

Comparative Growth and Yield Performance of Different Brassica Varieties

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ABSTRACT

A field experiment was conducted to study the growth and yield performance of six varieties of different Brassica species. The treatments comprised of V₁ (BSA), V₂ (Shiralee), V₃ (Westar), V₄ (Rainbow), V₅ (Dunkled), V₆ (Oscar). Among the six varieties, Oscar produced maximum seed yield (1843 kg ha⁻¹) with improved yield components like number of branches, pods plant⁻¹, and 1000 seed weight as compared to other varieties. Oscar also proved best in qualitative traits like erucic acid, glucosinolates and seed oil contents.

Key Words: Brassica spp; Yield performance; Growth

INTRODUCTION

Agriculture is the mainstay of Pakistan's economy and majority of the population is directly or indirectly dependent on this sector. Although some advancement have been made in agriculture, like self-sufficiency in wheat and cotton in particular, still there exists chronic shortage of a very important constituent of human diet i.e. edible oil has persisted unabated for the last two decades. Thus, country is constrained to import edible oil in large quantities.

The edible oil requirement for 1999-2000 was 1.998 million tons while the local production was 0.419 million tons (34%) and the rest 1.576 million tons (66%) was imported. The annual growth rate in consumption of edible oil is 9% (Anonymous, 1999). Huge import of edible oil imposes a severe threat to national economy.

Rapeseed and mustard are the conventional oil seed crops of Pakistan and rank second after seed cotton in oil production in the country. Improved cultivar and good management are important tools, which have geared production in many countries of the world. In addition to many other factors responsible for achieving higher yields, cultivars with higher yield potential and a wide range of adaptability to adaphic and climatic conditions is essential for increasing yield per unit area, ultimately boosting up total production.

In recent years, many canola varieties have been imported and cultivated in Pakistan but their yield potentials and production technologies have yet not been explored. Wright *et al.* (1995) observed comparative adaptation of canola (*Brassica napus*) and Indian mustard (*Brassica juncea*) to yield and yield components and found that components of yield differed between the two species with mustard having more pods plant⁻¹ but fewer seeds pod⁻¹. Gupta and Khanna (1998) evaluated double zero cultivars of (*Brassica napus*) under dry land conditions of Jammu. They observed that "Jaris" had the highest seed yield (1.05 t ha⁻¹), low glucosinolate content (25.40 µm g⁻¹) and oil content (36%) Karat, Hermes, Milla, Legend, Jupiter Gullivar and topa also had low glucosinolate

contents and low erucic acid but yielded less. So keeping in view the yield potential of cultivars, the present study was planned to compare the production potential and quality traits of different Brassica varieties.

MATERIALS AND METHODS

Studies pertaining to comparative yield performance of different Brassica varieties were carried out at the Agronomic Research Area, University of Agriculture, Faisalabad, during 1998-99. The experiment was laid out in randomized complete block design (RCBD) with four replications. The net plot size was 2.7 m x 5m. The experiment comprised of the following varieties: V₁ = BSA; V₂ = Shiralee; V₃ = Westar; V₄ = Rainbow; V₅ = Dunkled; V₆ = Oscar.

The crop was sown on October 27, 1999 using a seed rate of 5 kg ha⁻¹ in 45 cm spaced rows on a well prepared seed bed, with single row hand drill. Total plant population (148148) was maintained by 15 cm intra row distance. Nitrogen and phosphorus @ 90-60 kg ha⁻¹ were applied in the form of urea and triple super phosphate (TSP). Whole of the phosphorus was applied as a basal dose and N in splits, 1/3 at sowing, 1/3 at 1st irrigation and 1/3 at flowering. The weed population was checked by hand hoeing. The crop was irrigated twice during the whole growth period and was sprayed twice for the control of aphids and bollworms with Lennate @ 1.5 L ha⁻¹. The cultivars were harvested on April, 20, 1999. Observations on various yield and yield parameters were recorded by using standard procedures.

The seed oil concentration of all samples was determined by nuclear magnetic resonance spectrometer (NMR) (Robertson & Morrison, 1979). Erucic acid was determined by gas-liquid chromatography (Freedman *et al.*, 1986) while glucosinolate contents were determined according to the trimethyl silyl procedure as described by Daun and McGregor (1983). Analysis of variance was performed on agronomic and seed quality data using MSTAT-C (Freed & Eisensmith, 1986). The least

significance difference (LSD) test was used to compare the means at 5% probability level (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Plant height. Plant height of a crop is a function of both the genetic and environmental factors. The data (Table I) revealed that plant height was significantly affected by different Brassica varieties. The maximum plant height (215.3 cm) was attained by Westar, which was statistically at par with BSA. Whereas, minimum plant height (177.9 cm) was observed in Rainbow that was statistically at par with dunked variety. The maximum plant height in Westar might be due to genetic character. Similar findings were reported by Chaudhry *et al.* (1987) who found differences in plant height of different Brassica spp.

Number of branches plant⁻¹ Number of branches plant⁻¹ was significantly influenced by different brassica varieties (Table I). Maximum number of branches plant⁻¹ was observed in Oscar, which produced 24 branches plant⁻¹ which was statistically at par with Rainbow. Minimum number of branches plant⁻¹ (14.05) was observed in Shiralee. The significant difference in branches plant⁻¹ may be due to genetic variation in varietal characteristics. The findings of this research are in agreement with those of Chaudhry *et al.* (1987) who found significant differences in branches plant⁻¹ among different varieties.

Number of pods plant⁻¹ Numbers of pods plant is a major yield determining component of Brassica varieties and contribute substantially towards seed yield. The parameter under study was significantly influenced by different Brassica varieties. Maximum number of pods plant⁻¹ (557) was attained in Oscar variety which was statistically at par with Rainbow and BSA producing 510 and 476 number of pods plant⁻¹, respectively (Table I). The significant difference regarding number of pods plant⁻¹ in different Brassica varieties may be due to their genetic potential. Oscar produced maximum number of branches plant⁻¹ which ultimately resulted in more number of pods plant⁻¹. These results corroborate the findings of Rakow (1978) who reported significant differences in number of pods plant⁻¹ among different cultivars of Brassica species.

Number of seeds pod⁻¹. Data presented in Table I show non-significant effect of different brassica varieties on number of seeds pod⁻¹. These results are contradictory to those of Chaudhry *et al.* (1987) who found significantly different number of seeds pod⁻¹ in different Brassica species.

1000-seed weight. The 1000-seed weight is also an important yield determining component which contribute towards the final seed yield of a crop. The 1000-seed weight was significantly affected by various cultivars. The maximum 1000-seed weight (3.63 g) was attained by Oscar variety. Whereas, the minimum tested weight (2.59 g) was observed in BSA. All other varieties were statistically similar. Maximum 1000-seed weight in Oscar variety may be attributed due to better source sink relationship than the other varieties. These results are in line with those of Munir and McNeilly (1992) who found significant differences for 1000-seed weight.

Biological yield. Data presented in Table I show non-significant effect of biological yield on different varieties. The results are quite in line with the findings of Jat *et al.* (1987) who reported non-significant differences in biological yield of different Brassica species.

Seed yield (kg ha⁻¹). Final seed yield of a crop is the combined expression of various yield components like number of pods plant⁻¹, seeds pod⁻¹ and 1000-seed weight. Seed yield was significantly influenced by different varieties. The maximum seed yield (1843 kg) was produced by Oscar variety, which is statistically at par with Westar, Rainbow and Dunkled, produced 1825, 1801 and 1760 kg ha⁻¹, respectively. While, minimum seed yield (1366 kg ha⁻¹) was attained by BSA. The significant difference in seed yield in Oscar variety was attributed to improved yield components over the other varieties. These results confirmed the findings of Patil *et al.* (1996) working on Brassica species found higher seed yield over *Brassica campestris*.

Harvest index. The data (Table I) revealed that harvest index was not significantly affected by any of the varieties. These results are contrary to those of Munir and McNeilly (1987, 1992) who worked on Brassica cultivars in U.K. and represented significant differences in its harvest index values.

Table I. Response of yield and yield components, oil contents, erucic acid and glucosinolates to different Brassica spp.

	Plant height (cm)	Branches plant ⁻¹	Pods plant ⁻¹	Seeds pod ⁻¹	1000-seed weight (g)	Biological yield (kg ha ⁻¹)	Seed yield (kg ha ⁻¹)	Harvest index (%)	Seed oil contents (%)	Erucic acid (%)	Glucosinolates (μ mol g ⁻¹)
V ₁ (BSA)	210.6 a	19.75 b	476.8 ab	23.3 ^{NS}	2.59 c	14583 ^{NS}	1366 b	10.11 ^{NS}	42.76 ab	16.05 a	39.39 a
V ₂ (Shiralee)	191.7 b	14.05 c	308.0 c	22.6	3.41 ab	12291	1402 b	12.31	41.77 b	3.46 d	22.85 c
V ₃ (Westar)	215.3 a	19.20 b	396.96 bc	26.4	3.42 a	13437	1825 a	14.01	39.94 c	4.47 c	34.93 b
V ₄ (Rainbow)	177.9 c	21.65 ab	510.0 a	22.3	3.04 b	11568	1801 a	16.35	41.76 b	7.61 b	16.78 d
V ₅ (Dunkled)	179.4 c	20.20 b	477.2 ab	26.8	3.29 ab	14127	1760 a	12.67	43.99 a	4.01 cd	13.68 e
V ₆ (Oscar)	185.5 bc	24.10 a	557.0 a	24.4	3.63 a	13333	1843 a	14.55	43.28 a	4.25 cd	13.97 e
LSD 5%	11.05	2.96	98.01	-	0.36	-	310.8	-	1.35	0.91	1.25

V₁=BSA; V₂=Shiralee; V₃=Westar; V₄=Rainbow; V₅=Dunkled; V₆=Oscar, Mean in the same column having different letters differ significantly at (P≤0.05)

Quality Characteristics

Seed oil contents (%). Seed oil contents were significantly influenced by different Brassica cultivars (Table I). The maximum oil contents were observed in Dunkled which was statistically at par with Oscar and BSA. Minimum seed oil contents were attained by Westar. Seed oil concentration is purely genetically controlled character and plays vital role in determining total oil yield per unit area. These results are in accordance with the findings of Bengtsson (1988) who reported 9% difference between different varieties of winter rape.

Erucic acid. Erucic acid contents were significantly affected by different Brassica varieties (Table I). Maximum erucic acid contents (16.05%) were recorded in BSA followed by Rainbow (7.61%). Minimum erucic acid contents (3.46%) were observed in Sheralee, which was statistically at par with Dunkled and Oscar varieties having 4.01 and 4.25% erucic acid. A minimum erucic acid of < 2% is desired for good quality oil which increased taste and flavour. Significant difference of erucic acid in different Brassica varieties were definitely due to genetic make up because canola type varieties has minimum erucic acid contents (< 2%). These observations are in accordance with the findings of Getinet *et al.* (1997) who found significant differences for erucic acid percentage in different Brassica cultivars.

Glucosinolates ($\mu\text{ mol g}^{-1}$). Data presented in Table I revealed that highly significant differences in Glucosinolates were found among different brassica varieties. The maximum glucosinolates ($38.39 \mu\text{ mol g}^{-1}$) were found in BSA; whereas, minimum contents (13.97%) were observed in Oscar, which was statistically at par with Dunkled ($13.68 \mu\text{ mol g}^{-1}$).

Glucosinolates content is an important quality trait in Brassica species which affects the quality of rapeseed and mustard cake. More concentration of gluconinolates reduced the palatability of seed cake. Therefore, canola type varieties are more desirous as for as erucic acid and glucosinolates contents are concerned.

CONCLUSION

It can be concluded from the findings of this study that Oscar variety proved to be the best in seed yield, seed oil contents, erucic acid and glucosinolates among the different Brassica cultivars. It is suggested that Oscar

variety should be sown for attaining maximum yield and quality under the agro-ecological conditions of Faisalabad.

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