Animal Production

Level II

Learning Guide # 50

Unit of Competence: Assist Crop Residues Treatment and Urea Molasses Block Preparation

Module Title: Assisting Crop Residues Treatment and Urea Molasses Block Preparation

LG Code: AGR APR2 M15 0919 LO1- 50

TTLM Code: AGR APR2 TTLM 0919V1

LO3: Prepare appropriate packing material for treatment

Instruction Sheet	Learning Guide # 50

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- ✓ Determining type of packing materials and equipment
- ✓ Preparing packing materials and equipment

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- ✓ determine type of packing materials and equipment
- ✓ prepare packing materials and equipment

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 4.
3. Read the information written in the information “Sheet 1 and Sheet 3.
4. Accomplish the “Self-check 1 and Self-check 2” **in page - 9 and 12** respectively.

Information sheet – 1	Determining type of packing materials and equipment

The treatment needs time for reaction. Therefore the straw has to be stored during treatment. The storage should be airtight. If airtight condition is not maintained ammonia (NH_3) will escape and the occurrence of mould will increase and the treated straw will be poor quality. Until now recommendation is to keep or store the straw completely airtight. It should be made clear that any system which is airtight will suffice. There are different **storage systems** which can be stalk on the ground, pit on the ground or pit/bunker in the ground.

1.1. Stack method

This type of storage method implies a pile of crop residues on the ground surface. On flat and dry ground, plastic sheet is placed underneath and the crop residue is laid in a stack. The top is covered with plastic and sealed all round with soil. Sandbags, or any other suitable objects, are placed on top to prevent the top cover from being blown away by the wind.

Advantages of this method

- ✓ Low cost and flexibility of placement
- ✓ Easy to load and unload
- ✓ Stronger walls are required in case a pit is constructed

Disadvantages of this method

- ✓ Ammonia may leak through small opening that reduces straw quality.
- ✓ Easy damage of the plastic sheet by sunlight, not durable
- ✓ Only suitable for anhydrous ammonia treatment of crop residue

1.2. Pit/bunker method

This storage method involves storing the treated crop residue above or in the ground by building walls.

1.2.1. Tower (above ground) silo

Tower silos are constructed from brick, and are several meters in diameter and 10-20 m in height. The advantages of this type of silo include: long life, small space required, low storage losses, and possibility for mechanization. Both the filling operation and daily extraction can be mechanized. However, tower silos are expensive.

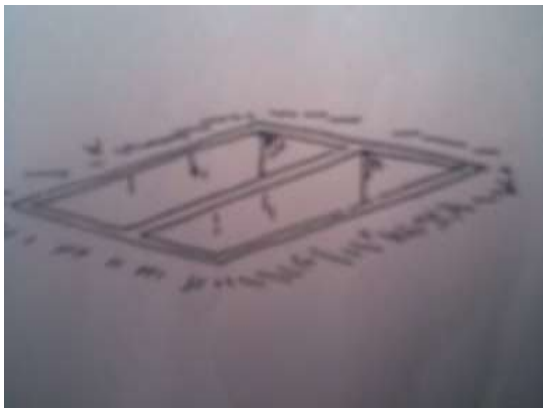
1.2.2. Cellar silo

The cellar type is the most common silo on individual farms. Round or square concrete silos are usually built inside houses for protection from the weather. Advantages are lower cost and easy management. Size can be adjusted according to scale of production. A disadvantage is high effluent loss, especially with clay walls.

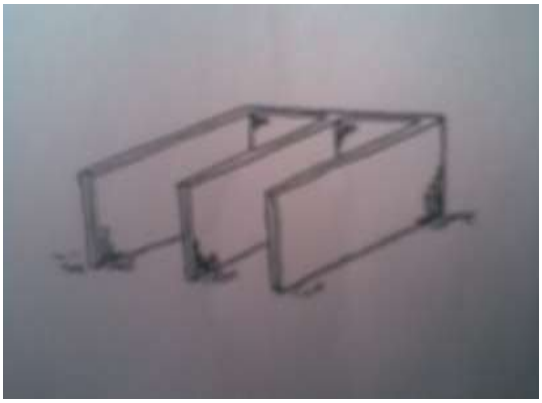
1.2.3. Trench/ bunker silo

This type is generally built underground or semi-underground, with two solid walls of 1.5-2 m in height. Advantages are similar to the cellar silo, but the trench silo is more suitable for mechanization. The tractor can be driven on top from one side to the other for compaction purposes. After compaction, it is covered with a plastic sheet pressed down with soil, sandbags or straw bales to maintain anaerobic conditions.

On many dairy farms, trench silos are built on the surface of ground. This type of silo has vertical walls of 0.4-0.5 m in thickness and 3-4 m in height. This design makes mechanization more convenient, and may also prevent bottom leakage.



Pit in the ground



pit on the ground

Advantages

- ✓ Pit or bunkers are easy to manage and avoid rodent damage to plastic films.
- ✓ Silos or bunkers constructed with cement are the best, since they save on plastic (only one sheet is needed, to cover) and minimize repairs.
- ✓ Once a silo or bunker is constructed, it can be used for several years. In addition, the
- ✓ Pit or bunker facilitates the estimation of straw weight.

Disadvantages

- ✓ Difficult to load and unload
- ✓ Water may collect inside
- ✓ Especially in sand soils the wall tends to cave in, making the straw dirty.

N.B: The treated crop residue needs to be properly packaged and stored. In both stack and pit/bunker storage methods plastic film is required to cover the crop residue stack or to line the bottom and walls in case of pit/bunker method. Therefore, the amount of packaging materials required needed should be calculated before treatment.

1.3. Determine the size and amount of plastic film for stack method

1.3.1. Measurement of the stack density

Weighing the stack is a basic task for straw treatment. It is well known that it is important to use the correct amount of ammonia gas or urea: too little ammonia is ineffective; too much ammonia increases the cost and has no further effect on treatment. The exact weight of straw must be

known so that the correct amount of ammonia can be applied. But weighing is difficult under field conditions. A simple method is to first measure the average density of stack for various straws, then to multiply it by its volume. Stack density depends upon plant species, moisture content and particle size. Of course, density also varies with time. In order to get reliable data, it is necessary to measure many stacks (at least 8 for each straw type). Density is expressed in kg/m^3.

In old stacks, volume is measured first, and then it is weighed. New stacks are weighed before stacking and volume measured after. It is very easy to calculate the volume of rectangular and cylinder stacks. The volume of stack with irregular shape may only be estimated.

General guidelines in determining of crop residue stack density

The average density of air dry teff, barley and wheat straw ranges **55 and 79 kg/m^3** for new and old whole straw respectively. The average density of air dry maize and sorghum stover ranges **79 and 100 kg/m^3** for new and old, whole stover, respectively.

For chopped crop residue average density is $100kg/m^3$

Based on these guidelines the volume of a given weight of straw/stover could be determined, so that the amount of plastic film required could be calculated. However, if the crop residues is chopped the density increases, that is the amount of crop residue increases as compared to un-chopped straw/ stover.

Example: based on the above general guidelines calculate the average volume of

1000kg new stack of wheat straw

1000kg old stack of wheat straw

1000kg new stack of maize stover

1000kg old stack of maize stover

1000kg chopped crop residue

Answers – use the formula Density= mass/volume

The average volume of 1000kg new stack of wheat straw = $1000kg/55kg/m^3 = 18.2\ m^3$

The average volume of 1000kg old stack of wheat straw = $1000kg/79kg/m^3 = 12.7\ m^3$

The average volume of 1000kg new stack of maize stover = 1000kg/79kg/m^3= 12.7 m^3

The average volume of 1000kg old stack of maize stover = 1000kg/100kg/m^3= 10 m^3

The average volume of 1000kg chopped crop residue = 1000kg/100kg/m^3= 10 m^3

The amount of film required can be calculated by the size of stack.

Size of bottom sheet: Length = Length of stack + (0.5-0.7) m (overlap)

Width = Width of stack + (0.5-0.7) m

Size of covering sheet: Length = Length of stack + height x 2 + (0.5-0.7) m

Width = Width of stack + height x 2 + (0.5-0.7) m

1.3.2. Determining Size of pit or bunker

To determine size of pit or bunker to build depend on; density of straw, animal type (daily straw intake 2 to 3 percent of live weight (2 to 3% body weight), number of animals and number of days. Generally it should be known how much straw (air dried) can be placed per m^3 of bunker; how much ammoniated straw an animal requires per day.

Straw density- Average weight of air-dried and chopped crop residue (wheat, teff, barley and maize) is about 100 kg per m^3, but could range 70-110 kg (air-dry: straw per m^3. It will be low when the straw is very crisp and dry and higher when the straw is moister (chopping can again increase the density. Once the volume required is known the dimensions of pits are governed by width of the polythene and the reasonable height.

Example: if 1000kg of chopped crop residue is required to treat, the volume of the pit/bunker is calculated as: Volume = Weight/Density = 1000kg/100kg/m^3 = 10m^3

Therefore, to treat 1000kg crop residue 10m^3 pit need to be dig out. This means that pit of 1m length, 1m width and 1m high is adequate to treat 100kg crop residue.

1.3.2.1. Recommended pit/bunker dimensions

The height or depth of the pit should not be more that 1.5 m high or deep.

The width of the pit should not be more than 3m wide

The length of the pit depend on the amount of crop residue to be treated, however it should not be more than 15m long.

The following table shows the dimensions of pits, there volumes and the amount of crop residue to be treated.

Length	Width	Height	Volume	Quantity to be treated
4.4ft	3ft	3ft	$40ft^3$	100 kg straw
1.25m	0.9m	0.9m	$1m^3$	100kg straw
11.7m	3m	1.5m	$52.56m^3$	5256kg straw

Self-Check-1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List storage systems of treated crop residue (3 points)
2. Mention advantages of stack method in storing crop residues (3 points)

Note: Satisfactory rating – 3 points unsatisfactory rating –below 3 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score: _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

2._____

Information sheet – 2	Preparing packing materials and equipment

Materials, equipment's and tools required for the urea ammonia treatment of crop residues are listed below. The amount of materials depends on the amount and type of crop residues, type of treatment pit or packaging materials.

1.1. Materials

- ✓ Urea
- ✓ Water
- ✓ Polyethylene plastic sheet
- ✓ Molasses
- ✓ Crop residue (cereal straw or stover)

1.2. Tools and equipment's

- ✓ **Suspended measuring balance**- to measure urea, water and crop residues.
- ✓ **Bucket**– to contain urea, urea and water
- ✓ **Barrel or open container**- to contain urea solution
- ✓ **Wooden stick**- to stir and dissolve urea in water
- ✓ **Watering can**- to sprinkle urea solution on the crop residue
- ✓ **Machete or chopper**- to chop the crop residue to the required size
- ✓ **Spade**
- ✓ **Pick axe**
- ✓ **Wheel barrow**
- ✓ **Sacks**

To prepare the packaging materials and storage of crop residue follow the following steps:

Stack method

- ✓ Determine the amount of crop residue to be treated
- ✓ Determine the volume of crop residue to be treated
- ✓ Measure the width of the plastic film (sheet)
- ✓ Select elevated flat area and clear it from vegetation
- ✓ Cover the area with the plastic sheet

Pit/bunker method

- ✓ Determine the amount of crop residue to be treated
- ✓ Determine the volume of crop residue to be treated
- ✓ Measure the width of the plastic film (sheet)
- ✓ Decide the height or depth of the pit
- ✓ Calculate the length of the pit
- ✓ Select elevated flat area and clear it from vegetation
- ✓ Measure the length and width of the required size, and mark it
- ✓ Start digging the ground and make a pit or bunker
- ✓ After reaching the required depth or height
- ✓ Level the bottom and cover the bottom and walls with plastic sheet
- ✓ Now the pit/bunker is ready for treatment

Self-Check-2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the advantage of wooden stick in crop residue treatment? (3 points)
2. Mention tools and equipment's in crop residue treatment(3 points)

Note: Satisfactory rating – 3 points unsatisfactory rating –below 3 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score: _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions:

1._____

2._____

REFERENCES

Alemayehu Mengistu, 1997. Conservation-based forage development for Ethiopia. Self help Development International Institute for Sustainable Development. Berhanena Selam Printing Enterprise. Addis Ababa, Ethiopia. 1p.

Azage Tegegne, Workneh Ayalew, Berhanu Gebre Medhin and Salvador Fermandez-Rivera, 2002. Opportunities for improved dairy production in Ethiopia. In: Resource Management for Poverty Reduction. Approaches and Technologies. Ethio-forum 2002. 118p.

Chenost, M., 1995. Optimizing the use of poor quality roughage through treatments and supplementation in warm climate countries with particular emphasis on urea treatment. First Electronic Conference on Tropical Feeds with particular Emphasis on Urea Treatment. FAO, Rome.

Daniel Kiftassa, 1988. Role of crop residues as livestock feeds in Ethiopian Highlands. pp. 430-439. In: B.H. Dzzowela (eds.). Proceedings of a Workshop on African Forage Plant Genetic Resources, Evaluation of Forage Germplasm and Extensive Livestock Production Systems. Arusha, Tanzania, 27-30 April 1987.