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Response of potassium nitrate and urea phosphate on biochemical observation of Cape gooseberry (*Physalis peruviana* L.)

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Abstract
A research was conducted on the response of potassium nitrate and urea phosphate for biochemical evaluation of Cape gooseberry (*Physalis peruviana* L.) locally genotype Sel-VK-601 at the permanent farm of Bihar Agriculture College, Sabour, Bhagalpur during 2018-19. There were seven treatments with three replications was maintained and different doses of chemicals were applied with Randomized Block Design. Out of seven treatments, whereas the TSS (15.96 brix), Total sugar (10.53%), Ascorbic acid (45.80 mg/100g), Total carotenoids (5.48 mg/100g), Total flavonoids (3.07 mg RE/100g) was found with application of KNO_3 @ 1.5%. The other parameters like Titrable Acidity (1.67%), Total phenol (80.03 GAE/100g), Antioxidant (601.10 µMol trolex eq.100g) were found with sprayed Urea phosphate @ 1.5%. Therefore, the application of potassium nitrate and urea phosphate are very useful chemicals which increase the biochemical ranges in cape gooseberry because of applied these chemicals delayed the ripening process.

Keywords: Cape gooseberry, biochemical observation, family Solanaceae, urea phosphate

Introduction
Cape gooseberry (*Physalis peruviana* L.) is minor fruit which is a pulpy round berry in nature belongs to the family Solanaceae native to South America. The pulp contains numerous small seeds which are completely edible and smooth and its peel is thin, elastic, smooth and shiny and fruits are entirely covered by calyx (Marquez *et al.* 2009) [11]. It is commonly called as Rasbhari, Makoi or Tepari in India, Poha in Hawaii, Golden Berry in South Africa (Gupta and Roy, 1980) [3]. The first description of *Physalis* genus was made by Linnaeus in 1753. *Physalis* having more than 120 species but there are few are of economic value like- strawberry tomato, husk tomato or ground cherry, *P. pruinosa* grown for its small bright yellow fruits used for sauce, pies and preserves in mild-temperate climates (Licodiedoff *et al.*, 2013) [9].
Cape gooseberry is tetraploid having chromosome number 2n = 48 which constitutes high amount of vitamins A and C levels as well as minerals such as calcium, iron and phosphorus etc. (Menzel, 1951) [12].
During the ripening process, the fruit colour turns from green to bright orange due to chlorophyll breakdown and carotenoids accumulation and progressive softening occurs. When the fruit is ripened, calyx shows a brown colour which is determining known as the point of harvest (Avila *et al.*, 2006) [1]. *Physalis* is a climacteric fruit which shows a clear rise in ethylene production during ripening. *Physalis* seeds germinate more easily when the temperature lies between 7 to 13°C at night and 22 to 28 °C during the day. It can grow around 1.0 to 1.5 meters height. However, with training it can exceed up to 2.0 meters' height (Fischer, 2000) [2]. Cape gooseberry is famous for its flavour and having good blend of acid-sugar. The fruits are very attractive in colour at maturity time. *Physalis* fruits show high level of ascorbic acid 36 mg/100g pulp, rich in vitamin A 1730 IU 100g of pulp, iron 38 mg/100g of pulp and phosphorus 1.2 mg/100g of pulp (Fisher, 2000; Ramadan & Morsel, 2007) [2, 14]. The ripe fruits are eaten fresh or can be used for preparation of excellent quality of jam for which it is also called the 'Jam Fruit of India'

A number of species in the genus are of horticultural and economic importance due to their high nutritional value in vitamin A, C and B complex, minerals and phosphorus, antioxidants (Wu *et al.*, 2005) as well as potential medicinal properties including anti-bacterial, anti-inflammatory and anti-cancer properties.

Hence in Indian condition, where population pressure is more and land is inadequate while as it's a better chance to grow *Physalis* which is high demandable crops due to its nutritional as well as medicinal point of view. As fruits are consumed mostly as fresh and their fruit quality should be more desirable and nutritional quality is essential for *Physalis* fruit.

Materials and Methods

The present investigation entitled "Effect of potassium nitrate and urea phosphate in flowering, fruiting and yield of cape gooseberry" (*Physalis peruviana* L.) using biochemical observation" it was under taken during the winter season of the year 2018-19 at the experimental field of Horticulture Garden, Bihar Agricultural College, Sabour, Bhagalpur (Bihar).

Bihar agriculture college is established between $20^0 50'$ N latitude and $87^0 19'$E longitude at an altitude of 52.73 m height from mean sea level near vast alluvial Gangetic Plains of North India, located South to River Ganga. The climatic condition of this region is sub-tropical of lithely semi-arid in occurrence and identified with dry summer, moderate precipitation and cold winter climatic condition. The meteorological data recorded regarding temperature, relative humidity, rainfall and wind speed for the experimental period were collected from meteorological observatory at Bihar Agricultural College, Sabour (Supplementary Table1).

Plant Materials: The research material consists of single genomic constituent of Cape gooseberry **(***Physalis peruviana* L.**)** *viz*. Sel-VK-601. The genotypes are collected from the experimental garden of Bihar Agriculture College, Sabour, Bhagalpur. Tiny seeds are sowed in the protray it consists coco peat: Vermicompost: Sand with ratio 2:1:1/2 in the initial month of October. These seedlings were mature for transplanting after 3-4 weeks and transplanting was done after just after one month. The uniform seedlings were planted at a distance of 60 x 60 cm. Planting of seedling was done in the evening period for their high degree of survival. The field was irrigated immediately just after transplanting.

A dose of 5 Kg farmyard manure, 40g nitrogen, 40g phosphorus and 20g potash per square meter was applied. The half dose of nitrogen and total amount of phosphorus, potash and farmyard manure mixed properly in the soil at the time of preparing beds and the remaining half dose of nitrogen was applied one month after planting. All the selected plants were almost uniform, healthy, and free from pest and diseases. Ten fruits were selected for biochemical analysis per treatments in triplicate grown according to randomized block design with seven treatments.

Treatments and details: After transplanting, two foliar sprays of potassium nitrate and urea phosphate on plants at 30 days' interval after transplanting. Seven treatments with three replications was maintained and different doses of chemicals were applied with Randomized Block Design. The different concentration of chemicals and its description with treatments such as; T_1 (KNO_3 @ 0.5%), T_2 (KNO_3 @ 1.0%), T_3 (KNO_3 @ 1.5%), T_4 (Urea Phosphate @ 0.5%), T_5 (Urea Phosphate @ 1.0%), T_6 (Urea Phosphate @ 1.5%) and T_7 (Control) was applied.

Results and Discussion

Total Soluble Solid, Acidity percentage, total sugar: For all the biochemical parameters, we were collected ten freshly extracted juice samples of cape gooseberry. In the estimation of total soluble solids (TSS) was recorded with the help of hand refractometer and was shown as in ^{0}Brix.

It is obvious from the data the total soluble solid (TSS) content (15.96 ^{0}Brix) was found with KNO_3 @ 1.5% followed by (15.37^{0}Brix) with Urea phosphate @ 1.5%. which have been influenced by the environment (Singh *et al.* 2011) [19]. TSS was not affected either by room temperature or low temperature storage (Javanmardi and Kubota, 2006) [4]. several scientists such as, Kour and Bakshi (2006) [5], Labarca *et al.* (2013) [7], Lopez *et al.* (2013) [10] and Resterpo (2008) [16] reported the TSS varied from 13 to 15^0 Brix respectively.

Titratable acidity of cape gooseberry was calculated by applying titration method (Rangana, 2010) [15]. The titratable acidity was (1.67%) was found in Urea phosphate @ 1.5% followed by (1.64%) in Urea phosphate @ 1%. However, the acidity factor has been identified as an important variable in the process of ripening and flavor of the fruit (Rodriguez *et al.* 2006) [17]. While as, the total sugar in cape gooseberry were estimated by Lane and Eynone (1923). The total sugar (10.53%) was recorded in KNO_3 @ 1.5% and followed by (10.15%) in KNO_3 @ 1.0%. Whereas, Panayotov and Popova (2014) supported data which varies from 9 to 10% depending upon the environment.

Total carotenoids, Ascorbic acid, Total Phenols: Total carotenoids content of cape gooseberry fruit was determined by the method of Roy (1973). The data regarding to carotenoids (5.48 mg/100g) were found in KNO_3 @ 1.5% followed by (5.32 mg/100g) in KNO_3 @ 1.0%. while as, Lopez *et al.* (2013) [10] identified β-carotene (722-783 mg/ 100g) sample which was varied from region to region and genotype to genotype.

Ascorbic acid was quantitatively estimated by Jones and Huges (1983). The ascorbic acid contents (45.80 mg/100g) was found in KNO_3 @ 1.5% followed by (44.05 mg/100g) with Urea phosphate @ 1.5%. whereas, Valdenegro *et al.* (2013) reported that the level of ascorbic acid determined in fresh fruit was 32 mg/100 g. The total phenolic constituent of cape gooseberry was recognized by the Singleton and Rossi method (1965). The total phenol (80.03 mg GAE/100g) was found in Urea phosphate @ 1.5% followed by (78.60 mg GAE/100g.) in Urea phosphate @ 1.0%

Total flavonoids content and antioxidant: Total Flavonoids content of Cape gooseberry was estimated by aluminum chloride method Zhishen *et al.* (1999) [22]. The flavonoids (3.07 mg/100g) was found in KNO_3 @ 1.5% followed by (3.02 mg/100g) with Urea phosphate @ 1.0%. While as, Kumar *et al.* (2021) [6] reported that the highest flavonoid was found in CITH Sel-XV genotype of cape gooseberry (16.60 mg/100g). Antioxidant capacity in the cape gooseberry was estimated by using DPPH (2,2-Diphenyl-1-picrylhydrazyl) advance modified method (Rop *et al.*, 2012), The antioxidant capacity recorded (601.10 TMμM/100g) in Urea Phosphate @ 1.5% followed by (541.34 TMμM/100g) with Urea phosphate @ 1.0%. The range of phenol and flavonoids varies from 321 to 356 mg, Gallic acid/100g and 100 to 145 mg quercetin equivalents 100g DW respectively (Lopez *et al.*, 2013) [10].

A high antioxidant capacity has been demonstrated for golden berry juice and synergistic effect of different antioxidants has been suggested (Ramdan and Morsel, 2007) [14]. Rop *et al.* (2012) [18] recommended antioxidant that varied from 7 to 9 (grams of AAE kg-1 FM) by DPPH test.

Statistical analysis and interpretation of data: The experimental data were subjected to statistical analysis in order to find out which of the treatments showed significant variation in different parameters studied under investigation. The technique of analysis of variance (ANOVA) for randomized block design was adopted as suggested by Panse and Sukhatme (1967).

Conclusion

The present study has revealed that sprayed of urea phosphate and potassium nitrate in cape gooseberry results in proper uptake of nutrient from soil and hence resulted in increased physico-chemical and yield parameters of cape gooseberry tested. Hence, As the nutritional point of view, the several parameters regarding to biochemical attributes like TSS (15.96 ^{0}B), sugar (10.53%), ascorbic acid (45.80 mg/100g.), carotenoids (5.48 mg/100g) and flavonoids (3.07 mg RE/ 100g.) were found with application of urea phosphate @ 1.5%. Therefore, the application of potassium nitrate and urea phosphate are very useful chemicals which increase the biochemical ranges in cape gooseberry because of applied these chemicals delayed the ripening process.

Response of Potassium Nitrate and Urea Phosphate Spray on biochemical observation of Cape Gooseberry (*Physalis peruviana* L.)

Table 1: Biochemical Observation of different treatments on Cape gooseberry

Treatments	TSS (^{O} Brix)	Acidity%	Total sugar%	Ascorbic acid mg/100g	Total carotenoids mg/100g	Total phenol mg GAE/100g.	Total flavonoids mg RE/100g.	Antioxidant (TEµM/100g)
T_1	15.10	1.49	9.93	42.68	5.24	56.72	2.67	494.02
T2	15.36	1.46	10.15	44.01	5.32	65.43	2.87	521.14
T3	15.96	1.39	10.53	45.80	5.48	70.36	3.07	561.58
T4	14.98	1.42	9.98	42.74	5.10	63.94	2.36	520.34
T5	15.20	1.64	10.03	43.18	5.24	78.60	3.02	541.34
T6	15.37	1.67	10.12	44.05	5.32	80.03	2.24	601.10
T7	14.23	1.36	8.89	40.99	4.85	55.17	1.96	461.84
S.E.M (±)	0.26	0.03	0.25	0.85	0.09	1.66	0.06	0.63
CD(P=0.5)	0.79	0.09	0.78	2.63	0.29	5.12	0.18	1.95
CV	2.92	3.56	4.38	3.41	3.09	4.28	3.99	4.07

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