Organic agriculture can feed the world

TOF - Organic farmers can get the higher crop yields as conventional farmers if they observe good organic crop management practices. Organic farming also improves soil fertility and increases farm productivity and income for farmers. These are the findings of the first six years of the Long-Term System Comparison Trials (SysCom) that are going on in Kenya, aimed at comparing the performance of maize, beans and other crops when grown under conventional practices and organic practices where farmers use on-farm resources to grow food crops using natural and environmentally friendly methods to improve soil fertility and control pests and diseases.

More yields, more profits

The results of the study show that organic systems start to give farmers better returns than conventional farms after three years during which the soils in organic farms build fertility and structure and start giving higher crop yields. The results also show that organic farming system can give the same crop yields including profits as conventional farming system. However, organic farmers stand to earn more if organic produce is sold at a premium price due to its health benefits.

“Our results show that soil under organic system, had soil fertility improve significantly in calcium, magnesium, and potassium and soil pH. Furthermore, the profitability was similar in both systems, but when premium price was considered, organic farming was more profitable starting from the fifth year,” says Dr. Noah Addamtey the SysCom Project Coordinator.

Organic controls nematodes

The results show that organic SysCom also can suppress Plant Parasitic Nematodes (PPN), which damage crops, much better than conventional methods. Organic systems were also found to increase the number of termites in the soil.

On-farm trials, which are going hand-in-hand with on station research have enabled participating farmers adopt some of the technologies being used in the trials which they practise in their farms. The farmers have learnt how to improve the quality of compost, fodder production, maintaining hygiene in animal sheds and fodder conservation and recycling of farm waste.
Organic farming system is effective in controlling destructive nematodes

Peter Kamau

Insects and other microorganisms in the soil play an important role in soil health, plant life, and the environment. The insects and soil microorganisms are very critical to any healthy ecosystem. The most common insects found in the soil are termites, earthworms, and nematodes (though these are barely visible with the naked eye). Thousands of microorganisms such as bacteria, fungi and viruses also live and interact and create an ecosystem in the soil.

They recycle nutrients, dig or burrow tunnels that allow air into the soil structure and in the process increase the activity of microbes in the soil. The presence of these microorganisms is essential for the proper functioning of the ecosystem because they help break down and add organic matter into the soil structure. All plants and even crops we grow rely on mycorrhiza fungi which facilitate the release of nutrients to feed the crops and enable them to grow well while regulating the amount of moisture in the soil.

However, the activities of these soil organisms can be severely affected in conventional farming systems where chemical fertilizers and pesticides are used to enrich the soil and control pests and diseases. It is against this background that the ongoing Long Term Farming Systems Comparison trials (SysCom) of comparing conventional and organic farming to determine the effect the two systems have on termites and nematodes were setup. These two soil organisms that are considered as pests also play an important role to the environment.

Termites can be destructive to crops and wood based products, but they play a very important role by breaking down wood material and converting it into organic matter. All species of termites have bacteria in their digestive system which help break down wood material (cellulose) that they feed on. They also create tunnels that help to aerate the soil by allowing oxygen to get into the soil for use by other living organisms in the soil.

Nematodes are classified in two groups - the Plant Parasitic Nematodes (PPN) that cause great damage to many crops including beans and maize and the Free Living Nematodes (FLN) which are beneficial; their presence in the soil is taken as an indicator that the soil is healthy. Scientific studies have established that organic farming systems can reduce the destructive PPN nematodes in the soil to a level that does not cause damage (Farahal and others, 2012). When chemicals are used especially in conventional systems to control PPN nematodes, they have been found to affect the beneficial (FLN) nematodes (Neher, 1999).

In the ongoing Long Term Farming Systems Comparison Trials (SysCom) two studies - Effect of farming systems on termite abundance and damage on maize crop and Field evaluation of soil nematode communities under organic and conventional farming systems are being done to determine the effects of organic and conventional farming systems on termites and nematode abundance in scientific experimental sites and farmers’ fields at KALRO-Thika and Chuka.

Termite experiments

During the study, four experimental plots were put under different organic and conventional treatments. Two of the plots were put under Organic High (Org. High) and Conventional High (Conv. High). The remaining two plots were placed under Organic Low (Org. Low) and Conventional Low (Conv. Low) and repeated 4 and 5 times in Chuka and Thika experimental sites respectively.

In the Conventional High plots, 7.5 tonnes of Farm Yard Manure (FYM), 225kg of DAP and 100kg of CAN were applied on maize per hectare. Chloryphos chemical for termite control was used as recommended in conventional production system. In the Organic High Plots 11 tonnes of compost, 54 tonnes of tithonia and 364kg of rock phosphate and 3 tonnes of dry grass for mulching were applied in one hectare of maize crop. For pest control 2kg of icipe-69 biological pesticide and fungicide was applied for termite management.

In Conventional Low (Conv. Low) 2.5 tonnes of Farm Yard Manure (FYM) and 1.5 tonnes of compost were applied in the plots and 2kg of Chloryphos used for termite control. In Organic Low (Org. Low) 2.5 tonnes of Farm Yard Manure (FYM) and 1.5 tonnes of compost were applied in the plots and 1.5kgs of Nematicide for termite control was used.

Most chemicals used in conventional farming kill beneficial organisms in the soil.

Long Term Farming Systems Comparison Trials (SysCom)

The results show that organic farming systems can reduce the need to buy expensive and poisonous chemicals to control PPN nematodes while conventional PPN control has negative effect on the soil ecosystem.

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 views of The Organic Farmer do not necessarily reflect the views of ICIPE nor Biovision Foundation.

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control of destructive nematodes

The use of chemicals to control pests in crops has had great impact on the environment, human and animal health. Chemicals do not only affect the targeted pests but also have more disastrous effects on microorganisms in the soil, which play a very important role in creating the right conditions for all plants to grow. The soil on which we grow crops is full of living microorganisms such as viruses, bacteria, fungi, algae, protozoa, mites, nematodes, worms, ants, maggot and grubs and other large animals. All these microorganisms form what is called the soil biota. Together with climate, microorganisms are responsible for the decay of organic matter and the recycling of both macro and micro nutrients back into a form that the crops and other plants can use for growth. The activities of these living microorganisms enable the soil to acquire all the right conditions for plant life building a better soil habitat and improving the soil structure, texture, productivity and while improving the overall health of the ecosystem.

increase their population and the overall health of the soils. This helps to clean the air and water in the soil, increasing the activities of microorganisms.

It is important to note that the organic matter including soil microorganisms control both the physical structure and chemical processes that take place in the soil (see diagram left). This means that to have a healthy soil, the organic matter and other life in the soil should remain undisturbed as they determine and control all other processes and structure that make up the soil. The interim findings of the ongoing Long Term Farming Systems Comparison Trials (SysCom) confirm this. Organic farming is the only sustainable system of farming that restores soil fertility, maintaining soil structure and ensures a healthy ecosystem that improves farm productivity.

Chemicals destroy natural balance

However the use of synthetic chemicals has serious consequences for the soil organisms and microorganisms because they kill both the harmful and beneficial bacteria, fungi, earthworms and all other soil organisms disrupting the natural processes that sustain and feed the soil. When beneficial soil organisms are eliminated, this disrupts the natural process of replenishing and nourishing the soil resulting in an imbalance in nutrients, loss of natural predators and destruction of the soil structure.

Organic farming inputs protect soil microorganisms, allowing them to function as they should hence building soil fertility and maintaining a natural balance between predators and harmful microorganisms and reducing nutrient balance.

Peter Kamau
Earnings from organic farming system start to increase from third year, reaching Ksh260,000 per acre by the sixth year. This is a total increase of 53 per cent against that of conventional system at Ksh 192,000 per acre.

**Peter Kamau** Farmers practising organic agriculture can improve soil fertility, productivity and income more than those using conventional methods of crop production. They can also get higher crop yields than their conventional counterparts if they maintain proper organic crop management practices. These are findings and partial results of the first six-years of long-term experiments comparing the two farming systems at two sites in different climatic (ecological) zones in Thika and Chuka in Kenya, which were released in June 2016. The aim of the trials is to compare conventional and organic farming systems to find out which of the two is the most suitable farming system in Kenya and other tropical countries.

According to the results of the on-going Long-term Farming Systems Comparison trials (SysCom) being led by the Research Institute of Organic Agriculture (FiBL) Switzerland and partners including the International Centre of Insect Physiology and Ecology (icipe), The Kenya Agricultural and Livestock Research Organisation (KALRO), Kenyatta University (KU), Tropical Soil Biology and Fertility Institute (TSBF-CIAT), The Kenya Institute of Organic Farming (KIOF) and the Kenya Organic Agriculture Network (KOAN), there were differences in soil fertility levels in experimental plots under organic treatments (where only inputs such as compost, tithonia, rock phosphate and, organic fertilizers and biopesticides were applied) and conventional plots (using chemical and organic inputs such as fertilizers, pesticides and fungicides).

In the Thika site, 20 plots were put under different organic and conventional inputs. The conventional plots were divided into Conventional High (Con. High)-where the crops were provided with all chemical inputs and supplemented with limited organic fertilizers and related inputs as recommended by Kenya’s Ministry of agriculture and irrigated when the rains failed to ensure consistency in data) and Conventional Low (Con. Low)-where the crops were provided with limited chemical and organic inputs as practiced in small-scale farming system in Kenya but no irrigation was provided.

The organic plots were also divided into Organic High (Orga. High)- where only organic inputs were used as recommended by the Kenya Organic Standards and crop irrigation and Organic Low (Org. Low) where limited organic inputs were used in the same way farmers practice organic farming, with no irrigation. Organic farmers in Kangari, Makuyu and Chuka had access to the experimental site to learn and replicate what they had learnt in their farms.

Maize, beans, cabbage, baby corn, French beans, potatoes and grain legumes were planted in rotation in all conventional and organic plots in three-year cycles and their performance, including yields recorded.

In Conventional High plots, 225kg of nitrogen per hectare (90kg of nitrogen per acre) and 286kg of phosphate (114kg of per acre) fertilizers were applied and pests and diseases controlled with chemicals. In Organic High plots, organic inputs used were mainly compost, tithonia, liquid manure and rock phosphate. Nitrogen was further provided through an intercrop of *Mucuna pruriens* (for maize) and its residue ploughed back to provide nutrients to the relay crops of beans and other grain legumes (the intercrops and other organic inputs provided 225kg of nitrogen/ha and 286kg phosphate organic fertilizer; organic pesticides and fungicides were also applied and the crops put under irrigation when necessary. Well-prepared compost was regularly applied to boost soil fertility in Organic High plots. In Organic Low plots, organic inputs such as compost, pests and diseases were controlled in the same way as it is done in Low input systems or as practised by farmers.

Selected organic farmers taking part in Kangari, Chuka and Makuyu regions in Muranga and Meru Counties were allowed to visit the experimental sites to learn and to encourage them to adopt what they had learnt.

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**Research findings**

The results show that organic farming gives higher crop yields in the long term. Organic farming also protects soils and biodiversity which is key to the survival of all ecosystems and in extension life in our planet.

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Farmers learn the best method of composting manures

Study shows that fresh Boma (farmyard) manure composted for 63 days is of better quality than the one composted for a period of 14 days, while Masai manure is of superior quality and does not require composting.

**Peter Kamau** Farmers across the country do not ordinarily compost farmyard (or Boma manure), rather, they apply it directly to fields because they know that farmyard manure increases soil fertility and improves yields which means more income from their farming efforts. However, this research in the ongoing Participatory Technology Development (PTD) on-farm trials that is verifying findings of the on-station Long Term Farming Systems Comparison Trials (SYSCOM) reveals Boma manure should be composted before applying it to crops. The on-station SYSCOM trials are comparing conventional versus organic farming systems under different ecological zones and management practices for their agronomic, economic and ecological performance in Central Kenya while the PTD trials are aimed at developing and adapting agricultural practices developed in the SYSCOM project to ensure effective technology transfer to farmers after the long term trials are over.

Preliminary results of the study titled Effects of different types of manure and composting techniques on carrots (Daucus carota) and beans (Phaseolus vulgaris) yield that was done between 2005 and 2008 in Kangari and released in June this year, shows that the method used in compost making has effects on soil fertility and crop productivity and therefore income for farmers.

The study was conducted at a Demonstration Experimental Site in Kangari (Kigumo Sub County, Murang’a County) as well as in 12 farmers’ fields. While the Demonstration Experimental Site was managed by researchers and all treatments were subjected to the same conditions, the trials in farmers’ fields were managed by the farmers themselves, but researchers were involved in the data collection. At the beginning of the trials, all the sites, that is, both the experimental demonstration site and farmers’ fields had their soils tested to determine the levels of acidity and soil nutrients.

Farmers were exposed to six treatments in the Demonstration Experimental Site which included uncomposted Boma manure and composted Boma manure for 14 or 63 days and uncomposted Masai manure and composted Masai manure for 14 or 63 days. Plant residues were added to both Boma and Masai manure composted for 14 or 63 days but the uncomposted manures were applied in their natural state without adding residues. The differently prepared manures were then tested on climbing beans, beans and cabbages.

**Composting improves quality of Farm Yard Manure (FYM)**

In its natural state, Masai manure improved bean yields by 400% compared to Boma manure. When composted for 14 days, Masai manure deteriorated decreasing yields by 5%, and when composted for 63 days yields decreased by 50%. On the other hand, composting improved Boma manure, improving yields by 175% when composting was done for 14 days and by 200% when the period was extended to 63 days.

**Recommendations**

The results obtained from the various modes of composting showed that:

- Boma manure should be composted; the longer the manure is composted, the better.
- Boma manure should be composted for 63 days. This extended period also allows weed seeds to be eliminated, saving the farmer the extra labour they would spend in weeding the young crop.
- Masai manure should not be composted; instead, it should be applied directly to crops.

Farmers participating in this study also benefited from interactions with the researchers, who also trained them on various aspects of animal husbandry, such as farm yard manure handling; cowshed hygiene; fodder establishment, production and preservation; selection and composting techniques; and preparation of liquid manures and plant teas for foliar feed application on crops. Farmers also got an opportunity to learn various natural methods of pest and disease control.

Dr Anne Muriuki, a Kenya Agricultural & Livestock Research Organization (KALRO) Researcher and Centre Director based at KALRO Kabete (National Agricultural Research Laboratories) says that the aim of the project is to help farmers utilize cheap and easily available resources on their farms to improve crop production. When nutrient release is enhanced from these resources (like demonstrated in this trial for Boma manure), farmers have a reliable alternative to chemical fertilizers which may not always be available in the right amount and type for the crops they want to grow in their locality. Besides being expensive, farmers may also not know the right amount of fertilizer to apply and at what crop stage.

There is need for policy makers to embrace and support organic farming as viable production method (among many others available) for achieving sustainable crop production. Players in the organic sector should also consider ways to subsidize certification costs so that local farmers can earn premium price from organic produce.

James Njoroge, a farmer in Kirathaini village, Makuu central, in Muranga County is one of the 60 participating in the Long Term System Comparison trials (SysCom). Like many farmers he did not understand the value of farmyard manure. But this has now changed since he received training on how to prepare compost.

“Before I would apply raw manure on my crops and the result was not very good. But now I prepare it by mixing with various crop residue such as maize stalks, lithonia, and foliage from trees around the homestead. The results have been very good. I have seen the benefits of proper preparation of compost because I harvest more maize than I used to. I have discovered that chemical fertilizer is not good for crops because I can clearly see that the portions I have used compost have higher maize and bean yields.”

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**Long Term Farming Systems Comparison Trials (SysCom)**

Farmers participating in the SysCom trials have learnt the best methods of composting farmyard manures and preparation of plant teas which they later practice in their own farms.
The findings
From the first year to third year (2007-2009) there was no difference in yield and soil condition in both Conventional High and Organic High plots. However in the third year (2009), differences in yield and soil fertility began to show in both Conventional and Organic High plots with organic showing a slight increase in yields and soil conditions.

The results showed that organic carbon content had increased by 85 per cent in Organic High plots over that of Conventional High plots (More than 4 tonnes per acre in Organic High and 2.5 tonnes per acre in Conventional High in both sites in Chuka). However there was loss of Soil organic carbon in both Organic High and Organic Low plots in the Thika experimental site, which was attributed to other factors such as the weather and the type of soil. There was also a notable difference in change in the cation exchange capacity (CEC) - a process that enables ease of movement and uptake of nutrients in soil by crops, with organic plots showing higher movement and uptake of nutrients such as potassium, magnesium and calcium than in conventional plots in both Thika and Chuka.

Cost of production
At the beginning of the experiments, the cost of production (input, labour, transport, irrigation and certification costs) for organic and conventional production remained more or less the same. The results show that, except for labour, organic farming requires less inputs financially but it gives higher yields in the long term.

Gross margins
When the gross margins from the two farming systems are compared in the two trial sites, earnings from organic low and high start to increase from third year, reaching 6500 US dollars per hectare (Ksh 260,000 per acre) by the sixth year, the results show a cumulative increase of 53 per cent in Organic High against Conventional High income of USD 4800 per hectare or Ksh 192,000 per acre.

Conclusion
The results of the six-year trials show that an organic farmer can get the same yields as a conventional farmer if they maintain proper management of their soils and crops. Organic farmers should maintain intercropping and crop rotation, which is one of the key principles of maintaining soil fertility and increasing crop yields and income. However when it comes to the gross margins, organic systems become more profitable where the organic farmers are paid premium prices of between 20 per cent to 53 per cent for their produce.

Organic farming systems showed a significant improvement in soil fertility, reduction of soil acidity and the ability to ensure key plant nutrients are available to crops. Conventional farming systems increase soil acidity in the long term locking up essential nutrients that crops require for growth - a big problem now facing farmers in Kenya especially in key maize, sugar-cane and rice growing areas.

Recommendations
The trials show that organic farming is an effective, productive, viable and profitable production system and should be promoted for adoption by farmers in Kenya. This is especially so for farmers who grow maize and beans in moderate to high rainfall areas as long as they practise good crop management and get premium prices for their produce.

The research team advises the Kenya Government and extension State departments of agriculture in other African countries to consider assisting farmers in their countries to adopt organic farming practices and create a separate market where they can sell their produce to get premium prices for their produce.
The value of sweet potato vines in animal fodder

I would like to know what nutrients sweet potato vines provide to dairy cows, sheep, goats and even pigs.

Sweet potato vines have many nutritional benefits for people and animals. It is easy to grow, cheap to buy and it is delicious because it is loaded with healthy vitamins that are essential for maintaining good health. Sweet potatoes are high in Vitamin B6, C and D. They contain sufficient sources of iron, magnesium and potassium. Like carrots, they are also high in beta-carotene which is essential in the processing of vitamin A within the body.

More proteins
Sweet potatoes carry nutrients in both tubers and their leaves. Animals fed on the vines get to benefit from its high nutritional value. Sweet potato forage is a main source of protein that animals require for healthy and rapid growth- they contain between 15-30 per cent crude protein when in dry matter form. However, the forage quality depends on the proportion of leaves and stems. Unlike legume forages such as calliandra, leucaena, gliricidia or mucuna, it does not contain compounds that prevent the absorption of its proteins.

Sweet potatoes contain up to 70 per cent dry matter that animals are able to digest and convert into various nutrients for growth, milk production and meat quality. Furthermore, sweet potatoes are easily broken down in the rumen (first stomach of a cow, goat or sheep). The following animals can benefit a lot from sweet potato vines:

Dairy cows
Sweet potato vines can be fed to dairy cows as a supplement to their dairy forage rations such as grasses, sorghum or maize stalks. When given in addition to these forages, sweet potato vines enable dairy cows to produce more milk because they help to increase energy thus saving the farmer the extra cost they would incur in providing more feed. Studies have found that sweet potatoes can help increase milk production in dairy cows by up to 70 per cent.

Calves
Sweet potato vines have been found to be high quality feed for calves due to their high nutrient content, palatability (calves like it) and protein content. When calves are fed consistently with sweet potato vines and Napier grass, farmers can reduce by half the milk they feed their calves - this means that sweet potato vines are a good milk replacer. Calves fed on Napier grass supplemented with sweet potatoes grow faster than those fed on Napier grass alone although calves fed on a combination of Napier grass, sweet potato vines, lucerne, desmodium, leucaena and Sesbania sesban do much better than those fed on Napier grass and sweet potato alone.

Sheep
Mixed sweet potato vines and roots fed to sheep have been found to increase nutrient intake (and use by sheep) - this combination also helps to cut down the cost of feeding sheep. Lambs (young sheep) have been found to increase their daily weight gain by between 50g-60g per day.

Goats
Goats love sweet potato vines. Daily weight gains of 44g-82g have been recorded in goats fed with sweet potato vines supplemented with cotton seed cake. Sweet potato vines provide sufficient crude protein and energy to sustain goats for milk and meat production even during dry spells when there is less forage for feed. Feeding goats with sweet potato vines provides cheap nitrogen and increases feed efficiency; sweet potato vines can comfortably replace concentrates especially in bucks (male goats).

Pigs
Sweet potato vines are one of the most important feeds for pig diet mainly due to its high crude protein content, high crude protein digestibility (above 65 per cent) and amino acids content. Sweet potato vines whether they are fed fresh, dried or as silage are a good source of protein and amino acids (compounds that combine to form proteins eg lysine, glycine, tryptophan, methionine etc). Small-scale farmers can reduce the use of expensive feedstuffs such as soybean and fishmeal by feeding pigs sweet potato vines. Sweet potato vines can be fed to pigs without any negative effect on their health resulting in lower production costs and higher net income.

Farming Tip
Do not burn crop residue, spread it again

Most farmers have already harvested their beans and even maize in some parts of the country. After harvest, much of the crop residue is burnt in preparation for planting for the short rains which start in September and October. Crop residue especially from beans is full of many essential nutrients that can be recycled either through composting or just spread on the prepared land. It can then act as mulch to prevent moisture loss. Bean crop residue also contains nitrogen which the following crop will require in large quantities; when the residue breaks down, it releases nitrogen that is taken up by the growing crop. If not fed to livestock, maize stalk can also be spread along the rows of the growing maize and beans. If fed to livestock, the manure from the livestock can be converted into high quality compost that can further be applied as organic fertilizer for other crops such as vegetables, tomatoes or even your fruit trees.
Control onion diseases for more yields

Dick Davey | Onions grow well under many different conditions. But when grown in the rainy season, onions have a greater chance of contracting diseases. Onions get more diseases in warm humid weather and your onions are more likely to get infected in the parts of your field where there is water logging.

Different onion diseases can show different symptoms; however most diseases can be managed in the same way. The most common disease starts as a brown oval spot on the leaves. The spots then turn into yellow streaks that run along the leaf. Once the yellow streak turns brown, the leaves fold.

It is important for farmers to stay vigilant so as to be able to prevent and manage the diseases. After harvest, the germs that cause the diseases are found in the soil. This means that after growing onions, it is important to plant other crops in rotation. You should avoid planting onions in that field for three years until the soil is free of the diseases.

There are ‘improved’ varieties of onions that can cope better in wet conditions than other types. You can find out from your local dealer or extension agent what varieties to grow. Then you could plant small amounts to see how they perform on your farm.

Diseases can also be passed on in the seed, especially in untreated seed from the local market. To avoid this you should buy genuine seed from a trusted seed dealer.

Diseases will often attack weak plants in poor soil. A way around this is to get healthy seedlings and try improving the quality of your soil. Adding organic compost or well-rotted manure to your seedbed is a good control measure. Seed transplants can also spread the disease. All crops that attract thrips act as hosts for the pest disease. All crops attract thrips as hosts for the pest disease.

Studies have established that some varieties of onions are less prone to the disease. The disease-causing thrips are attracted by the colour of onions. For example Red Pinoy has been found to attract more thrips per plant while the Texas Grano and Bombay Red have least infection. The green colour of Texas Grano and Bombay Red leaves were found to be the cause of less infection. The Thrips tabaci is more attracted to blue colour than the green colour. Farmers are therefore advised to grow Texas Grano and Bombay Red onion varieties to reduce infection of their onion crop.

Control devastating IYSV viral disease

One of the most destructive diseases in onions is the Irish Yellow Spot Virus (IYSV) disease. The viral disease can wipe up to 75 per cent of onion crop. The symptoms of the disease include yellow to straw coloured lesions (wounds) on the onion leaves and stalks. Dry long strips of lesions show on the leaves which may look like insects (thrip) damage. Late in the season the leaves may dry up and fall. Plant vigour (strength) is reduced and bulb size reduces affecting the overall onion yield in a farm.

Symptoms

Symptoms of Iris Yellow Spot Virus on onion include yellow to straw coloured lesions (wounds) on onion leaves and stalks. Dry, elongated lesions or flecks may resemble thrips injury. Lesions may be diamond shaped (this occurs rarely on leaves, more commonly on scapes). Late in the season, infected seed stalks and leaves may fall. Plant vigour and bulb size are also reduced including the onion yield.

Control measures

The viral disease is spread by thrips (Thrips tabaci). The number of thrips in an onion crop determines the severity of the disease. Volunteer onion from the previous crops transfer the disease to the new crop (this is why crop rotation with crops not prone to the disease is a good control measure). Seed transplants can also spread the disease. All crops that attract thrips act as hosts for the pest and the disease.

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