Yield Evaluation and Interrelationship between Yield Related Traits in Advance Lines of Mustard through Correlation Studies

Hafiz Saad Bin Mustafa^{1*}, Tariq Mahmood¹, Ejaz ul Hasan¹, Hafiz Saeed-ur-Rehman² and Muhammad Aftab¹

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ABSTRACT

Purpose : Pakistan is spending a large amount of foreign exchange on the import of edible oil every year. The present experiment was conducted to study the relationship between different seed yield related traits in advance lines of *Brassica juncea* developed through pedigree method of plant breeding. The seed yield performance of these advance lines was also evaluated during the experiment.

Research Method : Twelve lines were grown in Randomized Complete Block Design with three replications during September 2016. All recommended cultural practices were used throughout the experiment. The data for plant height, days to flowering, days to maturity, branches per plant, seeds per silique, seed yield per plot and oil% was collected.

Findings : The correlation analysis revealed that seed yield per plot was highly and significantly correlated with the number of branches per plant and seeds per silique. ZBJ-13006 & ZBJ-15009 produced significantly higher seed yield (2.21kg/plot) & (2.10kg/plot) respectively than the check variety AARI Canola.

Research limitations : Although the study was carefully carried out and reached its aim, environmental conditions were unavoidable limitations.

Originality/Value : The present study has clearly indicated the need for giving due weightage for the number of seeds per silique and the number of branches per plant for improving seed yield in Mustard.

Keywords: *Brassica*, Correlation, Evaluation, Silique and Seed Yield

INTRODUCTION

Mustard (*Brassica juncea* L.) is amphidiploid (AABB genome, 2n=36) and is believed to have arisen through inter-specific cross between *Brassica rapa* L. (*Brassica campestris*, genome=AA, 2n=20) and *Brassica nigra* L. (genome=BB, 2n=16). *B. juncea* belongs to the family Brassicaceae (Cruciferae). *B. juncea* originated in minor Asia and southern Iran and the center of origin is Middle East and China (Song *et al.*, 1988).

Pakistan has an agriculture based economy but

production of edible oil in the country does not meet its requirement due to increasing demand with the rapid growth of population (Mahmood, *et al.*, 2017). Consequently, a big volume of required edible oil compensates through its import (Hasan, *et al.*, 2015). The major oilseed crops in the country include Sunflower, Canola, Rapeseed/Mustard and Cotton. Total availability of edible oils during 2015-16 remained at

¹ Directorate of Oilseeds, Ayub Agricultural Research Institute, Faisalabad, Pakistan. saadpb@gmail.com

² Directorate General, Ayub Agricultural Research Institute, Faisalabad, Pakistan.

3.726 million tonnes of which local production contributed 0.462 million tonnes (14 percent) and the import share of edible oil/oilseeds was 3.264 million tonnes (86 percent). The import bill of edible oil during 2015-16 was US\$ 2.710 billion (Govt. of Pakistan, 2016-17).

Mustard is used as condiments, oilseeds and a vegetable, but in Pakistan or Indian sub-continent it is mostly grown for the purpose of edible oil (Chen *et al.*, 1997). *Brassica juncea* is important oilseed crop in Pakistan due to early maturity, non-shattering type, heat and pest resistance. Yield is an ultimate trait which is dependent on many other parameters which are mostly inherited quantitatively. (Tuncurk and Ciftci, 2007).

Seed yield is a quantitatively inherited trait and depends upon many other characters or traits. These characters are also inherited quantitatively. The contribution of these parameters in yield is also influenced by environment (Yadava *et al.*, 2011). To study the interaction between two characters, simple correlation analysis is used. A plant breeder should know about the importance of correlation because correlation shows the relationship between the different variables which are helpful in making decisions in selection for breeding program (Engqvist and Becker, 1993). The present study was planned to estimate correlation co-efficiency between different yield related traits in mustard and evaluate the performance of different advanced lines on the basis of seed yield.

The Oilseeds Research Institute, Faisalabad (Pakistan) is working on the development of canola quality varieties in mustard. The breeding program aims to develop high yielding canola quality *B. juncea* cultivars along with non-shattering, short duration, disease tolerant and good drought/heat tolerant traits.

MATERIALS AND METHODS

The research trial was conducted during crop growing season 2016-17 at the research area

of Oilseeds Research Institute, Faisalabad, Pakistan. Twelve genotypes of *Brassica juncea* with different genetic makeup were selected for Advance Yield Trial on the basis of seed yield performance in Preliminary Yield Trial (PYT) 2015-16 viz; ZBJ-13006, ZBJ-13013, ZBJ-13015, ZBJ-14005, ZBJ-14017, ZBJ-14018, ZBJ-15009, ZBJ-15016, ZBJ-15018, ZBJ-15020, ZBJ-15021, ZBJ-15023 and AARI Canola was used as a check variety. The trial was sown in Randomized Complete Block Design (RCBD) with three replications. Each entry was sown in three rows of 5 m length. Seeds were planted with Hand Seed Drill by maintaining 45cm distance between the rows. So, the plot size for each genotype was 16.5 feet long and 4.5 feet wide in each replication. All recommended agronomic and cultural practices were applied throughout the growing period. Five plants were randomly selected and tagged to record data for plant height (cm), days to 50% flowering, days to maturity, branches per plant, seeds per silique and oil percentage. Plant height was measured with a steel made scale in centimeters (cm) at the time of plant maturity. The duration was counted from days of plants' emergence to 50% flowers blooming to measure the days to 50% flowering. Branches per plant were counted at the time of plant maturity. Seed yield (kg/plot) per plot was also recorded for each genotype in all replications. The oil content of each advance line was estimated by Soxhlet apparatus in Hi-tech Oil Technology Laboratory, Oilseeds Research Institute, Faisalabad, Pakistan. Correlation analysis was performed to estimate the relationship between different traits and seed yield as described by Kwon and Torrie (1964).

RESULTS AND DISCUSSION

Variation is the basic necessity for improvement in any breeding or selection system. All the 13 genotypes had different genetic makeup and differed significantly from each other. The Table 01, showed the mean values of all traits under study during the experiment while the Figure

01, exhibited the overall comparison between genotypes for different yield components. The maximum plant height was observed in ZBJ-15020 (239 cm) while minimum plant height was observed in ZBJ-15009 (153 cm) and all the others genotypes had less plant height than the ZBJ-15020. ZBJ-13006 produced maximum seed yield (2.21kg/plot) associated with maximum number of branches/plant (11) and maximum number of seeds per siliqua (23 seeds per siliqua) and mature in 150 days. The maximum oil (43%) was extracted in ZBJ-14017. Similar results were reported by Mustafa *et al.*, (2017).

Table 02, showed the correlation between different yield components. Branches per plant did not show any relationship with days to flowering and days to maturity. Branches per plant negatively correlated with plant height. Branches per plant showed highly significant and positive correlation with seeds per silique and seed yield per plot. Similar results were reported by chowdhury *et al.*, (1987); Somu (2001); Srivastava and Singh (2002) and Doddabhimappa *et al.*, (2009).

The data showed there is positive correlation between days to flowering and days to maturity.

No relationship was observed between the days to flowering and plant height. Data showed positive correlation between the days to flowering and days to maturity but no effect was observed on seed yield. Similar results were reported by Sinha *et al.*, (2001) & Mustafa *et al.*, (2017). The days of flowering showed no correlation with plant height, number of seeds per silique and oil content. Similar findings were observed in his experiment by Mustafa *et al.*, (2017)

The plant height showed highly significant and negative correlation with seeds/silique and seed yield i.e. a decrease was observed in seed/silique and seed yield with increase in plant height and similar results were reported by Nagaraja (1990), Shalini (1998) and Somu (2001).

The analysis showed a highly significant and very strong positive correlation between the number of seeds per siliqua and seed yield/plot. High seed yield was observed with increase in the number of seeds/silique. Similar results were reported by Yadava (1973); Singh & Singh (1974); Paul *et al.*, (1976); Sirohi *et al.*, (2004) and Doddabhimappa *et al.*, (2009).

Table 01: Mean data for different traits.

Sr. #	Entries	Days to 50% flowering (DF)	Days to maturity (DM)	Plant Height (cm)	Branches/ Plant	Seeds/ siliqua	Seed Yield (kg/plot)	Oil%
1	ZBJ-13006	66	150	161	11	23	2.21	40
2	ZBJ-13013	73	151	202	8	17	1.80	37
3	ZBJ-13015	74	152	217	6	14	1.59	40
4	ZBJ-14005	73	151	194	8	17	1.77	39
5	ZBJ-14017	58	147	208	7	16	1.74	43
6	ZBJ-14018	57	150	199	7	17	1.75	41
7	ZBJ-15009	63	146	153	10	21	2.10	41
8	ZBJ-15016	72	151	191	6	13	1.41	37
9	ZBJ-15018	80	153	170	7	17	1.74	42
10	ZBJ-15020	73	151	239	5	12	1.17	41
11	ZBJ-15021	75	150	217	6	14	1.37	40
12	ZBJ-15023	81	152	169	9	19	1.85	41
13	AARI Canola (C)	74	152	181	8	18	1.83	42

Figure 01: Comparison between different genotypes for yield components.

Table 02: Correlation between different traits.

	Branches	DF	DM	Oil%	Height	Seeds/silique
DF	-0.1733					
P-VALUE	0.5712					
DM	-0.2998	0.7743				
	0.3196	0.0019				
Oil%	0.0500	-0.2140	-0.2067			
	0.8713	0.4826	0.4980			
Height	-0.8408	-0.0029	0.1340	-0.1050		
	0.0003	0.9926	0.6624	0.7329		
Seeds/silique	0.9782	-0.2201	-0.2781	0.1925	-0.8520	
	0.0000	0.4700	0.3575	0.5288	0.0002	
Seed Yield	0.9458	-0.2856	-0.2991	0.1571	-0.8338	0.9674
	0.0000	0.3442	0.3208	0.6083	0.0004	0.0000

Figure 02: Yield performance of different advance lines.

Figure 02, clearly exhibited the seed yield comparison between different advance lines of *Brassica juncea*. Three lines (ZBJ-13006, ZBJ-15009 & ZBJ-15023) produced higher seed yield than the check variety AARI Canola while other nine lines (ZBJ-13013, ZBJ-13015, ZBJ-14005, ZBJ-14017, ZBJ-14018, ZBJ-15016, ZBJ-15018, ZBJ-15020 & ZBJ-15021) showed lower seed yield than the check variety. ZBJ-13006 & ZBJ-15009 were produced the highest seed yield (2.21kg/plot) & (2.10kg/plot) respectively.

CONCLUSIONS

It is concluded from results of experiment that the number of seeds per siliqua and number of branches per plant are the yield contributing traits in Mustard (*Brassica juncea* L.). Brassica breeders should select plants with more number of seeds/siliqua and more number of branches/plot to develop high yielding Mustard cultivars. Furthermore, advance lines ZBJ-13006 and ZBJ-15009 produced significantly higher seed yield than the check variety, so these lines should be evaluated in Micro Yield Trials to check the yield stability in different agro-ecological zones.

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