



REPUBLIC OF KENYA



# MANAGEMENT AND UTILIZATION OF MANURE IN SMALLHOLDER DAIRY FARMS





*Farmers learning manure application methods in a farmer field school*

## **INTRODUCTION**

In many smallholder systems manure is considered as important as milk, meat or draught power. Farmers not only keep dairy cows for the production of milk, but also for manure. In the Kenyan highlands, use of livestock manure has been on the increase among smallholder farmers due to its substitutability over chemical fertilizers as the cost of the latter rises due to market distortions, resulting from physical constraints such as roads infrastructure. Utilization of manure to improve soil fertility is widely practiced in smallholder crop-livestock farming systems of the Kenyan highlands and East Africa.

## DIFFERENT TYPES OF MANURE

Manure can be categorized into different types. These differences occur due to storage method used and the types of treatment done if any. The most commonly found manure includes:

1. Slurry manure.
2. Farm yard manure.
3. Compost (dry manure).
4. Green manure.

### 1. SLURRY MANURE



#### *Farm yard manure or Boma compost*

- A mixture of dung and urine in wet form, is used by farmers as a natural fertilizer for their crops.
- Is produced in a more intensive livestock rearing systems where concrete or slats are used, instead of straw as bedding material - (zero grazing, intensive pig sty and poultry battery cage systems)
- Slurry manure is usually collected every morning or evening and is pushed into a slurry pit or lagoon for storage.

- The quality of this manure is better as losses through evaporation of nitrogen is reduced and especially if the pit is covered.

### **Utilization of slurry manure:**

- On existing forage or crop field, apply in shallow furrows dug between plant rows or on the surface between the plant rows and work it in the soil during weeding.
- On a ready prepared seed bed, apply 2-3 weeks before sowing or transplanting.
- The rate of application is 10-20 tons/ha depending on the crop eg annual crops or perennial.
- Apply on Napier at planting and during wet seasons of the year.

### **How nutrients are lost in slurry manure**

These are some of the pathways for nutrient losses:

- Soluble nutrients from urine include nitrogen, potassium, Sulphur.
- Gaseous e.g. ammonia –volatilization mainly during collection, storage and application.
- Dry matter losses, storage conditions like heaped or pits.

### **Benefits of using slurry manure**

- Increases soil fertility.
- It is a good source of biogas.
- Aids water and nutrient retention.
- Helps break down heavy soils such as clay.
- Helps in soil erosion control.

## 2. FARM YARD MANURE



### *Farm yard manure or Boma compost*

- Farm yard manure is allowed to stay for some time in the cow shed or goats shed. It is therefore a decomposed mixture of Cattle dung and urine with straw and litter used as bedding material and residues from the fodder fed to the cattle. It can also be referred to as boma compost.
- It is often collected when it is semi dry and heaped at some point to allow further natural process of decomposition. It is later carried to the 'shamba' for application to the crops/forage.
- Farm yard manure is sometimes ferried in vans for long distance by farmers who may not have animals or do not have enough.
- Farm yard manure is valuable soil improver which enhances and restores a range of natural properties of the soil such as the physical properties e.g structure, water holding capacity
- Farm yard manure is estimated to have approximately 1.62% N, 0.5% P and 1.43% K.

- The nutrient content in this type of manure is generally low and hence requires higher application per unit area.

### **Utilization of farm yard manure**

- Farm yard manure should be uniformly spread over the soil surface before planting.
- Surface application on napier grass is possible.
- 15-20 days before sowing or transplanting (ammonification and nitrification process).
- Soil should have adequate moisture at the time of application.
- Application rate 10-20 tons/ha depending on the crop eg annual crops or perennial.
- Annual crops at planting, perennial crops at planting and in wet seasons.

### **Benefits of farm yard manure**

The following are some of the benefits of farm yard manure

- Increases soil fertility.
- Adds humus and slow releasing nutrients.
- Aids water and nutrient retention.
- Helps break down heavy soils e.g. clay.
- Helps in soil erosion control.
- Enhances soil microbial community.
- Suppresses soil pests.
- Increases cation exchange capacity.
- Reduces bulk density.

### 3. COMPOST MANURE



#### *Desmodium as feed and green manure*

- Compost manure is the decomposed remnants of organic materials to produce a soil conditioner.
- This is the type of manure that has undergone some process of treatment in controlled heaps or pits.
- It is kept moist and warm and is frequently turned to facilitate aerobic organisms to hasten decomposition and to destroy some pathogens and weed seeds.
- It is usually of plant origin, but often includes some animal dung or bedding.

- There are two types of compost manure
  - **Vegetation compost**- uses green vegetation, topsoil, manure dry vegetation, ash, and rough vegetation
  - **Boma compost (Farm yard manure)** - uses only bedding material as plant source of vegetation
- Other animal manure that are used in compost are poultry manure (guano) which has high nitrogen as birds excrete urea, pig manure and rabbit manure.
- Compost contains a variety of the basic nutrients that plants require for healthy growth.
- Nutrients - nitrogen, phosphorous, and potassium.
- Other nutrients - manganese, copper, iron, and zinc.

### Utilization of compost manure

The rate and time of application of compost manure is as outlined underneath.

- At planting depending on the crop;
  - Annual crops – e.g. maize - once a year in the holes at planting.
  - In the nursery – e.g. vegetables during planting.
  - At transplanting of seedlings in the holes very close to the roots.
- Perennial crops- e.g. Napier grass at planting and twice (long rains and short rains) after every cutting.
- Rate of application is 10-20 tons/ha depending on weather an annual or perennial crop.



## Step by step method of making vegetation compost

### Materials required

- Rough vegetation e.g. dry woody stems that can decompose.
- Plant materials, both dry and green.
- Animal manure, e.g. cattle, sheep, goats, poultry, rabbits etc.
- Wood ash or charcoal dust.
- 3-4 jerry cans of water.
- Along sharp pointed stick –temperature stick

### Steps in making vegetation compost

- Step 1 – select a location.
- Step 2- measure area 4 X 4 feet.
- Step 3 – loosen and water ground.
- Step 4 – lay down the bottom layer (hedge cutting or maize stalks).
- Step 5 – sprinkle some water on this layer (sprinkle water after every pile/layer).
- Step 6 – second layer of dry vegetation about 4 inches thick e.g dry grass, banana leaves, dry tree leaves.
- Step 7 – add some manure about 2 inches thick.
- Step 8 – sprinkle on some top soil (Do not add too much soil).
- Step 9 – add green vegetation preferably from leguminous crops (6-8 inches).
- Step 10 – sprinkle ash or charcoal dust on top of green vegetation.
- Step 11 – repeat the process starting with step 6 up to step 9 and remember to water every layer.

- Never put plastics, cloth, polythene papers and any material with fat in the compost pile.
- Step 12 – build the pile up to 4 feet by repeating the process.
- Step 13 – to complete the pile, cover it with a layer of top soil 4 inches thick.
- Step 14 – take along sharp stick and drive it at an angle of 45 so as to pass through a bigger section of the pile.
- Step 15 – remember to sprinkle the pile with water after every 3 days depending on the weather condition.
- Step 16 – turn the pile every 3 weeks without adding fresh material except water.
- Step 17 – turn the pile again 3 weeks after the 1<sup>st</sup> turning.
- Step 18 – turn the pile again 3 weeks after the 2<sup>nd</sup> turning (monitor the warmth of the compost pile at regular intervals).
- Step 19 – if the compost is ready for use, remove and store in a shed.
  - Remember always to keep the compost moist.
  - Avoid wetness and dryness before use.

## 5. GREEN LEGUME MANURE



- Green manure involves growing of plant materials, usually legumes, for the express purpose of incorporating it into the soil.
- It is recommended that the green plant material is incorporated at fully vegetative development to achieve maximum effect i.e. at flowering stage of the legume.
- Decomposition greatly depends on when the green manure is incorporated and the soil conditions.
- Young plants decay much faster, while old ones containing lignin and cellulose take longer.
- Good decomposition can be expected when the soil is well aerated, moist and soil temperature relatively high.

### Advantages of green legume manure

There are many advantages of using green a legume manure crop in rotation, which include:

- Nitrogen fixation- nitrogen is fixed and becomes available for subsequent crops.
- Disease control- it provides a break in crops which helps in minimizing disease pressure.
- Erosion control- fallow operations like tillage, can leave the soil exposed to water and wind erosion. Legume green manure, provides cover and promotes soil retention by helping to build and maintain soil structure.
- Increases soil aggregation – legume crop increases soil aeration, water infiltration and root growth thus increasing soil aggregation.
- Green manure crops remove carbon dioxide from the atmosphere and also build organic matter after termination.

### **Disadvantages of green legume manure**

There are disadvantages of using green legume manure crop, they include:

- Moisture use- where the moisture is limiting, green manure crop utilizes the moisture thus suppressing growth of other crops
- Establishment cost- a marketable crop is not achieved with green manure crop. Cost of producing green manure crop should not exceed potential soil and nitrogen benefits.

### **Remember**

- Use of Green legume manures improve soil water retention capacity, add soil organic matter and act as soil conditioners

- Intercropped Green legume manures produce 800-1600 kg/acre of material which decays to provide 20-36 kg of Nitrogen. This amount is equal to 80-150 kg or 1.5 -3 bags CAN.
- Maize requires 24kg Nitrogen per acre (about two bags of CAN) and so the GLMs in this system supply enough Nitrogen for the maize crop.

## FACTORS INFLUENCING NUTRIENT COMPOSITION OF MANURE

- The amount and composition of nutrient in slurry manure, especially the N content is determined by several factors.
- The physical and chemical properties of slurry manure are affected by several factors. These includes but not limited to:

### 1. Types of livestock management systems

Dung from un-supplemented, extensively grazed Sahiwal cows, contains about 1.5% N (on dry mater basis).

**2. Variation in feed ration composition and utilization by animals:** The quality of slurry manure depends on type of feed rations and management of animals.

**3. Types of forages fed to the livestock:** There is a direct relation between N content of the grass and what is excreted in urine. Furthermore, dairy farmers with higher milk production tend to have higher N content in manure which could either be attributed to better feed intake or the influence of high protein feeds in the offered rations.

**4. Animal physiological factors:** Size of the animal, as measured by its live weight, is the most important physiological factor that affects the quality of manure. Others include sex, breed and activity of the animal. Studies have shown that the maximum quantity of manure produced by

ruminants is estimated at 0.8 % of live weight. Implying that the heavier the animal, the more the manure excreted. However, this calculation assumes that there are no losses in DM. Another experiment conducted using steers estimated urine production of 25 g/kg live weight. The urine is assumed to contain 10 and 12 grams of N and K per litre of urine respectively.

**5. The digestibility** of the feed ration, the protein and fiber content, and the nature of the other feed elements also affect the physical composition of manure.

**6. Environmental factors:** Temperature is the most important environmental factor.

**7. Addition of organic materials, in particular feed refusals.** Organic matter helps in absorption of urine thereby increasing the Nitrogen content in slurry manure. Indeed it is advisable to incorporate feed leftovers in the dung and mix them with urine to improve the Nitrogen content in the manure.



**Compiled by:** Ayako W.O, Sambu K.S, and Kanegeni. N.N.

**Edited by:** Otieno A.S., Omondi, S.P, Nyambati, E and Changwony, K

**For further information contact**

KALRO Dairy Research Institute

P.O. Box 25-20117 Naivasha, Kenya Telephone: +254 (0)776173996

Email: [director.dri@kalro.org](mailto:director.dri@kalro.org) Website [www.kalro.org](http://www.kalro.org)

*Design and layout by Emma. Nyaola*

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