INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2005/07–4–609–611
http://www.ijab.org

Adaptation and Yield Potential of Different Genotypes of Rapeseed and Mustard Under Agro-Climatic Conditions of Bahawalpur (Pakistan)

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ABSTRACT

The study pertaining to adaptation and yield potential of 14 genotypes of rapeseed and mustard under agro-climatic conditions of Bahawalpur region was conducted at Arid Zone Research Institute (AZRI), Bahawalpur–Pakistan. Significant differences were observed for yield (kg ha^{-1}), number of seeds per siliqua, number of siliquas per plant, secondary branches per plant and primary branches per plant. The genotype AZRI raya produced the highest seed yield of 2075 kg ha^{-1} followed by BARD-I (1729 kg ha^{-1}) and 95102/15-5 (1625 kg ha^{-1}). The genotype Con-II produced the lowest seed yield of 727 kg ha^{-1}.

Key Words: Rapeseed; Mustard; Genotypes; Adaptation; Seed Yield; Potential

INTRODUCTION

Pakistan is chronically deficient in the production of edible oil. Therefore, about three fourth of the country's requirements are met through imports, costing a huge amount in foreign exchange. It is a matter of great concern that efforts made so far to enhance the domestic production of edible oil, have not had any significant impact. One of the important factors for insignificant growth in edible oil production in Pakistan is non-replacement of traditional low yielding genotypes with the improved and high yielding genotypes of oil producing crops. Thus, edible oil production can be increased by introducing and adapting the newly developed and high yielding genotypes of rapeseed-mustard (Ozer & Oral, 1997; Sharma & Manchanda, 1997; Khan *et al.*, 1998).

In the present study, 14 improved genotypes of rapeseed-mustard were compared to find out high yielding, resistant to insects, diseases, drought tolerance, resistant to shattering and lodging under the existing climatic conditions of Bahawalpur region.

MATERIALS AND METHODS

The proposed study was conducted on clay-loam soil of Experimentation Station of Arid Zone Research Institute (PARC), Bahawalpur. The experiment was laid out according to RCBD, having three replications. A total number of 14 genotypes of rapeseed-mustard, i.e. (G_1) Dunkled, (G_2) Rainbow, (G_3) Oscar, (G_4) Westar, (G_5) Shirallee, (G_6) H-19, (G_7) Peela raya, (G_8) Goldrush, (G_9) Con-I, (G_{10}) Con-II, (G_{11}) BARD-I, (G_{12}) 95102/15-5, (G_{13}) AZRI raya and (G_{14}) P-16 were included in this study. The crop was planted in rows spaced 45 and 10 cm plant-to-plant distance. There were 10 rows in each plot having row length of 20 m. The net plot size was 4.5 x 20 m^2. The nitrogen and phosphorus were applied @ 75 and 50 kg ha^{-1}, respectively. All P_2 O_5 and one third of nitrogen were applied at the time of sowing while the remaining doses of nitrogen fertilizer were applied at 1st and 2nd irrigation. A total number of three irrigations were applied to this crop. All other agronomic practices were kept normal and uniform for all the treatments.

Data on days to 50% flowering completion, days to physiological maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of siliquas per plant and number of seeds per siliqua were recorded at different growth stages of this crop. Days to 50% flowering completion were noted from the sowing date to the time when 50% flowering was completed. Plant height was measured at physiological maturity of crop as an average from 10 randomly selected plants from each plot. The collected data were statistically analyzed by using fisher's analysis of variance technique and treatment means were compared by using LSD test at 0.05 probability level (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

The results regarding the days to 50% flowering completion did not differ among most of the genotypes; while, some differences were also recorded in few genotypes (Table I). The genotype, BARD-I has taken maximum of 110 days to 50% flowering completion, while the genotypes, Dunkled, Rainbow, OSCAR, Westar, Shirallee, H-19, Peela Raya and P-16 remained at par with one another that had taken 102 days to 50% flowering

Table I. Comparison of Means of Yield and Yield Components of Fourteen Genotypes of Rapeseed and Mustard

Code No.	Treatment/Genotypes	DFC 50%	DPM	Plant height (cm)	Primary Branches/ plant	Secondary Branches/ plant	Siliquas/ plant	Seeds/ siliqua	Seed yield kg/ha^{-1}
13	AZRI raya	90.00	132.00	189.2C	10.0 A	34.97 A	412.5 A	28.43 A	2075 A
11	BARD-I	110.00	146.00	192.7C	7.77 DEF	28.47 AB	355.5 B	27.67 A	1729 B
12	95102/15-5	94.00	146.00	196.8C	8.03 BCDF	19.27 CD	357.2 B	16.77 E	1625 B
1	Dunkled	102.00	146.00	68.07D	8.06 BCD	25.37 BC	345.7 BC	23.2 BC	1439 C
3	Oscar	102.00	146.00	60.13D	8.0 BCDEF	23.53 BC	306.8 CD	24.6 AB	1356 CD
2	Rainbow	102.00	146.00	63.87D	7.0 FG	24.13 BC	368.5 AB	22.1 BCD	1349 CD
7	Peela raya	102.00	152.00	258.2A	8.3 BCDE	23.10 BC	299.7 CD	19.7 CDE	1279 DE
5	Shirallee	102.00	146.00	64.17D	9.1 AB	22.5 BC	244.0 EF	24.87 AB	1182 EF
4	Westar	102.00	146.00	73.47D	7.76 DEF	26.2 BC	279.7 DE	22.93 BCD	1107 F
14	P-16	99.00	146.00	237.9AB	8.5 BCD	13.97 DE	340.4 BC	18.8 DE	1072 F
8	Goldrush	94.00	146.00	173.1C	7.2 EFG	14.4 DE	217.1 F	18.77 DE	863.6G
6	H-19	102.00	146.00	52.70D	8.93 ABC	10.2 E	209.1 F	26.1 AB	828.2G
9	Con-I	94.00	146.00	180.0C	7.9 CDEF	15.17 DE	263.9 DE	17.67 E	823.4G
10	Con-II	94.00	146.00	204.5B	6.4 G	14.47DE	287.5 DE	17.37 E	727.0G
	LSD	NS	NS	35.96	1.11	7.01	46.19	4.29	136.6
	CV			14.96%	8.12%	19.77%	8.99%	11.57%	6.53%

NS: Non Significant; DFC= Days to 50% flowering completion; DPM= Days to physiological maturity; CV= Coefficient of variance; Means with the same letters are not significantly different

completion; whereas, the genotypes Gold rush, Con-I, Con-II and 95102/15-5 differed from the other genotypes and remained at par with one another and had taken 94 days to complete 50% flowering. The genotype, AZRI raya had taken minimum of 90 days to 50% flowering completion. Similar findings have been reported by Kiekushkin (1992) who reported that the duration of this phase is correlated with seed weight per fertile node, branching height, number of siliquas on the central inflorescence, number of seed per siliqua and also lodging resistance.

The statistical analysis of the data revealed that days to physiological maturity were non-significantly affected by different genotypes of rapeseed and mustard (Table I). However, maximum days (152) to physiological maturity were recorded in Peela Raya, on contrary, minimum days (132) to physiological maturity were noted in case of genotype AZRI raya; whereas, all other genotypes remained at par with one another.

The rapeseed-mustard genotypes showed highly significant differences with respect to plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of siliquas per plant, number of seed per siliqua and seed yield (Table I). The results regarding plant height (cm) showed highly significant differences among different genotypes of rapeseed and mustard. The highest plant height of 285.2 cm was obtained from Peela raya followed by genotype P-16 with a plant height of 237.9 cm, on contrary the shorter plant height was recorded in genotype H-19. The genotypes Con-II, 95102/15-5, AZRI raya, BARD-I, Con-I and Gold rush remained at par with one another and statistically differed from all other genotypes. The genotypes Westar, Dunkled, Shirallee, Rainbow and Oscar were at par with one another and differed from all other genotypes (Table I). This variation in plant height might be attributed by genotypes inherent characters. These results are in line with Wright *et al.* (1995).

The analysis of data regarding number of primary branches per plant showed highly significant results among different genotypes of rapeseed and mustard. The maximum (10) number of primary branches per plant was recorded in genotype AZRI raya and the minimum (6.4) in Con-II. The genotypes Shirallee, H-19, Dunkled, P-16, Peela Raya, 95102/15-5 and Oscar remained at par with one another and statistically differed from all other genotypes. Similarly, genotypes Con-I, BARD-I, Westar, Goldrush and Rainbow remained at par with one another but statistically differed from the other genotypes (Table I). This difference in number of primary branches per plant is due to the genetic potential of the genotypes, which might contribute toward the final yield. These results are supported by Munir and Mc Neilly (1986).

The results regarding number of secondary branches per plant revealed that, the said trait was highly significantly affected by different genotypes of rapeseed and mustard (Table I). The maximum (34.97) number of secondary branches per plant was recorded in genotype AZRI raya. On contrary, the genotype H-19 produced minimum (10.20) number of secondary branches per plant. The genotypes BARD-I, Westar, Dunkled, Rainbow, Oscar and Shirallee remained at par with one another and statistically differed from all other genotypes. The genotypes 95102/15-5, Con-I, Con-II, Gold rush and P-16 remained at par with one another and statistically differed from all other genotypes included in this study. These results are support those of Sharma and Manchanda (1997).

It is indicated that there were highly significant differences in number of siliquas per plant, produced by different genotypes under study (Table I). The highest (412.5) number of siliquas per plant were obtained from the

genotype AZRI raya. On the contrary, the lowest (209.1) number of siliquas per plant were produced by the genotype H-19. The genotypes Rainbow, 95102/15-5, BARD-I, Dunkled and Westar were at par with one an other and differed from all other genotypes under study. The genotypes Oscar, Peela raya, Con-II, Westar and Con-I remained at par with one another and differed from all other genotypes under study. This character might be attributed to the genetic potential of different genotypes. These results also support those of Guohuai *at al.* (2002), and Munir and Mc Neilly (1986).

Number of seeds per siliqua contributes materially towards final yield, which often varies among different genotypes. The number of seeds per siliqua was significantly affected by various genotypes included in the study (Table I). Genotype AZRI raya produced maximum (28.43) number of seeds per siliqua and was statistically at par with the genotypes BARD-I, H-19, Shirallee and Oscar. In contrast, genotype 95102/15-5 produced minimum (16.17) number of seeds per siliqua and was at par with the genotypes Peela raya, P-16, Gold rush, Con-I and Con-II, and statistically differed from other genotypes. The number of seeds per siliquas produced by genotypes Dunkled, Westar and Rainbow were at par with one-another. These findings are in agreement with those of Guohuai *et al.* (2002).

Final seed yield is a function of the interplay of the various yield parameters. There were highly significant differences in seed yield among different genotypes of rapeseed and mustard (Table I). The mustard genotype AZRI raya produced highest yield of 2075 kg ha^{-1}. These results support those of Vollioud (1982) and Santonoceto (1997). On the other hand, the genotype Con-II produced lowest yield of 727.0 kg ha^{-1}, which did not significantly differ from Gold rush, H-19 and Con-I. These results are in line with those of Allen and Morgan (1975) and Redmann and Belyk (1994). The genotypes BARD-I and 95102/15-5 were at par with each other, but statistically differed from other genotypes of rapeseed and mustard. The genotypes Dunkled, Oscar and Rainbow remained at par with each other and statistically differed from all other genotypes. The genotypes Peela raya, Shirallee, Westar and P-16 remained at par with one another but statistically differed from the other genotypes included in this study. These results are in agreement with those of Abraham and Lal (2002). The differences in the yield of 14 genotypes were due to best performance of genotypes under the existing agro-climatic conditions of Bahawalpur and this difference in yield might be due to well adaptation and genetic potential of genotypes of rapeseed and mustard.

CONCLUSION

In the light of results obtained, it may be concluded that the genotype AZRI raya performed well under existing climatic conditions of Bahawalpur. It produced maximum seed yield of 2075 kg ha^{-1}. The results also revealed that the genotype AZRI raya performed better in case of yield components such as primary branches per plant, secondary branches per plant, number of siliquas per plant and number of seeds per siliqua. The genotype AZRI raya is a medium size, short duration and early maturing genotype of mustard. These character put together may give attributes to AZRI raya like resistant to drought, lodging, shattering, insect pest and other yield reducing factors. It is suggested to cultivate AZRI raya to obtain maximum economic return.

Acknowledgments. The principal author and his team is grateful to CSO/National Coordinator Oilseed Research Programme, NARC, Islamabad, Government of Pakistan for provision of seed of the most genotypes to conduct this study.

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(Received 20 May 2005; Accepted 10 June 2005)