Bulky Organic Manures

Bulky organic manures are those materials of plant and /or animal origin, which when added to the soil have tendency to decrease bulk density and to increase soil volume ,thus providing better physical conditions for plant growth especially in coarse textured soils and also provide essential nutrients in smaller quantities than the chemical fertilizers.

Characteristics of bulky organic manures:

1. Organic materials are relatively poorer in concentration of plant nutrients.
2. These materials possess wider C:N ratio and C:S ratios and so supply energy needed for microorganisms.
3. The mineral nutrients that are available in the organic materials become available to plants after mineralization.
4. Judicious combination of organic and inorganic manures is quite essential to maintain fertility status.

Examples : 1. FYM, 2. Composts, 3. Green manures, 4. Pouderette, 5. Biogas slurry, 6. Sewage or sludge, 7. Molasses and 8.Vermicompost

FARM YARD MANURE (Cattle manure)

The physical composition of cattle manure is called Farm Yard Manure, which consists of dung and urine of cattle and the litter, a bedding material like hay, straw used for cattle.

Cattle manure is slow acting, bulky organic and however is a low analysis fertilizer, obtained from dung and urine of farm animals mixed with litter and other miscellaneous farm wastes.

Constituents of FYM:

Dung: The dung is a solid excreta voided by farm animals, which represents the undigested and non-digestible portion of the animal feed. Besides, it is also admixed with digestive juices, tissues of alimentary canal, microbial cells etc.. The percentage of moisture varies from 70-80 per cent.

Urine: The liquid excreta of farm animals, which is composed essentially of the by products of nitrogen metabolism of farm animals. It also consists of 90 per cent water with small amounts of urea, hippuric acid, sulphates of sodium and potassium and also chlorides and phosphates of Ca, Mg, K and Na etc.,

Litter: Litter is a variable mixture consisting of straw, leaves, stems used as bedding material for cattle during their rest and eventually absorbs the urine and adds carbonaceous matter in the manure to facilitate decomposition.

Quality and composition of FYM:

The quality of manure and chemical composition in particular is highly variable as the following factors affect the product.

1. Kind of animal
2. Age and condition of the individual animal
3. Quality and quantity of feed consumed
4. Kind of litter used
5. Collection and
6. Storage of manure

1) Kind animal:

The quality of manure depends on the class of manure. viz., cattle, horse manure. With in the same class, quality varies according to the kind of animal, such as milch cattle, dry cattle, work cattle, breeding bulls etc., By and large the dung and urine from animals, which assimilates less (little) for their maintenance and production will provide better quality manure .

2) Age and condition and individual animal:

Growing animals, milch cattle, pregnant or carrying cattle utilize much of the ingredients in the feeds for building up their growing bodies, milk production and for the development of the embryo [calf]. Old or adult animals kept on light work or no work utilize little from feeds and as such, most of nitrogen is voided through urine and dung. Eventually, the adult old cattle provide better manure.

3) Quality and quantity of feed consumed:

Nutritious and protein rich feeds like oil cakes enriches the nitrogen content to the resulting manure than the bulky feeds like straw and green grass. Animals fed on concentrated feeds yield better quality manure.

4) Kind of litter used:

The quality of manure depends to a considerable extent on the nature of litter used. Remnants of leguminous hays (*Bhusa*) give richer manure than usual straws.

5) Collection of manure:

The method adopted for collection of dung, urine and litter primarily decide the quality of manure as the loss of nutrients particularly nitrogen occurs from the time urine and dung

are voided by cattle. The quality of manure depends upon the methods of collection viz., Byre, Lose box and Dry earth systems.

Byre system:

Cattle are stalled in a shed with a non absorbent floor provided with necessary slope towards the urine drains. The urine that flows into the drains is collected into a covered tank .From where it is periodically removed and sprinkled on the manure stored in a covered pit .The urine which is an important component of FYM can be properly stored (conserved) in this system. The perfect cleanliness and hygienic conditions of the stalls as well as cattle can be maintained in this system.

Dry earth system:

The floor of the cattle shed is well rammed and compacted .Layers of fine sand ,red earth of loamy soil are spread as an absorbent for urine .The wet portions are properly covered with dry layers or any of the above materials and once a week the surface layer is removed and dumped in the manure pit. Available saw dust, paddy husk, groundnut shell, paddy winnowed dust would serve the purpose very well compared to the earth absorbents. This system is popular and extensively adopted in rural parts being cheep, convenient and practicable under the existing rural conditions in India.

6) Storage of Manure:

Method of storage of manure influences the quality of manure to a large extent. During storage the manure undergoes fermentative changes, decomposition which leads to loosing its original structure and shape. There are three methods of storage viz., pit method and heap method and covered pit method.

A) Pit method (Below ground level):

In this method, the manure is stored in a pit with non –absorbent bottom and sides. The pit is provided with a bund at the rim of the pit to prevent the surface run-off of waters during rainy season .The dimensions of the pit can be variable depending on the quantity of dung, urine and litter produced on the farm per day .The losses also occur in this method due to exposure to sun and rain, but it is relatively a better method than the heap method.

B) Heap method (Above the ground level):

This is the most common method adopted in Indian villages. Manure is heaped on the ground preferably under the shade of a tree. Ideal procedure is to dump the dung first and to cover it with litter soaked urine. This is further covered with a layer of litter /ash / earth to prevent the loss of moisture and to avoid direct exposure to sun. It is also desirable to put up a small bund around the base of the heap to protect against surface run-off washing out the

manurial ingredients. It is beneficial to cover the exposed portion of the heap with Palmyra leaves or any other available material.

The maximum losses of nutrients occur in this method of storage, resulting in poor quality manure. Direct exposure to the vagaries of climate such as sunshine and rainfall causes looseness and dryness of manure, which hasten the losses of nutrients and rapid oxidation of organic matter.

C) Covered pit method:

Of all the methods described, it is the best method. In this method, the bottom and sides of the pit are made non-absorbent by granite stone lining. The pit is also provided with a bund of 1½ feet height to prevent surface flow of water (Rain water) and a suitable cover by way of roofing with locally available materials like Palmyra or phoenix leaves etc., organic matter and 8nutrient losses can be effectively controlled in this method of storage in order to obtain better quality manure [FYM: 0.68 % N- 0.5%P – 1 % K].

Improved methods of handling farm yard manure

It is practically impossible to check completely the loss of plant nutrients and organic matter during handling and storing of FYM .However, improved methods can be adopted to reduce such loss. Considerably, they are.

A) Trench method of preparing FYM:

This method has been recommended by **C. N. Acharya**. The manure preparation should be carried in trenches of suitable size, say 20-25 feet length, 5-6 feet breadth and 3-3.5 feet depth .All available dry litter and refuse from the farm and the houses should be heaped up near the cattle shed and portions of litter mixed with earth if available should be spread in the shed in the evening @ 2.26 kg per animal for the absorption of urine. The litter should be localized in the areas where urine generally drops and soaks into the ground. Every morning the urine soaked litter and dung should be well mixed and then taken into the manure trench. A section of 3 feet length of the trench from one end should be taken up for filling with daily collection of refuse from cattle shed. When the trench is filled to the height of 1.5 to 2.0 feet above ground level, the top is made dome shaped and plastered with cow dung mixed with soil. The manure becomes ready for about three months .By this time the next 3 feet length of the trench being filled up. Generally 2 such trenches would be needed for three to four cattle. It is possible to prepare by this process 250-300 cubic feet of manure (3 to 5 tones or 10-12 cart loads) per animal. The FYM should be enriched by addition of super phosphate @ 30-40 kg per trench before application to fields. The content of nitrogen is at least 0.7 to 0.8 % N on the fresh weight basis or 1.4 to 1.6 % N on dry weight basis.

Losses of Nutrients From FYM During Collection and Storage

There are two types of losses of FYM, which are as follows.

1. Losses during handling
2. Losses during preparation and storage

Losses during handling:

FYM consists of two original components such as i) dung (solid portion) and ii) urine (liquid portion) which are subjected to different losses in different ways.

Both the components contains N, P_2O_5 and K_2O. Approximately, half of nitrogen and potash in dung and other half in urine. Whereas nearly all the phosphorus (96%) in the solid portion. To conserve N, P_2O_5 and K_2O, it is most essential that both the parts of cattle manure are properly handled and stored.

i) Losses of dung: Dung is a valuable manure. Still larger portion is dried in dung cakes and burnt as fuel .Besides this large portion of cattle excrements is dropped out side the cattle shed, when the animals are grazing on the uncultivated lands. This can be used for preparation of FYM.

ii) Losses of urine: Urine contains nitrogen and potassium in large portions. But there is no good method of preserving the urine in our country. In our country most of the cattle sheds have uncemented or *kachha* floor and the urine gets soaked in the soils of *kachha* floor of the cattle shed and the large quantities of nitrogen are thus lost through the formation of gaseous ammonia as follows.

$$CO(NH)_2 + 2H_2O \rightarrow (NH_4)_2CO_3$$

Urea in urine — Ammonium carbonate

$$(NH4)2\ CO3 + 2H2\ O \rightarrow 2\ NH4OH + H2\ CO3$$

Carbonic acid

$$NH4OH \rightarrow NH3\uparrow + H2O$$

Ammonium hydroxide — Ammonia

B. Losses during preparation and storage:

Cow dung and other farm wastes are collected daily and these are accumulated in manure pit in open space for months together .The manure remain exposed to sun and rain during this period .Due to this effect the nutrients are lost in following ways.

i) By leaching:

Nutrients of manures are water soluble and these are liable to get washed by rain water .The leaching loss of nutrients will vary with the surface exposed, the intensity of rain fall

and the slope of the surface on which manure is heaped .The leaching loss may be prevented by erecting a roof over the pit.

ii) By volatilization:

During storage, the urine and dung are decomposed and considerable amount of ammonia is produced. The ammonia combines with carbonic acid to form ammonium carbonate and bicarbonate, which are rather unstable and gaseous ammonia may be readily liberated and passes into atmosphere as indicated in the following equations.

I. Urea and other nitrogenous compounds in urine and dung by microbial decomposition liberates NH_3 (Ammonia)

II. $2\ NH_3 + H_2CO_3 \rightarrow (NH_4)_2CO_3$

III. $(NH_4)_2\ CO_3 + 2H_2O \rightarrow 2\ NH_4OH + H_2CO_3$

IV. $NH_4OH \rightarrow NH_3 \uparrow + H_2O$

Ways to minimize these losses from FYM during handling

1. Adopt trench method as suggested by C.N.Acharya for handling of dung and urine.
2. Use of Gobar gas plant: 50 % of dung is made dung cakes and burnt as fuel for cooking. The use of cow dung in gas plant produces a combustible gas, methane used as fuel gas which, is an improved method of handling FYM.
3. Adopting covered method of storing FYM: Nutrients losses can be effectively controlled by this method
4. Adoption of BYRE system in collection of FYM
5. Proper field management of FYM: During spreading of FYM in the field in small heaps leads to loss of nutrients from it .It is advisable to spread the FYM before ploughing.
6. Use of chemical preservatives:

Chemical preservatives are added to FYM to decrease nitrogen losses. To be most effective, the preservatives are applied in the cattle shed to permit direct contact with the liquid portion of excreta or urine .This has to be done because the loss of nitrogen from urine starts immediately.

Commonly used preservatives are 1) Gypsum 2) Super phosphate .It is recommended that 450 g to 900 g of super phosphate should be applied per day per animal in the cattle shed .Super phosphate should be applied in places where animal pass urine . The reaction of gypsum with ammonium carbonate (intermediate product from decomposition of urea present in urine) is

$$(NH_4)_2\ CO_3 + CaSO_4 \rightarrow Ca\ CO_3 + (NH_4)_2\ SO_4$$

With this reaction ammonium carbonate is converted to $(NH_4)_2\ SO_4$. As long as manure is in moist, no loss of ammonia will occur but if dried the chemical reaction is reversed and loss of ammonia may occur. Use of gypsum also prevents the bad smell caused by production of ammonia in the cattle sheds. As such in Indian conditions use of gypsum to decrease N loss does not offer practical solution.

Super phosphate has been extensively used as a manure preservative. Since ordinary superphosphate contains up to 50to 60 per cent gypsum besides mono calcium phosphate. The reaction with ammonium carbonate is given below

$$2CaSO_4 + Ca\ (H_2PO_4) + 2(NH_4)_2\ CO_3 \rightarrow Ca_3\ (PO_4)_2 + 2(NH_4)_2SO_4 + 2H_2O + 2CO_2$$

(TCP)

In this reaction, tricalcium phosphate is formed which does not react with ammonia sulphate when manure becomes dry as such there is no loss of ammonia.

STRAW:

Straw is sometimes left on the field as waste product from the harvest. It is useful as organic fertilizer especially on farms without live stock. Although straw contains few nutrients, it yields decomposable organic matter (Eg. Cellulose).Fertilization with straw thus supplies energy [1 kg straw = 12 Kilo Joules energy] ,but mainly improves the structure of medium and heavy soils .The nutrient contents of straw vary but are small in any case viz., 0.5 % N – 0.1 % P – 1 % K and dry matter of 85 %. The C:N ratio is very large about 100:1 .This may cause inhibition of decomposition because the microbes lack in nitrogen ,[Compensating supplies of N about 1% of the quantity of straw] is thus required.