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Research Article

Compost manures for the qualitative and quantitative improvement of *Trigonella* (*Trigonella Foenum-Graecum* L.)

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Abstract

Fenugreek *(Trigonella foenum-graecum* L.) is an annual, self-pollinated plant from Leguminoceae family with small seeds and since ancient times has always been known as a medicinal herb. The species *T. foenum-graecum*, wild or cultivated is widely distributed throughout the world.A field experiment was conducted in the research farm of Botanical garden at Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. Compost was prepared from the weeds *Cassia tora* L., *Ipomoea muricata* L. and *Hyptis suaveolens* (L.) Poit. Experiment was laid out in a randomized block design (RBD) with six treatments as *Cassia* compost (CC), *Ipomoea* compost (IC), *Hyptis* compost (HC), Mix compost (MC) in equal proportion of above three (1:1:1), recommended dose of fertilizer alone (NPK) and absolute control (CON) with four replicates each. These treatments were compared with 100 % fertilizers alone (NPK) and control (CON). Trigonella (*Trigonella foenum-graecum* L.), local variety was cultivated at the seed rate of 30 kg/ha. **Among various types of composts *Ipomoea* and *Cassia* composts shows highest yield and nutrient uptake as compared to other composts. Weed composts are the best, active and cheapest source of plant nutrients.** Instead of eradicating weeds with different physical, mechanical, biological methods or burning it, the practice of composting is the best way of weed management which increases the soil fertility.

INTRODUCTION

Organic agriculture is natural in the Indian context. It is not just a philosophy but is also a means to stabilize our food product through maintenance of soil health and avoiding the use of hazardous chemicals, fertilizers and pesticides which have been disturbing our ecosystem on a large scale (Mogle, 2014). Besides improving soil health, organic manures supply the major nutrients and micronutrients (Palaniappan and Annadurai, 1999). Organic cultivation not only helps in enhancing availability of nutrients to plant, but also reduces dependency upon external inputs as it is near to nature (Lampkin, 1999). Organic manures prepared from weeds increases the productivity of crop and show long term effect (Mogle *et al.*, 2013). A relatively large quantity of weed biomass consists of organic fraction which can help to meet regular and other requirements associated with crop productivity and soil nutrient uptake. Leaf litter compost generated from the plantation floor assist to compensate the deficiency of organic matter content along with nutrients in the soil and acts as an ideal substitute against inorganic fertilizers (Naikwade *et al.*, 2011).

Recent trends in agriculture are centred on reducing the use of inorganic fertilizers by organic manures and biofertilizers (Gyaneshwar *et al.,* 2002 and Darzi *et al.,* 2011).

Green Leafy Vegetables (GLVs) like fenugreek are very good source of minerals and vitamins and when consumed regularly they can substantially improve micronutrient status of the Indian population(Naikwade *et al*,2012). Fenugreek has been reported as a cultivated crop in Portugal, Spain, United Kingdom, Germany, Austria, Switzerland, Greece, Turkey, Egypt, Sudan, Ethiopia, Kenya, Tanzania, Israel, Lebanon, Morocco, Tunisia, India, Pakistan, China, Japan, Russia, Argentine and USA (Rouk and Mangesha, 1963; Fazli and Hardman, 1968; Rosengarten, 1969; Smith, 1982; Edison, 1995).Fenugreek is considered to be the most popular and utilized herbal galactagogue in the world (Lawrence R, 2005). Several case series have also been reported suggesting fenugreek reduced post-prandial hyperglycemia in individuals with and without diabetes or improved glycemic control in individuals with T2DM. (Neeraja *et al., 1*996; Madar e*t al.,* 1988; Bordia e*t al*., 1997; Sharma R., 1986; Sharma R e*t al*, 1996). Fenugreek protein is rich in lysine (345 mg/g) and in comparison to the data for human requirements, calculated from the amino acid pattern, approaches that of soybeans (Hidvegi *et al*., 1984). Fenugreek contains 5 per cent oil with a strong celery odour and is used in butterscotch, cheese, licorise, pickle, rum, syrup and vanilla flavours (Duke, 1986).

Composting is a biological process through which microorganisms convert organic materials into compost. It is predominantly an aerobic or oxygen (O_2) requiring process. The microorganisms consume O_2 to extract energy and nutrients from organic matter. Many biological transformations and products occur in the composting process, mediated by a variety of microorganisms, inhabiting diverse microenvironments (Epstein, 1997; Poincelot, 1975).

In the present investigation efforts have been made to use the weeds as substrates for the preparation of composts. The selected weeds were *Cassia tora* L., *Ipomoea muricata* L. and *Hyptis suaveolens* (L.) Poit. Composts prepared from above weeds were applied as organic manures to improve the quality and yield of the vegetable *Trigonella*.

MATERIALS AND METHODS

Field site and experimental design

A field experiment was conducted in the research farm of Botanical garden at Dr. Babasaheb Ambedkar Marathwada University, Aurangabad during. The experimental design was a randomized block design (RBD) with six treatments and four replicates.

Treatments, composting process and plot size

The fresh vegetation of *Cassia tora* L., *Ipomoea muricata* L. and *Hyptis suaveolens* (L.) Poit. was collected from the Dr. Babasaheb Ambedkar Marathwada University campus, brought to laboratory and chopped into small pieces (2-3 cm) by iron cutter. Equal amount (13333 kg/ha) of weed vegetation was used for the preparation of Banglore pit compost. The fresh vegetation of *weeds* was spread on the hygienic floor was sprayed with 5 % dung slurry to enhance the composting process. These pretreated materials were arranged alternately along with well composted inoculum and soil on each layer in the Bangalore pit. Each pit used for composting was 105 x 75 x 90 cm (l x w x h). Experiment was laid out in a randomized block design (RBD) with six treatments as *Cassia* compost (CC), *Ipomoea* compost (IC), *Hyptis* compost (HC), Mix compost (MC) in equal proportion of above three (1:1:1), recommended dose of fertilizer alone (NPK) and absolute control (CON) with four replicates each.

All the prepared composts were transferred to the experimental area and incorporated into the top of soil (15 - 20 cm) by disking. Samples (100 g) of each treatment were collected for nutrient analyses and the contents of these manures are reported (Table 2). These treatments were compared with 100 % fertilizers alone (NPK) and control (CON). The leafy vegetable Trigonella (*Trigonella foenum-graecum* L.), local variety was cultivated at the seed rate of 30 kg/ha. A plot with the size 1.5 x 1.5 m was adopted to keep the reliable population application.

Application of mineral fertilizer

The fertilizers were applied at the recommended levels of 40 N, 30 P, and 30 K kg/ha as urea, single super phosphate and muriate of potash to NPK treatment alone. Entire amount of P_2O_5 and K_2O was applied as basal dose for all the plots at the time of cultivation.

Harvesting and Sample collection The crop received irrigation as per requirement regularly**.** To assess the effect of treatments; analyses were done at 39 DAS as Chlorophyll content. At the time of

harvest, total yield of *Trigonella* crop per plot was recorded. Samples (100 g) from each plot were randomly collected and kept in oven at 90°C till constant weight (48 hr), Dry matter was determined and the dried samples were grinded and passed through 0.5 mm sieve to get equal size and packed in air tight polythene bags for analyses of nutrient uptake.

Chemical analysis

The plant samples were analyzed for nutrient uptake by using standard agronomic practices. The dry matter (DM) and calcium (Ca) content was analyzed (AOAC,1995); Nitrogen (N) was estimated by micro- Kjeldahl method (Bailey,1967) and crude protein (CP) was then calculated as N x 6.25 (AOAC,1995). Reducing sugar (RS) and phosphorus (P) was determined by colorimetric methods (Oser, 1979) and potassium (K) content was analyzed (Jackson, 1973).

Statistical analysis

All the results were statistically analyzed using standard statistical methods i.e. analysis of variance (ANOVA) test and treatment means were compared using the least significant difference (C.D., p = 0.05) which allowed determination of significance between different applications (Mungikar, 1997).

RESULTS AND DISCUSSION

Analysis of the weed composts

All manures were prepared from equal amount of fresh vegetation of above mentioned weeds i.e. 13333 kg/ha. Results from the Table 1 indicates that, the fresh weights of the composts prepared from selected weeds were quite different. Compost prepared from Hyptis weed gives highest fresh weight followed by CC and lowest from IC. The dry matter (kg/ha) was found highest in the treatment of HC followed by the treatment of MC followed by CC and lowest in treatment IC. The nitrogen content was found maximum in the treatment of HC followed by MC, CC & and lowest in. The C/N ratio was highest in MC treatment as 33.50, followed by HC (32.90), IC (29.49) and recorded less in CC (28.25).

Chlorophyll contents

Chlorophyll a, b and total chlorophyll contents ranged from 0.419-0.911, 0.311-0.650 and 0.730-1.561 mg/g leaf fresh weight (fw), respectively at 39 DAS. The chlorophyll a, b and total chlorophyll were highest in IC treated plots followed by NPK, MC, HC, CC, and lowest in untreated plots (fig.1).

Yield of *Trigonella*

a) Effect of composts on yield (kg/ha) of *Trigonella*

Results from Table 2 shows that the application of weed composts significantly increase the yield and nutrient uptake by *Trigonella* vegetable. The average yield (kg/ha) of fresh vegetation of *Trigonella* was highest in IC followed by CC and lowest in CON plots. Dry matter yield was maximum in CC applied plots and minimum in CON plots (Fig.2). The nitrogen (kg/ha) was highest in CC followed by MC, HC, IC, NPK and was lowest in CON. All the results were statistically significant over control (at p. = 0.05) except NPK shows nonsignificant increase for reducing sugar.

Results from Table 3 shows that phosphorus percentage was recorded maximum in IC and least in CON. Potassium percentage was recorded highest in HC and least in CON treatment. Calcium uptake was high with the CC and lowest in CON treatment. Maximum Ash percentage was found in HC treatment followed by IC, CC, MC, NPK and minimum in CON plots.

All the results are calculated on the dry matter basis and values are the means of four replicates.

b) Percent increase over control and N efficiency

The percent increase over control for fresh weight was maximum with the fertilization of IC followed in order by CC, HC, MC and minimum in NPK treatments. The percent increase over control for nitrogen and crude protein was maximum in CC, followed by MC 4 and lower in NPK (Table.5). The nitrogen efficiency ratio for fresh vegetation was highest in plots treated with IC and lower in NPK. The nitrogen efficiency ratio for the dry matter was found highest in CC treatment followed by IC, MC, HC, and lastly NPK (Table 4 & 5).

Nitrogen efficiency ratio was very high in IC and CC as compared to NPK. These present results are in agreement with the earlier findings of Piper (1947).

Conclusion

On the basis of the results obtained it is concluded that the application of various weed composts were more effective in increasing the growth and productivity without any negative effect on Trigonella vegetable. **Among various types of composts *Ipomoea* and *Cassia* composts shows highest yield and nutrient uptake as compared to other composts.**

Table 1: Analysis of weed compost

Treatment	Fresh weight		Dry matter		Nitrogen		%					C/N
	kg/plot	kg/ ha	%	kg/ ha	%	kg/ ha	Ash	Ca	P	K	C	
Cassia	1.60	7111	69.51	4943	0.81	39.9	39.35	1.88	0.12	0.32	22.82	28.25
Ipomoea	1.50	6667	64.58	4305	0.82	35.1	41.50	1.49	0.15	0.29	24.07	29.49
Hyptis	1.70	7555	74.86	5656	0.76	42.9	43.00	1.75	0.15	0.44	24.94	32.90
Mix	1.65	7333	73.35	5379	0.75	40.3	43.30	1.84	0.10	0.32	25.11	33.50

Table 2: Nutrient content of *Trigonella* as influenced by various weed composts (Age of plant: 40 days)

Treatment	Fresh weight		Dry matter		Nitrogen		CP		RS	
	kg/ plot	kg/ha	%	kg/ ha	%	kg/ ha	%	kg/ ha	%	kg/ ha
CC	2.37	10533	14.45	1522	2.75	42.5	17.18	265.8	0.52	8.0
IC	2.50	11111	12.48	1387	2.42	32.7	15.10	204.5	0.57	7.8
HC	2.25	10000	12.10	1209	2.96	35.2	18.48	219.9	0.53	6.4
MC	2.23	9911	13.04	1292	2.81	36.1	17.57	225.5	0.43	5.6
NPK	2.00	8889	12.11	1077	2.60	28.0	16.27	175.0	0.36	3.8
CON	1.45	6444	12.58	811	2.25	17.7	14.06	110.6	0.33	2.7
SE	**0.15**	**678**		**102**		**3.5**		**21.6**		**1.0**
CD	**0.39**	**1742**		**262**		**8.9**		**55.5**		**2.5**

Table 3: Nutrient content of *Trigonella* as influenced by various weed composts (Age of plant: 40 days)

Treatment	%			
	Ash	Ca	P	K
CC	20.50	1.56	0.17	0.38
IC	20.68	1.30	0.19	0.39
HC	20.74	1.33	0.15	0.42
MC	18.69	1.22	0.14	0.34
NPK	17.24	1.23	0.12	0.32
CON	14.56	1.05	0.11	0.31

Weed composts are the best, active and cheapest source of plant nutrients. Instead of eradicating weeds with different physical, mechanical, biological methods or burning it, the practice of composting is the best way

Table 4: Percent increase over control of *Trigonella* vegetation (kg/ha)

Treatment	kg/ha				
	Fresh Veg.	Dry matter	Nitrogen	Crude Protein	Reducing Sugar
CC	63	88	140	140	163
IC	72	71	85	85	159
HC	55	49	99	99	111
MC	54	59	104	104	85
NPK	38	33	58	58	26
CON	0	0	0	0	0

Table 5: Nitrogen efficiency ratio of leafy vegetable *Trigonella*

Treatment	kg/ha				
	Input N	Increase over control		N efficiency ratio of	
		Fresh Veg.	Dry matter	Fresh Veg.	Dry matter
CC	39	4089	711	104	18
IC	35	4667	576	133	16
HC	43	3556	399	83	9
MC	38	3467	482	92	13
NPK	40	2444	266	61	7

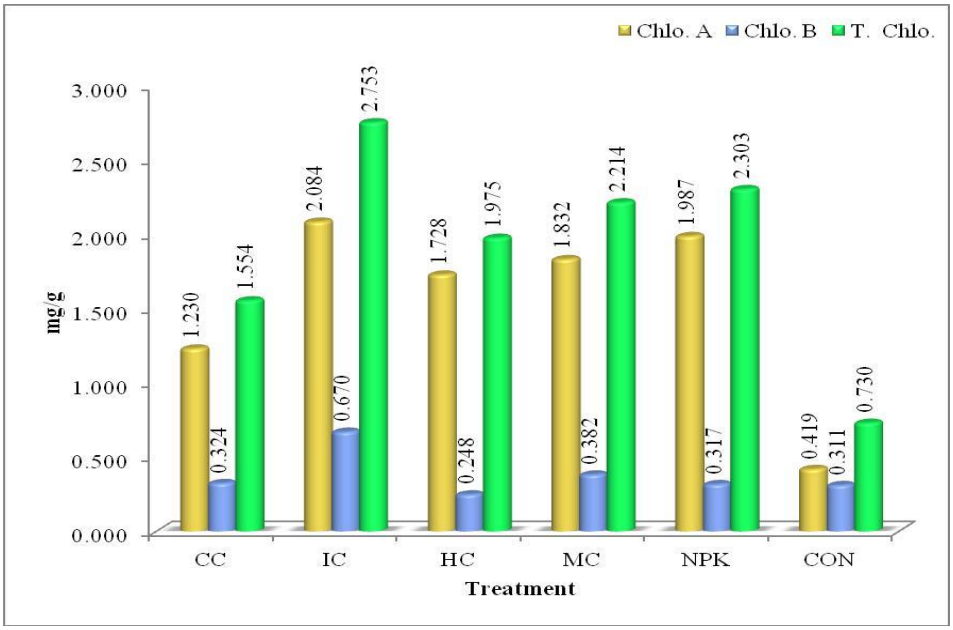
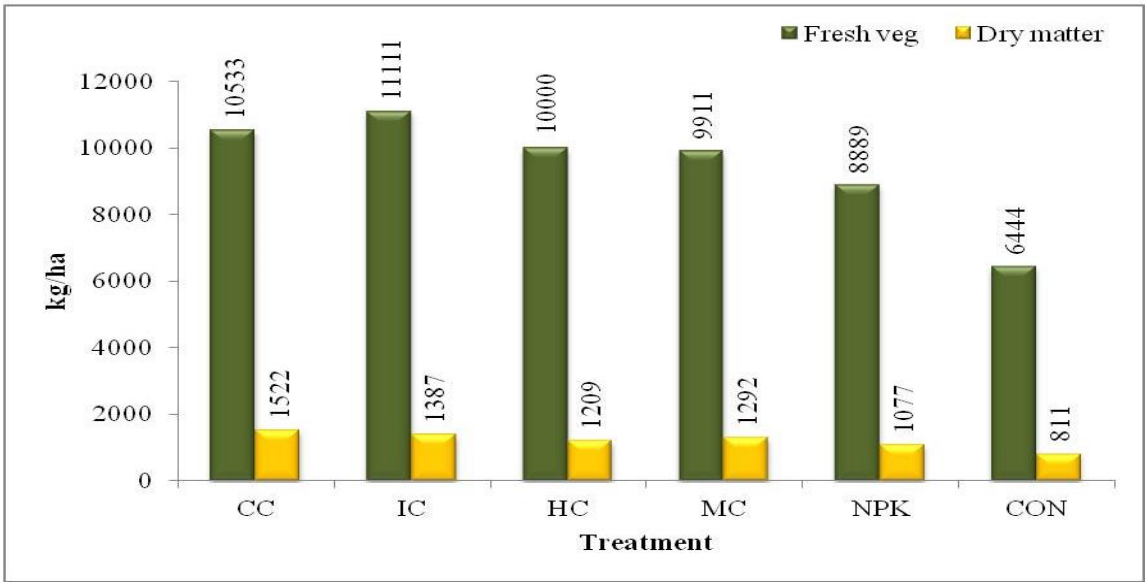


Fig.1 Leaf Chlorophyll content of *Trigonella* influenced by various weed composts (39 DAS)

Fig.2 Fresh and dry yield of the *Trigonella* tending by various weed composts (40 DAS)



of weed management which increases the soil fertility. Nitrogen efficiency was more in the organic amendments as compare to inorganic treatment. Hence it is concluded that the organic manures are the best source of nitrogen for the growth of the crop and soil fertility, thus decreasing the production cost of the crop.

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