
**EFFECT OF DIFFERENT COMBINATIONS OF FEED MATERIALS
ON GROWTH AND DEVELOPMENT OF EARTHWORM
*EUTYPHOEUS WALTONI***

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ABSTRACT: The effect of various animal agro and kitchen wastes on the growth and development of an earthworm *Eutyphoeus waltoni* was studied under identical laboratory condition. There was observed significant growth and development of earthworm among combination of buffalo dung with agro and kitchen wastes. Maximum number of earthworm was observed in buffalo dung with gram bran. Highest significant growth was observed in gram bran with cattle dung. Whereas, the maximum significant gain in weight and length attained in combination of gram bran with buffalo dung. Therefore, buffalo dung in combination with gram bran was very potent to be used for growth and development of earthworm *Eutyphoeus waltoni* when it combined with gram bran.

KEYWORDS: Animal dung, Development, *Eutyphoeus waltoni*, Growth, Wastes.

INTRODUCTION

Excessive use of chemical fertilizers makes the soil infertile and reduces productivity. Generation of organic agro-wastes has increased at an unprecedented rate around the globe, because of increased food grain production to feed the population, leading to disposal problems⁹. India produces around 3000 MT (million tonnes) of organic waste annually² and according to conservative estimates, around 600-700 MT of agricultural wastes (including 272 MT of crop residues) is available in India every year, but most of it is unutilized^{1,21} for sustainable practices. In India the livestock dung are produced annually millions of tons as the rate of buffalo dung 12.20 kg animal⁻¹ day⁻¹, cow dung 11.6 kg animal⁻¹ day⁻¹ and goat dung 0.70 kg animal⁻¹ day⁻¹ ⁷. Earthworms are one of the major soil macro

invertebrates and are known for their contributions to soil formation and turnover with their widespread global distribution¹⁵. Vermicomposting is one of the most important tools in the campaign to recycle agricultural wastes as biofertilizers¹⁸. The US geological survey found that the increase in in-stream loads of nitrogen and phosphorus was strongly correlated with increased animal concentrations. Organic wastes can be ingested by earthworms and egested as a peat-like material termed as vermicompost.

Different combinations of cattle dung (sheep, horse, goat, buffalo) with agro-wastes (vegetable waste, wheat bran, rice bran, gram bran, barley bran, straw) have been used as an effective tool for vermicomposting¹⁸. Addition of vermicompost enhances the soil fertility as

changes physical and chemical properties of soil¹⁶. The growth and reproduction of the earthworm are significantly affected by various factors such as waste type, temperature, density, moisture, chemical complexity, bulky material, and earthworm species during vermicomposting²². As huge amount of wastes can be managed through more population of earthworms⁸ reproductive and growth performance of various species of earthworms in a range of substrates can act as useful biomarkers to measure the efficiency of an earthworm species in vermicomposting or earthworm based biotechnology²⁰. *Eutyphoeus waltoni* is an anecic earthworm species that is widespread in India¹⁷. *Eutyphoeus waltoni* has been found abundantly in the agricultural fields of eastern U.P. and the sufficient number of *Eutyphoeus waltoni* is necessary for better recycling of wastes in agricultural fields¹⁰. The biomass gain and cocoon production by *Eisenia fetida* was more in cattle waste than goat waste¹¹. Earthworm seems to be a potential tool to overcome or reduce both feed cost and waste disposal challenges by conversion of negative wastes into beneficial materials.

The aim of present work was to access the growth and development of *Eutyphoeus waltoni* in different combination of animal, agro and kitchen wastes.

MATERIALS AND METHODS

Collection and Culturing of the Earthworm:

Adult earthworm *Eutyphoeus waltoni*,

were randomly picked from several stock culture maintained in the vermiculture research center, Department of Zoology, D. D.U. Gorakhpur University, Gorakhpur, U.P.

Collection of Cattle Wastes:

The fresh wastes of animal viz. buffalo were collected from animal farms located in Gorakhpur city. The animal dung was used after 10 days of collection because pre-composting is very essential to avoid the death of the worms.

Collection of Agro and Kitchen Waste:

The organic wastes (agro and kitchen) used as substrate were collected from the garbage and different parts of villages, situated under the Gorakhpur region. All the samples were kept at normal room temperature for biological and visual analysis.

Experimental Design:

Measurement of growth (length, weight and number) of *Eutyphoeus waltoni* was conducted on cemented surface of the floor. 2kg of combination (ratio 1:1) was put on 30 cm × 30cm ×10cm areas at cool and elevated places on the floor. Animal dung measured as control. The combinations turn over manually every n24 hr for 10 days in order to eliminate the volatile substances. The moisture content was maintained during experimental period between 40-60 percent. After 60 days the total number of earthworm and their length and weight were counted from each bed. Each experiment was replicated at 6 times.

Statistical Analysis:

Data have been expressed as mean \pm SE of 6 replicates. Student's t-test was applied to compare the significant ($P < 0.05$)

between different cattle dung and different combination of cattle dung with agro and kitchen wastes¹⁹.

RESULTS AND DISCUSSION

Table: Effect of animal dung and its combinations with agro / kitchen waste on the growth and development of earthworm *Eutyphoeus waltoni*

Wastes	Number	Weight	Length
Buffalo Dung	67.00 \pm 0.89	748.02 \pm 32.43	6.28 \pm 0.7
Dung + Gram Bran	107.00 \pm 0.77*	1132.45 \pm 33.03*	9.68 \pm 0.21*
Dung + Straw	99.76 \pm 0.81*	963.31 \pm 38.40*	8.92 \pm 0.61
Dung + Wheat Bran	91.94 \pm 0.75*	924.51 \pm 38.52*	8.12 \pm 0.23
Dung + Rice Bran	82.01 \pm 0.62*	783.80 \pm 27.00*	7.50 \pm 0.02
Dung+ Vegetable Wastes	68.02 \pm 0.02	729.90 \pm 36.99	7.92 \pm 0.23
Dung + Barley Bran	106.98 \pm 0.59*	1048.38 \pm 31.06*	9.12 \pm 0.32

Each value is mean \pm SD of 6 replicates.

*Significant ($P < 0.05$, t test) between treated and control group.

Number counted in 30.0 \times 30.0 \times 10.0 cm area of vermicomposting bed.

The combination of cattle dung, agro and kitchen wastes caused a significant growth in the *Eutyphoeus waltoni*. There was significant increase in number, weight and length of earthworm in combination of buffalo dung with agro/kitchen wastes with respect to cattle dung only. The average weight gain 1132.45 mg/animal and length 9.68 cm/animal were observed in the *Eutyphoeus waltoni* inoculated in bed of buffalo dung with gram bran. Highest increase in number of earthworm after 60 days of inoculation was observed in bed of buffalo dung + gram bran (107) with respect to 20 inoculated earthworms in the

beginning. However, the number of earthworms in buffalo dung was observed to be 67.00 \pm 0.89. Two ways ANOVA applied in between the different combination of buffalo dung and agro/ kitchen wastes demonstrated that there is a significant variation in between number and weight of the column of different combination.

The different binary combination of buffalo dung with agro-wastes rice bran, wheat straw, barley bran, gram bran and banana peels caused a significant growth of *E. fetida* as well as significantly increase in number of cocoons, clitellum development and initiation of cocoon production and

weight gain¹⁸. So for our experiment we have taken buffalo dung with combination of agro and kitchen wastes to examine the growth and development of earthworm *Eutyphoeus waltoni* because buffalo dung was very potent to be used. The physical and chemical parameters were changed in all final vermicomposts with respect to initial feed mixtures. The agro wastes have low nitrogen residue due to immobilization of inorganic nitrogen of soil by microbes resulted unavailable to plants³. Throughout the world, earthworms play an important role in determining the balance of greenhouse gases from soils, and their impact is expected to increase in the coming decades¹². The different variables necessary for earthworm production, the type of food seems to be most important⁶. Worms could not survive in fresh cattle solids, pig solids, fruit wastes, or vegetable wastes. The reproduction pattern of earthworms was different among different combinations, depending on the quality of the worm feed. The rate of weight gain by *E. fetida* is dependent on population density and the type of food¹⁴. Indeed, 1 kg of adults earthworm can convert up to 5 kg of waste per day and approximately 10 kg of adults can convert one ton waste per month. Growth rate is a good indicator for comparing the growth of earthworms in different wastes⁵. The feed material of buffalo dung with gram bran have rich organic nutrients¹³. Feeds that provides earthworms with sufficient amount of easily metabolizable organic matter and non-assimilated carbohydrate, favor growth and

reproduction of earthworms⁴. Therefore, we got significant result due to combination of agro and kitchen wastes with animal dungs. The average weight gain 1132.45 ± 33.03 mg/animal and length 9.68cm/animal were observed in the inoculated bed of buffalo with gram bran. The maximum increase and decomposition in the number of earthworms in combination of buffalo with gram bran is due to the biochemical quality of food, which is an important factor in determining the time taken to reach sexual maturity and onset reproduction.

The observation, indicate that the combination of agro and kitchen wastes, with buffalo dung shows significant growth and development of *Eutyphoeus waltoni*. The combination of agro and kitchen wastes with buffalo dung provides an environment for better growth and development of *Eutyphoeus waltoni*. The growth and reproduction of *Eutyphoeus waltoni* were highest when allowed to feed on buffalo dung with gram bran. Thus, the combination of gram bran with buffalo dung is suitable for better growth and development of earthworm *Eutyphoeus waltoni*.

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