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SOLID WASTE UTILISATION IN DAIRY FARMS

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Wastes of animal origin are one of the major under-utilized resources in India. Animal wastes refer mainly to excreta (dung, urine etc.) along with bedding and mixed soil. Though animal wastes cause collection and transportation problems, they are valuable source of organic matter and plant nutrients. These wastes could not be fully exploited due to the non-availability of viable technology for economic recycling. The technology has to be cost effective, eco-friendly and socially acceptable to the farmers at village level.

Advantages of recycling animal wastes

1. Supplying essential plant nutrients
2. Improving soil physical properties
3. Reducing the accumulation of animal wastes near the livestock farms/ dairies/ houses etc.,
4. Reducing health hazards
5. Providing employment and income to many people
6. Improvement of environment quality

Composition of dairy solid waste

The wastes from ruminants have a different composition from wastes of monogastric animals. The faeces of ruminants consist mainly of undigested feed materials and it also contains residues from digestive fluids, waste mineral matter, worn out cells from gastrointestinal tract, bacteria and foreign matter.

Undigested protein is also excreted in the faeces and the excess nitrogen from the digested protein is excreted in urine as urea. Potassium is absorbed during digestion, but most of it is excreted through urine. Ca, Mg, Fe and P are excreted mostly in faeces. The chemical composition and the nutrients in different species of animal excreta are shown in Table I.

Utiiization of manure

There are various methods for handing and treating animal waste. The simplest and most effective method is to utilize them as a soil nutrient by recycling it back to the soil. Methods that are available for applying animal excreta into the soil include.

i. Direct surface application followed by immediate ploughing
ii. Application after processing as Farm Yard Manure
iii. Conversion into compost and
iv. Vermicomposting
v. As a feed stock in biogas plants to produce gas and slurry manure.

(i) Direct surface application

Both liquid and solid waste is directly spread on the open fields and is subjected to sun drying under natural conditions. This is the oldest and cheapest method of recycling animal waste. The end products are CO_2 and H_2O with an accumulation of N, S, P and minerals in the soil. This method is environmentally undesirable. There is partial decomposition of organic matter with valuable losses of nitrogen and energy.

(ii) Farm yard manure (FYM)

The FYM is the decomposed mixture of dung and urine of farm animals along with litter, left over fodder fed to the animals. It is estimated that FYM from all animal excreta in India can supply 6.33 million tonnes of N, P_2O_5 and K_2O per annum. A well decomposed FYM contains 0.7-1.3% N. 0.3-0.8% P_2O_5 and 0.4-1.0% K_2O on dry weight basis. it is also influenced by the processes of handling and storage. Under normal conditions, there is invariable loss of nutrients either by leaching or volatilization when manure remains exposed to rain and sun.

(iii) **Composting**

Composting is a natural process in which organic matter is decomposed by micro-organisms forming humus like substance. This process is in practice for centuries by farmers who stock dung into piles or in pits. Composting can be either aerobic or anaerobic. The advantages of aerobic decomposing are shorter stabilization time, no foul smell and destruction of weeds and pathogens.

(iv) **Vermi-composting**

Vermi-composting is composting aided by earthworms. Worms feed on the organic waste converting it into castings which have high manurial value. Vermi composting achieves the following objectives.

a. Abatement of organic pollution by reduction in waste's bulk density and elimination of foul odour;

b. The production of vermin-fertilizer of vermi-compost for application on land;

c. The production of vermi-protein in the form of earthworms, which can be used as animal feed.

Vermiculture is the latest technique, which is 100 times more efficient than any other conventional techniques. Use of earthworms for waste disposal achieves three ideal objectives:

1. Upgrading the value of the original waste materials so that they can be reduced.
2. Produces the upgraded materials in situ without having to transport waste material over long distance and
3. Yields a final product free of chemical or biological pollutants.

Steps for vermicomposting

1. Dig a pit of about half a meter square, one meter deep
2. Line it with straw or dried leaves and grass
3. Organize the disposal of organic waste into the pit as and when generated
4. Introduce a culture of worms that is now produced commercially
5. Ensure that the contents are covered with a sprinkling of dried leaves and soil everyday
6. Water the pit once or twice a week to keep it moist
7. Turn over the contents of the pit every 15 days
8. In about 45 days the waste will be decomposed by the action of the microorganisms
9. The soil derived is fertile and rich in nutrients.

A comparative analysis of vermin-composting and FYM is given in Table II.

(v) **Bio-Gas Technology**

According to estimates, one kg of cattle dung produces about .073m (1.3c.ft) of biogas at atmospheric pressure. The availability of dung from a medium size cow is approximateiy 10 kg per day. For the smallest plant producing 1.7 m^3 (60.c.ft) of biogas, waste from at least 5 head of cattle is necessary. Biogas (1.7m^3) produced from this small plant is considered sufficient to meet the cooking and lighting needs of a family of four.

Two products are obtained form the plant, biogas and fermented slurry.

Biogas is non-poisonous, with a characteristic odour, which disappears on burning. When mixed with air, it burns with a non-luminous blue flame without producing any smoke. It has a very low level of inflammability. Biogas is used for household cooking, lighting and power. Special lamps are available for lighting where biogas can been used. For a 100 candle power mantle lamp, approximately 0.13m^3 (4.5c.ft) fuel gas is required per hour. Regarding the production of power, about 0.48 m^3 (17c.ft) of biogas is required to run an engine of 1 horse power for one hour. Combustion engines, commonly available, can be run with biogas. To do this, a special attachment is fitted to the combustion engine. Such attachments are readily available.

The biogas-spent slurry is far better than Farm Yard Manure (FYM) since it is well digested and has

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Conclusion

It is concluded that dairy wastes could be efficiently recycled and anyone of the above technology is economically feasible to the farmers.

Table I: Comparison of Nutrient content in excreta of different animals (in per cent)

Nutrient	Nutrient content of manure (mg g dry weight)				
	Cattle	Sheep	Pig	Horse	Poultry
Nitrogen	25-40	20-45	20-45	17-30	28-62
Phosphorus	4-10	4-11	6-12	3-7	9-29
Potassium	7-25	20-29	15-48	15-18	8-29
Calcium	5-8	8-19	3-20	7-29	17-69
Magnesium	5-8	3-6	2-3	3-5	3-8
Sulphur	3-4	2-3	3-5	1-3	4-7

Table II: Composition of vermicompost and FYM (% on dry weight basis)

Constituent	Vermicompost	FYM
Nitrogen (N)	1.5	0.78
Phosphorus (P2O5)	0.3	0.72
Potash (K2O)	0.56	0.65
Organic Carbon	17.98	24.40
C/N ratio	11.98	31.28

Table III: Composition of biogas slurry and FYM (% on dry weight basis)

Constituent	Biogas slurry	FYM
Nitrogen (N)	1.41	0.78
Phosphorus (P205)	09.92	0.72
Potash (K20)	0.84	0.65
Organic Carbon	27.32	24.40
C/N ratio	19.37	31.28

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