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Composting *Limnocharis flava* Buchenau : A Comparative Analysis

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ABSTRACT

Limnocharis flava (L.) Buchenau is fast achieving the status of an invasive weed in the sandy loam soils of Onattukara, Kerala, India. There is high prospect for composting *Limnocharis* due to its nutrient recycling compared to the normal weed management through herbicides. The present study was undertaken with a view of recycling *Limnocharis flava* using various composting methods during November 2020 to January 2021 at Onattukara Regional Agricultural Research Station, Kayamkulam, Kerala. The treatments were T_1- normal composting, T_2 - vermi-composting, T_3 - composting using KAU inoculum and T_4 - composting using enriched *Pleurotus florida*. The design used was CRD and was replicated five times. The results revealed that all the composting methods tried had converted *Limnocharis flava* to quality compost. The highest recovery percentage was registered for vermi composting. The highest N, Ca and Fe contents were found to be in composts from *Pleurotus florida* (T_4) but the highest BC ratio was recorded for vermi composting (T_2). Hence, for commercial use, *Limnocharis flava* can be profitably converted to vermi-compost.

Key Words: Compost, Economics, *Limnocharis*, Nutrient uptake, Vermicompost.

INTRODUCTION

Water cabbage or Yellow bur-head, *Limnocharis flava* (L.) Buchenau is a weed which is fast achieving the status of an invasive weed in the sandy loam soils of Onattukara, Kerala, India. *Limnocharis flava* belongs to the family of Alismataceae. It is a native of tropical and sub-tropical America (Chandran and Ramasamy, 2015) and found to be invading swamps, shallow ditches and rice wetlands in Kerala. *Limnocharis flava* clogs irrigation channels, water drainages and wet lands making the area unsuited for cultivation. The weed is mainly propagated by seeds and a single plant is capable of producing 10,00,000 seeds every year. The weed can also propagate vegetatively. Since it flowers throughout the year, the seeds are easily dispersed through birds, animals and even by farm machineries. Hence eradicating the weeds prior to flowering is much necessary. The weed can be easily uprooted by hand and is the most effective method of weed eradication. But this is a very labour intensive and cost incurring process.

Onattukara sandy tract covers an area of over 71,000 ha extending from the sandy tracts of Alappuzha to Kollam and Pathanamthitta districts in Kerala. The main cropping system followed here is rice-rice-sesame. *Limnocharis flava* is now taking hold of the wetlands in this region (plate 1). The weed can effectively be managed by application of herbicides like 2,4-D (Nishan, 2012) or Glyphosate depending on the crop stand, but as the weed contains a large amount of nutrients, using herbicides will only result in the loss of these nutrients. The nutrients present in this weed can be recycled by composting. Water cabbage is ideal for composting (Anushma, 2014). Hence the present study was undertaken with a view of recycling *Limnocharis flava* using various composting methods.

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MATERIALS AND METHODS

A trial was carried out during November 2020 to January 2021 at Onattukara Regional Agricultural Research Station, Kayamkulam, Kerala with a view of utilizing the weed *Limnocharis flava* by composting. *Limnocharis flava* was collected and composted using different composting techniques. The treatments were T_1- normal composting, T_2 - vermi-composting, T_3 - composting using KAU inoculum, T_4 - composting using enriched *Pleurotus florida*. The design used was completely randomised design (CRD) and replicated five times. In normal composting, the weed biomass and cow dung were placed in layers. For vermi-composting, the weed biomass was mixed with cow dung in 8:1 ratio (on weight basis). Earth worms (*Eudrillus euginiae*) were introduced after 10d, after the completion of the thermophilic stage. In T_3 (composting using KAU inoculum), composting inoculum developed from the Department of Microbiology, College of Agriculture, Vellayani, Kerala was used. For every kilogram of the weed biomass, 10g inoculum on weight basis was used for composting and was filled in layers. In T_4, *Pleurotus florida* was used for composting the weed biomass and was enriched with urea (10 g). A layer of the weed was followed by a layer of *Pleurotus* and again by a layer of the weed followed by a layer of urea. This was repeated till the pots were filled up. Chopped pieces of coconut husks were placed before subjecting the pots to treatments to ensure proper drainage of excess moisture. Adequate moisture was given by watering at regular intervals. Turning was given at regular intervals to provide aeration. Days for compost maturity was recorded from the physical appearance of the compost. The recovery percentage was worked out to find the quantity of compost produced from biomass used and was measured by the formula,

$$\text{Recovery (\%)} = \frac{\text{Weight of compost}}{\text{Initial weight of biomass}} \times 100$$

Standard procedures were done for laboratory analysis. Nitrogen content was found out using the modified microkjeldahl method. Phosphorus, sulphur and boron was recorded using spectrophotometer. Potassium content in the compost was recorded using flame photometer. Atomic absorption spectrophotometer was used to record calcium, magnesium, iron, manganese, zinc and copper.

Plate 1. *Limnocharis flava* dominance at ORARS, Kayamkulam, Kerala

RESULTS AND DISCUSSION

The results revealed that all the composting methods converted *Limnocharis flava* to compost. The compost recovery was found to be the highest for vermi composting (T_2) with 12.47% followed by KAU inoculum composting (T_3) with 8.93% (Table 1). The population of earthworms after the trial in the treatment T_2 was found to be low. This was in accordance with the findings of Nishan and George (2014) who has also reported low earthworm population after the experiment. The lowest recovery (7.07%) was obtained for T_4 (composting using enriched *Pleurotus florida*) even though the time taken for compost was the lowest (60d) among all the treatments. The longest time taken for composting was recorded for the treatment T_1 (normal composting) with 70 d. Vermi composting (T_2) had taken 67 d for formation of compost. This is in confirmation with the studies of Bhat *et al* (2017) who had reported that vermicomposting accelerates the bioconversion process as compared to traditional composting. The colour of the composts produced were promising and of different colours (plate 2). Composts produced from normal composting and vermi-composting were black in colour whereas compost produced by using enriched *Pleurotus florida* had a brownish black colour. The compost produced using KAU inoculum was greyish black. This colour difference might be due to talc which is used for producing KAU inoculum.

Table 1. Effect of types of composting on recovery and days for composting.

Treatment	Recovery (%)	Days for composting
T_1- Normal composting	7.93	70
T_2- Vermi-composting	12.47	67
T_3 - Composting using KAU inoculum	8.93	64
T_4 - Composting using enriched *Pleurotus florida*	7.07	60

Plate 2. Composts prepared from different composting methods

Table 2 depict the effects of types of composting on the content of primary and secondary nutrients in compost from *Limnocharis flava*. Composting methods produced significant results for nitrogen. The highest nitrogen content (1.63%) was registered for T_4 (composting using *Pleurotus florida* which was followed by T_2 (vermi-composting) with 1.15 per cent. This increase in nitrogen may be due to the application of urea in T_4. Even though, the results were non-significant, the highest phosphorus was recorded for T_4 (0.19) followed by t_3 with 0.14 per cent. Highest potassium content was registered for the treatment T_1 (1.75%). But the treatments were not found to be significant. Among the secondary nutrients, highest calcium content was registered for T_1 with 0.55 per cent, but was found to be on a par with T_4 (0.54%). The highest magnesium content was registered by the treatment T_3 (0.032%). This may be due to the activity of various micro-organisms present in the KAU inoculum. Sulphur content was found to be more for vermi compost even though the result was not significant.

The highest iron content was recorded from T_4 with 10.06 mg/ kg but was found to be on a par with normal composting (T_2 - 8.99 mg/ kg). Zinc was found to be significantly higher for vermi-composting (T_2 - 1.78 mg/ kg) and was found to be at par with T_1 (1.73 mg/ kg). Even though copper and boron contents were found to be higher for T_2 (vermi-composting with 0.93 mg/ kg and 15.02 mg/ kg respectively), the effects were not found to be significant.

A detailed analysis of the cost of production (Table 4) revealed that the highest cost (₹ 3583/-) incurred for production of compost from one ton of *Limnocharis flava* was by composting using *Pleurotus florida* (T_4). This high cost of production might be due to the cost of *Pleurotus*, and urea that was used for enrichment. Normal composting (T_1) registered the lowest cost (₹ 1916/-) as the inputs needed for composting is less. The highest gross return was obtained for T_3- composting using KAU inoculum with ₹ 3126/-. Since the cost of production was more in T_3, the benefit cost ratio (BCR) was only 1.25. The treatment T_2 (vermi composting) registered the highest BCR with 1.53. The gross returns were also found to be ₹ 3115/-. The lowest BC ratio was recorded for T_4 (composting using enriched *Pleurotus florida*) with 0.69 which may be due to the low recovery percentage and higher cost of production.

Table 2. Effect of types of composting on primary and secondary nutrient status of compost from *Limnocharis flava*.

Treatment	N	P	K	Ca	Mg	S
T_1- Normal composting	0.2	0.11	1.75	0.55	0.028	0.0062
T_2- Vermi-composting	1.15	0.11	1.45	0.08	0.028	0.0076
T_3 - Composting using KAU inoculum	0.35	0.14	1.45	0.39	0.032	0.0074
T_4 - Composting using enriched *Pleurotus florida*	1.63	0.19	1.47	0.54	0.027	0.009
CD (0.05)	0.192	NS	NS	0.095	0.003	NS

NS- Not significant

Table 3. Effect of types of composting on micronutrient content of compost from *Limnocharis flava*, mg/ kg.

Treatment	Fe	Mn	Zn	Cu	B
T_1- Normal composting	8.99	2.16	1.73	0.8	14.85
T_2- Vermi-composting	6.42	1.7	1.78	0.93	15.02
T_3 - Composting using KAU inoculum	8.62	1.33	1.06	0.51	14.36
T_4 - Composting using enriched *Pleurotus florida*	10.06	1.71	1.08	0.67	14.78
CD (0.05)	2.33	NS	0.51	NS	NS

NS- Not significant

Table 4. Cost of production of different composts from one ton of *Limnocharis flava*.

Treatment	Cost of production (₹)	Gross returns (₹)	BC ratio
T_1- normal composting	1916.67	2776.55	1.45
T_2- vermi-composting	2033.33	3115.00	1.53
T_3 - composting using KAU inoculum	2500.00	3126.55	1.25
T_4 - composting using enriched *Pleurotus florida*	3583.33	2473.10	0.69

CONCLUSION

All the composting measures tried had converted *Limnocharis flava* to compost. The highest recovery percentage was registered for vermi composting. Highest N, Ca and Fe contents were found to be in T_4- composting using *Pleurotus florida*. The highest BC ratio was recorded for vermi composting (T_2). Hence, for commercial use, *Limnocharis flava* can be profitably converted to vermi-compost.

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