Anita Roddick, Founder Body Shop
Ask any farmer their biggest fear apart from bad weather and most will say, pests. Hands On checks out what can be done to stamp out maggots and beetles that devastate human crops. And what you can do to keep those garden pests at bay and how to grow and store and sell different products.

So stay tuned, there may be a solution right here for you.

NARRATOR
Since the first bread was baked in Egypt around 6,000 years ago, it’s been a staple for millions around the world especially in west and central Asia.

Good bread comes from good wheat but the scourge of farmers in this part of the world is the Sunn pest, also known as the stink bug or shield bug.

Even a small infestation can render harvests worthless and ruin farmers. Now the insects’ weaknesses are being explored and targeted by new research that’s giving farmers a chance to fight back.

Mustapha El-Bouhssini
As you see here this is a nice wheat field but the Sunn pest is so damaging you only need about two to three percent of the grains to be infected then the flour from this grain will be useless. You cannot make bread out of them.

NARRATOR
When the Sunn pest feeds on wheat grain, it injects an enzyme which destroys its natural gluten and renders the flour useless for making bread.

Fouad Jaby El-Haramed, Germplasm Program, ICARDA
The flour looks as normal flour but when you add the water to the flour to make a dough, it’s becomes like a gum, very sticky and very difficult to handle.

V/O:
The baking process is also affected, producing misshapen and poor quality bread.

Fouad Jaby El-Haramed
For normal bread you can see here the separation completely. The Sunn-damaged flour is not separated completely.

NARRATOR
In a project by ICARDA, the International Centre For Agricultural Research in Dry Areas, supported by DFID, the UK Department for International Development, farmers from all over west and central Asia meet at farmer field schools to learn natural ways of controlling the threat.

Turkish farmers are testing this field for Sunn pest infestation. Using 50cm square frames they sample random areas and count the number of pests in each frame.

If the average is less than 10 nymphs per square metre, they’re advised to leave nature to control the insects without using pesticides.

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But ICARDA has developed a way to control the threat using the Sunn pests’ natural enemies.

**Fouad Jaby El-Haramed**
As you see here, these are newly hatched eggs and this is the first natural stage here.

This small black animal’s natural enemy will reproduce on some pest eggs and thus they kill the Sunn pest eggs and there’s not a lot of pest reproduced. So the more we have these natural enemies in the field, the less Sunn pest we have and the less worry we will have about our, the quality of our wheat.

Each of these cardboard incubators hatches a thousand parasites, enough to keep the Sunn pest at bay over a tenth of a hectare.

**Dr Ramazan Canrizal, Planta Protection Director, Ankara**
They hang these packages on the wheat stems. After hatching the natural enemies fly out through the nets and they find the Sunn pests’ eggs in the field.

**NARRATOR**
Another weapon in the farmers’ arsenal is the partridge. It seeks out wooded areas where the Sunn pest spends the winter months and eats the insects.

In a third prong of attack, measured doses of a fungus are injected onto partially cooked wheat grains in a lab and left to incubate for two weeks to produce spores. These are then dried leaving a granular residue.

**Fouad Jaby El-Haramed**
We sprinkle the grains around the tree. The spores of the fungus come in contact with the insects and then they would kill the Sunn pest.

The efficacy of the use of this treatment is about 90% mortality which is great.

**NARRATOR**
Spraying pesticides by air has been banned in Turkey and Iran and will soon be outlawed in Syria, but farmers in these countries are now armed with natural ways to control this serious pest.

**Prof Adel El-Belyagi**
The amount of pesticide which is used every year is more than one hundred and fifty million dollars, and this is not only the price the economical stress which will have on the countries but it’s the pollution which has on water which is used by the population later, or the impact on the environment which is very lethal.

**Sureyya Celebi**
If I control the Sunn pest well, I can sell my wheat for a good price and the quality is good.

**Enver Celebi, Turkish Regional Farmers**
The Sunn pest is a real problem because bread is so important for us. I can’t imagine life without bread.
NARRATOR
Autumn in Sweden, and a harvest with a difference.

Bio-dynamic agriculture is not about increasing yields at any cost. Here the aim is to interact positively with the surrounding environment and make farming a fundamental part of a sustainable society.

Students at this Rudolph Steiner Institute are harvesting the fruits of their labour as part of their studies in bio-dynamic agriculture. It's the first term of a three year course.

A botany class is underway with students examining in microscopic detail the structure of plants, flowers and herbs and their individual roles within a bio-dynamic system.

The Institute’s principal is Thomas Luthi who’s been studying, practicing and teaching bio-dynamic concepts for nearly 40 years.

Thomas Luthi, Skillebyholm Institute
The difference between organic and bio-dynamic farming is that you go even one step further. In a way we would like to work on a deeper knowledge about nature, plants animals and human beings.

NARRATOR
Central to bio-dynamic agriculture is infusing compost with measured doses of six special compounds or preparates.

Thomas Luthi
So here we have the ingredients for the compost preparates: camomile, yarrow, stinging nettle, the dandelion and it's just the flowers we pick and use for the preparates and here we have Valerian. We press some juice out of the flowers.

NARRATOR
A teaspoon full of each of the ingredients is injected deep into different parts of the compost heap followed by the juice of Valerian flowers.

One capful is added to half a bucket of water and stirred vigorously clockwise and anti-clockwise for fifteen minutes.

Finally the liquid is sprayed over the compost heap which is then covered with straw, not plastic, and left 'til the following autumn.

Thomas Luthi
And now all the earth worms and micro-organisms they have to come and also fungus and they are actually going to do the work. We create the right circumstances and nature will carry on.

NARRATOR
Yields are not necessarily higher than conventional methods, so what are the real benefits?
Over the past fifty years agricultural run-off into the Baltic Sea has added to its degradation. Now a growing number of farmers in Jarna are using bio-dynamic methods to reverse the decline.

Neither pesticides nor artificial fertilisers are permitted on their land and where possible their animals are treated with homeopathic remedies.

**Artur Borghs, Nibble Gard**
A farm is a process, an organism, and that way we try to live and to produce our products, important for us is the quality of the products.

**NARRATOR**
Bio-dynamic products are increasingly popular with consumers who’ll pay a premium for them. They look for the universal symbol Demeter which guarantees it’s been produced in a bio-dynamic system.

**NARRATOR**
Andhra Pradesh is one of the most fertile regions in India but these warm moist conditions are also perfect for fungi that can produce harmful poisons.

One of the most common is aflatoxin, potentially lethal to humans and animals.

**Dr Farid Waliyak, ICRISAT**
Most of our crops are affected. The fungi itself is affecting the quality of our products so that it’s not going to be acceptable in the market. In addition to that, the most important thing is that the health of people are affected.

**NARRATOR**
Now there’s a cheap and convenient test to check contamination levels, safeguarding farmers’ livelihoods and consumers’ health.

The fungus that produces aflatoxins contaminates economically important crops in countries all over the world.

**Dr Farid Waliyak**
In January last year it was reported that 126 people died because they have, they were eating for many months highly infected corn and the toxin is impossible to see, so there are many technologies but most of them are very expensive so that’s why we try to develop our own system.

**NARRATOR**
Methanol is used to extract any toxins from the ground up crop sample.

Then what’s known as the ELISA Test gives a colour indication if the deadly poison is present.

**Dr Veera Reddy**
Well we analyze the samples using the Elisa Test. As the reaction progresses, we can see the colour development takes place.
Now using these values the computer will calculate what the quantity of the toxin percent in the unknown samples is.

**NARRATOR**
Now that ICRASAD has produced a cheap reliable way to test for Aflatoxin, farmers can develop methods of toxin management. This may mean more resistant crops, control agents or altering the soil type.

More importantly farmers can learn new ways of harvesting to lower contamination.

**Dr Farid Waliyak**
With some of the treatment by 90% we have been able to reduce aflatoxin. We are now trying to see how these technologies can be adopted by the farmers.

So what we are recommending is this way, and try to put the crop up so that it will dry quicker and the pod will be exposed to air.

**Farmer**
For the last 20 years I have been growing maize but I was not aware of the aflatoxin for those years. Just six months ago the ICRASAD people came and informed me about aflatoxin. Before we used to heap the produce in piles. Now with ICRASAD’s recommendations we are not doing that practice. We are immediately removing the cobs and drying them out.

**Dr Farid Waliyak**
This Elisa Test was not only used, it’s not only used for research. It’s used also for helping farmers, traders, exporters to use it and to know where they are, what the situation is in their college.

**NARRATOR**
ICRASAD, one of the consultative group of international agricultural research centres, CIGAR, aims to promote research that'll directly benefit the rural poor. With this test and other research into aflatoxins, they’re helping raise farm productivity while making sure farmers’ products are safer for both animals and humans.

These British woods are host to a valuable commodity, elusive and fleeting. Edible mushrooms can be tracked down by those who know where and when to look.

There’s growing demand for mushrooms valued not just for the food but also as a medicine. Not all mushrooms can be easily cultivated but now a Welsh company has found a way to produce a steady supply of popular varieties.

Although mushrooms can be found in the wild, they’re very sensitive and will only grow under certain conditions. To grow mushrooms commercially, Humungus Fungus have designed a shipping container with all the necessary environmental qualities.

Now they can produce mushrooms all year round anywhere the container is set up. The mushrooms are grown on chipwood from surrounding forests.
Joy Edwards, Humungus Fungus
For any of the mushrooms we start with a culture just from one mushroom. Take a very small sample, grow it onto agar on a plate, mycelium will grow.

When we have enough mycelium, when the plate is covered and you can transfer that onto the next food source - and the next food source in our case it will be grain - once the mycelium has gone all the way through the grain then you use that to inoculate sawdust and so on through the process.

NARRATOR
Some mushrooms grow best on whole logs while others flourish better in a mixture of sawdust and woodchip.

Mark Wassell
These patches indicate that the actual block is full of mycelia getting ready to fruit to create mushrooms, to grow mushrooms.

NARRATOR
Humungus Fungus is able to produce a huge variety of mushrooms. Some are for immediate consumption.

But others are processed further to produce a medicinal extract.

Dr Julian Kenyon, Dove Clinic
I've been involved in the use of extracts from medicinal mushrooms for over 25 years and find them very powerful. They're stimulating cell-mediated immune function and that's fundamentally important in a whole range of diseases.

There are very, very few side effects, none of any significance so they're very, very safe.

NARRATOR
The popularity of edible mushrooms is spreading, thanks to enthusiasts like chef Raymond Blanc.

Raymond Blanc, Le Manoir aux Quatre Saisons
Oh look at that, it’s incredible.

NARRATOR
He asked Humungus Fungus to help set up a mushroom garden for his restaurant.

Raymond Blanc
I started to be a hunter-gatherer from the age of six, five.

I used to follow my, my brothers or father deep in the wood and gather food whether it was wild asparagus, snails, frogs. Of course wild mushrooms were at the very heart of the hunt. Mushrooms are very much a building block of flavours and textures in any cuisine of the world. What we have here is a first wild mushroom garden in Great Britain okay, that ever a hotel or restaurant has ever done.
You would be amazed to taste a shiitake when it’s fresh. All the moisture is inside, the colours are a wonderful beige-y brown okay and nutty, delicately nutty flavour. It makes all the difference I would say.

Bon appetit.

**NARRATOR**
To grow crops you need light, water and soil, right?

Wrong, at least about the soil. You still need water and light but doing away with soil means you can grow crops anywhere. The idea has been around for a long time but the latest technology means hydroponics is easier and more efficient than ever before.

Fertilisers allow farmers to make even the most barren land yield crops but it can be inefficient since nutrients not absorbed by plants are washed away. Hydroponics delivers nutrients directly to plant roots in a closed system.

**Simon Whitehead**
Hydroponics comes from the Greek word hydro which is water and ponics which is works, so basically the water does all the work of growing the plants for us.

Back in the 18th century we actually found out that plants only use soil for ballast to keep the roots in.

**NARRATOR**
In a hydroponics system, soil is replaced with an inert substance that simply supports the plant.

**Simon Whitehead**
Don’t use electricity. It’s all worked off of water pressure through our main tank here. We can join these up and have many, many plants, up to a thousand plants running off of one system.

**NARRATOR**
The controlled environment means the plant receives a constant supply of nutrients.

**Simon Whitehead**
This is our liquid plant feed. It comes with nitrogen, potassium, phosphates and the trace chemicals that a plant needs to grow.

**NARRATOR**
The nutrient stream re-circulates, minimising waste.

**Simon Whitehead**
Re-circulating means water being pumped to a top tank, fed by gravity through the channels past the plant roots and to a bottom collection tank and from there it’s pumped to the top tank again and then re-circulated past the plant’s roots.

This means the plants grow a lot faster, a lot quicker than they would do in a normal soil bed.
NARRATOR
Apart from initial set-up costs, the main disadvantage has traditionally been the large amounts of water and energy used but that's changing.

Simon Whitehead
Now we have systems where we re-circulate the water and we don’t have to use any electricity at all which means the plants are growing as efficiently, cheaply and as environmentally friendly as possible.

NARRATOR
Jinan, the spring city, is the rapidly developing modern capital of Shandong province.

But just beyond the outskirts lies the relatively poor rural countryside. Shandong is China’s biggest agricultural exporting province. Rice is the most important crop but in the dry infertile hills where the poorest communities live, rice won’t grow so these people depend on sweet potato for their livelihood.

Dr Zhong-Xul, Shandong Academy of Agricultural Sciences
Eighty five percent planting area for sweet potato in the world is in China and in Sha province some mountain area poor people get most of their incomes from sweet potatoes.

NARRATOR
The sweet potato is very versatile. It can be eaten fresh or chipped, dried and then fried as a tasty accompaniment to other Chinese delicacies.

It can also be processed to make noodles.

The farmers use cuttings from the previous year’s crop to produce new seedlings for planting. This method is very cheap and easy but leads to spreading of viruses.

Dr Zhong-Xul
The sweet potato uses a tuber to get the new generation so the virus disease is very serious and each year the yield of sweet potatoes lost in China is about nine billion tonnes.

Dr Wang Qimei
Virus spread root by root, year by year so the farmers just use the root not use seed so the virus can accumulate in the roots.

NARRATOR
The Shandong Academy of Agricultural Sciences and the International Potato Centre are working with farmers to improve yields and help alleviate poverty.

The technique allows the sweet potatoes to flower and to go to seed.

Then in a lab tissue cultures are used to produce plantlets. These plantlets are checked with an Elisa Test to make sure they’re virus-free.
Dr Zhong-Xul
We now can make the piece in China and the price of the piece very cheap, for one simple only four to five Chinese yen. If we use piece from overseas, the price for one sample about 25 Chinese yen.

NARRATOR
Once the plantlet has been found to be virus-free, it’s then used as a mother plant for further propagation.

Dr Wang Qimei
You see with a small amount of plant is just like this, this size.

After several months we are copying them and propagated them into many, many mother plants, all of the mother plants are virus-free. After five months then we will harvest as well to get small roots and the next year we will take the small roots to produce cuttings and then we will take the cuttings to the farmer.

Guo Yuanxian
In my right hand the sweet potato has the virus but in my left there is no virus and the yield is better.

With virus free I’m harvesting 3,000 kilograms but with the virus I only get 2,000 kilograms.

Dr Wang Qimei
We have many, many varieties even if it is on the market because some farmers like high starch content variety, some farmers like purple flesh variety. We will sell this kind of variety to the open market.

NARRATOR
Virus free plants increase yields by 30% in the first year though this drops over following years as the virus slowly re-infects the crop, so after every third year the farmers need to replant again with healthy tubers.

Thanks to this technique farmers will harvest enough to make a profit and maybe have time to sit, relax and enjoy some of their own produce.