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Effect of bio-stimulants on growth and quality of cluster bean

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Abstract

The experiment on “Effect of bio-stimulants on growth and quality of cluster bean” was carried out during summer season, 2019 at the Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, NAU, Navsari, Gujarat. The experiment was conducted in a Randomized Block Design (RBD) with three replications consisted a set of eleven treatments viz., T₁ (Water spray), T₂ (*Panchgavya* 2.5%), T₃ (*Panchgavya* 5.0%), T₄ (*Jeevamrut* 2.5%), T₅ (*Jeevamrut* 5.0%), T₆ (Novel plus 1%), T₇ (Novel plus 2%), T₈ (Moringa leaf extract 2%), T₉ (Moringa leaf extract 3%), T₁₀ (*Panchgavya* 0.8% + Novel plus 0.3% + Moringa leaf extract 0.6%) and T₁₁ (*Jeevamrut* 0.8% + Novel plus 0.3% + Moringa leaf extract 0.6%). The results revealed that among different treatments, moringa leaf extract 3% (T₉) exhibits maximum growth and quality characters of cluster bean.

Keywords: Cluster bean, *Panchagavya*, *Jeevamrut*, Novel plus, Moringa leaf extract

Introduction

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] is belong to the family fabaceae and popularly known as *guar* which is an important legume crop grown during *kharif* and summer season. Cluster bean as a vegetable purpose is grown for its young tender green immature pods in all types of soil due to their hardiness and wide environment adaptability. Since, many years in description use of chemicals, fertilizers, pesticides in conventional agriculture has made an adverse impact on soil and plant health. However, to prevent further deterioration and to meet the incremental demand of food production and sustain the soil health, it is necessary to incorporate the use of organic manures, to balance the addition of salt amendments in the soil. As well as, positive effect of organic liquid formulations which have been recently used extensively in vegetables cultivation including cluster bean. Now a day, its use widely popularized and utilized to boost quality vegetables production by researchers and farmers.

Materials and methods

The field experiment on, “Effect of bio-stimulants on growth and quality of cluster bean” was conducted during summer season, 2019 at the Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, NAU, Navsari, Gujarat. The experiment was planned out in Randomized Blocked Design with three replications and eleven treatments viz., T₁ (Water spray), T₂ (*Panchgavya* 2.5%), T₃ (*Panchgavya* 5.0%), T₄ (*Jeevamrut* 2.5%), T₅ (*Jeevamrut* 5.0%), T₆ (Novel plus 1%), T₇ (Novel plus 2%), T₈ (Moringa leaf extract 2%), T₉ (Moringa leaf extract 3%), T₁₀ (*Panchgavya* 0.8% + Novel plus 0.3% + Moringa leaf extract 0.6%) and T₁₁ (*Jeevamrut* 0.8% + Novel plus 0.3% + Moringa leaf extract 0.6%). The cluster bean planted with spacing of 45 cm × 15 cm in gross plot (2.25 m × 2.25 m) and net plot (1.35 m × 1.65 m) of experiment. On the basis of water applied @ 500 and 1000 l ha⁻¹ at 25 and 50 DAS, respectively the quantity of bio-stimulant organics calculated accordingly. All collected solution considered as 100% concentration and same used for preparing the require solution. The growth parameters like, number of node at which 1st flower cluster appear, days to 50% flowering observed by visual observation. Inter-nodal length and plant height at 50, 75 DAS and final harvest was measured with measuring tape from the ground level to the tip of the main shoot of the selected five plants from each net plot. Chlorophyll index was measured by chlorophyll meter from the middle leaf of five tagged plants at 50 and 75 DAS of each net plot. For fresh biomass of plant previously tagged 5 plants from each treatment of net plot was uprooted carefully after final harvest and weighted in the laboratory.

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Crop span was narrated in the days and counted from the date of sowing to the last harvest of the respective treatments. Harvest index was calculated from the following formula.

Harvest index formula

$$HI (\%) = \frac{\text{Total economic yield}}{\text{Total biological yield}} \times 100$$

The same five plants were used for quality parameters and all the quality parameters observations were taken at 4th harvest. The protein content of cluster bean pod was estimated by using Lowry's method as described by Sadasivam and Manickam (1996) [13] and presented in per cent. The crude fiber content in pods of cluster bean was determined by method as described by Sadasivam and Manickam (1996) [13].

$$\text{Crude fiber (\%)} = \frac{(W_2 - W_1) - (W_3 - W_1)}{\text{Weight of sample}} \times 100$$

Calcium and Fe content in pods of cluster bean was measured as method given by Elwell and Gridley, 1967 [14].

$$\text{Ca content (mg 100 g}^{-1}\text{)} = \frac{\text{Reading} \times \text{Normality of EDTA} \times 1000 \times 20 \times 10}{\text{ml of aliquot}}$$

$$\text{Fe content (mg 100 g}^{-1}\text{)} = R \times \frac{\text{Volume made} \times 10}{\text{Weight of sample}}$$

Results and Discussion

The data pertaining to growth parameters were influenced by different bio-stimulant have been presented in Table 1 and 2. The bio-stimulant treatments 3% moringa leaf extract (T₉) was recorded minimum days to 50% flowering (31.33) as compared to other treatments. It might be due to the moringa leaf extract being rich in zeatin content, cytokines which managed the green photosynthetic area and thereby, might be expected to convert vegetative to reproductive phase, resulted early flowering by the treatment. The above result was

accordance with findings of Hemalatha *et al.* (2018) [5] in okra; Yusuff and Abiola (2019) [12] in cucumber.

The maximum inter-nodal length (33.45 cm) and plant height at 50 DAS (56.17 cm), 75 DAS (103.17 cm) and at final harvest (123.43 cm) found by the same treatment T₉ than rest treatments. It might be due cytokinins and zeatinin to moringa leaf extract promote the process of cell division and elongation. The marked effect in terms of mentioned parameter have been reported by Mvumi *et al.* (2012) [8]; Muhamman *et al.* (2013) [7]; Bashir *et al.* (2014) [1] and Rajamani *et al.* (2015) [10] in tomato Ozobia (2014) [15] in brinjal Mathew (2016) [16] and Hala *et al.* (2017) [3] in chilli.

The data on growth attributing characters such as number of node at which 1st flower cluster appear and harvest index was not significantly influenced by bio-stimulants. However, maximum number of node at which 1st flower cluster (3.93) appear under T₉ (MLE 3%) and T₄ (Jeevamrut 2.5%). Whereas, maximum harvest index (42.77%) calculated by the treatment T₁₁: Jeevamrut (0.8%) + novel plus (0.3%) + moringa leaf extract (0.6%).

Chlorophyll index at 50 DAS (47.77) and 75 DAS (70.47) reported maximum with foliar application of 3% moringa leaf extract (T₉). This might be due to high content of nutritional potentialities of macro elements such as Mg, a constituent of chlorophyll that responsible for induction high amount of chlorophyll in leaves received moringa leaf extract. The result congruence with conclusion by Emongor (2015) [2] in French bean; Hala *et al.* (2017) [3] in chilli and Hanafy (2017) [4] in soya bean. Maximum fresh biomass (20.46 t ha⁻¹) recorded in same treatment (T₉) over other treatments. The might be due to the presence of growth promoting substances, macro and micro nutrients as well as photo-hormones in the MLE which raised chlorophyll in the leaves and enhanced inter-nodal length resulted profuse vegetative growth of the plants. The scientists Singh *et al.* (2013) [11] in pea Rajamani *et al.* (2015) [10] in tomato and Hanafy (2017) [4] in soya bean recorded the analogous results for biomass of crop.

Table 1: Effect of bio-stimulants on growth characters of cluster bean

Treatments	Number of node at which 1 st flower cluster appear	Days to 50% flowering	Inter nodal length (cm)	Chlorophyll index	
				50 DAS	75 DAS
T ₁ : Water spray (Control)	3.67	36.67	29.14	39.33	56.95
T ₂ : Panchgavya 2.5%	3.80	35.67	30.25	41.18	64.95
T ₃ : Panchgavya 5.0%	3.47	34.00	30.29	40.47	65.80
T ₄ : Jeevamrut 2.5%	3.93	36.33	30.14	41.01	58.59
T ₅ : Jeevamrut 5.0%	3.40	36.00	30.21	40.34	62.94
T ₆ : Enriched sap of banana pseudostem (Novel plus) 1%	3.73	35.00	30.84	41.49	66.17
T ₇ : Enriched sap of banana pseudostem (Novel plus) 2%	3.60	32.33	32.04	42.34	68.55
T ₈ : Moringa leaf extract 2%	3.60	32.00	33.21	45.23	70.09
T ₉ : Moringa leaf extract 3%	3.93	31.33	33.45	47.77	70.47
T ₁₀ : Panchgavya (0.8%) + Novel plus (0.3%) + Moringa leaf extract (0.6%)	3.73	32.67	32.27	44.24	69.06
T ₁₁ : Jeevamrut (0.8%) + Novel plus (0.3%) + Moringa leaf extract (0.6%)	3.60	33.33	31.95	41.95	68.22
S. Em.±	0.18	1.05	0.91	1.43	2.76
C.D. at 5%	NS	3.10	2.69	4.20	8.14
C.V.%	8.62	5.33	5.06	5.83	7.28

The result (Table 2) revealed that foliar application of 3% moringa leaf extract (T₉) got the longest crop span (96.33 days) whereas, shortest (83.00 days) by the T₁ (Water spray). The extension of crop production phase might be due to healthy plant growth and prevents premature leaves senescence by presence of cytokinin in MLE which induce

high chlorophyll and thereby photosynthetic activity encourages the translocation of food reserves to new shoots with extra leaves of expand size even in the later stage of crop. Hala *et al.* (2017) [3] in chilli; Hanafy (2017) [4] in soya bean were authenticated with unique results.

Table 2: Effect of bio-stimulants on growth characters of cluster bean

Treatments	Plant height (cm)			Fresh Biomass (t ha ⁻¹)	Crop span (days)	Harvest index (%)
	50 DAS	75 DAS	Final Harvest			
T ₁ : Water spray (Control)	42.56	86.29	103.38	16.38	83.00	39.36
T ₂ : <i>Panchgavya</i> 2.5%	46.13	92.23	109.78	17.47	88.67	41.21
T ₃ : <i>Panchgavya</i> 5.0%	46.67	92.61	111.03	17.45	90.00	42.46
T ₄ : <i>Jeevamrut</i> 2.5%	44.82	89.45	106.25	16.80	85.67	40.16
T ₅ : <i>Jeevamrut</i> 5.0%	45.49	91.18	108.11	17.15	86.33	41.02
T ₆ : Enriched sap of banana pseudostem (Novel plus) 1%	47.04	93.13	111.91	17.65	91.67	42.27
T ₇ : Enriched sap of banana pseudostem (Novel plus) 2%	48.41	99.33	116.55	18.62	94.00	42.17
T ₈ : Moringa leaf extract 2%	51.53	101.65	121.01	19.90	96.00	41.48
T ₉ : Moringa leaf extract 3%	56.17	103.17	123.43	20.46	96.33	42.58
T ₁₀ : <i>Panchgavya</i> (0.8%) + Novel plus (0.3%) + Moringa leaf extract (0.6%)	50.04	100.33	118.71	19.15	94.67	42.30
T ₁₁ : <i>Jeevamrut</i> (0.8%) + Novel plus (0.3%) + Moringa leaf extract (0.6%)	48.05	97.03	114.76	17.97	93.33	42.77
S.Em.±	:	3.48	3.80	0.71	2.72	1.70
C.D. at 5%	:	10.27	11.22	2.08	8.03	NS
C.V.%	:	6.34	5.82	6.75	5.19	7.09

The result allied to quality parameters showed that fiber and calcium content of pod affected significantly by bio-stimulants but protein and Fe content had no major affected by foliar application of bio-stimulants.

In case of fiber content, 3% moringa leaves extract significantly higher (3.29%) than other treatments. This might be due to application of moringa leaves extract have high zeatin content which increased the level of internal hormones like GA₃ and NAA. It was activated enzymatic activity by conversion of nutrition to food chain as fiber content. The

significantly higher calcium content (159.63 mg 100 g⁻¹ pod) was noted with same treatment (T₉). Because of MLE had enormous source of macro and micro elements supplemented directly with spray application. As well as better nitrogen suction from soil caused pulled force to cation, it accumulated in pods at maturity. The same marked effect have been reported by Hala *et al.* (2017) [3] in chilli.

The higher protein (3.62) and Fe content (1.08 mg 100 g⁻¹ pods) recorded by the treatment 5.0% *panchgavya* (T₃) and data pointed out in Table 3.

Table 3: Effect of bio-stimulants on quality parameters of cluster bean

Treatments	Protein Content (%)	Fiber Content (%)	Calcium Content (mg 100 g ⁻¹ pods)	Fe content (mg 100 g ⁻¹ pods)
T ₁ : Water spray (control)	3.21	2.75	133.85	0.89
T ₂ : <i>Panchgavya</i> 2.5%	3.56	3.20	143.42	1.06
T ₃ : <i>Panchgavya</i> 5.0%	3.62	3.22	145.74	1.08
T ₄ : <i>Jeevamrut</i> 2.5%	3.29	2.99	134.58	1.02
T ₅ : <i>Jeevamrut</i> 5.0%	3.31	3.00	136.98	1.02
T ₆ : Enriched sap of banana pseudostem (Novel plus) 1%	3.49	3.15	150.35	0.94
T ₇ : Enriched sap of banana pseudostem (Novel plus) 2%	3.51	3.16	154.50	0.95
T ₈ : Moringa leaf extract 2%	3.44	3.25	158.05	0.97
T ₉ : Moringa leaf extract 3%	3.46	3.29	159.63	1.01
T ₁₀ : <i>Panchgavya</i> (0.8%) + Novel plus (0.3%) + Moringa leaf extract (0.6%)	3.41	3.10	141.81	0.92
T ₁₁ : <i>Jeevamrut</i> (0.8%) + Novel plus (0.3%) + Moringa leaf extract (0.6%)	3.35	3.06	140.83	0.91
S. Em.±	0.12	0.10	5.05	0.04
C.D. at 5%	NS	0.28	14.91	NS
C.V.%	5.85	5.37	6.02	7.54

Conclusions

From the foregoing result of the experiment, it could be concluded that plant sprayed with 3% moringa leaf extract (T₉) enhanced growth like days to 50% flowering, inter nodal length, chlorophyll index, plant height, fresh biomass, and crop duration of cluster bean crop and quality like fiber and calcium content of pods.

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