

## Original Research Article

# Growth and Yield of Ridge Gourd [*Luffa acutangula* L. (Roxb.)] as Affected by Application of Nitrogen and Potash Fertilizers under Agro-Climatic Condition of Zone V Prevailing in Bokaro District of Jharkhand

Anil Kumar<sup>1\*</sup> and A. K. Dwivedi<sup>2</sup>

<sup>1</sup>Krishi Vigyan Kendra, Bokaro, Birsa Agricultural University, Ranchi- 834006, India

<sup>2</sup>Krishi Vigyan Kendra, Giridih, India

\*Corresponding author

## ABSTRACT

A trial was conducted to study the interactive effects of nitrogen and potash fertilizers on growth and yield of ridge gourd [*Luffa acutangula* L. (Roxb.)] during *kharif* planting seasons of 2016 and repeated in 2017 at the Krishi Vigyan Kendra, Bokaro. The results based on two years mean revealed that out of twelve different treatments, the vines fertilized with 250 kg N ha<sup>-1</sup> attended the maximum length of main shoot of 7.80 m. Days taken for appearance of first female flower and first harvest were recorded maximum in vines fertilized with 250 kg N ha<sup>-1</sup> (48.57 and 54.36, respectively). Fruit length and weight and number of fruits plant<sup>-1</sup> (22.13 cm, 210 g and 3.35) were recorded maximum from vines fertilized with 250 kg N ha<sup>-1</sup>. However, maximum fruit circumference was found in vines treated with 250 kg N ha<sup>-1</sup> (25.15 cm) but it was not superior significantly to other doses of nitrogen application. Vines fertilized with 250 kg N ha<sup>-1</sup> produced maximum fruit yield of 35.75 t ha<sup>-1</sup>. Cultivation of ridge gourd at different rates of potassic fertilizer plays significant difference in case of growth parameters and plants fertilized with K @ 100 Kg ha<sup>-1</sup> attended maximum growth. However, yield attributes and yield of 35.23 t ha<sup>-1</sup> was recorded maximum from plants fertilized with K @ 100 Kg ha<sup>-1</sup>. In last, it can be concluded that cultivation of ridge gourd planted under fertilizer application of nitrogen @ 250 Kg and potash @ 100 Kg ha<sup>-1</sup> will be attractive and beneficial for farmers of Bokaro district and adjoining areas of agro-climatic condition of Zone V of Jharkhand.

## Keywords

Ridge Gourd  
[*Luffa acutangula*  
L. (Roxb.)],  
growth, yield

## Introduction

Cucurbits vegetable crops belonging to family cucurbitaceae, which primarily comprised species consumed as food worldwide. The family consists of about 118 genera and 825 species. India is world's largest producer of vegetables next to China with an annual production around 162.187 (Million tonnes) from 92.05 (Million hectare) of land (Indian Horticulture Database, 2013). This quantity is much less than our requirements and serves capita<sup>-1</sup>

intake on only 135 g against the recommended requirement of 285g capita<sup>-1</sup> day<sup>-1</sup> for balance diet. The vegetable requirement for the country has been estimated 225 million tonnes by 2020. To achieve this target and to provide balanced diet it is necessary to boost up the production of vegetables by increasing area, use of improved technology and by developing and using high yielding varieties and hybrid varieties. *Luffa* [*Luffa*

*acutangula* L. (Roxb.)] is believed to have originated in India and commonly called as ridge gourd, having diploid chromosome number  $2n = 2x = 26$ . It is one of the most important cucurbits grown throughout the country and world. It belongs to the family cucurbitaceae which includes about 118 genera and 825 species a number of major and minor cucurbits are cultivated which share about 5.6 per cent of the total vegetable production.

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, Bokaro during *Kharif* planting seasons of 2016 and repeated in 2017 on ridge gourd [*Luffa acutangula* L. (Roxb.)]. A  $F_1$  hybrid named 'Arka Vikram' newly developed by IIHR, Bangalore 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 1 m spacing. The field was irrigated immediately after planting. The crop was fertilized with nitrogen in the form of urea as per the treatment scheduled (100, 150, 200 and 250 kg N ha<sup>-1</sup>) and potash in the form of murate of potash as per the treatment scheduled (50, 75 and 100 kg K ha<sup>-1</sup>) 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 @ 100 kg ha<sup>-1</sup>. Need based 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. Staking of plants is done using available wild bushes individually to each plant to ensure individual plant data. 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<sup>2</sup> consisting thirty two 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), days taken for appearance of first female flower and days taken for first harvest and yield and yield attributes namely fruit length and circumference (cm) and weight (g), number of fruits plant<sup>-1</sup> and fruit yield (t ha<sup>-1</sup>) 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 Figure 1.

### Results and Discussion

Perusal of the data (Table -1) clearly indicated that the significant differences existed in all plant growth characters, flowering and fruiting. Considerable variations in the length of main shoot were observed due to the four rates 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 with 250 kg N ha<sup>-1</sup>.

The lowest length of main shoot (6.80 m) was observed with 100 kg N ha<sup>-1</sup>. 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 ridge gourd was increased significantly by increasing K levels (Table 1). The highest length of main shoot (7.53

m) was observed at 100 kg K ha<sup>-1</sup> and lowest (6.89 m) at 50 kg K ha<sup>-1</sup>.

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 (48.57 days) was observed with application of 250 kg N ha<sup>-1</sup> and early flowering (42.12 days) was observed with application of 100 kg N ha<sup>-1</sup>. Prasad *et al.*, (2009) has also reported similar finding with bitter gourd.

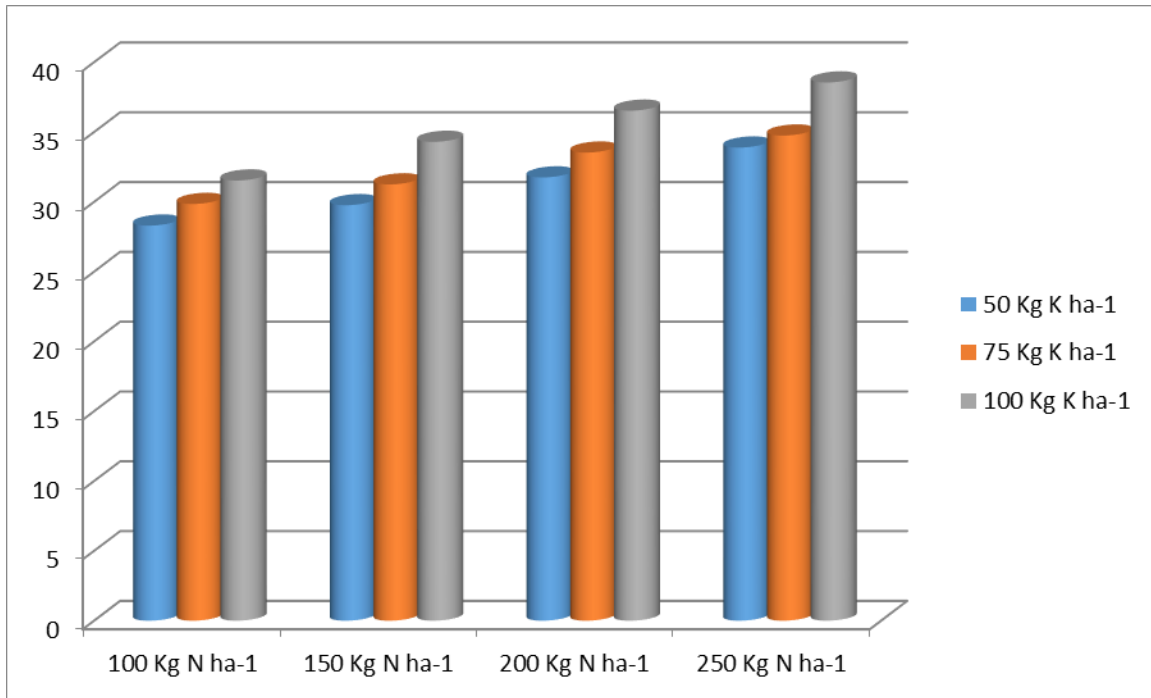
Maximum number of days taken to appearance of first female flower (48.34) was observed in vines fertilized with 100 kg K ha<sup>-1</sup> followed by vines fertilized with 75 kg K ha<sup>-1</sup> with 46.10 days. The minimum number of days taken to appearance of first female flower (43.43) was observed in vines fertilized with 50 kg K ha<sup>-1</sup>. 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), circumference (cm) and weight (kg), number of fruits per plant and fruit yield (t ha<sup>-1</sup>), as influenced by different levels of nitrogen and potash application are presented in the Tables 1. The fruit length (cm) was found significant among the different rates of fertilizers applications. The highest fruit length and weight (22.13 cm and 210 g) was observed in vines fertilized with 250 kg N ha<sup>-1</sup> which significantly superior by vines fertilized with 200 kg N ha<sup>-1</sup> with 19.04 cm and 200 g, respectively. Lowest fruit length and weight (18.79 cm and 190 g) was observed in vines fertilized with 100 kg N ha<sup>-1</sup>.

**Table.1** Growth parameter, flowering, fruiting, yield and yield attributes of ridge gourd [*Luffa acutangula* L. (Roxb.)] as influenced by nitrogen and potash fertilizers

Treatments	Length of main shoot (m)	Days taken for appearance of first female flower	Days taken for first harvest	Fruit length (cm)	Fruit circumference (cm)	Fruit weight (kg)	No. of fruits plant <sup>-1</sup>	Fruit yield (t ha <sup>-1</sup> )
<b>Nitrogen</b>								
100 Kg ha <sup>-1</sup>	6.80	42.12	47.55	18.79	22.53	190	3.15	29.89
150 Kg ha <sup>-1</sup>	6.96	44.67	51.23	18.93	24.09	192	3.30	31.77
200 Kg ha <sup>-1</sup>	7.24	44.75	51.77	19.04	24.14	200	3.33	33.94
250 Kg ha <sup>-1</sup>	7.80	48.57	54.36	22.13	25.15	210	3.35	35.75
CD <sub>0.05</sub>	0.27	1.33	NS	1.08	NS	8.5	0.06	0.18
<b>Potash</b>								
50 Kg ha <sup>-1</sup>	6.89	43.43	48.54	18.84	22.51	193	3.20	30.93
75 Kg ha <sup>-1</sup>	7.18	46.10	52.82	18.96	24.12	202	3.21	32.35
100 Kg ha <sup>-1</sup>	7.53	48.34	55.08	22.11	25.18	212	3.32	35.23
CD <sub>0.05</sub>	0.33	1.67	NS	1.11	NS	9.2	0.08	0.25

**Fig.1** Interactive effect of nitrogen and potash on Fruit Yield of ridge gourd [*Luffa acutangula* L. (Roxb.)]



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 (22.11 cm and 212 g) was observed in vines fertilized with 100 kg K ha<sup>-1</sup> which significantly superior by vines fertilized with 75 kg K ha<sup>-1</sup> with 18.96 cm and 202 g, respectively. Lowest fruit length and weight (18.84 cm and 193 g) was observed in vines fertilized with 50 kg K ha<sup>-1</sup>. The circumference of fruit was not found significant due to nitrogen and potash application.

Maximum number of fruits per plant (3.35) was recorded with the application of 250 kg N ha<sup>-1</sup> followed by 200 kg N ha<sup>-1</sup> bearing 3.33 fruits, whereas, the minimum number of fruits per plant (3.15) was recorded with

the application of 100 kg N ha<sup>-1</sup>. Maximum number of fruits per plant (3.32) due to application of potash was observed in vines fertilized 100 kg ha<sup>-1</sup> followed by vines fertilized with 75 kg K ha<sup>-1</sup> with 3.21 fruits. The minimum number of fruits per plant (3.20) was observed in vines fertilized with 50 kg K ha<sup>-1</sup>. 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<sup>-1</sup>. 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 cucumber. The higher number of branches and nodes per plant could be also attributed to the higher fruit number.

Marketable yield at the 250 kg N ha<sup>-1</sup> rate was the highest compared to all the other rates. Though the highest fruit yield was

obtained in vine fertilized with 250 kg N ha<sup>-1</sup> (35.75 t ha<sup>-1</sup>) that produced maximum number of fruits plant<sup>-1</sup> to a tune of 3.35 and fruit weight (210 g). Poor yield (29.89 t ha<sup>-1</sup>) was recorded in vines fertilized with 100 kg N ha<sup>-1</sup>, a plant having poor vegetative growth, might be due to lower number and weight of fruits plant<sup>-1</sup>.

Maximum fruit yield (35.23 t ha<sup>-1</sup>) was recorded with the application of 150 kg K ha<sup>-1</sup> followed by 75 kg K ha<sup>-1</sup> producing 32.35 t ha<sup>-1</sup> fruits. Whereas, the minimum fruit yield (30.93 t ha<sup>-1</sup>) was recorded with the application of 50 kg K ha<sup>-1</sup>. Working with tomato and cucumber grown in greenhouses under arid conditions of Al-Qassim 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) 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) in chickpea 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 ridge 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 fertilizer at increased rates significantly increased the studied parameter of yield at increased levels. The highest yield of ridge gourd plants fertilized with 250 kg N ha<sup>-1</sup> was obtained 38.55 t ha<sup>-1</sup> closely followed by vines fertilized with 200 kg N ha<sup>-1</sup> shown under application of potash fertilizer @ 100 Kg ha<sup>-1</sup> and significantly differed over other treatment combinations of nitrogen and potash fertilizer.

In last, it can be concluded that cultivation of ridge gourd planted under fertilizer application of nitrogen @ 250 Kg and potash @ 100 Kg ha<sup>-1</sup> will be attractive and beneficial for ridge gourd [*Luffa acutangula* L. (Roxb.)] cultivation by the farmers of Bokaro 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.

## References

- Ahmed, M. A. and Badr, E. A. 2009. Effect of Bio- and mineral Phosphorus fertilizer on the growth, productivity and nutritional value of some chickpea cultivars [*Cicer arietinum* L.] in newly cultivated land. *Australian Journal of Basic and Applied Sciences*, 3(4):4656-4664.
- Al-Moshileh, A.M. 2003. Effect of Potassium Fertilization on Development and Yield of Potatoes under Central Saudi Arabia Conditions. *Proc. Potassium and water management in West Asia and North Africa*, Session 6, p. 168.
- Al-Moshileh, A.M.; Errebhi, M.A. and Motawei, M.I. 2005. Effect of various potassium and nitrogen rates and splitting methods on potato under sandy soil and arid environmental conditions. *Emirates Journal of Agricultural*

- Science*, 17 (1): 01-09.
- Al-Moshileh, A.M.; Errebhi, M.A. and Obiadalla-Ali, H.A. 2017. Effect of potassium fertilization on tomato and cucumber plants under greenhouse conditions. *Bioscience Research*, 14(1): 68-74.
- Baset Mia, M.A.; Serajul Islam, Md.; Yunus Miah, Md.; Das. M.R. and Khan H.I. 2011. Flower synchrony, growth and yield enhancement of small type bitter gourd (*Momordica charantia* L.) through Plant growth regulators and NPK fertilization, *Pakistan Journal of Biological Sciences*. pp: 1-6.
- Bashir, J. S.; Aliyu, A. and Shaibu, B. 1997. *Nigeria National Agricultural Research Strategy Plan: 1996 – 2010*, Federal Ministry of Agriculture and National Resources (FMANR).
- Dzevelin, R. M. 1973. *Plant physiology*. Indian Edition Affiliated East West Press Private Limited. P. 446.
- Gomez, K.A. and Gomez, A.A. 1984. *Statistical Procedures for Agricultural Research*. John Willey & Sons, INC., Singapore.
- Indian Horticulture Database. 2013. National Horticulture Board, Ministry of Agriculture, and Government of India (Website: www.nhb.gov.in).
- Kiranpatro, T. S. K. K. and Mallareddy, K. 2007. Studies on propagation, production and post-harvest storage of Kakrol (*Momordica dioica* Roxb.) *PhD. Thesis submitted to ANGRAU*, Hyderabad.
- Lester, G.E.; Jifon, J.L. and Stewart, W.M. 2007. Foliar potassium improves cantaloupe marketable and nutritional quality. *Better Crops*, 91: 24-25.
- Mare, R. and Modi, A.T. 2009. Influence of planting date and organic fertilization on growth and yield of taro landraces. *African Crop Sci. Conf. Proc.*, 9:179-189.
- Maynard, G.; Hale and David Morcutt. 1987. *The physiology of plants under stress*. A Wiley Inter Science Publications, Newyork. pp: 71-72 & 145-166.
- Nek, D.J.; Mohammad, I.; Abdul, G.; Kashif, W. and Mohammad, S.J. 2000. Effect of NPK fertilizers and spacing on yield of bottle gourd (*Lagenaria siceraria* M.). *Pakistan Journal of Biological Sciences*, 3(3): 448-449.
- Orji, K. O.; Ogbonna, P. E. and Chukwa, L. A. 2016. Studies on the interactive effects of cultivars, NPK fertilizer and seasons on the growth and yield of taro [*Colocasia esculenta* (L.) Schott] on plains of Nsukka, Nigeria. *J. Global Biosciences*, 5(3):3699-3710.
- Parmar, M.K.; Patel, B.L. and Mane, S.R. 2011. Response of cucumber (*Cucumis sativus* L.) to chemical fertilizers and bio-fertilizer. *Vegetable Science*, 38(2): 235-236.
- Prasad, P.H.; Mandal, A.R.; Sarkar, A.; Thapa, U. and Maity, T. K. 2009. Effect of biofertilizers and nitrogen on growth and yield attributes of bitter gourd (*Momordica charantia* L.). *International Conference on Horticulture*, 2009, pp: 738-739.
- Rasul, M.G, Hiramatsu, M. and Okubo, H. 2004. Morphological and physiological variations in Kakrol (*Momordica dioica* Roxb.). *Journal of the Faculty of Agriculture*. 49(1): 1-11.
- Shiyam, J.O.; Obiefuna, J.C.; Ofoh, M. C.; Oko, B.F.D. and Uko, A.E. 2007. Growth and corm yield response of upland cocoyam (*Xanthosoma sagittifolium* L.) to sawdust mulch and NPK 20:10:10 fertilizer rates in the humid forest zone of Nigeria. *Continental J. Agronomy*, 1:05-10.
- Tisdale, S.A. and Nelson, W.L. 1975. *Soil Fertility and Fertilizers*. Macmillian Publ. Co. Inc. 3<sup>rd</sup> Edn. New York, p.694.