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Sustainable Poultry Waste Management: Transforming Waste into Valuable Resources

R. Kumar, K. Sethy*, O. S. Andure and R. P. Kharade
Department of Animal Nutrition, C.V.Sc and AH , Odisha University of Agriculture and Technology, Bhubaneswar,751003, India
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Abstract

Poultry farming produces substantial waste streams encompassing litter, mortalities and byproducts from hatcheries and slaughter houses. Effective waste management, while demanding, offers significant potential for sustainable agricultural practices. Poultry litter is transformed into organic fertilizer through composting, thereby enriching soil and diminishing reliance on chemical use. Poultry waste can be converted into methane, a renewable energy source, through biogas production. Furthermore, processed poultry waste, including feather meal and dried manure, offers a cost-effective protein supplement for animal feed. Industrial applications, such as keratin extraction for biodegradable materials and biodiesel production from poultry fat, significantly increase its value. Despite the aforementioned advantages, numerous poultry farmers encounter challenges including insufficient awareness, substantial initial investment costs, regulatory hurdles, and disease-related risks. Strategic support encompassing government initiatives, financial aid, and comprehensive farmer training programs will facilitate the effective repurposing of poultry waste, thereby mitigating environmental impact and enhancing the economic viability of poultry farming.

Introduction

The poultry sector is one of the fastest-growing segments in India. The Indian poultry industry is a well-organized and significantly contributes to entrepreneurship and employment opportunities for both rural and urban populations. Poultry industry is very important since it complete the protein requirement of Indian population through meat and eggs. The 2019 Livestock Census reported India's poultry population at approximately 851.81 million birds. Subsequently, BAHS 2024 data indicates egg production reached approximately 142.77 billion eggs in 2023-24, confirming India's position as the world's second largest egg producer. Simultaneously, total meat production is approximately 10.25 million tonnes, ranking India fifth globally. These figures highlight the sector's robust performance. As the poultry sector is growing problem regarding litter and poultry waste disposal is a major problem. Currently, the Indian poultry sector alone produces around 3.30 million tons of waste per year (Kokilan

and Priya, 2022). which needs a sustainable management approach for turning waste into wealth. Sustainable poultry farm waste management offers significant environmental benefits and creates profitable business opportunities in waste recycling and processing. The principal challenge in poultry waste management in developing countries is the widespread practice of disposal through burial, rendering, or landfilling. These methodologies lack scientific rigor and cause substantial environmental pollution via soil, air, and water contamination. Moreover, the considerable cost of large-scale waste disposal presents a significant obstacle, especially for smaller poultry operations.

Poultry Waste

Poultry waste consists of litter, deceased birds, hatchery byproducts (e.g. eggshells, dead embryos, infertile eggs, culled chicks), and abattoir waste (e.g., heads, feet, lungs, trachea, intestines, feathers). Employing this waste offers substantial agricultural opportunities as fertilizer and livestock feed supplement (Arefin *et al.*, 2024).

Practical ways to handle poultry waste efficiently

1. **Composting**: Transforming Waste into Organic Fertilizer.

   Composting is a natural process that allows poultry waste to decompose under controlled conditions, resulting in a nutrient-rich organic fertilizer. This method is not only eco-friendly but also enhances soil fertility and improves farm sustainability.

   Benefits of composting poultry waste

   - ❖ Helps break down harmful pathogens and reduces ammonia emissions.
   - ❖ Produces high-quality compost that can replace chemical fertilizers.
   - ❖ Enhances soil structure and improves moisture retention.
   - ❖ Lowers overall farm expenses by reducing reliance on commercial fertilizers (Kokilan and Priya, 2022).

Farmers can set up composting pits on their farms, mixing poultry litter with carbon-rich materials like straw, sawdust, or rice husks. The resulting compost can then be used for crop production, cutting down on input costs while promoting organic farming

2. Biogas production: Turning poultry waste into renewable energy

Another efficient way to manage poultry waste is through biogas production, which involves anaerobic digestion of manure and other organic waste. This process generates biogas, a clean and renewable energy source primarily composed of methane.

3. Poultry waste as livestock feed: Some components of poultry waste, such as feathers, hatchery byproducts, and properly processed manure, can be repurposed into nutrient-rich animal feed for livestock and aquaculture (Zhang *et al.*, 2023).

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Examples of poultry waste in animal feed

Feather meal: When feathers are processed using heat treatment, they become a digestible protein source for livestock (Rahman *et al.*, 2022).

Dried poultry manure: When properly treated, poultry manure can be used as a supplementary feed ingredient for cattle and fish (Verma et al., 2020). Strict safety measures, including heat treatment and microbial fermentation, must be followed to eliminate pathogens before incorporating poultry waste into animal diets. This approach not only reduces feed costs but also minimizes waste disposal issues (Arefin *et al.*, 2024).

4. Industrial applications of poultry waste

Poultry waste isn't just useful in agriculture it also has industrial applications that can add economic value to poultry farming (Zhang *et al.*, 2023). Feathers contain keratin, a protein used in textiles, biodegradable plastics, and composite materials. Poultry processing waste, particularly fat and offal, can be converted into biodiesel, providing an alternative to fossil fuels (Rahman *et al.*, 2022). By tapping into these industrial uses, poultry farmers can open up new revenue streams and contribute to sustainable resource management (Zhang *et al.*, 2023).

Utilization of poultry waste

1. Bedding or litter materials

In poultry farming, rice hulls, sawdust, straw, wood shavings, shredded paper, and peanut hulls are generally used for bedding material. During the production cycle, bedding material becomes mixed with excreta, feathers, spilled water, and waste feed. Consequently, this waste-enriched litter material exhibits elevated levels of nitrogen, phosphorus and potassium. Poultry litter, comprised of bedding, excreta, feathers, and residual feed, is a valuable source of organic matter, making it an ideal natural fertilizer. Its application enhances soil organic matter content, thereby improving water retention and soil structure. Poultry litter serves as a dietary supplement for poultry, swine, lambs, ewes, lactating cows, and cattle.

2. Dead birds

Mortality in poultry farms can occur due to diseases, transportation stress, or management-related issues. Improper disposal of waste in fields creates noxious odors and poses significant health risks to both humans and animals (Arefin *et al.*, 2024). Numerous commercial products, including meat, fat, bones, and feathers, can be derived from animal carcasses. Nevertheless, a substantial portion of the meat and fat from these carcasses is frequently wasted, indicating a significant underutilization of available resources. Carcass-derived meat meal and separately processed fats provide viable alternatives for animal feed or industrial applications.

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3. Hatchery waste

This encompasses infertile eggs, eggshells, unhatched embryos, and culled chicks. These materials, while frequently discarded, offer potential applications in animal feed and organic fertilizer production (Zhang *et al.*, 2023). Feed production involves sterilization and milling of all components. It provides a substantial protein source for livestock, containing approximately 26% protein, 11% ether extract, and 21% calcium, in addition to an unidentified growth factor. Hatchery waste offers a viable partial replacement for fishmeal and maize in poultry feed formulations. The inclusion of hatchery waste meal in poultry feed rations does not adversely affect growth performance or feed conversion efficiency (Panda and Sharma, 1974).

4. Slaughter house byproducts

When birds are processed for meat, a significant amount of waste is generated, including blood, intestines, heads, feet, lungs, trachea, and feathers. Offal comprises 5.3% Kjeldahl nitrogen, 32% protein, 54% lipid, and a methane production potential ranging from 0.6% to 0.9%. (Salminen and Rintala, 2002). Slaughterhouse byproducts provide a highly suitable protein source for swine feed.

Challenges in poultry waste management

Despite the numerous advantages of sustainable waste management, several challenges make widespread adoption difficult:

1. Limited awareness – Many small-scale poultry farmers are unaware of the potential benefits of recycling poultry waste (Kokilan and Priya, 2022).

2. High initial costs – Setting up composting units, biogas plants, or waste processing facilities requires an initial investment, which may be a barrier for some farmers (Arefin et al., 2024).

3. Regulatory constraints – The use of poultry waste in animal feed and fertilizers is often subject to strict government regulations (Rahman *et al.*, 2022).

4. Disease risks – Improper waste disposal can lead to outbreaks of avian influenza, bacterial infections, and other zoonotic diseases.

To address these issues, government support, financial incentives, and farmer training programs are crucial in promoting safe and efficient poultry waste management practices.

Conclusion

Poultry waste management is not just an environmental necessity but also an economic opportunity. By adopting sustainable waste disposal strategies such as composting, biogas production, livestock feed processing, and industrial applications, poultry farmers can reduce costs, increase profits, and contribute to environmental conservation.

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References

Arefin *et al.* Poultry farm waste management practices: Environmental challenges, health concerns, and farmers' perspectives in Chattogram, Bangladesh. *J. Biosci. Env. Res.* 1(2): 32-38 (2024).

Kokilan and Priya. A sustainable approach for processing organic waste in India. *Materials Today: Proceedings*. 64:1069-1074 (2022).

Rahman *et al.* Current state of poultry waste management practices in Bangladesh, environmental concerns, and future recommendations. *J Adv Vet Anim Res*. 9(3):490-500 (2022).

Salminen and Rintala. Anaerobic digestion of organic solid poultry slaughterhouse waste: A review. *Bioresour Technol*. 83:13-26 (2002).

Zhang *et al.* A Review of Poultry Waste-to-Wealth: Technological Progress, Modelling and Simulation Studies, and Economic. *Environmental and Social Sustainability*, 15, 1041-1050 (2023)