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EFFECT OF WEED VERMICOMPOSTS ON MAIZE

***D. R. Chamle**
Department of Botany, Sharda Mahavidyalaya, Parbhani- 431401, (M. S.) India.

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ABSTRACT:
A field experiment was conducted in the research farm of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad to assess the performance of weed vermicomposts on yield and nutrient uptake of maize. The experimental design was a randomized block design (RBD) with six treatments and four replicates. The treatments were *Achyranthes* vermicompost (AV), *Cassia* vermicompost (CV), *Tephrosia* vermicompost (TV), mixed vermicompost (MV), fertilizer (FE) and control (CO). The fodder maize (cv. African Tall) was planted at the rate of 100 kg ha^{-1}. The fertilizers were supplied in the form of N, P_2O_5 and K_2O at the rate of 120:80:40 kg ha^{-1}. The observations were recorded on morph-physiological traits at 62 days after sowing (DAS). On the basis of results obtained, it is concluded that the combination of *Cassia* vermicompost (CV) and chemical fertilizers is ideal organic manure enhancing growth, nutrient uptake and productivity of maize crop as compared to all other treatments.

Keywords: *Achyranthes, Cassia, Tephrosia,* Vermicompost, Fertilizers, Maize.

***Corresponding Author:**
Dr. D. R. Chamle
Department of Botany,
Sharda Mahavidyalaya,
Parbhani- 431401, (M. S.) India.
Mob. +91 9422734327
Email: drchamle@gmail.com

INTRODUCTION

Approximately, India produces 3000 million ton of organic wastes annually[1, 2], which includes animal dung, urine, bone meals, slaughter house wastes, crop residues, weeds, oil cakes, urban garbage, sewage effluent etc. Much of these organic wastes remain unutilized, leaving enormous scope for development of organic manures through recycling. Utilization of these waste materials for productivity purposes is important[3] for both economical and environmental reasons[2].

Weeds are the plants, which grow in places where they are not wanted[4] (Shaw, 1956). They compete with crop plants for light, moisture, nutrients and thus reduce yield of main crops up to 20 to70 % [5, 6]. *Achyranthes aspera*, *Cassia tora, Tephrosia hamiltoni* etc. are the major invaded weeds[7]. Biomass of the weed is reported to have higher nutrient contents, which adds humus to soil on decomposition and degradation[8]. It not only supplies NPK to soil, but also sustains soil health enhances crop productivity and lead to sustainable agriculture. Several methods have been developed to convert agricultural wastes into organic manure[2] to replace inorganic fertilizers. But recently, interest has been shown in the development of ecofriendly novel processes, which are based upon the utilization of biological systems[9].

Vermicomposting is the newest and an appropriate biotechnological technique for the degradation or composting of organic wastes[10] aided by earthworms, resulting in a stable, non-toxic material with good structure (waste to wealth), which has a potentially high economic value as soil conditioner for the growth of the plants[11]. During this process, the important plant nutrients viz. nitrogen, potassium, phosphorus and calcium present in feed material are converted into forms that are much more soluble and available to plants than those in the parent compounds[12, 13]. In this investigation attempts were made to evaluate the efficiency of locally available weeds for the growth and nutrient uptake of maize.

MATERIALS AND METHODS

Weeds collection and vermicomposting: The fresh green foliages of Aghada (*Achyranthes aspera* L.), Tarwat (*Cassia tora* L.) and Unhali (*Tephrosia hamiltoni* Drumm.) were collected from Dr. Babasaheb Ambedkar Marathwada University campus and chopped into small pieces (2 - 3 cm). The same amount (13333 kg ha^{-1}) of weed vegetation was used separately and together (i.e. 1:1:1) for the preparation of vermicomposts. These materials were placed into pits to a height of 5 cm, sprinkled with 10 % cow dung slurry (1 kg dung in 10 L water) and soil alternately. This procedure was repeated until the composting materials were used. Finally, the trenches were sealed with dung-mud mixture to prevent loss of heat or moisture. After partial decomposition (25 days), first turning was given for uniform decomposition of the organic wastes. Then sufficient amount of water was sprinkled for maintaining 50 - 60 percent moisture and the exotic African night crawler variety *Eudrilus eugeniae* (70 - 75 individuals per pit) was released. Identification of earthworm was done by[14]. The vermicomposting was completed within 15 days and finally, completely decomposed fine, dark brown coloured granular materials were obtained which were used for field trials.

Experimental site, design and treatments: The field experiment was conducted in the research farm of University campus. The experimental design was a randomized block design (RBD) with six treatments and four replicates. The six treatments were (i) *Achyranthes* vermicompost (AV); (ii) *Cassia* vermicompost (CV); (iii) *Tephrosia* vermicompost (TV); (iv) Mixed vermicompost (MV); (v) Fertilizer (FE) and (vi) Control (CO). These treatments were applied to the appropriate plots along with mineral fertilizers and control plots. The samples (100 gm) of each amendment were randomly collected in duplicate before application to the plots for nutrients analyses. The results of vermicomposts are summarized in Table 1. The fodder maize (cv. African Tall) was planted at the seed rate of 100 kg ha^{-1}.

Applications of fertilizers

The fertilizers were applied in the form of N, P_2O_5 and K_2O at the rate of 120:80:40 kg ha^{-1}. Whole amount of P_2O_5 and K_2O was supplied as a basal dose to all the treatments except absolute CO at the time of sowing and N was applied in two equal doses at 42 and 75 days after sowing (DAS) to FE treatment only.

Growth analyses

The morph-physiological traits of the crop were noted at 62 days after sowing (DAS) as plant height, diameter, number of leaves per plant, fresh weight of root, stem, leaves and total weight, 4th upper leaf length, its width and weight and leaf area per plant was determined by gravimetric method[15, 16].

Crop harvesting

The crop was harvested during the early hours of the day at 10 - 20 % flowering stage. At the time of harvest, total yield of maize crop per plot was recorded[17].

Chemical analyses

Organic matter was estimated by rapid titration method[18]. Leaf chlorophyll contents were estimated[19]. The dry matter (DM) content was analyzed[20] and nitrogen (N) was estimated by micro-Kjeldahl method[21].

Statistical analysis

The results were statistically analyzed for analysis of variance (ANOVA) and treatment means were compared using the critical difference at $P \leq 0.05$[22].

Table. 1: C:N ratio of weed vermicomposts

Treatments	%			C:N
	Ash	OC	N	
AV	86.75	3.36	0.33	10.18
CV	84.12	4.56	0.45	10.13
TV	85.10	4.20	0.41	10.24
MV	85.55	4.20	0.41	10.24

OC= Organic carbon, N= Nitrogen

RESULTS AND DISCUSSION

Growth analyses

The growth analyses of maize crop were done at 62 DAS (Table 2). During the growth analyses, the tallest plant was observed with the fertilization of CV followed in order by AV, TV, MV and FE treatments over the CO plots. This trend was observed with respect to fresh weight of leaves, width of 4th upper leaf and leaf area. The diameter and 4th upper leaf length was more in CV treated plots then in the MV, AV, TV and less in CO than that of FE alone. The root weight was highest with the CV amendment followed by AV, MV, TV and FE applications and lowest in untreated plots. However, analogous results were obtained in respect of stem and total weight of plant where as fresh weight of 4th upper leaf was maximum for CV treatment then in TV and AV and minimum in FE than the MV application (Table 2).

Percent increase over CO and N efficiency ratio

The percent increase over CO for fresh weight was maximum in the plots treated with CV followed by AV, MV, TV treatments than the FE alone applied plots and almost similar trend was observed with respect to dry matter (Fig. 2). The highest nitrogen efficiency ratio for fresh vegetation was observed for AV amendment than in MV, CV, TV and lowest in FE treatment while in case of dry matter, it was more in AV followed in order by

CV, TV, MV and then in FE treatment where N was supplied through urea (Fig. 3).

All the results are calculated on dry matter basis and the values are the means of four replicates. These results are statistically significant over the control with the exceptions of leaf area in the FE treatment only.

The results of the present study indicate that the applications of weed vermicompost along with chemical fertilizers were found to be significantly higher growth and yield of maize as that of individual application of inorganic fertilizers. Application of weed vermicomposts enhances growth and quality of the crop was also reported[24].

Table 2. Growth analyses of maize plants

Treatments	Plant height (cm)	Diameter (cm)	No. of leaves (plant^{-1})	Fresh weight (g plant^{-1})				4th upper leaf			Leaf area (cm^2 plant^{-1})
				Root	Stem	Leaves	Total	Length (cm)	Width (cm)	Weight (g)	
AV	84.35	1.37	8.50	2.97	47.62	21.34	71.93	61.25	3.40	1.86	149.81
CV	86.55	1.67	8.50	3.68	58.16	29.81	91.66	65.45	3.77	2.74	174.07
TV	78.45	1.37	8.00	2.16	37.07	20.96	60.20	61.25	3.35	1.87	148.88
MV	73.20	1.43	7.75	2.70	37.13	20.92	60.75	62.37	3.17	1.60	135.55
FE	71.20	1.21	7.50	1.43	26.53	17.67	45.64	53.95	2.85	1.12	109.27^{ns}
CO	47.32	0.97	6.25	0.83	12.80	8.64	22.27	44.70	2.52	0.85	84.08
S.E.	5.27	0.08					8.76				12.00
C.D.	11.91	0.18					19.79				27.12

AV= *Achyranthes* vermicompost, CV= *Cassia* vermicompost, TV= *Tephrosia* vermicompost, MV= Mixed vermicompost, FE= Chemical fertilizers, CO= Control

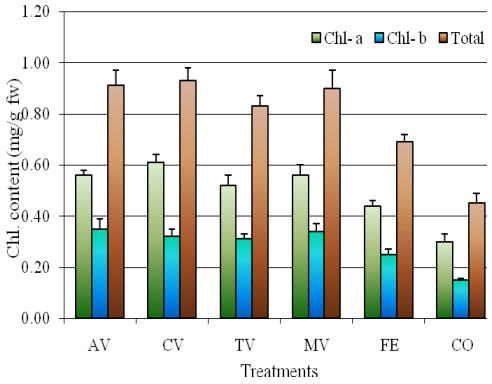

Fig.1. Leaf chlorophyll contents of maize as influenced by weed vermicomposts (n = 4 ± SE).

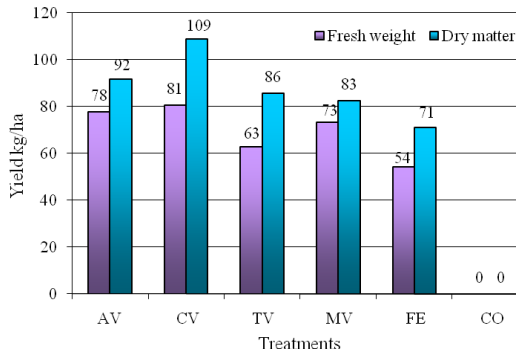

Fig. 2. Percent increase over control.

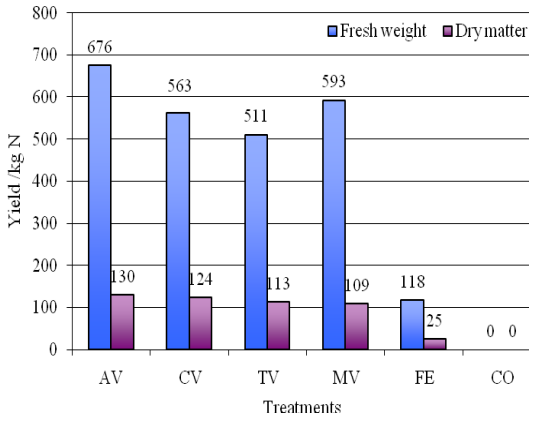

Fig. 3. Nitrogen efficiency ratio.

CONCLUSION

Based on the above results, it can be concluded that the combination of *Cassia* vermicompost (CV) and inorganic fertilizers is best organic manure enhancing growth and productivity of maize in comparison with all other treatments. There are no earlier reports on increased crop growth amended with these weed vermicomposts. However, the growth of plants amended with other vermicompost plus fertilizers are reported[25,26].

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