumaria indica* (Fig.3). The rapeseed dry matter yield was higher in the weed-free than in the weedy plots; with topping at first flower producing the highest yield, followed by topping at the bud stage, followed by topping at the pre-bud stage.

Effect of weed competition on the seed yield of ratooned crop: In the 1988-89 rainfed trial, weed-free plots produced higher seed yields than the weedy treatments for all topping treatments (Table 3), being 32% higher for the check, 135% for pre-bud topping, 123% for topping at bud stage, 40% for topping secondary branches at first flowering, and 45% for topping at first flower. These findings agree with the previous work where detrimental effect of increased weed and volunteer cereal competition on rapeseed yield was found (Ohlson, 1976; Marshal *et al.*, 1989).

Weed density and dry matter production was measured from one week to ten days before harvesting of the crop which was gradually increased with early topping (pre-bud) followed by bud and first flower stage as the canopy of the crop was reduced whereas the dry weight of the weeds declined with delays in topping, being the lowest in the untopped check (Table 1).

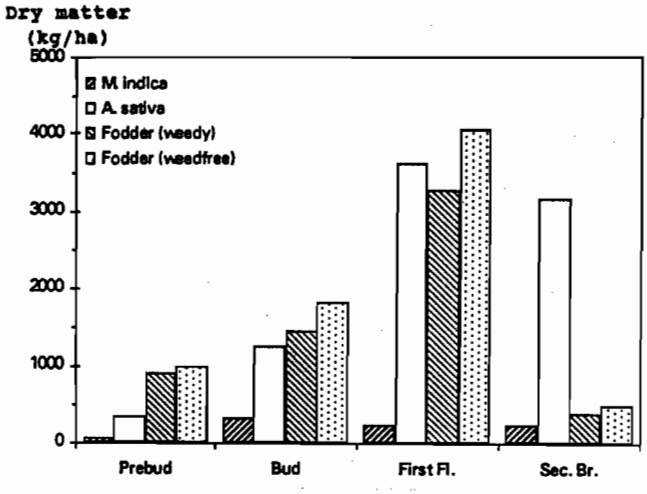

Fig.2. Dry matter yield of weedy and weed free rapeseed and dominant weeds at several topping stages. Location: Islamabad (Rainfed), 1989-90.

Topping permitted established weeds to grow with little competition from the rapeseed crop until the rapeseed ratooned. Early topping allowed competition from the weeds for the longest period of time and resulted in the lowest seed yield and highest weed dry matter as compared to crop topped at first flower (3/4 plant cut) or removal of secondary branches (Table 1). This observation is in agreement with the findings of Kondop *et al.*, (1983), Eplee *et al.*, (1968) and Mani *et al.*, (1981) who found that competition from weeds is most severe from early upto 5-6 weeks after sowing.

In 1989-90 (rainfed) trial, the seed yield increases were slightly higher ranging from 6 to 32% for weed-free treatments than for weedy treatments (Table 3). It could be due to suppression effect of crop on weed growth as indicated by the weeds dry matter near harvest as compared to the 1988-89 rainfed trial (Tables 1). Kumar & Sing, (1989) reported 24 to 70% yield reduction in mustard due to the presence of weeds, depending upon the type of weeds, intensity of weed growth and time of their occurrence.

In 1989-90 (irrigated) crop there were no significant yield differences among all the topping treatments in weedy and weed free conditions (Table 3). The weed infestation was low in 1989- 90 (irrigated) and the weeds did not overgrow rapeseed plants and gained lower biomass, though their competitive effect was not so high as to make any significant difference (Table 2).

Results based on three weedy trials showed yield reduction by weed infestation in the range of 49-58% as the crop was topped early between pre-bud to bud stage, delay in topping showed lower yield reduction, even lowest in the check plots (Table 3). These findings agree with previous reports of Goudy (1972) and Dew (1972) who found that wild oats are capable of reducing rapeseed yield by more than 60-70.

Table 3. Effect of weeds on seed yield of the ratooned crop of rapeseed during 1988-89 and 1988-90.

Ratooning Treatment	Seed yield (kg/ha) 1988-89 W	(R.F) W.F	1989-90 W	(R.F) W.F	1989-90 W	(Irrig) W.F	Av % inc over weedy
Check	1481	1953	1271	1428	1419	1551	18
Prebud	670	1575	937	1007	1041	1088	49
Bud	499	1112	987	1090	595	832	58
First F1.	833	1207	1166	1239	523	673	27
Sec. Br.	1446	2026	1294	1713	1620	1626	24
LSD (0.05)	112		127		NS		

All the topping treatments reduced the seed yield than the check plots except in the treatment where the removal of secondary branches significantly produced higher yield over all treatments apart from the check plots in all three trials under both weedy and weed-free conditions. Generally, this treatment appeared to the best over all treatments including check plots (Table 3).

This demosntrates the capability of the primary branches to compensate for potential yield loss from the removed branches by increasing yield in the remaining reproduc-

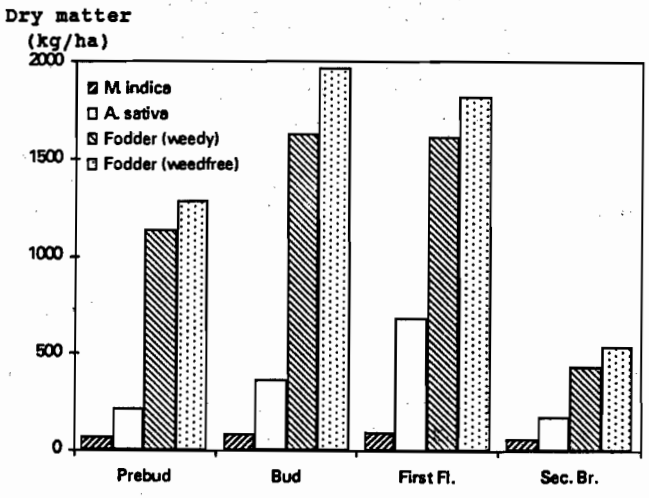

Fig.3. Dry matter yield of weedy and weed free rapeseed and dominant weeds at several topping stages. Location: Islamabad (Irrigated), 1989-90.

tive structures. Ancha & Morgan (1987) also found that removal of lower-positioned relatively unproductive branches in *B. napus*, at anthesis, led to stronger development of the remaining inflorescences and increased the seed yield. They hypothesized that the effect is achieved by making more carbon assimilates available to the upper inflorescences at times when the important yield components of pod and seed numbers are being determined.

References

Ancha, S. and D.G. Morgan. 1987. Branch removals and their effect on pod and seed yields in oilseed rape (*Brassica napus* L.). In: *7th Rapeseed Congress, Poznan*, 11-14 May, 3: 713-718.

Dew, D.A. 1972. Effect of wild oat density on yields of wheat, barley, rape and flax. *Proc. N. Cent. Weed Control Conf.*, p.38.

Eplee, R.E. and G.C. Klingman. 1968. Effect of corn population and Simazine on weed growth. *Agron. J.*, 60: 87-89.

Goudy, K. 1972. Weeds and voluntary crop control. In: *Proc. 5th Ann. Meeting Rapeseed Association Canada*. pp. 30-32.

Harper, F. and I.J. Compton. 1980. Sowing date, harvest date and the yield of forage brassica crops. *Grass and Forage Science*, 35: 147-157.

Khan, A.R., M. Munir and M. Aslam-Yousaf. 1987. *Rape and Mustard in Pakistan*. Pakistan Agricultural Research Council, Islamabad, pp. 141-179.

Kondap, S.M., Y.V. Narsimamurthy and P. Venugupal. 1983. More oilseeds through weed control. *Indian Fmg.*, 33: 24-25.

Kumar, A. and R.P. Singh. 1989. Agronomic investigation on rapeseed and mustaard at Pantnagar. *Brassica Sub-NetWork Meeting* G.B. Pant University of Agric. and Technology, Pantnagar, District, Nainital. Jan 4-6.

Labana, K.S., S.S. Banga and K. Gandhi. 1987. Source Sink Manipulation and its implication on biomass productivity in *Brassica. 7th Int. Rapeseed Congress, Poland.* Proc. 3: 719- 723.

Lutman, P.J.W. 1984. The effect of weed competition on the growth and yield of oilseed rape. In: *Aspects of Applied Biology.* 6. Agronomy, physiology, plant breeding and crop protection of oilseed rape, pp. 209-220.

Mani, V.S., K.C. Gautam and Bhagwan Das. 1981. A study of direct and residual effect of herbicide in potato-wheat relay. *Indian J. Agron.*, 26: 180-183.

Marshall, G., I.N. Morrison, L. Friesen and W. Rother. 1989. Effect of volunteer wheat and barley on the growth and yield of rapeseed. *Can. J. Plant Sci.*, 69: 445-453.

Ohlsson, I. 1976. Effect of row spacing on quality of spring rape and spring turnip rape. *Lantbrukshogskolans Medd.*, 55: 253.

Rao, J.V. 1987. *Weed management in oilseed crops*. Proc. Pak-Indo-US Weed Control Workshop and First Annual Conference of the Pakistan Society fo Weed Science, Pakistan Agric. Research Council, Islamabad, March 11-14, pp. 135-145.

Raut, M.S. and M. Ali. 1986. Studies on defoliation and detopping in mustard under rainfed conditions. *Indian J. Agron.*, 31: 252-255.

Steel, R.G.D. and J.H. Torrie. 1980. *Principles and procedures of statistics. A biometric approach.* McGraw-Hill, New York, pp. 481.

Ward, J.T. and M.F. Askew. 1984. The control of annual grass and broad-leaved weeds in winter oilseed rape. *Aspects of Applied Biology* 6. Agronomy, physiology, plant breeding and crop protection of oilseed rape, 239-250.

Williams, H. and J.B. Free. 1979. Compensation of oilseed rape (*Brassica napus* L.) plants after damage to their buds and pods. *J. Agric. Sci.*, (Camb.) 92: 53-57.

(Received for Publication 12 April 1993)