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Response of Greengram (*Vigna radiata* L.) as Succeeding Crop to Residual Effect of Micronutrients Mixture Administered in Preceding Sweet corn [*Zea mays* (L.) Saccharata]

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ABSTRACT

Background: Maize followed by pulses is the predominant cropping system in many parts of India. After harvesting sweet corn, most farmers leave their land unplanted, even though it has significant potential for growing a second crop during the *rabi* season. Greengram is one of the best options for farmers, as it not only increases their income but also utilizes the soil's residual nutrients and moisture. Greengram, a short-duration crop, is one of the key pulse crops in India and serves as a protein-rich food. In light of the aforementioned considerations, an experiment was conducted to evaluate whether the foliar application of micronutrients mixture to the previous *kharif* sweet corn crop had any residual effects on the productivity and profitability of the subsequent greengram crop.

Methods: The experiment, which included ten treatments was carried out in two consecutive *rabi* seasons during 2022 and 2023 at the College of Agriculture, V.C. Farm, Mandya, University of Agricultural Sciences, Bangalore, Karnataka, was designed using a randomized block design (RBD) with three replications. After sweet corn stubbles were incorporated into the soil, greengram was planted as a follow-up crop to preserve soil fertility. With the exception of absolute control, the recommended dosage of NPK fertilizers (20:50:50 kg ha^{-1}) for greengram was common.

Result: The pooled data showed that the foliar application of MM_2 (0.2%) + Humic acid @ 0.5% greatly enhanced growth parameters and yield attributes over absolute control, resulting in the highest net return (Rs. 45,203 ha^{-1}) and benefit:cost ratio of 2.47 among the residual effect of micronutrients mixture.

Key words: Economics, Greengram, Micronutrients mixture, Residual effect, Seed yield.

INTRODUCTION

In many parts of India, the emerging cropping system (cereal based legume cropping system) is maize followed by pulses (Rani *et al*., 2022). Most farmers do not plant anything on their land after harvesting sweet corn, even though there is a lot of potential for growing another crop during the *rabi* season. In India, pulses, also referred to as food legumes, are produced and consumed second only to cereals. The word "pulse" is derived from the Latin word "puls", which means "pottage" *i.e.*, seed boiled to make porridge or thick soup (Kavya *et al*., 2021). For vegetarians, pulse is an excellent source of energy, minerals, vitamins and dietary protein (25%). It is not only a vital source of food for humans and animals, but it is also essential for maintaining soil fertility. In addition to enhancing the physical characteristics of the soil, these pulses fix atmospheric nitrogen and are primarily grown as a sequence crop or intercrop alongside other cereal crops. Greengram is one of the most important choice available to farmers as it boost their income, while utilizing the nutrients and remaining moisture in the soil.

One of the most significant pulse crops in India is the greengram (*Vigna radiata* L.), a short-duration crop that fits into a variety of cropping systems (Thesiya *et al*., 2019). It is a staple food high in protein, with about 25% of its protein coming from the leguminaceae family, which means it has the ability to fix nitrogen from the atmosphere. Its origins are in Central Asia and India.

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Greengram (*Vigna radiata* L.), a short duration crop that fits into a variety of cropping systems, is one of the most important pulse crops in India. It is a staple food high in protein, with about 25% and belongs to leguminaceae family, which has the ability to fix atmospheric nitrogen. It is originated from India and Central Asia (Kavya *et al*., 2021). In India, greengram is produced on an average of 1.51 mt across an area of about 3.27 mha. Karnataka has 2.05 lakh hectares of total mungbean cropland, producing 0.67 lakh tonnes and yielding 324 kg ha^{-1} (Anonymous, 2023).

Hedge (1998) asserts that providing nutrient sources to the previous crop has a significant positive impact on the subsequent crop. A study was conducted to ascertain whether the foliar application of a micronutrients mixture (MM) in the previous *kharif* sweet corn crop had any lasting effects on the productivity and profitability of the subsequent greengram crop, taking into account the previously mentioned factors.

MATERIALS AND METHODS

Experimental site

The field experiment was carried out in the *rabi* seasons of 2022 and 2023 at the College of Agriculture, V.C. Farm, Mandya, University of Agricultural Sciences, Bangalore, Karnataka, India at 695 meters above mean sea level. The location of the experiment is 12°57′N latitude and 76°83′E longitude. The sandy loam type of soil used in the experiment has the following properties: At the initiation of the experiment, the following values were recorded: pH- 7.5, EC- 0.17 dS m^{-1}, soil organic carbon- 0.48%, available nitrogen- 263.78 kg ha^{-1}, available phosphorous- 48.45 kg ha^{-1} and available potassium- 251.84 kg ha^{-1}.

Treatment and experimental design

The experiment was set up in randomized complete block design with ten treatments replicated thrice *viz*., T_1: Absolute control, T_2: Recommended package of practices, T_3: Foliar spray of MM_1 (0.1%), T_4: Foliar spray of MM_2 (0.2%), T_5: Humic acid spray @ 0.5%, T_6: Biostimulant spray @ 625 ml ha^{-1}, T_7: Foliar spray of MM_1 + Humic acid spray @ 0.5%, T_8: Foliar spray of MM_2 + Humic acid spray @ 0.5%, T_9: Foliar spray of MM_1 + Biostimulant spray @ 625 ml ha^{-1} and T_{10}: Foliar spray of MM_2 + Biostimulant spray @ 625 ml ha^{-1}. The study was carried out at the same location the following year to evaluate any lingering effects in greengram, with the treatment's randomization remaining unchanged. The composition of micronutrients mixture is Zn, Mn, Fe, Cu and B. MM_2 is double the concentration of MM_1. The biostimulant used in the present study is macarena (seaweed extract).

The greengram variety KKM-3, released from ARS, Kathalagere, Karnataka was sown on September 30th, 2022 and September 29th, 2023, respectively, without any treatment imposition after the previous crop's stubbles (sweet corn) were incorporated into the soil in 4.8 m × 4.2 m plots, maintaining a spacing of 30 cm × 10 cm between rows and plants in a randomized block design with three replications. For all treatments other than absolute control, the recommended dose of fertilizer for greengram (25:50:50 kg N, P_2O_5 and K_2O ha^{-1}) was administered. Irrigations were applied based on need.

Data collection

Each net plot's growth and yield parameters were noted after five representative plants at random and tagged. During the crop growth period, all subsequent observations were made on the chosen plants. Matured pods from the net plot area were picked manually and dried in the sun. Following threshing, the weight of the cleaned seeds obtained from each plot was noted. Five plants that were designated to record post-harvest observations had their net plot seed yield added and it was expressed in kg ha^{-1}.

Net return and benefit-cost ratio

To determine which treatment is the most profitable, all costs related to cultural operations from pre-harvest tillage to harvesting, including additional treatment costs were calculated and deducted from each treatment's gross income in order to determine net monetary returns per hectare. Gross income was calculated using the current market prices. For every treatment, the B: C ratio was computed by dividing the net return by the cost of cultivation. Fisher's method of analysis of variance as out lined by Gomez and Gomez (1984) was employed for statistical analysis of the obtained experimental data. The F test was conducted with a 5% level of significance. When the F test was significant, critical difference (CD) values are provided for the data at the 5% level of significance.

RESULTS AND DISCUSSION

Growth parameters

The pooled data in Table 1 and 2 indicated that the growth characteristics of the greengram were significantly impacted by the various foliar applications of the micronutrients mixture used in the previous *kharif* sweet corn crop. Significantly higher number of branches $plant^{-1}$ at 30 DAS (2.73), 45 DAS (4.18) and at harvest (8.67) was observed under the treatment receiving foliar application of MM_2 (0.2%) along with humic acid @ 0.5% sprayed at 30 DAS. However, lower values were recorded in absolute control (1.16, 2.11 and 5.18, respectively) at 30, 45 DAS and at harvest. Similar trend was obtained with respect to dry matter accumulation at 30, 45 DAS and at harvest. The foliar application of MM_2 (0.2%) along with spraying of humic acid @ 0.5% at 30 DAS registered significantly higher dry matter accumulation (1.29, 5.64 and 14.19 g $plant^{-1}$, respectively). Absolute control recorded significantly lower dry matter accumulation (0.66, 3.30 and 8.30 g $plant^{-1}$, respectively).

The treatment which received foliar spray of MM_2 (0.2%) + Humic acid @ 0.5% in previous sweet corn crop was found superior over other treatments in obtaining significantly higher growth parameters in succeeding greengram even with the application of RDF alone and incorporating the stubbles of sweet corn along with root biomass. This might be attributed to application of MM_2 resulted in scorching effect in previous crop *i.e.*, sweet corn which affected the normal growth and development of sweet corn even with the sufficient nutrient availability (Mahesh, 2020). In turn, these left over nutrients was available for succeeding greengram which increased the uptake of nutrients resulting in improved growth and yield of greengram. Additionally, stubbles and root biomass which was incorporated into the soil after the harvest of sweet corn which undergoes decomposition and releases nutrients in a synchronized manner with the crop growth stages of greengram, thus there is enhanced soil fertility leading to improved nutrient uptake and dry matter production of greengram ultimately resulting in higher growth and yield parameters in greengram (Imade, 2014; Mansuri, 2016; Patel *et al*., 2018; and Kantwa *et al*., 2024).

Yield attributes

The foliar application of a micronutrients mixture resulted in a significant increase in the number of seeds pod^{-1}, the number of effective nodules plant^{-1} and the seed yield in

Table 1: Number of branches plant^{-1} at different growth stages of succeeding greengram in relation to the residual effect of foliar application of micronutrients mixture.

Treatments	30 DAS			45 DAS			At harvest		
	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
T_1: Absolute control	1.15	1.17	1.16	2.02	2.19	2.11	5.10	5.27	5.18
T_2: Recommended package of practices	1.36	1.36	1.36	2.39	2.89	2.64	6.07	6.79	6.43
T_3: Foliar spray of MM_1	1.49	1.51	1.50	2.57	3.09	2.83	6.36	7.22	6.79
T_4: Foliar spray of MM_2	1.79	1.82	1.81	3.13	3.69	3.41	7.13	7.95	7.54
T_5: Humic acid spray @ 0.5%	1.57	1.64	1.60	2.79	3.31	3.05	6.67	7.46	7.07
T_6: Biostimulant spray @ 625 ml ha^{-1}	1.66	1.77	1.71	2.96	3.47	3.22	6.91	7.73	7.32
T_7: Foliar spray of MM_1 + Humic acid spray @ 0.5%	2.48	2.69	2.59	3.74	4.16	3.95	7.95	8.87	8.41
T_8: Foliar spray of MM_2 + Humic acid spray @ 0.5%	2.66	2.80	2.73	3.88	4.47	4.18	8.26	9.07	8.67
T_9: Foliar spray of MM_1 + Biostimulant spray @ 625 ml ha^{-1}	1.96	2.05	2.01	3.34	3.91	3.63	7.44	8.06	7.75
T_{10}: Foliar spray of MM_2 + Biostimulant spray @ 625 ml ha^{-1}	2.11	2.28	2.20	3.62	4.03	3.83	7.67	8.58	8.12
S.Em. (±)	0.14	0.15	0.10	0.21	0.26	0.16	0.53	0.34	0.29
CD @ 5%	0.42	0.46	0.29	0.63	0.77	0.46	1.58	1.02	0.87

Note: RDF alone was applied for all treatments except absolute control.

Table 2: Dry matter accumulation (g plant^{-1}) at different growth stages of succeeding greengram in relation to the residual effect of foliar application of micronutrients mixture.

Treatments	30 DAS			45 DAS			At harvest		
	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
T_1: Absolute control	0.66	0.67	0.66	3.00	3.60	3.30	8.16	8.43	8.30
T_2: Recommended package of practices	0.75	0.76	0.76	3.15	4.49	3.82	11.05	12.09	11.57
T_3: Foliar spray of MM_1	0.77	0.78	0.78	3.20	4.67	3.94	11.44	12.53	11.99
T_4: Foliar spray of MM_2	0.85	0.91	0.88	3.86	5.27	4.57	12.21	13.93	13.07
T_5: Humic acid spray @ 0.5%	0.78	0.80	0.79	3.26	4.98	4.12	11.68	12.93	12.30
T_6: Biostimulant spray @ 625 ml ha^{-1}	0.80	0.86	0.83	3.50	5.03	4.26	11.92	13.27	12.60
T_7: Foliar spray of MM_1 + Humic acid spray @ 0.5%	1.15	1.26	1.21	4.89	6.01	5.45	13.01	14.85	13.93
T_8: Foliar spray of MM_2 + Humic acid spray @ 0.5%	1.26	1.31	1.29	5.07	6.20	5.64	13.29	15.09	14.19
T_9: Foliar spray of MM_1 + Biostimulant spray @ 625 ml ha^{-1}	0.91	0.93	0.92	4.13	5.48	4.81	12.54	14.22	13.38
T_{10}: Foliar spray of MM_2 + Biostimulant spray @ 625 ml ha^{-1}	1.01	1.15	1.08	4.58	5.80	5.19	12.80	14.52	13.66
S.Em. (±)	0.06	0.07	0.04	0.31	0.23	0.15	0.72	0.98	0.54
CD @ 5%	0.18	0.20	0.13	0.91	0.69	0.44	2.12	2.90	1.61

Note: RDF alone was applied for all treatments except absolute control.

the subsequent greengram crop (Table 3). The pooled data revealed that the foliar application of MM_2 (0.2%) + Humic acid @ 0.5% recorded maximum number of seeds pod^{-1} (10.57), number of effective nodules $plant^{-1}$ (30.75) and seed yield (996 kg ha^{-1}) which was significantly superior over rest of the treatments. The lowest number of seeds pod^{-1} (7.06), number of effective nodules $plant^{-1}$ (13.79) and seed yield (398 kg ha^{-1}) were also observed in absolute control.

Sowing greengram as a sequential crop after incorporating the stubbles of sweet corn after its harvest, coupled with the application of the recommended dose of fertilizers, can significantly enhance yield and yield parameters. The residual nutrients from the sweet corn crop, particularly nitrogen, can improve the number of seeds per pod due to better nutrient availability and improved soil structure left by the sweet corn stubbles. The number of effective nodules per plant is likely to be higher, facilitating better nitrogen fixation and overall plant vigour. This, in turn, can boost test weight as the seeds develop more robustly. Significantly higher seed and haulm yield was ascribed to the combined effect of better growth conditions and effective nutrient uptake resulting in improved biological yield. Similar results reported earlier by Gawai and Pawar (2006) and Devi *et al.* (2024).

Available soil micronutrients after harvest of sweet corn

Although micronutrients were not given through soil, to check the impact of foliar application of micronutrients mixture on soil micronutrient status, soils were analyzed for micronutrient content and when analyzed statistically, it was found non significant (Table 4). However, numerically highest soil micronutrients *viz.,* Fe, Zn, Mn, Cu and B (11.99, 2.84, 8.85, 0.23 and 0.55 mg kg^{-1}, respectively) was recorded under the foliar application of MM_2 (0.2%) sprayed at 30 DAS. Whereas, absolute control registered lower soil micronutrients (8.94, 2.29, 6.80, 0.19 and 0.48 mg kg^{-1}, respectively).

Micronutrient content in stover of sweet corn

The data pertaining to the micronutrient content in stover of sweet corn as affected by foliar application of micronutrients mixture are presented in Table 5. Significantly higher iron, zinc, manganese, copper and boron content (83.53, 18.88, 29.09, 3.47 and 2.26 mg kg^{-1}, respectively) was recorded with the foliar application of MM_1 (0.1%) combined with humic acid @ 0.5% sprayed at 30 DAS and lower micronutrient content was observed in absolute control (61.66, 12.02, 22.05, 2.69 and 1.72 mg kg^{-1}, respectively).

The foliar application is a more efficient and effective approach which helps to improve micronutrient uptake by plants. Similar conclusion was also drawn by Piri (2012) and Balbaa and Awad (2013).

Economics

The pooled data in Table 6 revealed that the foliar application of MM_2 (0.2%) + Humic acid @ 0.5% (T_7) gave the highest gross returns (Rs. 75,871 ha^{-1}), net returns (Rs. 45,203 ha^{-1}) and B:C ratio (2.47), respectively followed by the treatment T_7 (Rs. 71,369 ha^{-1}), (Rs. 40,700 ha^{-1}) and (2.33). The absolute control (T_1) produced the lowest gross returns (Rs. 30,512 ha^{-1}), net return (Rs. 6008 ha^{-1}) and a B:C ratio

Table 3: Number of seeds pod^{-1}, number of effective nodules $plant^{-1}$ and seed yield (kg ha^{-1}) of succeeding greengram in relation to the residual effect of foliar application of micronutrients mixture.

Treatments	Number of seeds pod^{-1}			Number of effective nodules $plant^{-1}$			Seed yield (kg ha^{-1})		
	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
T_1: Absolute control	7.00	7.12	7.06	13.78	13.79	13.79	398	398	398
T_2: Recommended package of practices	8.01	8.64	8.33	16.54	16.62	16.58	726	727	727
T_3: Foliar spray of MM_1	8.49	9.56	9.03	17.78	17.86	17.82	775	776	775
T_4: Foliar spray of MM_2	9.30	10.11	9.70	22.92	23.01	22.96	831	831	831
T_5: Humic acid spray @ 0.5%	8.78	9.72	9.25	20.09	20.18	20.13	815	816	815
T_6: Biostimulant spray @ 625 ml ha^{-1}	9.04	9.99	9.52	20.94	21.04	20.99	828	828	828
T_7: Foliar spray of MM_1 + Humic acid spray @ 0.5%	9.82	11.02	10.42	28.92	28.98	28.95	935	937	936
T_8: Foliar spray of MM_2 + Humic acid spray @ 0.5%	10.01	11.13	10.57	30.64	30.86	30.75	995	997	996
T_9: Foliar spray of MM_1 + Biostimulant spray @ 625 ml ha^{-1}	9.43	10.40	9.92	25.78	25.85	25.82	880	881	881
T_{10}: Foliar spray of MM_2 + Biostimulant spray @ 625 ml ha^{-1}	9.59	10.77	10.18	27.33	27.42	27.38	920	921	921
S.Em. (±)	0.53	0.72	0.49	1.58	1.58	0.94	31.73	26.59	28.41
CD @ 5%	1.58	2.14	1.45	4.69	4.70	2.78	94.27	79.01	84.42

Note: RDF alone was applied for all treatments except absolute control.

Table 4: Available soil micronutrients (mg kg^{-1}) after harvest of sweet corn in relation to the foliar application of micronutrients mixture.

Treatments	Fe (mg kg^{-1})			Zn (mg kg^{-1})			Mn (mg kg^{-1})			Cu (mg kg^{-1})			B (mg kg^{-1})		
	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
T_1: Absolute control	9.30	8.59	8.94	2.38	2.20	2.29	6.60	7.01	6.80	0.19	0.19	0.19	0.48	0.47	0.48
T_2: Recommended package of practices	12.06	11.82	11.94	2.76	2.74	2.75	9.02	8.54	8.78	0.22	0.22	0.22	0.56	0.53	0.55
T_3: Foliar spray of MM_1	11.64	11.45	11.55	2.73	2.71	2.72	7.84	8.05	7.94	0.21	0.21	0.21	0.51	0.51	0.51
T_4: Foliar spray of MM_2	12.12	11.86	11.99	2.92	2.76	2.84	9.13	8.56	8.85	0.23	0.23	0.23	0.57	0.53	0.55
T_5: Humic acid spray @ 0.5%	11.96	11.62	11.79	2.74	2.72	2.73	7.87	8.30	8.09	0.21	0.21	0.21	0.51	0.52	0.52
T_6: Biostimulant spray @ 625 ml ha^{-1}	12.03	11.76	11.90	2.75	2.73	2.74	8.94	8.51	8.73	0.22	0.22	0.22	0.56	0.53	0.55
T_7: T_3 + Humic acid spray @ 0.5%	10.61	10.33	10.47	2.65	2.70	2.68	7.57	7.87	7.72	0.20	0.20	0.20	0.48	0.49	0.49
T_8: T_4 + Humic acid spray @ 0.5%	12.02	11.74	11.88	2.74	2.73	2.74	8.93	8.51	8.72	0.22	0.22	0.22	0.54	0.52	0.53
T_9: T_3 + Biostimulant spray @ 625 ml ha^{-1}	11.36	11.07	11.21	2.64	2.69	2.66	7.64	7.91	7.78	0.21	0.21	0.21	0.49	0.50	0.50
T_{10}: T_4 + Biostimulant spray @ 625 ml ha^{-1}	11.99	11.74	11.87	2.74	2.72	2.73	8.90	8.51	8.70	0.21	0.21	0.21	0.53	0.52	0.53
S.Em.±	0.58	1.08	0.63	0.13	0.12	0.10	0.58	0.43	0.46	0.01	0.01	0.01	0.02	0.02	0.02
CD @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Note: Foliar spray was done at 30 DAS.

Table 5: Micronutrient content (mg kg^{-1}) in stover of sweet corn in relation to the foliar application of micronutrients mixture.

Treatments	Fe (mg kg^{-1})			Zn (mg kg^{-1})			Mn (mg kg^{-1})			Cu (mg kg^{-1})			B (mg kg^{-1})		
	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
T_1: Absolute control	61.55	61.78	61.66	12.00	12.03	12.02	22.04	22.06	22.05	2.68	2.70	2.69	1.71	1.73	1.72
T_2: Recommended package of practices	80.06	80.63	80.35	16.25	16.27	16.26	28.51	28.52	28.52	3.28	3.29	3.29	2.11	2.12	2.12
T_3: Foliar spray of MM_1	82.13	82.99	82.56	18.34	18.38	18.36	28.93	28.96	28.95	3.42	3.43	3.43	2.24	2.24	2.24
T_4: Foliar spray of MM_2	73.59	73.24	73.41	14.33	14.30	14.32	28.40	28.41	28.41	3.15	3.13	3.14	2.05	2.04	2.05
T_5: Humic acid spray @ 0.5%	81.76	82.34	82.05	18.02	18.14	18.08	28.87	28.9	28.89	3.42	3.41	3.41	2.22	2.23	2.22
T_6: Biostimulant spray @ 625 ml ha^{-1}	80.50	81.04	80.77	17.17	17.20	17.19	28.66	28.68	28.67	3.34	3.35	3.35	2.15	2.17	2.16
T_7: T_3 + Humic acid spray @ 0.5%	82.41	84.65	83.53	18.85	18.91	18.88	29.08	29.1	29.09	3.47	3.48	3.47	2.26	2.27	2.26
T_8: T_4 + Humic acid spray @ 0.5%	81.08	81.79	81.43	17.47	17.51	17.49	28.73	28.74	28.74	3.37	3.38	3.38	2.18	2.20	2.19
T_9: T_3 + Biostimulant spray @ 625 ml ha^{-1}	82.27	83.38	82.82	18.56	18.62	18.59	29.00	29.03	29.02	3.45	3.45	3.45	2.24	2.26	2.25
T_{10}: T_4 + Biostimulant spray @ 625 ml ha^{-1}	81.50	82.00	81.75	17.85	17.93	17.89	28.74	28.79	28.77	3.39	3.39	3.39	2.19	2.21	2.20
S.Em.±	3.61	3.40	3.34	0.72	0.72	0.69	1.20	1.20	1.14	0.15	0.14	0.15	0.09	0.09	0.09
CD @ 5%	10.73	10.11	9.91	2.13	2.14	2.04	3.56	3.56	3.39	0.45	0.42	0.44	0.28	0.27	0.26

Note: Foliar spray was done at 30 DAS.

Table 6: Economics of succeeding greengram in relation to the residual effect of foliar application of micronutrients mixture.

Treatments	Total cost of cultivation (Rs. ha^{-1})	Gross return (Rs. ha^{-1})			Net return (Rs. ha^{-1})			B:C ratio		
		2022	2023	Pooled	2022	2023	Pooled	2022	2023	Pooled
T_1: Absolute control	24504	30529	30496	30512	6025	5992	6008	1.25	1.24	1.25
T_2: Recommended package of practices	30669	55477	55525	55501	24809	24856	24833	1.81	1.81	1.81
T_3: Foliar spray of MM_1	30669	59180	59246	59213	28512	28578	28545	1.93	1.93	1.93
T_4: Foliar spray of MM_2	30669	63411	63449	63430	32743	32781	32762	2.07	2.07	2.07
T_5: Humic acid spray @ 0.5%	30669	62221	62286	62253	31552	31617	31585	2.03	2.03	2.03
T_6: Biostimulant spray @ 625 ml ha^{-1}	30669	63182	63202	63192	32513	32533	32523	2.06	2.06	2.06
T_7: Foliar spray of MM_1 + Humic acid spray @ 0.5%	30669	71306	71432	71369	40637	40763	40700	2.33	2.33	2.33
T_8: Foliar spray of MM_2 + Humic acid spray @ 0.5%	30669	75754	75988	75871	45086	45320	45203	2.47	2.48	2.47
T_9: Foliar spray of MM_1 + Biostimulant spray @ 625 ml ha^{-1}	30669	67138	67252	67195	36469	36583	36526	2.19	2.19	2.19
T_{10}: Foliar spray of MM_2 + Biostimulant spray @ 625 ml ha^{-1}	30669	70162	70224	70193	39494	39555	39524	2.29	2.29	2.29

Note: RDF alone was applied for all treatments except absolute control.

of (1.25). Higher net returns and a better B:C ratio might have been caused by the production of more yield in combination with a higher market price for greengram seeds. The outcome of Kamanga *et al*. (2010) is consistent with the outcomes of this study.

CONCLUSION

Residual effect of treatments on growing succeeding greengram without fertilization after sweet corn grown with foliar application of MM_2 (0.2%) + Humic acid @ 0.5% secured highest number of branches plant^{-1}, dry matter accumulation, number of seeds pod^{-1}, number of effective nodules plant^{-1}, seed yield, net return and B:C ratio in greengram on sandy loam soil. Thus, reported the promising residual effect on productivity and profitability of succeeding greengram in sweet corn - greengram cropping sequence.

Conflict of interest

All authors declare that they have no conflicts of interest.

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