Research Article
Open Access

Improvement of yield and fruit quality attributes through organic and inorganic fertilizers in cape-gooseberry (*Physalis peruviana* l.) cv. Aligarh

Abstract

An investigation was undertaken during 2015-16 in the trial field of Department of Horticulture, Khalsa College, Amritsar (Punjab) to study the effect of integrated nutrient management on the yield and quality of fruits in Cape gooseberry cv.' Aligarh'. Treatments consisted of application of inorganic fertilizers alone and in combination with bio fertilizers and FYM. The experiment was laid out in Randomized Block Design with seven treatments replicated four times. Results of the study revealed that the seedlings treated with 75% NPK + 1.25 t/acre FYM proved to be the best in terms of plant height, shoot length, juice percentage, while maximum yield was recorded with the treatment of 50% NPK+ 0.7t/a FYM+ bio fertilizers.

Volume 9 Issue 1 - 2019

Amarjeet Kaur, Maninder Singh
Department of Horticulture, Agriculture and Forestry, Khalsa College, India

Correspondence: Amarjeet Kaur, Department of Horticulture, Agriculture and Forestry, Khalsa College, Amritsar- 143001, India, Email dr.amarjitkur30@gmail.com

Received: January 26, 2017 | **Published:** February 07, 2019

Introduction

Cape gooseberry (*Physalis peruviana* L.) is an important tropical fruit crop under minor fruit category of India. It is known by different names like golden berry (South Africa and UK), giant ground cherry, pervuvian golden cherry (US), poha (Hawaii), jam fruit (India) and uchuva (Colombia). It belongs to family Solanaceae[1] and it is a potential underutilized fruit crop which is grown as perennial in tropics and as an annual in temperate and subtropical regions of the world (Morton 1987). It is native to tropical highlands in Peru and Chile in South America. The name of cape gooseberry was derived from Cape of Good Hope in South Africa,[2] where it is commercially grown. It is widely grown in Australia, New Zealand, United States, Mexico, India, Sri Lanka, United Kingdom, China, South Africa, Kenya, Egypt, Caribbean, California and Hawaii. In China, India and Malaya, it is commonly grown but on a lesser scale. Inspite of numerous beneficial aspects of Cape gooseberry it is restricted to limited area in our country. Thus there is a great scope to increase production and productivity of Cape gooseberry. For getting higher yields and quality produce, soil health is a critical factor. In recent days, consumers are becoming more and more health conscious and are ready to pay more prices for organically grown quality fruits, due to its taste, appearance, more shelf life and richness in nutritive parameters. Bio fertilizers are natural fertilizers containing carried based micro-organisms which help to enhance productivity by biological nitrogen fixation, producing vitamins and other growth factor required for plant growth.[3] The growers also have realized the importance of the same as the cost of chemical fertilizers is increasing day by day. Hence, keeping these views in mind and to know if the quantum of inorganic fertilizers can be substituted with organic manures and/or bio fertilizers, without reducing the yield and deteriorating the quality of fruits.[4] Therefore, chemical fertilizers must be integrated with organic fertilizers such as FYM and bio fertilizers. Hence, the present investigation was carried out to study the integrated effect of chemical fertilizers in combination with organic manures and bio fertilizers on growth and quality parameters of Cape gooseberry.

Materials and methods

The present investigation was carried out at an experimental orchard and laboratory of Department of Horticulture, Khalsa College, Amritsar during 2015-16. For raising a nursery, seeds of Cape gooseberry genotype 'Aligarh' were sown on 15 June 2015 in raised nursery beds measuring 1m x 1m. Seedlings were transplanted a month after sowing i.e., in mid July (when these attained a height of 20cm) in well-prepared field beds measuring 4m x 2m. Plant-to-plant and row-to-row spacing was 1m x 1m. The experiment was laid out in Randomized Block Design. The experiment consisted of 7 treatments with 4 replications. FYM was applied according to the treatments 20 days before transplanting. Nitrogen was applied in the form of urea and phosphorous in the form of SSP before transplanting. There was no need of applying potash according to soil test report. Non-symbiotic bio fertilizers (*Azotobacter*, *Azospirillium*), well known for their broad spectrum utility in various crops, were used in the experiment. These were applied @ 10g/plant by mixing with1kg FYM during the time of transplanting. Effect of different combinations of biological and chemical fertilizers on crop was recorded in terms of plant height, shoot number, shoot length, stem girth, leaf area, apparent fruit maturity, Organoleptic rating, juice percentage and yield/plant from randomly selected plants from each replication.

Treatment details

T_1-100% NPK

T_{2-} 75% NPK + 1.25t/acre FYM

T_{3-} 50% NPK + 0.70t/acre FYM + bio fertilizers (*Azotobacter* and *Azospirillum* @10g/plant)

T_{4-} 1.0t/acre FYM + bio fertilizers (*Azotobacter* and *Azospirillum* @10g/plant)

T_{5-} 2.0t/acre FYM

T_{6-} Bio fertilizers (*Azotobacter* and *Azospirillum* @10g/plant)

T_{7-} Control (No fertilizers)

Results and discussion

The data with regard to plant height as influenced by organic and inorganic fertilizers indicated that the maximum plant height

(127.5cm) was recorded in T_2 treatment(NPK 75% + 1.25 t/acre FYM) followed by T_4, T_3 and T_5 which recorded 127.00cm, 126.50cm, 124.02 cm respectively. The height of plants under control was recorded to be minimum (102.75cm). It is evident that the difference among treatments was not significant. The maximum plant height in T_2 might be due to the synergic effect of organic manures along with inorganic fertilizers. Similar findings were also reported by Sahu[5] in guava, Pal et al (2015) in tomato. The minimum plant height in control might be due to non application of nutrients and ultimately due to the supply of insufficient quantity of nutrients needed for the growth of the plant as also reported by Garg & Singh[6] in cape gooseberry. Addition of bio fertilizers (*Azotobacter* and *Azospirillum*) might have helpful in nitrogen fixation and quicker source for plant absorption. Sepat et al.,[4] in tomato also reported positive effect of combination of organic fertilizers and farmyard manure on plant height in tomato. The greatest plant height had also been reported with the addition of FYM by Khan and Begum (2007)7 in acid lime. The maximum number of shoots (6.75) per plant were obtained in treatment T_2 followed by (6.25), (6.24) and (6.00) in T_5, T_4 and T_3. This increase might be due to the availability of major as well as minor nutrient elements at optimum proportion in the soil and assimilation of food material within the plant.[8] Mohankumar & Gowda[9] found that the number of branches were highest in the treatment of 150% recommended FYM in brinjal plants due to steady and adequate supply of nutrients from FYM alone or with mixture of FYM and NPK. The minimum number of shoots (5.00) per plant was reported under control T_7. These results are also in agreement with the findings of *Pal et al (2015)* in tomato.

It is evident from the data that maximum average shoot length (92.28cm) was found in treatment T_2 followed by T_5 (83.67 cm), T_4 (82.96 cm), T_1 (80.74cm) .The maximum length of shoots could be attributed to the easily availability of required quantity of nutrients and improved soil conditions due to the addition of FYM for releasing the different macro and micro nutrients at proper stage required for plant growth which might have manifested in enhancing the growth in terms of shoot length. The lower values of these traits (73.58cm) in control treatment (T_7) could be attributed to non-availability of required quantum of nutrients.[8] Similar findings were also reported by Sahu[4] in guava. The perusal of data regarding stem girth indicated that the maximum stem girth (2.96cm) was obtained in plants treated with T_2 followed by T_4, T_3 and T_1 with stem girth of 2.47cm, 2.34 cm and 2.31cm respectively. These results do not differ significantly from each other. The minimum stem girth (2.02cm) was found under control T_7. The maximum stem girth (2.69cm) might be due to the increase in shoot length and number of leaves which might have resulted to the production of more quantum of carbohydrates and subsequently their translocations towards the stem. While, the minimum values of stem girth in control might be due to the poor availability of nutrients required for better plant growth. These findings are well supported with the findings of Dutta et al.,[10] in papaya and Sahu[4] in guava plants, respectively. The maximum leaf area (0.358m^2) was found under T_3 followed by T_1 with leaf area of 0.277m^2. Treatment under control had minimum leaf area (0.229m^2) followed by T_6 which have leaf area of 0.250m^2. All these results do not show significant difference among them. Increase in leaf area by combined application of inorganic fertilizers with FYM might be due to the easily availability of required quantity of nutrients and improved soil conditions which promoted the vegetative growth and also the leaf area. It can be inferred that bio fertilizers, along with NPK and FYM, helps proliferation of roots which, ultimately, resulted in sturdy and healthy plants showing resistance to biotic and abiotic stresses. Moreover, this also promoted better nutrient uptake and carbohydrate accumulation in leaves, resulting in healthy leaf growth. These results are in accordance with the findings of Sandhu & Gill[11] in capegooseberry. The minimum days (100.75) for apparent fruit maturity were found in T_3 followed by T_6 with (103.00), T_5 with (104.25) and T_2 with (104.75) days respectively. These treatments were found to be at par with each other. This might be due to the elaboration of small quantities of growth promoting substances like GA, IAA, cytokinins, Vitamin B, etc or by *Azotobacter,* which, along with NPK and FYM might have improved the physiology of plants causing a shift from the vegetative to the reproductive phase. These results are in accordance with the findings of Sandhu & Gill[11] in capegooseberry. Maximum Organoleptic scores 9.12 and 9.07 were awarded to the fruits from the plants under T_3 and T_1 respectively. Both of these treatments were found to be at par with each other. It was also observed that the fruits from treatments T_2, T_4 and T_6 scored 8.50, 7.75 and 7.62 organoleptic ratings, respectively, which differ significantly. Fruits yielded from control got minimum 7.00 Organoleptic scores. Results of the study revealed that the combined application of organic and inorganic fertilizers enhanced the fruit quality of capegooseberry. Plants treated with 50% NPK + 0.7 t/acre FYM + bio fertilizers produced fruits of better quality with high organoleptic characters. Results of these findings are confirmed by Umar et al.,[12] in strawberry. Maximum percentage of juice (74.05%) was found in fruit of plants treated with T_3 followed by T_1, T_2 and T_4 with 73.40, 73.36 and 72.56 per cent juice, respectively. All of these results were found to be at par with each other. Minimum juice percentage (68.31%) was found in the treatment under control (T_7) (Table 1) (Table 2). It was noted that plants treated with T_3 registered maximum fruit yield (1.30kg), it was followed by T_1, T_2 treatments with fruit yield of 1.04kg and 0.94 kg per plant respectively. T_3 differ significantly from all other treatments. Minimum yield (0.72kg) was found in the treatment under control which is found to be at par with T_6 with yield of 0.76kg. Increase in yield due to application of organic manures, fertilizers and bio fertilizers together was might be responsible for synthesis of plant growth hormone, development of root system and therefore high nutrient utilization by crop plants. Similar findings have been reported by Sepat et al.,[8] and Singh and Singh[13] in tomato.

Table 1 Effect of integrated management on vegetative characteristics of Cape gooseberry

	Plant height (cm)	Shoot number/ plant	Average shoot length (cm)	Stem girth (cm)	Leaf area (sq.m)
Treatments					
T1- 100% NPK	126.75	5.5	80.74	2.49	0.277
T2- 75%NPF+1.25t/a FYM	127.65	7.5	93.87	2.78	0.262
T3-50%NPK+ 0.7t/a FYM+ bio fertilizers	127	5.75	81.91	2.6	0.358
T4 – 1t/a FYM+ bio fertilizers	127.4	6	82.24	2.6	0.255

Citation: Kaur A, Singh M. Improvement of yield and fruit quality attributes through organic and inorganic fertilizers in cape-gooseberry (*Physalis peruviana* l.) cv. Aligarh. *Adv Plants Agric Res.* 2019;9(1):216–218. DOI: 10.15406/apar.2019.09.00438

Table Continued....

	Plant height (cm)	Shoot number/ plant	Average shoot length (cm)	Stem girth (cm)	Leaf area (sq.m)
T5 – 2t/ a FYM	119.5	5	74.78	2.44	0.251
T6 - bio fertilizers	112.87	4.25	73.66	2.37	0.25
T7 – Control	108	3.75	73.62	2.08	0.229
MEAN	121.14	5.39	80.12	2.48	0.26
CD at 5% level	14.4	2.18	12.09	0.28	0.13

Table 2 Effect of integrated management on fruit characteristics of Cape gooseberry

Treatments	Fruit maturity(days)	Juice Percentage (%)	Organoleptic rating	Yield/plant (kg)
T1- 100% NPK	105.5	73.4	9.07	1.04
T2- 75%NPF+1.25t/a FYM	104.75	73.36	8.5	0.94
T3-50%NPK+ 0.7t/a FYM+ bio fertilizers	100.75	74.05	9.12	1.3
T4 – 1t/a FYM+ bio fertilizers	104.74	72.56	7.75	1.01
T5 – 2t/ a FYM	104.25	71.05	7.62	0.77
T6 - bio fertilizers	103	70.98	7.61	0.76
T7 – Control	107.25	68.31	7	0.72
MEAN	104.32	71.95	8.1	0.936
CD at 5% level	1.72	2.81	1.1	0.54

Acknowledgments

None.

Conflicts of interest

The authors declared there is no conflict of interest.

References

1. Girapu RC, Kumar A. *Influence of nitrogen and spacing on growth, yield and economics of capegooseberry (Physalis peruviana L.) production*. Proceeding of national symposium on production, utilization and export of underutilized fruits with commercial potentialities held at Bidhan Chandra Krishi Viswavidyalaya, West Bengal: 2006.
2. Klinac DC. Capegooseberry (*Physalis peruviana* L.) production systems. *New Zealand J. Exptl. Agri* 1986;14(4):425-430.
3. Bhattacharya P, Jain RK, Paliwal MK. Bio fertilizers for vegetables. *Indian journal of Horticulture*. 2010;44:12–13.
4. Sepat NK, Kumar A, Yadav J, et al. Effect of integrated nutrient management on growth, yield and quality of tomato in trans Himalayan. *Ann Pl Soil Res*. 2012;14(2):120–123.
5. Sahu PK. Studies on effect of integrated application of chemical fertilizers, organics and biofetilizers on growth, yield and quality of guava under Chhattisgarh plains. M.Sc. thesis Indira Gandhi Krishi Vishwavidyalaya, Raipur: 2014.
6. Garg RC, Singh SK. Primary nutrient deficiency in capegooseberry. *Prog Hort.* 2010;7:53–58.
7. Khan MAA, Begum H. Effect of organic, inorganic and bio fertilizer on plant growth and chlorophyll content of acid lime. *Asian J of Horti*. 2007;2(1):161–165.
8. Atom A. Effect of inorganic and bio fertilizers on growth, yield and quality of Sardar Guava (*Psidium guajava* L.). M.Sc. Thesis, College of Agriculture, Latur: 2013.
9. Mohankumar AB, Gowda Narase NC. Effect of different organic manures and inorganic fertilizers on growth and yield of brinjal. *The Asian J of Horti*. 2010;5(2):444–449.
10. Dutta. Effect of biofertlizers on homestead fruit production 0f papaya cv. Ranchi. *ISHS Acta Horticulturae*. 2010;11:851.
11. Sandhu S, Gill BS. Effect of integrated nutrient management strategies on growth and yield of capegooseberry. *J Hort Sci*. 2011;6(1):29–32.
12. Umar I, Wali VK, Kher R, et al. Effect of FYM, urea and Azotobacter on growth, yield and quality of strawberry cv. Chandler. *Not Bot Hort Agrobat Cluj*. 2009;37(1):139–143.
13. Singh VN, Singh SS. Studies on the effect of INM on growth, yield and economics of tomato cv. *NDT-6. A J of multidisciplinary Advance Res*. 2013;2(2):94–102.