

Deputy President William Ruto is shown how bee artificial insemination is done by an ICIPE Research scientist Loise Kawera during the inauguration of the new Africa Reference Laboratory for Bee Health at ICIPE. Swiss ambassador Jacques Pit-teloud looks on.



Dear farmers,

We are approaching the end of the harvesting period in December; that time of the year when farmers start planning for the following year. One challenge that many farmers who keep livestock have failed to address year after year, is how to plan for the dry season. Beginning January every year, there is severe shortage. This problem relates to the way farmers manage and use crop residue on the farm.

After harvest, most crop remains are wasted by farmers as they let loose animals to graze in the harvested *shambas*. The animals only eat a small portion of maize stalks, beans, grasses and other crop residue. Most of it is trampled upon and wasted. What remains of the residue is burnt later when farmers prepare their land. Farmers end up having very little fodder left, which forces them to take their animals out to the roadsides to graze on the few patches of pastures they can find.

Crop residue should be gathered and put in sheds where it is preserved for use in the dry season. This ensures the animals do not starve and also reduces time spent looking for pastures. Indeed, farmers who feed their animals well can make good money because milk prices are high during the dry season due to fodder shortage. Crop residue can also be enriched with legumes to balance nutrients for animals (4 and 5).

Most Kenyans do not eat or grow yellow maize perhaps due to lack of knowledge on its nutritional value and the fact that it has been discredited in the past as 'food for the poor'. Indeed, no seed company produces yellow maize seed in the country for lack of demand from farmers. In this issue, we provide farmers and consumers information on the benefits of yellow maize in terms of nutrition and show how to plant it. This is especially important now that consumers' demand for more nutritious food is increasing. Farmers should take advantage of this opportunity and start growing the maize variety for food and sale (page 2).

ICIPE launches bee health lab for Africa

TOF - The first Reference Laboratory for Bee Health in Africa has been set up at the International Centre of Insect Physiology and Ecology (ICIPE) at Dardaville campus, Nairobi. The lab which cost Ksh 1.7 billion will be used to conduct research on bee diseases and pests in the African continent.

During the facility's inauguration ceremony on 3rd November 2014, presided over by Deputy President William Ruto, ICIPE's Director General Dr. Segenet Kelemu said the knowledge gen-

erated by the research at the facility will help to develop ways of controlling bee diseases and pests to ensure the insects continue to play their important role in food production.

Apart from producing honey, bees pollinate more than 71 of the 100 food crops in the world. Bees also provide much-needed income for small-scale farmers, who sell honey, wax and other products.

Scientists to monitor bee diseases

"The research facility will help scientists to monitor and understand bees better in order to control diseases and pests and their impact on pollination with the objective of protecting the African bees from diseases such as the Colony Collapse Disorder (CCD)," said Dr. Kelemu.

The chairman of ICIPE Governing Council Professor Bill Hansson said the reference laboratory will strengthen and modernize research and development of African beekeeping while helping to expand sources of income for small-scale farmers in Africa.

"This facility will benefit millions of African farmers by improving food security in the continent and even the rest of the world," he said. He noted that the African bees had shown resistance to some of the diseases that affect bees in other continents

such as the CCD.

The European Union Ambassador to Kenya Lodewijk Briet said the EU will spend Ksh 21 billion in Africa in the next 6 years to support programmes in food security and drought management.

Research on livestock diseases

Mr. Ruto asked research institutions including donors to step up research and development activities in the livestock sector such as tsetse fly control, to improve the quality of livestock in the country. He challenged research scientists to come up with facts and figures to enable policy makers make informed decisions on issues that affect food security.

The construction and equipment in the reference laboratory has been funded by a number of donors from the European Union (EU), including the German Federal Enterprise for International Cooperation (GIZ), the Swedish International Development Agency (SIDA), the Swiss Agency for Development and Cooperation (SDC), UK Aid and the Kenya government.

The bee project is being implemented by ICIPE in collaboration with African Union Inter-Africa Bureau for Animal Resources (AU-IBAR). It has satellite laboratories in Cameroon, Ethiopia, Burkina Faso, and Liberia.

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Yellow maize is good for people and livestock

Although yellow maize is more nutritious than white maize, Kenyans consider it food for poor people since it is often brought into the country as relief food for starving people.

Trostky Lumiti | Maize is a staple food for many millions of people in sub-Saharan Africa. Although white maize is more popular in most households, few know that yellow maize is more nutritious than white maize.

Yellow maize is not liked by most rural communities in East Africa. For many years, yellow maize was donated to Kenya from different parts of the world as relief food during the famine of the late 1980s, 1990 and late 2000. This made many people view yellow maize as food aid for poor people. Besides, many people think yellow maize is only used for livestock feed in Western countries and is therefore not meant for human consumption.

"There was no way we can eat feeds meant for livestock," Joseph Makhanu, a farmer in Bungoma argues. Some people just do not like the taste of yellow maize. Most of the people interviewed by TOF say yellow maize has a sugary taste, which they do not like. Those who eat yellow maize say they harvest the crop early, when still green.

Yellow maize is more nutritious

Despite the taste and the colour, yellow maize is nutritious. In fact, research has shown that yellow corn has a higher nutritional value than the ordinary white maize, due to its higher levels of lutein, carotenoids and vitamin A. Vitamin A deficiency is very common in Africa and afflicts millions of children, resulting in diseases, blindness, and even death.

One large cob of boiled yellow maize contains almost 4g of protein, 3.5g of dietary fiber,



Yellow maize is more nutritious than white maize.

Yellow maize is planted in the same way as ordinary white maize. The maize is planted through direct seeding, preferably early in the season or as soon as soil and temperature conditions are favourable. Delay in planting always leads to reduced yields - there is a drop in yields by 1 - 2% every day if planting is delayed. Seeds are dropped in furrows or planting holes. For a pure stand of maize, the Ministry of Agriculture recommends a spacing of between 75cm by 30cm for all areas with adequate rainfall, resulting in a total population of about 44,000 plants per acre.

Good management

Yellow maize should be planted as soon as the seedbed is prepared. Like the ordinary maize, yellow maize is sensitive to weeds during the first 4-6 weeks after germination. The crop should be weeded twice until it reaches a height of one metre.

In areas of low rainfall, irrigation should be done especially at the time of tasselling and fertilization. The maize can be intercropped with legumes as this increases yields.

Harvesting and storage

Yellow maize can be harvested when mature, when the leaves start yellowing. The maize can be left in the field until when the moisture levels fall to about 15-20%. However, care should be taken to protect the maize from pest attack. The yellow maize can also be harvested when immature for use as a vegetable. After harvesting, maize should be stored well to prevent attack by pests and diseases. There are new metal silos that are effective against maize pests such as the larger grain borer. The silos are made out of galvanized flat iron sheets. The structures are airtight and can be used to store different types of grain.

Farmers can get yellow maize seeds from Mr Lusalia contact him on tel 0729 950 051.

Vitamin	Amount per 100 grams
Vitamin A	310 IU
Vitamin B1 (thiamine)	0.254 mg
Vitamin B2 (riboflavin)	0.085 mg
Vitamin B6	0.071 mg
Vitamin C	7.3 mg
Vitamin E	0.11 mg
Vitamin K	0.5 mcg
Vitamin E	0.11 mg
Niacin	1.9 mg
Folate	54 mcg
Pantothenic Acid	1.036 mg

The Organic Farmer is an independent magazine for the East African farming community. It promotes organic farming and supports discussions on all aspects of sustainable development. It is published monthly by ICIPE. The articles in the *The Organic Farmer* do not necessarily reflect the views of ICIPE or Biovision Foundation.

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Get good harvest with climbing beans

Unlike other bean varieties, climbing beans give more yields and can be harvested continuously for up to 4 months giving farmers more yields and income.

Joseph Mulindo | The increasing population, especially in the towns has led to increased demand for food, and this presents great opportunities for organic farmers. Compared to eggs and meat, beans are an affordable source of protein for families in East Africa, particularly those with low incomes.

The legumes are also important in improving soil fertility because they fix nitrogen in the soil. To meet the increasing protein demands, high yielding bean varieties that can grow in small land sizes have been developed through years of research.

Climbing beans are unique from other varieties in that they take up little space in the farm compared to bush beans. Also, one climbing bean plant can produce about 100 pods in a season, compared to a bush bean, which yields about 25 pods.

Since climbing beans grow upwards up to 4m, they need to be supported through staking (use of sticks to hold them in place). Unlike bush beans that are only harvested once, climbing beans can be harvested for up to 4 months.

The yield for climbing beans ranges from 18 to 22 bags per acre whereas the bush beans yield only 6-11 bags per acre. Another advantage is that a farmer can grow climbing beans on a small area, as little as 1 metre by one and half metre space.

The beans are often called Medium Altitude Climber (MAC) beans and can grow anywhere under irrigation or in high rain-



Climbing beans at KARI Embu. They give more yields and can be harvested over a long period.

Photo: TOF

fall areas. Two superior varieties, MAC 49 and Omuvano are available for planting. Farmers can get seeds from Kenya Agricultural and Livestock Research Organisation (KALRO) -Kakamega.

Growing climbing beans

Land preparation: Prepare land well in advance (3-5 weeks prior to onset of rains) to allow organic matter to fully decompose. Incorporate the uprooted weeds and other plant residues in the soil as they contribute to soil fertility. The soil should be made to a fine tilt.

Seed: Get clean seed from KALRO-Kakamega or any certified seed merchant.

Qualities of good bean seed: [1] Comprise one variety, [2] Same size, [3] Free from seed-borne diseases and pest damage, [4]

Should not be shrivelled, mouldy or cracked, and [5] Should not be rotten or discoloured.

Planting: Plant early at the onset of rains. If put under irrigation, plant at any time. Spacing should be 75 cm between the rows and 30 cm from one hill to the next. Each hill should have 2 seeds. Use a stout stick firmly embedded in the soil for each hill with 2 seeds, 2 weeks after germination.

Fertilizer application: During planting, well-composted manure should be applied to meet the high nutritional needs of climbing beans.

Growth management: After germination, the plants are guided along the height of the stick. At 2 metres, a running lateral string (or a stout stick) should be fastened successively to the tops of the terminal sticks and finally to

the top of a firm fence post. This ensures that the beans do not grow above two metres for ease of management. Weeding should be done to ensure a weed-free field.

Pest and disease control: The two varieties from KALRO-Kakamega are resistant to bean root rot, the main problem in bean production in high rainfall areas. A mixture of plant extract of African marigold, neem, stinging nettle and garlic can effectively be used to control fungal diseases, spider mites and aphids. This should be applied immediately after germination, once a week.

Harvesting: Climbing beans mature at about 90 days. Harvesting should commence and continue for the next 4-6 months as long as water is available to plant. Harvest when the pods turn yellow and start to dry.

Post-harvest handling of beans: Dry the harvested crop for 2-4 sunny days. Spread the bean pods loosely on a mat, canvas or a plastic sheet to allow air circulation and to prevent them from becoming mouldy. Thresh the dry pods on a clean mat, canvas or a plastic sheet. Spread the seed thinly on the drying surface to allow air to pass through it. Turn the seeds regularly to ensure uniform drying. Winnow and sort the beans to remain with clean dry material for storage in sacks. Store the seeds in a clean, dry and well-ventilated place. The sacks should be placed on a raised platform of wood away from the wall.

Josephat Mulindo is a scientist based at KALRO – Kakamega. For more information on this bean variety call 0736231949. Farmers from Western region can also visit KALRO- Kakamega.



Gross margin for climbing beans

Description / Activity	Cost (KSh)
Land preparation [ploughing and harrowing]	7,000
Seed - 30kg × 200	6,000
Manure - 5 tonnes × 700	3,500
Planting - 15 Man-days × 430	6,450
Staking – 15 Man-days × 430	6,450
Weeding - 10 Man-days × 430	4,300
Pest and disease management - 8 Man-days × 430	3,440
Bird scaring: 4 Months × 10,000	40,000
Harvesting - 20 Man-days × 430	8,600
Gunny bags - 20 pieces × 30	600
Drying, winnowing and packaging - 10 Man-days × 430	4,300
Total variable costs [TVC]	90,640
Total Revenue [TR]: 20 bags × 7,000	140,000
Gross Margin: KES 140,000 – 90,640	49,360

Conserve adequate fodder for dry season

Feeding the cattle during the dry season needs good planning. A lot of fodder can be conserved and be used to feed the animals between January and April when there is severe fodder shortage.

Peter Kamau Maize harvesting is going on in most parts of the country. A lot of crop residue such as dry maize stalks, beans and sorghum residue and pasture grasses such as Napier and Rhodes are available in plenty. It is, therefore, important that the entire crop residue is collected and conserved well for use as fodder in the dry season.

Immediately after harvesting maize or beans, the farmer should start planning on how to collect and store the residue in a good store where it is protected from the rains or other damage. Grazing the animals in the harvested fields just after the harvest as most farmers do is wasteful because they tend to trample, soil or urinate on it making it unsuitable for use as fodder later.

Store fodder well

Many farmers leave crop residue in the field where it is exposed to wet conditions. If the farmer can put up a good store, trough and feeding rack, a good part of the fodder can be conserved and used to feed the animals during the dry season.

Production depends on fodder quality

Dairy cows will only produce milk if they are given enough



Crop residue such as cobs and maize stalks when ground, chopped and mixed with legumes can make good quality fodder that can be conserved and used to feed dairy cows during the dry season.



Photos: TOF

and good quality feed. In the same way, beef cattle can only attain the correct weight if they are given the correct feed rations. The more and better the quality of feed dairy cows are given, the more the milk they will produce, as long as the farmer observes all other management practices.

The feed nutrients

Animal feed should have various groups of nutrients, and the composition depends on which type of animal is being fed. Proteins help to build the animal's body and maintain its health. Carbohydrates provide energy while minerals and vitamins help the body to function and grow properly. For dairy cows, these provide nutrients found in the milk. A dairy cow also needs plenty of water for milk production, body building and heat regulation.

Dry matter intake

The amount of fodder a dairy

cow needs depends on its body-weight. For example a Jersey (400 kg) that produces 15 kg of milk per day will need 11.5 kg of fodder but a Friesian cow (600 kg) needs 16.5 kg/day of dry matter to produce the same amount of milk. It is always important for every dairy farmer to measure the weight of each of their dairy cows to determine how much feed they need to give them. Bands for measuring weight are available in most agrovet shops and every farm should have one.

Cut fodder into small pieces

The amount of feed given to dairy cows should be easy to chew and swallow. Fodder should be cut in small sizes. Nutrition experts advise that fodder for dairy cows should be the same length as the animal's muzzle (mouth). This is ideal as it allows the animal to chew it into the right quality for ease of digestion. The quality of crop

residues can be improved by doing the following:

- Adding fodder legumes such as lablab or desmodium to feed improves the quality of fodder.
- Supplementing fodder with concentrates like cotton or sunflower seed cakes and are a good source of vegetable protein for the animals supplementation of fodder with concentrates like cotton seed cake or sunflower seed cakes.
- Soaking the dry/tough crop residues in water increases palatability (this softens the fodder for easy chewing and digestibility)
- Soaking the residues in molasses overnight makes it tastier and provides extra energy.

Farmers can also make the crop residue more palatable (easy to eat) by sprinkling it with urea. However, this technology is tricky as there is a risk of poisoning the cow if too much urea is used (*Farmers who are interested in this urea technology can order a leaflet from TOF office.*)

Proper planning is key

A farmer should start making fodder for the dry season when there is a lot of green forage material from maize, beans, Napier grass or other crop residue. This is when there is more fodder available than the animals can eat. It is important for the farmer to prepare early by doing the following:

- Growing grasses and deep, rooted legumes that provide high quality fodder for a longer period (leguminous forage contains protein).
- Planting fodder trees such as

Making silage in polythene bags

Take care of the excess fodder in your farm. If stored well, it feeds your cow during the dry season and increases your income. It can be stored as hay or used for making silage (See TOF No. 19 December 2006 and No. 20 January 2007).

There are many methods of making silage, but the use of polythene bags is one of the most suitable for small-scale dairy farmers. The following steps should be taken when making silage using polythene bags.

1. Chop the forage to the correct length using a panga or chaff-cutter. Spread a sheet (*Chandrua*) or canvas onto a flat surface

and place 100 kg of fodder on it. Spread the material into a thin layer.

2. Dilute 3 *Kasuku* tins of molasses with 3 litres of water. Sprinkle the diluted molasses onto the chopped forage as evenly as possible. Turn evenly and spread it.
3. Tie one end of a 2 metre long polythene bag (1.5 metres, 1000 gauge) to make a large polythene bag. Place the 100 kg of forage already mixed with molasses into the polythene bag and compact as much as possible. Repeat the same process twice, each time compressing the forage thoroughly after adding forage into the polythene bag.
4. Tie the top of the polythene

bag tightly ensuring as little air as possible remains above the forage/ molasses mixture. Place some weight on the tied sack to compact the mixture further. Store the bags away from direct sunlight or rain. The silage will be ready for use after two month. The silage can be stored as long as the farmer wishes.

Important: Each time you open the silage bag, expel the air from the bag and then tie it tightly to avoid spoilage. Polythene bags cost about Ksh 110 per metre while molasses cost Ksh 300 per 20-litre jerrican. It costs Ksh 385 to make one bag of silage, which can feed one dairy cow for up to 4 days.

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Improving fodder quality with legumes

The cost of feed concentrates has increased and it takes up a good part of the dairy farmer's earnings. Adding legumes in fodder production and preparation can help cut down feed costs and improve profits.

The Organic Farmer | Almost every small-scale farm in Kenya has Napier grass, which provides fodder to feed dairy animals. As mentioned in TOF No. 113, October 2014, grasses such as Napier, Boma Rhodes, Nandi Setaria alone cannot meet a dairy cow's daily nutrient requirements. As production costs continue to increase due to the cost of feed concentrates like dairy meal, it is important that farmers add legumes in their pastures to improve the quality of feed to increase milk production.

There are many legumes that can be grown together with grasses to provide the much needed proteins and minerals for improved milk production and quality. These include lucerne, desmodium, sweet potato vines and even root crops such as beetroot, radish and turnips. Below we provide farmers with guidelines on how to grow some of the legumes to help improve fodder quality:

Common Lucerne (*Medicago sativa*)

Lucerne is a high yielding perennial forage legume that grows upright to about 1 metre. It is ideal for conservation as hay or silage. Lucerne can remain productive for 4 to 6 years. Lucerne is best grown as a pure stand. It is drought resistant and is a deep-rooted legume.

Climatic requirements: Lucerne requires a well-distributed rain-

fall of about 860mm and above. It requires well-drained soils with a pH of 6 - 6.5.

Planting: Seeds can be planted at a depth of not more than 10cm or broadcast. The seedbed should be well-prepared and firm for good germination. The seed rate can be maintained at 6kg per acre with a spacing of 20cm by 25cm.



Maturity: Lucerne matures at between 4 to 5 months depending on the weather.

Yield: Lucerne can produce between 6 and 8 tons of dry matter per acre every year depending on the weather. Cutting can be done at intervals of 4-8 weeks.

Feed value: Crude Protein 19-22%, Dry matter 21%, Crude Fibre 21%.

Purple vetch (*Vicia sativa*)

Purple vetch is a fast growing legume with a high nutritive value. It can be grown with Napier grass, oats, barley, other grasses or on its own.

Planting: Purple vetch does well in well-drained soils that are not acidic. Planting should be done in well-prepared seedbed for

good seed germination. Broadcast or drill the seed. A spacing of 45 cm by 30cm is recommended. About 5kg of seed per acre is recommended when planting a pure stand or 3kg per acre when intercropped with grasses and fodders such as Napier grass and oats.



Maturity: Purple vetch matures in 4 months (120 days) and can be used for hay production. It produces 1.5 to 2.5tons of hay per acre when mixed with other grasses.

Feed value: Purple vetch has Crude Protein (CP) content of 17- 22 per cent, 89% Dry matter (DM) and 30 % Crude Fibre (CF).

Sweet Lupin (*Lupinus albus*)

There are two varieties of lupin *Lupinus albus* and *Lupinus angustifolius*.

Climatic requirements: Sweet Lupin prefers high rainfall (1000-2000mm), a cool climate and can tolerate low temperatures.

Planting: Sweet Lupins grows in

well-drained soils. A seed rate of 20kg of seed per acre is ideal. Seeds should be planted at a spacing of 45cm by 30cm.

Maturity: Sweet Lupins matures in 4 to 5 months. Crop rotation is and seed treatments can reduce disease and pest infection.

Yield: Sweet Lupins produce



between ½ ton to 1 ton of grain per acre. The grains can be milled and mixed with maize to make high quality feed.

Feed value: *Lupinus albus* - Crude Protein 29-32%, dry matter 95%, crude fibre 10% kilo calories per kg 2,444.7.

Lupinus angustifolius - Crude protein 30-36% , dry matter 93%, crude fibre 4 %, Kcal/kg 2173.6.

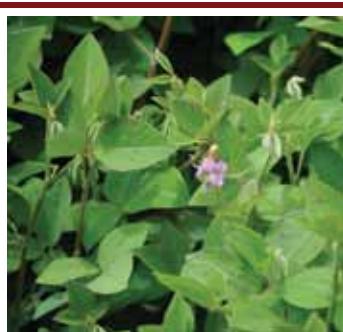
Desmodium (green and silver leaf)

Desmodium is a climbing perennial legume that has deep roots and long stems that grow freely and roots at the nodes. It can grow in areas of low temperatures and can be mixed with Napier and Kikuyu grasses. The silver leaf can withstand frost better than the green leaf.

Climatic requirements: Desmo-

dium requires well-distributed rainfall of 850mm and above. It prefers light soils to clay loam soils with a pH of more than 5.

Planting: The seedbed should be well prepared for good germination. Seeds can be broadcasted or planted in holes that are not more than 1cm deep and well covered. Desmodium vine cuttings or root



splits are the easiest to grow. About 4000 pieces of cuttings or vines can be planted in one acre.

Spacing: A spacing of 1m by 1m for cuttings is recommended.

Yield: One acre of desmodium can produce between 5 to 8 tons of dry matter per year.

Feed value: Crude Protein 15-20 %, Dry Matter 20-26%, Crude Fibre 25-30%.

Sweet potato vines (*Ipomoea batatas*)

Sweet potato vines are drought resistant. They are palatable and easy to digest for dairy cows. The ideal varieties for fodder production include KEMB10, KSB20, Ex-Mukurweini and Ex-isinya. Sweet potatoes should be planted as pure stands. These are chopped when mature and mixed with Napier, maize stalks

or grasses at a rate of 50% of the feed.

Planting: Dig hills of soil 15cm deep and plant when the soil is 15cm wet. Cut vines of 30cm to 60cm and bury ¾ of the potato vine in the soil. Plant 3-4 vines per hill. Apply plenty of well composted manure that is well



mixed with the soil before planting the vines. Plant 8,800 vines in 1 acre.

Yield: About 5 to 6 tons of fresh vines can be harvested in one acre. Harvesting can be done every 2 to 3 months depending on the weather.

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Farmer succeeds by growing different crops

Thomas Mutuli | Rosemary Owano is a widow with six children. Her husband died in 1994 and left her with school-going children. She has made good income by keeping dairy cows and growing tissue culture bananas, local indigenous vegetables, maize, cassava, groundnuts, Napier grass and soya beans on her 3-acre farm in Masukuta village, Butere.

Abandoned sugarcane

When her husband passed away, she took over sugar cane plantation, which used to produce sugar worth Ksh 7,000 to Ksh 10,000 after eighteen months. In 1980, Rosemary uprooted canes

and stopped sugarcane production. Her choice to plant a variety of new crops has enabled her to educate all her six children and get daily food for the family. She keeps records on her farm diligently.

Adopted organic farming

Rosemary has embraced organic farming including most of the technologies she has learnt from reading *The Organic Farmer* magazine. Last year she made a total of Ksh 87,000 from the sale of maize, groundnuts, cassava, indigenous vegetables and soya beans. In addition, she made Ksh 7,000 from milk sales from her two dairy cows in the same period.



Rosemary Owano in her farm.

She sells her farm produce to the local market. Her indigenous vegetables are sold to restaurants, neighbours and schools.

Ms Owano used the money well. All her children attend school; one went up to university level, three have college education and the rest have finished secondary school.

Working with others

Ms Owano is involved in various development activities in her home area: She is a member of Muyundi CBO, which is associated to the Rural Outreach Programme (ROP) and One-Acre fund. It is through ROP that she acquired her first dairy cow, which enabled her to go into dairy farming. Her group has embraced value addition. They make flour from soybeans including soya crisps, which they sell and use it to feed their children. They also mill cassavas to produce nutritious flour for sale.

Farmers can get in touch with Rosemary Owano Contact on 0712 802 634.

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Improving fodder quality

Root tuber crops

Fodder root crops include root tubers like mangold, beetroot, radish and turnips. The tubers are drought tolerant and contain simple sugars that provide animals with quick energy.

The root tubers can stay fresh in the soil and can be harvested and stored with little loss of nutrients. After harvest they can be covered with straw. They do not change milk taste when fed

to dairy cows.

Planting: The seed rate at planting should be 2 to 3kg per acre with a spacing of 45cm by 60cm depending on the size of the tubers. Thin the plant population at 15cm between one plant and the next when they are 5 to 10cm high.

Maturity: The tubers mature in 3 to 4 months.

Yield: Root tubers produce



Beetroot tubers

between 16 to 100 tons per acre depending on the variety and weather conditions.

Feeding: A dairy cow can feed up to 20kg of tubers in one day. Allow the tubers to wilt for about 2 weeks before feeding to prevent diarrhoea. The leaves (tops) can also be fed to animals. Before feeding, the tubers must be chopped to avoid choking the animals.

Feeding value: Crude protein 11%, Dry matter 20%, Crude Fibre 16%.

Farmers can buy seeds for all the legumes in the above article from KALRO, Ol Joro Orok Tel. 0710 854 357, 020 202 6 510 Email: karioljk@yahoo.com. Additional information obtained from Kanegeni N, KALRO Ol Joro Orok.

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Fodder...

calliandra, mulberry and Leucaena etc. (See TOF Nr 12 April 2008) which provide farmers with large amounts of high-quality but low-cost fodder (See



Processed maize stalks and cobs mixed with legumes and molasses makes good silage.

TOF No. 12 April 2008);

- Planting sweet potatoes: the sweet potato vines are protein boosters and can survive even during the dry season (See TOF No. 31 Dec. 2007).

- Making your own mineral salts by use of plants such as pumpkins and amaranthus (See TOF No. 41 October 2008)

Table 1. Dairy ration options for producing 15kg milk/cow/day by a cow weighing 400kg under zero grazing production system

Ration code	Nature of ration	Ration ingredients										Total Fed per day (kg)
		Napier grass medium	Rhodes grass hay	Oat straw	Vetch fodder	Tree Lucerne	Lupin grain	Soya cake	Oats grain	Stock lime	DCP	
1	DM basis (kg)			5.15		2.21	0.32	2.24	6.61	0.12	0.06	16.71
	As fed basis (kg)			5.72		4.16	0.33	2.49	7.27	0.12	0.06	20.16
2	DM basis (kg)		5.15			2.21	3.31	0.16	5.73	0.07	0.08	16.71
	As fed basis (kg)		6.06			4.16	3.45	0.18	6.29	0.07	0.08	20.30
3	DM basis (kg)	3.68			3.68		0.66		2.89	0.06	0.08	11.05
	As fed basis (kg)	21.03			3.93		0.69		3.18	0.06	0.08	28.97
4	DM basis (kg)	6.62				0.74	3.88		3.14	0.05	0.05	14.49
	As fed basis (kg)	37.85				1.39	4.05		3.46	0.05	0.05	46.84

Table 2. Dairy ration options for producing 15kg milk/cow/day by a cow weighing 400kg under zero grazing production system

Ration code	Nature of ration	Ration ingredients										Total Fed per day (kg)
		Napier grass medium	Rhodes grass hay	Oat straw	Vetch fodder	Tree Lucerne	Lupin grain	Soya cake	Oats grain	Stock lime	DCP	
1	DM basis (kg)		2.94		4.42		2.21		5.72	0.11	0.16	15.56
	As fed basis (kg)		3.46		4.72		2.31		6.29	0.11	0.16	17.05
2	DM basis (kg)	5.15				2.21	1.51	1.53	6.15	0.11	0.06	16.71
	As fed basis (kg)	6.06				4.16	1.57	1.70	6.75	0.11	0.06	20.42
3	DM basis (kg)	3.68			3.68		2.47		4.82	0.10	0.13	14.88
	As fed basis (kg)	21.03			3.93		2.58		5.30	0.10	0.13	33.07
4	DM basis (kg)	6.29		0.34		0.74	3.88	0.80	4.50	0.10	0.08	16.71
	As fed basis (kg)	35.93		0.37		1.39	4.04	0.89	4.94	0.10	0.08	47.74

Source: KALRO Ol Joro Orok, Tel 0710 854 357 or 020 202 6 510, email: karioljk@yahoo.com

Poultry keeping is profitable business

1.What do I need to start rearing chickens and make profit?

Poultry keeping is one of the enterprises that a farmer can start with little capital. Indigenous chickens are particularly good since they are hardy and survive in harsh environments with minimal inputs. A small-scale farmer needs a well-constructed chicken house that can accommodate 100 to 200 chickens, vaccines and some supplements. Good hygiene is necessary to prevent pests and diseases.

The chicken house should have adequate light and ventilation. If there is adequate land, the farmer should leave some portion of the land where the chickens can run around in the evenings and pick vegetation, insects or cereals to balance their diets if they are not provided with enough proteins. The chickens also use the empty space for exercise. Provide some building sand, soil and wood ash, which the chicken use as dust bath.

A good and reliable incubator is also important in chicken rearing. This is especially important for farmers with a source of electrical power because incubators are more reliable and hatch chicks at a faster rate compared to when using hens.

With proper feeding and management of diseases, a farmer can be assured of very good returns especially if they start rearing the chickens between May and June for selling in December during Christmas festivities. Most indigenous chickens sold at this time fetch between Ksh 700 to Ksh 1000 if the farmer sells them direct to the market. Assuming the farmer has 200 chickens, they can make between Ksh140,000 and Ksh 200,000 if they sell the chickens at the prices mentioned above.

Products a farmer can get from chickens

How many types of products can a farmers generate from poultry?

In developed countries chicken feathers are sorted and used to make plastics, paper pulp products, and even clothing material. Quill feathers, are processed to make feeds for other animals. But this technology has not reached Kenya and East Africa. But in East Africa,



farmers mainly get eggs, meat and chicken manure which is a very rich source of nitrogen when prepared into compost. A farmer can add wood ash and other plant material such as tithonia, comfrey and crop residue, then cover it. Keep turning it until it is ready for application as fertilizer into their kitchen gardens to grow vegetables, tomatoes, potatoes, maize, beans, fruit crops such as avocados, or any other crop.

Chicken feathers can be sorted, processed and made into many useful products. The processed fibres from the feathers have been used in making plastics, paper pulp and textiles. They can be used to make a polymer film that is made into thin sheets of plastic similar to cellophane. The feathers can also be used in plastics for dog food bowls and automobile dashboards. Manure has long been used in gardens to amend the soil as fertilizer. Chicken manure is very high in nitrogen.

Wild birds are classified as poultry

Are quails, guinea fowls and ostriches classified as poultry?

Any bird that is domesticated can be called poultry, but the term is mostly used when referring to chickens. If a farmer wants to domesticate wild birds such as quail, guinea fowl or



Quail chicks

ostriches, they have to acquire a licence from the nearest office of the Kenya Wildlife Service (KWS). The licence costs between Ksh1000 to Ksh 2000.



Poultry keeping has a bright future

What is the future of poultry production and marketing in Kenya?

With the diminishing sizes of land as a result of the increasing population, poultry keeping could become one of the profitable agribusiness ventures in Kenya and East Africa. The demand for eggs and meat has increased considerably. Any farmer with his/her eye on the market can make good returns from chickens rearing as it does not require a lot of money to start.

Farmers can keep many types of birds

Can I keep more than one type of poultry in my farm?

Yes. There is no restriction on the

type of poultry a farmer would like to keep. It all depends on the farmer's interest. Some birds like guinea fowl can be kept for sale to other farmers or as pets. A farmer can keep different types of birds to increase his/her income sources. Currently, there are many farmers keeping bantams, duck and geese. Some birds such as peacocks can fetch very good prices in the market because of their ornamental or aesthetic value.

You can keep poultry in the house

Is there anything wrong if human beings share a house with poultry?

NO. The decision on where to house the chickens depends on availability of space. Some farmers have devised an innovative method of brooding chicks by building cooking stoves with a lower chamber where the chicks are kept warm until they grow feathers. They are later transferred to the main chicken house where they grow to maturity. Wherever you keep chickens, ensure they are provided with perches where they can rest at night. Laying hens also require a dark area where they can lay eggs without disturbance or pecking from other chickens. However in organic production systems, chickens should always be provided with adequate space or open area or run. They also need to exercise and exhibit their normal behaviour.

Different birds require separate housing

Can different types of poultry be housed in one house?

No. Different birds have different behavior or characteristics. For example, ducks and geese cannot be mixed with chickens as they are water birds. They require a house with a water



Guinea fowl

bath where they can swim during the day. They also tend to scare other chickens, so they are better housed separately.

TOFRadio answers your questions

TOFRadio is broadcast on Milele FM at 8:45pm on Sunday, and KBC on Thursday at 8:15pm. Tune in and listen to farmer experiences and expert advice on agribusiness and eco-friendly farming methods. On this page, we respond to some of the issues raised by farmers in their correspondence to the radio program. Send your questions and comments via SMS 0715 916 136.

Cooperatives help farmers to market

According to Farm International Radio, globally, 800 million people are members of cooperatives. To respond to Farmer queries on how cooperatives can be formed, how they operate and their benefits, The TOF Radio team, John Cheburet and Musdalafa Lyaga, interviewed Professor Jackson Ombui on his paper, "The role of Dairy Cooperative Societies in providing services to small holder dairy farmers in Kiambu." Professor Ombui says that many farmers still do not understand cooperatives or their benefits.

Q: How does the cooperative movement work?

The primary objective of forming a cooperative has always been to market farmers' produce. This is because most farmers are smallholders and cannot afford on their own marketing facilities. They, therefore, pool their resources together and a small fee is deducted from payments on their produce for administration and management purposes.

The formation of a farmer cooperative movement begins with a group of farmers sharing a common vision coming together, subscribing and then registering a cooperative society, which is regulated by the Government laws and policies. The members elect management board officials led by a chairperson with the other main members being a secretary, who sometimes acts as the chief executives of the cooperative. There is also a treasurer and other officials. The board formulates strategies on how the cooperative is to be run. The chief executive responsible for day-to-day running of the cooperative.

Q: How different are cooperatives from chamas and Self-Help Groups?

Even though the objectives may be related, which is mainly to come and work together to take advantage of economies of scale to improve farmers' welfare, their activities may differ. The primary objective of any cooperative is to provide marketing services to farmers. This is their core responsibility. Chamas mainly rely on their strength in number. They use their numbers



The success of any cooperative society depends on transparency and accountability in running of its day to day affairs.

to collect money from members and give to one member at a time. A practice known as table banking which is gaining prominence in mobilising savings.

Q: What other roles can cooperatives play?

The most successful cooperatives now go beyond this objective. Some buy and sell to their members farm inputs at a lower cost. They also provide input on credit and loans for improving breeds and household needs like school fees. They also help cushion farmers against losses especially during drought by providing them with seed money, all of which are deducted from their dues.

Q: Which are some of the cooperatives in Kenya, which have been successful?

In the early 1990s, the Government started to provide farmers services like marketing through Kenya Cooperative Creameries (KCC), Artificial Insemination (AI) services, Veterinary services among others. At the same time, cooperatives, were formed to shield the farmers from unscrupulous business people who were taking advantage of the farmer in the free market.

The dairy cooperatives gained popularity when they started offering farmers an attractive services. While KCC was giving farmers Ksh 5 for one

litre of milk then, these cooperatives were offering them Ksh 14 per litre and retaining a 10% commission. As more farmers joined, they moved from the primary objectives of marketing to providing farmers with input like feeds, veterinary and Artificial Insemination services. With the money from the farmers, they invested in milk shops, sales people, veterinarians and managers, vehicles and equipment like nitrogen cylinders for artificial.

Among the cooperatives that have followed this path are Gitunguri Dairy Farmers Dairy Cooperative Society in Gatundu, which controls 13% of the milk market and is well known for processing and packaging the Fresha brand of milk.

The success of a cooperative starts with the commitment of the members who realise the benefits farming together. They have structures that enable them to question their management board. The chief executives must be visionary, transparent, accountable and qualified to hold their positions. In turn they should hire personnel with integrity and skills. Many cooperatives make the mistake of hiring board members such as relatives who are at times not well equipped to handle tasks assigned. This affects the planning and operation of cooperatives.



farmers forum

0717 551 129 / 0738 390 715

Beehives for sale: We make beehives for sale. Interested farmers can make orders on any quantity they require. The following are prices for various hives: Langstroth Ksh 4,500, Kenya Top Bar Hive Ksh 3,800, Stingless bee hives between Ksh 400 and Ksh 1,500 depending on size. Interested farmers can call Stephen Amboka on 0734 371 557.

Silage tubes for sale: We have silage tubes for sale. We also conduct training for farmers groups. Call Star Rays Education Centre Tel. 0721 245 443.

Grafted avocado seedlings: We have grafted avocado seedlings, selling at Ksh 70 per seedling. Call 0716 795 253, Nairobi and Muranga.

Tree tomato seedlings wanted: I would like to buy good tree tomato seedlings. Call Kimani 0722 408 539.

Kuroiler chicks: We have one month-old Kuroiler chicks for sale. We sell each chick for Ksh 250. Call 0724 742 656.

Goose eggs wanted: I need goose eggs (fertilized) if you have them, SMS "goose eggs" to 0722 878 635.

Fleckvieh bull for sale: I have a 9-month Fleckvieh bull for sale. Interested farmers can contact me on 0726 434 521.

Foliar fertilizer: Imported organic foliar fertilizer (KEPHIS certified). Call 0726 754 014 (8am to 5pm, week days).

Feed Chopper: We make electrical choppers which process maize stalks, maize cobs and napier into fine animal feed.

Tree tomato: Giant tree tomato seedlings. Contact Moses 0724 803 760 email: mosesthaithi@gmail.com

Strawberry seedlings: We can supply any farmers interested in growing strawberries. Contact Gracie's Organic Strawberries on 0726 857 441 or 0726 852 582.

Seedlings: Hass avocado at Ksh 70, tree tomato at Ksh 60, mangoes at Ksh 70 and grafted oranges at Ksh 60. Free transport in Thika and Murang'a. Henry 0707 548 300 email: henrywnjk@gmail.com

Moringa Leaf powder: 50g packet at Ksh 200. Contact 0722 557 316 email: stan.asiyo@gmail.com