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Effect of soil and foliar application of organic nutrients on growth and yield of bottle gourd (L*agenaria siceraria* (Molina) Standl.)

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ABSTRACT

An experiment was carried out on bottle gourd during 2022 to study the effect of soil and foliar application of organic nutrients on growth and yield of bottle gourd (Lagenaria siceraria (Molina) Standl.). The field experiment was laid out in randomized block design with fifteen treatments which were replicated thrice. The organic manures used in the experiment were farm yard manure (FYM) @ 25 t ha^{-1}, vermicompost (VC) @ 5 t ha^{-1} and enriched manure (EM) @ 1 t ha^{-1} as soil application along with consortium biofertilizers (CBF) @ 2 kg ha^{-1} and foliar application of biostimulants viz., panchagavya (3%), effective microbial inoculants (2%), Humic power (1%) and Jeevamrutha (2%) were tested. Result revealed that the growth parameters viz., vine length, number of leaves, leaf length, leaf breadth and leaf area were recorded highest in the treatment that received the application of enriched manure 1 t ha^{-1} combined with consortium biofertilizers (CBF) 2 kg ha^{-1} and humic power (1%) as foliar were applied. The yield attributes viz., the number of fruits plant^{-1}, fruit length, fruit girth, fruit weight and fruit yield plant^{-1} were registered the highest in the treatment which received the application of vermicompost 5 t ha^{-1} combined with CBF 2 kg ha^{-1} and humic power (1%) as foliar application in both the seasons respectively.

Keywords: Bottle gourd, organic manure, bio-stimulants, growth parameters, yield attributes

INTRODUCTION

Bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) locally known as Chorakkai is an important home garden vegetable. It is a fast growing winter seasonal climbing annual, native to Africa. It is also known as “poor man’s vegetable” in India. Cucurbit vegetables are a reasonable source of thiamine and riboflavin (Rhaman and Akter, 2020). As a vegetable, it is easily digestible, even by cardiac patients. The decoction made from the leaves is a very good medicine for curing the jaundice. The fruit has a cooling effect, cardio-tonic properties and used in cholera. The pulp containing vitamin-A is used for curing night blindness (Nadoda *et al.,* 2020). There is an increasing demand for this crop throughout the country. Use of organic manures such as, farmyard manure, vermicompost, enriched manure as soil application along with consortium biofertilizers and foliar application of biostimulants like panchagavya (PG), effective microbial inoculants (EMI), humic powder (HP) and jeevamrutha (JM) provide all the major nutrients required for growth of the crop. Thus they enhance the growth of crop and can help in sustaining of safe environment and crop productivity (Perminder Singh Brar *et al.*, 2019). Hence the present investigation was conducted to study the effect of soil and foliar application of organic nutrients on growth and yield of bottle gourd (*Lagenaria siceraria* (Molina) Standl.).

MATERIALS AND METHODS

The experiment was carried out in the farmer’s field, Pattagapatti village, Dharmapuri District of Tamil Nadu to study the effect of soil and foliar application of organic nutrients on growth and yield of bottle gourd (*Lagenaria siceraria* (Molina) Standl.). The experimental field was situated at 11º 47´ N latitude and 77º 02´ E longitude at an altitude of 503 M above mean sea level. The field experiment was laid out in randomized block design with fifteen treatments which were replicated thrice. The treatments comprised of T_1- FYM + consortium biofertilizers (CBF) as soil application, T_2- FYM + CBF + PG (3%) as foliar application, T_3- FYM + CBF + EMI (2%) as foliar application, T_4- FYM + CBF + HP (1%) as foliar application, T_5- FYM + CBF + JM (2%) as foliar application, T_6- VC + CBF as soil application, T_7- VC + CBF + PG (3%) as foliar application, T_8- VC + CBF + EMI (2%) as foliar application, T_9- VC+ CBF + HP (1%) as foliar application,

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T_{10}- VC + CBF + JM (2%) as foliar application, T_{11}- EM + CBF as soil application, T_{12}- EM + CBF + PG (3%) as foliar application, T_{13}- EM + CBF + EMI (2%) as foliar application, T_{14}- EM + CBF + HP (1%) as foliar application and T_{15}- EM + CBF + JM (2%) as foliar application. The bottle gourd variety "Mahy warad hybrid bottle gourd (MGH 4)" produced by Mahyco Private Limited, Mumbai was used for the experiment. It is a variety most suitable for long distance transportation, because of longer shelf life. The field was laid into ridges and furrows of 1 m x 1 m size and divided into plots of 2m x 2m. Six pits per plot were formed and the seeds were sown. The standard package of practices for the crop was followed. The foliar application of biostimulants was given three split doses *viz.,* 15, 30 and 45 days after sowing. The growth parameters *viz.,* vine length, number of leaves, leaf length, leaf breadth and leaf area were observed. The yield attributes *viz.,* the highest number of fruits plant^{-1}, fruit length, fruit girth, fruit weight and fruit yield plant^{-1} were recorded using standard tools. The experimental data were statistically analyzed and critical difference was worked out at 5 per cent probability for significance. The pooled mean data of two seasons was also observed using the statistical procedure.

RESULTS AND DISCUSSION

Growth Parameters

Organic nutrient management for nutritional balance had a significant impact on all growth characteristics *viz.,* vine length, number of leaves plant^{-1} and leaf area. Among all the treatments tested, the highest vine length 120.54 cm, 264.33 cm, 413.80 cm and 628.32 cm for season I and 129.23 cm, 268.52 cm, 427.12 cm and 641.43 cm at 30, 60, 90 and 120 days after sowing (DAS), respectively for season II (Table.1), number of leaves 52.33 cm, 93.32 cm, 205.83 cm and 327.53 cm for season I and 61.71 cm, 111.31 cm, 212.60 cm and 332.09 cm for season II (Table.2) at 30, 60, 90 and 120 DAS respectively, leaf length (19.90 cm for season I and 20.80 cm for season II), leaf breadth (23.79 cm for season I and 24.59 cm for season II) and leaf area 508.20 cm^2 for season I and 522.02 cm^2 for season II (Table.3) were recorded in T_{14}, which received the application of enriched manure 1 t ha^{-1} combined with CBF 2 kg ha^{-1} and humic power (1%) as foliar application in first and second season respectively. The pooled data of different stages on vine length (124.89 cm, 266.43 cm, 420.46 cm and 634.88 cm), number of leaves (57.02 cm, 102.32 cm, 209.22 cm and 329.81 cm) at 30, 60, 90 and 120 DAS respectively, leaf length (20.35 cm), leaf breadth (24.19 cm) and leaf area (515.11 cm^2) showed that the highest was recorded with the application of enriched manure 1 t ha^{-1} combined with CBF 2

Table1: Effect of soil and foliar application of organic nutrients on vine length (cm) in bottle gourd

	Treatment details	Season I				Season II				Pooled mean			
		30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS
T_1	FYM + CBF	71.02	160.90	284.19	413.85	78.05	166.84	294.12	421.00	74.54	163.87	289.14	417.43
T_2	FYM+CBF+PG	104.27	218.15	358.31	565.40	109.49	222.01	369.60	572.01	106.88	220.08	363.96	568.71
T_3	FYM+CBF+EMI	100.01	213.04	359.68	555.29	105.10	215.20	368.50	559.50	102.56	214.12	364.09	557.40
T_4	FYM+CBF+ HP	111.20	232.18	381.42	589.71	117.08	235.29	392.20	595.64	114.14	233.74	386.81	592.68
T_5	FYM+CBF+ JM	94.53	191.42	330.56	488.63	97.56	196.28	333.67	485.12	96.05	193.85	332.12	486.88
T_6	VC + CBF	75.41	165.72	295.87	425.99	82.11	173.38	305.82	445.18	78.76	169.55	300.85	435.59
T_7	VC + CBF+ PG	109.05	223.80	371.00	568.20	112.62	228.42	383.20	581.90	110.84	226.11	377.10	575.05
T_8	VC + CBF+EMI	99.32	206.21	350.45	537.00	104.60	211.62	356.10	544.00	101.96	208.92	353.28	540.50
T_9	VC + CBF + HP	117.96	248.07	400.48	616.63	124.71	253.56	411.30	628.05	121.34	250.82	405.89	622.34
T_{10}	VC + CBF + JM	88.24	176.35	317.25	476.13	94.28	182.93	331.69	485.73	91.26	179.64	324.47	480.93
T_{11}	EM + CBF	80.33	170.50	305.33	446.44	85.44	176.29	312.32	450.01	82.89	173.40	308.83	448.23
T_{12}	EM+ CBF + PG	115.30	235.01	393.17	601.22	120.17	244.28	402.48	611.65	117.74	239.65	397.83	606.44
T_{13}	EM + CBF+EMI	96.45	199.23	341.73	520.01	99.32	205.14	353.18	528.84	97.89	202.19	347.46	524.43
T_{14}	EM+ CBF + HP	120.54	264.33	413.80	628.32	129.23	268.52	427.12	641.43	124.89	266.43	420.46	634.88
T_{15}	EM + CBF+JM	84.00	184.24	323.43	454.14	89.45	189.45	323.03	466.20	86.73	186.85	323.23	460.17
CD (P= 0.05)		2.55	4.67	6.74	9.95	3.06	6.23	8.22	11.87	2.81	5.45	7.48	10.91

kg ha^{-1} and humic power (1%) **as** foliar application.The increased vine length could be due to several group of microorganisms have the potential to enhance growth and improve the health of crops. Among microbes, bacterial population is the highest as compared to fungal and actinomycetes at all crop growth stages. These findings are quite in agreement with the findings of Okoli and Newke (2015) in cucumber. Another reason for the increase in vine length could be due to the effect of nitrogen supplied by consortium biofertilizer in promoting vegetative growth, enhancing cell division and elongation as well as greater chlorophyll synthesis. Application of biofertilizer consortia not only fixed atmospheric nitrogen, but also solubilized unavailable phosphorous to available form and released some growth promoting substances thereby increased the vegetative growth. Similar findings due to increased vine length by the application of consortium biofertilizers were reported by Kanaujia and Daniel (2016) in cucumber. Further, in the present study application of humic acid also enhanced the vine length. This could be due to the effect of humic acid on chemical and biological properties of soil as well as morpho-physiological processes of a plant. Hence, the application of humic acid also promoted the uptake of macro and micro nutrients *viz.,* N, P, Fe and Cu of tomato and other plants. A similar finding on increase in vine length by humic acid was reported by Ashokkumar *et al.* (2020) in brinjal.

Table 2: Effect of soil and foliar application of organic nutrients on number of leaves (cm) in bottle gourd

Tr. No	Treatment details	Season I				Season II				Pooled mean			
		30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS
T_1	FYM + CBF	14.15	37.74	134.42	233.01	17.42	51.23	138.57	229.86	15.79	44.49	136.50	231.44
T_2	FYM + CBF + PG	38.81	67.85	176.40	279.53	46.58	82.51	178.25	281.53	42.70	75.18	177.33	280.53
T_3	FYM+ CBF + EMI	35.26	65.70	168.00	279.16	43.80	76.01	171.85	280.37	39.53	70.86	169.93	279.77
T_4	FYM + CBF + HP	44.80	80.23	188.32	292.28	51.03	95.32	193.22	297.24	47.92	87.78	190.77	294.76
T_5	FYM + CBF + JM	29.45	55.81	157.41	254.52	34.19	70.10	157.67	257.51	31.82	62.96	157.54	256.02
T_6	VC + CBF	16.67	41.00	138.10	240.25	20.02	55.83	142.60	237.84	18.35	48.42	140.35	239.05
T_7	VC + CBF + PG	41.32	73.01	181.98	290.80	48.63	87.19	184.21	293.13	44.98	80.10	183.10	291.97
T_8	VC + CBF + EMI	36.53	62.84	166.76	265.00	41.53	79.25	170.53	270.00	39.03	71.05	168.65	267.50
T_9	VC + CBF + HP	49.34	82.88	201.49	315.76	55.60	104.41	205.30	324.75	52.47	93.65	203.40	320.26
T_{10}	VC + CBF + JM	25.89	51.91	152.19	250.04	29.00	64.78	155.17	255.88	27.45	58.35	153.68	252.96
T_{11}	EM + CBF	19.20	44.66	140.25	242.06	22.61	57.29	144.89	244.85	20.91	50.98	142.57	243.46
T_{12}	EM + CBF + PG	46.15	80.05	194.08	308.62	52.22	100.09	200.50	315.42	49.19	90.07	197.29	312.02
T_{13}	EM + CBF + EMI	33.00	61.14	161.54	263.29	35.13	74.53	167.00	267.67	34.07	67.84	164.27	265.48
T_{14}	EM + CBF + HP	52.33	93.32	205.83	327.53	61.71	111.31	212.60	332.09	57.02	102.32	209.22	329.81
T_{15}	EM + CBF + JM	23.37	46.34	147.87	249.43	26.09	61.40	148.71	248.47	24.73	53.87	148.29	248.95
	CD (P= 0.05)	2.14	2.63	3.24	4.30	2.30	3.01	3.53	6.11	2.22	2.82	3.39	5.21

The increase in leaf parameters in the present study could be due to the application of enriched manure which causes cell elongation due to the presence of nitrogenous compounds. Nitrogen being a constituent of amino acids, nucleotides, nucleic acids, a number of enzymes, auxins, cytokinins and alkaloids, induced cell elongation, cell enlargement and cell division. This could favour the increased number of leaves in the best treatment. Similar findings on increase in number of leaves due to the application of enriched manure were reported by Fowmina Sulaiha and Anburani (2021) in cucumber. The increase in the number of leaves might be due to the effective function of biofertilizer which provided bioactive substances. These findings are quite in agreement with the findings of Moakala *et al.* (2015) in broccoli. Another reason for increase in number of leaves is due to the addition of humic substances tends to increase the permeability of plant membranes resulting in higher metabolic activity. As a cofactor for improving physical properties of soil, it helped in promoting good soil structure; there by improve aeration and moisture retention. It also provided carbon as an energy source to nitrogen fixing bacteria and thus proved its biological function. Similar findings of enhanced number of leaves due to humic acid were reported by El-Nemr *et al.* (2012) in cucumber.

Table 3: Effect of soil and foliar application of organic nutrients on leaf length (cm), leaf breadth (cm) and leaf area (cm) in bottle gourd

Tr. No	Treatment details	Leaf length (cm)			Leaf breadth (cm)			Leaf area (cm^2)		
		Season I	Season II	Pooled mean	Season I	Season II	Pooled mean	Season I	Season II	Pooled mean
T_1	FYM + CBF	14.62	15.03	14.83	17.67	18.25	17.96	421.58	431.62	426.60
T_2	FYM + CBF + PG	17.82	18.69	18.26	21.64	22.25	21.95	476.75	488.37	482.56
T_3	FYM + CBF + EMI	17.33	18.22	17.78	21.12	21.70	21.41	476.93	483.71	480.32
T_4	FYM + CBF + HP	18.45	19.34	18.90	22.63	22.91	22.77	492.77	504.44	498.61
T_5	FYM + CBF + JM	16.18	17.12	16.65	20.00	20.09	20.05	452.91	460.23	456.57
T_6	VC + CBF	15.10	15.53	15.32	18.45	18.80	18.63	428.15	438.78	433.47
T_7	VC + CBF + PG	18.31	19.20	18.76	22.10	22.37	22.24	484.71	497.22	490.97
T_8	VC + CBF + EMI	17.20	17.70	17.45	21.03	21.48	21.26	468.64	475.00	471.82
T_9	VC + CBF + HP	19.44	20.29	19.87	23.27	24.02	23.65	501.32	514.84	508.08
T_{10}	VC + CBF + JM	16.10	16.64	16.37	19.88	20.00	19.94	445.03	458.33	451.68
T_{11}	EM + CBF	15.49	16.00	15.75	18.91	19.41	19.16	434.65	442.16	438.41
T_{12}	EM + CBF + PG	18.96	19.83	19.40	22.75	23.48	23.12	494.44	507.25	500.85
T_{13}	EM + CBF + EMI	16.67	17.61	17.14	20.52	20.64	20.58	460.10	468.35	464.23
T_{14}	EM + CBF + HP	19.90	20.80	20.35	23.79	24.59	24.19	508.20	522.02	515.11
T_{15}	EM + CBF + JM	15.59	16.63	16.11	19.40	19.45	19.43	436.82	450.41	443.62
CD (P= 0.05)		0.36	0.40	0.39	0.47	0.50	0.48	6.47	7.02	6.75

The increased leaf length, leaf breadth and leaf area might be also due to the application of enriched organic manure, which improved their availability in soil by preventing fixation and precipitation, thereby enhanced the use efficiency of applied nutrients through organic sources. A similar finding on increase in leaf area due to the application of enriched manure was reported by Singh *et al.* (2018) in cucumber. The role of biofertilizers which had a positive relationship with crop growth by maximizing the solubilizing potential assisting in efficient transformation of nutrients from unavailable form to available form. These results are in accordance with the findings of Fowmina Sulaiha and Anburani (2021) in cucumber. Application of humic substances would have influenced both respiration and photosynthesis in turn helps to increase leaf area. Similar results were reported by Shafeek *et al.,* (2016) in cucumber.

Yield Attributes

The results of the present investigation showed a significant difference in yield attributes among various treatments that tested. The highest number of fruits plant^{-1} (18.87 for season I and 22.17 for season II), fruit length (40.22 cm for season I and 41.57 cm for season II), fruit girth 32.85 cm for season I and 33.23 cm for season II (Table.4), mean single fruit weight (806.49 g for season I and 810.04 g for season II), fruit yield plant^{-1} (15.21 kg for season I and 17.72 kg for season II) and total yield 34.22 t ha^{-1} for season I and 36.61 t ha^{-1} for season II (Table.5) for first and second season respectively were recorded in the treatment that received application of vermicompost 5 t ha^{-1} + CBF 2 kg ha^{-1} + humic powder (1%) as foliar application. The pooled mean data on number of fruits plant^{-1} (20.52), fruit length (40.90 cm), fruit girth (33.04 cm), mean single fruit weight (808.27 g), fruit yield plant^{-1} (16.47 kg) and total yield (35.42 t ha^{-1}) was found to be maximum in the treatment that received foliar application of vermicompost 5 t ha^{-1} + CBF 2 kg ha^{-1} + humic powder (1%).

The increase in yield and yield parameters in the best treatment could be due to the increased nutrient availability from the organic manures especially by the application of vermicompost which have increased the various endogenous hormonal levels in the plant tissues which might be responsible for enhanced pollen germination and pollen tube growth and this ultimately increased the number of healthy flowers to set more fruits that leads to increased number of fruits plant^{-1}, resulting in the yield maximization. Among all the organic manures tested, application of vermicompost showed better results in yield attributing characters like fruit weight, length, diameter and fruit number. Similar findings were reported by Baghel *et al.* (2017) in bottle gourd, Singh *et al.* (2017) in cucumber and Sureshkumar *et al.* (2019) in bitter gourd.

Table 4: Effect of soil and foliar application of organic nutrients on number of fruits plant^{-1}, fruit length (cm) and fruit girth (cm) in bottle gourd

Tr. No	Treatment details	Number of fruits plant^{-1}			Fruit length (cm)			Fruit girth (cm)		
		Season I	Season II	Pooled mean	Season I	Season II	Pooled mean	Season I	Season II	Pooled mean
T_1	FYM + CBF	7.80	10.19	9.00	24.51	27.65	26.08	18.64	20.84	19.74
T_2	FYM + CBF + PG	14.47	18.41	16.44	33.85	36.52	35.19	28.85	27.65	28.25
T_3	FYM + CBF + EMI	9.79	13.81	11.80	27.01	30.00	28.51	21.89	22.78	22.34
T_4	FYM + CBF + HP	17.75	21.10	19.42	39.01	40.36	39.69	31.02	31.00	31.01
T_5	FYM + CBF + JM	12.15	15.71	13.93	30.77	33.70	32.24	26.14	24.97	25.56
T_6	VC + CBF	8.55	10.71	9.63	25.61	27.65	26.63	20.01	20.92	20.47
T_7	VC + CBF + PG	15.64	19.52	17.58	34.92	37.80	36.36	30.08	28.90	29.49
T_8	VC + CBF + EMI	10.85	13.92	12.39	27.58	31.32	29.45	23.53	23.10	23.32
T_9	VC + CBF + HP	18.87	22.17	20.52	40.22	41.57	40.90	32.85	33.23	33.04
T_{10}	VC + CBF + JM	13.21	16.78	14.99	30.92	34.91	32.92	27.11	25.88	26.50
T_{11}	EM + CBF	6.69	9.14	7.92	22.86	25.21	24.04	18.00	19.03	18.52
T_{12}	EM + CBF + PG	13.32	17.20	15.26	32.78	35.30	34.04	28.07	26.11	27.09
T_{13}	EM + CBF + EMI	9.60	12.68	11.14	25.99	28.84	27.42	21.30	21.84	21.57
T_{14}	EM + CBF + HP	16.71	20.05	18.38	36.64	39.13	37.89	30.16	29.85	30.01
T_{15}	EM + CBF + JM	11.03	15.36	13.20	29.32	32.58	30.95	25.32	24.00	24.66
CD (P= 0.05)		1.00	1.04	1.02	1.00	1.09	1.05	0.75	0.82	0.79

The increase in fruit length might be due to increased diversion of photosynthates to reproductive organs in the present study. A similar finding of increased fruit length was reported by Fowmina Sulaiha and Anburani (2021) in cucumber. With regard to diameter of fruits, application of different combinations of organic and biofertilizer sources of nutrients considerably increased the fruit diameter. This could be due to the effect of consortium bio-fertilizer which provides protection against the non-parasitic pathogens, along with production of biologically active substances like auxins and gibberellins and transformed unavailable mineral and organic compounds into available forms to the plants. Similar results were reported by Patel *et al.* (2018) in bottle gourd. Humic acid is the main fraction of humic substance and the most active component of soil and compost organic matter. It has been shown to stimulate plant growth and consequently yield by acting on mechanisms involved, cell respiration, photosynthesis, water and nutrient uptake and enzyme activities. Similar findings on increase in yield by humic substance were reported by El-masry *et al.* (2014) in cucumber.

Table 5: Effect of soil and foliar application of organic nutrients on mean single fruit weight (g) and yield parameters in bottle gourd

Tr. No	Treatment details	Mean single fruit weight (g)			Fruit yield per plant (kg)			Estimated fruit yield per hectare (t ha^{-1})		
		Season I	Season II	Pooled mean	Season I	Season II	Pooled mean	Season I	Season II	Pooled mean
T_1	FYM + CBF	451.80	455.04	453.42	3.52	4.64	4.08	8.66	10.44	9.55
T_2	FYM + CBF + PG	681.70	687.22	684.46	9.86	12.65	11.26	22.19	29.22	25.71
T_3	FYM + CBF + EMI	544.12	537.60	540.86	5.32	7.42	6.37	11.97	13.80	12.89
T_4	FYM + CBF + HP	787.32	791.01	789.17	13.97	16.69	15.33	29.76	31.54	30.65
T_5	FYM + CBF + JM	635.44	640.74	638.09	7.72	10.07	8.90	17.37	22.65	20.01
T_6	VC + CBF	472.88	478.99	475.94	4.04	5.16	4.60	10.06	11.61	10.84
T_7	VC + CBF + PG	739.65	743.13	741.39	11.57	14.50	13.04	23.94	28.27	26.11
T_8	VC + CBF + EMI	557.33	560.22	558.78	6.05	7.80	6.93	13.61	17.55	15.58
T_9	VC + CBF + HP	806.49	810.04	808.27	15.21	17.72	16.47	34.22	36.61	35.42
T_{10}	VC + CBF + JM	654.22	657.08	655.65	8.64	11.03	9.84	19.44	24.82	22.13
T_{11}	EM + CBF	420.00	422.03	421.02	2.81	3.85	3.33	7.00	8.66	7.83
T_{12}	EM + CBF + PG	679.66	683.42	681.54	9.05	11.75	10.40	20.36	26.44	23.40
T_{13}	EM + CBF + EMI	480.11	481.98	481.05	4.61	6.11	5.36	9.96	12.83	11.39
T_{14}	EM + CBF + HP	759.42	765.85	762.64	12.07	15.36	13.72	24.98	25.80	25.39
T_{15}	EM + CBF + JM	590.00	597.63	593.82	6.19	8.71	7.45	14.64	20.65	17.65
	CD (P= 0.05)	14.21	15.88	15.04	0.42	0.51	0.47			

From the results, it can be concluded that foliar application of enriched manure 1 t ha^{-1} combined with CBF 2 kg ha^{-1} and humic powder (1%) were found to be significantly best in favouring the growth parameters. The yield attributes were found to be the highest in the treatment that received foliar application of vermicompost 5 t ha^{-1} + CBF 2 kg ha^{-1} + humic powder (1%) in both the seasons respectively.

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