Article ID 42402110

Livestock Waste Management

Renuka Biradar, Vanishree S. and Aravind Rathod
Agriculture Extension Education Centre, Behind VCB College, Gudadanal road, Lingasugur-584122
*Corresponding Author: renubiradar456@gmail.com

Livestock Waste" means livestock excreta, bedding material, rain or other water, soil, hair, feathers or other debris normally included in animal waste handling operations. According to 19th Livestock Census livestock population in India is 512.05 million which produces 1095 million MT dung per year. The early method of handling livestock wastes was very simple. The manure droppings from livestock on pasture were not even recovered but left to become integrated in the soil. However, with the advent of modern livestock production, considerable attention is being given to alternative uses and treatments of livestock wastes to recover fertilizer, feed, and fuel and at the same time achieve pollution control.

Importance of livestock waste management

The most common concern with animal waste is that it releases large quantities of CO2 and ammonia which might contribute to acid rain and the greenhouse effect. It could also pollute water sources and be instrumental in spreading infectious diseases. If the disposal of water is not properly planned it might create social tension owing to the release of odours and contamination of water sources.

Proper management of livestock waste is required due to following reasons

1. Livestock manure helps to maintain soil fertility in soils lacking organic content. Adding manure to the soil increases the nutrient retention capacity, improves the soil's physical condition by increasing its water holding capacity and improves soil structure.
2. Animal manure also helps to create a better climate for micro flora and fauna in soils.
3. Dung is also used as fuel.
4. Waste manure and other organic materials from livestock farms could be an important source of energy production.
5. Livestock waste management plays an important role in the livelihoods of many rural dwellers in India.
6. Bio-energy sources are increasingly gaining attention as a sustainable energy resource that may help to cope with challenges like, increasing demand for energy, rising fuel prices by providing substitutions for expensive fossil fuels.
7. Biogas from livestock waste and residues provides renewable and environmentally friendly sources that support sustainable agriculture. Additionally, the by-products of the 'digesters' provide organic waste of superior quality.
8. Reduce source of infection for animal and human population.
9. Reduce source of methane emission (0.28-1.95g/day) and Cause of bad odour in surroundings.
10. Helps in controlling vectors and fomites and reduce environment pollution.
11. Nitrogen in manure is tied up in its organic state until, through decomposition it is converted to a soluble form (ammonium nitrate). When ammonium nitrate is mixed with soil it improves soils fertility.

Types of livestock waste

Solid Waste

Dung: also known as cow pats or cow manure is the waste product of bovine animal species. Cow dung is the undigested residue of plant matter which has passed through the animal gut. The resultant fecal matter is rich in minerals. Cow dung contain Moisture 77 per cent Organic matter 20 per cent Nitrogen 0.32 per cent Phosphorus 0.14 per cent Potassium 0.30 per cent Calcium 0.40 per cent

Wasted feeding material: Food waste is food that is discarded or lost or uneaten by the animals.

Soiled bedding material: Straw, saw dust and wood shavings, Paper-based bedding materials etc.

Liquid Waste A. Urine B. Washed water

Methods of livestock waste management

Traditional methods

1. **Dung cake:** The only use for manure other than fertilizer is in underdeveloped countries, where cow manure is gathered by hand and placed on suitable racks to sun-dry for use as fuel for cooking and heating. In north Indian States-Cow-Dung Cake is major fuels for cooking.
2. **Dumping into heaps or pits:** It is most common and old method of waste management, in this method all waste material dumped in to a pit at farm or field.
3. **Composting:** Composting is an accelerated bio-oxidation of organic matter passing through a thermophilic stage (45 to 65°C) where microorganisms (mainly bacteria, fungi and actinomycetes) liberate heat, carbon dioxide and water. The heterogeneous organic material is transformed into homogeneous and stabilized humus like product through turning or aeration. Composting is the aerobic degradation of biodegradable organic waste. It is a relatively fast biodegradation process, taking typically 4–6 weeks to reach a stabilized material. The composted material is odourless and fine textured with low moisture content and can be used as an organic fertilizer.

Advantages

- Low power consumption.
- Frequent cleaning gives better hygiene and better cow health.
- Easy installation.
- Smart equipment features.

Disadvantages

Loss of nitrogen and other nutrients during composting, equipment cost, labour, odour and requirement of land. Moisture (60%) and C/N ratio (20:1) have a major influence on a successful composting process. High moisture content of more than 75% inhibits a quick start to the composting process.

Methods of composting

Farm compost is made by placing farm wastes in trenches of suitable size (4.5 m to 5.0 m long, 1.5 m to 2.0 m wide and 1.0 m to 2.0 m deep). Farm waste is placed in the trenches layer by layer. Trenches are filled up to a height of 0.5 m above the ground. The compost is ready for application within five to six months.

There are various methods of composting:

1. **Coimbatore method**: Composting is done in pits of different sizes depending on the waste material available. A layer of waste materials is first laid in the pit. It is moistened with a suspension of 5-10 kg cow dung in 2.5 to 5.0 I of water and 0.5 to 1.0 kg fine bone meal sprinkled over it uniformly. Similar layers are laid one over the other till the material rises 0.75 m above the ground level. It is finally plastered with wet mud and left undisturbed for 8 to 10 weeks.
2. **Indore method**: Organic wastes are spread in the cattle shed to serve as bedding. Urine-soaked material along with dung is removed every day and formed into a layer of about 15 cm thick at suitable sites. Urine-soaked earth, scraped from cattle sheds is mixed with water and sprinkled over the layer of wastes twice or thrice a day.
3. **Bangalore method**: Dry waste material of 25 cm thick is spread in a pit and a thick suspension of cow dung in water is sprinkled over for moistening. A thin layer of dry waste is laid over the moistened layer. It is given a turning, plastered with wet mud and left undisturbed for about 5 months or till required.

Advanced methods

Biogas production

Biogas is clean environment friendly fuel that can be obtained by anaerobic digestion of animal residues and domestic and farm wastes. Biogas is bacterial conversion of organic matter in to gases under anaerobic conditions. Biogas generally comprise of 55-65% methane, 35-45% carbondioxide,0.5-1.0% hydrogen sulphide and traces of water vapor. Average calorific value of biogas is 20MJ/m3 (4713kcal/m3). An estimate indicates that India has a

potential of generating 6.38X1010m3 of biogas from 980 million tons of cattle dung produced annually. The heat value of this gas amounts to 1.3X1012MJ. In addition, 350 million tons of manure would also produce along with biogas. Various advantages of bio gas production 1. Biogas provides an environmentally friendly process that supports sustainable agriculture. 2. It is one of the simplest sources of renewable energy and can be derived from sewage; liquid manure from hens, cattle and pigs; and organic waste from agriculture or food processing. 3. The by-products of the 'digesters' provide organic waste of superior quality 4. Biogas is particularly well suited to household energy needs as it, improves both soil conditions and household sanitation. 5. Manure-based biogas digester systems are considered ecological since the technology captures and utilizes methane directly, thereby limiting total greenhouse gas emissions from livestock. 6. By using bio-energy resources and non-polluting technology, biogas generation serves a triple function: waste removal, environmental management and energy production. 7. Biogas is now widely integrated with animal husbandry and can become a major means of manure treatment in the agricultural sector and environmental protection.

Types of biogas digester

Biogas digesters are generally sized on the basis of local energy requirements and the cattle dung production of the farm. Two main types of designs exist the fixed dome type of biogas plant and the floating drum type biogas plant. 1. The fixed dome biogas plant placed underground. The plant is constructed with local materials: bricks sand and cement and has an estimated lifetime of 25 years. The family size biogas plant ranges from 1 to 10 cubic meters, depends on the resources available and gas utilization. The average cost of a 2 m^3/day fixed dome biogas plant is approximately Rs. 21,500.

Utilization of biogas

Cooking Biogas can be used in a specially designed burner for cooking purpose. A biogas plant of 2 cubic meters capacity is sufficient for providing cooking fuel needs of a family of about five persons. Lighting Biogas is used in silk mantle lamps for lighting purpose. Power generation Biogas can be used to operate a dual fuel engine to replace up to 80% of diesel-oil. Diesel engines have been modified to run 100 per cent on biogas. Petrol and CNG engines can also be modified easily to use biogas

Vermicomposting

The earthworm eats the organic matter and excrete little pelleted material called "Vermicompost". During vermicomposting, the important plant nutrients, such as N, P, K, and Ca present in the organic waste are released and converted into forms that are more soluble and available to the plants. Vermicompost also contain biologically active substances such as plant growth regulators. Moreover, the worms themselves provide a protein source for animal feed. It Increase N, P, K content 3 to 4 times and composting time is reduced to 60-75 days.

Types of earthworms there are different species of earthworms Viz. *Eisenia foetida* (Red earthworms), *Eudrilus eugeniae* (night crawler). Perionyx excavates etc. Red earthworm is preferred because of its high multiplication rate and thereby converts the organic matter into vermicompost within 45-50 days. Since it is a surface feeder it converts organic materials into vermicompost from top. Its conversion rate is 2 quintal/ 1500worms/2months.

Methods of vermicomposting Vermicomposting is done by various methods; among them bed and pit methods are more common. Bed method Composting is done on a pucca/kachcha floor by making bed (6x2x2 feet size) of organic mixture. This method is easy to maintain and to practice.

Process of vermicomposting Following steps are followed for vermicompost preparation

- Vermicomposting unit should be in a cool, moist and shady site.
- Cow dung and chopped dried leafy materials are mixed in the proportion of 3:1 and kept for 15-20 days.

- A layer of 15-20 cm of chopped dried leaves/ grasses should be kept as bedding material at the bottom of the bed. Beds of partially decomposed material of size 6x2x2 feet should be made.
- Each bed should contain 1.5- 0.2 quintal of raw material and the number of beds can be increased as pre raw material availability and requirement.
- Red earthworm (1500-2000) should be released on the upper layer of bed.
- Water should be sprinkled daily and cover with gunny bags.
- Bed should be turned once after 30 days for maintaining aeration for proper decomposition.
- Compost gets ready in 45-50 days.
- The finished product is 3/4th of raw materials used.

Harvesting

When raw material is completely decomposed it appear black. Watering should be stopped as compost gets ready. The compost should be kept over a heap of partially decompose cow dung from compost. After two days compost can be separated and sieved for use. Optimum moisture level 30-40 % should be maintained and 18-25 ^{o}C temperature. C/N ratio of vermicompost should be 11.88, total nitrogen should be 1, 02%, Total Phosphorus should be 0.30%, Total potassium should be 0.24% and calcium and Magnesium should be 0.17% and 0.06% respectively. Doses: The doses for field crops should be 4.5-5 t. per hectare, for fruit crops 3-5Kg per plant.

* * * * * * * *