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Effect of foliar application of nitrogen on growth and yield of vegetable pea (*Pisum sativum* L.) Cv. Kashi Udai

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Abstract
Foliar feeding of nitrogen was given on vegetable pea (*Pisum sativum* L.) Cv.Kashi Udai at flowering stage with doses of nitrogen 1%, 2% and 3% as urea by dissolving in per litre of common water as well as distilled water separately. The experimental finding revealed that pea respond well to foliar feeding of nitrogen. Data recorded on height of plant, length of pod, fresh weight of pod, yield of pods per plant as well as per hectare significantly increased with application of 2% nitrogen (20 g urea/litre of water), and non- significant effect noticed only on number of pods per plant. It had also been observed that higher dose of nitrogen beyond 2% promoted plant growth but yield attributing characters adversely affected.

Keywords: Vegetable Pea, Nitrogen, urea, foliar feeding

Introduction
Vegetable Pea (*Pisum sativum* L.) is an important legume crop grown for its green pod. It is grown throughout the world but india has credit of bagging the highest production. In India, it is grown as winter vegetable in the plains of north india and as summer vegetable in the hills. It is widely grown in the state of U.P., Bihar, M.P., Punjab, Haryana and Himanchal Pradesh. Off late Himanchal Pradesh is going to succeed other pea growing states expect U.P. which ranks first as for area and production are concerned. Vegetable pea is highly nutritive containing high percentage of digestible protein along with carbohydrate, vitamins, minerals, Amino acids and sugar. It contains moisture 72.0 g, carbohydrate 15.89g, protein 7.2 g, fat 0.1 g, fiber 4.0 g, minerals 0.8 g, vitamin A 139 IU, vitamin B 0.25 mg and vitamin C 9.0 mg per 100 g edible part (Aykroyd 1963) [2]. Vegetable pea is an excellent food for human consumption taken as vegetable soup and other dishes. It is also canned, frozen or dehydrated for consumption in off-seasons. Being highly protenous it is quite valuable in vegetarian diet.
Vegetable pea native of central Asia belong to family leguminosae (Fabaceae), is of very ancient origin and its wild prototype has never been found. It is an annual herbaceous, glaucous which climbs by leaflet tendrils. It is self pollinated crop capable of using atmospheric nitrogen. The stem is slender, circular, weak and leaves are pinnate with up to three pairs of leaflets and terminal branched tendrils. The flowers are solitary, auxiliary bear in single or a group of white colour. Pods are swollen, curved, 8 to 10 cm long with as many as 10 seeds. Cultivar Kashi Udai had been chosen to examine to the response of nitrogen.
The growth and development are greatly regulated by environmental and cultural factors. Environmental factors viz- temperature, light, humidity etc. affect the seed germination, general survival, development of seedlings, quality of produce, occurrence diseases and pests. Cultural operations such as optimum showing date, spacing, number of irrigation, nutrient management etc. play vital in pea cultivation. Efficient nutrient management and expertise feeding is the need of the hour to increase quality production with maintaining fertility and sustainability of soil.
Garden pea an important crop extensively grown as cash crop. It is being realized that the productivity of crop is adversely affected in different areas due to deficiency of macro and micro nutrients. There are steady trends to reduce the use of minerals such as N, P, K through soil because its use has decreased by 7 times rather than foliar feeding. These facts create pre-conditions to increase the importance of foliar fertilization as an alternative to meet plant nutrients demand during the growing period. Foliar feeding give rapid and effective response to plants need, regardless of soil conditions Additional foliar application during growth and development of crop can improve their nutrient balance, which may in tern lead to an increase

in growth and yield.

The keenness in foliar feeding increased due to development of machinery for spraying and overhead system of irrigation which facilitate the application of nutrients to crop in the form of sprays. It also reduce cast of production and maintain soil quality. Though foliar sprays cannot be substitute of soil fertilization but it can be used as supplement of soil application in sustainable crop production Foliar fertilization may indeed be an enviornmently, friendly feeding method since the nutrients are directly delivered to the plant in limited amounts, thereby helping to reduce the environmental impact associated with soil application.

At flowering pea plants need more feeding due diversion of nutrients from vegetative phase to reproductive phase. Insufficient supply of MO also leads to significant reduction of MO content in plants and nitrogen fixation activity. Hence plants need more nitrogen during flowering to proper growth and development. Foliar feeding is the best option to supply nitrogen to the plants.

Materials and Methods

The experiment was carried out at the field of Department of Horticulture, Kulbhaskar Asharam Post Graduate College, Allahabad (U.P.) during the year 2015-16. The field was prepared and laid-out. A common dose of nitrogen, phosphorus and potash (30:60:60 kg/ha) was incorporated in the field through urea, single super phosphate and murate of potash respectively during field preparation. The seeds of Kashi Udai pea were shown in plain beds on 6 November 2015 at spacing of 20 cm row to row and 15 cm plant to plant. Essential cultural operations were adopted to raise good crop. To study the effect of foliar application of nitrogen on growth and yield of vegetable pea three levels of nitrogen viz 1%, 2% and 3% were sprayed at flowering stage of pea crop. Each level of nitrogen was applied in form of urea as 10g, 20g and 30g respectively by dissolving in per litre of common water and distilled water separately. There were seven treatments viz N0, N1, N2, N3, N4, N5, and N6. As control (N0) only common water was sprayed. The treatments N1, N2 and N3 (10:20:30 g) was applied with common water and N4, N5 and N6 (10:20:30:g) was sprayed with distilled water. Observation were recorded for growth and yield attributing characters such as height of plants, length of pod, number of green pods per plants, fresh weight of green pods per plant, yield of green pods per plant and per hectare. The data were analyzed to study the impact of foliar feeding of nitrogen on growth and yield of pea crop.

Result and Discussion

Some of the parameters involved in growth and yield of vegetable pea were analyzed for the cultivar "Kashi Udai". The experimental result on growth and yield of vegetable pea as influenced by different levels of nitrogen are presented in tables.

Effect of nitrogen levels on growth parameters

The data summarized in table 1 Showed that height of plants significantly increased with application of all N treatments expect N1 and N4. The maximum plant height was observed (70.0 cm) with feeding of N2 (2% urea). The result is lined with Lysenko (1980) [3] who reported that application of nitrogen as urea with increased dose was effective and improved plant height. Foliar feeding of nitrogen exhibit ated significant variation of morphological parameter viz plant height over control where no foliar feeding was applied. This increased and development in plant height with application of N^2 level was chiefly associated with the availability of optimum and adequate quantity of nitrogen through foliar feeding. The result further proved that nitrogen is key and vital compound for initiation of meristematic activity and growth of pea plants.

Table 1: Effect of nitrogen levels on height of plants (cm)

Treatments	Height at spraying	Height at last picking	Increased growth (%)
No	54.0	62.6	15.93
N1	56.4	65.7	16.49
N2	55.6	70.0	25.96
N3	55.4	69.6	25.63
N4	56.2	66.4	18.14
N5	54.5	69.8	28.07
N6	54.6	68.6	25.64
CD at 5%	NS	4.2	3.21

The table 2 envisage that application of N levels significantly increased the length of pod at each picking stages Only N1 and N4 levels (1% urea) exhibited non-significant effect on pod length. The highest and significant pod length 9.2, 8.9 and 8.4 cm. was recorded at 1st, 2nd and 3rd picking stages respectively with application of N2 (2% urea). The other treatment levels i.e. N3, N5 and N6 were also recovered significant pod length at each picking stage. It also obvious from table that maximum pod length obtained at 1st picking in all treatments in comparison to 2nd and 3rd picking. Similarly pod length at 2nd picking was noted higher in comparison to 3rd picking in all N treatments. It has also been noticed that pod length gradually declined at each successive picking stages in all treatments. Achakzai and Banqulzai (2006) [1] advocated that pod length of pea significantly increased with positive increase application of N fertilization.

The significant pod length influenced by varying nitrogen levels is directly correlated with production of photosynthesis in leaves which regulated by presence of chlorophyll. It is worth wise to mention that nitrogen is the main constituent of chlorophyll, hence, directly involved in production of photosynthesis in plant leaves and translocated in different part.

Table 2: Effect of nitrogen levels on length of pod (cm)

Treatment	At 1st picking	At 2nd picking	At 3rd picking	Mean
No	8.0	7.6	7.4	7.6
N1	8.4	8.0	7.9	8.0
N2	9.2	8.9	8.4	8.8
N3	9.0	8.8	8.4	8.7
N4	8.6	8.2	7.9	8.1
N5	9.0	8.7	8.2	8.6
N6	8.9	8.6	8.2	8.6
CD at 5%	0.68	0.65	0.63	0.66

Effect of nitrogen levels on yield parameters

The data on pods number per plant exhibited non-significant result at each picking stages in all treatments. Total average number of pods per plant varied from 8.9 to 10.3 during investigation (table 3). The treatments N2, N3, N5 and N6 noted highest and nearby same number i.e. 10.3 pods/ plant followed by 9.2 and 9.3 pods/plant under N1 and N4 respectively. Woyke and Rzymlowska (1986) [8] reported that increasing dose of nitrogen increased the number of pods/plant. Achakzai and Bangulzai (2006) [1] were also in opinion that number of pods/plant increased with increasing

of nitrogen fertilizer. The minimum number of pods per plant (8.9) was noted under control (N0). The increased number of pods/plant under higher foliar feedings (2% and 3% urea) was mainly due to increase in plant height, which was the result of nitrogen availability in adequate quantity from foliar fertilization.

Table 3: Effect of nitrogen levels on number green pods per plant.

Treatment	At 1st picking	At 2nd picking	At 3rd picking	Total
No	3.3	3.3	2.3	8.9
N1	3.5	3.4	2.3	9.2
N2	4.2	3.6	2.5	10.3
N3	4.2	3.5	2.6	10.3
N4	3.6	3.4	2.3	9.3
N5	4.3	3.4	2.6	10.3
N6	4.2	3.5	2.5	10.2
CD at 5%	NS	NS	NS	NS

The perusals of table 4 reveales that foliar feeding of nitrogen to pea plants significantly influenced the fresh weight of pods/plant. The nitrogen level N2 recorded highest fresh weight of pods (80.1 g) per plant followed by N3 and N5 levels of nitrogen which gained pods weight 79.62 g and 79.5 g respectively. All N levels (N2, N3, N5 and N6) expect N1 and N4 were yielded fresh weight significantly at par in comparison to control (N0). Gradual decline in pods weight per plant was also noted with advance picking under each treatment. 1st picking remarked higher fresh weight of pods per plant rather than 2nd and 3rd picking. Similarly 2nd picking also made superiority over 3rd picking regarding fresh weight of pods per plant under each nitrogen levels. These findings are further supported by Lysenko (1980) [3] and Novikova *et al* (1986) [5]. They were of opinion that increased foliar feeding of nitrogen had positive and significant effect on yield contributing characters of pea.Nitrogen up take by plants quickly improves the metabolism of plants resulting weight of pods also improved. The increase weight of pods per plant under higher level of nitrogen feeding manly associated with improved plant height, increase pod number, length of pods and higher number of grains per pod which all had direct or indirect individual effects on pod weight.

Table 4: Effect of nitrogen levels on fresh weight of green pods per plant (g)

Treatments	At 1st picking	At 2nd picking	At 3rd picking	Total
No	24.72	23.58	15.36	63.62
N1	24.72	24.30	15.68	64.70
N2	36.72	26.46	16.92	80.10
N3	36.64	26.22	16.76	79.62
N4	25.80	24.51	15.36	65.67
N5	36.00	26.64	16.92	79.56
N6	36.64	25.92	16.48	79.04
CD at 5%	1.28	0.94	0.64	2.86

The yield of green pods/ha statistically calculated and presented in table 5. The significant result showed that the yield of pea pods greatly influenced by foliar feeding of N fertilizer as source of urea. The application of higher doses of nitrogen i.e. N2 and N3 in common water achieved higher yield 138.84 and 138.01 q/ha respectively in comparison to foliar feeding of N5 and N6 which sprayed by dissolving in distilled water. Highest yield (138.84g/ha) recorded under N2 level. Which lowest yield (112.40 g/ha) received under control plot where no foliar feeding was given.The result consonance by opinion of Silva and Uchida (2000) [7] and Mahmoud *et al* (2010) [4]. They stated that nitrogen is the major part of the chlorophyll molecule. This indicate the role of nitrogen on synthesis of chlorophyll which directly associated with yield and yield attributing characters. Rashid *et al* (2004) [6] reported that lower chlorophyll content plants were observed for N deficient plots and higher chlorophyll content plants were observed for N sufficient plots. This investigation reflect that higher pods yield received with N sufficient plots and vice-versa

Table 5: Effect of nitrogen levels on yield of green pods per plot and per hectare

Treatments	No. of plants per plot	Weight of pods per plant (g)	Yield of pods per plot (g)	Yield of pods per hectare (q)
No	53	63.62	3371.86	112.40
N1	54	64.70	3493.80	116.46
N2	52	80.10	4165.20	138.84
N3	52	79.62	4140.24	138.01
N4	52	65.67	3414.84	113.83
N5	52	79.56	4137.12	137.90
N6	52	79.04	4110.08	137.00
CD at 5%	-	2.86	126.24	8.14

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