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Effect of nitrogen and phosphorus levels on growth and yield parameter in bottle gourd (*Lagenaria siceraria*) variety Pusa Manjri under Kanpur agro-climatic condition

Santoshi Khadka, Jitendra Kumar, Ram Niwas, Umesh Thapa and Arjun Dahal

Abstract

A field experiment entitled "Effect of nitrogen and phosphorus levels on growth and yield parameter in bottle gourd (*Lagenaria siceraria* var Pusa manjri) under Kanpur agro-climatic condition" was conducted at Horticulture field of Rama University, Kanpur, U.P., India during March to June 2022 to evaluate the effect of nitrogen and phosphorous and their combination with the fixed proportion of FYM and 40kg/ha potassium on vegetative growth as well yield of Pusa manjri variety of bottlegourd.

The experiment was laid out in RCBD considering eight treatments and three replication. The variety Pusa manjri was selected and the combinations of treatment were T₁= 40kg P/ha, T₂= 80 kg P/ha, T₃=20kg N/ha and 40 kg P/ha, T₄= 20kg N/ha and 80 kg /haP, T₅= 40kg N/ha and 40 kg P/ha, T₆= 40kg N/ha and 40 kg P/ha, T₇ = 60kg N/ha and 40 kg P/ha.; T₈= 60kg N/ha and 40 kg P/ha.

All the organic manures, 40kg/ha potassium and combinations of nitrogen and phosphorous were applied at the time of transplanting of bottle gourd in the plot according to the doses that is to be applied in the plot. On the basis of this experiment, it may be concluded that the application of nitrogen and phosphorous combination (60 kg N + 80 kg P per ha) increase the vegetative growth as well yield of bottle gourd. In treatment T₈the vegetative parameters like leaf area, average length of fruits, vine length, number of branches per plant, length of laterals branches shows positive response to the increasing nitrogen and phosphorous combination. It has also the positive impact on the reproductive attributes like Days to appearance of first female and male flower, number of female flower, umber of male flower and on the yield attributes of Pusa manjri variety of bottle gourd under the climatic condition of Kanpur. Therefore, it can be concluded that the increasing rate of nitrogen and phosphorous with the fixed proportion of potassium may increase the vegetative growth yield attributes as well the quality of fruits.

It is recommended to the bottle gourd growers for the application of combination of nitrogen and phosphorous for Pusa manjri variety of bottle gourd under which gives better growth and yield is (60 kg n + 80 kg P per ha) for higher production to bottle gourd under Kanpur condition.

Keywords: Macronutrient, growth attributes, bottle gourd and yield

Introduction

Bottle gourd (*Lagenaria siceraria*) is an important vegetable plant belongs to family Cucurbitaceae and largely cultivated in the tropics and subtropics areas of different part of world. It has a wide range of uses such as its edible fruits, which are good source of carbohydrates, minerals and calcium, the pulp and leaves have medicinal properties (Decker-Walter, 2) ^[1].

Bottle gourd originated in Tropical Africa and domesticated in Asia, Africa and New World. India is the second largest producer of vegetable in worlds after china. According to recommendation given by India Council of Medical Research (ICMR) an average man with vegetarian or Non- Vegetarian food habit should consume 300 g vegetable per day, which include 125 mg leafy vegetable, 100 g of root vegetable and 75 g of other vegetable (Fagaria *et al.*, 2010) ^[4]. In the country, vegetable crops are grown only in 2.8% of total cultivated land and share 10% of the world's vegetable production with productivity of 13.6 t ha⁻¹, which is quite low as compared to other advanced countries (Shanmugasundram, 2001).

It has diuretic and high blood pressure-lowering qualities, as well as the ability to relieve chronic constipation. It can also be used to treat urinary problems. It's a natural alkalizer. In recent years, a new technology for enhancing the output of vegetables, fruits, grains, and other crops through the use of modified seeds has been developed.

When used in conjunction with correct cultural methods, the enhanced seeds have been found to provide good yields and quality. The purpose of this study was to see how different quantities of nitrogen and phosphorus affected the development of a better bottle gourd type. It is common knowledge that enhanced varieties produce greater growth, higher yields, more uniform maturity, and longer harvest periods. In light of the foregoing, a field experiment for the efficient utilization of applied nutrients and the preservation of soil fertility at a sustainable level of production is urgently needed.

Material and Method

The experiment was carried out in a Randomized Complete Block Design (RCBD) from March 2022 to June 2022 at the Horticulture Farm of Rama University, Mandhana Kanpur, India. The test crop was Bottle gourd (Pusa manjri).

The experiment was considering eight treatments and three replication. The variety Pusa manjri was selected and the combinations of treatment were T₁ = 40kg P/ha, T₂ = 80 kg P/ha, T₃ = 20kg N/ha and 40 kg P/ha, T₄ = 20kg N/ha and 80 kg P/ha, T₅ = 40kg N/ha and 40 kg P/ha, T₆ = 40kg N/ha and 40 kg P/ha, T₇ = 60kg N/ha and 40 kg P/ha,; T₈ = 60kg N/ha and 40 kg P/ha. Nitrogen and phosphorous combination was made. The experimental field of 646.25 m² and total length of the field is 27.5m and width is 23.5m. The experiment was laid out in factorial RCBD considering different levels of nitrogen and phosphorous as factors. They were evaluated under RCBD design with 3 replications and 8 treatments. There were 24 plots and the size of the plot is 3*2.5 m. The space between rows is 2m and plant to plant is 1.5*1.5 m. the

main irrigation channel is 0.5 m and field border is also 0.5m. The collected data were entered in Excel and analyzed statistically by F-test to examine the treatment effects and the mean differences were judged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984)^[7].

Result and Discussion

Effect of nitrogen and phosphorous on growth attributes of bottle gourd

Results presented in table 1, indicates the significant differences the different level of nitrogen and phosphorous. At 90 DAT treatment T₈ (60 kg N + 80 kg P₂O₅) had the largest leaf area (506.91 cm²), followed by T₇ (60 kg N + 40 kg P₂O₅), with (501.19 cm²), and treatment T₁ had the smallest leaf area (459.87 cm²) (40 kg P). According to Hatwar *et al.*^[11], increased photosynthetic and other metabolic activities that result in an increase in various plant metabolites responsible for cell division and elongation may be the cause of the increase in Leaf area as a result of macronutrient provision (2003).

Treatment T₈ (60 kg N + 80 kg P₂O₅) recorded the longest vines (8.63 m), followed by T₇ (60 kg N + 40 kg P₂O₅) with (8.56 m), and treatment T₁ had the shortest vines (5.38 m) (40 kg P). Treatment T₈ (60 kg N + 80 kg P₂O₅) recorded the most branches per plant (6.98), followed by T₇ (60 kg N + 40 kg P₂O₅) with (6.77 branches per plant), while treatment T₁ had the fewest branches per plant (3.49). (40 kg P). Treatment T₇ (60 kg N + 40 kg P₂O₅) had the longest lateral branches (3.89 m), followed by T₆ (40 kg N + 80 kg P₂O₅) with the shortest (3.19 m), and treatment T₁ had the shortest lateral branches (3.19 m) (40 kg P).

Table 1: Effects of nitrogen and phosphorous on the vegetative growth of bottle gourd.

Treatment	Leaf area (cm ²)			Vine length (cm)			Number of Branches/ plant			Length of lateral Branches (m)		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T ₁	156.23	316.52	459.87	1.23	3.16	5.38	2.23	3.16	3.49	1.29	1.78	3.19
T ₂	159.54	326.45	484.54	1.56	3.42	6.16	2.56	3.42	4.33	1.39	1.94	3.38
T ₃	165.42	358.47	485.30	1.78	3.56	7.37	2.78	3.56	4.67	1.46	1.98	3.71
T ₄	172.24	378.26	494.32	1.82	3.98	7.51	2.82	3.98	5.03	1.52	2.01	3.76
T ₅	178.23	398.54	496.77	1.85	4.56	7.32	2.85	4.56	5.32	1.78	2.07	3.79
T ₆	186.45	416.53	498.76	2.14	4.78	7.98	3.14	4.78	5.70	1.98	2.24	3.83
T ₇	196.56	456.28	501.19	3.46	4.98	8.56	3.46	4.98	6.46	2.16	2.36	3.89
T ₈	206.45	472.94	506.91	3.96	5.16	8.63	3.96	5.16	6.77	1.92	2.19	3.74
S. E. (M)	5.272	6.376	7.287	0.272	0.376	0.293	0.272	0.279	0.376	0.272	0.276	0.293
C. D.	1.268	1.586	1.829	0.568	0.786	0.293	0.568	0.686	0.786	0.562	0.682	N/A

Effect of nitrogen and phosphorous on reproductive growth of bottle gourd

Treatment T₈ recorded the lowest Node No. to first female flower emergence (12.02), followed by T₇ with (13.49), while treatment T₁ recorded the highest Node No. to first female flower emergence (15.82).

Treatment T₇ recorded the shortest time (69.3 days) for the development of the first male flower, followed by T₅ with (67.14 days), and the longest time (79.31 days) was recorded in treatment T₁.

The first female flower appeared were lowest for treatment T₇ at 73.92 days, followed by highest for treatment T₅ at 74.17

days, and lowest for treatment T₁ at 79.31 days (40 kg P). These results are in agreement with the findings of earlier workers Narayanamma *et al.* (2009)^[12] in bitter gourd, Rab and Haq (2012)^[13] in tomato and Kumar *et al.* (2010) in cauliflower.

Treatment T₈ recorded the highest number of male flowers per plant (72.78), followed by T₆ with 71.98, while treatment T₁ had the lowest number of male flowers per plant (63.97). Treatment T₈ recorded the highest number of female flowers per plant (30.46), followed by T₇ with 29.72, and while the lowest number (17.01) was recorded in treatment T₁.

Table 2: Effect of different levels of nitrogen and phosphorous on reproductive parameters of bottle gourd.

Treatment	Days to appearance of first male flower	Days to appearance of first female flower	Node No. to first female flower emergence	Number of male flower per plant	Number of female flower per plant
T ₁	79.31	83.48	15.82	63.97	17.01
T ₂	73.97	77.92	14.60	65.54	20.72
T ₃	74.50	77.26	13.79	67.59	23.05
T ₄	72.92	74.17	13.85	71.92	25.20
T ₅	71.35	74.13	13.50	69.41	27.20
T ₆	73.46	77.10	13.84	71.98	28.35
T ₇	69.30	73.92	13.49	70.44	29.72
T ₈	73.98	77.83	12.02	72.78	30.46
S. E. (M)	1.326	1.190	0.538	1.457	1.012
C. D.	1.923	1.923	4.837	2.534	4.852

Effect of nitrogen and phosphorous on yield attributes of bottle gourd

The application of T₈ (60 kg N + 80 kg P₂O₅ ha⁻¹) resulted in the greatest fresh weight of fruits (1077.27 g), followed by T₇ (1041.06) and T₆ (955.71) and minimum was found in T₁ (754.24) at 90 DAT.

The maximum yield per plant at 90 DAT was recorded under the treatment T₈ (14.48) followed by T₇ (13.23) and T₆ (11.79) and minimum no of fruits was found in T₁ (5.70). The maximum girth of fruit at 90 DAT was recorded under the treatment T₈ (24.32cm) followed by T₇ (23.04 cm) and T₆ (22.34 cm) and minimum no of fruits was found in T₁ (17.96

cm).

The maximum length of fruit at 90 DAT was recorded under the treatment T₈ (42.85 cm) followed by T₇ (39.10 cm) and T₆ (38.60 cm) and minimum no of fruits was found in T₁ (28.58 cm).

Application of increasing doses of N + P fertilizers brought about significant increase in number of fruits per plant. Significantly, the highest number of fruits per plant (13.44) was obtained with application of T₈ (60 kg N + 80 kg P₂O₅ ha⁻¹) followed by T₇ (12.71) and T₆ (12.34) at 90 DAT and minimum number of fruits per plant was obtained in T₁ (7.56).

Table 3: Effect of nitrogen and phosphorous on yield attributes of bottle gourd

Treatment	Girth of fruit (cm)			Fresh wt. of fruit			Number of fruit/plant			Yield per plant			Girth of fruit		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T ₁	6.32	12.52	17.96	106.32	536.52	754.24	1.23	4.16	7.56	1.23	3.14	5.70	6.32	12.52	17.96
T ₂	6.83	12.68	20.00	109.52	568.56	815.14	1.56	4.52	8.53	1.56	3.42	6.95	6.83	12.68	20.00
T ₃	7.12	13.12	20.81	112.74	593.58	760.32	2.56	5.19	8.60	1.78	3.56	6.54	7.12	13.12	20.81
T ₄	7.23	13.62	21.00	117.54	604.53	827.43	2.59	5.46	10.28	1.82	3.98	8.51	7.23	13.62	21.00
T ₅	8.16	13.96	22.01	119.73	616.58	926.25	2.85	5.78	11.05	1.85	4.56	10.24	8.16	13.96	22.01
T ₆	8.42	14.53	22.34	122.48	658.48	955.71	3.14	5.96	12.34	2.14	4.78	11.79	8.42	14.53	22.34
T ₇	8.56	15.02	23.04	123.46	698.47	1041.06	3.46	6.13	12.71	3.46	4.98	13.23	8.56	15.02	23.04
T ₈	8.96	15.63	24.32	125.84	703.56	1077.27	3.96	6.56	13.44	3.96	6.16	14.48	8.96	15.63	24.32
S.Em ±	0.60	1.09	0.79	0.60	1.09	32.60	0.36	0.42	0.45	0.36	0.32	0.38	0.60	1.09	0.79
CD (P = 0.05)	2.79	2.96	2.36	43.58	69.52	97.72	1.03	1.23	1.35	1.03	1.08	1.14	2.79	2.96	2.36
CV (%)	6.78	6.87	6.57	6.28	6.37	6.42	7.28	7.37	7.83	6.28	7.17	7.30	6.78	6.87	6.57

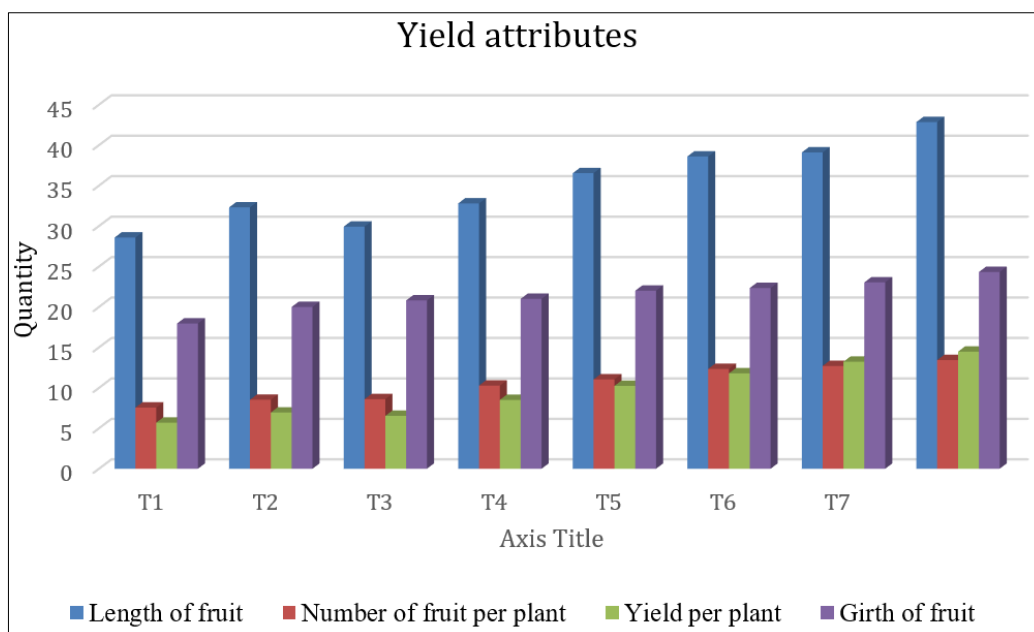


Fig 1: Effect of different levels of nitrogen and phosphorous on yield attributes of bottle gourd.

Conclusion

From the study, it can be concluded that T8 (60 kgN/ha + 80 kgP/ha) showed the best performance as it recorded highest leaf area, average length of fruits, vine length, number of branches per plant, length of laterals branches to the increasing nitrogen and phosphorous combination. It has also the positive impact on the reproductive attributes like Days to appearance of first female and male flower, number of female flower, number of male flower and on the yield attributes of Pusa manjri variety of bottle gourd under the climatic condition of Kanpur. So it can be suggested to use 60 kg nitrogen, 80 kg phosphorus per hectare to obtain maximum yield from bottle gourd.

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