E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(7): 587-590
Received: 23-05-2024
Accepted: 29-06-2024

Sangita Mehta
Krishi Vigyan Kendra, Jalalgarh, Purnea, Bihar, India

Govind Kumar
Krishi Vigyan Kendra, Jalalgarh, Purnea, Bihar, India

Praveen Kumar
Bhola Paswan Shastri Agricultural Collage, Purnia, Bihar, India

Birendra Prasad
Nalanda College of Horticulture, Noorsarai, Nalanda, Bihar, India

Corresponding Author:
Birendra Prasad
Nalanda College of Horticulture, Noorsarai, Nalanda, Bihar, India

Effect of different treatments and pruning on fruit development, yield and economics of passion fruit

Sangita Mehta, Govind Kumar, Praveen Kumar and Birendra Prasad

DOI: https://doi.org/10.33545/2618060X.2024.v7.i7Sh.1145

Abstract
The passion fruit is a high value and export-oriented crop. Which belongs to the family *Passifloracea*, it is represented by 14 genera and comprises of nearly 580 species, distributed throughout the tropical and subtropical regions of the world (Silva and San Jose 1994). Despite this, its production is low and it needs to be increased. In this regard this experiment was taken to standardize the nutrient doses and pruning on development of fruits and yield of passion fruit. The experiment was conducted in the experimental farm, Department of Horticulture, BAU, Ranchi, Jharkhand. In all the treatments 2 kg of vermin-compost and 0.5 kg of lime were applied as basal dose except absolute control. All the treatments exhibited better results over untreated control and absolute control. Highest yield (56.65 q/ha) was obtained by NPK (250: 125:125 gm/vine) + boron 1.2 gm/vine which was at par with, NPK (300: 150:150 gm/vine) + boron 1.2 gm/vine (49.15 q/ha) and NPK (250: 125:125 gm/vine) + sulphur 24 gm/vine (52.48 q/ha). Highest return (Rs. 128376) was obtained in NPK (250: 125:125 gm/vine) + boron 1.2 gm/vine. Thus, NPK (250: 125:125 gm/ vine) + boron 1.2 gm/vine appeared to be the best treatment in the development of fruit characters and yield followed by NPK (250:125:125 gm/ vine) + sulphur 24 gm/vine.

Keywords: Passion fruit, high-value crop, export-oriented crop, passifloracea family

Introduction
Achievement of self -sufficiency in food grains production is not enough for India, without ensuring nutrition and balance diet to everyone. Fruit, being a rich source of carbohydrate, protein, minerals, vitamins, etc., are considered very much essential for proper growth and protection of human body from different diseases and disorders.

Almost all types of fruit can be grown in one or the other parts of the country. China is the largest producer of fruits followed by India which now accounts for about 10 percent of world production. Due to explosion of population and wastage of the harvested produce, the per capita availability of fruits (40 gms against the recommended 120 gms per day) is far below the required level. Hence, it is urgently necessary to increase the availability of fruits by increasing the area and the productivity. Introduction of high valued, nutritious and prolific bearer fruits is also necessary for taking into consideration.

The passion fruit is a high value and export oriented crop, distributed throughout the tropical and subtropical regions of the world. It belongs to the family *Passifloracea*, which is represented by 14 genera and comprises of nearly 580 species. From these species, 150 sp. are native to Brazil, and widely cultivated in South Africa, Australia, Newzealand and Indonesia. Out of which 60 bear edible fruit but only a few are of commercial importance.

In India, it grows widely in Nilgiri hills, Kodaikanal, Coorg, Malabar, Kerala and Himachal Pradesh. It occupies an important place among the fruits grown in India. North Eastern parts of India have greater potential for establishing passion fruit globe on commercial scale. Recently, this fruit has come into prominence among the people of north eastern states of India due to its pleasant aroma, rich flavor, prolific bearing habit and higher return even without much care.

It flowers throughout the year; however main harvesting seasons are September- October and January- February, producing about 75 fruits/ vine/year.

The juice of passion fruit is acidic in nature and has an excellent flavor and is quite delicious, nutritious and liked by most people for its blending quality. Passion fruits are good source of

vitamin-A, ascorbic acid, riboflavin and niacin and also contain fair amount of minerals sodium, magnesium, sulphur and chlorides. When eaten with the seeds, it serves as an excellent source of fiber.
Passion fruit is getting popularity and its cultivation is gradually increasing in India. Research works had been initiated in many passion fruit growing areas. Passion fruit is not used as a desert fruit because of its being high acidic in nature. Very few researches had been carried out regarding this fruit. Hence, there is need to improve successful cultivation of this high value crop, nutrient dose is to be standardized. There is also need to improve fruiting and quality of fruit. Keeping in view, the present investigation was undertaken to standardize the nutrient doses for the development of fruits and yield of this crop.

Materials and Methods
The experiment was conducted in the poly-houses of Horticultural research farm of Birsa Agricultural University Kanke, Ranchi (Jharkhand). The mean value of each treatment was subjected for statistical analysis.

Details of Treatments
T_1- NPK (300:150:150 g-1vine)
T_2- NPK (250:125:125 g-1vine)
T_3- Boron (1.2 g-1 vine)
T_4- Sulphur (24 g-1 vine)
T_5- NPK (300:150:150 g-1vine) + Boron (1.2 g-1 vine)
T_6- NPK (250:125:125 g-1vine) + Boron (1.2 g-1 vine)
T_7- NPK (300:150:150 g-1vine) + Sulphur (24 g-1 vine)
T_8- NPK (250:125:125 g-1vine) + Sulphur (24 g-1 vine)
T_9-Control
T_{10}- Absolute control (without vermicompost)

(Note: A uniform dose of 2 kg vermicompost + 500 g lime per pit during planting).

- **Design, Plot size and Layout Experimental Design:** RBD.
- **Treatments:** 10.
- **Replications:** 3.
- **Spacing:** 3 x 2 m.
- **Plot size:** 4 pits/ line/ treatment.
- **Total no. of plots:** 30 lines with four plants in each line Number of plants per line: 4.
- **Number of plants per treatment:** 4x3=12.

Observation of flowering and fruiting characters were recorded on five randomly tagged shoots.

Fruit Characters
Fruit length and fruit breadth (cm)
Only fully matured fruit from each tagged plant was selected at random from each treatment and the length and breadth of five fruits were measured in cm with the help of slide callipers and then the average length and breadth was calculated.

Weight of fruit (g)
The weight of individual fruit was taken with the help of physical balance. In this way total weight of all five individual fruits was obtained and then its average weight per fruit was calculated.

Volume of fruit (cc)
The volume of individual fruit was taken by water displacement method. The same fruits which were used for measuring size and weight were also used for estimation of volume.

Yield
The Yield of fruits per plant was recorded by weighting the harvested fruits in different pickings in each replication under each treatment. The average Yield per plant in kilogram was noted and it was converted in to q/ha also.

Economics
Estimation of benefit: Cost Ratio
The benefit: Cost ratio was calculated after estimation of the cost involved including the operational and as well as 10% overhead charges incurred during the experimentation for fruit production. The benefit: cost ratio was computed by the formula as given below

$$\text{Benefit: cost ratio} = \frac{\text{Gross income}}{\text{Total cost of production}}$$

Result and discussion
Effect of different treatments on fruit character of passion fruit
The data regarding different fruit characters have been presented in table 1. The treatment effects on fruit length, fruit breadth, fruit weight and fruit volume were significant.
The maximum fruit length (7.30 cm), fruit breath (6.43 cm), fruit weight (72.63 g) and fruit volume (138.33 cc) were recorded in case of T_6 (application 250:125:120g NPK+ 1.2g Boron) which were closely followed by T_8 (6.40 cm), (5.88 cm), (70.85 g) and (136.93 cc) respectively. Whereas the minimum fruit length (4.75 cm), fruit breadth (4.18 cm), fruit weight (54.68 g) and fruit volume (101.28 cc) were observed in case of absolute control. Vine treated with NPKB (250:125:125:1.2 g/vine/year) showed the maximum in fruit development characters and yield. Similar findings was observed by Natal *et al.*, (2004) [3] and Russel, 1957 [4].

Table 1: Effect of different nutrient and pruning on fruit character and Yield

Treatment		Fruit length (cm)	Fruit breath (cm)	Fruit weight (g)	Fruit volume (cc)	Yield	
						Kg/vine	q/ha
T_1	300:150:150 g NPK vine-1	5.80	5.25	63.50	113.70	3.0	49.98
T_2	250:125:125 g NPK vine-1	5.95	5.55	65.30	124.05	3.4	56.64
T_3	1.2 Boron g vine-1	5.33	5.17	61.75	109.50	1.80	30.00
T_4	24 Sulphur g vine-1	5.08	4.75	59.10	106.73	1.50	25.00
T_5	300:150:150:1.2 NPKB g vine-1	6.10	5.55	67.95	126.45	3.9	64.97
T_6	250:125:125:1.2 NPKB vine-1	7.30	6.43	72.63	138.33	4.5	74.97
T_7	300:150:150:24 g NPKS vine	6.03	5.63	69.18	132.88	3.7	61.64
T_8	250:125:125:24 g NPKS vine-1	6.40	5.88	70.85	136.93	4.2	69.94
T_9	Control	5.25	4.73	56.63	102.55	1.50	24.12
T_{10}	Absolute Control	4.75	4.18	54.68	101.28	1.4	23.32
SE(m)		0.13	0.10	0.27	0.37	0.24	3.99
CD 5%		0.37	0.28	0.79	1.08	0.74	12.33
CV %		4.32	3.57	0.84	0.62	9.23	9.23

The application of different levels of NPKB was effective in increasing maximum fruit character and yield. It was observed that lower level of NPK induced more fruit length, fruit breath, fruit weight, fruit volume and yield than higher dose. Fruit weight is very important with respect to fruit quality as it adds towards fruit yield. Fruit weight follows yield trends. Like fruit size, significant increase in fruit weight, was also obtained with boron treatment. These observations are in consonance with Brahamchari *et al.*, (1997) [1] and Haque and Ibrago (1994) [2] in guava. The possible reason behind increasing fruit weight might be due to hormonal mediated direct transport, accumulation and ensure balanced partitioning of photosynthetic assimilates to the developing fruit than by enabling the shoot to meet the nutritional requirement of fruits throughout their development.

In all the treatments, production was better because of pruning. But among all the treatments NPK B (250:125:125:1.2 g/vine/year) (T_6) resulted the best yield of passion fruit (4.5 kg/vine) which was significantly at par with T_5 (3.9 kg/vine) T_8 (4.2 kg). The minimum production was obtained in absolute control. Similarly for one hectare, the maximum yield (74.97 q/ha) was obtained is case of T_6 with was at par with T_5 (64.97 q/ha) and T_8 (69.97 q/ha) and minimum yield (23.32 q/ha) was reported in T_{10}.

Nitrogen, phosphorus and potash and sulphur are among the macro-metabolic elements, boron is micro-metabolic element essential for plants, for beneficial effects upon fruit development and yield for a crop.

Nitrogen is the important constituent of aminoacids, acidamides, auxin, purines, pyrimidines pigments, alkaloids and co-enzymes. Nitrogen increases the level of auxin in plants. This auxin helps in accelerating the cell-elongation and cell enlargement in different plant organs. The assimilation of photosynthetic compound together with cell enlargement might have caused the plants to produce more yield.

Phosphorus is absorbed by the plants as (H_2PO^{-}) ion. Phosphorus is mostly found in plants as a constituent of nucleic acids, phospholipids, the enzymes NAD and NADP and most important as a constituenst of ATP. Thus, phosphorus is involved in the synthesis of protein and fatty acids, hydrogen-tranfer, photosynthesis, glycolysis, respiration, which suffice its essentiality to plant. A very large proportion of phosphorus accumulates in the seed and fruit during the period of their development. The role of phosphorus and nitrogen in plant metabolism are inter-related in number of ways. It may alter the nitrogen balance to the plant resulting in earlier maturation of plant that occurs when available phosphorus is high, and delay in reaching maturity due to phosphorus deficiency.

Potassium is a monovalent cation with a high mobility in the plant both at the cellular level and in transport in the xylem and phloem. Potassium in the same way is involved in the synthesis of proteins from amino-acids. Carbohydrate metabolism is also affected by in- adequate supply of potassium. Photosynthesis is checked and respiration is increased by potassium deficiency. Generally, a plant deficient in potassium is stunted in growth.

Boron occupies an impact position of all elements which are necessary for the growth of the plants. However, the need for boron is least understood. The element is involved in lignifications of the cell wall and in differentiation of xylem-A deficiency of boron immediately results in inhibition of the length growth of the primary and secondary roots.

Sulphur is taken up by the roots as SO_4 at a relatively slow speed. As nitrate, sulphur has to be reduced first before it can be used for the synthesis of sulphur containing compounds like amino acids, proteins and enzymes. Sulphur is incorporated in sulpholipids and polysaccharides in non-reduced form.

Thus, we see that nitrogen, phosphorus, potash, boron and sulphur are responsible for better growth and yield of crop. They must be supplied to the plant in optimum quantity for maximizing production of the crop. Their deficiency in plants will result in retarded growth, low yield and poor quality of the produce.

Economics of different treatments

The data regarding economics of cultivation have been presented in table 2. Highest net return of Rs. 128376 has been obtained in treatment NPKB (250:125:125:1.2 g/vine/year) (T_6). The next superior treatment in this regard was NPKS (250:125:125:24 g/vine/year) (T_8) with net income of Rs 114446. Similarly highest net benefit: cost ratio (4.88) has been obtained in the treatment (T_6), followed by the treatment T_8 with net benefit: cost ratio 3.66.

As far as economics associated with the trial is concerned, the treatment NPKB (250:150:150:1.2 g/vine/year) gave maximum net profit Rs. 128376 as per the cost of cultivation and net profit calculation. This might be due to higher yield.

Table 2: Economics of passion fruit cultivation

Treatment		Cost of cultivation (Rs.)	Yield (q/ha)	Selling Rate (Rs.)/q	Gross income (Rs.)	Net income (Rs.)	Benefit: Cost Ratio
T_1	300:150:150 g NPK vine^{-1}	9681+22330=42011	35.82	3000	10740.00	65449.00	2.56
T_2	250:125:125 g NPK vine^{-1}	19681+19593=39274	39.15	3000	117450.00	78176.00	2.99
T_3	1.2 Boron g vine^{-1}	19681+2300=21981	24.99	3000	74970.00	52989.00	3.41
T_4	24 Sulphur g vine^{-1}	19681+2480=22161	19.99	3000	59970.00	37809.00	2.71
T_5	300:150:150:1.2 NPKB g vine^{-1}	19681+24630=44311	49.15	3000	147450.00	103139.00	3.33
T_6	250:125:125:1.2 NPKB vine^{-1}	19681+21893=41574	56.65	3000	169950.00	128376.00	4.88
T_7	300:150:150:24 g NPKS vine	19681+26050=45731	45.82	3000	137460.00	91723.00	3.01
T_8	250:125:125:24 g NPKS vine^{-1}	19681+23313=42994	52.48	3000	157440.00	114446.00	3.66
T_9	Control	19681+0=19681	18.33	3000	54990.00	35309.00	1.79
T_{10}	Absolute Control	19681-1830=17851	14.15	3000	42450.00	24599.00	1.38

Conclusion

The experiment conducted at the Department of Horticulture, BAU, Ranchi, Jharkhand, demonstrated that standardized nutrient doses and pruning significantly enhance the development and yield of passion fruit. Among various treatments, the combination of NPK (250:125:125 g/vine) with boron (1.2 g/vine) proved to be the most effective, yielding the highest fruit length, breadth, weight, volume, and overall yield (56.65 q/ha). This treatment also resulted in the highest economic return (Rs. 128,376), followed by the NPK (250:125:125 g/vine) with sulphur (24 g/vine) treatment. The study underscores the importance of optimized nutrient application in maximizing the growth, yield, and economic benefits of passion fruit cultivation.

References

1. Brahamchari VS, Shreshtha AK. Effect of nutrient and growth studies on fruit retention. Physico-chemical composition and shelf life of mango c.v. Langra. M.Sc. (Ag.) thesis submitted to R.A.C. Pusa, Bihar; c1997.
2. Haque MH, Ibrago JA. Fruit size and economic performance of guava cv Guapple as affected by fruit thinning and boric acid. South Indian Hortic. 1994;42:289-292.
3. Natal W, Prado RM, Leal RM, Franco CF. Effect of boron application on the development, nutritional status and production of passion fruit cuttings. Rev Bras Frutic. 2004;26(2):310-314.
4. Russel DA. Boron and soil fertility. In: Yearbook of Agriculture. USDA, Washington, D.C.; c1957.
5. Silva AC, San Jose AR. Classificacao Botanica de Maracujazeiro. In: San Jose AR, editor. Maracuja: Producao e Mercado. Universidade Estadual do Sudoeste da Bahia, Departamento de Fitotecnia e Zootecnia, Vitoria da Conquista BA, Brazil; c1994.