INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2004/06–3–557–559
http://www.ijab.org

Effect of Different Potassium Fertilization Levels on Growth, Seed Yield and Oil Contents of Canola (*Brassica napus* L.)

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ABSTRACT

Studies were carried out to assess the influence of different levels of potassium fertilization (0, 25, 50, 75, 100, 125 & 150 kg ha^{-1}) on growth, seed yield and oil contents of canola. The results revealed that the highest seed yield (3473 kg ha^{-1}) was obtained with K @ 150 kg ha^{-1}, which was however, at par with treatments where 50,75,100 and 125 kg K ha^{-1} was applied. While minimum seed yield (2585 kg ha^{-1}) was recorded in case of control i.e. with no K. Oil content progressively decreased with increase of K level with highest (42.86%) in case of control and lowest (37.42%) with a K level of 150 kg ha^{-1}. But a perusal of economic analysis showed that application of 125 kg ha^{-1} was more economical than all other treatments.

Key Words: Canola; Oil contents; *Brassica napus* L.; Potassium; Fertilizer

INTRODUCTION

Pakistan has been facing a shortage of edible oils. As a result large quantities of edible oil are being imported annually from other countries. The country has got the status of the third largest importer of the edible oil in the world (Anjum, 1993). During 2001-02, local oilseed production met only 29% of the total consumption, the remaining 71% was met through imports (Anonymous, 2002). After cotton, rapeseed-mustard is the second most important source of domestic oil production. Oil obtained from conventional 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) and low level of oleic and linoleic acids.

Introduction of canola (*Brassica napus* L) in Pakistan has shown success at many places. It is low in erucic acid and glucosinolate and hence is a suitable cooking oil. During 2001-02, area under canola was 118000 acres with an oil seed production of 59000 tonnes (Anonymous, 2002). Being a recent introduction in Pakistan, many aspects of canola package production technology need to be unveiled.

Fertilizer has the pivotal role in increasing crop production. Besides N and P, the use of K has been reported to influence productivity of seed yield and seed oil contents (Ghosh *et al*., 1995). Kuo and Chen (1980) reported that K increased the seed oil content of Tower var. of rape. Kandil (1983) reported that application of K along with N and P fertilizers improved the seed yield of rape.

The present study was, therefore, conducted to investigate the yield and oil quality response of canola to different potassium levels.

MATERIALS AND METHODS

A field experiment was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad during 2002-2003. Experiment comprised of the following treatments: 0 , 25, 50, 75, 100, 125 and 150 kg ha^{-1} K).

The experiment was laid out in randomized complete block design (RCBD) with three replications and a net plot size of 1.8m x 5m. Canola variety "Zafar-2000" was sown in the 1st week of October using seed rate of 5 kg ha^{-1} in 30 cm apart rows with a single row hand drill. Soil samples were taken before sowing of crop to a depth of 30 cm for physico-chemical analysis which showed that the experimental soil contained 0.929 O.M., 0.042% N, available phosphorus 6.7 ppm and available K 131 ppm with pH 8.0. Nitrogen and phosphorous @ 90-60 kg ha^{-1}, respectively were applied to all plots. Urea, diammonium phosphate and potassium sulphate were used as a source of N, P and K, respectively. All P, K and 1/2 N were side drilled at the time of sowing and remaining 1/2 N was top-dressed at early flowering stage.

Data were recorded on number of pods per plant, number of seeds per pod, 1000-seed weight (g), Biological yield (kg ha^{-1}), seed yield (kg ha^{-1}), harvest index %, oil contents and protein %. Economic analysis was also made to determine the economic fesibility of the treatments under study.

Data collected were analyzed statistically by using the Fisher's analysis of variance technique and LSD at 5% probability was used to compare the differences among treatments' means (Steel *et al*., 1997).

RESULTS AND DISCUSSION

Number of pods plant^{-1}. Data on number of pods plant^{-1} described in Table I show that seven different levels of K with recommended doses of N and P had highly significant effect on the parameters in question.

The maximum number of pods plant^{-1} (658.7) was recorded in T5 treatment where potassium level used was 125 kg ha^{-1}. This treatment differed significantly from rest of the treatments except T6. Minimum number of pods was observed in case of control treatment. The maximum number of pods plant^{-1} noted in case of T5 treatment can be attributed towards rich soil environments because of presence of sufficient quantities of K which promoted plant vegetative as well as reproductive growth processes. The results are in line with those of Mahadkar *et al*. (1996) who also reported that increasing the rate of K fertilizer increased the number of pods.

Number of seeds pod^{-1}. Number of seeds pod^{-1} is an important yield component which contributes materially towards final seed yield of canola. Results in table I show that various levels of fertilizer had highly significant affect on the number of seeds pod^{-1}.

The highest number of seeds pod^{-1} (24.30) were recorded in the treatment T5 where (125 kg ha^{-1} K and recommended doses of N & P) were used. However, it was statistically at par with treatments T6, T4, T3 and T2 treatments. The lowest number of seeds (19.67) pod^{-1} were found in T0 (control) treatment. These results are in agreement with Abd-EI-Gawad *et al*. (1990) who reported that increasing levels of K application not only increased the seed yield but also increased the pod number plant^{-1} and number of seeds pod $^{-1}$.

1000-seed weight (g). Seed weight has a direct bearing on the formation of final seed yield of a crop. The results in Table I reflect that K fertilizers had a significant influence on 1000-seed weight. The highest values of 1000-seed weight were recorded in the treatment T6 (3.630 g) where potassium was applied @ 150 kg ha^{-1}. This was, however, statistically at par with T5 and T4 treatments. The lowest value of 1000-seed weight was noted in control treatment T0 (3.043 g). The differences in mean seed weight are generally related to a short period between anthesis and maturity. At this time, supply of assimilates to the pods (seed) plays a crucial role in the development of seed and probably plants with greater supplies of nutrients are at greater advantage than those under low nutrition (Scott *et al*. 1973).

Biological yield (kg ha^{-1}). Data in Table I exhibit that different levels of potassium with recommended doses of N and P had highly significant effect on the parameter under discussion.

The maximum biological yield (23020 kg ha^{-1}) was recorded in T6 where the level of potassium (150 kg ha^{-1} K) was used. This treatment was statistically at par with T4 and T5 treatments. The lowest level of biological yield was, however, found in case of control treatment (16670 kg ha^{-1}).

Generally, TDM yield increased with increasing rate of fertilizer application. These results are similar to that of Munir and McNeilly (1987) who reported that increasing rates of K increased the dry matter production of canola.

Seed yield (kg ha^{-1}). Data regarding seed yield of canola as affected by different levels of K are presented in Table I, which indicate that different levels of fertilizers had highly significant effect on the parameter under study. The maximum seed yield (3473 kg ha^{-1}) was recorded in T6 treatment, where 150 kg ha^{-1} K was applied. It was however, statistically at par with treatments; T2, T3, T4 and T5 where 50, 75, 100 and 125 kg ha^{-1} K with recommended doses of N and P (90 & 60 kg ha^{-1}) were applied. While control treatment (T0) showed the lowest seed yield (2585 kg ha^{-1}). The higher seed yield in the treatment mentioned above was due to increased growth under sufficient macro nutrient status resulting in improvement in components of yield.

These results are in agreement with that of Ghosh *et al*. (1993) who reported that seed yield increased in response to increasing K rates.

Harvest index (%). Data in Table I indicate that the maximum H.I values (17.73%) were recorded in T2 treatment (50 kg ha^{-1}) and thereafter the increasing level of K resulted in decreased HI. These results are supported by that of Kandil (1983) who reported that increasing rate of fertilizer application increased HI.

Oil content (%). The results (Table I) showed significant sappressive effect on oil percentage by different levels of K. Maximum oil contents (42.86%) were found in T0 (control) where no fertilizer was applied and it was statistically at par

Table I. Production efficiency of canola (*Brassica napus* L.) as affected by different K levels

Treatments (K kg ha^{-1})	No. of pods/ plant	No. of seeds/pod	1000-seed weight (g)	Biological yield (kg ha^{-1})	Seed yield (kg ha^{-1})	Harvest Index	Seed oil content (%)	Protein content (%)
T_0 (0 kg)	607.0d	19.67c	3.043c	16670c	2585c	15.58bcd	42.86a	19.26d
T_1 (25 kg)	606.3d	20.30bc	3.293bc	17720bc	3055b	17.35ab	41.65ab	20.46c
T_2 (50 kg)	616.7cd	22.37ab	3.337b	18250bc	3174ab	17.73a	40.65bc	20.55c
T_3 (75 kg)	622.0c	23.07a	3.367bc	19980ab	3248ab	16.94abc	39.74cd	20.71c
T_4 (100 kg)	640.7b	22.97a	3.437ab	20370ab	3314ab	16.32abcd	38.99de	21.35bc
T_5 (125 kg)	665.0a	24.30a	3.507ab	22750a	3426a	15.21cd	38.29ef	21.80ab
T_6 (150 kg)	658.7a	23.50a	3.603a	23020a	3473a	14.91d	37.42f	22.37a

Any two means not sharing a letter in common differ significantly at 5% probability level

Table II. Economic analysis

Treatments (K kg ha^{-1})	Net Income (Rs. ha^{-1})
T_0 (0 kg)	43889.99
T_1 (25 kg)	53474.99
T_2 (50 kg)	55141.39
T_3 (75 kg)	5595.08
T_4 (100 kg)	56413.89
T_5 (125 kg)	58154.89
T_6 (150 kg)	58177.69

with the treatment T1. The T6 treatment (150 kg ha^{-1} K with recommended doses of N & P) gave significantly the lowest oil content (37.42%). These results are in agreement with that of Ved (1983) who reported that seed oil content increased with decreasing NPK rates.

Seed protein content (%). The comparison of treatment means given in Table I reflects that the maximum protein content (22.37%) was recorded in T6 (150 kg ha^{-1} K with recommended doses of N & P) treatment which was statistically at par with T5 treatment. These results are in agreement with the findings of Nordestgaard *et al*. (1984) who reported that nitrogen and potassium applications increased protein contents.

Economic analysis. Maximum net benefit of Rs. 58177.69 ha^{-1} was obtained in T6 (150 kg ha^{-1}) treatment closely followed by T5 (125 kg K ha^{-1}) treatment (Table II). Minimum net income was observed in T0 treatment, where no K fertilizer was applied.

CONCLUSION

Production efficiency of canola crop can be enhanced when fertilized @ 90-60-125 kg ha^{-1} N, P and K under agro-ecological conditions of Faisalabad (Pakistan).

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(Received 10 February 2004; Accepted 28 March 2004)