

Original Research Article

RESIDUAL EFFECT OF VARIOUS TYPES VERMICOMPOSTS ON GROWTH AND YIELD OF GREENGRAM (*Vigna radiata*) IN RICE-PULSES CROPPING SYSTEM

ABSTRACT

Aim: To study the residual effect of various organic wastes based vermicomposts on growth and yield of Greengram (*Vigna radiata*) in Rice-Pulses cropping system.

Methodology: Vermicomposts were prepared using different wastes materials and the two earthworm species and applied to the rice crop. The experiment was conducted by using randomized complete block design (RBD) with above mentioned 11 treatments and replicated thrice. After harvest of rice, greengram was raised as residual crop. The earthworm *Eudrillus eugeniae* species with organic wastes such as paddy straw (T₁), coconut wastes (T₂), vegetable wastes (T₃), farm wastes (T₄) and FYM (T₅) and *Eisenia foetida* was released the wastes like paddy straw (T₆), coconut wastes (T₇), vegetable wastes (T₈), farm wastes (T₉) and FYM (T₁₀) and absolute control (T₁₁).

Results: The result indicated that there was a residual effect of vermicompost in the greengram crop after rice. The residual effect in the treatment T₂ (*Eudrillus eugeniae* along with Coconut wastes) found superior on growth parameters of greengram viz., plant height, DMP and number of pods plant⁻¹ and on seed and haulm yields than all other treatments. This was followed by the treatment T₇ (*Eisenia foetida* + Coconut wastes). The least effect was found in Absolute control (T₁₁).

Conclusion: Among the organic wastes used for vermicompost with two different species, the coconut wastes produced by using *Eudrillus eugeniae* have more residual nutrients and had positive influence on growth and yield of greengram crop than the other residues and earthworm species.

Keywords: Vermicompost, rice, residual effect, greengram, growth and yield.

INTRODUCTION

Vermicompost is an utilizable organic source which is efficiently used by the plants due to its mucous coating in vermicast and slow release of the nutrients. India is having large potential for manurial sources like crop wastes, animal wastes, agro-industrial wastes and municipality wastes. Crop wastes have the most potential for recycling and have the highest nutritional availability of all of these sources. Vermicompost offers a good solution to tones of organic agro wastes that are being burnt by the farmers which can be easily recycled and reused in more efficient, economical and environmental friendly manner to increase agricultural production (Borang *et al.*, 2016). Vermicompost has a variety of micro sites for nutrient retention and exchange, as well as microbial activity (Shi-Wei and Fu-Zhen, 1991). Vermicompost progressively released nutrients into the soil (Chaoui *et al.*, 2003), hence it has the residual effect on the succeeding plant (Nurhidayati *et al.*, 2018). It also improves the nutritional balance of soil and ensures long-term viability.

Rice-pulses cropping system is the most grown and preferred system in the Southern India. The inclusion of pulses in the rice cropping system have enhanced the soil mineral nitrogen which otherwise be lost in flooded rice system (Singh, 1984). The cropping sequence of rice-legumes is viable, economically feasible and sustains the soil fertility, as the legumes have the capability to fix the atmospheric nitrogen and profusely make use of the nutrients present in the soil.

Residual effect of nutrients may be more pronounced for organic sources of nutrients applied to the preceding crop, benefiting the succeeding crop to a greater extent (Hegde, 1998). In, India, greengram finds a place in almost all the rice based cropping systems of various regions. Generally rice fallow pulses are grown by utilizing the nutrients applied to rice crop. Since, pulses are grown as a residual crop to utilise the residual available nutrients and moisture, the study on the residual effect of fertilization to rice crops, in rice-pulse cropping system assumes significance. Though there are many reports in inorganic residual effects, under organic nutrient system especially with vermicompost, the information is scanty. Hence, the present study was made.

MATERIALS AND METHODS

The experiment was conducted at the Wetland farms, Tamil Nadu Agricultural University, Coimbatore during the year 2021. The texture of the soil was clay loam and the nutrient status of the soil was low in nitrogen, medium in phosphorus and high in potassium. The experimental design used in the field was randomized complete block design with 11 treatments and three replications. The treatment details followed were T₁ – *Eudrillus eugeniae* + paddy straw, T₂ - *Eudrillus eugeniae* + coconut wastes, T₃ - *Eudrillus eugeniae* + vegetable wastes, T₄- *Eudrillus eugeniae* + farm wastes, T₅ - *Eudrillus eugeniae* + FYM, T₆ – *Eisenia foetida* + paddy straw, T₇- *Eisenia foetida* + coconut wastes, T₈ – *Eisenia foetida* + vegetable wastes, T₉ – *Eisenia foetida* + farm wastes, T₁₀ – *Eisenia foetida* + FYM and T₁₁ - Absolute control (without application of vermicompost). Plot size used was 8 m x 3 m. The experiment was carried out after the harvest of the rice crop. Vermicomposts were applied to the preceding rice crop and the succeeding greengram used the residual nutrients. The field was left undisturbed after the harvest of rice. The rice stalks were cut by using bush cutter and the irrigation channels were cleaned before sowing of the greengram crop. The greengram variety grown was CO (GG) 8 with the duration of 60 days. The seeds were sown at the spacing of 30cm x 10cm in between the rows of rice stalks in each plot. The other cultivation practices were followed as per the CPG (2020).

Observations recorded

The observations were made by selecting five plants randomly from each net plot. The plant height at harvest stage was measured from the tagged plants of each plot from the ground level to the tip of the last opened leaf. For drymatter production, five plants were collected randomly at harvest stage from the sample rows of each plot. The collected plants were cleaned, air dried and then oven dried at 65±5° C till a constant weight was obtained. The weight was measured and expressed in kg ha⁻¹.

Number of pods was counted from the five tagged plants of each net plot. Seed yield was determined by harvesting the pods separately from each plot and threshed manually. The seeds were further cleaned, dried to 12 per cent moisture level and then weighed and expressed in kg ha⁻¹. The haulm yield after separating the pods from the plants were weighed and expressed in kg ha⁻¹.

Statistical analysis

The observed data were statistically analyzed for randomized complete block design given by Gomez and Gomez (2010). The critical difference was worked out at five per cent probability level.

RESULTS AND DISCUSSION

Plant height

The residual nutrients from the various organic wastes vermicompost had positive impact on plant height of the succeeding greengram crop in all the treatments (Table 1). Taller plants were observed in coconut wastes decomposed by using the worms of *Eudrillus eugeniae* (T₂) and this was followed by the treatment *Eisenia foetida* used in coconut wastes decomposition (T₇). The least plant height was observed in the absolute control (T₁₁). Higher availability of residual nutrients in coconut leaf based vermicompost applied to the preceding crop which slowly released the nutrients and changed the soil environment that might have supplied to the succeeding crops. Similar findings were also observed by Ahmad (2017) and Dash *et al.* (2017).

Drymatter production (DMP)

Various organic substrates based vermicompost applied to the preceding rice crop influenced the drymatter production of succeeding greengram (Table 1). Significantly higher drymatter accumulation was obtained with the treatment *Eudrillus eugeniae* + coconut wastes (T₂) compared to the other treatments. This was followed by the treatment *Eisenia foetida* + coconut wastes (T₇). Application of the coconut leaf based vermicompost increased the nutrient uptake, improved the soil physical and biological properties and beneficial growth promoting substances which might be led to the increase of drymatter accumulation. This was in line with the findings of Jeyabal and Kuppaswamy (2001) and Balasubramanian *et al.* (2016). The minimum drymatter production was noticed in the treatment Absolute control (T₁₁).

Number of pods plant⁻¹

The yield component of the crop greengram was statistically analyzed and found impact of residual nutrient on number of pods plant⁻¹ of the crop in all the treatments. Among the other treatment, the treatment *Eudrillus eugeniae* + coconut wastes (T₂) produced more number of pods plant⁻¹ and superior over the other. This was followed with the treatment *Eisenia foetida* + coconut wastes (T₇). Higher number of pods obtained might be due to the buildup of the soil fertility and increase in the microbial population due to the application of the coir based vermicompost and increase in drymatter

accumulation leads to higher yield attributes. Similar results were also found by Rajkhowa *et al.* (2017) and Lakum *et al.* (2020). The least number of pods plant⁻¹ was observed in Absolute control (T₁₁) which was not applied with any manure for both the crops.

Seed and Haulm yield

The residual effect of the applied vermicompost to the rice crop has greatly influenced the seed and haulm yields of the succeeding crop greengram. The yield data were statistically analyzed and depicted in the Table 1. The treatment *Eudrillus eugeniae* + coconut wastes (T₂) was observed to produce higher seed yield, which was followed by the treatment *Eisenia foetida* + coconut wastes (T₇) compared to the other treatments. The seed yield was increased by 51.78 % over control. The treatment *Eudrillus eugeniae* along with the organic residue coconut wastes performed better due to the improvement in the yield components, prolonged availability of nutrients and improved physical and biological activity of the soil. This was in line with the findings of Nurhidayati *et al.* (2018) and Thiagarajan and Somasundaram (2019). The haulm yield was also observed greater with the treatment *Eudrillus eugeniae* + coconut wastes (T₂). There was 45.40 % increase in the haulm yield with the treatment *Eudrillus eugeniae* + coconut wastes (T₂) over the treatment absolute control (T₁₁). This might be due to increased drymatter production and greater availability of residual soil nutrients. This was similar to the findings of Bejbaruha *et al.* (2009). Lower haulm yield was observed with treatment absolute control (T₁₁).

Conclusion

It can be inferred that the application of vermicompost in the rice field has great impact on the succeeding greengram by efficiently using the residual nutrients. Among those, the vermicompost prepared from earthworm species *Eudrillus eugeniae* with the coconut wastes applied to the rice has enhanced the growth and yield of the succeeding greengram.

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Table 1. Residual effect of various vermicompost on the growth, yield components and yield of greengram

Treatments	Plant height (cm)	Drymatter Production (kg ha ⁻¹)	Number of Pods plant ⁻¹	Seed yield ha ⁻¹)	Haulm yield ha ⁻¹)
T ₁ - <i>Eudrillus eugeniae</i> + Paddy straw	46.85	2674	23.96	483	1623
T ₂ - <i>Eudrillus eugeniae</i> + Coconut wastes	55.14	3245	36.89	589	2066
T ₃ - <i>Eudrillus eugeniae</i> + Vegetable wastes	41.98	2387	19.05	399	1440
T ₄ - <i>Eudrillus eugeniae</i> + Farm wastes	38.04	2225	15.07	328	1312
T ₅ - <i>Eudrillus eugeniae</i> + FYM	45.32	2512	22.25	456	1568
T ₆ - <i>Eisenia foetida</i> + Paddy straw	43.12	2435	21.49	429	1510
T ₇ - <i>Eisenia foetida</i> + Coconut wastes	51.15	3016	30.93	542	1901
T ₈ - <i>Eisenia foetida</i> + Vegetable wastes	39.12	2309	18.19	367	1385
T ₉ - <i>Eisenia foetida</i> + Farm wastes	36.17	2144	14.11	311	1250
T ₁₀ - <i>Eisenia foetida</i> + FYM	47.74	2795	26.14	501	1774
T ₁₁ - Absolute control	31.67	1965	11.16	284	1128
S.Ed	1.69	95	1.37	17	59
CD (p=0.05)	3.44	193	2.89	34	120