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Impact of fertilizer on yield of papaya cv. Pusa Dwarf under *Indo Gangetic* condition

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ABSTRACT

Papaya is one of the important fruits being grown in Indo- Gangetic plain and has an important place in homestead gardening in diverse ecosystems. The productivity of papaya is low due to lack of appropriate nutrient management. In a field experiment, an attempt was made to evaluate the interaction effect of nitrogen and potassium on yield and its contributing characters of papaya cv. Pusa Dwarf with the objective to enhance papaya productivity under Eastern Uttar Pradesh conditions. Results revealed that fruit set and growth (number and weight) along with fruit yield hectare^{-1} were found significantly maximum with the combination of 200g nitrogen and 300g potassium doses over all other nutrient combinations. However, significantly lowest value with respect to fruit number and weight along with yield was observed for N_0K_0 treatment; therefore, experiments might be concluded that balanced fertilizer application with appropriate interaction of nutrient could be more beneficial and remunerative in papaya cultivation under Indo- Gangetic plain.

***Key words*:** Nutrient management, papaya, yield

Papaya (*Carica papaya* L.) is essentially a tropical fruit and commercially grown in tropical and sub-tropical areas (Yadava *et al.,* 1990). In India, it is commercially grown in Karnataka, Uttar Pradesh, Orissa, Bihar, West Bengal, Tamilnadu, Gujarat, Maharashtra, and Chhattisgarh. Taiwan and China are the leading countries in the world in papaya production and development of varieties including hybrids. The productivity of papaya varies from 100-150 t ha^{-1} depending upon cultivar, soil type and fertility, system of cultivation and agro-ecological conditions. Papaya fruit is rich in carotene, vitamin A, thiamin, riboflavin, minerals and a number of proteolytic enzymes are consumed as fresh ripen fruit and is well as vegetable.

Tremendous efforts should be made to enhance the production of fruit crops through a rationale and balanced use of inputs including fertilizers. Fruit crops which can be easily grown and are accessible to rural population may be given due attention if nutritional security to millions of poor people is to be addressed. Papaya is one of the fruits widely grown and adopted to rural areas.

The success of the commercial cultivation of papaya depends upon balanced nutrient supply, with suitable agro-techniques. The key nutrients required in sufficient quantities for optimum plant growth and productivity are nitrogen, phosphorus and potassium. Nitrogen being the constituent of amino acids, proteins, nucleic acid, chlorophyll, and a number of secondary plant metabolites, plays a vital role in regulating metabolic functions of the plants leading to better growth and productivity. Potassium is often referred as the quality element for crop production (Usherwood, 1985) and it has been widely proven to have a crucial role in many crop quality parameters. Fruit size, appearance, colour, soluble solids, acidity, vitamin content, taste, as well as shelf life are significantly influenced by adequate supply of potassium. These characteristics are affected by photosynthesis, regulation of stomatal movement, activation of various enzymes, and other anabolic and catabolic processes. Potassium regulation of plant water balance and tolerance to various stresses like drought, excess water, salinity, high and low temperature is related to productivity and quality of fruits (Ganeshmurthy *et al*., 2011). Other beneficial effects of potassium include high juice content, high vitamin C, uniformity in ripening and resistance to bruising and physical breakdown during shipping and storage. Susceptibility of plants to diseases and pests due to high use of N fertilizers is effectively counteracted by K nutrition.

A number of publications have appeared on the role of proper nutrient management on yield and quality components namely vitamin A and vitamin C, sugars, TSS, acidity, flesh thickness, colour, and mineral contents of papaya fruits (Yadav *et al*., 2011a and 2011b). However, proper nutrient management studies in Pusa dwarf cultivar of papaya under Varanasi conditions of eastern Uttar Pradesh are inconclusive. Therefore, the present study was aimed at to find out the suitable nitrogen and potassium doses for better productivity of papaya which can improve farm economy and farmers livelihood in Eastern Uttar Pradesh.

MATERIALS AND METHODS

An experiment with two treatments consisting of three levels each of nitrogen and potassium and in three replication during two consecutive years in Randomized Block Design

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(Factorial) at the Horticulture farm of Udai Pratap Post Graduate College, Varanasi, Uttar Pradesh located at 25° 34' N latitude and 82° 96' E longitude. The field soil was sandy loam (1:2) having pH value of 7.2, medium in organic carbon, available nitrogen and potassium and low in phosphorous with good drainage facility. The planting pits of size 45x45x45cm were prepared during last week of September and left for 1-2 weeks for weathering after which each pit was filled with top soil mixed with 20kg FYM, 1 kg neem cake, 1 kg bone meal and 50g BHC powder. Two healthy seedlings of papaya cv. Pusa Dwarf of two months age were planted in each pit in the last week of October at a spacing of 1.5x1.5 m. A uniform basal dose of phosphorous @ 250g pit^{-1} was applied during both the years of experiment. The nitrogen treatment @ N_0 (Control), N_{200} (N_1) and N_{300} (N_2) and potassium @ K_0 (Control), K_{300} (K_1) and K_{500} (K_2) pit^{-1} were applied during both the years to standardized the fertilizer dose with respect to nitrogen and potash to get the higher yield along with yield attributing characters. The entire quantity of potassium was mixed initially in the pit soil as basal dose while nitrogen was applied at three and six months after planting in two equal splits. The fertilizers were placed 20-25 cm away from the collar of the plants to avoid any injury to them. Proper package and practices were adopted to ensure optimum growth of the plants. Only 10 per cent male plants were allowed in the orchard. Observations on yield and yield parameters were recorded.

RESULTS AND DISCUSSION

Nutrient management in papaya in sandy loam soils of Varanasi showed positive effect with respect to fruit yield and yield parameters. Application of nitrogen at the rate of 200g pit^{-1} produced maximum number of fruits $plant^{-1}$ with highest average fruit weight (28.83 and 758.30 g) respectively which was significantly superior to control (Table1). Though, higher dose of nitrogen (N_{300}) was also significantly superior to control but was inferior to lower dose of nitrogen (N_{200}). Fruit yield $plant^{-1}$ and $hectare^{-1}$ was also highest with lower nitrogen level and showed similar trend at higher dose as depicted for fruit number and average fruit weight (Table2). Potassium application 300 g pit^{-1} also produced significantly higher number of fruits as well as average fruit weight (27.93 and 754.36 respectively) relative to control treatment. The best potassium dose was K_{300}g pit^{-1} and beyond which the increase in number and weight of fruit showed a declining trend though was still far better than control (Table 3). Similar results have also been recorded with respect to yield per hector and found significantly superior for N_{200} and K_{300} (106.30 and 100.5) t ha^{-1} respectively.

Interaction effects between nitrogen and potassium was best at N_{200} and K_{300} g pit^{-1} for number of fruits $plant^{-1}$ (31.1) and average fruit weight (825.8 g) (Table1 & 2). Further increase in nitrogen and potassium level showed declining interactive beneficial effects although was still better than control (24.5 and 626.2 g) respectively for number of fruit $plant^{-1}$ and average fruit weight. Interaction between nitrogen and potassium for fruit yield $hectare^{-1}$ harvested almost similar trend as depicted for fruit number and average fruit weight. Maximum fruit yield of 121.5 t ha^{-1} was observed with N_{200}x K_{300} g pit^{-1}. Further increase in nitrogen and potassium level showed a declining interactive trend in fruit yield indicating negative response of higher levels of nutrients.

Table 1: Interaction effects of nitrogen and potassium on number of fruits $plant^{-1}$ in papaya cv. Pusa dwarf (pooled)

Potassium (g pit^{-1})	Nitrogen (g pit^{-1})			Mean
	N_0	N_{200}	N_{300}	
K_0	24.5	26.4	25.5	25.46
K_{300}	25.1	31.1	27.6	27.93
K_{500}	24.9	29.0	26.9	26.93
Mean	**24.83**	**28.83**	**26.66**	**--**
LSD(0.05)	**N**	**K**	**N x K**	
	0.636	**0.636**	**1.103**	

Table 2: Interaction effects of nitrogen and potassium on average fruit weight (g) of papaya cv. Pusa dwarf (pooled)

Potassium (g pit^{-1})	Nitrogen (g pit^{-1})			Mean
	N_0	N_{200}	N_{300}	
K_0	626.2	661.3	749.5	679.00
K_{300}	676.8	825.8	760.5	754.36
K_{500}	649.3	787.8	728.5	721.86
Mean	**650.8**	**758.3**	**746.2**	**--**
LSD(0.05)	**N 23.48**	**K 23.48**	**N x K 40.66**	

Therefore, present study concluded that papaya production in Eastern Uttar Pradesh might be augmented with suitable nutrient management strategies. Further it is also advocated that indiscriminate use of higher doses of nutrients could be economically unviable and may create soil and water pollution problem in long run. Beneficial effects of nitrogen and potassium on fruit yield and yield parameters have also been reported by Irulappan *et al*. (1984), Biswas *et al*. (1989) and Hadole *et al.* (1992). In contrast, Balamohan *et al.* (1992) observed beneficial effects of plant nutrition on yield of papaya cv. Co-2 but under Coimbatore conditions.

Table 3: Interaction effects of nitrogen and potassium on fruit yield (t ha^{-1}) in papaya (pooled)

Potassium (g pit^{-1})	Nitrogen (g pit^{-1})			Mean
	N_0	N_{200}	N_{300}	
K_0	72.5	89.1	91.5	84.4
K_{300}	80.4	121.5	99.5	100.5
K_{500}	76.5	108.3	92.8	92.5
Mean	**76.5**	**106.3**	**94.6**	**--**
LSD(0.05)	**N 0.252**	**K 0.252**	**N x K 0.438**	

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