PRELIMINARY STUDY ON THE EFFECT OF NPK FERTILIZATION ON OIL SEED RAPE (BRASSICA NAPUS L.) IN EGYPT

by

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ABSTRACT

Two field experiments were carried out at the Agricultural Experiment and Research Centre, Faculty of Agriculture, Cairo University, Giza, Egypt during 1979/80 and 1980/81 seasons to study the effect of N levels (0, 30 and 60 kg N/faddan) P fertilization (0 and 30 kg P_2O_5/faddan) and K fertilization (0 and 24 kg K_2O/faddan) on growth, yield and yield components of oil seed rape cv. Techowski. The results could be summarized as follows :

1. Nitrogen fertilization caused significant increase in LA, dry matter, number of pods, seed weight / plant and plant height in both seasons. As average of both seasons seed yield increased by addition of 60 kg N/faddan by 53.8% over the unfertilized plots.

2. The marked increase due to phosphorus fertilization was observed in seed yield/faddan. The increase due to addition of 30 kg P_2O_5/faddan was estimated by 30.7 % over the zero level.

3. Addition of 24 kg K_2O/faddan increased seed yield by 35.1% over the untreated yield.

4. The interaction effect between N, P and K was significant on most of the studied characters in both seasons. The greatest seed yield was obtained from addition of 60 kg N + 30 kg P_2O_5 + 24 kg K_2O/faddan. This yield outyielded that of the untreated plots by 251 % (mean of the two seasons).

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INTRODUCTION

Response of oil seed rape to N, P and K may differ according to location, soil type, variety and other factors. In India, Patil and Rajat (1978) reported that the rape crop responded to N fertilization and it was profitable to use 53 kg N/ha under dryland conditions. However, Allen and Morgan (1972), in England, indicated that seed yield of oil seed rape responded to N application up to 212 kg N/ha. The response of oil seed rape to N fertilization was also reported by Stabbetorp (1973), Kolodziej - Deboswska (1973) and Herrmann et al. (1976). Seed oil content was reduced by N application (Kolodziej - Debowska, 1973 ; Allen and Morgan, 1972 ; and Patil and Rajat, 1978). However, plant height, number of branches and pods/plant, number of seeds/pod, 1000-seed weight and dry matter per plant were increased due to N application (Allen and Morgan, 1972 ; Osborne and Batten, 1978 ; and Patil and Rajat, 1978).

Concerning phosphorus and potassium fertilization, Stabbetrop (1973) reported that seed yield and oil content were increased by P fertilization. The same author and Osborne and Batten (1978) indicated that seed yield was not affected by potassium fertilization.

Nowadays, in Egypt, there is a great shortage in vegetable oils production. Consequently, satisfying the local consumption of vegetable oils could be achieved through increasing the productivity of well adapted oil crops and/or introducing new oil crops such as oil seed rape to adapte it under our condition. The present investigation aimed to give some information about the effect of NPK fertilization on oil seed rape (Brassica napus L.) under the condition of Giza district.

MATERIALS AND METHODS

Two field experiments were conducted at the Agricultural Experiment and Research Centre, Faculty of Agriculture, Cairo University, Giza, Egypt during 1979/80 and 1980/81 seasons. The soil type was clay loam in texture, pH 7.8 and contained 0.13 % total N, 0.18 % total phosphorus and 0.23 % total potassium. Oil seed rape cv. Techowski imported from West Germany was drilled at 40-cm row-spacing with seed rate of 4 kg/fad. The preceding crop was barley followed by fallow in 1979/80 season and by sesame in 1980/81 season. Seeding date was Nov. 26 and Nov. 19 in 1979/80 and 1980/81 seasons, respectively. Plants were irrigated four times at 30-day intervals. Harvesting took place on April 25 and April 30 in the two successive seasons. The following treatments were used in both seasons : a) N levels : 0,30 and 60 kg/faddan supplied from ammonium nitrate (31 % N). b) Phosphorus levels : 0 and 30 kg P_2O_5/faddan as supherphosphate (16 % P_2O_5). c) Potassium levels : 0 and 24 kg K_2O/faddan as potassium sulphate 50 % K_2O). All fertilizers were applied at seeding date.

The experimental design was split-split plot with three replications. The main plots were devoted to N levels, subplots were occupied by P levels and K levels were distributed in the sub-sub-plots. The sub-sub-plots size was 3 x 3.5 m. Each plot had 7 rows. The outer two rows were excluded to avoid the border

effects. Three samples of 10 plants were taken from the 2nd row at 45, 75 and 105 days plant age to determine the leaf area (LA)/ plant (dm^2), with disk method, and dry matter (DM) per plant (gm). At harvest time another 10 plants were taken to determine the average of plant height, number of branches, number of pods, seed weight/plant and 1000-seed weight. Seed yield/faddan was estimated from the rest four rows. Seed oil content was determined according to A.O.A.C. (1955).

All data were analysed statistically according the method described by Snedecor and Cochran (1967) and L.S.D. test was used for comparison between treatment means.

RESULTS AND DISCUSSION

1. Growth characters

Data in Table 1 show that LA and DM per plant were increased as plant age was increased. However, the rate of increase in LA/ plant at the growth stage of 45-75 days was greater than the rate of increase at the growth stage of 75-100 days. These results are in general agreement with those obtained by Tayo and Morgan (1975). Concerning DM/plant, it increased as plant old was increased and the rate of dry matter accumulation was high during the growth stage of 75-105 days. The increase in DM/plant at the later growth stage may be due to the increase in plant height, stim thickness and formation the pods and branches.

1.1. Effect of nitrogen :

Nitrogen fertilization increased LA/plant at the three growth stages in both seasons. The relative increase, as average of both seasons, estimated by 4 and 80 % over the zero level when N was applied at 30 and 60 kg N/faddan, respectively. Similar trend was observed with DM/ plant, but the accumulation of dry matter at latter stage was greater than earlier one. This could be explained by the increase in plant height, number of branches per plant (Table 1) and pod formation (Table 2). Allen and Morgan (1972) explained the increase in DM/ plant due to N application by the increase in plant height, number of flowering branches and LAI. Also, they stated that there are differences between the response of growth attributes to N fertilization during the different stages of development. The present results also agreed with the results of Osborne and Batten (1978), and Patil and Rajat (1978).

1.2. Effect of phosphorus :

Data in Table 1 show that the growth attributes namely LA and DM/ plant were significantly increased due to P application especially at the growth stage of 75-105 days. The increase in LA may be due to the profitable effect of phosphorus on the leaf duration, while the increase in DM per plant at late stage could be explained by the increase in fruiting branches.

1.3. Effect of potassium

Data in Table 1 cleared that K fertilization had no significant effect on growth characters at all growth stages in both seasons. This might be due to that native K which was present in the soil of this experiment was enough to satisfy the requirements of vegetative growth.

2. Yield and yield components

2.1. Effect of nitrogen :

Data in Table 2 show that N application had significant effect on number of pods, seed weight per plant and seed yield per faddan. However, 1000- seed weight and seed oil content were not significantly affected. As average of both seasons, addition of 30 and 60 kg N/faddan increased seed yield/faddan by 9.3 and 53.8% over the zero level. Such increase in seed yield was attributed to the increase in yield components especially number of pods and seed yield per plant. These results are in line with those obtained by Allen and Morgan (1972), Stabbeterp (1973), Herrmann et al. (1976) and Patil and Rajat (1978).

On the other hand, N fertilization had no significant effect on seed oil content in both seasons. These results disagreed with those obtained by Allen and Morgan (1972), Kolodziej-Debowska (1973) and Patil and Rajat (1978). They reported that N fertilization reduced seed oil content.

2.2. Effect of phosphorus :

In both seasons, Table 2 shows that the all tabulated characters were not significantly affected due to addition of 30 kg P_2O_5/faddan, except seed yield/faddan. The average of both seasons cleared that seed yield/faddan increased by 30.7% when 30 kg P_2O_5/faddan was applied compared to unfertilized treatment. These results in general are in harmony with those obtained by Stabbetorp (1973). Seed oil content was not significantly affected due to P fertilization. However Osborne and Batten (1978) reported that oil content was increased by P application.

2.3. Effect of potassium :

Table 2 shows taht K application caused a significant increase in seed yield/faddan in both seasons and number of pods/plants in one season. Addition of 24 kg K_2O/faddan caused an increase in seed yield/faddan estimated by 35.1% over the untreated control (mean of both seasons). Such increase was attributed to the increase in number of pods/plant. These results disagreed with the results of Stabbetorp (1974) who found that seed yield was not affected by K fertilization.

3. Interaction effects

Table 3 shows the significant symbols of the interaction effects on yield and yield components. Shortly, the 2nd order interaction between N, P and K had significant effect on seed yield in both seasons. The greatest seed yield (548 kg/faddan - average of both seasons) was obtained by addition of 60 kg N + 30 kg P_2O_5 + 24 K_2O/faddan. As average of both seasons, this yield outyielded the yield of $N_o + P_o + K_o$ treatment by 251 %. Also it was greater than the yield of 60 kg N only by 21 %. The increase over the yield of N 60 + P 30, N 60 + K 24, and P 30 + K 24 was 4.5 %, 10.9 % and 24.8 % respectively. These results cleared that the response of oil seed rape to NPK fertilizers was pronounced under the conditions of this experiment, especially when they were applied together. Such study must be followed by further studies about different rates and time of application of these fertilizers.

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Table 1 : Growth characters as affected by N, P and K fertilization in 1979/80 and 1980/81 seasons.

Characters	Growth stage (days)	N (kg/faddan)			P_2O_5 (kg/fad.)		K_2O (kg/fad.)	
		0	30	60	0	30	0	24
		1979/80 season						
1. LA/plant (dm^2)	45	9.30a	8.10a	14.80b	9.90a	11.70a	9.90a	11.50a
	75	27.30a	32.20a	50.60b	33.10a	41.60a	32.70a	37.90a
	105	35.80a	43.50a	74.70b	44.00a	58.70b	47.90a	54.70a
2. LM/plant (gm)	45	0.49a	0.42a	0.78b	0.52a	0.60a	00.51a	0.62a
	75	2.58a	3.22a	4.24b	3.15a	3.52a	3.21a	3.41a
	105	6.22a	7.47a	10.26b	7.01a	9.10b	7.93a	8.21a
3. Plant height (cm)	at	93.90a	89.50a	109.80b	96.00a	99.10a	98.90a	98.60a
4. No. of branches/plants	Harvest	2.37a	2.48a	3.11a	2.84a	3.18a	2.84a	3.17a
		1980/81 season						
1. LA/plant (dm^2)	45	13.40a	11.20a	22.30b	15.70a	16.80a	15.50a	17.10a
	75	48.20a	44.90a	76.80b	49.60a	63.60b	46.10a	67.80b
	105	42.30a	42.70a	80.00b	48.50a	61.50b	45.80a	64.20b
2. DM/plant (gm)	45	0.69a	0.71a	0.92a	0.77a	0.92a	0.76a	0.93a
	75	3.26a	4.00ab	5.26b	3.86a	4.49a	3.93a	4.42a
	105	8.67a	10.51a	14.98b	10.25a	12.52b	10.97a	11.81a
3. Plant height (cm)	at	106.80a	108.30a	125.50b	111.30a	113.60a	114.20a	115.00a
4. No. of branches/plant	Harvest	3.63a	3.53a	4.38a	3.53a	4.14a	3.67a	4.40a

Note : In this table and succeeding tables means followed by the same letter (a) are not significantly different at 0.05 level of significance.

Table 2 : Yield and yield components as affected by N, P and K fertilization in 1979/80 and 1980/81 seasons

Characters	N (kg/faddan)			P_2O_5 (kg/fad.)		K_2O (kg/fad.)	
	0	30	60	0	30	0	24
	1979/80 seasons						
1. No. of pods/plant	40.30a	53.30ab	70.30b	53.50a	59.00a	46.80a	53.10a
2. 1000-seed weight (gm)	2.65a	2.54a	2.63a	2.67a	2.53a	1.60a	1.81a
3. Seed weight/plant (gm)	1.21a	1.80ab	2.12b	1.68a	1.73a	2.70a	2.61a
4. Seed yield/fad. (kg)	279.00a	298.00a	417.00b	296.00a	367.00b	282.00a	381.00b
5. Seed oil content (%)	36.70a	36.50a	36.50a	36.10a	36.50a	36.10a	35.90a
	1980/81 season						
1. No. of pods/plant	48.80a	56.60a	81.10b	60.30a	64.00a	54.00a	72.50b
2. 1000-seed weight (gm)	2.44a	2.65a	2.71a	2.86a	2.88a	2.58a	2.76a
3. Seed weight/ plant (gm)	1.93a	2.80b	2.38b	2.52a	2.66a	2.81a	2.73a
4. Seed yield/fad. (kg)	310.00a	346.00a	489.00a	322.00a	441.00b	324.00a	438.00b
5. Seed oil content (%)	36.20a	35.90a	36.10a	36.20a	36.40a	36.10a	35.80a