Yield Performance of Different Genotypes of Mustard under Agro-Climatic Conditions of Bahawalpur, Pakistan

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Abstract: ***The study regarding yield performance of ten genotypes of mustard under agro-climatic conditions of Bahawalpur region was conducted at Experimentation Station of Arid Zone Research Institute (AZRI), Bahawalpur. Ten genotypes of mustard were tested for their yield potential under agro-climatic conditions of Bahawalpur. The objective of this study was to find out the high yielding genotypes of mustard best suited for southern Punjab. Significant differences were observed for yield Kg ha^{-1}, number of siliquas per plant, number of branches per plant, siliqua's length and thousand grains weight. The genotype AZ-raya produced the highest seed yield of 2001.2 Kg ha^{-1} followed by khanpur raya (1838.4 Kg ha^{-1}) and BARD-1 (1741.1 Kg ha^{-1}). The genotype RL-18 produced the lowest seed yield of 1380.5 Kg ha^{-1}.***

Keywords: Agro-climatic, Genotypes, Mustard, Yield.

1. Introduction

Pakistan is chronically deficient in the production of edible oil and spending huge amount of foreign exchange on its import. About 35 % of the total demand of edible oil is met through local production of oilseed crops and the remaining 65 % requirement is met through import. One disturbing aspect of this crisis issue is an annual increase in the gap between consumption and domestic production of edible oil. Edible oil is the single largest food import item, total cost involved for the import of edible oil during 2004-05 was 53.481 billion rupees, which is great burden to the national economy of the country.

In the country, after cotton, rapeseed-mustard is the second most important source of oil, but mustard is dominating species and grown on about 80 %area The total area under rapeseed-mustard is (243.00) thousands hectares with the annual production of (205.00) thousands tonnes. In the country, the average yield of rapeseed-mustard is (843) kg ha^{-1}, which is very low as compared to other countries of the world (Economic Survey of Pakistan 2004-05). By identifying and introducing the high yielding genotypes of rapeseed-mustard can increase the seed yield kg ha^{-1}. So, the replacement of traditional low yielding genotypes with the improved and high yielding genotypes is very necessary for increasing the domestic production of edible oil.

The previous studies showed that yield of rapeseed-mustard can be increased by introducing and adapting the newly developed and high yielding genotypes of rapeseed-mustard (Anjum *et al*, 2005) (Ozer and Oral, 1997), (khan *et al*, 1999), and (Sharma and Manchanda 1997). In the present study ten improved genotypes of rapeseed-mustard were compared for their yield potential, resistant to insects, diseases, drought tolerance, resistant to shattering and lodging under the existing climatic conditions of Bahawalpur region.

2. Materials and Methods

The proposed study was conducted on clay-loam soil at Experimentation Station of Arid Zone Research Institute (AZRI), Bahawalpur. The experiment was laid out according to Randomized Complete Block Design (RCBD), having three replications during Rabi season 2013-13 at AZRI Bahawalpur. A total number of ten genotypes of mustard, i.e. (G_1) AZ-raya, (G_2) Khanpur raya, (G_3) RL-18, (G_4) BARD-1, (G_5) ZBJ-96006, (G_6) RL-9, (G_7) RD-7, (G_8) KH-33, (G_9) OR-15 and (G_{10}) Varyana were included in this study. The crop was planted in rows spaced 45 cm and 10 cm plant-to-plant distance. There were 6 rows in each plot having row length of 10 meters. The net plot size was 2.7 x 10m^2. The nitrogen and phosphorus were applied @ 75 and 50 kg ha$^{-1.}$ 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 treatments.

The data on following parameters i.e. days to 50% flowering completion, days to physiological maturity, Plant height (cm), number of branches per plant, number of siliquas per plant, number of seeds per siliqua, thousand grains weight and seed yield kg ha-^{1} were recorded at different growth stages of this crop. Days to 50% flowering completion were noted from the sowing date to the time when the 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 the treatment means were compared by using LSD test at 0.05 probability level (Steel and Torrie, 1984).

3. Results and Discussion

The results regarding the days to 50% flowering completion were found non-significant among different genotypes of mustard. However, the genotype BARD-1 has taken maximum days (110) to 50% flowering completion. While, minimum days (92) to 50 % flowering completion were found in AZ-raya. Similar findings has been reported by Kukushkin-VA (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 (Table-1). The statistical analysis of the data revealed that days to physiological maturity were non-significantly affected by different genotypes of mustard. However, maximum days (155) to physiological maturity were recorded in genotype ZBJ-96006, on contrary, minimum days (127) to physiological maturity were noted in case of genotype AZ-raya (Table-1). In case of plant height, the analysis of results showed that non-significant differences were found among all tested genotypes of mustard under study. The highest plant height of 194.3 cm was noted in BARD-1, while the lowest plant of 163.5 cm was recorded in AZ-raya (Table-1). These results are contrary with Wright *et al.* (1995).

The highly significant differences were found with respect to number of branches per plant, number of siliquas per plant, siliqua length (cm), thousands grain weight (g) and seed yield kg ha^{-1} (Table-1). These findings are against with those of Wang Guohuai *et al* (2002). The results regarding number of branches per plant revealed that, the said trait was highly significantly affected by different genotypes of mustard (Table-1). The maximum number of 12.5 branches per plant was recorded in genotype AZ-raya. On contrary the genotype varyana produced (9.8) minimum number of branches per plant. The genotypes khanpur raya and RL-18, produced (11.4) and (10.8) number of branches per plant, remained at par with one another and statistically differed from all other genotypes. Where as the genotypes Kh-33, OR-15, ZBJ-96006, RL-9, RD-7 and BARD-1 produced (10.5), (10.5), (10.4), (10.0) and (9.9) number of branches per plant, remained at par with one another and statistically differed from all other genotypes included in this study. These results are in favor of Sharma and Manchanda (1997) and Munir and Mc Neilly (1986).

The statistical analysis of the data of number of siliquas per plant as affected by different genotypes of mustard is represented in tabel-1. It is indicated that there were highly significant differences in number of siliquas per plant produced by different genotypes under study. The highest number of siliquas per plant (386.3) was obtained from the genotype AZ-raya followed by BARD-1 and Khanpur raya bearing (360.2) and (357.9) siliquas per plant. On the other hand, the lowest number of siliquas per plant (315.7) was produced by the genotype Varyana and it statistically at par with the genotype RL-18 having (325.9) numbers of siliquas per plant. The genotypes OR-15, RD-71, Kh-33, RL-9 and ZBJ-96006 produced (348.7), (340.9), (340.6), (338.6) and (330.8) number of siliquas per plant, respectively and were at par with each other. This character might be attributed by genetic potential of different genotypes. These results are also supported by Wang Guohuai *at al* (2002) and Munir and Mc Neilly (1986).

Thousand grains weight contributes materially towards final yield, which varies from genotype-to-genotype. The highly significant differences among different genotypes were found regarding this character (Table-1). The maximum thousand grains weight of 5.5 g was found in genotype AZ-raya. In contrast, the lowest thousand grains weight of 3.2 g was noted in RL-9 and statistically at par with RL-18, RD-71 and Kh-33, all having the same vale (3.3 g) thousand grains weight. The genotypes Khanpur raya, BARD-1, ZBJ-96006, OR-15 and Varyana produced (4.5), (4.0), (4.0), (3.7) and (3.7) thousand grains weight (g) and remained at par with one an other and statistically differ from all other treatments.

The final seed yield kg ha^{-1} is a function of the interplay of the various yield parameters. There were highly significant differences among different genotypes of mustard (Table-1). The mustard genotype AZ-raya produced highest yield of 2001.2 kg ha^{-1}. On the contrary, the genotype RL-18 produced lowest yield of 1380.5 kg ha^{-1}, this genotype did not significantly differ from the genotype Varyana that produced yield of 1442.6 kg $ha^{-1.}$ The genotypes Khanpur raya and BARD-1 produced yield of 1838.4 and 1741.1 kg ha^{-1}, were at par with another, but statistically differ from other genotypes. The genotypes OR-15 and KH-33 produced yield of 1654.2 and 1596.4 kg ha^{-1}, remained at par with another and statistically differed from all other genotypes. The genotypes RL-9, RD-71 and ZBJ-96006 produced yield of 1494.2, 1467.3 and 1445.6 kg ha^{-1} respectively, were remained at par with one another but statistically differed from the other genotypes included this study. These results are in agreement with those of Abraham. T, and Lal R.B *et al.* (2002), Volliod (1982) and Santonoceto (1997). These results are in line with those of Allen and Morgan (1975) and Redmann *et al.* (1994) The differences in the yield of ten 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 mustard.

4. Conclusion

In the light of results obtained, it may be concluded that the genotype AZ-raya performed well under existing climatic conditions of Bahawalpur. It produced maximum seed yield of 2001.2 kg ha^{-1}. The results revealed that the genotype AZ-raya performed better incase of yield components such as number of branches per plant, number of siliquas per plant and thousand grains weight. It is proved through experimentation, the genotype AZ-raya is a medium size, short duration and early maturing genotype of mustard. Due to that good character, the genotype is resistant to drought, lodging, shattering, insect pest and other yield reducing factors

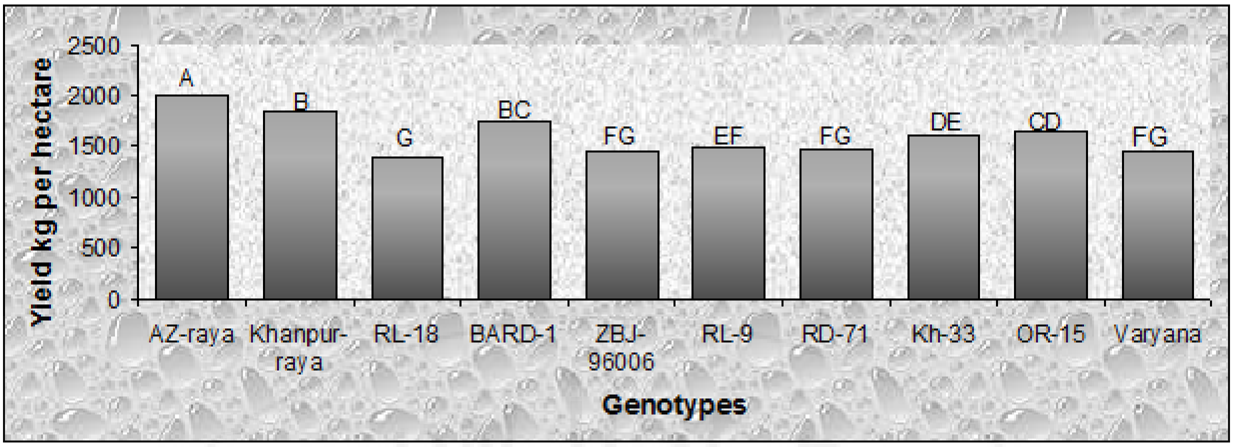

Figure 1: Yield potential of different genotypes of mustard under agro-climatic conditions of Bahawalpur, Pakistan during Rabi 2012-13.

Table 1: Comparison of Means of Yield and Yield Components of Ten Genotypes of Mustard

Treatment/Genotypes	*DFC 50%*	*DPM*	*Plant height (cm)*	*Branches / Plant*	*Siliqua's length (cm)*	*Siliquas/ plant*	*1000 Grains wt. (g)*	*Yield kg/ha^{-1}*
AZ-raya	92.00	135	163.5	12.5 A	4.4 A	386.3A	5.5A	2001.2A
Khanpur raya	98.5	140	183.4	11.4 B	4.3AB	357.9AB	4.5B	1838.4B
RL-18	94.5	140	190.6	10.8 BC	3.7D	325.9CD	3.3C	1380.5G
BARD-1	110.00	150.4	194.3	9.9 DE	4.1ABC	360.2AB	4.0BC	1741.1BC
ZBJ-96006	105	155	182.6	10.4 CDE	4.1ABC	330.8BCD	4.0BC	1445.6FG
RL-9	105	145	182.3	10.0 DE	4.0ABCD	338.6BCD	3.2	1494.2EF
RD-71	105	155	178.9	10.5 CDE	3.9CD	340.9BCD	3.3	1467.3FG
KH-33	99.5	155	178.7	10.5 CDE	3.8CD	340.6BCD	3.3C	1596.4D
OR-15	108.4	155	186.9	9.8 E	4.0ABCD	348.7BC	3.7BC	1654.2CD
Varyana	108.5	155	185.1	0.72	4.0ABCD	315.7D	3.7BC	1442.6FG
LSD	**NS**	**NS**	**NS**	**9.02**	**0.39**	**30.49**	**0.88**	**112.7**
CV					**5.73**	**12.29**	**13.44**	**4.67%**

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.

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Author Profile

Malik Muhammad Yousaf is Director (since 2012 continued) of Arid Zone Research Institute, Bahawalpur that is one of the prime multi-disciplinary institute of PARC. Established strong linkages with different international organizations, universities, research departments, NGOs and farming communities to boost-up the research activities of the institute. Reviewed the previous research activities and problem oriented research with special reference to introduction, selection and propagation of drought, heat and salinity tolerance in medicinal plants, pulses, cereals, oilseeds, arid horticultural plants, fodder crops, range grasses, shrubs and trees. In the capacity of the director AZRI as well as Principal Scientist, 10 projects have been developed and executed during last five years and 05 projects are currently undergoing at various implementation stages.