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Yielding Components of Canola Response to NPK Nutrition

Muhammad Zahir Afridi, Mohammad Tariq Jan, [1]Imtiaz Ahmad and [2]Muhammad Azim Khan
Department of Agronomy, NWFP Agricultural University, Peshawar, Pakistan
[1]CCRI, Pirsbak Nowshera, Pakistan
[2]Department of Weed Science, NWFP Agricultural University, Peshawar, Pakistan

Abstract: Two methods of N application, four levels of P and two levels of K were tested to evaluate the effect of NPK on the yielding components of canola (cv. Dunkeld). Sole dose of N proved superior to split dose and produced significantly more branches per plant. Nitrogen had no influence on pods per plant, seeds per pod and grain weight. Increase in P, linearly increased the pods per plant and seeds per pod, while P had no influence on grain weight and branches per plant. Potassium showed no significant effect on branches formation, pods per plant, seeds per pod and grain weight. Phosphorus seems to be the major influencing element among NPK in regulating the yielding components of canola.

Key words: N-application method, P, K, yielding components, canola

Introduction

Balanced use of fertilizers, their type, time and method of application play an important role in sustainable crop production. A good crop production depends upon the time and appropriate amount of fertilization (Jan and Khan, 2000). Nitrogen is major limiting element of plant growth because of its vulnerability to losses (Henry, 1978). Among the essential nutrient, nitrogen is considered as required in higher amount, which control the vegetative growth of plant. Therefore a good vegetative growth is essential for best reproductive growth (Wojnowska *et al.*, 1995). Similarly phosphorus has the same importance for higher yield but needed in less amount than N (Chen *et al.*, 1994). Phosphorus has large effect on oil content, it excesses or deficiency may reduce oil percentage (Holmes, 1980). Potassium is also required by crops for improved quality of crop (Holmes, 1980). As canola is in competition with other crops like wheat, fodders and pulses, which are of more economic importance. Due to less land availability it is suggested that instead of increasing area under oil seed the yield per hectare must be improved. Higher yield per unit area can be achieved by improving crop performance during its vegetative stage. Higher yield depends upon better understanding of yielding components of the crop. The increased grain yield is the main objective which can not be achieved with out the relevant yielding components i.e. branches per plant, pods per plant, grains per pod and grain weight. So this study was arranged to find the best method of N application (sole or split) and optimum levels of P and K for canola yielding components.

Materials and Methods

To study the NPK nutrition impact on yielding components of canola, an experiment was carried out at Malakandher Research Farm, NWFP Agricultural University, Peshawar during Rabi season 1999-2000. Treatments were consisted of two methods of N application (sole dose of 100 kg N ha^1 at sowing time or split 50+50 kg N ha^{-1} at sowing and rosette stage), four levels of P (0, 25, 50 and 75 kg ha^{-1}) and two levels of K (30 and 60 kg ha^{-1}). The experiment was laid out in randomized complete block (RCB) design. The size of sub plot was 4x3.5 m^2. Each subplot had 8 rows of 3.5 m length and 50 cm apart. Plant to plant distance was maintained at 10 cm. Urea was used as N source while triple super phosphate (TSP) for P and KCl as K source, respectively. The crop was sown on October 13, 1999 with seed rate of 5 kg ha^{-1} on a well-prepared field. Mean number of branches per plant was recorded from the 10 randomly tagged plants in each sub plot. Pods were counted from the selected 10 plants from each treatment and their averages were calculated. Seeds per pod were calculated by randomly selecting ten pods from each treatment and average of seeds per pod was obtained. Thousand grains were randomly taken from each treatment and their weight was recorded by an electronic balance.

The obtained data was statistically analyzed according to the appropriate method. F-test was employed to detect the significance of treatments effect and LSD was used for mean comparison. ANOVA was further manipulated to compare the means in detail, for which contrast were done.

Results

The combination of NPK had no significant effect on the number of branches per plant. The planned mean comparison was also unable to detect any significant influence of different levels of phosphorus and potassium on number of branches per plant (Table 1). However, different nitrogen application methods showed significant effect on number of branches per plant. A single dose of 100 kg N ha^{-1} at sowing produced significantly more branches per plant (8.2) than split application of N where 7.5 branches per plant were observed. No significant interaction among NPK was observed for number of branches per plant. The combination of NPK treatments had significant influence on number of pods per plant (Table 2). Statistically detecting the individual nutrient effect, only phosphorus had significant influence on number of pods per plant. While different N application methods and different levels of K had no significant effect on pods. The presence of P had significantly produced more (307) pods per plant than no P treatment, where 279 pods per plant were observed. The number of pods per plant linearly increased with increase in P fertilizer. Highest number of pods per plant (323) was observed by 75 kg P ha^{-1} followed by 308 and 291 pods per plant from 50 and 25 kg P ha^{-1}, respectively. There was no interaction among NPK for number of pods per plant. The mean number of pods per plant shows that whenever the highest dose of P is applied, a significant increase in number of pods per plant was observed regardless the N application method and K levels. Data recorded on number of grains per pod as effected by different NPK treatments showed that different nitrogen application methods and different levels of potassium and their interaction had no significant effect on number of grains per pod (Table 3). The planned mean comparison showed that phosphorus had significant effect on number of grains per pod. Phosphorus applied plots produced significantly more grains per pod than no-phosphorus treatment. The phosphorus had a significant positive linear effect on number of grains per pod. More grains (26) per pod were obtained from higher doses of P (50 and 75 kg P ha^{-1}) as compared to (25) grains per pod from 25 kg P ha^{-1}. No interaction for grains per pod was found among any combination of NPK. The combine effect of NPK on grain weight was non-significant. Similarly the interaction for any combination of NPK was non-significant for grain weight (Table 4).

Discussion

Number of branches are generally influenced by the type of variety, length of growing season, and soil fertility status. Nitrogen application methods showed significant effect on branch

Table 1: Effect of different NPK levels on the number of branches of canola

Treatment-wise data		Planned means comparison with statistical significance			
Treatments NPK (kg ha^{-1})	Branches plant^{-1}	Treatments NPK (kg ha^{-1})	Branches plant^{-1}	Contrast #	
$N_1P_0K_1$	8.3	N_1 100	8.2	Full vs. Split	**
$N_1P_0K_2$	8.3	N_2 50+50	7.5		
$N_1P_1K_1$	8.0				
$N_1P_1K_2$	8.3	No P	7.9	No P vs. P	NS
$N_1P_2K_1$	8.3	P	7.8		
$N_1P_2K_2$	8.0				
$N_1P_3K_1$	8.0	P_1 25	7.9	P Linear	NS
$N_1P_3K_2$	8.3	P_2 50	7.8	P Quadratic	NS
$N_2P_0K_1$	7.5	P_3 75	7.8		
$N_2P_0K_2$	7.5				
$N_2P_1K_1$	8.0	K_1 30	7.9	K_1 vs. K_2	NS
$N_2P_1K_2$	7.5	K_2 60	7.8		
$N_2P_2K_1$	7.4				
$N_2P_2K_2$	7.3	Interactions			
$N_2P_3K_1$	7.5	N X P			NS
$N_2P_3K_2$	7.5	N x K			NS
		P x K			NS
LSD(0.05)	NS	N x P x K			NS

= Contrasts followed by ** are significant at 0.01 level of probability, NS = not significant

Table 2: Effect of different NPK levels on the number of pods of canola

Treatment-wise data		Planned means comparison with statistical significance			
Treatments NPK (kg ha^{-1})	Pods plant^{-1}	Treatments NPK (kg ha^{-1})	Pods plant^{-1}	Contrast #	
$N_1P_0K_1$	273	N_1 100	300	Full vs. Split	NS
$N_1P_0K_2$	280	N_2 50+50	300		
$N_1P_1K_1$	288				
$N_1P_1K_2$	295	No P	279	No P vs. P	**
$N_1P_2K_1$	307	P	307		
$N_1P_2K_2$	312				
$N_1P_3K_1$	324	P_1 25	291	P Linear	**
$N_1P_3K_2$	323	P2 50	308	P Quadratic	NS
$N_2P_0K_1$	280	P_3 75	323		
$N_2P_0K_2$	282				
$N_2P_1K_1$	295	K_1 30	297	K_1 vs. K_2	NS
$N_2P_1K_2$	289	K_2 60	303		
$N_2P_2K_1$	301				
$N_2P_2K_2$	311	Interactions			
$N_2P_3K_1$	311	N X P			NS
$N_2P_3K_2$	334	N x K			NS
		P x K			NS
LSD (0.05)	19	N x P x K			NS

= Contrasts followed by ** are significant at 0.01 level of probability, NS = not significant

Table 3: Effect of different NPK levels on the number of grains per pod of canola

Treatment-wise data		Planned means comparison with statistical significance			
Treatments NPK kg ha^{-1}	Grains pod^{-1}	Treatments NPK kg ha^{-1}	Grains pod^{-1}	Contrast #	
$N_1P_0K_1$	24	N_1 100	25	Full vs. Split	NS
$N_1P_0K_2$	24	N_2 50+50	25		
$N_1P_1K_1$	25				
$N_1P_1K_2$	25	No P	24	No P vs. P	**
$N_1P_2K_1$	25	P	26		
$N_1P_2K_2$	25				
$N_1P_3K_1$	26	P_1 25	25	P Linear	*
$N_1P_3K_2$	26	P_2 50	26	P Quadratic	NS
$N_2P_0K_1$	24	P_3 75	26		
$N_2P_0K_2$	25				
$N_2P_1K_1$	25	K_1 30	25	K_1 vs. K_2	NS
$N_2P_1K_2$	25	K_2 60	25		
$N_2P_2K_1$	26				
$N_2P_2K_2$	26	Interactions			
$N_2P_3K_1$	26	N X P			NS
$N_2P_3K_2$	26	N x K			NS
		P x K			NS
LSD (0.05)	NS	N x P x K			NS

= Contrasts followed by *, ** are significant at the 0.05 and 0.01 level of probability, respectively; NS = not significant
N_1 = 100 kg ha^{-1} at sowing N_2 = 50 kg N ha^{-1} at sowing + 50 kg N ha^{-1} at rosette stage P_0 = No P P_1 = 25 kg P ha^{-1} at sowingP_2 = 50 kg P ha^{-1} at sowing P_3 = 75 kg P ha^{-1} at sowing K_1 = 30 kg K ha^{-1} at sowing K_2 = 60 kg K ha^{-1} at sowing

Table 4: Effect of different NPK levels on the grain weight of canola

Treatment-wise data		Planned means comparison with statistical significance			
Treatments NPK (kg ha^{-1})	Grain wt. (g)	Treatments NPK (kg ha^{-1})	Grain wt. (g)	Contrast #	
$N_1P_0K_1$	2.21	N_1 100	2.21	Full vs. Split	NS
$N_1P_0K_2$	2.23	N_2 50+50	2.22		
$N_1P_1K_1$	2.24				
$N_1P_1K_2$	2.21	No P	2.22	No P vs. P	NS
$N_1P_2K_1$	2.20	P	2.22		
$N_1P_2K_2$	2.20				
$N_1P_3K_1$	2.20	P_1 25	2.22	P Linear	NS
$N_1P_3K_2$	2.21	P_2 50	2.21	P Quadratic	NS
$N_2P_0K_1$	2.23	P_3 75	2.22		
$N_2P_0K_2$	2.21				
$N_2P_1K_1$	2.21	K_1 30	2.22	K_1 vs. K_2	NS
$N_2P_1K_2$	2.23	K_2 60	2.22		
$N_2P_2K_1$	2.22				
$N_2P_2K_2$	2.23	Interactions			
$N_2P_3K_1$	2.22	N X P			NS
$N_2P_3K_2$	2.25	N x K			NS
		P x K			NS
LSD (0.05)	NS	N x P x K			NS

formation. A single dose of 100 kg N ha^{-1} at sowing significantly increased branches per plant as compared with split N application. Xing *et al.* (1998) are of the same opinion that abundant availability of N at early stage is more beneficial in terms of plant growth and development. Our results also shows that canola responded well to higher doses of N (100 kg ha^{-1}) at sowing than 50 kg N ha^{-1} at sowing and remaining 50 kg N ha^{-1} at latter growth stage. Number of pods per plant is a major yielding component and determines the final grain yield. Nitrogen application methods and K levels had no influence on number of pods per plant. Phosphorous seems the influencing element in pod formation. Number of pods per plant linearly increased with increase in P level. As studied by Jain *et al.* (1995) and Kumar (1995) that increase in P level increases the uptake and utilization efficiency of N and K. It seems that the better utilization efficiency of N and K in response of optimum P reflected in greater vegetative growth by N and increased growth enzymatic activity by K. Similarly, Suelter (1970) stated that numerious enzymes are completely depend on or stimulated by K. The overall effect resulted in greater number of pods. Number of grains per pod significantly contributes to final yield as well as represents the productive efficiency of any grain crop. Nitrogen application and K had no effect on number of grains per pod. Only phosphorus significantly influenced the number of grains per pod. A positive linear relationship was observed in grains per pod with P. As the level of P increased the number of grains per pod also increased. The P effect is attributed to the activation of N and K by P as stated by Jain et al. (1995). There are two opinions among the researches about the role of P in relation to grains formation. According to Holmes, (1980) P had no relation with number of grains per pod, which is in contradiction with our findings. But Rajput, (1988) says that N and P may increase grains per pod. Similarly phosphorus regulates photosynthesis and carbohydrate metabolism and is considered as one of the major growth limiting factors particularly during the reproductive stage. Marchner (1986) and Giaquinta and Quebedeaus (1980) stated that at reproductive stage, P regulate the partitioning of photosynthate between the source and reproductive organs. These findings justify the greater number of grains per pod by higher P levels. But in our study the grain weight remained unaffected by NPK nutrition. Rajput (1988) endorsed our findings and stated that N and P do not affect grain weight. Among the NPK, a better result of 100, 75, 30 NPK kg ha^{-1} was seen regarding yielding componant response, while P seems to be the major influencing element in regulating major yielding components of canola.

References

Chen, M.L., X.L. Jaing, B.Y. Wang, B.Y. Zhov, Z.Y. Zheri and G.S. Xu, 1994. Mathematical models and best combination of high yield cultivation techniqes for rapseed variety Zhenyouyom-2. Acta Agriculturae Zhejiangensis, 6: 22-26. Abstracted in Common Wealth Agricultural Bureaux. 1/95-10/95.

Darrel, S. M. and M. E. Donald, 1980. Crop production principle and practices 4th Ed. Collier MaCmillan, Canada.

Giaquinta, R. T. and B. Quebedeaur, 1980. Phosphate-induced changes in assimilate partitioning in soybean leaves during pod filling. Pl. Physiol., 65. (Suppl): pp 119.

Henry, D. F., 1978. Soil and mineral nutrition of plants (nitrogen). The soil nitrogen cycle. Fundamentals of Soil Science 6th Ed., pp: 301-302

Holmes, M. R. J., 1980. Nutrition of the Oilseed Rape Crop. Applied Science Publisher, Inc. England.

Jain, N. K., A. K. V. Vas and A. K. Singh, 1995. Effect of phosphorus and sulphur fertilization on growth and nutrient uptake by mustard (*Brassica juncea* L. Czern and Coss). Ann. Agric. Res., 16: 389-390.

Jan, M.T. and S. Khan, 2000. Response of wheat yield components of N-fertilizer their levels and application time. Pak. J. Biol. Sci., 3: 1227-1230.

Marchner, H., 1986. Mineral Nutrition of Higher Plants. Academic Press.

Rajput, M. K. K., A. H. Ansari, S. M. Qayyum, W. A. Khan and A. M. Hassan, 1988. Effect of nitrogen and phosphorus fertilizers alone and in combination on the growth and yield of Toria (*Brassica compestris* L.). Sarhad J. Agric., 4: 367-371.

Singh, V., S. S. Rathore, S. Singh, V. Singh and S. Singh, 1997. Response of some oilseed crops to potassium. J. Pot. Res., 13: 148-152.

Suelter, C.H., 1970. Enzyme activated by monovalent cations. Science, 168: 789-795.

Wojnowska, T., H. Panak and S. Siekiewiez, 1995. Reaction of winter oil-seed rape to increasing level of nitrogen fertilizer application under condition of Ketrzyn chernozem. Rosling Oleiste, 16: 173-180.

Xing, L., W. J. Wei, L. C. Zhi, L. D. Ying, L. S. Hu, S. Y. Hua, L. X, J. W. Wang, C. Z. Liu, D.Y. Li, S. H. Leng and Y. H. Shan, 1998. Requirement of NPK nutrients of hybrid oilseed rape. Soils and Fertilizers Beijing, 6: 11-13.