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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 5(10): 1017-1020, 2002

Performance of Late Sown Rapeseed-mustard under Variable Management Levels

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Abstract: An experiment was conducted to find a suitable management practice to boost up the yield of late sown rapeseed-mustard. The results revealed that mustard variety "Dhali (*Brassica campestris*)" yielded the highest and it was significantly different from those of Daulat (*B. juncea*) and BARI sharisa-8 (*B. napus*). Seed yields of Daulat and BARI sarisha-8 were statistically similar. Three management practices (low, medium and high) were significantly different from each other in respect of seed yield. However, high management practice gave the highest seed yield and the low management practice yielded very poor. However, Dhali gave the highest gross return, net return and benefit cost ratio under high management practice. All the three varieties showed better performance in terms of economics under high management practices.

Key words: Rapeseed-mustard, late sown, management levels, Dhali, Daulat

Introduction

A huge amount of foreign currency expenses in each year for importing the same to meet the national demand shortfall, as available, of edible oil in Bangladesh is about 10 g/head/day against the balanced nutritional requirement of 22g/head/day. There is a big scope of increasing oilseed production through cultivation of high yielding varieties as well as adopting proper management practices. Rapeseed-mustard is the main source of edible oil in Bangladesh in respect of both acreage and production (Anonymous, 1999). The production and yield per acre of mustard are far below the potential yield in Bangladesh. Seed yield of mustard was influenced remarkably by date of sowing (Saran and Giri, 1987) and reduced gradually by 11.7, 21.5, 43.4 and 62.9%, respectively for each week delayed sowing after 2nd November (Rahman *et al.*, 1993). Application of fertilizer has a positive effect in increasing the seed yield of rapeseed-mustard (Ali *et al.*, 1976; Mondal and Gaffer, 1983; Anwar and Islam, 1989). Winter, the rapeseed- mustard growing season being usually dry, the yield of these crops could be increased through irrigation (Siag *et al.*, 1993). Weed sometimes also become a serious problem with fertilization and irrigation to reduce the yield considerably. Aphid infestation had also highly significant correlation with cultural practices like date of sowing, nitrogen levels & number of irrigation (Kalra, 1987). Kalra *et al.* (1983) found that seed yield could be increased through spraying insecticide to control aphid population. Management practices influenced remarkably the yield and yield attributes of rapeseed-mustard sown under optimum condition (Mondal *et al.*, 1995). Modern varieties are generally responsive to better management practices. A comprehensive management practice could improve the productivity of mustard sown late. A large area of land goes under late-sown condition because of late harvest of transplant aman rice (beyond the month of November) and recession of flood water in Bangladesh. As consequences, farmer harvests a poor yield. Seed yield of mustard per unit area of this crop could be increased under late-sown condition with better management practices. After harvest of this late-sown mustard the farmers easily go for boro rice cultivation. Thus inclusion of mustard in the fallow period of the existing cropping pattern t.Aman-Fallow-Boro will increase the cropping intensity as well as the total crop production. Information is still meager regarding these aspects. Therefore, a research work was under taken to study the effect of different management levels on the performance of rapeseed-mustard sown late.

Materials and Methods

The experiment was conducted at the Regional Agricultural Research Station, Jessore, during two consecutive rabi seasons (1995-96 and 1996-97) to determine a management practice suitable for minimizing seed yield loss of rapeseed-mustard under late-sown condition. Three varieties viz. Daulat (*Brassica juncea*), Dhali (*B. campestris*) and BARI sarisha-8 (*B. napus*) and three management practices viz. low (Fertilizer rate: 60-40-30-10 kg ha^{-1} of NPKS, respectively + No irrigation + No weeding + No use of insecticide + No use of fungicide), medium (Fertilizer rate: 100-60-45-20 kg ha^{-1} of NPKS, respectively + one weeding cum thinning at 21 DAS + insecticide (Malathion/Nogos) spray only at time of aphid infestation + one irrigation at 21 DAS + Fungicide (Rovral 50WP) spray only during disease prevalence) and high (Fertilizer rate: 140-80-60-30 kg ha^{-1} of NPKS, respectively + two irrigations-one at 21 DAS and another at 42 DAS + two hand weedings at 21 and 42 DAS + insecticide (Malathion/Nogos) spray at every 20 days interval from 20 DAS of crop up to harvest + Fungicide (Rovral 50WP) spray at every 20 days interval from 20 DAS of crop up to harvest) were included in the experiment. Design of the experiment was RCB (Factorial) with three replications. Seeds were sown on November 28, 1995 and December 2, 1996 @ 8 kg ha^{-1} (optimum sowing time 15 Oct.-15 Nov). Spacing maintained between the line was 25 cm. Weeding was done as per treatment. Only 1st weeding at 21 DAS was done in high management practice because of more canopy development of the crops at 42 DAS. All fertilizers were applied as basal during final land preparation in low management practices. Half N and full dose of PKS was applied as basal during final land preparation and the remaining ½ N was top dressed during irrigation in medium management. Under high management practice ½ N and all other fertilizers were applied as basal. The rest ½ N was top dressed into two installments during 1st (1/4th) and 2nd irrigation (1/4th N). Urea, triple superphosphate, muriate of potash and gypsum were used as the source of NPK & S, respectively. Medium management practice required 3 times spray of insecticide and fungicide in the latter growth stages of crop. At maturity ten plants were selected from each unit plot randomly to collect data on yield attributes. Yield data were calculated from an area of 8 m^2. Data were also collected on kinds, number and dry weight of weeds/m^2. Collected data were analyzed statistically and mean separation was done using Duncan's multiple range test (DMRT) with the help of computer package programme Mstat-C developed by Russell (1986). A partial budget analysis was also done.

Results and Discussion

The weed species, which infested the crop were *Cyperus rotundus*, *Cynodon dactylon*, *Eleusine indica* and *Dactyloctenium aegyptium*, which constituted the major weed population. The most predominant weed species was *Cyperus rotundus*, which

constituted 91 and 80% of the total weed vegetation in 1995-96 and 1996-97, respectively. Intensity of weed infestation (Table 1), weed population/m^2 at weeding and weed dry weight (g/m^2) at weeding and at harvest (Table 2) were lower in the second year than the first. However, weed dry weight both at weeding and at harvest was recorded the highest in Dhali irrespective of management levels while BARI sharisha-8 had the lowest (Table 2). Weed population/m^2 and weed dry weight differed significantly in both the years at harvest due to management practices irrespective of varieties. Weed population was reduced significantly with medium and high management levels. Both weeding and better canopy development of the crop under these two management practices probably suppressed the growth of weed species. Weed dry weight at weeding did not show significant variation in 1996-97 but varied significantly in 1995-96 to management levels. The highest weed dry weight at weeding was recorded from high management practices. The initial growth of weed in high management practices was enhanced due to the application of higher doses of fertilizers as well as weed removed higher amount of applied nitrogen resulting in higher growth and dry matter of weeds. Gruzev and Statarov (1967) obtained similar results and opined that fertilizer enhanced the growth of weeds. Besides, in low management no weeding was done at all. As a result weed population and dry weight of weed in low management could be increased specially at harvest compared with other management practices. Interaction effect of variety and management levels was non-significant for weed population/m^2 and weed dry weight (g/m^2) during both years.

Yield and yield components

Effect of variety: All the characters except straw yield in 1995-96 differed remarkably among the varieties irrespective of management levels (Table 3). The tallest plant stature and the highest number of siliqua/plant were found in Daulat during both years. The shortest plant stature was found in BARI sarisha-8 while the lowest number of siliqua/plant was observed in Dhali. In 1995-96 BARI sharisha-8 had the highest number of seeds/siliqua (22.0) which was statistically similar to that of Dhali (21.7) but in 1996-97 Dhali produced the highest number of seeds/siliqua (26.8) which was significantly different from those of other two varieties. The lowest number of seeds/siliqua was recorded in Daulat during both the years. Similar trend was recorded for 1000-seeds weight. The highest seed yield was produced in Dhali and the lowest in BARI sarisha-8 during both years. Seed yield in Dhali was mainly attributed to the higher number of seeds/siliqua and 1000-seeds weight. Daulat also produced statistically similar seed yield to that of BARI sarisha-8. Daulat failed to compensate seed yield inspite of highest number of siliqua/plant that might be due to the lowest number of seeds/pod and small seed size. Mondal *et al.* (1995) also observed yield variation among the mustard varieties (Tori-7, Daulat and SS-75) irrespective of management levels. Straw yield did not significantly differ in 1995-96 but in 1996-97, Daulat and BARI sarisha-8 being at par produced significantly higher straw yield than that of Dhali. Days to maturity was 86 for both Daulat and BARI sarisha-8 while Dhali was 2 days earlier in 1995-96. Similar trend was also found in 1996-97 for days to maturity.

Effect of management: All traits varied significantly due to variation in management practices (Table 3). However, the lowest values for all characters studied were recorded in low management practice while those increased sharply with the improvement of management levels. Different management practices differed significantly from each other in terms of seed yield in both years. The crop plants under medium and high management practices received better nutrition and intercultural operations like weeding, thinning, fertilization, irrigation, pest control measures etc. These

Table 1: Infesting species of weed in rapeseed-mustard with their intensity of infestation

		Weed population/m^2		Percentage of total weed vegetation		Intensity of weed infestation	
Name of weed species	Family	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97
Cyperus rotundus	Cyperaceae	469.8	302.7	91.22	80.10	5.50	3.54
Cynodon dactylon	Gramineae	23.4	9.3	4.54	2.46	0.30	0.11
Eleusine indica	Gramineae	2.3	9.1	0.45	2.41	0.03	0.11
Dactyloctenium aegyptium	Gramineae	15.6	6.2	3.03	1.64	0.20	0.07
Others	--	3.9	50.6	0.76	13.39	0.05	0.59
Total	--	515.0	377.9	100.0	100.0	6.08	4.42

Table 2: Effect of rapeseed-mustard variety and management level on the population and dry matter production of weed under late sown condition during rabi (winter), 1995-96 and 1996-97

	Weed population/m^2				Weed dry weight (g/m^2)			
	At weeding		At harvest		At weeding		At harvest	
Treatments	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97	1995-96-	1996-97
Varieties								
Daulat (V_1)	859.00	384.00	180.00	189.00	201.2	90.0	35.8	35.2
Dhali (V_2)	865.00	378.00	197.00	196.00	218.2	95.2	38.8	38.3
BS-8 (V_3)	814.00	371.00	152.00	144.00	179.8	82.1	32.2	20.9
Level of significance	NS	NS	NS	NS	NS	**	NS	*
Management levels								
Low (M_1)	831.00	372.00	221.00a	238.00b	196.3b	87.8	64.7a	64.9
Medium (M_2)	836.00	378.00	212.00b	128.00b	194.4b	89.1	30.4b	12.9
High (M_3)	856.00	383.00	96.00b	163.00a	205.0a	90.4	11.8c	16.6
Level of significance	NS	NS	**	**	*	NS	**	**
CV(%)	13.00	7.16	20.30	18.30	19.90	7.20	24.60	24.68

Notes for all tables: NS indicates non-significant, ** significant at 1% level and * significant at 5% level

Table 3: Yield and yield attributes of late sown rapeseed-mustard as influenced by varieties and management levels during rabi 1995-96 and 1996-97

	Plant height (cm)		Siliqua/plant		Seed/ siliqua(no.)		1000 seeds wt. (g)	
Treatments	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97
Varieties								
Daulat	111.3a	117.9a	83.00a	87.00a	13.2.00b	13.2c	1.33b	2.08c
Dhali	100.8b	99.2b	31.00b	31.00c	21.7.00a	26.8a	2.47a	3.21a
BS-8	98.1b	93.1c	47.00b	46.00b	22.0.00a	23.8b	2.13a	3.00b
Level of significance	*	*	**	**	**	**	**	*
Management levels								
Low	85.1c	84.4	26.00c	26.00c	16.8.00b	16.7b	1.31c	2.33c
Medium	104.3b	108.9	59.00b	57.00b	18.5.00b	23.0a	1.93b	2.87b
High	120.7a	116.9	96.00a	81.00a	21.7.00a	24.1a	2.69a	3.10a
Level of significance	*	**	**	*	**	**	**	*
CV(%)	4.08	3.42	15.4	12.05	11.2	7.37	19.0	4.61

Table 3: Contd.

	Seed yield (kg ha^{-1})		Straw yield (t ha^{-1})		Days to maturity	
Treatments	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97
Varieties						
Daulat	846.00b	1221.00b	3.35	3.14a	86	85
Dhali	1037.00a	1556.00a	2.98	2.52b	84	83
BS-8	782.00b	1211.00b	3.17	3.11a	86	85
Level of significance	**	**	NS	**	--	--
Management levels						
Low	143.00c	290.00c	1.64c	2.28c	77	76
Medium	857.00b	1567.00b	3.17b	3.08b	86	84
High	1665.00a	2132.00a	4.70a	3.41a	93	92
Level of significance	**	**	**	**	--	--
CV(%)	16.7	6.94	15.4	8.64	--	--

Table 4: Interaction effects of variety and management level on the yield and yield components of late sown rapeseed-mustard during rabi 1995-96 and 1996-97

	Plant height (cm)		No. of siliqua/plant		No. of seeds/siliqua		1000-seeds weight (g)	
Treatments	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97
V_1 M_1	93.6	105.3cd	33.00c	39.00ef	12.3d	11.8d	0.80e	1.90e
M_2	110.8	12.20a	97.00a	90.00b	13.6d	13.7d	1.27de	2.00e
M_3	129.4	126.4a	120.00a	132.00a	13.7d	14.2d	193.0bcd	2.33d
V_2 M_1	78.2	83.0e	20.00c	19.00g	19.6bc	20.1a	1.47de	2.70c
M_2	102.5	103.6d	30.00c	29.00fg	19.0bc	30.0a	2.20bc	3.37ab
M_3	121.5	111.0bc	44.00bc	45.00de	26.5a	30.2a	3.73a	3.57a
V_3 M_1	83.4	64.8f	25.00c	20.00g	18.5c	18.1c	1.67cd	2.40d
M_2	99.5	101.0d	50.00bc	52.00d	22.8ab	25.3b	2.33bc	3.23b
M_3	111.3	113.3b	65.00b	67.00c	24.9a	27.9ab	2.40b	3.37ab
Level of significance	NS	**	**	**	**	**	**	**
CV(%)	4.8	3.4	30.0	12.1	11.2	7.4	19.0	4.6

Table 4: Contd.

	Seed yield (kg ha^{-1})		Straw yield (t ha^{-1})		Days to maturity	
Treatments	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97
V_1 M_1	155.00	344.00e	1.74	2.04 d	76	75
M_2	856.00	1455.00d	3.13	3.48 ab	87	86
M_3	1528.00	1865.00c	5.18	3.91 a	95	94
V_2 M_1	178.00	355.00e	1.41	2.02 d	77	76
M_2	933.00	1823.00c	3.21	2.67 c	83	82
M_3	2000.00	2490.00a	4.33	2.87 c	92	91
V_3 M_1	96.00	170.00f	1.76	2.79 c	78	77
M_2	783.00	1424.00d	3.18	3.10 bc	87	86
M_3	1467.00	2040.00b	4.58	3.46 ab	93	91
Level of significance	NS	**	NS	**	-	-
CV(%)	16.7	6.9	15.4	8.6	-	-

might favorably enhance the growth and development of crop plants of medium and high management practices and eventually resulted in better seed yield. However, the crop under high management practice produced the highest seed yield ascribed to the highest number of siliqua/plant, seeds/siliqua and 1000-seeds weight during both years. The seed yields in high management were about two, and one and half fold higher than medium management practice during 1995-96 and 1996-97, respectively. The low management practice yielded very poor probably due to drastic reduction in all yield contributing characters. Such findings have also been obtained by Mondal *et al.* (1995). They observed a significant variation in all traits of rapeseed mustard with different management practices under optimum sowing conditions and the high management practice produced the highest seed yield. Days to maturity were also maximum in high management while it was minimum in level management practices.

Table 5: Partial budget analysis of late sown rapeseed-mustard under different management levels during winter 1995-96 and 1996-97

	Value of the product (Tk ha^{-1})				Cost of cultivation (Tk. ha^{-1})		Gross return (Tk. ha^{-1})		BCR (Tk. ha^{-1})			Net return (Tk. ha^{-1})	
	Seed		Straw										
Treatments	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97	Mean	1995-96	1996-97
Daulat													
Low	2790	6192	435	510	5313	5846	3225	6702	0.61	1.15	0.88	-2088	856
Medium	15408	26190	783	870	15295	23531	16191	27060	1.06	1.15	1.11	896	3529
High	27504	33570	1295	978	20499	30864	28799	34548	1.40	1.12	1.26	8300	3684
Dhali													
Low	3204	6390	353	505	5780	5733	3557	6895	0.62	1.20	0.91	-2223	1162
Medium	16794	32814	803	668	15371	23720	17597	33482	1.14	1.41	1.28	2226	9762
High	36000	48200	1083	718	20539	31486	37083	45538	1.81	1.45	1.63	16544	14052
BS-8													
Low	1728	5060	440	698	5265	5650	2168	3758	0.41	0.67	0.54	-3097	-1892
Medium	14094	25632	795	775	15289	23274	14889	26407	0.97	1.13	1.05	-400	3133
High	26406	36720	1145	865	20375	31028	27551	37585	1.35	1.21	1.28	7176	6557

Price:

1996-97 :

Mustard	:	Tk. 18/= per kg	Straw	: Tk. 0.25 per kg
Irrigation	:	Tk. 1500/= per ha	Labour	: Tk. 55/= per day
Urea	:	Tk. 5/50 per kg	Nogos 100EC	: Tk. 27/50 per 50ml
TSP	:	Tk. 13/= per kg	Rovral 50WP	: Tk. 68/50 per 50g
MP	:	Tk. 7/60 per kg		
B.Gypsum	:	Tk. 3/50 per kg		

1995-96 :

Mustard	:	Tk. 18/= per kg	Straw	: Tk. 0.25/= per kg
Irrigation	:	Tk. 1500/= per ha	Labour	: Tk. 40/= per day
Urea	:	Tk.5/40 per kg	Nogos 100EC	: 3/30 per/kg
TSP	:	Tk. 11/50 per kg	Rovral 50WP	: 55/= per 50g
MP	:	Tk. 7/50 per kg		
Gypsum	:	3/30 per kg		

Interaction effect: Interaction effect of variety and management level produced significant variation in respect of all characters except plant height, seed yield and straw yield in 1995-96 (Table 4). However, similar magnitude of variation in terms of seed yield was observed during both years. Maximum seed yield was obtained from the variety Dhali with high management practices. A drastic yield reduction was found in low management in all varieties. Similar observation was made by Faruque *et al.* (1999). Higher number of seeds/siliqua and 1000-seeds weight were mainly associated with higher seed yield of Dhali under high management practice. Daulat had the highest straw yield that might be due the tallest plant stature than those of others under high management. Days to maturity increased with increasing management levels in all varieties.

The crop yielded better in the second year might be due to prevailing favourable weather conditions. The results also showed that the number of seeds/siliqua and 1000 seeds weight increased in the second year.

Economics: The highest gross return Tk. 37,083/= and Tk. 45,538/= per hectare were obtained from the variety Dhali with high management during 1995-96 & 1996-97, respectively (Table 5). The highest net return and benefit cost ratio were also obtained from the same combination of high management in association with Dhali. Mean of BCR over two years also recoded the highest in Dhali with high management practice. Mondal *et al.* (1995) also documented the higher profitability in rapeseed-mustard with higher management practices. The mean of BCR also indicated that cultivation of all varieties under low management was non-profitable and it was loss concerned.

From the result, it may be recommended that the variety Dhali with high management practices could be cultivated profitably under late-sown condition. After harvest of T.aman and recession of flood water the farmers may adopt this technology which could increase their income generation activity as well as total productivity of land.

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