Indian Journal of Weed Science **45**(1): 55–57, 2013

Suitability of tough Asiatic grass for vermicomposting

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Received: 15 February 2012; Revised: 4 March 2013

ABSTRACT

A study was conducted at Vermiculture and Vermicomposting Centre of the University in 2009-10 on *Saccharum munja* as a feed material for the compost worm, *Eisenia foetida,* using three combinations with cattle dung. Impact of weed-dung combinations on the biomass of worms and their rate of reproduction was evaluated. Physico-chemical parameters of weed-dung combinations and vermicompost produced from these combinations were tested on the growth parameters of *Vigna radiata*. Fresh weed was chopped into 2 cm size, mixed with fresh cattle dung in 1:3, 1:1 and 3:1 combinations separately in rectangular plastic tub sized 43 x 32 x 14 cm in replicates of five. After pre-decomposition period of 15 days, 10 g matured *E. foetida* were introduced in each tub. It was found that worms fed upon 1: 3 (weed : dung) combination faster than other two combinations and transformed it earlier into vermicompost. Rate of reproduction of worms was recorded 2.47 times faster and total biomass of worms was 2.15 times more in 1 : 3 combinations than that of 3: 1. Application of vermicompost, transformed from 1:3 combination of weed: dung medium, with soil of known parameters in 1:1 combination showed an increase in the shoot length of *V. radiata* by 1.68 times compared to 3:1 combination.

Key words: Earthworm, *Eisenia foetida, Saccharum munja,* Vermicompost, Weed utilization

Tough Asiatic grass, *(Saccharum munja)* commonly known a 'munj' is a monocot perennial grass weed with a strong deep root system. It is fast spreading, weed found mostly in field bunds, roadsides, uncropped fields, river side and in low lying grounds. It reproduces rapidly, tillers profusely and develops barren conditions in the soil (Mandal and Pal 1997). In Rohilkhand region of Uttar Pradesh, India, it infests cropped and non-cropped areas both. The present paper synthesizes the use of *Saccharum munja* as a feed material for the worm, *Eisenia. fetida,* along with the cattle dung in three different combinations. Effect of these combinations on the growth and reproduction of worms was evaluated besides the effect of vermicompost on the growth of *Vigna radiata*.

MATERIALS AND METHODS

Weed was collected from the University campus area, chopped into small pieces of 2 cm. Pieces were mixed with cattle dung in three combinations of 1:3, 1:1 and 3:1, separately. Five rectangular plastic tubs (size 43 x 32 x 14 cm) were taken for each combination. In first five tubs, 4 kg mixed combination of 1:3 was filled in each; while in 2^{nd} and 3^{rd} sets, mixed combination of 1:1 and 3:1 were filled, respectively. All tubs were kept for pre-decomposition process for a fortnight. Moisture was maintained by sprinkling 250 ml tap water/tub regularly. Ten g matured (clitellates) earthworms, *Eisenia foetida* were introduced into each tub. After vermicomposting, the worms were sorted out from vermicompost and their biomass was taken by electronic balance (Afcoset ER-182A) and rate of reproduction was calculated as per Chaudhuri *et al*. (2001).

Physico-chemical parameters of different combinations and transformed vermicompost were analyzed. Moisture content (MC), water holding capacity (WHC) and bulk density (BD) as per Saxena (1994) and pH by Systronics pH meter (MK VI), organic matter and carbon by Walkley and Black method (1947), nitrogen by Kjeldhal method, phosphorus and potassium by Dass and Jadhav (2004). Estimation of micronutrients was carried out by atomic absorption spectrophotometer (Spectra A 220 model, VARIAN, Australia) (Srinivasa Murthy *et. al.* 1999). Experiment was conducted during winter months at room temperature 20-22^{0}C.

Effect of vermicompost was evaluated by mixing them separately with the soil of known parameters in the ratios of 1:3, 1:1 and 3:1 on the shoot length of *V. radiata*. Earthen pots having surface diameter of 11 cm were used in replicates of eight along with control. Three healthy seeds were sown in each pot at the depth of 1 cm. Moisture of each pot was maintained by sprinkling 100 ml of

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tap water every day. The shoot length of grown plants was measured after 40 days and the data was compared with the plants grown in the plane soil.

RESULTS AND DISCUSSION

It was found that feeding ability of earthworms was different in different combinations of weed and dung. It was more in 1:3 weed-dung combinations and least in 3:1. Increase in total biomass of worms was 4.75 and 2.25 times in 1:3 and 3:1 combinations, respectively with their initial values indicating worm's preferential feeding pattern. However, initial biomass of clitellate worms was slightly decreased in 1:3 and 3:1 combinations during and after the process of vermicomposting, while non-clitellates were developed 4 times more in 1:3 combination and 1.5 times only in 3:1 from the initial weight of clitellates. The total biomass of worms and rate of reproduction were also recorded maximum in 1:3 and minimum in 3:1 combinations. This difference was 2.17 times. It may also be noted that total gain in worm's biomass was 2.16 times in 1:3 than that of 3:1 weed-dung combination from the initial and the rate of reproduction was 2.47 times faster in 1:3 than that of 3:1 combinations (Table-1).

The transformed vermicompost was found to have reduced level of moisture, pH, organic matter, carbon and C/N ratio and increased level of N, P, K, Zn, Fe, Cu and Mn than the initial weed-dung combinations. Decreasing and increasing pattern of different parameters was recorded more in 1:3 combinations than that of other two combinations (Table 2). Such decrease in moisture content was in the range of 1.07 -1.17 times in different experimental combinations than that of their respective controls. Higher values of per cent moisture content in the experimental control media might be due to absence of worms.

It was also noted that worm's reduced the pH of weed-dung combination. Singh *et al.* (2010) reported that the level of such reduction in pH was less when plant waste was used. In weed-dung combinations, the maximum reduction in pH was from 1.08-1.17 in the experimental media with respect to experimental controls. The weed-dung combinations always had higher level of pH

Table 1. Biomass of worms, *Eisenia foetida* after vermicomposting of *Saccharum munja*

Weed-dung combinations	Clitellates (g) (A)	Non-clitellates (g) (B)	Total biomass of worms (g) (A+B)	Rate of reproduction (young/worm/week)
1:3	7.85 ± 0.40	39.69 ± 0.42	47.54 ± 1.3	2.3 ± 0.02
1:1	10.1 ± 0.37	25.53 ± 0.48	35.63 ± 1.3	1.3 ± 0.11
3:1	7.20 ± 0.53	15.34 ± 0.35	22.54 ± 1.4	0.93 ± 0.21

Table 2. Physico-chemical parameters of *Saccharum munja* before and after vermicomposting

Initial parameters of weed-dung combinations			Parameter	Experimental media (with worms)			Experimental control media (without worms)		
1:3	1:1	3:1		1:3	1:1	3:1	1:3	1:1	3:1
79.3±0.14	89.2±0.11	83.3±0.13	% MC	44.9±0.14	58.0±0.27	61.5±0.42	50.0±0.16	53.9±0.33	56.8±0.23
8.67±0.23	8.90±0.67	9.19±0.34	pH	7.01±0.77	7.54±0.52	7.64±0.26	8.25±0.55	8.72±0.61	8.78±0.29
27.91±0.33	19.47±0.66	11.87±0.87	% OM	9.75±0.15	8.33±0.22	6.08±0.28	25.9±0.42	17.1±0.61	11.4±0.08
16.22±0.23	11.29±0.84	6.90±0.60	% C	5.65±0.87	4.83±0.71	3.52±0.16	15.06±0.26	9.96±0.66	6.65±0.00
2.0±0.14	1.8±0.00	1.4±0.66	% N	3.3±0.17	3.0±0.77	2.0±0.77	2.2±0.60	2.1±0.15	2.0±0.77
8.11±0.72	6.27±0.53	4.92±0.19	C/N	2.95±0.61	2.77±0.16	3.04±0.13	6.84±0.14	4.75±0.62	3.33±0.28
0.14±0.02	0.10±0.05	0.09±0.01	% P	0.31±0.02	0.20±0.01	0.20±0.07	0.20±0.02	0.16±0.01	0.12±0.02
1.31±0.61	1.14±0.02	1.03±0.71	% K	2.03±0.13	1.71±0.27	1.29±0.18	1.68±0.41	1.49±0.15	1.21±0.60
1.02±0.77	1.16±0.77	0.92±0.77	Zn (ppm)	2.02±0.11	1.81±0.10	0.98±0.01	1.10±0.41	1.33±0.15	1.17±0.13
26.91±0.44	25.93±0.11	21.12±0.31	Fe (ppm)	28.92±0.22	28.08±0.34	28.18±0.44	24.87±0.67	27.04±0.77	21.53±0.73
0.25±0.01	0.09±0.01	0.14±0.01	Cu (ppm)	0.38±0.03	0.33±0.02	0.30±0.01	0.26±0.04	0.24±0.06	0.18±0.01
4.03±0.11	3.23±0.35	1.02±0.02	Mn (ppm)	4.26±0.75	3.23±0.22	3.18±0.21	3.88±0.25	4.09±0.57	2.92±0.25

than that of the plant waste media. Zhenjun (1995) has also reported higher level of such reduction in pH in weed media than the plant wastes.

The level of macro and micro nutrients was found increased in vermicompost then the control. The maximum increase in the level of nitrogen was 1.50 times when weed was taken with cattle dung in 1:3 combinations. More difference in nitrogen level in 1:3 combinations with respect to their experimental controls might be due to lignified foliage of weed, that would not be decomposed easily in experimental controls-devoid of worms, than that of those with worms. In contrast, the C/N ratio of feeding material gets reduced more in 3:1 weed-dung combinations than that of other two. Increase in phosphorus level was 2.14 times higher in 3:1 experimental media than control. This value was 1.66 times in 3:1 media and 1.55 times in 1:3 media. Increase in the amount of potassium was more in 1:3 combinations. The level of increase of potassium in the vermicompost prepared from different weed-dung combinations had different values. Sannigrahi and Chakravarthi (2002) have reported that vermicompost transformed from crop residues had nearly 0.6-1.5% potassium; while it was slightly more (0.7-1.9%) in the vermicompost prepared from this weed. The level of Cu was recorded more in all the vermicompost than that of their respective controls.

It was recorded that the growing medium having vermicompost, which was transformed from 1:3 combination, and soil in the ratio of 1:1 was best suited medium for the shoot length of the experimental plants than that of other media and least when vermicompost transformed from 3:1 weed-dung combination (Table 3). Although further studies are required to know the influence pattern of vermicompost and variations in shoot elongation of experimental plants. Tomati *et al.* (1995) have mentioned that the earthworm casts and vermicompost influenced the development of the plants and promoted stem elongation, root initiation and root biomass which suggest the linkage between biological effects of vermicompost and microbial metabolites that influence the plant growth and development. Das *et al.* (2002) have mentioned the effect of integrated application of vermicompost and chemical fertilizer on growth and yield of paddy crop in red soil of south eastern Ghat zone of Orissa. They have noticed that vermicompost integrated treatment have better influence than FYM integrated treatment at all the level of chemical fertilizer dose. These studies showed that transformation of such weed into vermicompost could certainly help in preventing barren conditions of the soil on one side and improving its health on the other.

Table 3. Effect of transformed vermicompost from *Saccharum munja* on the shoot length (cm) of *V. radiata* after 40 DAS

VC: soil media	Vermicompost transformed from weed-dung combination		
	1:3	1:1	3:1
1:3	24.2 ± 0.33	18.6 ± 0.32	21.9 ± 0.68
1:1	26.0 ± 0.95	23.8 ± 0.08	21.3 ± 0.01
3:1	22.1 ± 0.40	22.3 ± 0.23	15.5 ± 0.05
Plane soil		19.4 ± 0.25	

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