**Farm Yard Manure: Useful Resource for Agriculture**

**Neha Toppo, Iska Srinath Reddy and Arun Alfred David**

Department of Soil Science and Agricultural Chemistry,

Naini Agricultural Institute,

Sam Higginbottom University of Agricultural, Technology and Sciences,

Prayagraj, Uttar Pradesh, India

**Abstract**

Farmyard manure (FYM), a dependable organic resource for boosting soil fertility and overall crop output, is a time-honored agricultural technique. There are plenty of benefits of embracing FYM in agriculture. Farmyard waste is a useful resource for agriculture that is sustainable. It is crucial for both ecologically friendly and financially effective farming techniques because of its high nutritional content, enhancement of soil structure, and role in carbon sequestration. Farmers can improve soil fertility, lessen environmental consequences, and contribute to the long-term sustainability of world food production through integrating FYM into agricultural systems.

**Keywords:** *FYM, sustainable, soil fertility, organic, soil health,* *eco- friendly*

1. **Introduction**

Farmyard manure, also referred to as FYM, is a priceless organic substance that has been utilized for generations in agriculture to increase soil fertility and increase crop yields. This organic fertilizer is made up of a combination of decomposed plant debris, animal feces, and other organic material that has been gathered from farmyards, stables, and livestock pens. Since FYM has various advantages for both soil health and total crop output, it is a crucial part of sustainable farming techniques.



Fig. 1. Farm Yard Manure

The following are the primary goals of using farmyard manure:

1) To encourage soil nutrient enrichment

2) To emphasize the agriculture system's long-term sustainability.

3) To create food products devoid of dangerous substances.

1. **Definition**

Animal waste, straw, and other organic resources gathered from farms make up FYM, an environmentally friendly fertilizer and soil conditioner. To make the soil more fertile for crops to thrive, it is often used to improve the soil's structure and enrich it with nutrients.

1. **Composition**

Farmyard manure (FYM) is often composed of organic materials acquired from farms; many of these components are comprised up of waste from crops and animals. The composition may fluctuate depending on the types of livestock kept on the farm as well as the farming practices used. General breakdown of the components usually present in FYM are: -

1. **Animal manure:** This is a significant component that may include animal waste from a variety of animals, including dairy animals, horses, sheep, goats, hens, and pigs. Animal excrement is a rich source of nutrients like potassium, phosphorus, and nitrogen, which are essential for plant growth.
2. **Straw and bedding material:** Straw or other materials for animal bedding can be combined with manure. These materials provide carbon for composting, improve aeration, and aid in absorbing moisture.
3. **Urine:** Additionally adding to the composition of FYM is animal urine. It has soluble nutrients like nitrogen and other ingredients that are good for plants.
4. **Plant residues:** Farm field plants and crop remnants may be added to FYM to increase the amount of carbon and other organic matter in the mixture.
5. **Microorganisms:** FYM frequently contains helpful microorganisms, such as bacteria and fungus, which contribute to the breakdown of organic waste and the transformation of the manure into an advantageous organic fertilizer.
6. **Preparation**

**Three techniques are used to prepare FYM: -**

* 1. **Heap method**

Farmyard manure, also known as organic or composted manure, is a valuable and nutrient-rich fertilizer that can be prepared using the heap method. This method involves piling up organic materials, such as animal dung, straw, leaves, and kitchen waste, in layers to create a compost heap. The heap method of preparing farmyard manure allows you to recycle organic waste and create a valuable resource for improving soil fertility in your garden or farm. It is an eco-friendly and sustainable way to enhance crop yields and soil health.

**Materials and Tools Needed in preparation of farmyard manure using the heap method**

1. Animal dung (cow dung, horse dung, poultry manure, *etc*.)
2. Straw or dry leaves
3. Green organic material (kitchen scraps, grass clippings)
4. Shovel or pitchfork
5. Water source
6. Aeration tools (*e.g.,* a metal rod or PVC pipe)

**Steps to Prepare Farmyard Manure**

1. **Choose a Suitable Location:** Select a well-drained and flat area for your compost heap. Ensure it is easily accessible and away from buildings to prevent odour issues.
2. **Gather Organic Materials:** Collect a mix of brown materials (carbon-rich) and green materials (nitrogen-rich). Brown materials include straw, dry leaves, and cardboard, while green materials include kitchen scraps, grass clippings, and fresh plant trimmings. Aim for a balanced ratio of brown to green materials.
3. **Prepare the Base:** Create a base layer of straw or dry leaves about 6 inches thick on the chosen spot. This provides good aeration at the bottom of the heap.
4. **Layering:** Start layering the organic materials in the following order:
	* A layer of animal dung (about 4-6 inches thick).
	* A layer of green organic materials.
	* A layer of brown organic materials.
	* Repeat this layering process until the compost heap reaches a height of 3 to 4 feet. Make sure to moisten each layer as you go to ensure proper decomposition. The moisture level should be like a damp sponge, not too wet or too dry.
5. **Aeration:** To ensure adequate oxygen supply for decomposition, insert a metal rod or PVC pipe vertically into the heap at several locations. These aeration channels will help prevent the compost from becoming anaerobic.
6. **Cover the Heap:** Cover the top of the compost heap with a layer of straw or leaves to retain moisture and maintain an even temperature. You can also use a plastic sheet to protect it from rain.
7. **Regular Turning:** Every few weeks, use a shovel or pitchfork to turn the compost heap. This aerates the pile, mixes the materials, and speeds up decomposition. Monitor the moisture level and add water if necessary.
8. **Maturation Period:** Farmyard manure is usually ready for use in 6 months to 1 year, depending on various factors such as temperature, aeration, and the size of the heap. It should have a crumbly texture and earthy smell when it is fully matured.
9. **Storage:** Once the farmyard manure is ready, store it in a cool, dry place or directly apply it to your garden beds or farm as a nutrient-rich soil amendment.
	1. **Trench method**

The trench method of preparing farmyard manure is a traditional and effective way to create nutrient-rich organic compost on a farm. The trench method of preparing farmyard manure is an excellent way to recycle organic waste from your farm and enhance soil fertility naturally. It improves soil structure, adds essential nutrients, and promotes healthy plant growth.

**Materials and Equipment Needed in** **preparation of farmyard manure using the trench method**

1. **Manure**: Organic materials from the farm, such as animal dung (cattle, sheep, goat, *etc.*), crop residues (straw, leaves, *etc.,*), and any other organic waste material available.
2. **Digging Equipment**: Shovels, spades, or tractors with the necessary attachments for digging trenches.
3. **Water Source**: Access to water for moistening the materials is essential.

**Steps to Prepare Farmyard Manure using the Trench Method:**

1. **Select a Location**: Choose a suitable location on your farm for preparing the trench. It should be well-drained and away from water bodies to prevent contamination.
2. **Dig Trenches**: Dig trenches that are typically 0.91-1.06 m deep, 1.5 to 1.06 m wide, and 6.09 to 7.62 m long but may vary with the quantity of organic material you have and based on the requirements.
3. **Layer Organic Material**: Start layering the organic materials in the trench. Alternate layers of animal dung and crop residues. The exact ratio of dung to crop residues can vary, but a common practice is to use roughly 1 part dung to 2-3 parts crop residues.
4. **Add Water**: After adding each layer, sprinkle water over it to keep the materials moist. Proper moisture is crucial for the decomposition process.
5. **Repeat Layering**: Continue layering until the trench is filled. Make sure the top layer consists of crop residues to prevent excessive moisture loss.
6. **Cover the Trench**: Cover the filled trench with a layer of soil to help retain moisture and provide insulation. This also helps prevent odour and flies.
7. **Wait for Decomposition**: The organic materials in the trench will decompose over time, typically taking several months to a year or more, depending on factors like temperature and the materials used.
8. **Turn and Mix**: Periodically, you can turn and mix the materials in the trench to accelerate decomposition and ensure uniform composting. This step is optional but can help speed up the process.
9. **Harvest the Manure**: Once the materials in the trench have broken down into dark, crumbly compost and no longer resemble their original forms, you can harvest the farmyard manure.
10. **Store and Use**: Store the farmyard manure in a dry area until you are ready to use it in your fields. When applying it to your crops, spread it evenly for best results.
	1. **Pit method**

The pit method of preparing farmyard manure (FYM), also known as composting, is a traditional and effective way to convert organic waste materials into nutrient-rich fertilizer for your garden or farm. The pit method of preparing farmyard manure is a cost-effective and environmentally friendly way to recycle organic waste and improve soil fertility. It is essential to maintain proper moisture and aeration throughout the composting process to ensure the decomposition of organic materials.

**Materials and Equipment Needed in** **preparation of farmyard manure using the Pit Method**

1. **Organic waste materials:** This can include kitchen scraps, crop residues, animal manure, straw, leaves, and any other organic matter.
2. **Digging tools:** Shovel, spade, or a backhoe for digging the pit.
3. **Water source:** To maintain moisture levels during the composting process.

**Steps to Prepare Farmyard Manure using the Pit Method:**

1. **Select a Suitable Location:** Choose a well-drained location for your compost pit. It should ideally be in a shaded area to prevent excessive drying out but not waterlogged.
2. **Dig the Pit:** Dig a pit of suitable dimensions based on the amount of organic waste you have. A typical pit may be about 3-4 feet deep, 5-6 feet wide, and as long as needed.
3. **Layering:** Start by adding a layer of coarse materials like straw or dry leaves to the bottom of the pit. This helps with aeration and drainage.
4. **Add Organic Materials:** Add layers of organic waste materials such as kitchen scraps, crop residues, and animal manure. Make sure to mix different types of materials to create a balanced compost pile. Avoid adding diseased or pest-infested plant material.
5. **Moisten the Layers:** After adding each layer of organic matter, lightly moisten it with water. The compost pile should be kept moist but not waterlogged.
6. **Turn the Pile:** To ensure proper aeration and decomposition, turn the compost pile every few weeks. Use a shovel or fork to mix the materials and aerate the pile. This helps in speeding up the decomposition process.
7. **Maintain Moisture and Aeration:** Keep an eye on the moisture level. If the pile becomes too dry, add more water. If it is too wet, add dry materials like straw to improve aeration. Proper aeration and moisture are crucial for the breakdown of organic matter.
8. **Cover the Pit:** Covering the pit with a layer of straw or leaves can help in maintaining the moisture levels and temperature. It also prevents pests from getting into the compost.
9. **Monitor the Temperature:** As the organic matter decomposes, the temperature inside the compost pile will rise. This is a sign that the composting process is working. The temperature can reach up to 130-160°F (54-71°C).
10. **Maturation:** Allow the compost to mature for several months, typically 6 months to a year, depending on the materials used and environmental conditions. The compost is ready when it turns dark, crumbly, and has an earthy, pleasant smell.
11. **Use the Compost:** Once the compost is mature, you can use it to enrich your garden or farm soil by mixing it with existing soil or as a top dressing for plants.
12. **Nutrient content**

Farm management practices, animal breed, nutrition, and other elements can all have a significant impact on the nutrients in farmyard manure (FYM). FYM is an excellent source of nutrients for plants, and it often contains the following: -

1. **Organic matter:** Since FYM has a high organic matter content, the soil's structure, water-holding competence, and microbial activity are all boosted.
2. **Nitrogen:** Although FYM's nitrogen content might change, it normally has a moderate quantity. Nitrogen, which is necessary for plant growth, is progressively released as the organic matter in FYM breaks down.
3. **Phosphorus:** Phosphorus, an essential nutrient that plants require for root growth, blooming, and fruiting, is present in FYM.
4. **Potassium:** Another crucial component included in FYM is potassium, which supports plant health, disease resistance, and general growth.
5. **Micronutrients:** Even though in smaller amounts, FYM may also contain a variety of micronutrients such iron, manganese, zinc, and copper. In trace levels, these micronutrients are necessary for plant growth.
6. **C:N ratio:** Typically, the carbon-to-nitrogen (C:N) ratio of FYM is quite high. This ratio has an impact on how quickly FYM decomposes in the soil and can alter how readily available nitrogen is to plants. Composting FYM can aid in lowering the C:N ratio and increasing the nitrogen's availability.

\*In general, on an average FYM contains 0.5% N, 0.2%P2O5 and 0.5% K2O.

1. **Application**

It is crucial to consider the unique nutrient needs of the plants or crops being cultivated while utilizing FYM, as well as the amount of manure that will be applied. To make FYM a safer and more beneficial soil supplement, it can also be composted before use to help eliminate unwanted smells and infections. Agricultural practices, soil characteristics, and the crops being farmed can all affect how farmyard manure (FYM) is applied. Following are some instances of how FYM can be used in relation to various contexts:

1. **Field crops (*e.g.,* Wheat, corn, soyabeans *etc.)***

a**. Pre-Plant Application:** Spread FYM uniformly across the field prior to planting at the prescribed rate (*e.g.,* 2-5 tons per acre). Use tilling or ploughing tools to incorporate the manure into the soil to a depth of 6 to 8 inches. This enhances the structure and fertility of the soil.

* 1. **Crop Rotation:** As part of a crop rotation strategy, apply FYM to fields. Before growing another crop, add FYM to the soil to replace nutrients and organic matter after a crop has been harvested.
1. **Vegetable Gardens:**
	1. **Raised Beds:** Before planting vegetables in raised bed gardens, amend the soil in the beds using FYM. This offers a growing medium that is rich in nutrients.
	2. **Mulching:** To conserve moisture, control weeds, and provide a slow-release supply of nutrients, use FYM as mulch around vegetable plants.
2. **Fruit Orchards (*e.g.,* Apple, Peach, Citrus):**
	1. **Planting Holes:** Include FYM in the soil backfilled around the root ball when planting fruit trees. Having access to nutrients aids in the establishment of young trees.
	2. **Orchard Floor:** To increase the fertility and health of the soil, spread FYM as a mulch or topdressing on the orchard floor. To avoid causing root damage, avoid stacking manure up against tree trunks.
3. **Flower Beds and Landscaping:**
	1. **Bed Preparation:** To strengthen the soil's structure and supply nutrients to decorative plants, mix FYM into the ground in flowerbeds and landscape planting locations.
	2. **Mulching:** Around shrubs and flowers, spread a layer of FYM as mulch to improve nutrient availability and soil moisture retention.
4. **Composting:**
	1. **Compost Pile:** Utilize FYM as a source of nitrogen-rich materials for compost piles. To make a compost that is well-rounded, balance it with carbon-rich materials (such leaves and straw).
	2. **Vermicomposting:** Utilize FYM as bedding in bins for vermicomposting. Earthworms will eat the manure and create worm castings that are nutrient-rich.
5. **Greenhouses and Container Gardening:**
	1. **Potting Mix:** Create a nutrient-rich potting mix with FYM and other ingredients (such as peat moss and perlite) for greenhouse plants and container gardening.
6. **Restoration of Degraded Soils:**
	1. **Over Time:** Apply FYM over several seasons to restore soil fertility and enhance its general health in regions with severely degraded or nutrient-poor soils.
7. **Benefits**

When utilized as an organic soil amendment, farmyard manure (FYM) can have several beneficial benefits on the health of the soil and environment. The following are a few of the main advantages of using FYM for soil health:

1. **Increased organic matter:** As a result of the FYM's abundant organic matter, the soil's organic carbon concentration rises. Organic matter helps soil aeration, water-holding capacity, and soil structure. Additionally, it offers beneficial soil bacteria a food source.
2. **Nutrient enrichment:** In addition to micronutrients, FYM includes important plant nutrients like nitrogen (N), phosphorus (P), and potassium (K). These nutrients become available to plants when they are integrated into the soil, promoting their healthy growth and development.
3. **Improved soil fertility:** By providing nutrients and enhancing nutrient retention in the soil, FYM increases soil fertility. It functions as a slow-release fertilizer, gradually releasing a steady stream of nutrients.
4. **Enhanced microbial activity:** Earthworms, fungus, and other helpful microbes are added to the soil *via* FYM. These bacteria aid in the cycling of nutrients, the degradation of organic matter, and the decomposition of plant leftovers. The health of the soil and ecosystem processes can be improved by increased microbial activity.
5. **pH Buffering**: FYM can act as a pH buffer, enhancing soil stability and resistance to sudden changes in acidity or alkalinity. This encourages maintaining the pH range that is ideal for plant growth.
6. **Reduced erosion and runoff:** In soils modified with FYM, the enhanced soil structure and higher organic matter content can lessen soil erosion and runoff, preserving soil and water resources.
7. **Enhanced water retention:** By increasing soils' ability to store water, FYM enables soils to hold onto moisture for extended periods of time. This can lessen the need for frequent irrigation and is especially helpful during dry seasons.
8. **Better Soil Structure:** By promoting soil aggregation and minimizing compaction, FYM enhances soil structure. This enables greater water infiltration, enhanced aeration, and higher root penetration.
9. **Disease suppression:** According to certain research, FYM can encourage a diverse and healthy soil microbiome, which may assist to prevent several soilborne diseases.
10. **Environmental benefits:** Utilizing FYM as a natural and organic soil amendment helps promote more ecologically friendly and sustainable farming practices by reducing the need for synthetic fertilizers and chemical pesticides.
11. **Carbon Sequestration**: According to research, organic matter like FYM if added to soil on long term basis then it can help in carbon sequestration, a process that helps in climate change mitigation.
12. **Cost Savings**: FYM can help farmers and gardeners in saving money by lowering the demand for synthetic fertilizers and enhancing soil health.
13. **Management and precautions**

To ensure the safety, efficacy, and quality of the manure, proper management and safeguards must be taken throughout the preparation of farmyard manure (FYM). Following are some of the important considerations and actions to take when getting ready for FYM: -

**1. Collection of Raw Materials:**

* Gather animal waste (such as dung and urine) from the farm's healthy animals.
* As required, use straw, crop byproducts, or other suitable bedding materials.

2**. Proper Storage:**

* To avoid contamination, keep the raw materials in a designated area away from water sources.
* Keep the materials dry to prevent runoff and nutrient leaching.

3. **Maintain a Proper C: N Ratio:**

* By combining animal excrement, which is high in nitrogen, with carbon-rich bedding materials (such as straw and leaves), you may ensure that the carbon-to-nitrogen (C: N) ratio is suitable. For composting, a C: N ratio of about 20-30:1 is optimum.

4. **Size Reduction:**

* To speed up decomposition, use the shredded or chopped bulky materials like straw or crop leftovers.

5. **Composting Process:**

* Layer the components to create windrows or compost piles. Layers of animal faeces and bedding materials should be alternated.
* Rotate the pile frequently to allow air to circulate and hasten decomposition. To avoid anaerobic conditions and unpleasant odours, proper aeration is necessary.
* Keep the compost pile's moisture content at the ideal level, usually between 50% and 60%. Too little moisture hinders decomposition while too much moisture might cause odour problems and nutritional loss.

6. **Temperature Monitoring:**

* Use a compost thermometer to keep tabs on the compost pile's temperature. Compost that is properly handled will warm up when the organic material is broken down by microbes. Pathogens and weed seeds can both be destroyed by high temperatures (130-160°F or 54-71°C).

7. **Odour Control:**

* Bad scents should not be produced by properly maintained compost. Adjust the C:N ratio, moisture levels, or aeration if odours start to be an issue to restore appropriate decomposition.

8. **Pathogen Reduction:**

* As previously indicated, composting at high temperatures can help eliminate dangerous bacteria in the manure.
* For the compost to mature properly and decrease pathogens, give it several months to a year.

9. **Contaminant Screening:**

* Ensure that the raw materials used to prepare FYM are devoid of pollutants that could harm plants or soil, such as herbicides, pesticides, or heavy metals.

10. **Storage of Matured FYM:**

* To avoid nutrient leaching, store the fully matured FYM in a cool, dry location that is shielded from rain.

11. **Soil Testing:**

* Conduct soil tests to ascertain the precise nutrient needs before applying FYM to fields or gardens. To prevent overfertilization, adjust the application rate appropriately.

12. **Biosecurity:**

* When processing animal waste, use proper biosecurity practices to prevent the transmission of diseases to farms and animals.

13. **Personal Protective Equipment (PPE):**

* To lower the danger of contamination when handling raw manure, use the proper PPE, such as gloves and protective gear.

14. **Legal and Environmental Compliance:**

* To guarantee compliance with environmental standards, be informed of local laws governing the handling, application, and storage of manure.

**REFERENCES**

Abdulrahman Maina ZUBAIRU, Mohammed Kyari SANDABE, Rakiya ABDULLAHI Muhammad Tela BUBA and Ahmed BUNU (2021) Effects of Farmyard Manure (FYM) and Zinc Fertilizer Rates on Zinc Content and Uptake by Wheat (*Triticum aestivum* L.) on Sandy Clay Loam of Borno State, Nigeria. *Journal of Emerging Technologies and Innovative Research*. Volume 8, Issue 11. ISSN-2349-5162.

Biswas D.R., and Ghosh, A.K. (2017) Manure, biofertilizers and fertilizers. Soil science: An Introduction*. Indian Society of Soil Science,* New Delhi. Pp no. 426.

Brar, B.S., Singh, Kamalbir, Dheri, G.S., and Kumar, Balwinder, (2013) Carbon sequestration and soil carbon pools in a rice–wheat cropping system: Effect of long-term use of inorganic fertilizers and organic manure. *Soil and Tillage Research,* Volume 128, Pages 30-36, ISSN 0167-1987, https://doi.org/10.1016/j.still.2012.10.001.

Das, P. C., (2020) Manures. Fundamentals of manures and fertilizers. Kalyani Publishers. Pp:55-63.

Kumar, Ravindra, Kumar, Uday, Chandrakar, Nishchal and Kumar, Rajiv (2020) Studies on FYM and Vermi-Compost on Soil Health and Economics Profitability of Organic Fertilizer of Maize (*Zea mays* L.). *International Journal of Current Microbiology and Applied Sciences*.9(05): 2038-2041. doi: https://doi.org/10.20546/ijcmas.2020.905.232

Kumar, Sanjeev, Dhar Shiva, Barthakur Sharmistha, Rajawat Mahendra Vikram Singh, Kochewad S. A., Kumar Sudhir, Kumar Dileep, Meena L. R. (2021) Farmyard Manure as K-Fertilizer Modulates Soil Biological Activities and Yield of Wheat Using the Integrated Fertilization Approach. Frontiers in Environmental Science. Vol:9 .URL=https://www.frontiersin.org/articles/10.3389/fenvs.2021.764489 DOI=10.3389/fenvs.2021.764489. ISSN=2296-665X

Meena, Kunj, Bihari, Sarware Alam, Md., Singh, Hanumant, Amin Bhat, Mohammad, Singh, Abhinaw Kumar, Mishra, A.K., Thomas, Tarence (2018) Influence of farmyard manure and fertilizers on soil properties and yield and nutrient uptake of wheat. *International Journal of Chemical Studies*; 6(3):386-390.

Rathi, Deepika & Sharma, Manoj & Ahlawat, Isha & Dahiya, Garima (2019) Yield and Yield Attributes of Wheat Crop Response to FYM and Fertilizers Application: A Review.

Rupa, T.R., Srinivasa Rao Ch, Subba Rao A, Singh M., (2003) Effects of farmyard manure and phosphorus on zinc transformations and phyto-availability in two alfisols of India. *Bioresource Technology.* May;87(3):279-88. doi: 10.1016/s0960-8524(02)00235-3. PMID: 12507868.

Yawalkar, K.S., Agarwal, J.P., and Bokde, S. Manure and fertilizers. 12th edition. Pp: 28-39