Effect of Ta41 on Growth, Yield and Quality of Cucumber (*Cucumis Sativus* L.) Laxmi F1 Hybrid.

Abstract

The present experiment was carried out during 2021-22 in Central Horticulture Research Farm of Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in Randomized Block Design with 10 treatments replicated thrice. The treatments were **T_0** (Without TA41),**T_1** (soil drenching of TA41 @10ml/L),**T_2** (soil drenching of TA41 @ 10ml/L+ Foliar spray 20ml/spray tank),**T_3** (Soil drenching of TA41 @ 15ml/L),**T_4** (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank),**T_5** (Soil drenching of TA41@ 20ml/L),**T_6** (Soil drenching of TA41 @ 20ml /L + foliar spray 40ml / spray tank),**T_7** (Soil drenching of TA41 @ 25ml /L),**T_8** (Soil drenching of TA41 @ 25ml/l + foliar spray 50ml/spray tank) and **T_9** (Foliar spray of TA41 @ 30 ml/spray tank). On the basis of our findings it was concluded that the treatment T_4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) was found to be best in the terms of vegetative growth, yield and yield parameters, quality parameters, shelf life and benefit cost ratio.

Keywords: TA41, Trichoderma, Cucumber, Growth, Quality and B:C Ratio.

Introduction

Vegetables are protective foods. They are rich in vitamins and minerals which are most essential for maintaining good health of human. Among the vitamins, vitamin A, B, C, D and E are important. All vitamins are found in small or large quantities in the common vegetable crops. According to recommendation made by the ICMR (Indian Council of Medical Research, 2016), an average man with vegetarian or non-vegetarian food habit should consume 300 g of vegetables in his daily diet. It recommended that 125 g of these should be green leafy vegetables, 100 g of roots and tubers vegetables and the remaining 75 g of other vegetables. But our present consumption of vegetables is 184 g per day per capita. This means that we need to produce and consume vegetables than we do as present. Cucumber (*Cucumis sativus* L.) is one of the oldest cultivated vegetable crops having its origin probably in India. It belongs to family "Cucurbitaceae" genus Cucumis. The fruit of cucumber is said to have cooling effect, prevent constipation, checks jaundice and indigestion. Fruit is also used as astringent and antipyretic (Arora *et. al.,* 1989). Nutritively 100 g edible portion of cucumber contains 96.3 g moisture, 2.5 g carbohydrates, 0.4 g protein, 0.1 g fat, 0.3 g minerals, 10 mg calcium, 1.5 mg of iron 0.4 g fibre and traces of vitamin C and iron.

Cucurbitaceous plants have variable range of male and female flowers. The production of male flowers is greater than that of female flowers and ultimately only the female flowers contribute towards yields. Increase in number of female flowers per vine would obviously result into more production of fruits. The expression of different sex forms is influenced by genetic factors, the manifestation of which is influenced by environmental conditions. Besides, exogenous applications of plant hormones play an important role in changing sex tendency in these plants. Subsequently, growth regulating chemicals became important tools in this respect (Bindiya *et. al.,* 2006)

TA41(*Trichoderma asperelloides*) is a multifunctional organic growth promoter that takes care of viral, fungal, and sucking pests. As a result of this, the quality of crop produce is highly improved and increases the growth and yield of crops by 50%. It can be used for any types of crops. TA41 effectively controls and prevents soft-bodied sucking pests such as whiteflies, aphids, mites, scale insects, thrips, mealy bugs, and planthoppers. It is very effective & works quickly against sucking pests. TA41 also

helps in retaining soil moisture and prevent soil erosion and develops healthy soil for high yield (Khan *et. al.*, 2005)

Trichoderma species use different mechanisms for pathogen inhibition, such as myco- parasitism via hydrolytic enzyme secretion, antibiosis via secondary metabolite production, competition for space and nutrients, promoting plant growth, and inducing plant systemic resistance mechanisms. *Trichoderma* spp. are effective biocontrol agents due to the rapid multiplication or the tolerance of harsh conditions. *Trichoderma* spp. have potent antagonism and mycoparasitic actions on plant pathogens, allowing them to reduce the incidence of plant diseases, and the main mechanism for *Trichoderma* species is hyper-parasitism . Many genes in *Trichoderma* spp. encoding extracellular proteases and oligopeptide transporters are expressed when contacts occur between *Trichoderma* spp. and the host-pathogen . During the hyper parasitic process, cell wall degrading enzymes (CWDEs), i.e., glucanases, chitinase, and proteinases, can be secreted by *Trichoderma* spp. The secreted CWDEs can degrade the plant pathogen's cell wall . The *Trichoderma* colonization of roots causes root hair growth and triggers defense activities, such as significant changes in a variety of metabolic pathways and the activation of genes involved in plant host defense, primarily through signaling pathways involving jasmonic acid and ethylene. In Arabidopsis, colonization by *Trichoderma* fungus before infection by biotrophic or necrotrophic plant pathogens triggered an oxidizing status that enhanced resistance systemically (Kurup *et. al.*, 2011)

Materials and Methods

The present investigation entitled "**Effect Of TA41 On Growth, Yield And Quality Of Cucumber (*Cucumis Sativus* L.) Laxmi F1 Hybrid.**" was conducted at the central research farm of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj during 2022.

Climatic condition

The area of Prayagraj district comes under subtropical belt in the south east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46^{o} C-48^{o} C and seldom falls as low as 4^{o}C- 5^{o}C. The relative humidity ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm

annually. However, occasional precipitation is also not uncommon during winter months.

The experiment was conducted in Randomized Block Design with 10 treatment replicated thrice. The treatments were **T_0** (Without TA41),**T_1** (soil drenching of TA41 @10ml/L),**T_2** (soil drenching of TA41 @ 10ml/L+ Foliar spray 20ml/spray tank),**T_3** (Soil drenching of TA41 @ 15ml/L),**T_4** (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank),**T_5** (Soil drenching of TA41@ 20ml/L),**T_6** (Soil drenching of TA41 @ 20ml /L + foliar spray 40ml / spray tank),**T_7** (Soil drenching of TA41 @ 25ml /L),**T_8** (Soil drenching of TA41 @ 25ml/l + foliar spray 50ml/spray tank) and **T_9** (Foliar spray of TA41 @ 30 ml/spray tank).

TA41 is a multifunctional organic growth promoter that takes care of viral, fungal, and sucking pests manufactured by Rayan Farming Solution Pvt. Ltd. TA41 effectively controls and prevents soft-bodied sucking pests such as whiteflies, aphids, mites, scale insects, thrips, mealy bugs, and planthoppers. It is very effective & works quickly against sucking pests. TA41 also helps in retaining soil moisture and prevent soil erosion and develops healthy soil for high yield. TA41 contains bacteria (19x108 cfu/ml), Fungi (5x108 cfu/ml) and Actinomycetes (9x108 cfu/ml).

Experimental Findings

The maximum Vine length was recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (131.46) cm, followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (127.95) cm and the minimum was recorded in T0 (Control) with (115.34) cm. This is clearly indicated that integrated use of nutrient helpful in cell elongation of leaves use to development of cell and rapid cell division and cell elongation in meristematic region of plant due to production of plant growth substance and this may be due to abundant supply of plant nutrients and nitrogen which led in the growth of Cucumber. Similar findings of **(Mujahid *et al.*, 2010)** in lettuce and **(Bano and Kale, 1987)** in brinjal and radish were also observed.

The maximum number of leaves were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (50.65) , followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (49.37) and the minimum was recorded in T0 (Control) with (44.36). This is clearly indicated that integrated use of nutrient helpful in cell elongation of leaves

use to development of cell and rapid cell division and cell elongation in meristematic region of plant due to production of plant growth substance and this may be due to abundant supply of plant nutrients and nitrogen which led in the growth of Cucumber. Similar findings of **(Mujahid *et al*., 2010)** in lettuce and **(Bano and Kale, 1987)** in brinjal and radish were also observed

The maximum leaf length (cm) were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (17.86) cm , followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (17.05) cm and the minimum was recorded in T0 (Control) with (13.52) cm. This is clearly indicated that integrated use of nutrient helpful in cell elongation of leaves use to development of cell and rapid cell division and cell elongation in meristematic region of plant due to production of plant growth substance and this may be due to abundant supply of plant nutrients and nitrogen which led in the growth of Cucumber. Similar findings of **(Mujahid *et al*., 2010)** in lettuce and **(Bano and Kale, 1987)** in brinjal and radish were also observed

The maximum leaf area (cm^2) were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (293.28) cm^2, followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (279.59) cm^2 and the minimum was recorded in T0 (Control) with (258.92) cm^2. This is clearly indicated that integrated use of nutrient helpful in cell elongation of leaves use to development of cell and rapid cell division and cell elongation in meristematic region of plant due to production of plant growth substance and this may be due to abundant supply of plant nutrients and nitrogen which led in the growth of Cucumber. Similar findings of **(Mujahid *et al*., 2010)** in lettuce and **(Bano and Kale, 1987)** in brinjal and radish were also observed

The minimum days for harvesting were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (52.32) , followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (52.68) and the maximum was recorded in T0 (Control) with (258.92). The decreased in the number of days taken for appearance of first flower in best treatment of organic and inorganic fertilizers in Cucumber is due to combined effect of the organic manures and Chemical fertilizers.

The Similar results were also obtained by (**Bano and Kale, 1987)** in the cucurbits.

The maximum fruit length were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (18.53) cm, followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (17.32) cm and the minimum was recorded in T0 (Control) with (14.23) cm. The increased number of fruits and flowers in best treatment of organic and inorganic fertilizers in Cucumber is due to combined effect of the organic manures and Chemical fertilizers. The Similar results were also obtained by (**Bano and Kale, 1987)** in the cucurbits.

The maximum fruit width were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (25.628) mm, followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (24.35) mm and the minimum was recorded in T0 (Control) with (18.56) mm. The increased number of fruits and flowers in best treatment of organic and inorganic fertilizers in Cucumber is due to combined effect of the organic manures and Chemical fertilizers. The Similar results were also obtained by (**Bano and Kale, 1987)** in the cucurbits.

The maximum number of fruits were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (13.78), followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (13.12) and the minimum was recorded in T0 (Control) with (9.23). The integrated use of growth regulators along with N.P.K. significantly influenced the length diameter ratio of fruit. The results are conformity with findings of (**Abusaleh, 1992)** in okra.

The maximum weight of fruit were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (195.26)g, followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (190.35) g and the minimum was recorded in T0 (Control) with (170.65) g. The integrated use of growth regulators along with N.P.K. significantly influenced the length diameter ratio of fruit. The results are conformity with findings of (**Abusaleh, 1992)** in okra.

The maximum score for TSS ^{0}B were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (6.02) ^{0}B, followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (5.56) ^{0}B and the minimum was

recorded in T0 (Control) with (4.21) ^{0}B. Maximum TSS might be due to increased availability of major as well as minor nutrients specially nitrogen and potassium, because they play vital role in enhancing the quality. The minimum TSS in T_0 (Control) might be to lack of availability of nutrients. Similar findings were also reported by **Singh *et al.* (2018);Swetha*et al.* (2018)**and **Shnain *et al.* (2021)**in field grown tomato

The maximum test weight of seed were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (32.89) , followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (32.21) and the minimum was recorded in T0 (Control) with (26.33). Maximum test weight might be due to increased availability of major as well as minor nutrients specially nitrogen and potassium, because they play vital role in enhancing the quality. The minimum TSS in T_0 (Control) might be to lack of availability of nutrients. Similar findings were also reported by **Singh *et al.* (2018);Swetha*et al.* (2018)**and **Shnain *et al.* (2021)**in field grown tomato

The maximum B:C ratio were recorded in the Treatment T4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) with (2.37), followed by T9 (Foliar spray of TA41 @ 30 ml/spray tank) with (1.99) and the minimum was recorded in T0 (Control) with (1.89).

Conclusion

On the basis of our findings it was concluded that the treatment T_4 (Soil drenching of TA41@ 15ml/+Foliar spray 30ml/Spray tank) was found to be best in the terms of Vegetative growth, Yield and Yield parameters, Quality parameters, Shelf life and Benefit cost ratio.

Table 1 Effect of TA41 on vine length (cm), no. of leaves, length of leaves (cm) and Leaf area (cm^2) of Cucumber.

Treatment	Vine length (cm)			No. of leaves			Length of leaves (cm)			Leaf area (cm^2)		
	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP
T0	55.62	85.64	115.34	9.59	24.35	44.36	5.63	8.28	13.52	132.55	193	258.92
T1	59.67	89.46	119.46	10.25	25.36	45.15	6.63	9.28	14.52	132.98	193.49	259.65
T2	64.59	94.29	124.38	11.36	26.34	46.28	7.45	10.1	15.34	134.25	195.64	261.65
T3	61.49	91.73	121.37	13.25	28.34	48.27	6.97	9.62	14.86	135.48	198.26	249.65
T4	70.34	100.49	131.46	14.26	30.26	50.65	9.97	12.62	17.86	138.65	201.93	293.28
T5	63.12	93.49	123.64	12.65	27.12	47.21	8.46	11.11	16.35	135.89	199.24	268.34
T6	64.38	94.72	125.64	13.45	28.68	48.08	7.93	10.58	15.82	136.59	198.46	276.59
T7	65.27	95.67	126.46	12.92	27.82	47.09	8.9	11.55	16.79	136.73	196.59	270.59
T8	66.45	96.19	125.94	12.43	28.11	48.34	8.2	10.85	16.09	135.98	197.26	273.49
T9	67.19	97.08	127.95	13.86	29.46	49.37	9.16	11.81	17.05	137.25	200.23	279.59
F Test	S	S	S	S	S	S	S	S	S	S	S	S
C.D.$_{@\ 5\ \%}$	1.56	1.78	2.05	2.35	1.98	1.74	0.49	0.782	1.59	4.35	5.32	6.21
SE.d.	0.78	0.85	1.02	1.1	1.05	0.89	0.24	0.351	0.68	2.31	2.51	3.21

Table 2 Effect of TA41 on days to first flowering & harvesting, no. of flowers/plant, no. of fruits/plant, fruit length, fruit width, fruit weight, fruit yield, TSS, Test weight, shelf life and B:C ratio.

Treatment	Days to First Flowering	Days to first Harvesting	Number of flower/Plant	Number of fruit/Pant	Fruit Length (cm)	Fruit width (mm)	Fruit weight (g)	Fruit Yield (q ha^{-1})	TSS (^{0}Brix)	Test Weight	Shelf life	B:C Ratio
T0	39.65	55.65	11.53	9.23	14.23	18.56	175.65	161.25	4.21	26.33	4.56	1.89
T1	35.26	54.26	12.78	10.23	14.35	19.65	181.26	165.35	4.35	27.35	4.73	1.91
T2	35.67	54.39	14.56	11.65	14.89	20.35	188.64	166.49	5.12	27.89	5.12	1.92
T3	36.16	53.56	13.72	10.98	15.62	22.46	178.95	167.82	5.09	29.36	5.62	1.94
T4	34.12	52.32	17.22	13.78	18.53	25.62	195.26	171.35	6.02	32.89	6.86	2.37
T5	34.98	54.82	15.42	12.34	16.46	23.65	186.26	168.59	4.64	30.31	6.45	1.92
T6	35.02	53.26	16.18	12.95	16.89	22.89	187.38	169.37	4.82	31.26	6.59	1.93
T7	35.37	53.46	14.97	11.98	15.82	21.65	188.91	168.82	4.18	30.59	5.92	1.96
T8	36.56	54.75	15.8	12.64	17.08	23.46	189.21	167.95	5.36	31.95	6.08	1.95
T9	34.56	52.68	16.40	13.12	17.32	24.35	190.35	170.26	5.56	32.21	6.75	1.99
F Test	S	S	S	S	S	S	S	S	S	S	S	
C.D.$_{@5\%}$	2.13	4.26	2.34	0.81	1.56	2.86	4.35	**6.56**	1.55	2.31	0.89	
SE.d.	1.02	2.32	1.11	0.48	0.64	1.42	2.12	**3.46**	0.61	1.26	0.41	

Reference

Arora SK, Siyag Satish. Effect of nitrogen (N) and Phosphorous (P) on fruit yield and quality of sponge gourd (Luffa cylindrical L.) C.V. Pusa Chikani Crop Res. (Hissar) 1989;2(1):26-29.

Bindiya Y, Reddy IP, Srihari D, Narayanamma M, Reddy RS. Effect of integrated nutrient management on growth and yield of cucumber (Cucumis sativus L.). J Res. ANGRAU 2006;34(4):8-1.

Brantly BB, Warren GF. Effect of nutrition on flowering, fruiting and quality of watermelon. Proc. Amar. Soc. Hort. Sci 1961;75:644-53.

Choudhari SM, More TA. Fertigation, fertilizer and spacing requirement of tropical gynoecious cucumber hybrids. Acta Hort 2002;588:233-240.

Ebert (2020)The Role of Vegetable Genetic Resources in Nutrition Security and Vegetable Breeding. Plants (Basel) 9 (6): 736. doi: 10.3390/ plants9060736

Eguchi T, Matsumura T, Ashizawa M. Studies on the effect of nutrition on flower formation in vegetable crops. Bul. Nat. Isnt. Sci Hiratasuka, ser, E. No 1961, P7.

Gopalan C, Rama Satri BV, Balasubramanian SC. Nutritive value of Indian Food. Indian Council of Medical Res. National Institute of Nutritive, Hyderabad 1982.

Hassan MA, Sasidhar VK, Peter KV. Effect of graded dose of nitrogen, phosphorus and potassium on growth and yield of oriental picking melon (Cucumis melon var. conomon). Agric. Res. J Kerala 1984;22(1):43-47.

Jassal NS, Randawa KS, Nandpuri. A study on the effect of irrigation and certain does of N, P and K on the weight of fruit and yield of muskmelon. Punjab Hort J 1970;10:143-149.

Jilani MS, Abu Bakar KW. Effect of different levels of NPK on the growth and yield of cucumber (Cucumis sativus) under the plastic tunnel. J. Agric. and Soc. Sci 2009;5(3):99-101.

Khan AU. Muhammad Subhan Khan AU, Khan Bahader. Effect of NPK alone and in combination on the growth and yield of cucumber. Indus J plant Sci 2005;4(4):428- 431.

Kumari R, Singh DP (2019)Nano-biofertilizer: An Emerging Eco-friendly Approach for Sustainable Agriculture. Proc.

Natl. Acad. Sci., India, Sect. B Biol. Sci. https://doi.org/10.1007/s40011-019- 01133-6

Kurup SS, Al-Auraifan S, Al-Hunaidi M, Al-Salem SM, Al-Khabbas SA, Al-Sumei WA, Al-Gullaf GA. Response of cucumber (cucumis sativus L.) to different levels of NPK fertilizers under soilless culture. Indian J Agric. Res 2011;45(2):134-139.

Macías-Rodríguez L, Contreras-Cornejo HA, Adame-Garnica SG, del-Val E, Larsen J (2020)The interactions of Trichoderma at multiple trophic levels: inter-kingdom communication. Microbiological Research, 126552. doi:10.1016/j. micres.2020.126552

Pandey RP, Singh K. Note on the effect of nitrogen and maleic hydrazide on sex expression, sex ratio and yield of bottle gourd. Indian J Agri. Sci 1973;43(3):882-883.

Randhawa KS, Cheema DS, Sandhu DS. The effect of nitrogen, phosphorous and potassium on the growth, yield and quality of new muskmelon varieties. Haryana J Hort. Sci 1981;10(1/2):88-94.

Rebolledo-Prudencioa OG, Dautt-Castroa M, EstradaRivera M, González-López MC, Jijón-Moreno S, Casas-Flores S (2020)Trichoderma in the rhizosphere: an approach toward a long and successful symbiosis with plants. In: Vijai Kumar Gupta et al. (Eds.), New and Future Developments in Microbial Biotechnology and Bioengineering: Recent Developments in Trichoderma Research, pp. 3 – 38. https://doi.org/10.1016/B978-0-12- 819453-9.00001-5, Elsevier B.V

Rivera-Méndez (2020)Trichoderma Interactions in Vegetable Rhizosphere Under Tropical Weather Conditions. In: A. K. Sharma, P. Sharma (Eds.), Trichoderma, Rhizosphere Biology, https://doi. org/10.1007/978-981-15-3321-1_15, pp: 293 – 314. Springer Nature Singapore Pte Ltd

Shanmugasundaram S. Vegetable Surmountate challenges. The Hindu Survey of Indian Agriculture, M/S Kasturi and Sons Led, Chennai 2001, P126-127.

Singh DN, Chhonkar VS. Effect of nitrogen, phosphorus, potassium and spacing on growth and yield of muskmelon (Cucumis melo L.) Indian J Hort 1986;43(3/4):265-269.