1. Organic Manures

Organic Manures

Organic manures are natural products used by farmers to provide food (plant nutrients) for the crop plants. There are a number of organic manures like farmyard manure, green manures, compost prepared from crop residues and other farm wastes, vermicompost, oil cakes, and biological wastes - animal bones, slaughter house refuse.

Organic manures increase the organic matter in the soil. Organic matter in turn releases the plant food in available from for the use of crops. However, organic manures should not be seen only as carriers of plant food. These manures also enable a soil to hold more water and also help to improve the drainage in clay soils. They provide organic acids that help to dissolve soil nutrients and make them available for the plants.

Organic manures have low nutrient content and therefore need to be applied in larger quantities. For example, to get 25 kg of NPK, one will need 600 to 2000 kg of organic manure where as the same amount of NPK can be given by 50 kg of an NPK complex fertilizer.

The nutrient content of organic manures is highly variable from place to place, lot to lot, and method of preparation. The composition of fertilizers is almost constant. For example, urea contain 46% N regardless of which factory makes it any where in the world.

Different fertilizers contain different amounts of plant nutrients, organic manures are also not alike. Average quality of farmyard manure provides 12 kg nutrients per ton and compost provides 40 kg per ton. Most of the legume green manures provide 20 kg of nitrogen per ton. Each ton of sorghum/rice/maize straw can be expected to add 26 kg of nutrients.

Green manuring is the practice of growing a short duration, succulent and leafy legume crop and ploughing the plants in the same field before they form seeds. Sesbania, Crotalaria, 'Pillipesara', Cowpea etc are good for green manuring. **Green leaf manuring** refers to adding the loppings from legume plants or trees to a field and then incorporating them into the soil by ploughing. Glyricidia, Pongamia, Leucina are common green leaf manuring plants.

Products used in soil fertility management

Banned/Prohibited

(Obtained from non- organic farms)

- Chemical and synthetic fertilizers
- Sewage sludge
- Farmyard manure
- Slurry
- Urine
- Compost
- Calcified sea weed
- Straw
- Coir pith
- Plantation products
- Oil cakes
- Mulches and other crop residues

Permitted

- FYM
- Slurry
- Urine
- Poultry manure
- Vermicompost
- Composts produced from organic residues
- Green manure and green leaf manure, bio-dynamic preparations
- Azolla
- Straw, mulches from sugarcane tresh, kitchen waste coming from organically produced stuff
- Organic composted tea/coffee wastes, coir pith, plantation

Restricted

- Organically produced mushroom beds
- Oil cake and milled by products, human excrement (risk of contamination), biofertilizers
- Saw dust
- Organic by products of food and textile industries without any synthetic additives

(Obtained from other organic farms)

- Farm Yard Manure (FYM)
- Slurry
- Urine
- Compost
- Calcified sea weed
- Straw
- Coir pith
- Plantation products
- Oil cakes, Mulches
- Other crop residues

- Blood meal, meet meal and bone-meal brought from other sources with preservatives
- Fish and fish products without preservatives guano.
- Gypsum (risk of depletion of natural resources
- Lime stone (risk of contamination)
- Magnesium rock (risk of contamination)
- Pulverized rock, natural phosphates such as rock phosphates
- Mineral potassium with low chlorine content
- Calcareous and magnesium amendments
- Basic slag and trace elements

FIG. 6.1: Summary of standards for organic farming (Bhattacharrya, 2004).

IN–SITU MANURING

This is the method of manuring to the soil *at the site.* On the basis of origin of manure there are two types of in-situ manuring

1. Manuring by animals at site
2. Manuring with plant material grown at site, popularly known as **green manuring.**

Manure and compost have been the major traditional means sustaining plant nutrients in the soil throughout history, and they are equally as important today. However, in addition, the other methods of fertility maintenance are in-situ manuring, tapping flood water, cutting and carrying natural green manure species, slicing of weeds and soils from terrace risers, tree leaf litter decomposition in agroforestry and burying of crop residues on the land.

In-Situ Manuring by Animal

This is a widespread practice in areas where herders traditionally migrate their flocks each year for the search of better pastures. There is a mutual advantage to both herders – who need a place to settle their sheep each night – and farmers, who get urine and manure right in their fields for a small fee The manuring of fields by tethering the animals directly in the fields, is also an important strategy that farmers developed to suit their conditions. There are two types of in-situ manuring.

1. One is keeping of cattle and buffalos in the open lands (unirrigated, unbunded terraces) just after harvesting of the crops. This is commonly done in October-November (after the harvest of finger millet, and before planting winter crops, like wheat or barley).
2. The second period occurs in March-April after harvest of wheat or barley, and before planting maize or millet. Animals are moved from one peg to another after every 2-3 nights so as to completely manure the field. Certain pieces of lands are intensively manured, by keeping animals for a longer period where land is available, for about 2-3 month after the harvest of first crop. This is done by constructing temporary sheds in the fallow lands, and the animals are kept in these sheds for a few weeks at a time. Such temporary sheds are moved from time to time so as to manure the complete

follow area. In such intensively manured lands, nursery raising of finger millet and rice, and planting of maize or potatoes are the practices subsequently carried out. Some farmers also keep animals under the canopy of fruit trees, in order manure the orchard. Generally, these animals are kept for a period of one to three nights at a site depending upon the number of animals, or the size or type of land. All these systems, assist the farmer to feed crop residues at the same spot, and at the same time reduces the transportation cost of manure from the cattle shed to the fields. Depending on the season and location, some farmers provide temporary shade, but in most cases, animals are kept in the open overnight. Farmers have reported that urine and dung of a buffalo tethered for three days in one spot of land is equal to heavy application of compost.

3. The other system of in-situ manuring is carried out by using migratory flocks of sheep and goats kept under a transhumance system. In hilly areas, these flocks graze on the high hill alpine pasture (above 2500 m), where almost no crops are grown (from May to October/November) while in hot arid areas the time starts just after harvest in the one and only rainy season crop i.e. from November to June. The sheep and goats are kept overnight, preferably in dry lands.

When the flocks are kept overnight on a person's land, other than the sheep owners, the land owner has to pay the Shepherd in cash or kind usually food grain, for every night of the stay on the land. There is a very high demand for such flocks.

One method of farm yard manure application is the herding of sheeps into the field (in some parts, donkeys are used). The sheeps are allowed to remain in the field overnight. Urine and excreta deposits are available right where they are needed.

The droppings are later ploughed directly into the soil. This practice is undertaken when there are no crops in the field.

Advantages: (1) Useful to small and marginal farmers who do not own cattle and have limited land. (2) Useful to farmers having limited farm yard manure. (3) Transportation and labour charges are avoided. (4) Pastorals can generate income by charging a fee for this service. (5) Manure decomposes easily. (6) Release nutrient into the soil through decomposition. (7) Promotes easy infiltration in vertisols. (8) Utilizes urine which is normally wasted.

Limitations: (1) It is difficult for those areas where sheep population is low. (2) Farmers have to depend on migratory practices of the herders.

The most common practice is used by large proportion of farmers in the hills and hot arid areas, and is a system which has been developed by the farmers through their ingenuity and has been sustained since long time. The system seems quite sustainable as it is a very old and traditional system developed by the farmers themselves. Farmers' have already recognized its importance and value.

Labour is the key component for management of soil fertility. Limitations in the more widespread of compost and FYM are created because of labour constraints. The in-situ system is an efficient method of recycling organic residues, since crop(s) residues and animal waste are properly utilized directly into the soils, with no nutrient loss, and minimal involvement of human labour. Neither does the system involve any external inputs. Further, as a traditional practice, it does not suffer any communication barrier, as many new technologies does.

In-Situ Manuring with Plants (Green Manures)

Green manuring can be defined as a practice of ploughing or turning into the soil undecomposed green plant tissues for improving physical structure as well as soil fertility. From the time immemorial, the turning in a green crop for improvement of the conditions of the soil has been a popular farming practice. Green-manuring, wherever feasible, is the principal supplementary means of adding organic matter to the soil. It consists in the growing of a quick-growing crop and ploughing it under to incorporate it into the soil. The green-manure crop supplies organic matter as well as additional nitrogen, particularly if it is a legume crop, which has the ability to fix nitrogen from the air with the help of its root nodule bacteria. The green-manure crops also exercise a protective action against erosion and leaching.

Growing a green manure is not the same as simply growing a legume crop, such as beans, in a rotation. Green manures are usually dug into the soil when the plants are still young, before they produce any crop and often before they flower. They are grown for their green leafy material, which is high in nutrients and protects the soil.

If food is in very short supply, it may be better to grow a legume from which a bean crop can be harvested and then dig the plant remains into the soil. These plant remains will not break down in to

Prevention of soil erosion: Green manures help to stop the soil being carried away by wind and rain. The roots penetrate the soil and hold it in place.

Weed control: Green manures help to control weeds. Bare soil can become quickly overgrown with weeds, which can be difficult to remove. Green manures cover the ground well and stop weeds growing beneath them, by competing for nutrients, space and light.

Method of Use

Farmers often observe the benefits of green manures but many do not use them because they do not know which species to use and how to include them in their own farming system. It is, therefore, important to plan in advance where and when they are to be grown.

The adoption of green manuring depends upon the agroclimatic conditions. Broadly, the following two types of green manuring can be thought of:

Green Manuring *In Situ*: In this system, green manure crops are grown and buried in the same field which is to be green-manured, either as a pure crop or as an intercrop with the main crop. In India, various methods of growing green manure crops *in situ* are followed to suit local conditions. For the proper decomposition of the green manure, it is necessary that the green material should be succulent and there should be adequate moisture in the soil. Plants at the flowering stage, contain the greatest bulk of succulent organic matter with a low carbon/nitrogen ratio. The incorporation of the green-manure crop into the soil at this stage allows a quick liberation of nitrogen in the available form.

Green manuring *in situ* is followed in Northern India while green leaf manuring is common in eastern and central India. Green manuring is a practice of ploughing or turning into the soil undecomposed green plant material for improving the physical conditions of the soil or for adding nutrients. Any crop or plant (generally leguminous) grown and ploughed *in situ* is called a green manure, for example, dhaincha, sesbania, sunnhemp, wild indigo and pillipesara. A leguminous crop producing 10-25 tonnes of green matter per ha will add about 60 to 90 kg N. *green leaf manure* refers to turning under of green leaves and tender green twigs collected from shrubs and trees grown on the bunds, wastelands and nearly forest areas. Common shrubs and trees useful for this purpose are *karanj*, *glyricidia*, *neem*, *subabul*, etc.

1. **Dhaincha (*Sesbania aculeata*):** It is suitable for loamy and clayey soils. Dhaincha is an ideal green-manure crop for rice based cropping system. It is fairly resistant to drought as well as stagnation of water. The green manure grows well even in alkaline soils and corrects alkalinity if grown repeatedly for 4-5 years. The roots have plenty of nodules. It yields about 10-15 tonnes of green manure per ha and requires a seed rate of 30-40 kg/ha.
2. ***Sesbania speciosa:*** It is a valuable green manure for wetlands and can be grown in a wide range of soils. Seed production is prolific; however, pods are frequently attacked by insects. The green manure can be raised on the field borders along the bunds. *Sesbania* seedling (21 days) can be planted in a single line at 5-10 cm apart in the borders of the fields close to the bunds. In about 90 days it produces about 2-4 tonnes of green manure per ha. It does not affect the rice yield by shading or root effect. If second rice crop is planted immediately after the first crop, the manure can be incorporated into the field. About 300-400 g of seeds are sufficient to raise nursery and plant the seedlings along the bunds of one hectare.
3. ***Sesbania rostrata:*** One of the important features of this green manure is that in addition to the root nodules, it produces nodules in the stem. The stem nodulation is an adaptation for waterlogged situation since flooding limits growth of green manures and may reduce root nodulation. Under normal condition, both root and stem nodules are effective in N fixation. It can produce about 40-50 tonnes of fresh biomass from one ha in about 50-60 days. It has higher N content of 3.56 % on dry weight basis. Biomass production is higher during summer (April – June) than in winter (Dec.-Jan.) season. This green manure can also be produced by raising seedlings (30 days old) and planted in the paddy field along the bunds or as intercrop with rice.
4. **Sunnhemp (*Crotalaria juncea*):** It is a quick growing green manure crop and gets ready for incorporation in about 45 days after sowing. It does not withstand heavy irrigation leading to flooding. The crop is at times subject to complete damage by leaf eating caterpillars. The crop can produce about 8-12 tonnes of green biomass per ha. The seed requirement is 30 kg/ha.
5. **Wild indigo (*Tephrosia purpurea*):** This is a slow growing green manure crop and cattle do not prefer to graze it. The green manure is suitable for light textured soils, particularly in single crop

The Choice of Green Manure

When choosing which green manure plant to use, you should consider the following points:

1. A green manure must suit the local climate, and the soil that it is to be sown in. This will help to keep the green manure healthy and to keep pests and diseases to a minimum.
2. Fast growing and leafy green manures are often preferred as they provide more nutrients when dug in.
3. Green manures should not be closely related to the following crop as they could attract pests and diseases which may affect the following crop.
4. It is important to know whether seed is easily available and affordable.
5. The length of time that land is free and how long the green manure will take to grow.
6. Plants which can be grown as a green manure include legumes and non-legumes. Legumes have nodules on their roots which contain bacteria. These bacteria take nitrogen from the air. This is known as nitrogen-fixation. Plants use this to grow, but this extra nitrogen is also made available to future crops when the legumes are dug into the soil. The ability of legumes to fix nitrogen makes them

very good green manures. However, they do have limitations and non-legumes can sometimes be more suitable.

Legumes will only fix nitrogen if the right type of bacteria, for example *Rhizobium*, are in the soil. This is especially relevant if the legume is not a local plant. A product containing these bacteria can be bought but it may be expensive. Even if the bacteria are provided, other non-legume plants can be better in some situations. They may produce more organic matter and have a better root system. They may also survive better and grow faster and may be able to tolerate extreme weather conditions or poor soils.

EX-SITU MANURING

Ex-situ is literally *out of place* and the opposite of in situ (*in place*). Many a times in-situ manuring not able to fulfill the nutrient requirement of the soil on the other side plenty of organic waste from agriculture, animals and human being is available which is rich in nutrient and needs safe disposal and crop field are the best place for this. In the organic farming the nutrient cycle has to be maintain in which the nutrient taken out in terms of economic yield has to be returned to soil and use of agriculture waste is the appropriate solution for maintaining the cycle.

Organic manures from agriculture/animal/human waste, contain essential plant nutrients and other growth promoting agents like enzymes and hormones, while no synthetic chemical fertilizer can supply all together thus they are indispensable from the manural schedule for any crop production. The organic manure through the process of decomposition and humification gives humus which helps to improve the physical, chemical and biological properties of soil. The organic acid released during decomposition of organic manure controls certain fungal pathogens and nematode infestations. Commonly available organic manures like FYM, crop residues, poultry and sheep manure, oil cakes and other farm wastes will effectively be utilized for nutrient supplement.

Agricultural Wastes

Crop residues, tree wastes and aquatic weeds: (1) Crop wastes of cereals, pulses and oilseeds (wheat, paddy, *bajra*, *jowar*, gram, *moong*, *urad*, cowpea, *arhar*, *masoor*, ground-nut, linseed, etc.). (2) Stalks of corn, cotton, tobacco, sugar-cane trash, leaves of cotton, jute, tapioca, arecanut, tree leaves, water hyacinth, forest litter, etc.

Urban and rural wastes: (1) Rural and urban solid wastes. (2) Urban liquid wastes – sewage and sullage.

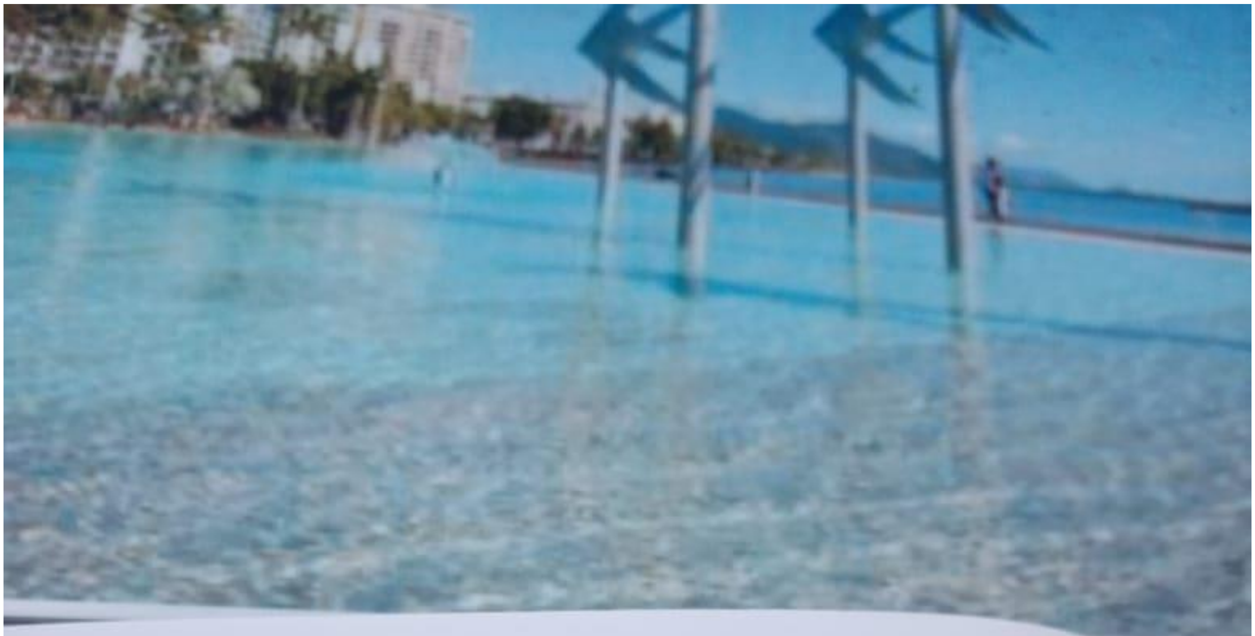
Agro-industries byproducts: (1) Oil-cakes, (2) Paddy husk and bran, (3) Bagasse and pressmud, (4) Sawdust, (5) Fruit and vegetable wastes, (6) Cotton, wool and silk wastes, and (7) Tea and tobacco wastes.

Marine wastes: Fish meal and aquatic/seaweeds.

Crop residues: Residues left out after the harvest of the economic portions are called crop residues/straw. In the developing countries like India, they are mostly used as cattle feed. In the developed countries, harvesting is done using combine harvester and hence the straw cannot be used as cattle feed. They are generally burnt in the field itself. Straw has good manurial value since it contains appreciable amount of plant nutrients. On an average, cereal straw and residues contain about 0.5 % N, 0.6 % P_2O_5 and 1.5 % K_2O. The crop residues can be recycled by way of incorporation, compost making or mulch material.

Agro-industrial wastes: Agro-industrial wastes are available in substantial quantities at processing sites and can be effectively utilized as manure.

Rice husk: It is the major by-product of the rice milling industry. Unhulled paddy grain constitutes 20-25 % of husk. It is a poor source of manure and the nutrient content is very low (0.3–0.4% N, 0.2-0.3% P_2O_5 and 0.3–0.5% K_2O). Rice husk should be incorporated into the wet soil and can be used in saline and alkaline soils to improve the physical conditions. It can also be used as a bedding material for animals.



Bagasse: The most important by-product of sugar industry is bagasse. It is mainly used as fuel in boilers of sugar factories. It can be used as manure raw or after composting. It contains 0.25 % N and 0.12 % P_2O_5.

Pressmud: It is a by-product obtained during the process of sugar manufacturing. It contains about 1.25 % N, 2.0 % P_2O_5 and 20-25 % organic matter. Addition of pressmud is highly useful to acidic soils since it contains high amount of lime (upto 45 %)

Tea wastes: In the tea industry, tea wastes are available during the course of tea production, processing and storage. Tea wastes are used for extraction of caffeine. The decaffeinated tea wastes can be used as a manure. Nutrient content of the spent tea waste is 0.3-0.35 % N, 0.4 % P_2O_5 and 1.5 % K_2O.

Coir waste: It is a waste product from the coir industry and mostly dumped near the road sides. Coirpith contains high amount of lignin (30 %), cellulose (26 %) and wide C : N ratio (112:1). To reduce the bulk and C : N ratio, composting is recommended. The composted coirpith contains 1.26 % N, 0.06 % P, 1.20 % K with C/N ratio 24:1. The lignin content is reduced to 4.8 % due to composting.

ditches and extended aeration systems.

Nitrogen: Nitrogen in liquid waste can exist in 4 forms, all of which are of interest to the agricultural sanitary engineer. The 4 forms are organic nitrogen, ammonia nitrogen, nitrite nitrogen, and nitrate nitrogen. The total of these 4 forms constitute total nitrogen.

1. **Organic Nitrogen:** All nitrogen present in organic compounds is considered to be organic nitrogen. The nitrogen-containing organic compounds are derivations of ammonia, the oxidation of which forms ammonia nitrogen.
2. **Ammonia Nitrogen:** The ammonia nitrogen is a result of bacterial decomposition of organic matter. Fresh sewage is generally high in organic nitrogen and low in ammonia nitrogen. The sum of organic and ammonia nitrogen should remain constant for the same liquid wastes, unless ammonia is allowed to escape to the atmosphere because of septic action. The total concentration of the two serves as a valuable index for evaluating the strength of liquid waste and for determining the type of treatment process to select.
3. **Nitrite Nitrogen:** Nitrite nitrogen is formed by bacterial oxidation of ammonia nitrogen. It is not present in fresh wastes but appears after bacterial activity has taken place. The presence of nitrite nitrogen indicate that the waste has undergone partial decomposition and is unstable. Nitrites can either be reduced back to ammonia or oxidized to nitrates.
4. **Nitrate Nitrogen:** Nitrate nitrogen is formed by the oxidation of nitrites and represents the most stable form of nitrogen. It is an

indication of stability and is a determination of the completeness of the biological decomposition process.

Phosphorus: Phosphorus plays an important role in the life processes and thus is important in waste treatment facilities. Phosphorus is especially important in assessing the potential biological activity of aerobic treatment processes. Excessive amounts of phosphorus in surface waters can stimulate algal bloom and eventually eutrophy the water.

pH: pH determinations have very little sanitary significance. It has no direct relationship to the strength of liquid waste or on the method of treatment to be used. Basically, pH is used to control the operation of various biological treatment processes. It is especially valuable in the design and control of anaerobic digestion.

Bio Plant Growth Promoters: The decayed plant extracts are also used liquid manure for promoting plant growth. The Eupatorium weed, the stinging nettle, *Glyricidia* and *Khaki* fruit can be used as liquid manure for growth promotion and observed to be good growth inhibitors of paddy crop.

Utilization of Agricultural Organic Waste

Chemical constituents like cellulose, hemi-cellulose and lignin lead to establish the potential of agricultural wastes as food, feed, fodder, fibre and chemical products of economic importance. The **calorific value** (CV) indicates the fuel utility of agricultural waste. The CV for various agricultural waste materials varies between 14 to 19 MJ/kg. Higher C content favours calorific value of the waste material. The volatile water in plant residues may be around 80 per cent and fixed carbon is 20 per cent. Volatile matter in plant residues contribute towards oil and tar content. The characteristics of common agricultural wastes available in India are pigeonpea stalks, bagasse, cotton sticks, groundnut shell, maize cobs, maize stalks, rice husk, rice straw and wheat straw.

The characteristics of the agricultural waste materials make them important in respect of their use and economic value. Agricultural wastes can be put to use because of: (1) Farm development (improvement of soil health, soil fertility, soil physical conditions and plant protection). (2) It is the source of energy and power. (3) It acts as animal feed and fodder. (4) It is the human food.

Direct Incorporation of Organic Materials in the Soil

Organic materials of different sorts can be ploughed in the soil (0-20 cm layer) about 3-4 weeks prior to sowing of crop with optimum moisture level. The prior decomposition of organic materials is important to ensure benefit to the crop and without nitrogen immobilization by microorganisms. The rate of decomposition will depend on the nature of organics used. Leguminous residues and non-edible cakes will mineralize faster as compared to cereal residues/straw). Addition of nitrogen in the form of chemical fertilizers or non-edible cakes will accelerate the pace of mineralization of cereal residues/ straw poor in nitrogen. On the other hand, mineralization of humified FYM or compost is slow and steady process and acts as a slow release fertilizer. It can be incorporated in soil even just before sowing of the crops. Application of farmyard manure or compost is the best source for maintenance of soil organic matter. The next in order is cereal straw/residues for the maintenance of organic matter in soil. Legume residues are not good for maintenance of soil organic matter in soil. Legume residues are not good for maintenance of soil organic matter in tropics but are good sources of plant nutrients, specially nitrogen and they may add as much as 40 k N/ha in one season.

COLLECTION AND STORAGE OF ORGANIC WASTE

Traditionally, animals were bedded with straw or other litter and the manure was mixture of urine, faeces, and straw. This farmyard manure was normally stored and spread as a solid. A high proportion of agricultural waste is still handled with straw, as farmyard manure. However, an increasing proportion is being stored and handled as a liquid or slurry where no bedding is used. This is particularly true on most new and large intensive animal enterprises.

Animal wastes can be divided into three main categories:

1. Farmyard manure, where straw or other bedding is used;
2. Slurry, which is a mixture of faeces and urine, often containing variable quantities of rainwater and washwater; and
3. Separated manure, where the waste is separated into two fractions-solid and liquid-which are handled separately.

The third category is receiving increased attention with the use of mechanical slurry separators, where the liquid fraction is spread or irrigated to land, and the solid fraction is handled separately as a solid. Other categories of manure in which non-mechanical separation takes place can be included here. In arid or semi-arid regions, manure quickly dries out by evaporation after it is produced in feedlots or corrals. This manure is handled as a solid and is sometimes stacked. With this method of storage, there is no liquid for disposal; however, there can be runoff problems after heavy rainfall.

Straw on soil after harvesting cereal crops is in a somewhat different category, as it can interfere with subsequent mechanical cultivation. To avoid this problem, straw is often burned or mechanically chopped into small pieces after harvesting. Straw left on the soil in this manner supplies the small quantities of phosphorus, potassium, and other nutrients present for subsequent crops. Due to the high carbon to nitrogen ratio of straw, the mineralizing organisms may reduce the available soil nitrogen, and extra should usually be applied-about 30 kg N/ha, if straw is not burned or removed.

Dairy cattle are sometimes housed in straw bedded sheds. The manure is usually allowed to accumulate to a depth of about 1 metre before cleaning. The manure is then either spread directly to land or stored in a heap for subsequent spreading.

Increasingly, manure is being collected and stored as slurry. The concept of handling manure as slurry containing a mixture of faeces, urine, and water is not a new one. Different methods of slurry handling have been practiced over the past century.

PROCESSING OF AGRICULTURE WASTE

Before application in the field the agriculture waste need to be processed for-

1. *Maintaining the low Carbon:* Nitrogen ratio, otherwise it would compete with crop for the nitrogen required for decomposition in the field.
2. Making material hygienic so that pathogen should not be transmitted to crop/human beings.
3. Composting is one way in which some of the problems associated with the utilization of various organic wastes (e.g., odors, human pathogens, and storage and handling constraints) can be resolved. Composting is an ancient practice whereby farmers have converted organic wastes into resources that provide nutrients to crops and enhance soil tilth, fertility, and productivity. Through composting, organic wastes are decomposed, nutrients are made available to plants, pathogens are destroyed, and malodours are abated. Composts provide a more stabilized form of organic matter than do raw wastes, and can vastly improve the physical properties of soils. For example, addition of sludge compost to sandy soils will increase their ability to retain water and render them less droughtly. In heavy-textured clay soils, the added organic matter will increase permeability and water infiltration and clay soils have been shown to reduce soil compaction, lower the bulk density, and increase the rooting depth.
4. Reduced the possibility of attack of Cellulose loving insects e.g. termite, as the Cellulose is decomposed during composting.