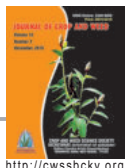
Journal of Crop and Weed, 19(1): 119-123 (2023) ISSN- O : 2349 9400 ; P : 0974 6315



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Effect of commercial bio-stimulating organic formulation on cucumber (*Cucumis sativus* L.)

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Received : 15.09.2022 ; Revised : 26.11.2022 ; Accepted : 02.12.2022

DOI: https://doi.org/10.22271/09746315.2023.v19.i1.1670

ABSTRACT

An investigation was carried out in Horticulture Farm, Sriniketan from November 2020 to March 2021 to examine the outcome of bio-stimulating organic formulation on growth and production of cucumber. Seven treatments [T1 (RDF + manures @ 5 tha^{-1}), T2 (RDF + manures @ 5 t ha^{-1} + seed soaking with Krish-Tee), T3 (RDF + manures @ 5 t ha^{-1} + seed soaking with Krish-Tee + 1 Foliar spray with Krish-Tee @ 2 mlL^{-1}), T4 (RDF + manures @ 5 tha^{-1} + seed soaking with Krish-Tee + 2 foliar sprays with Krish-Tee @ 2 ml L^{-1}), T5 (RDF + manures @ 5 t ha^{-1} + seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee @ 2 ml L^{-1}), T6 (RDF + Krishi Rasayan Organic Manure @ 375 kg ha^{-1}) and T7 (RDF (70%) + Krishi Rasayan Organic Manure @ 750 kg ha^{-1} + 2 Foliar sprays with Krish-Tee @ 2 ml L^{-1})] with three replications were assessed under randomized block design on cucumber cv. Kamalpur 12 Leaves (open pollinated variety). The variance study confirmed the existence of significant difference among different treatments. RDF (NPK@ 60:30:30 kg ha^{-1}) + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 ml L^{-1}) recorded maximum fruit yield, fruit weight, fruit number per plant and fruit length. This treatment combination can be suggested to the local growers of Red and Laterite Zone of West Bengal to boost cucumber productivity.

Keywords: Cucumber, Biostimulant, Krish-Tee, Yield, PLW

Cucumber (*Cucumis sativus* L.) is essentially the warm season crop of family Cucurbitaceae. It comes under the genus *Cucumis* with a diploid chromosome number of 2n=14. Cucumber is considered as the significant vegetable after tomato, cabbage and onion in Asia. It is a creeping vine plant, cultivated for fresh consumption or as pickling. China is the leading producer of cucumber followed by Turkey, Russian Federation, Iran, Mexico, Ukraine and USA (FAOSTAT, 2021). In India, cucumber covers 113 thousand ha area and production of 1638 thousand Metric Tonnes (MT). Among the states of India, West Bengal ranks first in production with 344.65 thousand MT followed by Madhya Pradesh with 258.19 thousand MT (Ministry of Agriculture and Farmers Welfare, 2022). The cucumber fruits contain 95% water content which is responsible for cooling and refreshing of human body. Fruits are rich in Vitamin B1, B2, B3, B5, B6, Ca, Fe, Mg, P, Zn and low in calories (2.5%). The seed oil is used as antipyretic. Fruits are primarily rich in Vitamin C and caffeic acid which aid in the relief of skin irritations and the juice is frequently advised to reform the complexion and health of the skin (Jung and Choi, 2020). Cucumbers are diuretics because of high water content, and they cleanse the body by eliminating collected packets of old trash and destructive substances (Kumar *et al.,* 2017).

Novel approaches including biostimulants are most universally accepted and registered in various applications by imparting advantages in plant development (Hassan *et al*., 2021). In order to augment and improve current agricultural techniques and crop inputs, biostimulants are acting as natural amendments with biological origins that are employed in crop production. This covers a wide range of product technologies, such as beneficiary microorganisms, synthesized substances, amino acids, humic acids, and seaweed extracts. By doing so, plants are better able to utilize nutrients efficiently, withstand abiotic stresses like heat, cold, drought, and waterlogging, and also exhibit higher levels of quality in terms of nutritional value, appearance and shelf life(Turkmen and Su, 2019). The use of organic manures improves soil microbial biomass, total organic carbon, soil productivity, soil physical, chemical and biological properties. In most forms, many natural elements like vegetable decay, plant decay have been administered as liquid manure to boost solubility and enhance plant productivity. Keeping in view the above facts, the current study is directed with the objective to test the outcome of commercial bio-stimulating organic formulation in cucumber.

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How to cite : Monisha, T. and Mandal, J. 2023. Effect of commercial bio-stimulating organic formulation on cucumber (*Cucumis sativus* L.). *J. Crop and Weed*, 19(1): 119-123.

MATERIALS AND METHODS

The present demonstration was conducted at Horticulture Farm of Palli Siksha Bhavana, Visva-Bharati, Sriniketan, West Bengal, India during rabi spring season of November 2020 to March 2021. The experimental site is located at $23^0$40'26.9" N latitude and $87^0$39'40.3" E longitude with an average altitude of 42 m greater than mean sea level. This site comes under Red and Laterite Zone of West Bengal. The cultivar taken for the experiment was 'Kamalpur 12 Leaves' (open pollinated variety). The seed trays filled with cocopeat were utilized for raising cucumber seedlings. Seed treatment was done with Bavistin (Carbendazim 50% Wettable Powder) @ 2 g L^{-1} of water before sowing. After seed sowing, paddy straw was used to shelter the trays and watered with a fine rose can. Regular spraying of IFFCO (Indian Farmers Fertilizer Cooperative Limited) water soluble NPK fertilizer at regular intervals was done to enhance the growth of the seedlings. Organic biostimulant KT i.e., Krish-Tee (Liquid form, which includes sea weed extract and other materials) was applied by soaking the seeds or by foliar spray (once or twice) and Krishi Rasayan Organic Manure (KROM) was applied @ 375 or 750 kg ha^{-1} as per treatment. This bio-activator is organically manufactured by Krishi Rasayan Group (Certified company), Kolkata for commercial use in farmers' field. Cucumber was planted in randomized block design followed by three replications and seven treatments. Planting system followed for raising this crop was 'Channel and Bed' system. Raised beds were made with a width of 1.5 m to trail the vines. 50 cm wide irrigation channels were spaced and pits were prepared at a distance of 50 cm throughout the beds. The experimental site was well drained sandy loam soil with 192.7 kg ha^{-1} available nitrogen, 35.7 kgha^{-1} available phosphorus, 164.5 kgha^{-1} available potassium and soil p^H of 6.7. The doses of Nitrogen, Phosphorus and Potassium were applied @ 60:30:30 kg ha^{-1} respectively. Nitrogen was applied in split doses but phosphorus and potassium were applied as basal before transplanting of seedlings. Seedlings were transplanted at 2-4 true leaf stage from germination trays after 30 days of sowing. Before transplanting, the seedlings were transplanted to the field in late afternoon and irrigated immediately. Gap filling was done up to 10-15 days after transplanting to maintain optimum plant population in the field wherever plant mortality was observed. At primary stages of crop growth, the crop was irrigated at 2 to 3 days interval for productive growth and later irrigation was given at 4 to 6 days interval until harvesting for quality and high fruit production. Light hoeing and subsequent hand weeding were done from 30 days after transplanting to reduce crop weed competition and to keep the plot weed free. Five plants per plot were selected to record the data on different growth and flowering characters such as vine length (m), number of branches per vine, number of leaves per vine, days to first male flower appearance, days to first female flower appearance and yield and quality characters such as fruit length (cm), fruit width (cm), average fruit weight (g), number of fruits per plant, fruit yield per plot (kg), fruit yield per hectare (q) and physiological loss in fruit weight. Different growth and flowering characters, yield and physiological loss in fruit weight were analyzed for significance at 5% by F test using ANOVA (Analysis of Variance) technique.

RESULTS AND DISCUSSION

Growth and flowering characters

The interpretation for growth characters such as vine length, number of branches per vine, number of leaves per vine confirmed significant statistical variation among different treatments. However, no significant variation was observed among the treatment combinations for flowering characters such as number of days taken for opening of first male and female flower. The average number of days taken for first male and female flower opening was 49.5 days and 56.4 days after sowing. Vine length varied significantly from 1.93 to 2.61 meters with a mean value of 2.28 m. Short vine length is a desirable trait for cucurbitaceous vegetables as it gives compact plant structure. The shortest vine length was noticed in the treatment combination T_7 *i.e.,* Recommended dose of fertilizers, RDF (70%) + KR Organic Manure (750 kg ha^{-1}) + 2 foliar sprays with Krish-Tee (2 ml L^{-1}) which was scientifically equal with T_3 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 1 Foliar spray with Krish-Tee (2 ml L^{-1}). Besides, maximum vine length was noticed in T_5 *i.e.,* RDF + Manures (5 t ha^{-1}) + Seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 ml L^{-1}) which was numerically equal with T_2 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee. Number of branches per vine is an important trait for good vegetative growth. The number of branches per vine varied from 3.47 to 4.70 with an average of 4.22 branches. Maximum number of branches per vine was remarked in the treatment combination T_2 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee followed by T_4 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee+ 2 foliar sprays with Krish-Tee (2 ml L^{-1}) whereas minimum number of branches per vine was observed in T_7 *i.e.,* RDF (70%) + KR Organic Manure @ 750 kg ha^{-1} + 2 foliar sprays with Krish-Tee (2 ml L^{-1}). The number of leaves per vine evidences the vigorous growth of the plant. The number of leaves per vine varied from 33.63 to 48.07 with a mean of 41.88

Table 1: Effect of bio-stimulants on growth and flowering characters of cucumber

Treatments	Vine length (m)	Number of branches vine^{-1}	Number of leaves vine^{-1}	Days to male flowering	Days to female flowering
T_1	2.29^{bc}	4.03^{bc}	41.34^{b}	49.0	56.1
T_2	2.48^{ab}	4.70^{a}	48.07^{a}	49.1	55.7
T_3	2.04^{de}	4.07^{abc}	41.81^{b}	50.1	57.6
T_4	2.40^{bc}	4.63^{ab}	41.41^{b}	49.0	56.1
T_5	2.61^{a}	4.43^{ab}	46.65^{a}	49.6	56.4
T_6	2.20^{cd}	4.20^{ab}	40.20^{b}	49.2	56.1
T_7	1.93^{e}	3.47^{c}	33.63^{c}	50.3	56.9
Mean	**2.28**	**4.22**	**41.88**	**49.5**	**56.4**
LSD(0.05)	**0.21**	**0.65**	**3.59**	**NS**	**NS**

(T_1- RDF + manure (5 t ha^{-1}), T_2- RDF + manure (5 t ha^{-1}) + seed soaking with KT, T_3- RDF + manure (5 t ha^{-1}) + seed soaking with KT + 1 foliar spray with KT (2 ml L^{-1}), T_4- RDF + manure (5 t ha^{-1}) + 2 foliar sprays with KT (2 ml L^{-1}), T_5- RDF + KR Organic Manure (375 Kg ha^{-1}), T_6- RDF + KR Organic Manure (375 Kg ha^{-1}) + 2 foliar sprays with KT (2 ml L^{-1}), T_7- RDF (70%) + KROM (750 Kg ha^{-1}) +2 foliar sprays with KT (2 ml L^{-1}))

Table 2: Effect of bio-stimulants on yield characters of cucumber

Treatments	Fruit length (cm)	Fruit width (cm)	Average fruit weight (g)	Number of fruits plant^{-1}	Yield ha^{-1} (q)
T_1	11.51^{bc}	4.20	91.79^{bc}	11.56^{a}	105.93^{bc}
T_2	12.01^{ab}	4.26	96.07^{ab}	11.80^{a}	119.53^{a}
T_3	11.98^{ab}	4.49	96.06^{ab}	11.79^{a}	117.93^{ab}
T_4	12.25^{a}	4.55	97.48^{a}	12.06^{a}	121.70^{a}
T_5	12.34^{a}	4.58	98.58^{a}	12.10^{a}	128.13^{a}
T_6	11.12^{cd}	4.08	87.57^{cd}	10.37^{ab}	99.67^{cd}
T_7	10.48^{d}	3.90	83.87^{d}	9.33^{b}	86.50^{d}
Mean	**11.67**	**4.30**	**93.06**	**11.29**	**111.34**
LSD(0.05)	**0.73**	**NS**	**5.63**	**1.85**	**13.6**

(T_1- RDF + Manure (5 t ha^{-1}), T_2- RDF + manure (5 t ha^{-1}) + seed soaking with KT, T_3- RDF + manure (5 t ha^{-1}) + seed soaking with KT + 1 foliar spray with KT (2 ml L^{-1}), T_4- RDF + manure (5 t ha^{-1}) + 2 foliar sprays with KT (2 mlL^{-1}), T_5- RDF + KR Organic Manure (375 Kg ha^{-1}), T_6- RDF + KR Organic Manure (375 Kg ha^{-1}) + 2 foliar sprays with KT (2 mlL^{-1}), T_7- RDF (70%) + KROM (750 Kg ha^{-1}) +2 foliar sprays with KT (2 mlL^{-1}))

Table 3: Effect of bio-stimulants on PLW i.e., Physiological loss in fruit weight of cucumber

Treatments	PLW % (First date)	PLW % (Second date)	PLW % (Third date)
T_1	7.41^{bc}	12.45^{c}	17.54^{b}
T_2	6.45^{cd}	11.48^{cd}	16.47^{c}
T_3	8.06^{b}	13.02^{ab}	18.66^{ab}
T_4	9.14^{ab}	13.68^{ab}	17^{bc}
T_5	3.4^{d}	9.5^{d}	15.14^{cd}
T_6	7.04^{c}	12.94^{b}	19.51^{ab}
T_7	12.15^{a}	15.29^{a}	24.05^{a}
Mean	**7.66**	**12.62**	**18.34**
LSD(0.05)	**3.65**	**2.88**	**4.64**

(T_1- RDF + Manure (5 t ha^{-1}), T2- RDF + manure (5 t ha^{-1}) + seed soaking with KT, T_3- RDF + manure (5 t ha^{-1}) + seed soaking with KT + 1 foliar spray with KT (2 ml L^{-1}), T_4- RDF + manure (5 t ha^{-1}) + 2 foliar sprays with KT (2 ml L^{-1}), T_5- RDF + KR Organic Manure (375 Kg ha^{-1}), T_6- RDF + KR Organic Manure (375 Kg ha^{-1}) + 2 foliar sprays with KT (2 ml L^{-1}), T_7- RDF (70%) + KROM (750 Kg ha^{-1}) +2 foliar sprays with KT (2 ml L^{-1}))

leaves. The treatment combination T_2 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee recorded maximum number of leaves per vine which was proportional with T_5 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 ml L^{-1}). On the contrary, treatment combination T_7 *i.e.,* RDF (70%) + KR Organic Manure (750 kg ha^{-1}) + 2 foliar sprays with Krish-Tee (2 ml L^{-1}) recorded minimum number of leaves per vine.

Ekinci *et al.* (2014) reported significantly higher vine length in cucumber treated with liquid organic fertilizer and also reported that plant growth increases with increase in application of liquid formulations. Singh *et al.* (2017) noticed significant variation in number of branches and leaves of cucumber and also reported that vegetative growth has been improved by application of organic formulations. The results reported with Thongney *et al.* (2020) also showed highest number of branches in cucumber.

Yield characters

The evaluation study for fruit length, average fruit weight, number of fruits per plant, yield per plot and yield per hectare recorded significant statistical difference among the treatment combinations. However, no significant statistical difference was noted among the treatment combinations for fruit width. The average fruit width (4.30 cm) ranged from 3.90 to 4.58 cm. Length of the fruit ranged from 10.48 to 12.34 cm with a mean of 11.67 cm. Fruit length was recorded maximum in treatment T_5 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 ml L^{-1}) which was numerically proportionate with T_4 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 2 foliar sprays with Krish-Tee (2 ml L^{-1}). Minimum fruit length was noted in T_7 *i.e.,* RDF (70%) + KR Organic Manure (750 kg ha^{-1}) + 2 foliar sprays with Krish-Tee (2 ml L^{-1}). The average weight of the fruit ranged from 83.87 to 98.58 grams with mean of 93.06 grams per fruit. The highest fruit weight was recorded in treatment T5 *i.e.,* RDF + Manures (5 tha^{-1}) + Seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 mlL^{-1}) which was equivalent to T_4 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 2 foliar sprays with Krish-Tee (2 ml L^{-1}). Moreover, Minimum average fruit weight was recorded in T7 *i.e.,* RDF (70%) + KR Organic Manure (750 kg ha^{-1}) + 2 foliar sprays with Krish-Tee (2 ml L^{-1}). Number of fruits per plant varied from 9.33 to 12.10 with an average of 11.29. Treatment T5 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 ml L^{-1}) recorded maximum number of fruits per plant whereas T_7 *i.e.,* RDF (70%) + KR Organic Manure (750 kg ha^{-1}) + 2 foliar sprays with Krish-Tee (2 ml L^{-1}) recorded minimum number of fruits per plant followed by T_6 *i.e.,* RDF + KR Organic Manure @ 375 kg ha^{-1}. Fruit yield per hectare varied from 86.50 to 128.13 q ha^{-1} with a mean of 111.34 q ha^{-1}. The fruit yield per hectare was maximum in T_5 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 ml L^{-1}) followed by T_4 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 2 foliar sprays with Krish-Tee (2 ml L^{-1}). However, minimum fruit yield per hectare was recorded in T_7 *i.e.,* RDF + manures (5 th a^{-1}) + seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 mlL^{-1}) followed by T_6 *i.e.*, RDF + KR Organic Manure @ 375 kg ha^{-1}.

In Nigeria, Marliah *et al.* (2020) observed significant variation in length of cucumber fruit among the plots served with liquid organic fertilizers. Likewise, Jung and Choi (2020) reported significant statistical variation in cucumber among different fertilizer applications and highest mean fruit weight noted in liquid fertilizer treated plots. Singh *et al.* (2018) and Thongney *et al.* (2020) reported strong and significant statistical correlation among all the applied treatments and observed that increase in organic fertilizers had increased the number of cucumber fruits and total yield in cucumber. An *et al.* (2018) observed significant statistical variation on cucumber fruit yield per hectare with applications of compost and liquid organic fertilizer. Sahu *et al.* (2020) also reported that recommended fertilizer dose with organic fertilizers probably increase the fruit yield of cucumber under adverse soil properties. The findings of cucumber fruit yield are in conformity with Valencia *et al.* (2018) and Hassan *et al.* (2021).

Physiological loss in fruit weight

Cucumber fruits were kept at room temperature and fruit weight was measured at regular interval to find out the physiological loss in weight. Significant statistical variation was noticed among the treatment combinations for physiological loss in fruit weight after 2, 5 and 7 days after harvesting. Loss in fruit weight at 2 days after harvesting (first date) varied from 3.4 to 12.15% with a mean of 7.66%. At 5 days after harvesting (second date), loss in fruit weight ranged from 9.5 to 15.29% with a mean of 12.62%. Loss in fruit weight at 7 days after harvesting (third date) varied from 15.14 to 24.05% with a mean of 18.34%. Minimum loss in fruit weight was recorded in T5 *i.e.,* RDF + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 ml L^{-1}). Besides, maximum loss in fruit weight was recorded in T_7 *i.e.,* RDF (70%) + KR Organic Manure (750 kg ha^{-1}) + 2 foliar sprays with Krish-Tee (2 ml L^{-1}) followed by T_4 *i.e.,* RDF + manures (5 t ha^{-1})

+ seed soaking with Krish-Tee + 2 foliar sprays with Krish-Tee (2 ml L^{-1}). It is found that as number of foliar sprays of liquid biostimulant Krish-tee increases, physiological loss in fruit weight decreases.

From the above experiment, it is clear that there is presence of significant variation on application of commercial organic formulations on cucumber. There is potential for increasing the yield and production of cucumber by increasing the rate of application of biostimulants. It can be concluded that administration of RDF (N-P_2O_5-K_2O @ 60-30-30 kg ha^{-1}) + manures (5 t ha^{-1}) + seed soaking with Krish-Tee + 4 foliar sprays with Krish-Tee (2 ml L^{-1}) encouraged yield attributes such as fruit length, fruit weight, fruits per plant and fruit yield. The same treatment also recorded minimum physiological loss in fruit weight up to 7 days after harvesting. Considering these responses, this combination can be suggested to the farmers for commercial cultivation of cucumber under Red and Laterite zone of West Bengal.

REFERENCES

An, N. H., Cho, J.R., Lee, S.M. and Nam, H. S. 2018. Assessment of soil properties and growth of organically cultivated cucumber (*Cucumis sativus* L.) with applications of livestock manure compost and fish meal liquid fertilizer. *J. Korea Org. Res. Recycling Asso.*, **26**(3): 23-31.

Ekinci, M., Dursun, A., Yildirim, E. and Parlakova, F. 2014. Effects of nanotechnology liquid fertilizers on the plant growth and yield of cucumber (*Cucumis sativus* L.). *Acta Scientiarum Polonorum Hortorum Cultus*, **13**(3): 135-141.

Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), 2021.

Hassan, S.M., Ashour, M., Sakai, N., Zhang, L., Hassanien, H. A., Gaber, A. and Ammar, G. 2021. Impact of seaweed liquid extract biostimulant on growth, yield and chemical composition of cucumber (*Cucumis sativus* L.). *Agric.*, **11**(4): 320.

Jung, J.S. and Choi, H.S. 2020. Eco-physiological properties of open-field cucumbers responded to organic liquid fertilizers. *Sustainability*, **12**(23): 9830.

Kumar, S., Datt, N., Sandal, S. K. and Sharma, S. K. 2017. Effect of cow urine and bio-fertilizers based fertigation schedule at varying levels of drip Irrigation on yield, growth, quality parameters and economics of cucumber under protected condition. *Int. J. Curr. Microbiol. Appl. Sci.*, **6**(6): 1242-1249.

Marliah, A., Anhar, A. and Hayati, E. 2020. Combined organic and inorganic fertilizer increases yield of cucumber (*Cucumis sativus* L.). In *IOP Conference Series: Earth and Environmental Science* (Vol. 425, No. 1, p. 012075). IOP Publishing.

Ministry of Agriculture and Farmers Welfare, 2022.

Sahu, P., Tripathy, P., Sahu, G., Dash, K. and Pattanayak, K. 2020. Effect of integrated nutrient management on growth and fruit yield of cucumber (*Cucumis sativus* L.). *J. Crop and Weed*, **16**(2): 254-257.

Singh, V., Prasad, V.M., Kasera, S., Singh, B.P. and Mishra, S. 2017. Influence of different organic and inorganic fertilizer combinations on growth, yield and quality of cucumber (*Cucumis sativus* L.) under protected cultivation. *J.Pharmacog. Phytochem.*, **6**(4): 1079-1082.

Singh, J., Singh, M. K., Kumar, M., Kumar, V., Singh, K.P. and Omid, A.Q. 2018. Effect of integrated nutrient management on growth, flowering and yield attributes of cucumber (*Cucumis sativus* L.). *Int. J. Chem. Stud.*, **6**(4): 567-572.

Thongney, P. L., Khare, N., Rout, S. and Debbarma, R. 2020. Effect of different level of vermicompost and FYM organic manure on growth and yield of cucumber intercropped with citrus based agroforestry system. *Adv. Biores.,* **6**(4): 225.

Turkmen, M. and Su, A. 2019. The effect of sea lettuce (*Ulva lactuca*) liquid fertilizer and zeolite combinations on the development of cucumber (*Cucumis sativus* L.). *Turkish J. Agric.-Food Sci. Technol.*, **7**(7): 1021-1027.

Valencia, R. T., Acosta, L. S., Hernández, M. F., Rangel, P. P., Robles, M. Á. G., Cruz, R. D. C. A. and Vázquez, C. V. 2018. Effect of Seaweed Aqueous Extracts and Compost on Vegetative Growth, Yield, and Nutraceutical Quality of Cucumber (*Cucumis sativus* L.) Fruit. *Agronomy*, **8 :** 264.