

The Organic Farmer

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Farmers learn how to scout and destroy Fall Armyworm (FAW) eggs in a maize field in Timbitoke village in Rwanda. Fall armyworm damage is expected to increase this season due to erratic rains and high temperatures in most of the maize growing areas in Kenya.



Dear farmer,

Climate is changing every year, making it very difficult for farmers to plan and even predict rain patterns as they did before. The delayed rains this year have confounded farmers across the country. Rains were expected in Mid-March but it did not rain until end of April 2019. Although we had advised farmers on how to choose seed and the different varieties required for each region, the rains received so far are inadequate and this may even affect the late maturing varieties that require at least 6 months of consistent rain to mature.

The depressed rains will have far reaching consequences for food security in the entire East African region. Kenya mainly relies on maize imports from Uganda and Tanzania to balance its maize deficit. However, the two countries have also been affected by inadequate rains, which places the country in a precarious food security situation that may force it to use a huge chunk of its budget to import maize.

The erratic rains also come with high temperatures that are conducive to proliferation of pests especially the devastating Fall Armyworm (FAW). Already, farmers in all maize growing areas have reported sighting of the pest in their germinating maize. The destruction by the pest is expected to force farmers to spend more on chemicals in their desperate attempt to protect their crops and reduce damage by the pest.

The use of chemicals is expected to increase the production cost. As most farmers have discovered, most of the chemicals have very little effect on the Fall Armyworm. In Kenya as in many other countries, the use of chemicals is one of the most misused methods of pest control. Apart from killing other beneficial insects in the environment, chemicals also kill very useful predators of the fall armyworm. In the past two years, scientists in East Africa have discovered many predators of the fall armyworm; these predators need protection by farmers and the only way they can do this is to stop the use of harmful pesticides to control the pest in their farms.

In this *TOF* issue, we have revisited the many natural and environmentally friendly methods that are cheap to use in the control of this devastating pest that poses the biggest threat to maize production in Kenya and the entire African continent. See pages 2, 3 and 4.

ICIPE discovers 'wasps' which control fall armyworm

Berita Mutune | Scientists at ICIPE have identified two local species of wasps, *Trichogramma sp.* and *Telenomus remus*, which can control fall armyworm. The wasps lay their eggs on the Fall Armyworm (FAW) eggs thus killing them before they reach the larval stage which is the most

destructive stage to crops. This way they parasitize the pest.

The two wasps mentioned above act as natural enemies which are divided into three main groups: predators, parasites and pathogens (bacteria, fungi and viruses) which help in the biological control of pests. A predator lives by attacking and feeding and eventually killing other living organisms. The fall armyworm attacks and destroys many crops, not just maize.

In the last few years, control has been through use of synthetic pesticides. However, the method is proving ineffective as during the day, the young larvae is relatively inactive as it hides in the funnel shielding from sprays and predators and only emerges at night to feed on the leaves. The adult moths are able to travel long distances at night assisted by wind.

Natural enemies (farmer's friends)

Excessive and repetitive use of the synthetic pesticides makes the pest to develop resistance to the chemicals which then make this control method ineffective.

Farmers need to understand

that indiscriminate use of these pesticides also kill other non-target beneficial organisms such as bees, birds, fish, natural enemies and many others in the ecosystem.

Using the natural method, ICIPE does not introduce foreign



Telenomus wasps lay their eggs on fall armyworm eggs.

insects but instead goes to the farms, collects the insects which are locally available and multiplies them in the laboratory then releases them back to the farm at no cost.

Way Forward

ICIPE in partnership with KALRO and University of Nairobi, are working on the mass production protocol which can be used for the rearing of the wasps.

Later on, these wasps will be readily available for the farmers.

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Use natural methods to control fall armyworm

Farmers are encouraged to use, environmentally friendly methods to control the fall armyworm as they seem to work better than the use of chemicals which are harmful to predators, people, animals and beneficial insects such as bees.



Beritah Mutune | The Fall Armyworm (FAW) is a very difficult pest to control. To start with, it lays eggs inside the maize or other host plants at night making it difficult for farmers to target it. Spraying chemicals when the pest is in its third stage of development does not work. The eggs hatch into larvae in few days. The newly hatched larvae moult into the third stage of development (third instar) which is very difficult to control; by the third stage, farmers can do very little to control it, hence it continues to feed on the plants.

Any kind of intervention against the fall armyworm can only work when the pest is in its larvae stage (second instar). Spraying should therefore be

done at this stage in order to kill the larvae. Early intervention helps the farmer to decide the best way to handle the pest in order to control it. Below are various environmentally friendly methods farmers can use to contain the pest.

Early warning and monitoring:

Farmers can remain alert in order to take action immediately the first signs of the pest are noticed. Pheromone traps are used for monitoring the pest population in the farm. Pheromones are natural compounds that are emitted by female FAW moths to attract male moths for mating.

While doing this, farmers should observe the general health of the plants. If the plants have a dark green colour, it shows they have proper nutrition. Check if they are moisture-stressed and if there is any damage from FAW.

Scout for the pest daily

Farmers are advised to visit their fields frequently at least twice a week. To control the pest effectively, farmers need to scout their maize crop daily to be able to detect it early. Farmers using organic or biological methods of control should spray their maize crop only when the fall armyworm is at its second stage (larvae or second instar).

Scouting helps

Understand the biology of the organisms in the field and their interactions (ecology) in a better way. This information increases our knowledge and leads to better decision-making, resulting in higher production, fewer wasted resources and more sustainability.

Help farmers learn the variability of their fields, more so for smallholders, e.g. low-lying spots are more humid, the soil condition, the presence of weeds, and so on.

Cultural methods

Plant early and ensure you plant when the other farmers are planting (pest populations are low at this time so the damage to your maize will be minimal). Avoid planting late when other farmers have already planted.

For farmers who plough land before planting, this exposes the fall armyworm pupae to birds and other predators, hence reducing the fall armyworm population.

Inter cropping

Plant a legume crop e.g. beans around the edges of your maize field 14 to 21 days before you plant maize. The pest will attack the beans first and fail to recognize the maize. Plant diversity also increases the populations of farmers' friends (predators) and keeps them close to your maize, so that they can find and kill the FAW.

Mechanical method

This involves hand picking of the larvae of FAW and also crushing of eggs and larvae once you find them in the underside of leaves and in the funnel or whorl (funnel) of the maize plant.

For more information on Natural pest control methods https://www.infonet-biovision.org/natural_pest_control

How to make plant extracts for pest control

A cheap way to control pests, including the fall armyworm is to make plant extracts at home. Also called Fermented Plant Extracts (FPE). Although some labour is needed in their preparation, extracts are environmental friendly and also keeping your crop safe for consumption as they do not have any chemical residues. Here is a simple method to make plant extracts:

-Get 4 kg of different types of plants that have insecticidal or nutritional benefits such as stinging nettle, neem, African marigold, sodoms apple, tithonia, garlic, chilli, pyrethrum or Lantana camara.

Preparation: Mix molasses 100ml and EM1 20ml (many agrovet shops have EM1). Add 5 litres of water.

- Dissolve a bar soap into the solution.
- Chop up the plants into small pieces and put into a bucket.
- Fill the bucket with water to the brim and close it tight to stop the air from escaping.
- Let the mixture remain closed for 14 days.
- Filter the solution after 14 days using a piece of clean clothing to ensure there are no particles in the solution that can block the nozzles of your

knapsack sprayer.

- Dilute the solution at the ratio 1 litre of the extract to 100 litres of water.

Spraying: Organic plant extracts do not work the same way as chemicals. So ensure you spray up to three times every week. Do not wait until you see the pests in your crops to spray. Spray at all times whether there are pests or not; this way you will prevent all pests and at the same time keep the plants well fertilized since plants such as stinging nettle and tithonia are full of nutrients and other properties that protect your crop from diseases.

The Organic Farmer is an independent magazine produced monthly for the East African farming community. It promotes organic farming and supports discussions on all aspects of sustainable development.

The articles in the *The Organic Farmer* do not necessarily reflect the views of icipe nor Biovision Foundation or Biovision Africa Trust (BvAT).



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Fall armyworm control too expensive for small-scale farmers

Thousands of farmers face the threat of fall armyworm invasion in all maize growing areas of the country due to erratic rains and a rise in temperatures.

Beritah Mutune | Sheila Keino is a farmer in Moiben, Uasin Gishu County. She planted her maize in Mid-March 2019, but she had to wait until the last week of April when rains started for her maize to germinate. But then she had another enemy to contend with, the fall armyworm. No sooner had the maize started germinating than she noticed damage on the leaves. The sight rekindled memories of a similar invasion in 2017 when she lost almost her entire 2 acres of maize destroyed by the pest. "If this situation persists, then we have no maize again this year," she says.

Costly chemicals

With more than 1400 acres of maize, Mr Paul Marus is a prominent large-scale farmer who owns farms in Moiben in Uasin Gishu and Kachibora in Trans-Nzoia County. He says with the fall armyworm invasion, maize production cost per acre has risen from Ksh 30,000 to Ksh 40,000 per acre due to the high cost of chemical pesticides which in most cases do not seem to work.

The above two farmers are

among thousands of farmers in the Kenya's maize belt that includes Uasin Gishu, Nandi, Trans-Nzoia, West Pokot Bungoma, Kakamega and Busia whose farms have been invaded by the fall armyworm this season.

We do not know how the situation will be this season because the pest has started attacking maize that is barely three weeks old. Already I have to replant 247 acres, due to lack of germination and the fall armyworm," he adds.

The two farmers are now among thousands of farmers who stare at huge losses this year especially due to poor rains and high temperatures which favour the proliferation of pests especially the Fall armyworm. Dr. Subramanian Sevgan, the principal scientist in charge of the fall armyworm project in ICIPE says temperatures between 25°C to 30°C may increase infestation by the fall armyworm.

Scientists at ICIPE are studying fall armyworm control methods used in other countries such as South America and the US, where the pest originated with a view to introducing the same fall armyworm control measures in Kenya and other African countries. Farmers can also employ other ways that help reduce the fall armyworm damage in their maize crops if they can practise the following control methods which are harmless to people, animals and the environment.



A maize plant destroyed by the fall armyworm.

Farmers can use the following biopesticides to control the pest.

Botanicals

Nimbecidine®: Nimbecidine is a neem-based biopesticide that kills pests on contact. It also makes the insect unable to feed. Neem-based biopesticides reduce the reproduction and longevity (lifespan) of the insect pest while interfering with the development of the larvae. The biopesticide is less toxic to other insects such as bees and even parasitic insects such as wasps.



Biopesticides

Bacillus thuringiensis: This is a biopesticide obtained from a fungus found in the soil and in several insects, which is very effective in the control of many pests including the fall armyworm. *Bacillus thuringiensis* (*Bt*) is harmless to non-target insects such as bees.

Metarhizium anisopliae: This is a fungus that infects insects when they come into contact with it. Once the fungus attaches itself to the insect pest, it germinates and begins to grow. Eventually the fungus manages to enter into the pest's body, growing inside until the insect dies. Insects that come into contact with infected insect also die.

Place wood ash at the funnel or whorl of the maize to reduce pest population. Sand soil can also be used.

Some farmers use sugar water to attract and feed the wasps that can eat or parasitize FAW

For more information on Natural pest control https://www.infonet-biovision.org/natural_pest_control

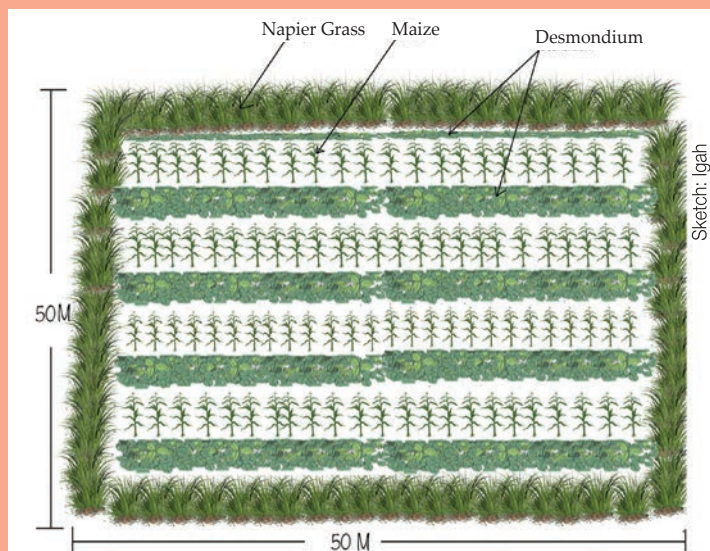
The Push-Pull method reduces fall armyworm damage

In this technology, desmodium is planted between maize rows and Napier grass or brachiaria around the maize crop field. The

desmodium produces a smell that stemborer moths do not like. The stemborer therefore is repelled away from the maize (the push

effect). It then moves away from the maize and is attracted by the Napier grass (Pull-effect). Once the moth is inside the Napier grass, it lays eggs that hatch into larvae. However, the Napier grass produces a sticky substance like glue, which traps the larvae and they die leaving the maize safe; this technology is now called the "Push-Pull."

Studies have shown that fall armyworm larva can reduce by 82.7 per cent in push-pull plots and 86.7 per cent less in plant damage. Similarly, maize grain yields in Push pull plots is 2.7 times higher than plot where the technology is not used. Farmers rated the technology significantly superior in reducing fall armyworm infestation and plant damage rates than any other control method.



Scientists map ways to contain fall armyworm threat in Africa

The pest is costing Africa more than US\$ 1.1 – 4.7 billion dollars every year in damage to maize and other crops that farmers rely on for food and income.

Peter Kamau | “The fall army worm is perhaps one of the most devastating pests to invade Africa in the 21st Century,” a scientist remarked during an inception workshop organised by ICIPE early this month to chart the way forward to combat the pest. Research institutions, governments and stakeholders need to put in place long term measures to control damage to crops especially maize, which is the major host to the pest and the main source of food for millions of people in Sub-Saharan Africa. Damage to maize in Africa due to the pest is estimated at between 1.1 to 4.7 billion dollars per year.

Regional approach

The European Union together with ICIPE and national partners are supporting the strategy to counter the threat of the fall armyworm in Eastern African countries of Kenya, Uganda, Tanzania, Rwanda and Ethiopia at a cost of 7 million Euros. More than 50 Scientists, government representatives and other stakeholders met recently in Nairobi to develop a coordinated approach to combat the pest.

The fall armyworm has been present in North America for more than 300 years. But research institutions, working with government have managed to keep it in check due to application of various scientific and cultural methods including huge support to farmers from the government in form of inputs, surveillance and early warning systems. A huge capital outlay is invested in research on ways to control the pest, which has stabilised and even reduced damage to maize in these countries.

Good management

The average yield for maize in North and South America is 4.5 – 9.4 tonnes per hectare compared to Africa’s 1.5 – 3.0 tonnes per hectare. The huge difference is due to the intensive management practices, use of irrigation and adoption of high yielding varieties in US and other countries while in Africa, farmers mainly rely on rainfed, low intensive system of production.

It is clear that without adequate and quick interventions, the invasion of the fall armyworm,

maize production per hectare is expected to go down drastically in Africa leading to food insecurity especially among the rural population that relies heavily on the staple for food and income.

Urgent measures needed to control pest

Urgent measures therefore need to be taken to reduce damage to maize and food shortages. However, such measures need to be economically viable, effective and amenable for smallholder maize producers in the continent. Agro-ecological conditions and maize production systems in Africa are markedly different from those in Americas. This means that research institutions have an enormous task to undertake studies to understand the ecology of the pest in African conditions in order to come with management protocols that work in our context.

Pest develops resistance to chemicals

With the invasion of fall armyworm, a marked increase in the use of pesticides by maize growers and promotion of the same by governments through subsidies have been observed. During the workshop, one issue that came out clearly is that the use of chemicals does not seem to work as would be expected. Although some chemicals show some degree of efficacy against the fall armyworm, the pest later develops resistance against them.

For example, according to Dr Peter Chinwada of IITA Zambia, studies conducted in Benin showed moderate resistance to *Lambda Cyhalothrin*, a chemical pesticide. In Cameroon studies showed that although a combination of *Emamectin benzoate*, *Imdacloprid* and *Lambda cyhalothrin* chemicals killed fall armyworm larvae, damage to maize and the yield remained the same.

Chemicals kill predators

Another combination of *Lambda cyhalothrin* and *indoxacarb*; *deltamethrin* and *Primiphos methyl* and *chlorantraniliprole* and *Lambda cyhalothrin* showed some level of efficacy but poisonous residue remained in maize, soils in the fields sprayed, making it poisonous for people and animals. Chemicals are known to kill non-target organisms like bees and natural enemies of FAW that could disrupt establishment of prey-predator balance that is very essential in the natural control of FAW.



Maize destroyed by the fall armyworm is unsuitable for human and animal consumption as it is contaminated by mycotoxins that include aflatoxins.

Natural methods more effective

On a positive note, some early research efforts led by ICIPE and partners have indicated the effectiveness of habitat management strategies such as “Push-pull technology”, maize-legume intercropping systems, use of botanical and microbial pesticides which have shown some promising results against FAW. Field surveys have also indicated the presence of effective parasitoids of FAW already in Africa, such as, *Cotesia icipe*, *Telenomus remus*, *Trichogramma* sp. and others (see page 1).

Efforts to strengthen the surveillance of FAW through community-based fall armyworm monitoring networks have highlighted the potential for establishing area-wide FAW monitoring networks. Based on these early results, the conference agreed on various measures that would help contain the pest to reduce damage to crops in East Africa, and beyond. These include:

Strengthen early warning and monitoring: Surveillance and early warning are very important in fall armyworm control. They ensure that the pest is identified before it causes much damage to crops and provides time for fast response and management of the pest.

Promote diversified maize cropping systems: in Africa: Diversified maize-cropping (eg. Push pull and maize-legume intercropping) has shown to reduce FAW incidence by 30 – 75% as compared to monocrops. Promotion of diversified maize

cropping system has the potential to decrease the need for pesticide application and also conserve natural enemies that can further reduce FAW population.

Adopt safe control methods: The scientists agreed that the best way to contain the pest was the adoption of safe and environmentally friendly options such as conservation and augmentation of indigenous and exotic natural enemies, use of botanical pesticides and biopesticides.

Strengthen Research: Sharing of research findings was identified as one of the most important steps in understanding the in-depth biology and ecology of the pest especially in the African context where the climatic conditions in Africa are different from North American countries where it originated.

An in-depth understanding of the biology and ecology of the pest, mechanisms of efficacy of crop and cropping system-based resistance, integration of natural enemies and biopesticides are critical in further strengthening the Integrated Pest Management (IPM) strategies implemented.

Awareness creation: Continuous education of farmers and extension officers is another important step that needs to be taken to ensure they adopt sustainable methods of fall armyworm control that help reduce damage and stabilize pest population to point where it no longer poses a threat to food production in the continent.

Clean water plays a critical role in human health

According to the United Nations, more than 80 per cent of diseases and deaths in developing countries are caused by consumption of unclean water. Clean water is needed to avoid these diseases.

Mary Mutisya | Water is a fundamental human need. Basically, people require clean safe water for running day to day activities such as drinking, cooking and maintenance of personal hygiene. On average, each person requires between 20-50 litres of clean, safe water a day for general use such as washing, hygiene and drinking. For this reason, therefore, the United Nations considers universal access to clean water a basic human right and a very important step towards improving people's living standards.

Human activities such as farming in sloppy land, cutting down forests in catchment areas and use of chemicals for crop protection have contaminated water sources causing many diseases to people especially those in rural communities.

Every year, about 1.8 million people die from diarrhoeal diseases such as cholera while other tens of millions are sickened by a host of water related ailments which are easily preventable. People need to know that polluted water is not just dirty-it is deadly, and lack of proper sanitized water not only breeds diseases but robs people off their human dignity and holds many things at stake.

For instance, when sick children miss school, their education suffers. Also, many economic opportunities are lost to the impacts of frequent illnesses and the time-consuming process of acquiring water where it is not readily available.

According to the World Health Organization (WHO), for drinking water to be considered safe, it has to meet several quality standards in terms of its acceptable microbiological, chemical and radiological characteristics and should therefore be consumed in any desired quantity without any adverse effects on one's health. The following key factors also affect the quality of water and should be put into consideration.

Water pH: Safe drinking water should have a pH of between 7.0 and 9.5. This usually acts as an indicator that the water has healthy levels of alkaline minerals



Water can be disinfected by placing it in plastic bottles and putting it out in the sun for more than 6 hours. The Solar Disinfection (SODIS) method is suitable for most people in rural areas and urban informal settlements.

such as calcium and magnesium.

Antioxidant: Safe drinking water should have a negative oxidation reduction potential. This is an indicator that the water has concentrated molecular hydrogen molecules.

Contaminant-free: Unhealthy toxins such as synthetic chemicals, toxic metals, bacteria and viruses as well as radioactive substances should be filtered before the water can be released for human consumption.

Good taste: Good tasting water is key as it motivates one to take the recommended amount for optimum body functioning.

In most developing countries such as Kenya, water infrastructures are well developed in urban regions but not in the rural areas where people mostly depend on rivers, streams, dams, lakes and ponds. These communities are prone to devastating effects of water borne diseases and their possible complications.

For this reason, therefore, methods of water purification for households use should be encouraged vigorously and sustained. Although water treatment equipment and methods are not 100% effective, they help reduce contamination to acceptable levels. The following is a simple 3 step guide in regard to water treatment that can be used by rural people.

- Physical removal of solid materials
- Boiling
- Chemical disinfection (for inactivation and killing of micro-organisms)

Physical removal of solid materials

This aims at the removal of large, undesirable materials such as organic particulate matter, stones and debris. The commonly used method involves the use of 3 pots labelled as 1, 2 and 3. After the water has been collected from the stream, lake or river, store it in the pot labelled 3. Leave the water to settle for at least 2 days before slowly pouring it into the pot labelled 2. After another 2 days, the water will have settled and is can transferred into the pot labelled 1. After this, the water should be further strained using a clean piece of cloth.

Step 2: Boiling

After physically sieving the water, transfer the water into a clean container and then bring it to a bubbling boiling state for about ten minutes. Most pathogenic micro-organisms die at temperatures of about 75 degrees and therefore boiling the water helps in killing most of the pathogens. It is good to note that although boiling water affects the taste as it drives out dissolved gases more so carbon dioxide, shaking the water vigorously after cooling will help improve the taste by trying to incorporate lost gases back.

Step 3: Chemical disinfection of water

Chemical disinfection aims at controlling potential pathogens either by killing them or by inactivating them. The most commonly used method of chemical disinfection is chlorination which involves the use of chlorine. Chlorine can be

applied in the following forms

- In the form of elemental chlorine which is mostly available as a gas.
- In the form of hypochlorite solution/bleach.
- As dry calcium hypochlorite.

In rural areas, chlorine is usually sold in small bottles branded differently. The most common brands are PuR® and WaterGuard®. The appropriate amounts are 1 cupful of the water guard lid for a 20 litre- jerrican if the water is clear and 2 cupfuls for 20 litres if the water is not clear. After this, the water should be well stirred using clean utensils and then left for at least thirty minutes before consumption.

Advantages of water chlorination

- Chlorine is effective against a wide array of pathogens.
- Residue chlorine helps prevent water sources against recontamination and reduces regrowth of biofilm.
- Chlorine is also easy to apply, control and monitor. It is also cost effective.

Disadvantages

- Formation of by-products which may have health implications.
- It is ineffective against parasites or cysts, that is why it is advisable to always boil water before consumption as it is the safest way to ensure all pathogens are eliminated.

For more information on water treatment <https://www.infonet-biovision.org/EnvironmentalHealth/Water-domestic-use>

How to control intestinal worms in livestock

Farmers should always deworm their animals at the beginning and end of the rains or every three months to ensure animals remain free of the internal parasites.

Caren Kemunto | Your livestock may look healthy but suffer from internal parasites infestation such as worms. Common parasites include roundworms, tapeworms and flukes.

If not treated, worms compete and drain the animal of crucial nutrients resulting to poor health, slow growth rate, low productivity, poor conception rates and unhealthy young ones being born. Animals reared for meat will have parts of their carcasses condemned at slaughter because of worms.

Symptoms of intestinal worm infestation in livestock

A regular deworming schedule alongside good overall herd management should be practiced to control significant parasitic infections that affect livestock. Where regular deworming is not practiced, recognizing the symptoms of worm infestation helps.

Infected animals show the following symptoms:

- Drop in milk production because worms deny them the full benefits of nutrients.
- They display poor physical appearance such that the ribs become conspicuous and coats dull and rough.
- Under heavy infestation, affected animals may become anaemic and develop oedema.



ascaris worms emerging from the bile duct

- Restlessness.
- Hair loss, mineral imbalances.
- Diarrhoea leading to dehydration.
- They also have difficulties consuming and digesting feeds thereby giving loose, foul-smelling stool. Such animals will also cough and have distended abdomens.
- In extreme cases, the animal may die.

Young animals are typically more susceptible to internal parasites than older ones. The older cattle have developed immunity having been frequently exposed previously to the parasites.

The older animals, however, experience the harmful side of internal parasites as they near giving birth because immunity is suppressed. Bulls are also more susceptible to internal parasites than cows because they start grazing early.

Control of worms

An animal must first be dewormed at intervals of three months. Several methods can be used to defeat worms. As long

as animals continue to graze on pasture, internal parasites will always raid them.

The amount of parasites will vary with pasture, season and management. Good pasture management practices will save the animals the burden of parasites.

The management includes:

- Grazing younger animals on safe pastures that have not been grazed on for almost 12 months as well as feeding them on small grain feeds.
- Always deworm animals before placing them on safe pastures. The less susceptible mature animals can be left to graze on the other pastures.
- Do not overgraze pastures. Animals graze closer to the ground hence pick up more larvae.

Dewormers should be used on time to reduce infection before symptoms occur.

Treatment should also aim at interrupting the life cycle of the internal parasite in an effort to minimize pasture contamination. Dewormers for treatment are

normally selected based on ease of application, whether broad spectrum, milk withdrawal periods and cost-effectiveness.

The de-wormers are grouped into either,

- Avermectins/ milbemycins eg Ivermectin,
- Benzimidazoles eg Albendazole, Avermectins/ milbemycins curb both external and internal parasites, as well as offer persistent protection for days to weeks after treatment.

NOTE: Before application, always read and follow the instructions and prescriptions.

Under-dosing can reduce the level of control and make the parasites become resistant to de-wormers. Overdosing, on the other hand, can poison the animals and lengthen withdrawal periods for products.

In a herd of dairy cows, deworming at early lactation consistently increases milk yields more than any other time of treatment.

Another option is to deworm all the cows in the herd at once then again after about three months depending on the drug used.

Use only antihelminths approved for use in lactating dairy cattle and consider milk withdrawal period.

Some dewormers are not recommended for treating pregnant animals, if used they can cause miscarriage; therefore, be sure of the choice of de-wormer.

Generally, it is advisable to reduce the animals' access to feeds, especially fresh pasture but not water 24 hours before administration.

This will slow down the exit flow of the rumen and increases the time that the dewormers remains there and get absorbed. For the same reason, do not feed the animals for about six hours after drenching.

For successful deworming, ensure the drenching gun is well calibrated. Shake the liquid suspension thoroughly before administration and draw into the gun the recommended dosage as per body weight. Drench and ensure that the animal swallows the whole dose.

Always change the dewormers to prevent the parasites from developing resistance to the drug.

For more information on worms <https://www.infonet-biovision.org/AnimalHealth/Worms>

Natural dewormers reduce worm infestation

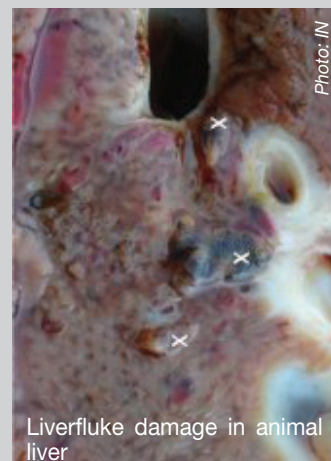
Natural dewormers reduce worm infestation

There are natural dewormers which help farmers to reduce infestation of worms in livestock. However, this natural or herbal dewormers do not act fast compared to synthetics ones. They help reduce worms in livestock if given to them regularly, over a long period of time. The most commonly used include:

- Mix Pyrethrum extract "pymac" with animal feed at all time.
- Minced 250g of garlic in 4 litres of water per day,

always after milking.

- Neem cake, seeds oil or bark mixed with feed.
- Artemisia spp. That is wormwood should use extracts
- Pumpkin seeds or seed extract.
- Mince 500g of wild ginger roots and feed it to cattle, sheep and goats.
- Soak 500g of chopped bark of Albinzia anthelmintic-mwawa or kyalundathi in kikamba in 3 litres of water overnight, sieve and drench.



Liverfluke damage in animal liver

Methods that help determine sex in young chicks

How can I tell a male or female chick after hatching?

Many farmers would like to know if their chicks are males or female after hatching. A lot of methods have been used to determine the sex of chicks but many of them have proved inaccurate. One of the most accurate methods is to check the vent (the cloaca or anal passage of the chick). If you check the lower part of anal passage, male chicks have a small bump or pimple while the female bump appears somehow flat. Many experts use the vent method to determine the sex of the chicks, which has brought a success rate of between 90 per cent 95 per cent of the chicks tested using this method. The method however requires experienced people trained for this particular purpose.

Down colour method

Farmers can also use the colour of down feathers (the small soft feather that chicks feathers) to tell if the chicks are male or female (this mainly applies to certain breeds such as Black-Breasted Red, Light Brown, among others). The males have a clean head with only two colours which end at the crown (top of the head). Females have three colours of the dorsal (at the back) stripes- a black or dark brown added outside the other two; the stripes run all the way to the crown.

In some cross-bred chickens, the females and males have distinct colours such as the KARI Improved Breed-in this breed, the female chicks have a black colour while the males have black and white spots or speckled colours.

Can wood shavings used as chicken beddings produce good poultry manure?

Wood shavings and saw dust are regularly used as bedding for chickens. However for young chicks, sawdust has been found to be unsuitable as bedding material as young chicks tend to feed on it leading to complications with their digestive system. Wood



Farmers can use various methods to determine the sex of their chicks.

shavings have been found to be most suitable material for this purpose.

Studies have established that composting chicken manure with saw dust and or wood produces high quality compost as long as the compost pile is well aerated by turning it regularly to allow for air circulation which enhances microbial organisms present in the pile to break down the lignin (tough organic substance that forms wood in combination with cellulose). So you can use wood shavings combined with chicken manure to make poultry manure.

Where can we have animal feeds analysed?

Feed analysis is very important for farmers who make their own feeds. It helps the farmer to know if they have used the right ingredients. It also helps the farmer to know if the feeds have the correct ratios or percentages of various nutrients that help balance the feeds to make sure the animals get each of the nutrients in the right proportions. Animals require feeds with the following nutrients:

Proteins: They are needed for growth and regeneration of body tissues. They are also essential

for production and maintenance of the animals. The main common sources of protein include soybean (soya), fishmeal, sunflower and cottonseed cake. The lack of enough proteins in an animal's diet leads to slower growth rate.

Carbohydrates: These are broken down into sugars, starch and fibre. Starch and sugars are sources of energy for animals. Sugars, for example molasses, provide an immediate source of energy to the animals. This energy is important for all activities e.g. movement, breathing, reproduction etc. Starches i.e. maize, cassava, sorghum, wheat and barley has to be broken down during digestion into simple sugars. The sugars are then absorbed into the animal's body to provide energy. Fibre from grass is more digestible compared to fibre from crop remains e.g. straw; it also contains a small percentage of proteins important in animal growth.

Minerals and Vitamins: compared to proteins and carbohydrates, minerals and vitamins are ingested in smaller quantities. Minerals e.g. calcium is important in the formation of bones. Most salts e.g. Cobalt contain minerals, they can be added to feeds or given as a lick. Vitamins can also be added to feeds or injected.

During feed formulation different proportions of proteins, carbohydrates, minerals and vitamins are mixed to ensure they are in balanced according to the requirements of each animal eg dairy cows, beef cattle, pigs and chickens (chicks, layers and broilers).

Additives: These include amino acids, toxin binders and stabilizers that prevent the feeds from caking or forming hard clods.

For farmers who make their own feeds at home, it is important that the feed is analysed in a laboratory to make sure the feed

is properly mixed and in the right proportion. Agricultural laboratories in research institutions or companies with feed analysis equipment can be able to do this.

The Kenya Agricultural & Livestock Research Organization (KALRO) laboratories in Naivasha and Thika can do feed analysis and advise farmers. All a farmer needs to do is to mix the feeds as advised for each category of animal and then take a 1 kg sample and send it to KALRO by courier services. The laboratories can analyse the samples and give results in 24 hours. It costs Ksh 1000 to analyse a sample. Farmers who require feed analysis can get in touch with KALRO on Tel: 0722565 819, Thika.

Provide enough space for chicken

Proper housing is an important aspect in poultry production. If not done well it causes stress and restlessness leading to cannibalism and pecking among the flocks. Proper housing means, the house has good lighting, enough space for chicken to move around during the day, bask and rest. Chicken houses should be constructed facing east-west to reduce wind.

One side of the house should be made darker so that hens can hide when laying eggs. It also should protect the chicken from predators. Proper hygiene is also necessary; the house should be cleaned regularly. The house should be kept warm and dry by spreading wood chippings on the floor and not saw dust because the chicken may end up eating the saw dust.

Answers by Elkanah Isaboke



Chickens in a shed with wood shavings

TOF Radio answers your questions

TOFRadio is broadcast on KBC on Thursday at 7:30pm and Mbaitu FM on Friday at 8.30pm. 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 422 460, email: admin@theorganicfarmer.org

There are many causes of infertility in chicken eggs

Musdalafa Lyaga | *A Farmer Hannington Okwemba from Siaya County says some of his chickens are not laying fertile eggs. He asks TOF Radio to inform farmers on what could be the cause and possible solutions for this challenge.*

Poultry products are an important source of income for many small-scale farmers in Kenya.

Many people like to eat poultry meat and eggs because of their delicious taste and nutritional value thus providing the much needed markets for rural farmers.

However, farmers like Hannington Okwemba continue to suffer great losses feeding chicken that are denying them the much needed income from the eggs.

Poultry farming is one the best agribusiness for small-scale farmers as it requires little capital to start, small space, it is not labour intensive and there is a ready market for poultry products.

As the farmer increases the number of birds, the income also increases while the cost of production goes down. Increase in the number of birds comes with many challenges. Poultry farmers have been reaching out to TOF Radio for possible solutions to this problem.

There are several factors that can cause the eggs not to hatch.

Ratio of hens to cocks

If the number of cocks serving the hen is less than the recommended one, then the farmer is likely to be denied good flock for the future. The farmer should make sure that there are a maximum of eight female chickens for one cock.

Age of cock

If the number of female chickens exceeds eight then the cock will not be able to serve them well, which affects the fertility of some eggs that fail to hatch. The age of the cock may also affect fertility. A cock that is two years old needs to be culled because the quality of its semen deteriorates.



All eggs should be checked to ensure only fertile ones are incubated

Cull unproductive hens

It is also important to choose high-quality eggs to put in an incubator or give the chickens to sit on for 21 days. Natural causes can also cause this condition. It



A candling box can help farmers check if eggs are fertilized or not

can be a flaw in its nature that a chicken may lay eggs that are not fertile. In such a case the farmer, should sell such chickens for meat to reduce the cost of using large amounts of money on feed.

Feed birds well

Lack or inadequate essential nutrients can also be a major cause of eggs' infertility. The farmer should always ensure that his chickens get enough nutrients such as *omena* (fish meal), soybeans and legume family plants; energy giving food such as maize, cassava, millet, sorghum, sweet potato; vitamin and mineral from vegetables like kales, cabbage and grass.

Free roaming chicken spend a lot of time and energy seeking food which hinders fast maturity. Make sure your indigenous poultry roaming diet is supplemented.

Regularly cleaning the birds

house can help reduce the bacteria present in the poultry house affecting their health. A sick chicken is an unproductive chicken that will cost you a lot of money on treatment.

Prevent diseases

Decontaminating your poultry house regularly will help you prevent diseases such as respiratory viruses, mites, and other poultry health problems especially in laying hens. Some of the pests brought about by dirty living conditions can colonize a chicken's intestinal tract without necessarily causing obvious disease in the chickens itself. This may lead to the organism invading other tissues and eventually finding its way into the reproductive tract and ovary, contaminating the egg itself.

If proper care of poultry is taken, farmers can make more money from their eggs and their customers will enjoy better quality poultry products.

For more information on chicken welfare and rearing <https://www.infonet-biovision.org/AnimalHealth/Chicken#simple-table-of-contents-3>

Radio Taifa frequencies for our TOFRadio programmes

TOWN	FM FRE-QUENCIES	MW (MEDIUM WAVE FRE-QUENCIES)
Nairobi	92.9 MHz	
Mombasa	100.8 MHz	
Kisumu	104.5 MHz	
Kakamega	104.5 MHz	
Bungoma	104.5 MHz	
Eldoret	88.6 MHz	
Nakuru	104.1 MHz	
Meru	90.4 MHz	
Nyeri	87.6 MHz	
Kisii	103.3 MHz	
Malindi	90.1 MHz	
Kapenguria	93.3 MHz	
Kitale 9	3.3 MHz	
Voi/Kibwezi	96.9 MHz	
Namanga	89.9 MHz	
Lodwar	88.6 MHz	
Lokichoggio	89.3 MHz	
Garsen	93.1 MHz	
Kajiado	92.9 MHz	
Kitui	92.9 MHz	
Lamu	96.3 MHz	
Maralal		1107 KHZ
Wajir		1152 KHZ
Marsabit		675 KHZ
Garissa		567 KHZ