SNV Kenya Market-led Dairy Programme

KMDP Interventions in Feed and Fodder

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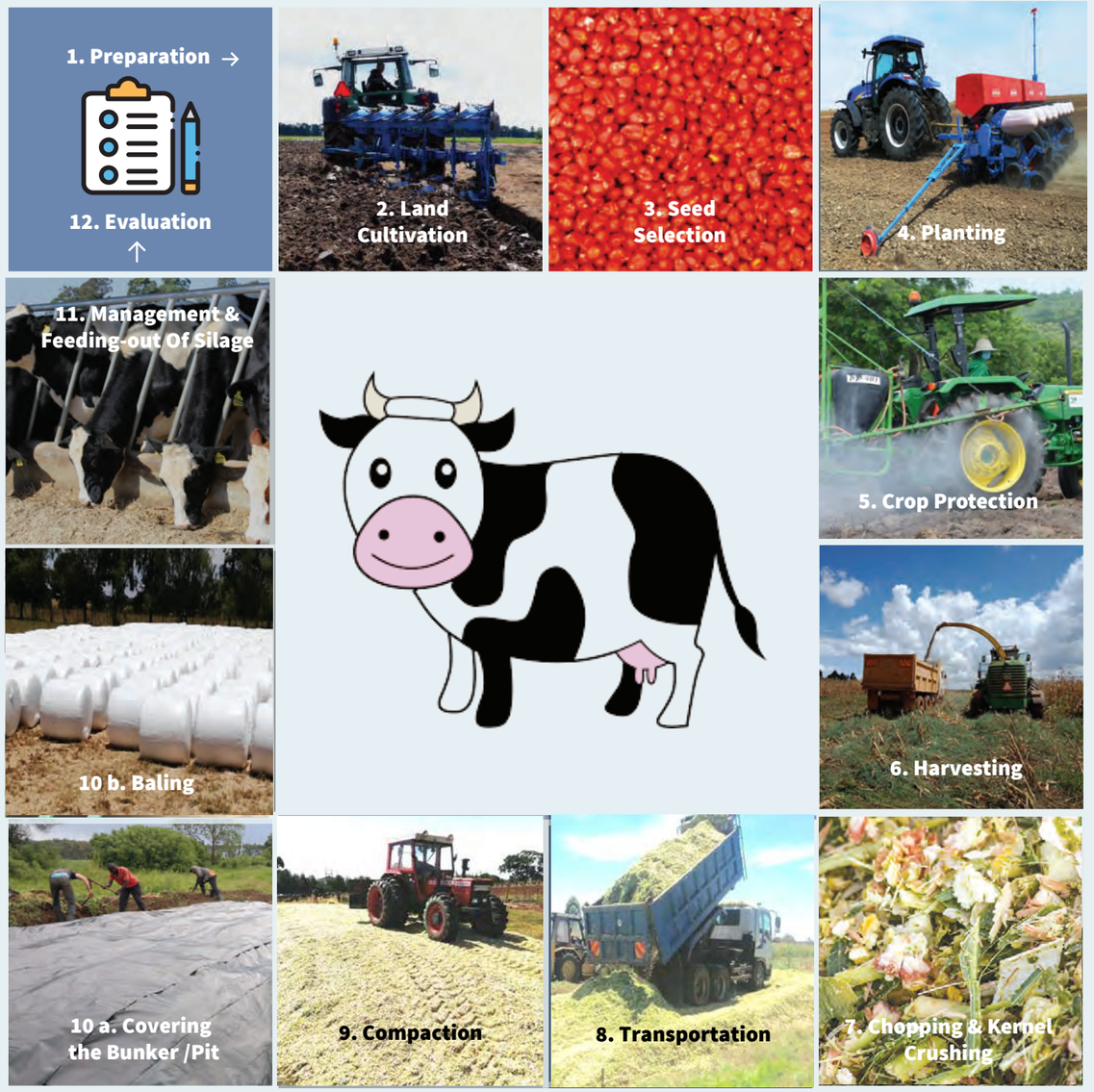
Kenya Market-led Dairy Programme
(KMDP)

Guidelines for Forage Maize Production and Ensiling



This guideline can be downloaded from **www.cowsoko.com/kmdp**

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A. Planning

1. PREPARATION

WHAT	HOW	WHY
a. Why maize silage	See steps 1-11 below	Maize silage provides low cost metabolizable energy (ME) for dairy cows and is a key ingredient in the cow's daily feed ration. If prepared in enough quantity, it also helps the farmer to counter seasonality in milk production. Whether maize silage is cost effective depends on quality, cost of production (and price in the market if bought externally), vis-a-vis other available feed and forages in the market.
b. Target high quality forages	See steps 1-11 below	To make better use of the (genetic) potential of the dairy cow and enhance milk production. To reduce the cost per unit of ME fed to the cows and per liter of milk produced. To make feed management more flexible.
c. Minimize cost of production	See steps 1-11 below	To seek to maximize efficiency and quality in each step of the silage making process (from seed to feed). Consider costs of hiring specialized contractors versus buying and operating own farm machinery. Is it more lucrative to outsource?
d. Feed planning	Use of a feed planning tool	To balance feed requirements based on number of cows and expected milk production with acreage under forage production and/or purchased forages.

B. Silage Making

2. LAND CULTIVATION

WHAT	HOW	WHY
a. Field selection	Select suitable fields for forage production	To make field characteristics: a) soil type, b) soil fertility, c) accessibility, d) suitability for mechanization.
b. Ploughing	Plough with a mould board plough or a fixed chisel tine cultivator with leveling harrow attached. Avoid disc ploughs!!	Completely turns the soil, breaks hard pan, increases soil aeration, reduces soil erosion, levels the field.
c. Seed bed preparation	Cultivate to a fine tilth and level by cross cultivating.	To encourage uniform growth of plants, maximum exposure to the sun, increase germination rates and easy machine operations, etc.

e. No cover on open silage face	Do not cover the open pit or clamp with polythene but keep the face open.	A loose cover will not avoid air coming in, but it may protect against rain. However during warm days the cover in front creates a micro-climate suitable for multiplication of moulds and bacteria in the silage.
f. Feeding space	Provide enough feeding space at the feeding rack in the cow barn. A minimum of 65 cm per cow is recommended to ensure a high feed intake.	To avoid competition at the feeding trough or feeding barrier, to give each animal the opportunity to eat the same diet and to ensure enough space for all animals to eat at the same time.
g. Avoid losses during feeding	Cows should not trample or foul the silage. Feed regularly and not in excess, only what animals can eat between two successive feedings. Keep feed-out areas, feed troughs and feed alleys clean to prevent contamination of fresh batches.	High feed quality will reduce wastage. Good feeding facility will reduce losses (waste, left overs).

D. Evaluation

12. WHOLE SILAGE MAKING PROCESS

WHAT	HOW	WHY
a. Field operations	Record keeping of all field activities (plot number, date, activity, cost, result).	To determine whether all operations were done at the right time, speed and compaction. What could have been done better, how can it be improved?
b. Inventory of all pits/ clamps /bales	Record keeping of all field activities (plot number, date, activity, cost, result). Calculate total tonnage of silage stored.	When the total stock of maize silage and other feeds is known a feeding plan for the dairy herd can be made for the coming year.
c. Sample each silage pit for analyses of nutritive value	Use feed analysis to monitor silage quality and for ration calculation/ formulation.	To have insight in the quality and nutritive value of the silage, and the effect of good/bad silage practices. To determine which other feeds are required to balance the ration for the different cow groups. To monitor if the production of the cows is in line with the analyzed quality of the silage.
d. Storage losses	Monitor/observe losses in the storage area pit/clamp/bale.	To explain and avoid in future the cause of the losses, and/or to ask your nutritionist for advice on how to reduce losses.
e. Feed-out losses	Estimate feed-out losses.	To ask yourself how the feed-out losses can be reduced.
f. Silage cost per kg intake	Monitor/re-calculate silage costs.	Assess possibilities to reduce cost per kg of silage. To calculate the costs per kg silage DM for comparison between silages with a different DM content.
g. Evaluate the silage making process with the contractor	Make calculations, pictures and exchange experiences.	To improve the results for all actors involved in the silage making and feeding process.

10. COVERING

WHAT	HOW	WHY
a. Sealing	Seal silage pits or clamps immediately when that particular pit has been filled.	Ideally within 12 hours from the start of making the pit/clamp.
b. Choice of plastic	The polythene should be preferably one continuous sheet, without any holes, of good gauge (>500) specially produced for silage making. Many farmers use a second, heavier gauge sheet to protect the vulnerable polythylene sheet.	The airtight plastic prevents oxygen from entering the pit. The one sheet plastic is best because there are no uncovered edges that can allow penetration of air into the silo. The economic value of well-preserved silage is high, and it can be cost-effective to invest in a heavy-duty outer sheet.
c. Covering	Dig a trench around the pit, place plastic, tighten the plastic with soil around the pit, and gently place soil up to 15 cm (6 inches) thick on the top and sides of the pit. Do not puncture the polythene; repair holes before covering with soil.	Soil or sand bags keep the polythene sheet tighter to the silage and continue exerting pressure on the silage pit. Tires are not preferred as they do not keep out the heat and sometimes wires stick out of old tires that can damage the polyethylene sheet.
d. Fencing	Fence-off the area to keep away animals from walking on the pit.	If cows are moved or grazed and there is access to the silage pit/clamp, they can walk on the silage bunker and the hooves can make holes in the plastic. Fencing keeps the livestock away.
e. Inspection	Weekly walk around the silage pit/clamp/bales.	Inspect the silage pit/clamp/bales at least once a week. This to ensure equal and sufficient soil cover (it may have washed off with heavy rain) and to repair holes in the polythene made by rodents, birds or wildlife.

C. Feeding

11. MANAGEMENT & FEEDING-OUT OF SILAGE

WHAT	HOW	WHY
a. Feeding speed	The feeding speed should be 1.5 - 2 meters per week based on the feed planning tool.	To prevent heating, moulding and rotting at the face of the silo.
b. Ease of removing	Make sure the silage can be removed easily and is accessible.	If silage removal takes great effort, staff will attempt to remove less than necessary. Make sure to remove corners every day and keep the face of the silage clamp straight and tight.
c. Removal of silage	Remove all loose materials from the open side (face) of the pit and feed immediately.	Loose materials in front or on the bottom of the silage pit or clamp cause moulds and rotting bacteria to grow. From here moulding and rotting will spread to the good parts of the clamp.
d. Cleanliness around	Clean the open silage face from all rotten and loose materials daily	This removes moulding and rotting materials hence preventing contamination of good feed.

3. SEED SELECTION

WHAT	HOW	WHY
a. Seed variety	Select forage maize variety or hybrid suitable for forage production i.e. with low NDF, cob stem ratio of 50:50 (on DM basis), high in starch and gradually maturing.	Good variety means good quality feeds (high energy/kg dry matter and high digestibility/kg organic matter), optimum crop yields and suitable varieties that mature gradually. Because there are no forage maize varieties available in Kenya, (only for grain), we have to look for those available varieties with characteristics that come closest to forage maize (see "How"
b. Seed size	The size of the seed should suit the planter to be used.	This will ensure that the machine drops the correct number of seeds, resulting in the desired plant population per acre or hectare.

4. PLANTING

WHAT	HOW	WHY
a. State of implement	Check the settings of the planter. Fertilizer placement should be 5 cms beside and below the seed. There should be no blockage.	To prevent scorching of the seeds, to ensure seeds are able to drop through the perforated plate, to ensure the correct seed rate is obtained.
b. Seed rates	Determine the correct seed rate to get the desired plant population.	To avoid plant competition and to ensure maximum yield per acre or hectare.
c. Fertilization	Analyze the soil: supplement the required amounts of nutrients at planting and top dressing as per the soil analysis.	To ensure that the amount of fertilizer supplied meets the deficit and to avoid waste of fertilizer and money in case of oversupply.



5. CROP PROTECTION

WHAT	HOW	WHY
a. Weed control	Use appropriate herbicide in the recommended concentration, apply correctly and under the right conditions.	To maximum yields, to avoid silage contamination by weeds, and to make harvesting of the crop by machine easier.
b. Pest control	Use appropriate pesticide in the recommended concentration. Apply correctly and under the right conditions.	To avoid losses through pest attacks. To maximize production per acre.

6. HARVESTING

WHAT	HOW	WHY
a. Stage of harvesting	Aim at a DM level of the whole crop of 30-35% and a starch level of at least 30%. The most accurate method of deciding when to harvest is to determine the dry matter on samples of the whole maize plant. DM can be determined with a probe, by NIRS or in an oven.	If machines with a well-functioning kernel crusher are available it is advised to ensile at a high DM content of 32-35% to maximize starch and ME levels. The energy in maize silage mainly comes from the starch in the cob and the energy level of the total crop increases as the plant matures. This happens in spite of an increase in the NDF content of the stem and a consequently lower energy content of the stem. Longer stubble length improves digestibility and energy content as the stubble is high in NDF.
	The kernel should be at dough ripe stage	To ensure maximum amount of energy which mainly comes from the starch in the cob.
b. Machine to be used (kernel crushers) and servicing	The machine should have a kernel crusher. The machine needs proper preventive maintenance and servicing during harvesting (e.g. calibration and sharpening of knives).	The kernel crusher allows for harvesting at a higher DM and starch content (dough ripe stage) and silage with higher energy content per kg DM. Chaff cutters usually do not have a kernel crusher which forces the user to harvest at milk ripe stage. At this stage the total crop has not reached its maximum energy (i.e. starch) content, as sugars in the kernels have not yet converted into starch, the DM of the silage is too low, and nutrients will be lost through effluent wastage.
c. Additives	Adding inoculants based on lactic acid bacteria.	Even if good silage preservation is expected certain inoculants can improve silage quality reduce losses and raises animal production. Additives will never compensate poor crop production or silage management!
d. Location of silage clamp/pit	Determine how far the clamp/pit is from the barn, how well-drained the location is, how safe from any other traffic and from birds, rodents and wild animals.	The clamp/pit should be on a dry well-drained area to avoid dampness, rain water stagnation and animals from entering the pit. When the crop has been harvested too early, there should be space for the effluent to drain-off.
e. Weather	Check the weather if appropriate for machines to enter the field and right for harvesting.	Monitor weather pattern and forecast so as to bring machines at best field conditions. This will avoid machines to get stuck and delays in the process, and contamination of silage with mud. It maintains silage quality.

7. CHOPPING AND KERNEL CRUSHING

WHAT	HOW	WHY
a. Chopping length	The machine used should be able to chop the crop into pieces of 8-12 mm.	This will reduce losses, enables easier compaction, increases voluntary feed intake per cow and avoids selective feeding.
b. Kernel crushing	The machine used should be able to crush the grains into at least 3 parts each.	This will ensure that the starch in the grains is faster available for bacteria that produce acids, thus preserving the silage. Moreover, crushed kernels will be better digested by the cows and whole grains will not be seen in the dung.

8. TRANSPORTATION

WHAT	HOW	WHY
a. Distance of field to pit	The distance should be as short as possible.	Unless more trucks or trailers are used, the shorter the distance, the faster the filling of the pit and the better the quality of the silage. A pit or clamp should always be filled, compacted and closed within 12 hours.
b. Truck or tractor	Should be selected depending on distance, access and state of roads.	The machine used should transport fast and efficiently to shorten time between chopping, compaction and covering. Plan in such a way that the trench can be closed within 12 hours after filling starts.
c. Accessibility and field conditions	The field and farm should be accessible to the forage harvester but also to trailers and trucks when loaded.	The farm should have good accesses roads and the maize fields should all be accessible to the machines. Obviously, large (e.g. 6 rows) self-propelled maize choppers need more space than smaller harvesters. The fields should be level and free from stones, tree stumps and other obstacles that can cause damage to the harvesters and the loaders.

9. COMPACTION

WHAT	HOW	WHY
a. Machine/ equipment	The silage should be compacted using the heaviest machines available: a tractor or a shovel.	This is to remove as much oxygen as possible from the pit to create the necessary (anaerobic) conditions for conserving the chopped maize. Good compaction is necessary to prevent the silage from heating during the ensiling process and feeding out.
b. Pit dimensions	The dimensions should be designed to give appropriate feeding speed of 1.5 to 2 meters per week. Narrow and long is better than short and wide. Ensure sufficient height of the trench.	The dimensions should tally with the number of cows to ensure good feeding speed of 1.5 to 2 meters a week and hence to minimize losses by heating and moulds.
c. Shaping of the pit	The sides should be as upright as possible. Avoid flat “chapati shaped” edges.	The sides should be slightly less than 45 degrees to minimize the surface area exposed to air/oxygen and to ensure firm edges.
d. Layering and spreading	Spread and compact each layer the moment it is tipped, i.e. keep a shovel or tractor on the pit during the ensiling process.	Each layer should be compacted to obtain properly and homogeneously compacted silage. Continuous compaction will eliminate air more effectively.