Effect of Nitrogen and Molybdenum on the Growth and Yield of Garden Pea (*Pisum sativum* L.)

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Abstract

A field experiment was conducted at the research farm of Sher-e-Bangla Agricultural University, Dhaka, during December 2006 to February 2007 to study the effect of nitrogen and molybdenum on the growth and yield of garden pea. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications of each treatment. There were 15 treatments combinations in the experiment comprising 5 levels of N (0, 30, 60, 90 & 120 kg ha^{-1} designated as N_0, N_{30}, N_{60}, N_{90} & N_{120} respectively) and 3 levels of Mo (0, 0.4 & 0.8 kg ha^{-1} designated as Mo_0, $Mo_{0.4}$& $Mo_{0.8}$ respectively). The individual and interaction effect of N and Mo on growth and yield was found significant. Nitrogen @ 90 kg ha^{-1} gave the highest number of branches plant^{-1}, highest number of pods plant^{-1}, highest pod length, highest green and mature seed weight 10 pods^{-1}, highest green and mature pod yield but maximum plant height and number of seeds pod^{-1} were found under 120 kg N ha^{-1}. In case of molybdenum application the highest plant height, highest number of branches plant^{-1}, highest pod length, highest seed weight 10 pods^{-1} were recorded in 0.4 kg Mo ha^{-1}. Molybdenum @ 0.8 kg ha^{-1} gave the highest fresh weight of plant and highest fresh weight of pods. The treatment combination of N_{120} $Mo_{0.4}$ produce the maximum plant height, highest number of seed pod^{-1}, highest number of pods plant^{-1}, highest fresh weight of plant, but the treatment N_{90} $Mo_{0.4}$ gave the maximum number of branches plant^{-1}, highest length of pod, highest number of seeds pod^{-1}, highest seed weight 10 pods^{-1}, highest pod yield, maximum P, K and S content in plants. Lowest N, P, K and S content was found in control (N_0Mo_0) treatment. From the present findings it can be concluded that application of N @ 90 g ha^{-1} along with Mo @ 0.4 kg ha^{-1} is the most suitable combination to achieve the maximum return from garden pea plants.

1. Introduction

The garden pea (*Pisum sativum* L.) is a cool season annual vegetable crop grown during the winter months in Bangladesh. It is widely spread legume belonging to the sub-family Papilionaceae under the family Leguminosae. The garden pea is grown mainly for green seeds and it can be eaten without any cooking process due to it's sweetly taste. Pea is highly nutritious containing high percentage of digestible protein along with carbohydrates and vitamins. It is also very rich in minerals (Choudhury, 1976). Pea contains 15-35% protein, 20-50% starch, 4-10% sugar, 0.6-1.5% fat and 2-4% minerals. This crop and it's by products can also be used as fodder. It is used as green manure as well (Makasheva, 1983). As a nitrogen fixing crop with a high assimilating capacity of the roots, it utilizes the chemical compounds, which are low in solubility and rarely accessible to cereals from the cultivated soil layers. Garden pea in crop rotation helps in improvement of soil fertility and yield of succeeding crops (Rana and Sharma, 1993). At present pea is being cultivated in an area of 7468 ha in Bangladesh, with a total production of 13540 mt (Anonymous, 2000). The average yield is only 0.77 t ha^{-1}, which is much lower as compare to other pea growing countries such as USA 3.94 t ha^{-1} and France 3.23 t ha^{-1} (Makasheva, 1983). Fertilizers exert significant influence on yield, vigorous growth and yield attributes of legume. Nitrogen is critically deficient and is the most limiting element in Bangladesh soil. Deficit of nitrogen results in poor growth and stunting of plants, and consequently reduction in crop yields (Machler et al., 1988). In general, starter dose of nitrogen fertilizer is being practised in Bangladesh for the cultivation of legume crops. It is assumed that legumes can fix atmospheric nitrogen and can meet up their requirement through biological nitrogen fixation process.

The importance of trace elements including molybdenum has been well suggested for various crops. Molybdenum (Mo), an essential micro nutrient, is known to participate in the nitrate reduction system of nitrogen metabolism in higher plants (Nicholas, 1961). Vanselow and Datta (1949) had shown that molybdenum was important for plant growth whether the plant was grown in nitrate or in ammonium medium. The increased yield of pea by the application of molybdenum, according to them, was the consequence of greater production of yield attributes and growth parameters. The direct effect of molybdenum deficiency was on nitrogen metabolism through accumulation of non-protein soluble nitrogen in the tissues without its utilization in the growth of the plant. Thus, molybdenum has taken an important place in the list of trace elements essential for plant growth and its use as a fertilizer has been widely recognized, especially in the pulse crop cultivation. So, balanced N application to the garden pea plant is a prerequisite condition for obtaining optimum potentiality of pea plant. Hence, there is an urgent need to maximize the pea production by applying different nutrients like N and Mo to the soil. Thus, an attempt was made in a field trial to observe the effect of nitrogen and molybdenum on the growth and yield of garden pea.

2. Materials and Methods

The experiment was conducted at the research field at Sher-e-Bangla Agricultural University, Dhaka- 1207, during the period from December 2006 to February 2007 using garden pea as a test crop. The General Soil Type of the experimental field was Deep Red Brown Terrace Soil. Topsoil was silty clay loam in texture. Organic matter content was very low (0.98%) and soil pH was 5.8. Five levels of nitrogen (N_0=control, N_1=30, N_2=60, N_3=90 kg N ha^{-1} and N_4=90 kg N ha^{-1}) and 3 levels of Molybdenum (Mo_0=control, Mo_1=0.4, and Mo_2=0.8 kg Mo ha^{-1}) in a full factorial combinations were applied as urea-N, Ammonium molybdate-Mo, TSP-P_2O_5, MOP-K_2O, gypsum-S and $ZnSO_4$-Zn following a randomized block design with three replications. Half of nitrogen and whole of molybdenum and basal dose of phosphorus, potassium, zinc and sulphur were applied during final land preparation. The fertilizers were mixed thoroughly with the soil and rest nitrogen was applied in two equal splits on 18th December, 2006 and 13th January, 2007. During the calculation of amount of urea plot^{-1}, nitrogen supplied through ammonium molybdate was subtracted. The normal cultural practices including gap filling, weeding, irrigation and insecticides spray were done as and when necessary. For data collection, five plants were selected at random in such a way that the border effect could be avoided. Data were recorded periodically from the sample plants at 15 days interval. Each plot were harvested to record the yield and different parameters like, plant height, number of branches plant^{-1}, number of pods plant^{-1}, pod length, number of seeds plant^{-1}, seed weight 10 pods^{-1}, green plant weight, mature plant weight, green pod yield and mature pod yield were statistically analyzed by using DMRT test.

3. Results and Discussion

3.1. Plant height

The effect of nitrogen on the plant height of garden pea was significant (table 1). The maximum plant height (40.31 cm) was attained in the treatment N_{120}, which was statistically similar to N_{90} and the minimum plant height of garden pea (30.80 cm) was found in control treatment. Gosal et al. (2000) also obtained the similar results. Rahman and Quasem (1982) also reported higher plant height in pea with 60 kg N ha^{-1}. Plant height of garden pea influenced significantly by the application of different levels of molybdenum (table 2). The highest plant height (38.71 cm) was obtained in treatments 0.4 kg Mo ha^{-1} which was statistically similar to that of 0.8 kg Mo ha^{-1}. The lowest plant height (33.99 cm) was obtained in the control treatment (0 kg Mo ha^{-1}). Zaman et al., (1996) recorded highest plant height with 1 kg Mo ha^{-1}. The treatment combinations of nitrogen and molybdenum had significant effect on plant

Table 1: Effect of different levels of nitrogen on the growth and yield contributing characters of garden pea

Nitrogen (kg ha^{-1})	Plant height (cm)	Number of branches plant^{-1}	Number of pods plant^{-1}	Pod length (cm)	Number of seeds pod^{-1}	Green seed weight 10 pods^{-1} (g)	Matured seed weight 10 pods^{-1} (g)	Green pod yield (t ha^{-1})	Matured pod yield (t ha^{-1})
N_0	30.80^{d}	1.78^{b}	4.98^{c}	6.52^{b}	3.75	17.02^{b}	13.43^{c}	3.85^{d}	3.62^{d}
N_{30}	35.96^{c}	2.17^{b}	5.40^{bc}	6.69^{b}	4.17	17.47^{ab}	13.84^{bc}	4.64^{c}	4.51^{c}
N_{60}	36.45^{bc}	2.44^{ab}	5.58^{b}	7.24^{a}	4.20	17.76^{a}	14.44^{ab}	5.00^{bc}	4.91^{bc}
N_{90}	39.42^{ab}	3.17^{a}	6.16^{a}	7.54^{a}	4.23	17.96^{a}	14.57^{ab}	6.73^{a}	6.36^{a}
N_{120}	40.31^{a}	2.67^{ab}	5.78^{ab}	7.23^{a}	4.44	17.84^{a}	14.70^{a}	5.70^{b}	5.36^{b}
LSD (p=0.01)	3.169	0.869	0.466*	0.386	NS	0.683	0.781	0.7389	0.5392

In a column figures having similar letter(s) do not differ significantly; *significant at 5% level of significance

height (table 3). The maximum plant height (45.87 cm) was found in the treatment combination of $N_{120}Mo_{0.4,}$ which was statistically similar to that of treatment combination of N_{120} $Mo_{0.8}$. The lowest plant height (26.0 cm) was obtained from the control treatment combination (N_0Mo_0).

3.2. Number of branches plant^{-1}

The effect of N on number of branches plant^{-1} was influenced significantly (table 1). The number of branches plant^{-1} ranged from 1.18 to 3.17 .The highest number of branches plant^{-1} (3.17) was recorded in the treatment of 90 kg N ha^{-1}, which was statistically similar with the treatment of 120 kg N ha^{-1} and 60 kg N ha^{-1}. The lowest number of branches plant^{-1} (1.18) was found in the control treatment (0 kg N ha^{-1}). Nitrogen enhanced vegetative growth and development of plant, which ultimately may have increased the number of branches plant^{-1} up to a certain level (90 kg N ha^{-1}). Further addition of N reduced number of branches plant^{-1}. Rahman and Quasem (1982) showed a similar result with 60 kg N ha^{-1}. Number of branches plant^{-1} varied significantly with different levels of molybdenum treatment (table 2). The number of branches plant^{-1} ranged from 2.0 to 2.7. The highest number of branches plant^{-1} (2.7) was found in the treatment of 0.4 kg Mo ha^{-1}, which was closely related to 0.8 kg Mo ha^{-1}. The lowest number of branches plant^{-1} (2.0) was obtained in the control treatment (0 kg Mo ha^{-1}). Zaman et al., (1996) recorded highest number of branches plant^{-1} with 2 kg Mo ha^{-1}. Number of branches plant^{-1} was significantly influenced by the interaction effects of the nitrogen and molybdenum. The combined effect of nitrogen and molybdenum levels on the number of branches plant^{-1} was highly significant (table 3). The number of branches plant^{-1} ranged from 1.5 to 3.5. The maximum number of branches plant^{-1} (3.5) was obtained from the treatment combination of 90 N ha^{-1} and 0.4 kg Mo ha^{-1} ($N_{90}Mo_{0.4}$), which was statistically similar to $N_{120}Mo_{0.4}$, $N_{90}Mo_{0.8}$, $N_{60}Mo_{0.8}$ and $N_{120}Mo_0$ treatment combination. The minimum number of branches plant^{-1} (1.5) was observed from control treatment combination (N_0Mo_0).

3.3. Number of pods plant^{-1}

Nitrogen had highly significant effect on the number of pods plant^{-1} (table 1). The number of pods plant^{-1} ranged from 4.98 to 6.16 .The highest number of pods plant^{-1} (6.16) was recorded in the treatment of 90 kg N ha^{-1}, which was statistically similar with the treatments 120 kg N ha^{-1}. The lowest number of pods plant^{-1} (4.98) was found in the control treatment (0 kg N ha^{-1}). But the application of 120 kg N ha^{-1} did not result in any further increase in number of pods plant^{-1} compared to 90 kg N ha^{-1}. Singh and Verma (2002), Tewari et al. (2000) and Calvache et al. (1997) also observed the similar results in bush bean. The number of pods plant^{-1} was not significantly influenced by different levels of Mo (table 2). The number of pods plant^{-1} ranged from 5.44 to 5.75. The higher number of green pods plant^{-1} (5.75) was recorded from the treatment of 0.8 Mo ha^{-1} and the lower number of pods plant^{-1} (5.44) was found in the control treatment. Further it was found that number of pods plant^{-1} increased insignificantly with increasing level of Mo. Manga et al., (1999) found highest number of pods plant^{-1} with 1 kg Mo ha^{-1}. Andrade et al. (1999) found no significant effect of Mo on number of pods plant^{-1}. The interaction of nitrogen and molybdenum levels showed the significant influence on the number of pods plant^{-1} (table 3). The number of green pods plant^{-1} ranged from 4.47 to 7.40. The highest number of pods plant^{-1} (7.40) was recorded from the treatment combination of 120 N ha^{-1} and 0.4 kg Mo ha^{-1} ($N_{120}Mo_{0.4}$), which was statistically similar with most of other treatments. The lowest number of green pods plant^{-1} (4.47) was obtained from the control treatment.

3.3. Pod length

The effect of different levels of N on the pod length was significant (table 1). The length of pods ranged from 6.52 to 7.54 cm .The highest pod length (7.54 cm) was recorded in the treatment of 90 kg N ha^{-1} (N_{90}), which was statistically similar to that of 120 kg N ha^{-1} and 60 kg N ha^{-1}. The lowest pod length (6.52 cm) was found in the control treatment (0 kg N ha^{-1}). Similar results were also reported by Tewari and Singh (2000) and Sharma (1996). Statistically influence on pod length was found by the application of different levels of Mo (table 2). The length of green pods ranged from 6.59

Table 2: Effect of different levels of molybdenum on the growth and yield contributing characters of garden pea

Nitrogen (kg ha^{-1})	Plant height (cm)	Number of branches plant^{-1}	Number of pods plant^{-1}	Pod length (cm)	Number of seeds pod^{-1}	Green seed weight 10 pods^{-1} (g)	Matured seed weight 10 pods^{-1} (g)	Green pod yield (t ha^{-1})	Matured pod yield (t ha^{-1})
Mo0	33.99^{b}	2.00^{b}	5.44	6.59^{b}	3.82	17.11^{b}	13.49^{b}	4.87^{b}	4.55^{b}
Mo0.4	38.71^{a}	2.70^{a}	5.55	7.47^{a}	4.39	18.25^{a}	14.63^{a}	5.31^{ab}	4.57^{ab}
Mo0.8	37.07^{ab}	2.63^{ab}	5.75	7.11^{a}	4.48	17.47^{b}	14.46^{a}	5.37^{a}	5.12^{a}
LSD (p=0.01)	3.815	0.256	NS	0.465	NS	0.755*	0.940	0.486	0.549

In a column figures having similar letter(s) do not differ significantly; *significant at 5% level of significance

to 7.47 cm. The highest pod length (7.47 cm) was recorded from the treatment of 0.4 kg Mo ha^{-1}, which was statistically similar to the treatment of 0.8 kg Mo ha^{-1}. The lowest pod length (6.59 cm) was found in the control treatment (0 kg Mo ha^{-1}). The interaction effect of different combination of nitrogen and molybdenum on pod length were significant (table 3). The length of green pods ranged from 6.10 to 8.23 cm. The highest pod length (8.23 cm) was obtained from the treatment combination of 90 N ha^{-1} and 0.4 kg Mo ha^{-1} ($N_{90}Mo_{0.4}$), which was significantly different from other treatments. The lowest length of pod (6.10 cm) was obtained from the control treatment.

3.4. Number of seeds pod^{-1}

There were no significant differences among the different levels of N on number of seeds pod^{-1} (table 1). But it was observed that the number of seeds was increased with the increase of nitrogen level. The maximum number of seeds pod^{-1} (4.44) was found in 120 N ha^{-1} and the lowest number of seed pod^{-1} (3.75) was obtained from the control treatment (0 kg N ha^{-1}). Rahman and Quasem (1982) showed a similar result with 60 kg N ha^{-1} in cowpea. Molybdenum had also no significant effect on the number of seeds pod^{-1} (table 2). The number of seed pod^{-1} ranged from 3.82 to 4.48. The highest number of seeds pod^{-1} (4.48) was obtained when the crop was fertilized with 0.8 kg Mo ha^{-1} and the lowest number of seeds pod^{-1} (3.82) was obtained in the control treatment. It was also observed that the number of seeds pod^{-1} was increased with increase of Mo levels. Manga et al., (1999) found highest number of seeds pod^{-1} with 1 kg Mo ha^{-1}. The interaction effects of different doses of nitrogen and molybdenum on seeds pod^{-1} was significant (table 3). The number of seeds pod^{-1} ranged from 3.17 to 4.80. The highest number of seeds pod^{-1} (4.80) was obtained from the treatment combination of 90 N ha^{-1} and 0.4 kg Mo ha^{-1} ($N_{90}Mo_{0.4}$), which was statistically similar to that of $N_{120}Mo_{0.4}$, $N_{90}Mo_{0.8}$ and $N_{120}Mo_{0.8}$ treatment combinations. The lowest number of seed pod^{-1} (3.17) was obtained from the control treatment combination (N_0Mo_0).

3.5. Green seed weight 10 pods^{-1}

The green seed weight 10 $pods^{-1}$ was significantly influenced by different levels of nitrogen (table 1). The green seed weight 10 $pods^{-1}$ ranged from 17.02 to 17.96 g. The highest green seed weight 10 $pods^{-1}$ (17.96 g) was obtained when the crop was fertilized with 90 kg N ha^{-1}, which was statistically similar with other treatments except control. The lowest green seed weight 10 $pods^{-1}$ (17.02 g) was found in control treatment where no nitrogen was applied. Singh et al., (1992) showed that seed yield of pea increased with increasing N up to 30 kg ha^{-1}. The green seed weight 10 $pods^{-1}$ was significantly

Table 3: Effects of different levels of nitrogen and molybdenum on the growth and yield contributing characters of garden pea

Nitrogen (kg ha^{-1})	Plant height (cm)	Number of branches $plant^{-1}$	Number of pods $plant^{-1}$	Pod length (cm)	Number of seeds pod^{-1}	Green seed weight 10 $pods^{-1}$ (g)	Matured seed weight 10 $pods^{-1}$ (g)	Green pod yield (t ha^{-1})	Matured pod yield (t ha^{-1})
N_oMo_0	26. 00^{e}	1.500^{f}	4.47^{c}	6.10^{i}	3.17^{g}	16.53^{d}	12.60^{h}	3.2^{j}	3.00^{h}
$N_{30}Mo_0$	32.61^{d}	1.667^{ef}	4.60^{bc}	6.13^{i}	3.73^{f}	16.73^{cd}	13.48^{efg}	3.9^{i}	3.70^{g}
$N_{60}Mo_0$	33.53^{d}	2.50^{b-d}	5.27^{bc}	6.87^{fgh}	4.067^{c-f}	16.80^{cd}	14.20^{cde}	4.40^{ghi}	4.84^{de}
$N_{90}Mo_0$	33.80^{d}	2.67^{a-d}	5.37^{bc}	7.07^{d-g}	4.27^{b-e}	17.13^{c}	13.35^{fg}	5.1^{d-g}	5.05^{cd}
$N_{120}Mo_0$	40.87^{bc}	2.83^{abc}	5.67^{abc}	7.07^{d-g}	4.33^{a-e}	17.60^{c}	14.60^{bcd}	5.77^{cd}	5.36^{cd}
$N_0Mo_{0.4}$	33.47^{d}	1.667^{ef}	4.80^{bc}	6.67^{h}	3.87^{ef}	16.73^{cd}	12.94^{gh}	4.14^{hi}	4.05^{fg}
$N_{30}Mo_{0.4}$	33.33^{d}	2.00^{c-f}	5.73^{abc}	6.97^{e-h}	4.27^{b-e}	17.60^{c}	13.97^{c-f}	4.90^{fg}	4.42^{def}
$N_{60}Mo_{0.4}$	41.27^{bc}	2.67^{a-d}	5.77^{abc}	7.13^{def}	4.27^{a-e}	18.20^{b}	14.67^{bc}	5.04^{efg}	5.52^{c}
$N_{90}Mo_{0.4}$	38.53^{c}	3.50^{a}	6.53^{ab}	8.23^{a}	4.80^{a}	19.13^{a}	15.30^{ab}	7.44^{a}	7.30^{a}
$N_{120}Mo_{0.4}$	45.87^{a}	3.33^{ab}	7.40^{a}	7.67^{bc}	4.73^{ab}	19.07^{a}	15.85^{a}	5.60^{c-f}	5.50^{c}
$N_0Mo_{0.8}$	33.53^{d}	1.833^{def}	5.20^{bc}	6.77^{gh}	4.00^{def}	16.60^{d}	13.82^{def}	4.73^{gh}	4.15^{fg}
$N_{30}Mo_{0.8}$	34.55^{d}	2.00^{c-f}	5.55^{abc}	6.8^{fgh}	4.40^{a-d}	17.33^{c}	14.05^{c-f}	5.01^{fg}	4.90^{de}
$N_{60}Mo_{0.8}$	38.87^{c}	2.83^{abc}	5.77^{abc}	7.37^{cd}	4.53^{abc}	18.33^{b}	14.75^{bc}	5.74^{cde}	5.20^{cd}
$N_{90}Mo_{0.8}$	39.07^{c}	3.00^{ab}	6.00^{abc}	7.77^{b}	4.73^{ab}	18.27^{b}	15.20^{ab}	6.60^{b}	6.28^{b}
$N_{120}Mo_{0.8}$	43.53^{ab}	2.67^{a-d}	5.77^{abc}	7.33^{cde}	4.73^{ab}	18.07^{bc}	14.15^{cde}	6.15^{bc}	5.05^{cd}
LSD (p=0.01)	2.815	0.772*	1.476	0.343	0.458	0.547	0.694	0.6563	0.479

In a column figures having similar letter(s) do not differ significantly; *significant at 5% level of significance

influenced by molybdenum application (table 2). The green seed weight 10 pods^{-1} ranged from 17.11 to 18.25 g. The highest green seed weight 10 pods^{-1} (18.25 g) was obtained when the crop was fertilized with 0.4 kg Mo/ and the lowest green seed weight 10 pods^{-1} (17.11 g) was obtained in the control treatment. Similar results were found by Manga et al*.,* (1999) in winged bean. The interaction effects of different doses of nitrogen and molybdenum on green seed weight 10 pods^{-1} were significant (table 3). The green seed weight 10 pods^{-1} ranged from 16.53 to 19.13 g. The highest green seed weight 10 pods^{-1} (19.13 g) was obtained from the treatment combination of 90 N ha^{-1} and 0.4 kg Mo ha^{-1} ($N_{90}Mo_{0.4}$), which was closely related to treatment combination of 120 kg N ha^{-1} + 0.4 kg Mo ha^{-1}. The lowest green seed weight 10 pods^{-1} (16.53 g) was obtained from the control treatment.

3.6. Matured seed weight 10 pods^{-1}

The matured seed weight 10 pods^{-1} was significantly influenced by different levels of nitrogen (table 1). The matured seed weight 10 pods^{-1} ranged from 13.43 to 14.70 g. The highest matured seed weight 10 pods^{-1} (14.70 g) was obtained when the crop was fertilized with 120 kg N ha^{-1}, which was statistically similar with the treatment N_{90} and N_{60}. The lowest matured seed weight 10 pods^{-1} (13.43 g) was found in control treatment where no nitrogen was applied. Singh et al*.,* (1992) showed that seed yield of pea increased with increasing N up to 30 kg ha^{-1}. The matured seed weight 10 pods^{-1} was significantly influenced by molybdenum application (table 2). The matured seed weight 10 pods^{-1} ranged from 13.49 to 14.63 g. The highest matured seed weight 10 pods^{-1} (14.63 g) was obtained when the crop was fertilized with 0.4 kg Mo ha^{-1}, which was statistically similar to 0.8 kg Mo ha^{-1} and the lowest matured seed weight 10 pods^{-1} (13.49 g) was obtained in the control treatment. Similar results were found by Manga et al*.,* (1999) in winged bean. The interaction effects of different doses of nitrogen and molybdenum on matured seed weight 10 pods^{-1} were significant (table 3). The matured seed weight 10 pods^{-1} ranged from 12.60 to 15.85 g. The highest matured seed weight 10 pods^{-1} (15.85 g) was obtained from the treatment combination of 120 N ha^{-1} and 0.4 kg Mo ha^{-1} ($N_{90}Mo_{0.4}$), which was identical to treatment combination of 90 kg N ha^{-1} + 0.4 kg Mo ha^{-1} and of 90 kg N ha^{-1} + 0.8 kg Mo ha^{-1}. The lowest matured seed weight 10 pods^{-1} (12.60 g) was obtained from the control treatment combination (N_0Mo_0).

3.7. Green pod yield (t ha^{-1})

The green pod yield ha^{-1} was significantly influenced by different levels of nitrogen (table 1). The green pod yield ranged from 3.85 to 6.73 t ha^{-1}. The highest green pod yield (6.73 t ha^{-1}) was obtained when the crop was fertilized with 90 kg N ha^{-1}, which was significantly higher than other treatments. The lowest green pod yield (3.85 t ha^{-1}) was found in control treatment where no nitrogen was applied. Nitrogen @ 90 kg ha^{-1} produced higher number of pods plant^{-1}. So, pod yield ha^{-1} was higher with 90 kg N ha^{-1} than 120 kg N ha^{-1}. Saini and Thakur (1996) stated that green pod yield increased with up to 30 kg N ha^{-1}. Negi (1992) found highest green pod yield with 20 kg N ha^{-1}. Singh and Singh (1990) found similar result with 40 kg N ha^{-1} in pea. The green pod yield ha^{-1} was significantly influenced by molybdenum application (table 2). Green pod yield of garden pea was gradually increased with increasing level of Molybdenum. The highest green pod yield (5.37 t ha^{-1}) was recorded in 0.8 kg Mo ha^{-1}, which was statistically similar to the treatment of 0.4 kg Mo ha^{-1}. The lowest green pod yield (4.87 t ha^{-1}) was recorded in control treatment. Hazra and Tripathi (1998) observed that molybdenum application @ 1.5 kg ha^{-1} gave the highest seed yield of pea. The interaction effect of different doses of nitrogen and molybdenum on the green pod yield ha^{-1} was significant (table 3). The highest green pod yield (7.44 t ha^{-1}) was recorded in 90 kg N ha^{-1} + 0.4 kg Mo ha^{-1}, which was statistically higher than other treatments. The lowest green pod yield (3.2 t ha^{-1}) was recorded in control.

3.8. Matured pod yield (t ha^{-1})

The matured pod yield ha^{-1} was significantly influenced by different levels of nitrogen (table 1). The highest matured pod yield (6.36 t ha^{-1}) was obtained from 90 kg N ha^{-1} and lowest (3.62 t ha^{-1}) was found in control treatment. From these results it was found that mainly nitrogenous fertilizer increased vegetative growth as well as pod yield. Nitrogen @ 90 kg ha^{-1} produced higher number of pods plant^{-1}. So, pod yield ha^{-1} was higher with 90 kg N ha^{-1} than 120 kg N ha^{-1}. Saini and Thakur (1996) stated that pod yield increased with up to 30 kg N ha^{-1}. Singh and Singh (1990) found similar result with 40 kg N ha^{-1}. Different levels of molybdenum had significant effect on matured pod yield ha^{-1} (table 2). The highest matured pod yield (5.12 t ha^{-1}) was recorded in 0.8 kg Mo ha^{-1}, which was statistically similar with $Mo_{0.4}$. The lowest matured pod yield (4.55 t ha^{-1}) was recorded in control. Hazra and Tripathi (1998) observed that molybdenum application @ 1.5 kg ha^{-1} gave the highest seed yield of pea. The interaction effect of different doses of nitrogen and molybdenum on the matured pod yield ha^{-1} was found to be significant (table 3). The highest the matured pod yield (7.3 t ha^{-1}) was recorded with 90 kg N ha^{-1} + 0.4 kg Mo ha^{-1}. The lowest the matured pod yield (3.00 t ha^{-1}) was recorded in control.

4. Conclusion

From the present study, it was clear that both nitrogen and molybdenum had significant effect on the growth and yield of garden pea. Solely 90 kg N ha^{-1} gave the highest number

of branches plant^{-1}, number of pods plant^{-1}, pod length, green seed weight, green pod yield and matured pod yield. On the contrary, 0.4 kg Mo ha^{-1} gave the highest plant height, number of branches plant^{-1}, pod length, green seed weight and matured seed weight. However, from statistical point of view among fifteen treatment combinations, 90 kg N ha^{-1} along with 0.4 kg Mo ha^{-1} was the best for maximum yield of garden pea.

5. References

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