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Dear Reader,

The harvesting season is here and most farms are ripe with harvest, despite the change in weather patterns, and the climaxing political activities in the country. Since farmers are preparing to harvest common crops such as maize, this edition puts together educative articles on how to safely store maize using hermetics storage technology.

Also, this is the time to make the most of the greenery in your farm to conserve feed for your animals for use in the months to come when fodder will be scarce. We share a step-by-step guide on how to use the maize plants in your farm for silage making. In previous edition an article on growing passion fruits as a source of income was featured. Read on to learn how to prevent and manage the passionfruit woodiness disease that can hamper your efforts to earn from this venture.

Lately, many parts of the country have been experiencing extreme weather conditions that have adversely affected farm production. An agroecology expert gives insights on how organic farmers can reduce losses caused by weather risks.

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Minimize post-harvest losses by safely storing your grains

By Caroline Mwendwa

As the harvesting season draws near, plan well for your farm produce to ensure they are safely handled during and after harvesting. Poor storage conditions will not only lead to losses but also poses health risks from occurrence of aflatoxins. Aflatoxins are poisonous substances produced by certain kinds of fungi (moulds) that contaminate food crops and pose a serious health threat to humans and livestock. Major factors contributing to aflatoxin contamination include, drought stress, insect damage and poor storage of grains. Approximately 25% of the world's food crops are destroyed annually due to aflatoxin contamination. Food crops can become contaminated both before and after harvesting. Pre-harvest contamination with aflatoxins is mainly limited to maize, cottonseed, peanuts and tree nuts. Post-harvest contamination can be found in a variety of other crops such as coffee, rice and spices. Improper storage under conditions that favour mould growth (warm and humid storage environments) can typically lead to levels of contamination much higher than those found in the field.

There are over 14 types types of aflatox-

in but four – aflatoxins B1, B2, G1 and G2 are particularly dangerous to humans and animals. Aflatoxin M1 (AFM1), a product of aflatoxin B1 (AFB1) metabolism, can be found in milk in areas of high aflatoxin exposure. These fungi can be passed to humans through consumption of contaminated milk and milk products produced by livestock fed with poor quality animal feed.

Also, currently, food prices are prohibitively high and the country is facing serious food security threats. Farmers must therefore leverage knowledge to ensure minimum losses of their farm produce this harvesting season. Studies show that Kenya experiences 10-30 percent losses brought by poor post-harvest management, a greater percentage being experienced during the storage process.

Safe storage of grains

To prevent post-harvest losses and contamination farmers can ensure safe storage of grains by drying them before storage and storing them in spaces with controlled moisture, temperature, mechanical or insect damage, and aeration, which influence contamination and toxin production by mould.

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Internal parasites of poultry

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Ensure your grains are dry enough before putting them away for storage. To check the moisture levels of your grains, put a few grains in a glass bottle with a pinch of salt and cover it tightly. Then shake the grains for 2 to 3 minutes and let the grains settle at the bottom of the bottle. If the salt sticks on the sides of the bottle, then the grains' moisture is still higher than required and need more drying, if the salt does not stick on the sides of the bottle, then this indicates that the grains are dry enough for storage.

There are various technologies of safe grain storage especially maize that keep your grains free of any contaminants especially pests. For instance, the Hermetic Storage technology bags, which are airtight bags that prevent air/water from getting into the cereals stored in them, is the most preferred method of storage. The Hermetic bags preserve the contents while restricting the existence of cereal pests by depleting oxygen supply levels and producing carbon dioxide. The resulting conditions create unfavorable conditions for the existence of such pests.

Other benefits of storing cereals in hermetic bags include; great reduction of possible grain and cereal losses with the ability to store contents for a maximum of up-to two years in good quality.

Additionally, when using the hermetic storage bags, farmers do not need to treat their grains with synthetic pesticides before storage. With these bags, there is no need for pesticides application, as once tightly closed, the conditions in the bag are unfavourable for pest survival. One hermetic storage bag goes for between Ksh 250 and Ksh 300 in retail shops.

<https://infonet-biovision.org/PlantHealth/Pests/Storage-pests>



ic peace demonstrates that tomatoes can be produced without the use of synthetic pesticides and fertilizers

By Dr Shepard Ndlela

Two years ago, there were reports in the mainstream media that tomatoes being consumed by Kenyans had high levels of chemicals and that this was likely to cause health problems in consumers. The hype has since died down, but the perceived danger of consuming tomatoes still containing high levels of synthetic pesticides remains real. The genesis of the problem can be traced to the invasion of African countries by the devastating invasive pest of tomatoes called Tuta absoluta. The pest originates from South America and was reported in Kenya for the first time in 2014 before spreading to all counties within a few months.

Where did the overuse of chemicals on tomatoes come from?

Overwhelmed by the devastating effects of the pest, tomato growers have responded by spraying their crop with anything and everything they think will kill the damaging caterpillars which eat the inside of leaves forming mine-like patches that result in the death of leaves. The pest also affects flowers, stems, and tomato fruits. In most cases, farmers have been forced to abandon their crops due to extensive damage. At first, some of the chemicals produced spectacular results but now have been reduced to ineffective pesticides as they seem to have lost their effect on the pest. This is because *Tuta absoluta* has developed resistance and most pesticides are no longer as effective as they used to be. The chemicals in harvested tomatoes are worsened by traders or middlemen who buy the tomatoes directly from farmers and sell them to markets in Nairobi who insist that the farmer must



spray his produce just before harvesting or the day before harvesting. This is based on the wrong assumption that such practice ensures long shelf life of the tomatoes.

People moving away from synthetic pesticide-produced crops to responsible production systems!

Can tomato production be done without using poisonous synthetic pesticides? If yes, is it sustainable? Can it be done in large-scale production? All these questions elicit different responses from various people depending on where they stand and who they are speaking for. The whole aim of the experiment conducted by the International Centre of Insect Physiology and Ecology -icipe was not to de-campaign synthetic pesticides but to prove that responsible production systems are possible. It is high time the farmer considers aspects such as the health of the soil, of workers, his/her own family, the environment and the consumers. We demonstrated that approaching tomato production from the point of soil health rather than from the limited angle of immediate plant nutrition has greater benefits, especially considering that farmers have small pieces of land on which they plant crops a year in and out without allowing the soil to rest. Organic fertilizers are ideal, as they build soil nutrition and encourage life within the soil, enabling the system to produce nutrients and even avail to the plant nutrients that would otherwise be inaccessible. They are avail-

able in the market from various companies and icipe is currently working with the private sector to avail insect-based fertilisers which are very fertile and cost-friendly.

If a farmer desists from using synthetic pesticides, what then can be used instead?

The idea is to ensure that the crop is healthy from the transplanting stage. Healthy plants are rarely attacked by insect pests. Thus organically maintained soils guarantee healthy soil which releases nutrients to the plant as required and chances of depleting nutrients are slim as this is a self-regulated cycle. Secondly, the farmer must ensure that insect pests and diseases do not attack the crop at all, and if they do, they must be dealt with before they spread in the crop. In the case of synthetic pesticides, they are applied in response to a big problem already in the crop. They are curative. Non-synthetic interventions making up the responsible production system are applied in anticipation before the problem manifests. These include physical mechanisms such as visual traps, trapping systems using lures/attractants, and biopesticides which are fungal, bacterial, or plant-based. Without mentioning any trade names, these are available in the market and information on where to access and use them can be obtained from agricultural extension personnel and institutions such as icipe.

Are tomatoes produced through responsible production systems of quality?

We did not observe any significant differences in flowering, fruiting and even the size of the tomatoes. However responsibly produced tomatoes have an extra benefit in that they are free from harmful chemicals, and the products used do not harm the user, the environment, pollinators such as bees, natural enemies and the consumer. This is the best gift that a farmer can give to the planet now and in the future! However, we are aware that responsible production systems are still in their infancy as several issues still need to be addressed. These include availability and cost of products. It will be difficult to immediately change the mindset of production, but small strides at a time will ensure healthy attitudes and behaviour. With millions of people in Kenya getting conscious of what they eat, change is inevitable.

A tomato grower in Kirinyaga sorts tomatoes produced without the use of synthetic pesticides before packing for the market.

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<https://infonet-biovision.org/PlantHealth/Crops/Tomato>



Managing weather-risks in organic farming

By Emmanuel Atamba

Lately, weather patterns have been ranging from extreme cold seasons to extreme hot seasons. Weather changes every time and when it does, we all have to adjust to it. We put on warm clothing when it is cold, add more on when it gets colder and do the reverse when it warms up. The thing is, it does not only affect us, it affects all living things including our animals and plants in the farm. Animals too can move to avoid extreme weather conditions, take shelter when it is too hot/rainy or even too cold, they sometimes group themselves tightly together to keep warm.

Plants out in the field however, have no opportunity to move when the weather gets tough. They have to face heavy rains, harsh sunlight, high or even low temperatures. Extreme weather events have both direct and indirect effects on crop growth, health and production.

Effects of extreme weather on crops

- i. When it is hot and dry for instance, plants lose a lot of water through transpiration, for young plants, short periods of dry and hot weather can cause plants to wither or die.
- ii. When it is too cold and there is less sunlight, plants do not manufacture enough food and therefore do not grow as fast.
- iii. When it gets too dry, plants are not only able to absorb as much water as needed from the soil, but they also are unable to absorb nutrients.
- iv. When it is warm and humid, most plant disease causing pathogens are able to thrive and therefore become more infectious.

Understanding how different weather events may affect your crop is important in enabling you to anticipate for possible outcomes and take proactive steps to deal with them. For instance, every farmer ought to know that crops are easily affected by fungal diseases during the rainy season.

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Having proper weather information is therefore critical for planning and anticipating weather related effects such as diseases, delay in crop growth and performance. It also helps to understand crop pests and disease cycles, which helps the farmer to decide whether to take action on pests or diseases or wait for nature to take its course.

For instance, pests that attack the crop from the lead surface are easily naturally eliminated when it rains and therefore it may not be necessary to worry/spend on crop protection products when the rains are near. One can also use high-pressure water spraying technique to manage aphids on crops because they are unable to stand high pressure and moisture.

What can you do to cope more with climate/weather related risks in the farm?

i. **Creating a microclimate** is probably one approach that is underestimated. A microclimate is a modified environment on the farm- different from the prevailing environment. Simple techniques such as planting trees around the farm can significantly reduce exposure to high sunlight, pests that thrive more in the sun such as aphids, caterpillars, ground-dwelling ants, spiders and predatory beetles can be substantially suppressed.

ii. **Proper drainage** can also reduce incidences of fungal diseases and



therefore save you crops as well as the expense of dealing with the diseases during heavy rains. Proper drainage however needs to be done in line with the land cultivation plan and crops being grown to ensure effectiveness and there is also the privilege that the drainage structures don't have to be redone every season as they can be labour intensive- depending on the type of soil and level of waterlogging one is addressing.

How are animals affected by extreme weather?

While livestock is less often affected by weather risks, the effects if proper consideration is not done could be devastating. Animals could suffer serious health issues if exposed to extreme weather conditions. Key things to consider in management of weather-

er/climate related risks in livestock production include:

- i. **Animal structures:** The structures need to be adjustable, eg: ventilation that can be adjustable depending on temperatures (close when cold, open when hot) - especially small animals and poultry which are easily affected by temperature change. The structures also need to be well drained.
- ii. **Feeding and watering:** Animals tend to need more energy feeds during cold weather due to the energy lost to keep warm therefore that should be factored in when planning for feeding. During hot seasons, more water should be provided, adjust frequency and quantity of watering. Keeping stock of dry feeds for bad weather (eg: rainy days or seasons) where animals cannot graze outside is important in making sure that production is sustained but also reduces exposure to diseases and worms that thrive in wet, dumpy grounds.
- iii. **Timing when the new ones come:** It is best to get young ones when the conditions are best for them to thrive. A farmer should therefore be able (with adequate weather information to time and plan for the best time to get young animals on the farm). Eg: For chicks that are, hatched artificially- it is best to get them during drier, warmer months. Fish keepers should aim to get fingerlings when there is assured adequate water in the ponds to sustain them. This however, has to align with production goals of the farmer.

With climate change, it is important to adequately plan for any weather-related eventualities. Resilience building through innovative animal structures and field conditions modification such as through agroforestry, proper drainage and water storage are important to safeguard the farmer from the increasingly unpredictable weather patterns.

Emmanuel Atamba is the Program Coordinator of Agroecology, Route to Food and Founder of APSID Company Ltd. Email: Atamba@apsid.org



Management of passion fruit woodiness potyvirus

By Mercy Kalya

Passion Fruit is a woody perennial plant grown for fruit production. It is becoming one of the major cash crops cultivated by farmers in the Northern Rift valley which contributes greatly to livelihood sustainability. In Kenya, there are two major types of passion fruits, the purple passion fruits and the yellow passion fruits.

In major towns, one passion fruit goes at a retail price of between Ksh30 and Ksh50, hence this is no doubt a worthwhile venture. The crop is mainly planted in regions with rainfall of above 1200mm distributed evenly through the year. In regions with rainfall below 1200mm, irrigation is recommended.

This article delves into a common disease in passion fruit farming known as purple woodiness potyvirus and which mostly affects the purple passion fruits. The disease popularly known as kangumu among the local farmers affects the entire commercial life of the vineyard and its effects are similar to those of the cucumber mosaic cucumorus (CMV) and they usually occur concurrently. If not well managed, this disease can lead to major losses for the farmer.

Causes of the purple woodiness potyvirus

- The disease is spread by two major aphid species, *Myzus persicae* and *Aphis gossypii* occurring mainly in certain legumes and multiple *Passiflora* species. The host is mainly the wild species of passion fruit and occur naturally in some tropical legumes.
- The aphids feed on the infected plant then spread the virus to healthy plants.
- Pruning equipment have also been found to spread the virus from one plant to the other.
- The disease is also known to be aggravated by cool weather.

Symptoms

- The leaves develop dark green patterns with yellow spots or ringspots.
- The leaves also become distorted

and crinkled

- The fruits appear small and shapeless and the pericarp (edible part) becomes hard/woody.
 - The juice area also becomes small (area containing the pulp).
 - On the severity of the disease the stems dry and stunt and the whole plant starts dwarfing.
- Management**
- **Planting material:** The planting material used should be disease free from credible nurseries, the rootstock used should be raised from seed as the virus is not transmitted through seed, while in the nursery check that they don't get infected before grafting.
 - When grafting use of yellow passion is recommend to be used as a rootstock for purple passion as it is resistant to the virus.
 - **Avoid intercropping:** Cucumber Mosaic Cucumorus (CMV) has a wide range of hosts with common crops that could be sources of infection on your vineyard e.g. cucurbits, capsicum, chilli, cucumber, banana and tomatoes. These crops should not be intercropped with passion or grown near the vineyard.
 - **Resistant varieties:** use Hybrids that are relatively tolerant to the disease. The yellow variety has been found to be more resistant to the woodiness virus.

up the vineyard should be warmer and sheltered. This is because cool weather is also a predisposing factor to the disease.

- **Weeds:** broad leaved weeds especially from the wild *Passiflora* species and leguminous weeds are known to harbor pests such as Aphids which spread the disease. Weeds within and around the plantation should be eliminated.

- **Scouting:** Regular scouting should be done (once a week) in cases of sick plants uproot and destroy by burning.

- **Avoid intercropping:** Cucumber Mosaic Cucumorus (CMV) has a wide range of hosts with common crops that could be sources of infection on your vineyard e.g. cucurbits, capsicum, chilli, cucumber, banana and tomatoes. These crops should not be intercropped with passion or grown near the vineyard.

- **Resistant varieties:** use Hybrids that are relatively tolerant to the disease. The yellow variety has been found to be more resistant to the woodiness virus.

Mercy Kalya is an experienced horticulturalist and a holder of Bachelor of Science in Horticulture from Jomo Kenyatta University of Agriculture and Technology.

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Internal parasites of poultry

By Maurice Barasa

Just like other livestock, domestic birds (chicken, ducks, and turkey) are affected by internal parasites. An internal parasite is an organism that lives in another organism, referred to as a host, and benefits by deriving nutrients at the other's expense. In poultry, the most common internal parasites are worms and protozoa. They usually reside in the intestines of affected animals.

In low quantities, parasites will not usually cause a problem. However, severe worm infestation can lead to reduced poultry production, poor health of birds, increased susceptibility to diseases and poor growth rates sometimes occasioned by sickness and death of the animal.

We look at the common parasites in poultry (especially chicken), signs in infested birds, and how to avoid/control infestation in your flock.

Common parasites

These can be categorised into worms and protozoa.

1. WORMS

i. Roundworms:

The most common worms are roundworms also called ascarids. These are large worms that can cause obstructions in the intestines when in large numbers. Birds get infested from ingesting eggs of the worms from the environment or ingesting insects with worm eggs in them.

ii. Tapeworms

Tapeworms are flat and ribbon-shaped and can range in length from 1mm to as much as 15 metres. Their bodies have segments that increase as they grow and break off upon maturity and pass out of the body with the faeces.

The segments and eggs in the faeces are ingested by intermediate (in-between) hosts such as a snail, slug, beetle, earthworm, grasshopper, or fly. The chickens get them when they consume the infected beetles, insects, etc.

iii. Cecal worms

They inhabit the cecum (a pouch that connects the small and large intestines) of the bird. They cause little or no damage to chicken flocks but can carry the organism that causes black-head disease in turkeys.

Like the roundworm, the cecal worm spreads when birds ingest worms from the environment or insects with worm eggs.

iv. Gapeworms

They are found in poultry trachea or windpipes. Affected birds breathe with their mouths open. Though not common, they affect chicks of up to eight weeks and turkeys of all ages. Adult turkeys often act as symptomless carriers.

v. Capillaria worms

There are seven species of worms

from the genus Capillaria that can infect domestic and wild birds, with Capillaria obsignata being the most common. They can be found in various areas along the digestive tract. Untreated birds with severe infestations tend to grow slowly.

2. PROTOZOA

The other common internal parasites are protozoans. Protozoa parasites are small, microscopic organisms that reside inside a cell. The most common in this class is coccidia which causes the condition called coccidiosis.

Chicken with Coccidiosis will exhibit drooping wings and tail feathers, listlessness, loss of appetite, pale combs and wattles, ruffled feathers, huddling like they are feeling cold, blood or mucus in the faeces, diarrhoea, dehydration, and even death.

Clinical signs of parasite infestation

Birds infested by parasites will show any of these signs depending on the severity of the infestation.

1. Poor growth or decreased egg production;
2. Loss of appetite;
3. Emaciation/ thin coupled with weakness;
4. The ruffled appearance of feathers;
5. Drooping wings and tail feathers;
6. Diarrhoea (sometimes blood-stained);

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7. Anaemia (indicated by a pale comb) and
8. In extreme cases death.

Control of internal parasites

The following management practices can help farmers control internal parasites.

1. Provide your chicken with adequate high-quality feeds.
2. Keep the chicken coop clean and dry by changing the litter at least once every week. Damp/wet areas in the house are good breeding sites for eggs and parasites. Dry any spills from drinkers and repair leaking roofs.
3. Clean your feeders and the drinkers every day using soap and water.
4. Isolate sick birds immediately upon detection.
5. Ensure that the birds are not overcrowded; Ideally, each bird should occupy a space of between 1sq foot to 1.5 sq feet depending on the breed.
6. Properly clean and rest the chicken coop for two weeks before bringing a fresh flock (an all-in, all-out production)
7. Do not mix birds of different ages. Young birds are more susceptible to parasites as they can pick eggs shed by the older birds.
8. Do not place young birds, especially those under three months, in the same coop where older birds have recently been housed. They may develop an infection with coccidia.
9. Try to regularly treat young birds for coccidia (ask your veterinarian for advice).
10. Buy your birds from reputable farms or organisations that will not deliver infected birds.

[https://infonet-biovision.org/
AnimalHealth/Chicken](https://infonet-biovision.org/AnimalHealth/Chicken)



Silage making from maize

By Dr Jesse Kagai
and Musdalafa Lyaga

Livestock plays an important role in the livelihood of most farmers by providing food to the family, supporting crop production and earning farm family's income. However, feed shortage and poor quality of available feeds continue to be a major challenge for farmers in Kenya.

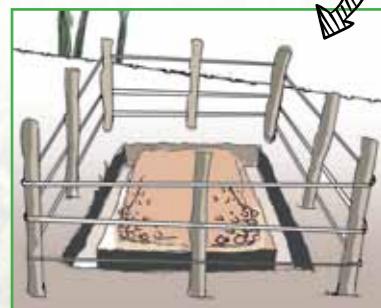
Farmers usually lack good quality feed that can enhance milk production as their animals depend on various grasses and crop residues which are only available in abundance during the rainy season.

As such, poor feeding leads to poor health and low milk production hence farmers get low income from their livestock. Fodder can be conserved to feed livestock during periods of shortage, caused by limited pasture growth or inadequate pasture conditions. One way to preserve the nutrients in green fodder and extend its storage to over a year, is by transforming it into silage.

Steps of silage making:

The key to making silage is to create the right conditions for a good fermentation.

- i. Harvest the maize plants when the ears are full size, but the plants are still green.
- ii. Chop the maize plants into small pieces of 1 to 2 cm. You can cut the fodder by hand, but this requires a lot of labour, so it is better to use a chopper that easily cuts the maize into small pieces of 1 to 2 centimetres. This is the best size for your cattle's digestion. If you do not have a chopper, then find one to rent when you make silage.
- iii. Always inspect the maize before you chop it, as some stalks mature faster than others. The maize should be soft but not milky when you squeeze it open. At this stage the kernels are still full of sugars that are needed for fermentation. Set the mature stalks aside and feed them directly to your



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Tuko Mbele Pamoja!

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- cattle instead of chopping them. Silage has to be made within hours of chopping the maize or else it will start to decompose and will not be suitable for silage.
- iv. Collect the chopped maize in a truck or containers and move it immediately to the place you will make and store your silage.
 - v. If left too long in the open air, the pile will heat up and this will increase the chance that everything will spoil.
 - vi. Then prepare a shallow pit depending on your feeding requirements.
 - vii. Two cubic meter can store 1,000 kilograms or 20 bags of fresh chopped maize. For this you will require 10 meters of strong plastic sheet to cover the silage pile. The area for your pit silage should be preferably on slightly sloping ground. Because you cannot move silage once it is made, ensure this space is free from potential disturbances. Make sure it is protected from water as this will rot the silage, and from animals that may dig into your silage pile.
 - viii. Place polythene sheeting over the sides and floor of the pit so that the forage does not come into contact with soil.
 - ix. Then empty 1 bag of about 50 kg of your first layer of chopped maize and then spread into a thin layer.
 - x. Repeat this till you fill the pit with 6 bags. Some farmers sprinkle molasses at this stage for each new layer but this is not a necessary cost as maize already contains adequate starch.
 - xi. To reduce the risk of air pockets in the pile, compress it with your



body weight. You can also use a drum full of water to force out as much air as possible. Without any air, finely chopped green maize ferments without rotting. This is because micro-organisms digest the sugars in the fodder and produce lactic acid, which acts as a natural preservative. This fermentation also makes the starch and fibres of the maize easier for livestock to digest.

- xii. When you have finished, pull the thick plastic over and across the pile, but make sure it is tucked tightly to avoid any air pockets.
- xiii. To keep the pile compressed for fermentation and prevent damage of the polythene from rain, birds and rodents, slowly spread sand on top of the plastic.
- xiv. Finally dig a small trench around the sides of the pit to prevent water from seeping into the silage.

Safe use of silage

Do not open the silage unless you want to feed your animals as exposure to air compromises the quality. It is normal that the outer layers will

be a little darker as they have been exposed to more air than the centre of the pile.

If silage is too dark or rotten, do not feed it to any animals. Large animals will require 20 to 25 kg of silage a day. Like any new feed, it is always best to introduce the silage gradually, so the animals get used to the taste.

It is best not to feed silage to animals under 6 months as their digestive systems are not fully developed. Silage is not easily digested by calves, so they will not benefit from its nutrition.

For more information contact Dr Jesse Kagai of International Livestock Research Institute (ILRI), Mazingira Centre. Email: jkagai@cgiar.org

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