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Growth and Marketable Green Pod Yield Performance of Pea (*Pisum sativum* L.) under Varying Levels of NPK Fertilizers

A. A. Kakar, M. Saleem, Rahim Shah and S. A. Qaim Shah
Agriculture Research Institute, Sariab, Quetta, Balochistan, Pakistan

Abstract: An Experiment to assess the effect of different rates of nitrogen, phosphorus and potassium (NPK) on morphological traits of local pea variety was conducted at Vegetable Seed Farm ARI, Sariab, Quetta during the year 2000-2001. The fertilizer treatments comprised control, 25-0-0, 25-60-0, 25-0-60, 25-60-60, 50-0-0, 50-90-0, 50-0-90, 50-90-90, 75-0-0, 75-120-0, 75-0-120, and 75-120-120, Kg NPK/ 4m^2 in a Randomized Complete Block Design. The maximum plant height (46.30 cm), number of branches per plant (5.60), number of pods per plant (33.10), pod length (8.49 cm), seed per pod (6.00), pod yield per plant (188.43 gms), total marketable green pod yield per plot (6.02 kg) and per hectare yield (5.01 m.t), were recorded in treatment 75-120-120 or 75-120-0, Kg NPK ha^{-1}, which displayed maximum green pod yield due to increase in pod per plant and pod length. It was further noted that an additional K did not increase the yield. Mean square attributable to treatment differed highly significant for all the quantitative traits showing the importance of fertilizer treatment in influencing morphological characteristics of pea plant.

Key words: Morphological traits, nitrogen, phosphorus and potassium fertilization, pea

Introduction

Pea (*Pisum sativum* L.) is a leguminous crop belonging to the family leguminoseae, which contain higher amount of protein and is an excellent human food. Peas are very common nutritious vegetable grown in cool season through out the world (Pandita and Pratap, 1986). It comes under the 3rd number in protein content after garlic and beans. The different cultivars studies in pakistan mostly contain 20-22 % of protein (Jabeen *et al.*, 1988). Lukina (1990) has reported 24.3-26.6 percent protein in 158 cultivars of pea. In Pakistan it occupies an area of 142 thousand hectare with production of 78.3 thousand tones and average yield of 552 kg ha^{-1} (Anonymous, 1995-96). In Balochistan, it occupies an area of 941 hectare with the production of 10,430 tones and average yield of 11084 kg ha^{-1} (Anonymous, 1998-1999).

Yield and quality of crop are very complex characters depending on certain biological alignments between environment and heredity. The characteristics of a cultivar as well as combination of traits differ according to the climatological conditions of the localities. Different approaches for improvement in yield per unit area has been under taken in pakistan and worldwide. It is reported that increase in yield is dependent on increase in fertilizer rates (Maynard *et al.*, 1986). The per hectare yield of pea can be increased by growing high yielding, pest and disease resistant varieties with proper package of technology.

Pea can be grown on a variety of soil from light sandy loam to clay, though best results are obtained on well drained, loose friable loamy soils. The pH range falls in between 6.0 and 7.5. It does not thrive on acidic soils and if the pH falls below 5.5. The role of both macro nutrients and micronutrients could not be ignored all together for getting high yield. As the nitrogen is required for improving vegetative growth of plant resulting in more pods and in turn to greater green pod yield. The phosphorus plays a prominent role in pod development, seed size and resistant against diseases. Potassium as it improves flavour of seeds and dry matter (straw) could not be ignored for better flowering and pod initiation. The role of K in plants includes cation transport across membrane, water economy, energy metabolism and anzymes activity. Potassium increases carbon exchange and enhances carbohydrate movement (Collins and Duke, 1981), and consequently stimulates vegetative growth and decreases the translocation of photosynthats in to storage organs.

Keeping these all in mind the study was made to know the effect of all the macro nutrients (NPK) in combined form and their more prominent effects on marketable green pod yield.

Materials and Methods

The study was carried out at Vegetable Seed Farm, ARI, Sariab, Quetta during the year 2000-2001. The experiment was laid out in a Randomized Complete Block Design. The plot was thoroughly prepared by giving three dry ploughing followed by clod crushing and leveling to irridicate weeds and uniform distribution of water. The seed of local pea variety were planted having a net plot area of 3.00 x 4.00 m^2 keeping 45cm distance between row to row. All the required cultural operations were adopted uniformly in all the treatments according to the crop requirements through out the growing period. The fertilizer treatments comprised

T_1, Control; T_2, 25-0-0; T_3, 25-60-0; T_4, 25-0-60; T_5, 25-60-60; T_6, 50-0-0; T_7, 50-90-0; T_8, 50-0-90; T_9, 50-90-90; T_{10}, 75-0-0; T_{11}, 75-120-0; T_{12}, 75-0-120; T_{13}, 75-120-120 NPK 4m^2.

Full dose of phosphorus and potash in the form of single super phosphate and potassium sulphate with half dose of nitrogen as urea was applied at the time of sowing, where as the remaining half dose of nitrogen was split in to two equal doses, which was applied at the time of flowering and pod formation stage.

Five plants in each treatment were tagged to record observations on plant height, no. of branches per plant, no. of pods per plant, pod length (cm), no. of seeds per pod, pod yield per plant (g), marketable green pod yield per plot (Kg) calculated marketable green pod yield per ha. (m.t)

The data thus collected were analyzed using Fisher's analysis of variance techniques and mean values were compared by LSD test following Gomez and Gomez (1984).

Results and Discussion

Plant height: Plots treated with NPK level of 75-120-120 resulted in taller plants at average of 46.30 cm followed by 75-120-0 and 75-120-0 kg NPK ha^{-1} giving 46.00 and 45.03 cm, respectively. Where as untreated plot (control) showed minimum plant height of 25.30 cm per plant. These result revealed that increasing level of nitrogen improved the plant height, while increasing P and K did not have any significant influence. These results were in agreement with Pandita and Pratap (1986). Sheikh (1997) and Anjum and Amjad (1999).

No. of branches per plant: The data (Table 1) revealed that plot receiving higher doses of NPK i.e., 75-120-120 kg NPK ha^{-1} significantly increased the number of branches 5.60 per plant followed by 75-0-120 or 75-120 or 75-120-0 and 75-0-0 kg NPK produced 5.58 and 5.45 average number of branches per plant, respectively. The untreated (control) showed minimum number of branches 3.02 per plant. It showed that number of branches were increased at the higher rate of nitrogen but increase of P and K did not improved the capacity of branches much more. These results are with the agreement of Sheikh (1997), Collins and Duke (1981) and Larik *et al.* (1999).

Table 1: Morphological traits of peas (*Pisum sativum* L.) as effected by the application of NPK fertilizers at different rates

Fertilizer Treatments		Plant height Per plant (cm)	No. of branches Per plant	No. of pod (cm)	Pod length per pod.	No: of Seed per plant (gms)	Green pod yield	Green pod yield per plot (kg)	Green pod yield (4m) per ha. (m.t)
T_1	Control	25.30f	3.02e	13.90f	6.95b	3.00d	104.42f	3.02d	2.34d
T_2	25-0-0	32.63e	3.94d	17.83ef	7.20b	4.00c	135.22e	3.52cd	2.76cd
T_3	25-60-0	35.30e	4.03d	19.37ef	7.38b	4.00c	153.98cd	4.03c	3.75c
T_4	25-0- 60	34.13e	3.93d	17.90ef	7.31b	4.00c	151.27d	3.50cd	2.71cd
T_5	25-60-60	36.57de	4.22d	20.20de	7.47ab	4.00c	155.77bcd	4.15bc	3.46bc
T_6	50-0-0	40.85cd	4.87c	24.30cd	7.39ab	3.00d	151.64d	3.52cd	2.94cd
T_7	50-90-0	41.17cd	5.13c	24.43c	7.49ab	4.00c	159.90bc	5.17a	4.30a
T_8	50-0-90	41.45bc	5.05bc	24.40c	7.51ab	4.00c	156.07bc	3.90c	3.25c
T_9	50-90-90	42.57abc	5.22abc	25.77bc	7.50ab	5.00b	163.50b	5.23a	4.36a
T_{10}	75-0-0	44.90abc	5.45abc	29.37ab	7.88ab	4.00c	152.63cd	4.18bc	3.48bc
T_{11}	75-120-0	46.00ab	5.58a	33.10a	8.46a	5.00b	183.80a	5.78a	4.82a
T_{12}	75-0-120	45.03ab	5.58a	30.30ab	7.98ab	4.00c	160.80b	5.00b	4.17ab
T_{13}	75-120-120	46.30a	5.60a	33.10a	8.49a	6.00a	188.43a	6.02a	5.01a
S.E		02.250	0.210	01.321	1.432	0.213	003.635	0.431	0.485
Cdi		06.300	0.588	06.499	2.210	0.596	020.718	1.207	1.360
Cdii		04.635	0.433	04.781	2.123	0.554	007.488	0.888	1.000

Values followed by similar letters are not significantly different at $P \leq 0.05$

No. of pods per plant: The data (Table 1) showed that with the application of 75-120-120 or 75-120-0 NPK ha^{-1} resulted in greater number of pods 33.10 per plant followed by 75-0-20 and 75-0-0 kg NPK ha^{-1} giving 30.30 and 29.37 pods per plant, respectively, while the minimum number of pods 13.90 per plant was found in untreated plot. These results are with the agreement of Rao *et al*. (1994).

Pod length: The plot treated with higher level of NPK 75-120-120 resulted in longer pods 8.49 cm followed by 75-120-0 and 75-0-120 NPK ha^{-1} giving 8.46 and 7.98 cm pod length, however the control produced 6.95 cm pod length, which was the minimum (Table 1) The results revealed that the active role in increasing the length of pod was due to N and P while K has not affected, progressively. These results are in agreement of Jahan *et al*. (1992) and Maynard *et al*. (1986).

No. of seeds pod^{-1}: Plot receiving higher dose of fertilizer i.e., 75-120-120 NPK ha^{-1} displayed greater number of seeds 6.00 per pod followed by 75-120-0 i.e., 5.00 seed per pod and with the equal number of seed per pod when the fertilizer dose was 50-90-90 kg NPK (Table 1). The minimum number of seed 3.00 per pod was found in case of N alone 50 kg ha^{-1} and untreated (control). The results are with the agreement of Thiraporn (1992) and Allen *et al*. (1996).

Pod yield per plant: Plot treated with 175-120-120 kg NPK ha^{-1} resulted in maximum pod yield of 188.43 gm per plant followed by 75-120-0 kg NPK ha^{-1} and 50-90-90 NPK giving 183.80 and 163.50 gm pod yield per plant, respectively. The minimum pod yield 104.42 gm per plant was obtained from untreated (control) plot. The data (Table 1) further showed that N with P increased the yield per plant, while potash affected less in improving pod yield per plant. These results are with the agreement of Suksri (1998) Thakuria and Saharia (1994).

Green pod yield per plot: Increasing NPK fertilizer upto 75-120-120 correspondingly increased the green pod yield per plot i.e., 6.02 kg followed by 75-120-0 and 50-90-90 kg NPK ha^{-1} giving 5.78 and 5.23 kg green pod yield per plot respectively. The untreated (Control) did lowest i.e., 3.02 kg per plot. The results are with the agreement of Lukina *et al*. (1990) and Jabeen *et al*. (1988).

Green pod yield per hectare (m.t): Among application of 75-120-120 NPK ha^{-1} resulted in maximum green pod yield i.e., 5.01 m.t ha^{-1} was obtained followed by 75-120-0 which was giving 4.82 and with the application of 50-90-90 giving yield of 4.36 m.t ha^{-1}. The minimum green pod yield i.e., 2.34 m.t was obtained when the plot was left untreated (control).

The results indicate that K even though the increased level was applied showed no prominent result and only the combination of N and P resulted in the above trait significantly. The results are with the agreement of Jager (1990) and Lopez *et al*. (1985).

The result shows that the combination of N and P is necessary for effecting yield. That is why the yield increased with the higher dose of 75-120-120 NPK when applied in T_{13} followed by $T_{11}$where again the combination of N and P was applied at the rate of 75-120-0. The role of K although applied in a higher dose but missing P was not able to provide maximum yield as seed per pod showed minimum numbers. The results was taken from T_{12} in which the dose given was 75-0-120, Thus missing phosphorous could not increased yield as shown in T_{11} and T_{13}.

It is concluded that in macro nutrient both P and N play a vital role in increasing yield, but the role of K is not so prominent, but it may effect plant vigour and accelerate uptake of the above mentioned nutrients.

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