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Comparative Yield Potential and Oil Contents of Different Canola Cultivars *(Brassica napus* L.)

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Abstract: The field experiment to evaluate the yield potential of seven cultivars of canola (***Brassica napus*** L.) namely Rainbow, Westar, Con11, Dunkeld, Oscar, Shiralee and Defender was carried out at the Agronomic Research Area, University of Agriculture, Faisalabad, during the year 2001-2002. The cultivar Con 11 produced the maximum seed and oil yields due to maximum number of siliquae per plant and seeds per siliqua whereas the cultivar Defender performed poorly and remained at the bottom.

Key words: Canola, cultivars, seed yield, oil contents

Introduction

The total requirement of edible oil for 2001-2002 was 2.0 million tones of which 29 per cent came from local production while remaining 71 per cent had to be imported at the cost of US $ 800 million (Anonymous, 2002). Nearly 65 -70% of our requirements are met through imports of palm oil and soybean oils (Anjum, 1993). So, there is a dire need to reduce dependence on the imported edible oil by enhancing the production of oilseeds in the country. Cottonseed is the major source of edible oil in the country. During 2000-2001 its oil accounted for 74.40% of indigenous vegetable oil production. Rapeseed and mustard is the second most important source of edible oil after cottonseed contributing 13.76 per cent towards the national oil production (Anonymous, 2002). Rapeseed is a rich source of oil and protein. The seed has 42-48% oil contents while seed meal has 43.6% protein and has a complete profile of amino acids including lysine, methionine and cystine. The oil obtained from rapeseed and mustard is not considered as regular cooking oil because of its inferior quality due to presence of high erucic acid (more than 40%) and glucosinolates (more than 100 micromole g^{-1}) (Anonymous, 1996).The erucic acid affects the taste and flavour while glucosinolates not only cause the nutritional disorder but also adversely affects growth and reproduction of animals if fed at significant levels in diet (Vermorel ***et al.***, 1986). Keeping in view health concerns, the Canadian Scientists through their intensive breeding programme developed rapeseed cultivars “Canola” with low erucic acid and glucosinolate contents. Canola is recently introduced in Pakistan, hence many aspects of its production technology need to be unveiled. Among the agronomic factors, which affect the yield of a crop, cultivars with high yield potential play a pivotal role in increasing the yield per unit area, if these are provided with optimum crop husbandry management (Anonymous, 1992). Baranyk and Zukalova (2000) compared the yield performance of winter hybrid oilseed rape 'Pronto' and conventional varieties Eurol, Falcon, Bristol, Capitol, Lirajet, Olymp, Slapska, Stela and Zorro and reported that hybrid variety Pronto gave higher seed yield than the best conventional variety and lower oil content than the average of the conventional varieties. In spite of lower oil content, cv. Pronto (owing to high seed yield) achieved also the highest oil yield. Similarly, Khoshanazar ***et al.*** (2000), Kolte ***et al.*** (2000) and Stringam ***et al.*** (2002) compared different mustard and rapeseed cultivars and reported that all the cultivars differed significantly for seed and oil yields. The present study, was therefore, carried out to compare the production potential and oil contents of different canola cultivars under agro-ecological conditions of Faisalabad.

Materials and Methods

The study pertaining to comparative yield potential and oil contents of different canola (***Brassica napus***) cultivars was carried out at the Agronomic Research Area, University of Agriculture, Faisalabad, during the year 2001-2002.The experiment was laid out in Randomized Complete Bock Design (RCBD) with three replications using a net plot size of 5.0 × 1.8 m. Canola varieties used as a medium of trial were Rainbow, Westar, Con 11, Dunkeld, Oscar, Shiralee and Defender. The Varieties were sown on October 8, 2001, using a seed rate of 5 kg ha^{-1} in 30 cm spaced lines on a well prepared seed bed, with a single row hand drill. Nitrogen and Phosphorous in the form of Urea and Triple Super Phosphate were applied @ 90 kg and 60 kg ha^{-1}, respectively. Whole of Phosphorous and 1/3 of Nitrogen was applied at sowing time. One-third nitrogen was applied at first irrigation and remaining at flowering. The crop was irrigated three times during the whole period of growth. First irrigation was given 40 days after sowing, second irrigation was given at flowering and third irrigation was applied during grain filling period. The thinning was done twice up to the age of one month to maintain 15 cm distance between the plants. All other agronomic practices were kept normal and uniform for all the. Data regarding yield and yield contributing parameters were recorded and analyzed statistically (Steel and Torrie, 1984).

Results and Discussion

Plant height (cm)

The final plant height reflects the growth behavior of a crop. Besides genetic characteristics environmental factors also play vital role in determining the height of the plants. The data revealed that plant height of different brassica species under study varied significantly. The maximum plant height was obtained by Shiralee, which is statistically at par with Defender whereas, Dunkeld gave the minimum plant height, which was statistically at par with Rainbow (Table 1). The varieties Westar and Oscar did not differ significantly with each other. The

Table 1: Comparative Performance of Different Canola Cultivars (*Brassica napus* L.)

Treatments	Plant Height (cm)	No. of branches per plant	No. of siliquae per plant	No. of seeds Per siliqua	1000-Seed wt.(g)
Rainbow	204.4c	22.80cd	569.7c	26.10bc	3.57b
Westar	221.5b	21.53d	471.7f	25.47bc	3.82a
Con II	223.5ab	25.33b	659.7a	28.30a	3.51b
Dunkeld	198.6c	22.40d	551.9d	27.20ab	3.14d
Oscar	220.6b	29.13a	591.1b	26.40abc	3.36c
Shiralee	229.3a	24.20c	487.9e	25.57bc	3.65b
Defender	226.5ab	19.33e	444.5g	24.47c	3.79a
LSD Values	7.105	1.573	13.37	1.886	0.1488
Treatments	**Biological yield ($Kg\ ha^{-1}$)**	**Seed yield ($Kg\ ha^{-1}$)**	**Harvest Index (%)**	**Seed oil content (%)**	**Oil yield ($Kg\ ha^{-1}$)**
Rainbow	14930d	1891bc	12.15b	44.17ab	828.1b
Westar	14380cd	1797c	12.60b	43.22b	776.5c
Con II	15820a	2079a	14.11a	45.36a	943.5a
Dunkeld	14500cd	1616d	11.81bc	43.16b	696.8d
Oscar	14530cd	1951b	13.44ab	43.92b	856.8b
Shiralee	15470ab	1677d	11.21c	43.34b	726.5cd
Defender	14190d	1430e	9.36d	41.46c	592.2e
LSD Values	647.8	103.0	1.024	1.285	51.04

DMR Test at 5% Probability level: Any two means, not sharing a letter in common, differ significantly at 0.05 probability level

variation in plant height of different varieties may be attributed to their genetic potential. Mastro (1995) and Reddy and Reddy (1998) reported that different brassica varieties differed significantly regarding their plant heights.

Number of branches per plant

The number of siliqua bearing branches per plant is the result of combined effect of genetic make up of the crop and environmental conditions, which plays a remarkable role towards the final seed yield of the crop. The data indicated that the number of branches per plant varied significantly among the varieties under study. Variety Oscar produced significantly more number of branches per plant whereas; minimum numbers of branches per plant were produced by Defender. The variety Con 11 produced 25.33 branches per plant and was significantly higher than Shiralee .All other varieties Rainbow, Dunkeld and Westar were statistically at par with each other. They produced 22.80, 22.40 and 21.53 branches per plant, respectively (Table 1). Variable number of branches per plant among different varieties, which are under genetic cum management control, has also been reported by Labana ***et al.*** (1987) and Khehra and Singh (1988).

Number of siliquae per plant

The number of siliquae per plant is known as a key and major yield determining component of brassica species and contributes substantially towards seed yield. It depends upon the factors like variety, suitable soil and environmental conditions. The data presented evinced that different varieties differed significantly from one another. The comparison of treatment means shows that maximum numbers of siliquae per plant were produced by Con 11, which differed significantly from rest of the varieties (Table 1). However, minimum numbers of siliquae were produced by Defender. The maximum number of siliquae per plant obtained by Con 11 was possibly due to the genetic potential of the variety. These results are in accordance with Khehra and Singh (1988), Reddy and Reddy (1998) who found significant differences in number of siliquas per plant among different cultivars of brassica.

Number of seeds per siliqua

The number of seeds per siliqua contributes materially towards the final seed yield in canola. The data on number of seeds per siliqua in Table 1 exhibits that maximum number of seeds per siliqua were found in Con 11, however, it did not differ statistically from Dunkeld and Oscar. All the other varieties Rainbow, Shiralee, Westar and Defender were statistically at par with each other and produced 26.10, 25.57, 25.47 and 24.47 seeds per siliqua, respectively. These differences among the varieties for no. of seeds per siliqua may be due to the genetic potential of the varieties. These results did not confirm the findings of Munir and McNeilly (1992) who found no significant difference for the number of seeds per siliqua between different brassica varieties. It seems absurd except, when the genetic material is very closely related or one variety is suppressed at fertilization stage by any of the management cum environmental factors. A certain cultivar may be susceptible to environmental factor while other may be tolerant.

1000-seed weight (g)

The weight of seed expresses the magnitude of seed development that is an important yield determinant and plays a decisive role in showing off the yield potential of a variety. It is evident from the data given in table that 1000-seed weight was significantly affected by various cultivars. Maximum 1000-seed weight of 3.82 g was attained by Westar, which is statistically at par with Defender. The varieties Shiralee, Rainbow and Con 11 produced statistically similar 1000-weights of 3.65 g, 3.57 g and 3.51 g, followed by Oscar that resulted in 3.36 g of 1000- seed weight. However, the minimum 1000-seed weight was obtained by variety Dunkeld (Table 1). The maximum 1000-seed weight attained by Westar and Defender may be due to less number of seeds per siliqua, which resulted in better utilization of resources and development of seeds. These results are in lines with those of Munir and McNeilly (1992), Hashem ***et al.*** (1998) and Om ***et al.*** (1998) who found significant differences for 1000-seed weight among different brassica varieties.

Biological yield (kg ha^{-1})

The weight of total biomass per hectare determines the overall growth behavior of crop during the given period of time. It is the combination of seed yield and straw yield. Data shows that biological yield was significantly affected by various varieties. A Comparison of individual treatment means reveals that Con 11 produced the maximum biological yield and it was statistically at par with Shiralee, while minimum biological yield resulted in case of Defender, which was statistically at par with Rainbow. The varieties Oscar, Dunkeld and Westar did not differ significantly with each other (Table 1). These results are contrary to the findings of Jat ***et al.*** (1987) who found non-significant differences in biological yields of different brassica varieties. It might be due to the drought conditions under which that experiment was conducted.

Seed yield (kg ha^{-1})

Final seed yield per unit area of canola is a cumulative effect of various yield components like number of siliquas per plant, number of seeds per siliqua, 1000-seed weight etc. The data regarding seed yield of different brassica varieties given in table revealed that seed yield was significantly affected by various varieties. Maximum seed yield was produced by variety Con 11 followed by Oscar, which is statistically at par with Rainbow with seed yields of 1951 and 1891 kg ha^{-1}, respectively. However, minimum seed yield was obtained by Defender followed by Shiralee and Dunkeld that gave statistically similar seed yields of 1677 and 1616 kg ha^{-1}, respectively (Table 1). The maximum seed yield produced by Con11 may be attributed to the combined effect of yield components such as more number of siliquas per plant and maximum number of seeds per siliqua, over the other varieties. These results are comparable with the findings of Reddy and Reddy (1998) and Khoshnazar ***et al.*** (2000) who found significant differences in seed yield among different varieties of brassica species.

Harvest index (%)

The physiological efficiency and ability of a crop plant for converting the total biomass into seed yield is known by its harvest index. The higher the value of harvest index, more will be the seed yield per unit of dry matter. It is evident from the data that the highest value of harvest index was obtained by Con 11, which however, did not differ statistically from Oscar where harvest index value was recorded. Whereas, the minimum harvest index value was noted in Defender (Table 1). Maximum harvest index obtained in case of Con 11 was possibly due to the fact that it produced the highest seed yield. These results coordinate the findings of Munir and McNeilly (1992) and Kolte ***et al.*** (2000) who worked on brassica species and found that different varieties significantly differ in their harvest indices values with each other.

Seed oil content (%)

An oilseed crop rich in oil content of high quality is the ultimate goal of a grower. The quality of a canola seed is determined from its oil content. Maximum oil content was recorded in Con 11 which is statistically at par with Rainbow which gave oil content of 44.17%. While minimum oil content was observed in variety Defender. The maximum oil content obtained from Con 11 might be due to the variation in the genetic make up of the variety. These results are in accordance with the findings of Bengtsson (1988) who reported 9% difference between two varieties of winter rape, while Getinet ***et al.*** (1996) observed 2.3% difference between different ***Brassica carinata*** lines for seed oil content.

Oil yield (kg ha^{-1})

The oil yield of a crop is the combined expression of seed oil content and seed yield of a variety. The oil yield was significantly affected by different varieties. The highest oil yield was obtained in Con 11, while the lowest oil yield was produced by Defender. The variety Oscar gave the oil yield and was statistically at par with Rainbow, which recorded oil yield of 8.28 kg ha^{-1}. The other varieties Westar and Shiralee and Dunkeld did not differ statistically with each other (Table 1). The highest oil yield in Con 11 might be on account of maximum seed yield and seed oil content than the other varieties. These findings are in lines with those of Getinet ***et al.*** (1996), Das (1998) and Baraynk and Zukalova (2000) who found differences in oil yields of different brassica species.

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