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Original Research Article

Growth and Yield of Ash Gourd [*Benincasa hispida* (Thumb.) Cogn.] as Affected by Application of Nitrogen and Potash Fertilizers Under Agro-Climatic Condition of Zone V Prevailing In Giridih District of Jharkhand

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A B S T R A C T

A trial was conducted to study the interactive effects of nitrogen and potash fertilizers on growth and yield of ash gourd [*Benincasa hispida* (Thumb.) Cogn.] during *kharif* planting seasons of 2015 and repeated in 2016 at the Krishi Vigyan Kendra, Giridih. The results based on two years mean revealed that out of twelve different treatments, the vines fertilized with 250 kg N ha^{-1} attended the maximum length of main shoot, number of primary branches at last harvest and intermodal length of 7.80 m, 6.44 and 22.80 cm, respectively. The vines fertilized with 250 kg N ha^{-1} showed the maximum number of nodes plant^{-1} of 58.48. Days taken for appearance of first female flower and first harvest were recorded maximum in vines fertilized with 250 kg N ha^{-1} (68.57 and 131.36, respectively). Fruit length and weight and number of fruits plant^{-1} (21.13 cm, 3.08 kg and 7.75) were recorded maximum from vines fertilized with 250 kg N ha^{-1}. However, maximum fruit diameter was found in vines treated with 250 kg N ha^{-1} (18.13 cm) but it was not superior significantly to other doses of nitrogen application. Vines fertilized with 250 kg N ha^{-1} produced maximum fruit yield of 34.40 t ha^{-1}. Cultivation of ash gourd at different rates of potassic fertilizer plays significant difference in case of growth parameters and plants fertilized with K @ 150 Kg ha^{-1} attended maximum growth. However, yield attributes and yield of 31.48 t ha^{-1} was recorded maximum from plants fertilized with K @ 150 Kg ha^{-1}. In last, it can be concluded that cultivation of ash gourd planted under fertilizer application of nitrogen @ 250 Kg and potash @ 150 Kg ha^{-1} will be attractive and beneficial for farmers of Giridih district and adjoining areas of agro-climatic condition of Zone V of Jharkhand.

Keywords

Ash Gourd [*Benincasa hispida* (Thumb.) Cogn.]

Introduction

Ash gourd / White gourd [*Benincasa hispida* (Thumb.) Cogn.] is a favorite palatable cucurbitaceous vegetable crop grown extensively throughout the tropical and sub-tropical countries. It is a popular Kharif as well summer season vegetables fulfill the demanded need of lag period consumption of nutrient from vegetable in India. It is moisture enriched vegetable contained nearly 96% water and a great source of vitamin B1, B3 and vitamin C and also possesses carbohydrates and various minerals such as calcium, sodium, zinc, iron, phosphorus. Ash gourd is a major contributor to the total vegetable production in India and plays an important role in the economy of Indian farmers. In addition to provision of food value and of the place of vegetables in the nation food requirement ash gourd production has increased in recent years. Its plants are climbing herb, cultivated largely in U.P., Punjab, Rajasthan, Bihar and Jharkhand for its fruit which is eaten as vegetable and also candied with sugar in preparation of 'Petha' by confectioners. Its seeds are edible and used in preparation of different types of sweets. Generally, ash gourds are grown as mono cultured crop by keeping wider spacing about 2m × 2m in between two rows.

Nitrogen (N) fertilization favors the development of the aerial parts over roots and consequently the promotion of flowering and fruiting of many crops. Ash gourd with huge vegetative growth needs high amounts of nitrogen to cover its requirements. Hence, there is a need to standardize the optimum level of nitrogen for getting higher yields.

Potassium (K) is the nutrient having the strongest influence on plant growth, yield and quality attributes that determine fruit marketability (Al-Moshileh, 2003; Lester *et al.,* 2007). The role of potassium in plant metabolism, growth, and development and its significance in production of marketable fruit and on fruit firmness, quality and visual appearance are published and well known (Al-Moshileh *et al.,* 2005). However, Bashir *et al.,* (1997) have noted that one of the problems facing rural farmers on the fertilizer usage is lack of information on what type of fertilizer and quantity that will suit their crops and soil types. A crop response to fertilizer is higher in soil with low nutrient contents than soil with high nutrient reserve (Tisdale and Nelson, 1975).

With this background the present study was undertaken to assess the interactive effects of nitrogen and potash fertilizers on the growth and yield of ash gourd under agro-climatic condition of Zone V prevailing in Giridih district of Jharkhand.

Materials and Methods

The present investigation was carried out as on-farm trial at the Krishi Vigyan Kendra, Giridih during *Kharif* planting seasons of 2015 and repeated in 2016 on ash gourd [*Benincasa hispida* (Thumb.) Cogn.]. A local strain famous in the name of 'Neha' was used as the planting material and the vines were grown in the main field in pits of 1 x 1' size, arranged at 2 x 2 m spacing. The crop was fertilized with nitrogen in the form of urea as per the treatment scheduled (100, 150, 200 and 250 kg N ha^{-1}) and potash in the form of murate of potash as per the treatment scheduled (50, 100 and 150 kg K ha^{-1}) at 15, 30 and 45 days after planting in main field. Entire phosphorus is applied as basal dose in the form of single super phosphate @ 125 kg ha^{-1}. Manual hand weeding was done and the plots were kept free of weeds. The crop was immediately irrigated after planting using 'Thala" method to avoid transplanting shock. Subsequent irrigations were given at 3-5 days interval depending upon the moisture condition of experimental plot to maintain uniform soil moisture throughout crop growth period. Need based plant protection measures were taken up to keep the plot free from pest and diseases and raise a healthy crop. The plants of ash gourd were grown under four doses of nitrogen and three doses of potashic fertilizer in the plot size of 8.0 X 8.0 m^2 consisting sixteen plants per plot and laid out in 4 X 3 factorial in Randomized Complete Block Design (RCBD) replicated thrice. Uniform cultural practices were followed for the experiment. The soil of the experimental field was sandy loam in texture with pH 5.8 and organic carbon 0.5 %. Observations on four plant characters viz. length of main shoot (m), number of primary branches at last harvest, internodal length (cm) and number of nodes plant^{-1}, days taken for appearance of first female flower and days taken for first harvest and yield attributes namely fruit length and diameter (cm) and weight (kg), number of fruits plant^{-1} and fruit yield (t ha^{-1}) were recorded. The data on growth parameters and yield attributes were pooled and analyzed statistically as per Gomez and Gomez, 1984 and presented in Table -1 and 2 and Figure 1.

Results and Discussion

Perusal of the data (Table -1) clearly indicates that the significant differences were existed in all plant growth characters, flowering and fruiting. Considerable variations in the length of main shoot were observed due to the four doses of nitrogen fertilizer. Application of fertilizers at different levels brought about significant differences in length of the main shoot. The highest length of main shoot (7.80 m) was observed at 250 kg N ha^{-1} whereas the lowest (6.80 m) was observed at 100 kg N ha^{-1}.

Similar increase in kakrol vine length with increased nitrogen was observed by Nek *et al.,* (2000) and Prasad *et al.,* (2009) & Baset Mia *et al.,* (2011) in case of bitter gourd. The increase in vine length at higher levels of nitrogen might be due to higher uptake of nitrogen as evident from Table 1. There shall be increased auxins, gibberellins, cytokinins and ethylene with increase in carbohydrates and amino acids due to increase in nitrogen levels (Maynard and David, 1987). Length of main shoot of ash gourd was increased significantly by increasing K levels (Table 1). The highest length of main shoot (7.53 m) was observed at 150 kg K ha^{-1} and lowest (6.89 m) at 50 kg K ha^{-1}.

It is evident from the data that the increase in the number of primary branches at harvest was significant among nitrogen and potash levels. The highest number of primary branches (6.44) was observed in vines fertilized with 250 kg N ha^{-1}, followed by the vines fertilized with 200 kg N ha^{-1} (6.10). Lowest number of primary branches (4.72) was observed in vines fertilized with 100 kg N ha^{-1}. Shariful Islam and Irabangon (1994) also found that the number of branches was highest at 240 kg N ha^{-1} in bitter gourd. Maximum number of primary branches at harvest (6.19) was recorded with the application of 150 kg K ha^{-1} followed by 100 kg K ha^{-1} with 5.66 branches, whereas, the minimum number of primary branches at harvest (5.08) was recorded with the application of 50 kg K ha^{-1}.

The variation in internodal length among the different doses of fertilizers was found to be significant. Highest internodal length (22.80 cm) was observed with application of 250 kg N ha^{-1} followed by 200 kg N ha^{-1} with 17.43 cm. The lowest internodal length (15.30 cm) was observed with application of 100 kg N ha^{-1}. Variations in vine length due to internodal length was also observed by Prasad *et al.,* (2009) and Baset Mia *et al.,* (2011) in bitter gourd and by Nek *et al.,* (2000) in bottle gourd due to nitrogen levels. Application of potassium fertilizer to ash gourd grown in field under acid soil conditions, and at the rate of 150 kg ha^{-1} level led to the highest internodal length of vines, and significantly higher than that the internodal length obtained at the 100 kg K ha^{-1} (Table 1). The increase in number of nodes per plant at harvest was significant among nitrogen and potash levels. Maximum number of nodes per vine at harvest (58.48) was recorded with the application of 250 kg N ha^{-1} which was followed by 51.50 nodes vine^{-1} at 200 kg N ha^{-1}.

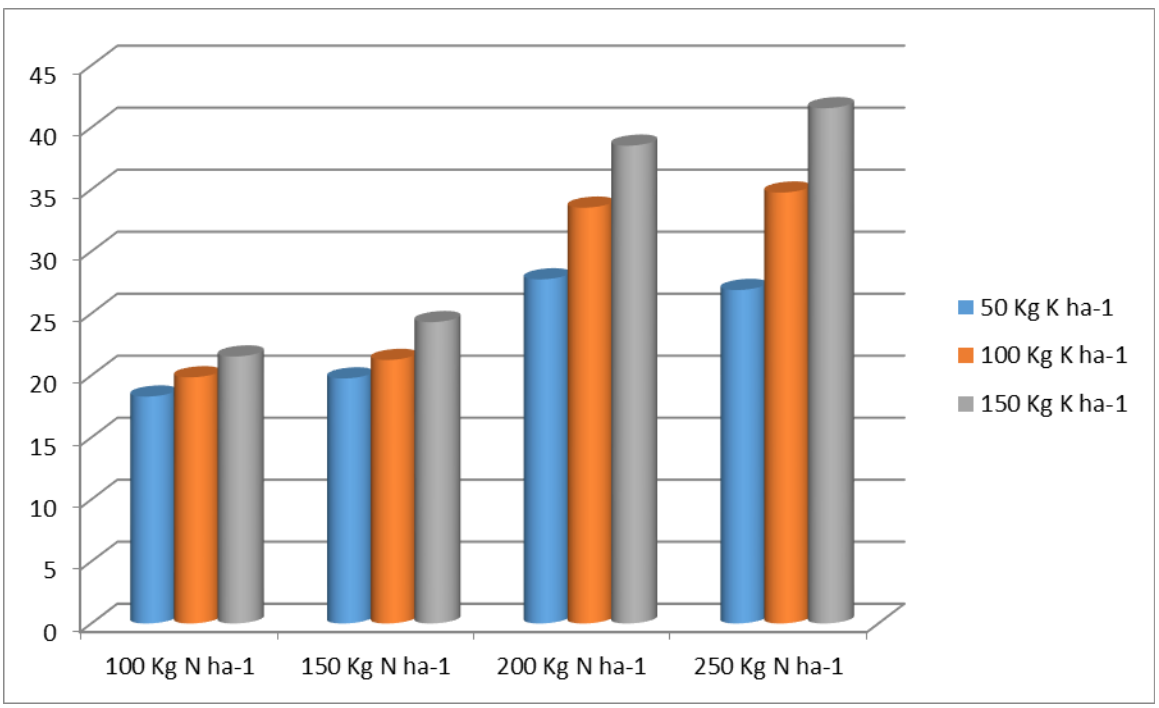
Table.1 Growth parameters, flowering and fruiting of ash gourd [*Benincasa hispida* (Thumb.) Cogn.] as influenced by nitrogen and potash fertilizers

Treatments	Length of main shoot (m)	No. of primary branches at last harvest	Internodal length (cm)	No. of nodes plant^{-1} at last harvest	Days taken for appearance of first female flower	Days taken for first harvest
Nitrogen						
100 Kg ha^{-1}	6.80	4.72	15.30	44.42	62.12	120.55
150 Kg ha^{-1}	6.96	5.31	16.37	48.31	64.67	122.23
200 Kg ha^{-1}	7.24	6.10	17.43	51.50	64.75	122.77
250 Kg ha^{-1}	7.80	6.44	22.80	58.48	68.57	131.36
CD $_{0.05}$	0.27	0.30	1.33	1.43	1.33	NS
Potash						
50 Kg ha^{-1}	6.89	5.08	14.90	45.80	63.43	122.54
100 Kg ha^{-1}	7.18	5.66	17.31	53.41	66.10	126.82
150 Kg ha^{-1}	7.53	6.19	22.21	48.83	68.34	131.08
CD $_{0.05}$	0.33	0.36	1.44	1.55	1.67	NS

Table.2 Yield and yield attributes of fruits of ash gourd [*Benincasa hispida* (Thumb.) Cogn.] as influenced by nitrogen and potash fertilizers

Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (kg)	No. of fruits plant^{-1}	Fruit yield (t ha^{-1})
Nitrogen					
100 Kg ha^{-1}	18.79	15.02	2.76	6.08	19.89
150 Kg ha^{-1}	18.93	16.06	2.85	6.86	21.77
200 Kg ha^{-1}	19.04	16.09	2.96	7.68	33.27
250 Kg ha^{-1}	21.13	18.13	3.08	7.75	34.40
CD $_{0.05}$	1.08	NS	0.09	0.16	0.18
Potash					
50 Kg ha^{-1}	18.84	15.01	2.79	6.64	23.18
100 Kg ha^{-1}	18.96	16.08	2.92	7.29	27.35
150 Kg ha^{-1}	21.11	18.13	3.02	8.11	31.48
CD $_{0.05}$	1.11	NS	0.10	0.28	0.25

Fig.1 Interactive effect of nitrogen and potash on Fruit Yield of ash gourd [*Benincasa hispida* (Thumb.) Cogn.]



Similar increase in number of nodes and fruits with increase in levels of nitrogen was also reported by Suresh and Pappaiah (1991) in bitter gourd which may be due to increased vegetative growth consequent to the increased production of auxins and carbohydrates. The highest number of nodes per vine (53.41) was observed in plant fertilized with 150 kg K ha^{-1}, followed by vines fertilized with 100 kg K ha^{-1} with

48.83 nodes. Lowest number of nodes per plant (45.80) was observed in vines fertilized with 50 kg K ha^{-1}.

Significant differences were observed among the different nitrogen and potash levels on number of days taken to appearance of first female flower. There was an increase in the days taken for appearance of first female flower with increase in levels of nitrogen. Late flowering (68.57 days) was observed with application of 250 kg N ha^{-1} and early flowering (62.12 days) was observed with application of 100 kg N ha^{-1}. Prasad *et al.,* (2009) has also reported similar finding with kakrol. Maximum number of days taken to appearance of first female flower (68.34) was observed in vines fertilized with 150 kg K ha^{-1} followed by vines fertilized with 100 kg K ha^{-1} with 66.10 days. The minimum number of days taken to appearance of first female flower (63.43) was observed in vines fertilized with 50 kg K ha^{-1}. This may be due to general tendency of plants towards vegetative phase with increased levels of potash as observed in many crops. The days to first harvest were not significant due to nitrogen and potash application.

The data pertaining to the yield parameters i.e, fruit length (cm), diameter (cm) and weight (kg), number of fruits per plant and fruit yield (q ha^{-1}), as influenced by different levels of nitrogen and potash application are presented in the Tables 2. The fruit length (cm) was found significant among the different doses of fertilizers application. The highest fruit length and weight (21.13 cm and 3.08 kg) was observed in vines fertilized with 250 kg N ha^{-1} which significantly superior by vines fertilized with 200 kg N ha^{-1} with 19.04 cm and 2.96 kg, respectively. Lowest fruit length and weight (18.79 cm and 2.76 kg) was observed in vines fertilized with 100 kg N ha^{-1}. Similar differences in fruit size in kakrol strains / cultivars were also reported by Rasul *et al.,* (2004). This may be due to the increase in fruit length and diameter and also due to increased nutrition to the vines with increase in levels of nitrogen and increased synthesis of chlorophyll and amino acids (Dzevelin, 1973). The highest fruit length and weight (21.11 cm and 3.02 kg) was observed in vines fertilized with 150 kg K ha^{-1} which significantly superior by vines fertilized with 100 kg K ha^{-1} with 18.96 cm and 2.92 kg, respectively. Lowest fruit length and weight (18.84 cm and 2.79 g) was observed in vines fertilized with 50 kg K ha^{-1}. The diameter of fruit was not found significant due to nitrogen and potash application.

Maximum number of fruits per plant (7.75) was recorded with the application of 250 kg N ha^{-1} followed by 200 kg N ha^{-1} (7.68 fruits), whereas, the minimum number of fruits per plant (6.08) was recorded at 100 kg N ha^{-1}. Maximum number of fruits per plant (8.11) due to application of potash @ 150 kg ha^{-1} followed by vines fertilized with 100 kg K ha^{-1} with 7.29 fruits. The minimum number of fruits per plant (6.64) was observed in vines fertilized with 50 kg K ha^{-1}. Similar findings were reported by Kiranpatro and Mallareddy (2007) where higher number of fruits per vine was obtained from 240:160:75 kg NPK ha^{-1}. On the other hand the increase in number of fruits was also due to increase in number of nodes on account of increased number of primary and secondary branches either due to increased nitrogen or potash. It was also reported by Parmar *et al.,* (2011) in bitter gourd. The higher number of branches and nodes per plant could be also attributed to the higher fruit number.

The highest fruit yield was obtained in vines fertilized with 250 kg N ha^{-1} (34.40 t ha^{-1}) due to production of maximum number of fruits plant^{-1} (7.75) with average fruit weight (3.08 kg). Poor yield (19.89 t ha^{-1}) was recorded in vines fertilized with 100 kg N ha^{-1}, a plant having poor vegetative growth, might be due to lower number and weight of fruits plant^{-1}. Maximum fruit yield (31.48 t ha^{-1}) was recorded at 150 kg K ha^{-1} followed by 100 kg K ha^{-1} producing 27.35 t ha^{-1} fruits. Whereas, the minimum (23.18 t ha^{-1}) was recorded at 50 kg K ha^{-1}. Working with tomato and cucumber grown in greenhouses under arid conditions of Al-Qassium region (latitude 26-27 N, longitude 44-45 E, altitude 725 m above sea level), in Kingdom of Saudi Arabia, Al-Moshileh *et al.*, (2017) also found that application of potassium fertilizer at the 250 ppm level led to the highest marketable yield.

Application of NPK fertilizer to the soil was necessary due to its low fertility in order to increase the crop growth and productivity which was in agreement with the results obtained by Shiyam *et al.*, (2007) and Mare and Modi (2009) in case of taro. A crop response to fertilizer is higher in soil with low nutrient contents than soil with high nutrient reserve (Tisdale and Nelson, 1975). Significant effect on the growth parameters and total yield of the cultivar (Table – 1 & 2) could be attributed to the maximum ecological factors which triggered high photosynthetic activities to produce enough photosynthates deposited in the economic yield character - fruit. This agreed with the result obtained by Ahmed and Badr (2009) and Orji *et al.*, (2016) found in case of taro. It is evident from studied figure reveal that both application of N and K fertilizer had a significant effect on the fruit yield of ash gourd. But application of nitrogen was found to be more responsive to yield than that of application of K fertilizer (Fig. 1). However, with the interaction of nitrogen & potash fertilizers the parameters of yield were significantly increased with increase in N & K levels. The highest yield of ash gourd plants fertilized with 250 kg N ha^{-1} was 41.55 t ha^{-1} closely followed by vines fertilized with 200 kg N ha^{-1} shown under application of potash fertilizer @ 150 Kg ha^{-1} and significantly differed over other treatment combinations of nitrogen and potash fertilizer.

In last, it can be concluded that cultivation of ash gourd planted under fertilizer application of nitrogen @ 250 Kg and potash @ 150 Kg ha^{-1} will be attractive and beneficial for ash gourd [*Benincasa hispida* (Thumb.) Cogn.] cultivation by the farmers of Giridih district and adjoining areas of agro-climatic condition of Zone V of Jharkhand and will be able to uplift the socio-economic conditions of population of the area.

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