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Impact of Row Spacing and Fertilizer Levels (Diammonium Phosphate) on Yield and Yield Components of Canola

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Abstract: An experiment was conducted to study the impact of row spacing (15, 30, 45 and 60 cm) and fertilizer levels (0, 50, 75 and 100 kg ha^{-1}) on canola. The number of pods $plant^{-1}$, number of grains pod^{-1}, thousand grain weight and grain yield ha^{-1} was recorded during the study. The highest number of pods (177) $Plant^{-1}$, number of grains (30), thousand grain weight 0.86 g) and grain yield kg ha^{-1} (1692) was observed from plots where row spacing was kept at 45 cm. Similarly the highest number of pods (211) $Plant^{-1}$, number of grains (36), thousand grain weight (1.02) and grain yield kg ha^{-1} (2270) was observed from plots where fertilizer level was 100 kg ha^{-1}. The maximum yield and yield components were observed at the interaction of 45 cm row spacing and 100 kg DAP ha^{-1}.

Key words: Yield and yield components, fertilizer levels, row spacing, canola

Introduction

Canola is a genetic variation of rapeseed; its oil content is less than 5%. Canola oil is of premium quality and is widely acceptable, being low in saturated fatty acid and high in unsaturated fatty acids (John *et al*., 1983). Its meal with glucosinolates less than 30 micromoles, can safely be used for animal and poultry feed.

Canola grown in September/October as a winter crops mature in 150-160 days. Canola varieties being high yielding and more profitable are becoming more popular in irrigated as well as barani (Rainfed) areas of Pakistan. During 1997-98 area under Canola was 110 thousand hectares with production of 159 thousand tons. It resulted in saving of US 4 52 million of foreign exchange.

Edible oil requirements of Pakistan are about 1.9 million tons (Anonymous, 1999-2000), and about 30% of which are met by local production and 70% from import. The imported oil cost about US $ 700 million. The contribution from domestic Canola during 1998-99 was 83,000 tons edible oil (valued at about US $ 45 million).

Keeping in view the importance of this problem for the shortage of edible oil, the study was conducted to observe the best row spacing and DAP fertilizer levels for the farmers to obtain the high yield of canola.

Materials and Methods

Study was conducted at Malakandher Farm, N.W.F.P. Agricultural University Peshawar during 1997-98. The experiment was replicated three times in Randomized Complete Block Design (RCBD) with 4 x 2.7 m plot size. Canola variety dunkled was drilled at a uniform rate of 4 kg ha^{-1} in different row spacing of 15, 30, 45, 60 cm. The levels of diammonium phosphate were applied at 0, 50, 75 and 100 kg ha^{-1}. The row spacing was allotted to sub-plots, while fertilizer levels were allotted to main-plots. A basal dose of N and K was applied at the rate of 60 and 120 kg ha^{-1}, respectively.

Number of pods $plant^{-1}$, number of grains pod^{-1}, thousand-grains weight and grain yield ha^{-1} was recorded during the experimental study. The data collected were analyzed statistically by Sher (1996) was used to detect the significance of treatment effect and the LSD was used as a test of significance.

Results

Row spacing, fertilizer levels and interaction among both the treatments (Table 1) significantly affected pods $plant^{-1}$. The highest 177 pods $plant^{-1}$ were observed from plots where row spacing was kept at 45 cm, followed by 30 cm row spacing with 168 pods $plant^{-1}$, while 15 cm row spacing had 160 pods $plant^{-1}$. The lowest 158 pods $plant^{-1}$ were recorded at the plots with 60 cm row spacing (Table 1). Fertilizer levels significantly affected grains pod^{-1}.The highest pods 211 were recorded from highly fertilized plots with 100 kg DAP $ha,^{-1}$ followed by 75 kg with 194 pods $plant^{-1}$, while the plots with 50 kg DAP ha^{-1} had 163 pods $plant^{-1}$. The lowest of 94 pods $plant^{-1}$ were observed at control plots (Table 1). The highest 222 pods $plant^{-1}$ were recorded at the interaction of 45 cm row spacing and 100 kg fertilizer levels (Table 1).

The highest grains 30 were recorded from plots with 45 cm row spacing, followed by 30 cm row spacing plots had 28

Table 1: Effect of row spacing and diammonium phosphate (DAP) levels on pods plant^{-1} of canola

Row spacing (cm)	Levels of DAP (kg ha^{-1}) 0	50	75	100	Means
15	87	160	190	205	160c
30	98	164	195	213	168b
45	102	175	206	222	177a
60	90	153	185	204	156d
Means	94d	163c	194b	211a	
LSD value for row spacing	= 6.40				
LSD value for DAP	= 7.27				

Table 2: Effect of row spacing and diammonium phosphate (DAP) levels on grains pods^{-1} of canola

Row spacing (cm)	Levels of DAP (kg ha^{-1}) 0	50	75	100	Means
15	13	24	32	35	26d
30	18	26	34	36	28b
45	20	28	36	38	30a
60	18	24	32	35	27c
Means	17d	25c	33b	36a	
LSD value for row spacing	= 0.65				
LSD value for interaction	= 1.31				

Table 3: Effect of row spacing and diammonium phosphate (DAP) levels on grain-weight of canola

Row spacing (cm)	Levels of DAP (kg ha^{-1}) 0	50	75	100	Means
15	0.41	0.63	0.89	0.98	0.73c
30	0.48	0.74	0.92	0.99	0.78b
45	0.50	0.84	0.94	0.1.16	0.86a
60	0.40	0.62	0.87	0.92	0.75d
Means	0.44d	0.71c	0.90b	1.02a	
LSD value for row spacing	= 0.06				
LSD value for DAP	= 0.07				

Table 4: Effect of row spacing and Diammonium phosphate (DAP) levels on yield ha^{-1} of Canola

Row spacing (cm)	Levels of DAP (kg ha^{-1}) 0	50	75	100	Means
15	854	1020	1570	2188	1408
30	886	1170	1637	2263	1488
45	943	1373	1973	2483	1692
60	866	988	1536	2138	1385
Means	885	1141	1678	2270	
LSD value for row spacing	= 13.76				
LSD value for fertilizer	= 13.76				
LSD value for interaction	= 27.53				

grains pod^{-1}, while the plots with 60 cm row spacing had (27) grains pod^{-1}. The lowest of 26 grains pod^{-1} was recorded from the plots with 15 cm row spacing Table 2). Fertilizer levels significantly affected grains pod^{-1}. The highest 36 grains pod^{-1} were recorded from highly fertilizer treated plots with 100 kg DAP ha^{-1} followed by 75 kg DAP ha^{-1} with 33 grains pod^{-1}, while 25 grains pod^{-1} were recorded from 50 kg DAP ha^{-1} treated plots. The lowest grains pod^{-1} was recorded from control plots (Table 2). Similarly the interaction among both the treatments were also significant. The highest of 38 grains pod^{-1} were recorded from plots with 45 cm row spacing and 100 kg fertilizer levels (Table 2).

Grain weight is an important trait that contributes to overall yield of canola. Row spacing, The highest grain weight 2.86 g was recorded from plots with 45 cm row spacing followed by 30 cm row spacing with .78 g 1000 grain weight, while the plots with 15 cm row spacing had .73 g 1000 grain weight. The lowest 1000 grain weight of .71 g was recorded from the plots with 60 cm row spacing (Table 3). Fertilizer levels had significant effect on grain weight. The highest grain weight of 1.02 g was recorded from plots with 100 kg DAP ha^{-1} followed by 75 kg DAP ha^{-1} with .90 g 1000 grain weight. While 50 kg DAP ha^{-1} had .71 g 1000 grain weight. The lowest 1000 grain weight of .44 g was recorded from control plots (Table 3). The interaction among both the treatments was also significant. The highest grain weight of 1.16 g was recorded at the interaction of 45 cm row spacing and 100 kg DAP fertilizer treated plots (Table 3).

Row spacing, fertilizer levels and interaction among both treatments had a significant effect on yield ha^{-1}. The highest yield of 1692 kg ha^{-1} was recorded from plots with 45 cm row spacing followed by 30 cm row spacing with 1488 kg ha^{-1}, While 15 cm row spacing had 1408 kg ha^{-1}. The lowest yield 1385 kg ha^{-1} was observed from plots with 60-cm row spacing (Table 4). Grain yield response to fertilizer levels. The highest yield of 2270 kg ha^{-1} from plots with 100 kg DAP ha^{-1} followed by 75 kg DAP ha^{-1} with grain yield of 1678 kg ha^{-1} was recorded, while 50 kg DAP ha^{-1} had grain yield of 1141 kg ha^{-1}. The lowest yield of 885 kg ha^{-1} was observed from control plots (Table 4). Interaction among DAP levels and row spacing also had a significant effect on yield ha^{-1}. The highest yield of 2483 kg ha^{-1} was recorded at the interaction of 100 kg DAP ha^{-1} and 45 cm row spacing followed by 100 kg DAP ha^{-1} and 30 cm row spacing with 2263 kg ha^{-1} and 2188 kg ha^{-1} recorded from 100 kg DAP and 15 cm row spacing. The lowest yield of 2138 kg ha^{-1} was observed from 100 kg DAP and 60 cm row spacing.

Discussion

The highest numbers of pods plant^{-1} were recorded from plots with 45 cm row spacing. While the lowest number of pods plant^{-1} were observed from 60 cm row spacing plots (Table 1). The possible reason is that 45 cm row spacing is an optimum row spacing that provide a suitable space to absorb plenty of nutrients and other basic requirements for ideal growth of canola crop and hence the highest pods plant^{-1} were observed. While in wider row spacing (60 cm). There was more space for the competition of weed with canola crop for water and other basic requirements, so, the lowest pods plant^{-1} were recorded. The highest pods plant^{-1} was observed from plots with

100 kg DAP ha^{-1}, while the lowest pods $plant^{-1}$ were recorded from control plots. The possible reason is that at 100 kg DAP ha^{-1} plenty of nutrients were available to Canola crop. Therefore the highest pods $plant^{-1}$ were observed as compared to control plots. The highest grains pod^{-1} were observed from plots at 45 cm row spacing, while lowest was observed from plots at 15 cm row spacing (Table 2). The number of grains pod^{-1} were directly proportional to the number of pods $plant^{-1}$. The possible reason is that 45 cm row spacing is an optimum row spacing that affect grains pod^{-1} significantly. In case of narrowest row spacing (15) there was an inter and intra row competition for moisture and nutrients and hence lowest grains pod^{-1} were observed. The highest grains pod^{-1} were recorded from highly fertilizer treated plots. The possible reason is that more nutrients were available in case of control plots. The highest grains pod^{-1} were observed at the interaction of 100 kg fertilizer and 45 cm row spacing. The possible reason could be that more nutrients were available and more space were available to absorbed these nutrients as compared to control plots and 15 cm row spacing. Grain weight was significantly affected by row spacing and fertilizer levels (Table 3). The highest grain weight was observed from 45 cm row spacing plots, While wider row spacing (60 cm) had less row spacing. The possible reason could be that 45 cm row spacing is an optimum row spacing that affected grain weight significantly. In case of 60 cm row spacing there was wide space available for losses of water through evaporation hence less grain weight was observed. The highest 1000 grain weight was observed from 100 kg fertilizer treated plots, While control plots had lowest grain weight. The possible reason is that from highly fertilized plots more nutrients were available to crop as compared to control plots. Yield was significantly increased with row spacing, fertilizer levels and interaction among row spacing and fertilizer levels (Table 4). The highest $yield^{-1}$ ha was recorded from 45 cm row spacing plots. While the lowest yield was observed from 60 cm row spacing plots. The possible reason could be that 45 cm row spacing is an optimum row spacing that affected yield significantly. In case of 60 cm row spacing wide space and some of the moisture for wider row spacing might have evaporated to the atmosphere and hence low yield was recorded. Our results are in agreement with Dalip *et al.* (1998), Mirsa and Rana (1992). They stated that the yield increased with 45 and 30 cm row spacing than wider (60 cm) row spacing.

The highest yield ha^{-1} was observed from 100 kg fertilizer treated plots. While the lowest yield was recorded from control plots. The possible reason is that more nutrients were available to crop in highly fertilized plots as compared to control plots. The results are in agreement with Gurkipal (1994), Noureldin *et al.* (1995) they stated that yield of canola was increased with phosphorous application. The highest yield ha^{-1} was observed at the interaction of 45 cm row spacing and 100 kg fertilizer ha^{-1}. The possible reason is that 45 cm row spacing and 100 kg fertilizer ha^{-1} was an optimum production requirement that affected yield more significantly as compared to 15 cm row spacing and control plots.

In conclusion 45 cm row spacing and 100 kg DAP is the best dose of fertilizer for canola to achieve the highest yield.

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