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EVALUATION OF THE BIO-EFFECTIVENESS OF SABUJ GOLD AS ORGANIC MANURE ON TOMATO, BRINJAL AND FRENCH BEAN

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Abstract

The present study on "Evaluate the bio-effectiveness of Sabuj Gold as organic manure on Tomato, Brinjal and Chilli" was carried out at the Instructional Farm, Faculty of Horticulture of Uttar Banga Krishi Vishwavidyalaya, Pundibari, Cooch Behar during *rabi* season of 2017 - 2018. In this experiment three experiment trails based on organic manure as supplemented by "Sabuj Gold" and combination with inorganic package of practice were evaluated to study their comparative performance on different growth, yield and quality related traits of three major *rabi* season crops namely tomato, brinjal, chilli. Results recorded showed that all the growth, yield and quality parameters were improved significantly against the other treatments which included the combination of organic and inorganic inputs as well as inorganic input alone. Maximum plant height was 68.97cm (Tomato), 58.96cm (Brinjal) and 55.24cm (French bean), the highest fruit yield per hectare was 31.97 tonnes (Tomato), 18.74tonnes (Brinjal) and 8.94tonnes (French bean), the highest total leaf chlorophyll content was 418.11mg/100g, lycopene 4.27mg/100g and β carotene 1.37 mg/100g (Tomato) recorded with the application of Sabuj Gold as organic manure.

Key words: Sabuj Gold, Organic manure, Tomato, Brinjal, French bean, Growth, Yield and Quality.

Introduction

Under ever increasing population pressure in most of the Asian countries, the mankind facing the major challenge from the beginning of the new millennium is to provide food substance with assured quality and quantity for every individual. India is the second most populous country in the world. Green Revolution in the post independence era has shown the path for self-sufficiency in food supply, but sustaining agricultural production against the finite natural resource the base demands has shifted from the "resource degrading" chemical assisted agriculture to a "resource protective" biological or organic agriculture. It is true that the increasing use of fertilizers and pesticides at high rates has boosted agricultural production in the country, but greatly associated with adverse impact on soil health and water resources, as well as environment and natural ecological system (Chinthapalli *et al.*, 2015, Kalbani *et al.*, 2016, Mullaimaran and Haripriya, 2016, Samadhiya *et al.,* 2013 and Vinnoli *et al.*, 2018). Long term continuous use of high doses of chemical fertilizers and pesticide day by day aggravating complexity in present agricultural system and in order to overcome this situation organic farming that aims at cultivating the land and raising crops in such a sustainable way to keep the soil alive and in good condition, may be an alternative option to the present system of farming solely depending on chemicals. (Beevi and Binsha, 2018, Blane *et al.,* 1989 and Oliveira *et al.,* 2013) Many scientists at different levels have elaborated the concept of Organic Farming. Organic Farming as, "A production system which avoids or largely excludes the use of synthetically produced fertilizers, pesticides, growth regulators and livestock feed additives" (Narayan *et al.,* 2008; Diver *et al.,* 1999). The organic manuring has positive influence on soil texture and water holding capacity (Kale *et al.,* 1991) and it can also positively affect the soil fertility, microbial population and improve the keeping quality of vegetables (Vogtmann *et al.,* 1993). But, organic agriculture supported by natural organic means is unable to meet up the huge agricultural output demand that highly argued for enrichment of naturally available organic sources by artificial means adopting special techniques. Keeping all this information in purview present investigation was laid out to evaluate the response of different important vegetable crops with Sabuj Gold.

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Materials and Methods

The present experiment was conducted during *rabi* season of year 2017-18 to study the evaluate the bio-effectiveness of SABUJ GOLD as organic manure on tomato, brinjal and chilli at the Horticulture Instructional Farm, Uttar Banga Krishi Viswavidyalaya (U.B.K.V.), Pundibari, Coochbehar. Geographically the farm is situated at $26^0$19'86" N latitude and 89^0 23'53" E longitude, at an elevation of 43 meter above mean sea level. The area lies under the Terai agro climatic zone of West Bengal. The soil of the experimental field was from Teesta alluvial plain group which is sandy loam in texture with poor water holding capacity and moderate fertility status with slightly acidic pH.

The entire crop species was laid out in a Randomized Block Design maintaining a spacing of 60cm x 60cm with 4 replicated (each plot sized 6m x 6m) individual treatment *viz.,* Treatment 1: 100% Organic Manure (Sabuj Gold as nutrient supplement) + full other Organic certified inputs (plant protection measures), Treatment 2: 100% Organic Manure (Sabuj Gold as nutrient supplement) + full other inorganic supplement (plant protection measures), Treatment 3: 100% In-organic practice (nutrient and plant protection), Treatment 4: Nil organic or inorganic supplements. Sabuj Gold is enriched processed dark brown colour complex organic manure having neutral pH level with high macro/micro nutrient value, applied at the rate of 300 kg per acre of land one month before sowing and was mixed thoroughly into soil. For plant organic and inorganic plant protection and nutrient management standard package of practice was followed. For taking observation randomly selected five healthy plants was selected from individual replication for collecting the sample. The observations were taken on growth and yield parameters like Days to germination, Germination percentage (emergence) (%), Seedling height (cm), Plant height (cm), Days to first flowering, Number of primary branches, Fruit length (cm), Fruit diameter (cm), Pericarp thickness (mm), Fruit weight (g), Locule number (Tomato), Flower per truss/cluster, Fruits per truss/cluster, Clusters per plant (Brinjal), Number of fruits per plant, Yield per ha (t/ha). Qualitative characters like Chlorophyll A, B and total chlorophyll of leaf and Ascorbic acid content of ripe fruit (as per Sadasivam and Manickam, 1996); Lycopene content of ripe fruit and β-carotene of ripe fruits (Davies, 1976). Total soluble solids content of the ripe fruits was estimated with the help of an "ERMA hand refractometer" (0 to 32ºBrix) and the values were corrected at 20ºC. Mean data were processed and Duncan's multiple range test of the SPSS programme version 17 was used for the comparison among the treatment means.

Table 1: Different collected vegetables and their sources.

S. No.	Crop	Variety/ cultivar	Collection area/Source
1	Tomato	Pusa Ruby (Bharat Seed)	Local market
2	Brinjal	Black Beauty (Sungro)	Local market
3	French bean	Falguni (Seminis)	Local market

Results and Discussion

Tomato

From the table 2 it had been found that there was no clear significant difference among all the treatments under experiment with respect to number of days to germination of tomato seed. However, 100% Organic manure + full other inorganic supplement (plant protection measures) showed little bit earlier (8.05 days) than the other treatments. Significant effect of Sabuj Gold as an organic manure was noticed on germination percentage as well as seedling height at 25 DAS. Maximum germination percentage as well as seedling height at 25 DAS was recorded through 100% Organic manure + full other inorganic supplement (plant protection measures) *i.e.,* 79.02% and 12.37 cm, respectively followed by the 100% Organic manure + full other Organic certified inputs (plant protection measures) *i.e.,* 78.24 % and 12.25 cm, respectively. In both the cases of Sabuj Gold supplemented treatments the plant tends to dwarfism (68.97 cm and 70.54 cm, respectively) indicated the effect of inorganic nutrient supplement helps to form new cells more rapidly and ultimately prone to more susceptible to varied biotic pressure.

It could be noted that, sole treatment of Sabuj Gold as an organic manure resulted in earliness with respect to flowering as mean first flower appeared within 32.62 days after transplanting in 100% Organic manure + full other Organic certifiedinputs (plant protection measures) followed by 33.95 days after transplanting in 100% Organic manure + full other inorganic supplement (plant protection measures). Whereas, population treated with chemical nutrient supplement were significantly late in blooming *i.e.,* 35.24 DAT and this was negatively correlated with the plant height as well as not acceptable trait in commercial cultivation. Other quantitative traits like number of primary branches, fruit length, fruit diameter, pericarp thickness and fruit weight exhibited maximum values with the treatment of 100% Organic manure + full other Organic certified inputs (plant protection measures) *i.e.,* 9.22, 5.21 cm, 3.89 cm, 6.11 mm and 74.57 g, respectively followed by the treatment 100% Organic manure + full other inorganic supplement

(plant protection measures). There were no significant variation noted with any of the treatments under experiments that might be due the fact locule number is highly governed by the genetic factors and could not be modified with any kinds of means.

Table 2 showed that there were no much significant difference among the number of flower per truss and this might to preponderance of genetic factor in governing this trait. However, number of fruit per truss which was genetic as well as environment *viz.,* climate, nutrient, water etc governed factor found to be maximum through the treatment 100% Organic manure + full other Organic certified inputs (plant protection measures) as well as 100% Organic manure + full other inorganic supplement (plant protection measures) *i.e,* 3.59 and 3.61, respectively. The effect of Sabuj Gold product used as organic manure was clearly visible with respect to number of fruit per plant and expected yield per hectare. It was found that 100% Organic manure + full other Organic certified inputs (plant protection measures) resulted significantly highest fruit per plant (37.42) and yield per hectare (31.97 t/ha). The treatment 100% Organic manure + full other inorganic supplement (plant protection measures) showed second highest number of fruit per plant (36.95) and yield per hectare (30.15 t/ha). The effect of SABUJ GOLD as an organic manure was noticed predominately in fruit quality for all the qualitative characters like TSS, lycopene content, beta-carotene content of fruits and chlorophyll A, chlorophyll B, Total chlorophyll of leaf. However, the treatment 100% Organic manure + full other Organic certified inputs (plant protection measures) showed significant highest values for TSS (5.01p B), lycopene content (4.27 mg/100g), beta-carotene content (1.37mg/100g) of fruits and chlorophyll A (296.57 mg/100g), chlorophyll B (121.54 mg/100g), Total chlorophyll (418.11 mg/100g) of leaf followed by the treatment 100% Organic manure + full other inorganic supplement (plant protection measures) *i.e,* TSS (4.85p B), lycopene content (4.21 mg/100g), beta-carotene content (1.24mg/100g) of fruits and chlorophyll A (288.91 mg/100g), chlorophyll B (117.45 mg/100g), Total chlorophyll (406.36 mg/100g) of leaf.

Brinjal

There was significant difference observed among treatments of the organic manure application with respect to number of days to germinate table 3. It was observed that earliest germination occurred in 100% Organic manure + full other inorganic supplement (plant protection measures) (9.21days) followed by 100% In-organic practice (9.20days). Whereas, maximum number of days to seed germinate (9.87 days) was recorded in the treatment without any organic or inorganic aids. Observation recorded for germination percentage revealed that maximum germination percentage (83.26%) was in treatment 100% Organic manure + full other inorganic supplement (plant protection measures) and followed by treatment 100% In-organic practice (82.74%). Minimum germination percentage (78.95%) observed in treatment number 4. Highest seedling height *i.e.,* 12.61cm observed in treatment 100% Organic

Table 2: Different quantitative and qualitative characters of Tomato with the treatments effects.

Treatment	Days to germination	Germin-ation (%)	Seedling height (cm)	Plant height (cm)	1st flowering	Primary branch	Fruit length (cm)
Treatment 1	8.11^{b}	78.24^{b}	12.25^{b}	68.97^{c}	32.62^{d}	9.22^{a}	5.21^{a}
Treatment 2	8.05^{c}	79.02^{a}	12.37^{a}	70.54^{b}	33.95^{c}	8.94^{b}	5.07^{b}
Treatment 3	8.09^{b-c}	78.06^{c}	11.04^{c}	72.56^{a}	35.24^{a}	8.91^{c}	5.09^{b}
Treatment 4	9.01^{a}	76.34^{d}	10.14^{d}	65.33^{d}	34.54^{b}	7.84^{d}	4.85^{c}

Treatment	Fruit dmt. (cm)	Pericarp thickness (mm)	Fruit Wt.(g)	Locule No.	Flower per truss	Fruit per truss	Fruit per plant
Treatment 1	3.89^{a}	6.11^{a}	74.57^{a}	4.32^{a}	5.85^{b}	3.59^{a}	37.42^{a}
Treatment 2	3.74^{b}	5.84^{b}	71.22^{b}	4.29^{a}	5.91^{a}	3.61^{a}	36.95^{b}
Treatment 3	3.61^{c}	5.61^{c}	68.94^{c}	4.21^{b}	5.89^{a-b}	3.44^{b}	34.23^{c}
Treatment 4	3.17^{d}	5.34^{d}	65.27^{d}	4.33^{a}	5.92^{a}	3.27^{c}	29.31^{d}

Treatment	Yield (t/ha)	TSS (°B)	Lycopene (mg/100g)	β carotene (mg/100g)	Chl A (mg/100g)	Chl B (mg/100g)	Total Chl (mg/100g)
Treatment 1	31.97^{a}	5.01^{a}	4.27^{a}	1.37^{a}	296.57^{a}	121.54^{a}	418.11^{a}
Treatment 2	30.15^{b}	4.85^{b}	4.21^{b}	1.24^{b}	288.91^{b}	117.45^{b}	406.36^{b}
Treatment 3	27.04^{c}	4.65^{c}	4.01^{c}	1.17^{c}	265.74^{c}	115.27^{c}	381.01^{c}
Treatment 4	21.92^{d}	4.54^{d}	3.54^{d}	1.06^{d}	254.23^{d}	103.35^{d}	357.58^{d}

Means followed by the same letters are not significant at 0.05 percent level according to Duncan's test.

manure + full other inorganic supplement (plant protection measures) followed by 100% Organic manure + full other Organic certified inputs (plant protection measures) (12.57cm). Highest plant height (58.96cm) and primary branches (6.74) recorded in the 100% Organic manure + full other Organic certified inputs (plant protection measures) followed by 100% Organic manure + full other inorganic supplement (plant protection measures) (57.29cm and 6.63, respectively). Minimum plant height (51.44cm) and primary branches (5.87) observed in treatment 4. Treatment of 100% Organic manure + full other Organic certified inputs (plant protection measures) (56.72 days) followed by 100% Organic manure + full other inorganic supplement (plant protection measures) (57.72) exhibited minimum number of days to first flower.

Maximum number of flowers per cluster (3.71) observed in treatment 100% Organic manure + full other inorganic supplement (plant protection measures) followed by treatment 100% Organic manure + full other Organic certified inputs (plant protection measures) (3.62). Highest number fruit per cluster (2.78), clusters per plant (5.88), fruits per plant (14.34), fruit length (34.26cm), fruit weight (159.67g), fruit diameter (5.66cm), yield per hectare (18.74t/ha) was recorded in treatment 100% Organic manure + full other Organic certified inputs (plant protection measures) followed by 100% Organic manure + full other inorganic supplement (plant protection measures).

Highest values for the quality parameters *viz*., chlorophyll A (297.85mg/100g), chlorophyll B (109.11 mg/100g) and total chlorophyll (406.66 mg/100g) observed in 100% Organic manure + full other inorganic supplement (plant protection measures) followed by 100% Organic manure + full other Organic certified inputs (plant protection measures). Lowest values for these quality parameters *viz*., chlorophyll A (202.39 mg/100g), chlorophyll B (73.86 mg/100g) and total chlorophyll (276.25 mg/100g) observed in treatment 3 without inorganic/organic inputs.

French bean

It was found in the present investigation table 4 that the 100% Organic manure + full other inorganic supplement (plant protection measures) (11.41 days) and 100% Organic manure + full other Organic certifiedinputs (plant protection measures) (11.57 days) showed significantly earlier in seed germination than the other treatments that indicated the important role of Sabuj Gold as an organic manure in earliness of seed germination that might be due to up-regulation of bio-chemicals present in seed due to intervention of Sabuj Gold as an organic manure in positive direction. In case of germination percentage though the entire organic nutrient supplement exhibited lesser germination, but the differentiate manifestation was not that much to draw conclusion and rather it is more genetic governed factor. Significantly highest plant height was noticed by 100% Organic manure

Table 3: Different quantitative and qualitative characters of Brinjal with the treatments effects.

Treatment	Days to germination	Germination (%)	Seedling height (cm)	Plant height (cm)	1st flowering	Primary branch
Treatment 1	9.24^{b}	82.34^{c}	12.57^{a}	58.96^{a}	56.72^{d}	6.74^{a}
Treatment 2	9.21^{c}	83.26^{a}	12.61^{a}	57.29^{b}	57.23^{c}	6.63^{b}
Treatment 3	9.2^{c}	82.74^{b}	11.34^{b}	56.38^{c}	59.66^{b}	6.11^{c}
Treatment 4	9.87^{a}	78.95^{d}	9.26^{c}	51.44^{d}	61.24^{a}	5.87^{d}

Treatment	Flower per cluster	Fruit per cluster	Cluster per plant	Fruit length (cm)	Fruit dmt (cm)	Fruit weight (g)
Treatment 1	3.62^{b}	2.78^{a}	5.88^{a}	34.26^{a}	5.66^{a}	159.67^{a}
Treatment 2	3.71^{a}	2.74^{b}	5.84^{b}	33.26^{b}	5.51^{b}	151.24^{b}
Treatment 3	3.61^{b}	2.51^{c}	5.66^{c}	32.59^{c}	4.89^{c}	132.51^{c}
Treatment 4	3.54^{c}	1.97^{d}	5.01^{d}	30.21^{d}	4.54^{d}	117.34^{d}

Treatment	Fruit per plant	Yield (t/ha)	Chl A (mg/100g)	Chl B (mg/100g)	Total Chl (mg/100g)
Treatment 1	14.34^{a}	18.74^{a}	294.33^{b}	107.33^{b}	401.66^{b}
Treatment 2	14.21^{b}	17.71^{b}	297.85^{a}	109.11^{a}	406.96^{a}
Treatment 3	12.33^{c}	15.34^{c}	256.34^{c}	93.65^{c}	349.99^{c}
Treatment 4	8.71^{d}	12.21^{d}	202.39^{d}	73.86^{d}	276.25^{d}

Means followed by the same letters are not significant at 0.05 percent level according to Duncan's test.

+ full other Organic certified inputs (plant protection measures) (55.24 cm) followed by 100% Organic manure + full other inorganic supplement (plant protection measures) (52.36 cm). Whereas, lowest value was recorded at the treatment number 4 *i.e.,* 42.29 cm. 100% Organic manure + full other inorganic supplement (plant protection measures) was recorded to be earliest in flowering (41.01 days) followed by 100% Organic manure + full other Organic certified inputs (plant protection measures) (41.25 days). Significantly highest number of primary branches, pod length, pod diameter, pod weight and number of pod per plant were recorded at the treatment 100% Organic manure + full other Organic certifiedinputs (plant protection measures) *i.e.,* 7.84, 14.71 cm, 2.71 cm, 3.37 g and 46.34, respectively followed by 100% Organic manure + full other inorganic supplement (plant protection measures) *i.e.,* 7.44, 14.25 cm, 2.65 cm, 3.34 g and 42.21, respectively.

Table number 2 exhibited that there was predominant effect of sole treatment of Sabuj Gold as organic manure on different yield attributes. The treatment 100% Organic manure + full other Organic certified inputs (plant protection measures) exhibited significantly highest yield per plant (151.24 g) and yield per hectare (8.94 t/ha). Significantly second highest value was exhibited by the treatment 100% Organic manure + full other inorganic supplement (plant protection measures) in case of yield per plant (144.68g) and yield per hectare (8.07 t/ha). Whereas, the treatment based on sole chemical fertilizer as well as no external nutrient support showed drastic reduction in yield indicated the effect of Sabuj Gold as an organic manure in up-regulation of yield parameters. In case of qualitative characters, most of the traits *viz.,* leaf and fruit chlorophyll content were positively affected by the organic treatment. Highest significant total chlorophyll content of leaf (315.21 mg/100g) and fruit (134.95 mg/100g) were observed by the 100% Organic manure + full other inorganic supplement (plant protection measures) followed by 100% Organic manure + full other Organic certified inputs (plant protection measures) *i.e.,* total chlorophyll content of leaf (310.99 mg/100g) and fruit (126.22 mg/100g).

The hormones were important compounds for cell size and cell division enhancement. Organic-fertilizers increased the hormone production and help to enhance the plant growth and development and Increase in number of leaves will result in the absorption of more light thus promotes the photosynthesis process which in turn further increase in yield of the plant (Sasikala *et al.,* 2016). It has been reported that higher yield response of crops due to organic manure application is linked to the ability of organic manure to improve physical and biological properties of the soil resulting in better supply of nutrients to the plants (Saidu *et al.,* 2011; Ekwu and Nwokwu,

Table 4: Different quantitative and qualitative characters of French bean with the treatments effects.

Treatment	Days to germination	Germination (%)	Plant height (cm)	1st flowering	Primary branch
Treatment 1	11.57^{c}	72.22^{a}	55.24^{a}	41.25^{c}	7.84^{a}
Treatment 2	11.41^{d}	72.25^{a}	52.36^{b}	41.01^{d}	7.44^{b}
Treatment 3	12.87^{b}	71.91^{b}	46.87^{c}	43.51^{b}	6.34^{c}
Treatment 4	14.03^{a}	70.08^{c}	42.29^{d}	45.69^{a}	5.44^{d}

Treatment	Pod length (cm)	Pod dmt (cm)	Pod weight (g)	Pod per plant	Yield per plant(g)	Yield (t/ha)
Treatment 1	14.71^{a}	2.71^{a}	3.37^{a}	46.34^{a}	151.24^{a}	8.94^{a}
Treatment 2	14.25^{b}	2.65^{b}	3.34^{b}	42.21^{b}	144.68^{b}	8.07^{b}
Treatment 3	13.95^{c}	2.01^{c}	2.65^{c}	37.88^{c}	121.58^{c}	6.01^{c}
Treatment 4	12.88^{d}	1.84^{d}	2.01^{d}	32.17^{d}	88.27^{d}	5.34^{d}

Treatment		Mature pod			Mature leaf	
	Chl A (mg/100g)	Chl B (mg/100g)	Total Chl (mg/100g)	Chl A (mg/100g)	Chl B (mg/100g)	Total Chl (mg/100g)
Treatment 1	214.58^{a}	96.41^{b}	310.99^{b}	98.45^{b}	27.77^{b}	126.22^{b}
Treatment 2	201.98^{b}	113.23^{a}	315.21^{a}	101.21^{a}	33.74^{a}	134.95^{a}
Treatment 3	197.42^{c}	84.61^{c}	282.03^{c}	93.54^{c}	20.53^{d}	114.07^{d}
Treatment 4	186.44^{d}	83.76^{d}	270.2^{d}	91.22^{d}	25.73^{c}	116.95^{c}

Means followed by the same letters are not significant at 0.05 percent level according to Duncan's test.

2012; Tiamiyu *et al.,* 2012). These results were in accordance with the findings of Azarmi *et al.,* (2008), Singh *et al.,* (2009), Prabhakar *et al.,* (2011), Mamta*et al.,* (2012), Kisetu and Heri (2014), Sarma *et al.,* (2014), Pappachan *et al.,* (2015), Islam *et al.,* (2016), Sasikala *et al.,* (2016), Mathews *et al.,* (2017), Sharma *et al.,* (2017), Thakur *et al.,* (2018).

In the present experiment it was concluded that Sabuj Gold as organic manure can be good alternative in organic agriculture with high desired positive effect on yield and fruit quality related traits.

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