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Minimizing the Scorching Effect of Animal Waste Used as Organic Manure on Crop Roots: A Panacea to Increase Agricultural Productivity

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Abstract: This study was conducted to investigate how to considerably minimize the scorching effect of animal waste used as organic manure on the roots of crops as well boost crop yields. Pelleted and deodorized organic manure were produced from animal wastes by using comminuting and pelleting machines. The organic manure produced were used in conducting a field experiment to determine the effects of organic manure on the performance of tomato in the Teaching and Research Farm of the Department of Agricultural Education, Federal College of Education, Technical, Ekiadolor in 2025/2026 cropping season. The experiment was carried out in four beds, labelled A, B, C and D. Bed A was provided with poultry manure whilst Bed B serves as a control in Plot 1. Bed C was provided with stinky raw organic manure whilst Bed D was provide with pelleted poultry manure in Plot 2. Data on height of plants, number of leaves parameters and number of plant deaths recorded from scorching effect on roots were collected at 1st, 2nd, 3rd and 4th weeks after transplanting (WAT). Data on yield parameter were collected during the time of harvest. The mean of each of the four parameters were taken. The results showed that the crops planted in Bed A proved superior in growth parameter as regards to height and number of leaves produced. The results further showed that crops in Bed A produced more fruits in terms of yield at harvest than the crops planted in Bed B. The result equally showed a good number of crops died in Bed C as a result of the application of stinky organic manure which had scorching effect on the roots of crops. In Bed D, no death of crop was observed. The study therefore recommended that animal waste should be made attractive for use by farmers to increase their agricultural yields through the removal of the stinky odour associated with it as well as applying it in pellets especially as it has been found to increase yield tremendously.

Keywords: *Agricultural Productivity, Animal Wastes, Comminuting and Pelleting.*

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I. INTRODUCTION

In developing nations as Nigeria, the connection between agriculture and development cannot in any way be over emphasized. There is historical proof that the industrialised nations all over the world today, funded their industries with resources gotten from agriculture (Badejo, 2020). About 70% of Nigerian Population is involved in agriculture and lives in rural area (Asikadi, 2010: and Akenbor, 2024). Therefore, the wellbeing as well as the livelihood of farmers in this country depends largely on the effective performance of the agriculture sector of the economy (Obue and Okeporo, 2015). Advancing food production in many developing countries such as Nigeria and other sub-Sahara Africa nations has become an urgent question challenging the international development community (Agbamu, 2005; Aphunu & Otoikhian, 2008; Tokula *et al*, 2015. This can be achieved through organic farming by the use of livestock waste as manure for crops and residue for livestock production. Animal wastes are feaces, urine, carcasses, bedding as well as other byproducts from livestock which are composed of nutrients and organic matter. Animal wastes are degradable and have socio-economic potentials if effectively managed (Mulak and Kitgakka, 2024). According to Omisore, James and Gwadia (2015), the increasing cost of inorganic manure as well as its inability to adequately condition the soil has focused attention to the use of organic manures in recent times.

However, using fresh animal wastes directly poses challenges. They are usually bulky, sticky and emits offensive odours. Furthermore, their high level of moisture content often makes handling, storage as well as field application difficult, thereby reducing the willingness of

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farmers to apply them in farming **(**Bernal, Alburkuquerque, and Moral, 2017**).** Processing techniques which includes drying, comminuting and pelleting can be carried out to address these challenges. Drying can significantly reduce the weight, moisture content, and volume. The odour can be reduce or totally eliminated by treating it with charcoal or Soya Bean Peroxide (Bernal et al., 2017). Pelleting process further improves the transportation, handling, as well as application efficiency of livestock wastes through the densification of the wastes into uniform pellets. In addition, pelleting reduces bulkiness and enhance uniform nutrient distribution to soil during field application (Orakwe, 2021). Animal wastes such as rabbit manure, poultry manure, swine manure, cow dung, goat manure are valuable organic resources that improves soil fertility as well as crop productivity. They contain plant nutrients which are essential to crops including nitrogen, phosphorus, potassium, magnesium and calcium. They are important for the growth of plants and sustainable agriculture (Agyarko and Kudadjie, 2020). Organic manures are capable of enhancing soil organic matter and promoting beneficial microbial activity unlike inorganic fertilizers, which are capable of degrading soil structure and reducing microbial diversity, (Savci, 2012). Despite these potentials, the utilization of animal waste by farmers in agricultural production remains limited owing to several constraints.

The unpleasant smell from animal wastes indicates the presence of pathogenic organisms and volatile organic compounds which often pose as health and environmental risks (Nicholson, *et al.* 2005). Further to this, the application of raw stinky animal waste usually leads to scorching of roots of cultivated crops which often leads to the death of crops. These challenges necessitates the importance of using safer sources of organic nutrient such as suitably processed animal waste. Processing activities such as drying, comminuting and pelleting have been anticipated as effective means of overcoming these challenges.

This study is set up to address the problem of farmers neglecting the use of organic manure to increase agricultural productivity, resulting in poor yield and high level of poverty among farmers. The study basically involves collecting, drying, deodorizing, comminuting and pelleting of animal waste. The resultant pelleted organic manure shall then be packaged for distribution and use by farmers to enhance and sustain organic farming which the world over is gradually embracing.

Therefore, the objectives of this study are to (i) comminute, deodorize, pellet and package raw organic animal waste and (ii) reduce the scorching effect of animal wastes on the roots of crops.

II. MATERIALS AND METHODS

➢ *Location of Study Area*

Field experiment was carried out at the Teaching and Research Farm of the Department of Agricultural Education, Federal College of Education, Technical, Ekiadolor Edo State in 2025/2026 cropping season. Edo State has a total land area of 19,281.93 square kilometers (km^2) lies roughly between latitudes 05^0 44'N and 07^0 34'N and between longitudes 05^0 4'N and 06^0 45'N. Edo State has a bimodal rainfall pattern with a peak period in July and September as well as a break period in August (NIMET 2011).

➢ *Materials Used*

Comminuting Machine (Fig.1), Pelleting Machine (Fig.2), Charcoal, Soya Bean Peroxide, Animal wastes such as poultry droppings.

➢ *Methods*

The processing of organic manure from poultry droppings was mechanically carried out using two main units: the comminuting unit and the pelleting unit. The system was actually designed in such a way as to reduce bulkiness, eliminate totally or minimize offensive odours, improve handling process, produce standardized pellets of organic manure which are suitable for agricultural application as well as boost agricultural yields in a bid to enhance food security.

- *Comminuting and Deodourising Process:*

Animal wastes and charcoal or Soya Bean Peroxide are feed into comminuting and deodourising unit. They are then crushed and ground mechanically to reduce them to smaller, uniform particle sizes. The crushed charcoal is responsible for deodorizing the animal waste and also serves as manure in the mixture as it contains a high level of carbon nutrient. The ground material is then conditioned with steam or slight moisture if necessary, to help improve pellet binding.

- *Pelleting Process:*

After the comminuting and deodourising process, the conditioned material is hard-pressed through a die under machine-driven pressure in a pelleting unit. This leads to the formation of uniform pellets of preferred size 4 mm which is certainly appropriate for even application to soil for crop utilisation. The pelleting process also involves cooling and hardening whereby the hot pellets are then air-cooled to toughen and stabilize them for storage, transportation and utilization by farmers wherever it is required. At completion, the final Product which is the resulting pellets are compact, odour-reduced, nutrient-rich, and easy to store, transport and apply to crops.

The process was carried out by reducing the moisture content and odour of animal waste through drying as well as deodorization. This is followed by reduction in size and densification of organic manure into pellets. When the process is completed, the raw bulky animal wastes is converted into a convenient, safe, farmer-friendly organic manure with enhanced storability, usability, and agronomic efficiency. The pelleted and deodorized organic manure produced were used in carrying out field experiment.

➢ *Field Experimentation*

The experiment was carried out in four beds, labelled Bed A, B, C and D in two plots. Bed A was provided with 25kg pelleted poultry manure whilst Bed B serves as a control in Plot 1. The experiment in plot 1 was to determine the influence of organic manure on tomato production. Bed C

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was provided with 25kg stinky raw poultry manure whilst Bed D was provided with 25kg pelleted poultry manure in Plot 2. The experiment in plot 2 was to determine the scorching effect of organic manure on the roots of tomato plants. Each bed measured 28.8m by 0.9m with the same crop spacing and plant population, same single treatment and separated from each other by a distance of 0.5m. Tomato seedlings with four true leaves of the same age were transplanted on the four beds same day.

➢ *Data Collection and Analysis*

Data on height of plants, number of leaves and scorching effects on crop roots were collected at 1st, 2nd, 3rd and 4th weeks after transplanting (WAT) whilst data on yield parameter were collected during the time of harvest. The mean of each of the four parameters were taken.

Fig 1 Comminuting Machine

Fig 2 Pelleting Machine

III. RESULTS AND DISCUSSION

Pelleted poultry manure and raw stinky poultry manure were tested on tomato crop to determine their influence in crop production. The observation was based on four parameters namely height of plants, number of leaves, yield of plants as well as scorching effects on crop roots.

Table 1 shows the distribution of the plants according to height based on 40 tomato plants from each of bed (A and B) which were randomly sampled. The transplanting of seedlings to their permanent site was carried out when they were 13cm in height with 4 true leaves. The first observation was carried out on 3/1/26 (WAT 1) and was observed that the sampled plants in Bed A (manured) and Bed B (control) had an average heights of 17cm and 15cm respectively. The observation was repeated on 10/1/26 (WAT 2) and was observed that the sampled plants in Bed A and Bed B had an average heights of 22.3cm and 19cm respectively. The third observation was carried out on 17/1/26 (WAT 3) when it was observed that the sampled plants in Bed A and Bed B had an average heights of 38cm and 28.4cm respectively. The fourth and final observation for heights was carried on 24/1/26 (WAT 4) and was found that Bed A and Bed B had average heights of 50cm and 34cm respectively. This result conforms to that of Omisore *el al,* (2015) where they found that the application of manure during the two cropping seasons of maize resulted in significant differences in plant height at 3 weeks after planting (3WAP). They further reported that lowest plant height were obtained from no fertilizer control plants. This result also conforms to that of Adesoji, Abubakar and Labe (2015), where they concluded that improving soil fertility through the use of plant nutrients is a major factor in enhancing crop growth as well as better biomass formation required for improved food crop production.

Table 1 Distribution of Height of Plants

WEEKS	DATES	BED A (PELLETED POULTRY MANURE)	BED B (CONTROL)
WAT 1	3/1/26	17cm	15cm
WAT 2	10/1/26	22.3cm	19cm
WAT 3	17/1/26	38cm	28.4cm
WAT 4	24/1/26	50cm	34cm

NOTE: WAT (Week After Transplanting) Values are in Averages
Source: Field data, 2026

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The distribution of number of leaves produced by plants is shown on Table 2. The first recording which was carried out on 3/1/26 (WAT 1) showed that the randomly sampled 40 tomato plants each in Bed A and Bed B had an average number of leaves 6.3 and 5 respectively. The second recording on 10/1/26 (WAT 2) shows that the sampled plants in Bed A and Bed B had an average number of leaves of 9 and 6 respectively. The third observation was carried out on 17/1/26 (WAT 3) and revealed that the sampled plants in Bed A and Bed B had an average number of leaves of 14 and 9 respectively. The final observation for number of leaves was carried on 24/1/26 (WAT 4) and shows that Bed A and Bed B had average number of leaves of 30 and 16.4 respectively. This result also conforms to that of Omisore *el al*, (2015) where they found that the application of manure during the two cropping seasons of maize resulted in the production of leaves with highest leaf area index. They added that lowest leaf area index were obtained from the plants at the control plot.

Table 2 Distribution of Number of Leaves of Plants

WEEKS	DATES	BED A (PELLETED POULTRY MANURE)	BED B (CONTROL)
WAT 1	3/1/26	6.3	5
WAT 2	10/1/26	9	6
WAT 3	17/1/26	14	9
WAT 4	24/1/26	30	16.4

NOTE: WAT (Week After Transplanting) Values are in Averages
Source: Field data, 2026

Table 3 shows the distribution of the plants according to the yield of 40 plants from each of beds (A and B) which were randomly sampled. The first harvesting of matured fruits was carried out on 14/2/26 (WAT 7) and shows the sampled plants in Bed A and Bed B had an average weights of 2kg and 0.9kg respectively. The second harvesting was on 21/2/26 (WAT 2) and it was observed that the sampled plants in Bed A and Bed B had an average weights 2.8kg and 1.4kg respectively. The third and final observation for harvested matured fruits was carried on 27/2/26 (WAT 9) and had recorded weights of 3.41kg and 1.6kg for Bed A and Bed B respectively. This result also conforms to that of Omisore, et al, (2015) where they found that maize grain yield was significantly increased by the application of organic and inorganic manure. They further found that lowest grain yields were recorded from plants at the control plot.

Table 3 Distribution of Yield of Plants

WEEKS	DATES	BED A (PELLETED POULTRY MANURE)	BED B (CONTROL)
WAT 7	14/2/26	2kg	0.9kg
WAT 8	21/2/26	2.8kg	1.4kg
WAT 9	27/2/26	3.41kg	1.6kg

NOTE: WAT (Week After Transplanting) Values are in averages
Source: Field data, 2026

Table 4 shows the distribution of the scorching effect of organic manure on the roots of crops. It was observed that there was death of tomato crops up to 23 stands representing 58% in beds C in the first two weeks after planting as a result of the scorching effect of stinky raw manure. No death was observed among the crops in Bed D throughout the four observations that were made. This is an indication that the poultry manure could not harm any tomato crop stand in Bed D through scorching of their roots as the manure was conveniently applied in form of pellets.

Table 4 Distribution of Scorching Effect of Organic Manure on Plants' Roots

WEEKS	DATES	BED C (STINKY RAW POULTRY MANURE)	BED D (PELLETED POULTRY MANURE)
WAT 1	03/1/26	15	0
WAT 2	10/1/26	9	0
WAT 3	17/1/26	0	0
WAT 4	24/1/26	0	0

NOTE: WAT (Week After Transplanting) Values are in Averages
Source: Field data, 2026

IV. CONCLUSION

The crops planted in Bed A were observed to have more height and leaves than those in Bed B. Further to this, the crops in Bed A were found to produce more matured fruits than those in Bed B. Therefore, it is clear that the pelleted organic manure applied to Bed A contributed to the high performance of crops planted on it. The complete absence of the death of any crop stand in Bed D is an indication that the application of organic manure in form of pellets ensures its safe utilization without scorching of roots. This is enhanced by removing the water in raw stinky animal wastes through drying, then comminuting and pelleting it.

It is hereby recommended that animal waste should be made attractive for use by farmers to increase their

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agricultural yields through the removal of the stingy odour associated with it and apply them in form of pellets for uniform application especially as it has been found to increase yield tremendously.

All tiers of government including Federal, state and local government should promote livestock production through intensive system and play down on extensive system. This could enhance increased availability of livestock wastes to boost the production of organic manure and hence increase in agricultural productivity which can earn farmers better living standards.

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