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Effect of Soil and Foliar Application of Organic Nutrients on Physiological and Plant Analysis Characters of Bottle Gourd (*Lagenaria siceraria* (Molina) Standl.)

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A B S T R A C T

An investigation on effect of soil and foliar application of organic nutrients on physiological and plant analysis characters of bottle gourd (*Lagenaria siceraria*) through organic nutrient management practices was carried out in the farmer's field, Pattagapatti village, Dharmapuri District, Tamil Nadu during two seasons *viz.*, season I (March – June 2020) and season II (January – April 2022). The experiment comprised of 15 treatments replicated thrice was executed following the principles of Randomized Block Design. The experimental results revealed that the physiological parameters *viz.*, chlorophyll content and dry matter production of plants were observed to be the highest in the treatment which received the combined application of vermicompost 5 t ha^{-1}, CBF 2 kg ha^{-1} and humi power (1 percent) as foliar application for both the season. Among the plant analysis the highest nutrient uptake was recorded in the treatment that received the combined application of vermicompost 5 t ha^{-1}, CBF 2 kg ha^{-1} and humi power (1 percent) as foliar application.

Introduction

Bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) is an important cucurbitaceous crop grown throughout the country. It is having a chromosome number of 2n=22. Bottle gourd is one of the most important summer season vegetable, but growing throughout the year in different part of the country. In India, it is grown extensively in the state of Bihar, Uttar Pradesh, Madhya Pradesh, Haryana, Chhattishgarh, West Bengal, Punjab, Orissa and Tamil Nadu in large scale. The production in Tamil Nadu is 105.30 thousand tonnes (NHB, 2022). The fruit of bottle gourd contains 96.3 % water, 2.9 % carbohydrate, 0.2 % proteins, 0.5 % fat, 0.5 % mineral matter and 11 mg of vitamin C (Imnatemsu *et al.*, 2020). The performance on the yield of crop is very much important for the growers, but with esteem to consumer the quality us the primary factor. One of the best methods for maximization of crop yield is

through balances utilization of fertilizers. The effect of organic and inorganic fertilizers is complementary to each other in terms of soil fertility improvement and sustainable agriculture (Chaudhary *et al.*, 2019).

Organic agriculture is a comprehensive production management system which promotes and enhances health of agro-ecosystem, including bio-diversity, soil biological activity and biological cycles (Raghavendra *et al.*, 2014). FYM is an organic fertilizer commonly used for crop production. It supplies all essential plant nutrients, which improves the physio-chemical properties of soil. FYM enhances soil fertility by addition of organic matter and nutrients (especially nitrogen) in the soil/ FYM replenishes the soil with essential elements and adds humus to the soil. Vermicompost is another organic input increasing soil organic matter and nutrient content, improves the soil structure and increase cation exchange capacity.

Vermicompost serves as organic manure, since it is a source of nutrients, such as nitrogen, phosphate, potassium, and micronutrients (Chanda *et al.*, 2011). It improves the availability and nutritional quality of nutrients in plants while being ecologically friendly.

Consortium bio fertilizer (CBF) is a biofertilizer made up of microorganisms that can fix atmospheric nitrogen, while it also increases the availability of nutrients to plants. It is an environmentally beneficial, economically viable and socially acceptable way to reduce chemical fertilizer input (Das *et al.*, 2015).

Biostimulants are natural or synthetic substances that can be applied to plants and soil. It stimulates endogenous plant defense response to both biotic and abiotic stress factors. It affect the plant metabolism when applied in small quantities, when stimulates the natural hormone synthesis and activity, stimulation of root growth. Panchagavya is a single organic input that can operate as a growth promoter and immune booster when applied to plants. It also aids the growth and development of a wide range of crops (Amalraj *et al.*, 2013). Humic substances extracted from natural resources and helps to increase the permeability of plant membranes resulting in higher metabolic activity (Senthilkumar *et al.*, 2011). Jeevamrutha is an another organic fertilizer which increases in number of beneficial microbes and also shows profound effect on soil enzymes activity. It enhances the growth of crop and can help in sustaining of safe environment and crop productivity (Brar *et al.*, 2019).

Materials and Methods

The experiment was conducted during two seasons *viz.*, Season I (March-June 2021) and Season II (January-April 2022) was carried out in the farmers field, Pattagapatti village, Dharmapuri District, Tamil Nadu. The experimental field was situated at 11^{o} 47' N latitude and 77^{o} 02" E longitude at an altitude of 503 M above mean sea level in Dharmapuri District of Tamil Nadu, India. The maximum temperature of the location reaches upto 31.7^{o}C to 35.8^{o}C and seldom falls as low as 19^{o}C to 24.3^{o}C with a mean of 21.11^{o}C. The average rainfalls in this area are around 839 mm annually.

The experiment consists of fifteen treatments *viz.*, T_1- FYM + CBF as soil application, T_2- FYM + CBF + PG (3 per cent) as foliar application, T_3- FYM + CBF + EMI (2 per cent) as foliar application, T_4- FYM + CBF + HP(1 per cent) as foliar application, T_5- FYM + CBF + JM (2 per cent) as foliar application, T_6- VC+ CBF as soil application, T_7- VC+ CBF + PG (3 per cent) as foliar application, T_8- VC+ CBF + EMI (2 per cent) as foliar application. T_9- VC+ CBF + HP (1 per cent) as foliar application, T_{10}- VC+ CBF + JM (2 per cent) as foliar application, T_{11}- EM + CBF as soil application, T_{12}- EM + CBF + PG (3 per cent) as foliar application, T_{13}- EM + CBF + EMI (2 per cent) as foliar application, T_{14}- EM + CBF + HP (1 per cent) as foliar application and T_{15}- EM + CBF + JM (2 per cent) as foliar application. These fifteen treatments were replicated thrice in Randomized Block Design. These organic sources *viz.*, Farm

Yard Manure, Vermicompost, Enriched manure, Consortium biofertilizer, Panchagavya, Effective microbial inoculants, Humi Power and Jeevamrutha.

Results and Discussion

The data on effect of soil and foliar application of organic nutrients on physiological and plant analysis characters *viz.*, chlorophyll content, dry matter production, total nitrogen uptake, total phosphorus uptake, total potassium uptake of bottle gourd is presented in Table 1.

Chlorophyll content

Among the treatments maximum chlorophyll content was observed in T_9 (2.67 mg for season I and 2.85 mg for season II) which received the application of VC 5 t ha $^{-1}$ + CBF 2 kg ha^{-1} + humi power (1 per cent) as foliar application, followed by T_4 (2.49 mg for season I and 2.64 mg for season II) which received the application of FYM 25 t ha^{-1} + CBF 2 kg ha^{-1} + humi power (1 percent) as foliar application whereas the lowest chlorophyll content was observed in T_{11} (0.26 mg for season I and 0.27 mg for season II) which received enriched manure 1 t ha^{-1} as soil application (Table 1 and Fig. 1).

The increase in cholorophyll content by the application of vermicompost, CBF and humi power was due to the availability of micronutrient such as magnesium and zinc in traces in the organic manures and increases the uptake of nitrogen. High chlorophyll content could be due to the better process utilization of nitrogen for protein synthesis, which would have indirectly influenced the photosynthetic activities resulting in better process of assimilation (Sureshkumar *et al.,* 2019).

Dry matter production

Impact of T_9VC 5 t ha^{-1}+ CBF 2 kg ha^{-1}+ HP (1 per cent)as foliar application on dry matter production of bottle gourd. The highest dry matter production was recorded in T_9 (869.00 g plant^{-1} for season I and 875.77 g plant^{-1} for season II) followed by T_4 (834.10 g plant^{-1} for season I and 841.72 g plant^{-1}) for season II) which received the application of FYM 25 t ha^{-1} + CBF 2 kg ha^{-1} + humi power (1 percent) as foliar application. The least dry matter production was recorded in T_{11} (EM 1 t ha^{-1} + CBF 2 kg ha^{-1}) as soil application (Table 1 and Fig. 2).

Total nitrogen uptake (kg ha^{-1})

Manures comprises many nutrients needed for crop production. Among these, nitrogen is one of the most important and is the very commonly added to soil for higher yield. It undertakes many transformations in soil microbes.

Maximum uptake of N (158.54 kg ha^{-1} for season I and 166.30 kg ha^{-1} for season II) was recorded in the T_9VC 5 t ha^{-1}+ CBF 2 kg ha^{-1}+ HP (1 per cent), followed by T_4 (153.27 kg ha^{-1} for season I and 158.02 kg ha^{-1} for season II) which receives the combination of nutrients FYM 25 t ha^{-1} + CBF 2 kg ha^{-1} + humi power (1 percent).

The least nitrogen uptake was recorded in T_{11} (89.23 kg ha^{-1} for season I and 93.86 kg ha^{-1} for season II) which received the application of enriched manure 1 t ha^{-1} + CBF 2 kg ha^{-1} (Table 2 and Fig. 3). Since organic manures are rich in organic matter that increased in those treatments where vermicompost, CBF and humi power were added (Chaudhary *et al.*, 2019).

Total phosphorus uptake (kg ha^{-1})

The maximum uptake of phosphorus by the plants is registered in T_9 (39.80 kg ha^{-1} for season I and 45.62 kg ha^{-1} for season II) which receives the application of VC 5 t ha^{-1}+ CBF 2 kg ha^{-1}+ HP (1 per cent) followed by T_4 (38.50 kg ha^{-1} for season I and 44.21 kg ha^{-1} for season II). The minimum phosphorus uptake was recorded in T_{11} (23.05 kg ha^{-1} for season I and 26.78 kg ha^{-1} for season II), which received the application of enriched manure 1 t ha^{-1} + CBF 2 kg ha^{-1} (Table 2 and Fig. 4).

Table.1 Effect of soil and foliar application of organic nutrients chlorophyll content and dry matter production in bottle gourd.

	Treatment details	Chlorophyll content (mg / 100g)			Dry matter production (g plant^{-1})		
		Season I	Season II	Pooled mean	Season I	Season II	Pooled mean
T1	FYM + CBF	0.41	0.46	0.44	470.12	472.59	471.36
T2	FYM + CBF + PG	1.98	2.18	2.08	730.9	706	718.45
T3	FYM + CBF + EMI	0.81	1.03	0.92	570	580.67	575.34
T4	FYM + CBF + HP	2.49	2.64	2.57	834.1	841.72	837.91
T5	FYM + CBF + JM	1.39	1.52	1.46	655.24	666.07	660.66
T6	VC + CBF	0.6	0.64	0.62	501.3	513.4	507.35
T7	VC + CBF + PG	2.13	2.2	2.17	765.81	773	769.41
T8	VC + CBF + EMI	1.04	1.26	1.15	605.93	610.02	607.98
T9	VC + CBF + HP	2.67	2.85	2.76	869	875.77	872.39
T10	VC + CBF + JM	1.65	1.75	1.7	689.51	695.12	692.32
T11	EM + CBF	0.26	0.27	0.27	435.06	440.21	437.64
T12	EM + CBF + PG	1.7	1.98	1.84	723.53	734.51	729.02
T13	EM + CBF + EMI	0.75	0.85	0.8	535.37	549.53	542.45
T14	EM + CBF + HP	2.2	2.43	2.32	800.01	809.13	804.57
T15	EM + CBF + JM	1.17	1.3	1.24	620.18	627.05	623.62
S.ED		**0.07**	**0.09**	**0.08**	**13.02**	**14.09**	**13.56**
CD (p= 0.05)		**0.13**	**0.17**	**0.15**	**26.03**	**28.17**	**27.1**

Fig.1 Graphical representation of Chlorophyll content

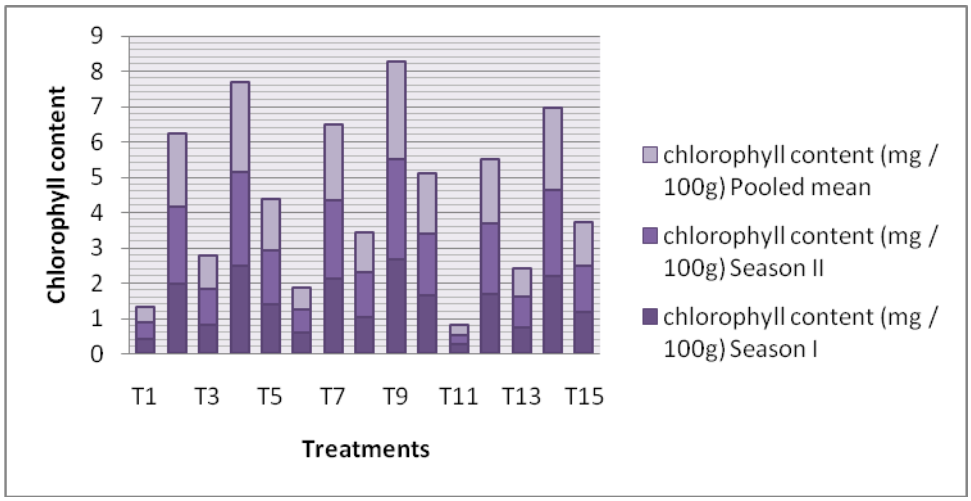


Table.2 Effect of soil and foliar application of organic nutrients on nutrient uptake (kg ha^{-1}) in bottle gourd

Tr. No	Treatment details	Nitrogen (kg ha^{-1})			Phosphorous (kg ha^{-1})			Potassium (kg ha^{-1})		
		Season I	Season II	Pooled mean	Season I	Season II	Pooled mean	Season I	Season II	Pooled mean
T1	FYM + CBF	95.2	101.66	98.43	25.45	28.23	26.84	110.05	113.21	111.63
T2	FYM + CBF + PG	139.63	138.1	138.87	34.97	39.51	37.24	161.07	165.77	163.42
T3	FYM + CBF + EMI	110.55	109.3	109.93	28.58	31.62	30.1	126.78	131	128.89
T4	FYM + CBF + HP	153.27	158.02	155.65	38.5	44.21	41.36	176.94	180.54	178.74
T5	FYM + CBF + JM	123.7	122.35	123.03	31.83	36.3	34.07	142.7	145.27	143.99
T6	VC + CBF	95.89	102.24	99.07	25.49	30.03	27.76	112.13	116.7	114.42
T7	VC + CBF + PG	141.35	146	143.68	35.21	41	38.11	161.96	166.01	163.98
T8	VC + CBF + EMI	111.86	116.63	114.25	28.76	33.28	31.02	128	132.04	130.02
T9	VC + CBF + HP	158.54	166.3	162.42	39.8	45.62	42.71	185.45	188.56	187.01
T10	VC + CBF + JM	131.92	130.15	131.04	32.06	37.49	34.78	144.35	152.63	148.49
T11	EM + CBF	89.23	93.86	91.55	23.05	26.78	24.92	102.2	105.65	103.93
T12	EM + CBF + PG	133.01	136.91	134.96	33.54	39	36.27	153.22	159.34	156.28
T13	EM + CBF + EMI	102.41	108.01	105.21	27.08	30.12	28.6	119.98	124.05	122.02
T14	EM + CBF + HP	146.15	150.22	148.19	36.72	42.79	39.76	169.09	173.19	171.14
T15	EM + CBF + JM	116.62	121.63	119.13	30.29	34.08	32.19	134.84	137.85	136.35
S.ED		**2.33**	**2.48**	**2.4**	**0.64**	**0.7**	**0.67**	**2.78**	**2.82**	**2.8**
CD (p= 0.05)		**4.65**	**4.96**	**4.81**	**1.27**	**1.39**	**1.33**	**5.56**	**5.64**	**5.6**

Fig.2 Graphical representation of Dry matter production

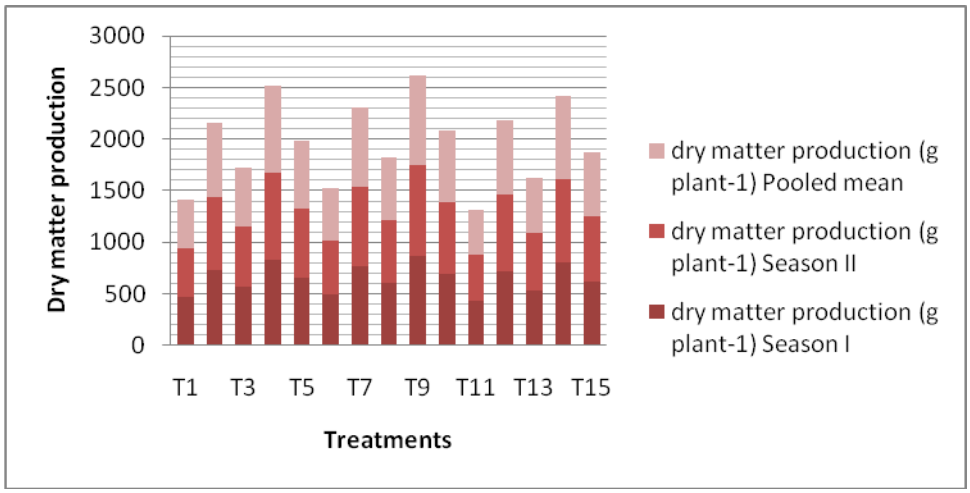


Fig.3 Graphical representation of Total nitrogen uptake (kg ha^{-1})

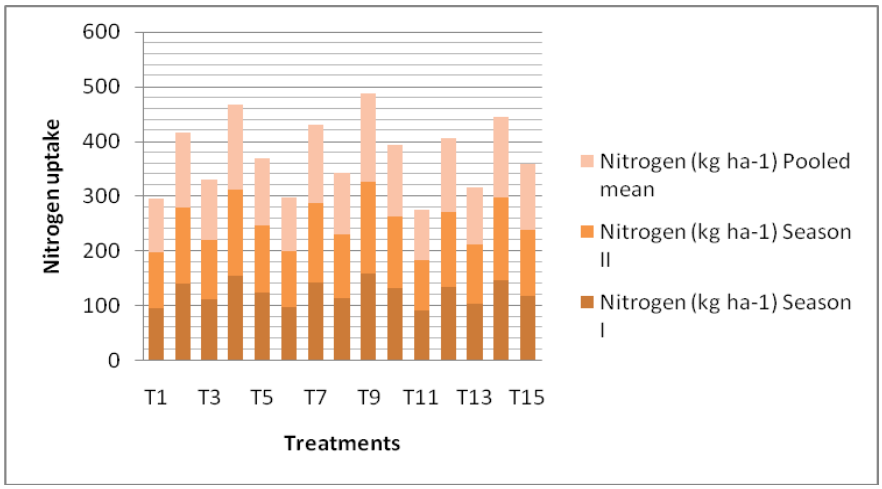


Fig.4 Graphical representation of Total phosphorus uptake (kg ha^{-1})

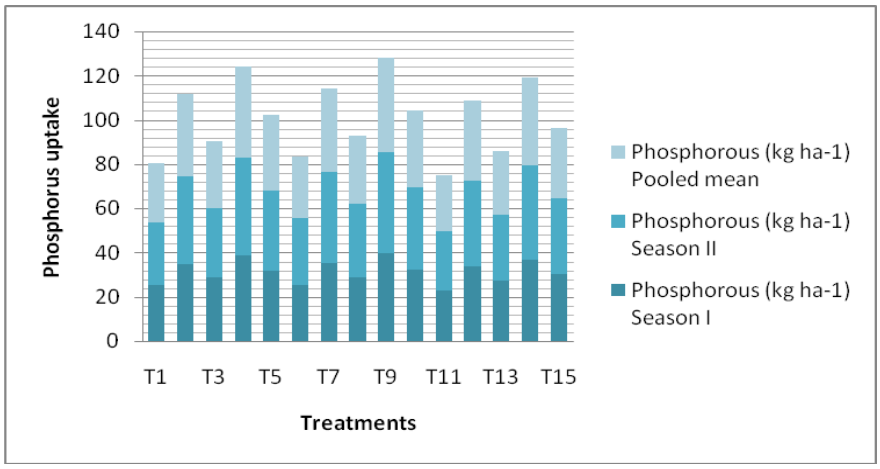
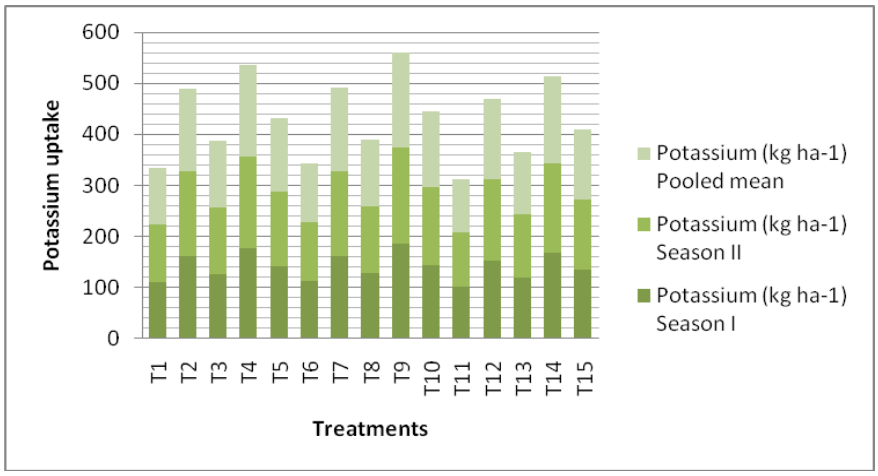


Fig.5 Graphical representation of Total potassium uptake (kg ha^{-1})



Total potassium uptake (kg ha^{-1})

Organic manures treated plot recorded significantly higher uptake of potassium was registered in T_9 (185.45 kg ha^{-1} for season I and 188.56 kg ha^{-1} for season II) which received the application of VC 5 t ha^{-1}+ CBF 2 kg ha^{-1}+ HP (1 per cent) followed by T_4 (176.94 kg ha^{-1} for season I and 180.54 kg ha^{-1} for season II). The lowest potassium uptake was shown in T_{11} (102.20 kg ha^{-1} for season I and 105.65 kg ha^{-1} for season II), which received the application of enriched manure 1 t ha^{-1} + CBF 2 kg ha^{-1} (Table 2 and Fig. 5).

References

Amalraj, E. L. D., Kumar, G. P., Ahmed, S. K. M. H., Abdul, R. and Kishor, N. (2013). Microbiological analysis of panchagavya, vermicompost, and FYM and their effect on plant growth promotion of pigeon pea (*Cajanus cajan* L.) in India. *Org. Agr.*, 3: 23-29. https://doi.org/10.1007/s13165-013-0042-2

Brar, P. S., Kaushal, R. and Bhardwaj, G. (2019). Beneficial effects of PGPR and noble liquid manures in enhancing soil fertility and sustainability. *International Journal of Current Microbiology and Applied Science*, 8(4): 409-415. https://doi.org/10.20546/ijcmas.2019.804.045

Chanda, G. K., Bhunia, G. and Chakraborty, S. K. (2011). The effect of vermicompost and other fertilizers on cultivation of tomato plants. *Journal of Horticulture For.*, 3(2): 42-45. https://doi.org/10.5897/JHF.9000110

Chaudhary, S. K., Yadav, S. K., Mahto, D. K., Azmi, N. Y., Sinha, N., Ranjan, A and Sharmna, R. (2019). Impact of organic and inorganic sources of nutrients on growth, yield attributes and yield of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) in Bihar. *Journal of AgriSearch*, 6: 54-58.

Chaudhary, S. K., Yadav, S. K., Mahto, D. K., Sinha, N. and Singh, S. K. (2019). Effect of organic and inorganic sources of nutrients on growth and yield of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) in Bihar. *Current Journal of Applied Science and Technology*, 37(6): 1-7.

Das, R., Mandal, A. R., Priya, A., Das, S. P. and Kabiraj, J. (2015). Evaluation of integrated nutrient management on the performance of bottle gourd (*Lagenaria siceraria* (Molina) Standl.). *Journal of Applied Natural Science*, 7(1): 18-25. https://doi.org/10.31018/jans.v7i1.557

Imnatemsu, Khare, N., Rout, S. and Debbarma, R. (2020). Effect of organic and inorganic fertilizers on growth and yield of bottle gourd (*Lagenaria siceraria*) under teak based agroforestry system. *Indian Journal of Pure Applied Bioscience*, 8(3): 388-395. https://doi.org/10.18782/2582-2845.8144

Raghavendra, K. V., Gowthami, R., Shashank, R. and Kumar, H. S. (2014). Panchagavya in organic crop production.*Pop. Kheti.*, 2(2): 233-236.

Senthilkumar, N., Poonkodi, P. and Prudvinath, J. S. (2011). Effect of foliar application of humic acid and organic manure on the growth, total output and fruits nutritional values of cucumber (*Cucumis sativus* L.) grown under plastic house conditions. *International Journal of Pharm. Tech. Res.*, 9(12): 52-57.

Sureshkumar, S., Deepa, S., Rajkumar, M., Sendhilnathan, R. and Barathkumar, T. R. (2019). Influence of organic nutrients on physiological and flowering characters of bittergourd (*Momordica charatia* L.) ecotype mithipagal. *Journal of Emerging Technology and Innovative Research*, 6(2): 177-181.

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