

# BANANAS

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## Part 1

Well, good morning everyone, as John said I am going to talk to you today about a fascinating crop, it's a crop that has occupied a lot of my working time and my hours throughout my career and it's a crop that I think all of you are very well acquainted with. I am sure it's a crop that is grown in the countries from where many of you come. What I intend to do really is just too - I am actually a biologist or an agriculturalist - so it's my duty to try, to inject a bit of science or tell you a little bit about the biology of certain of the aspects of cultivating bananas. But I will also, sort of dabble a little bit in international politics or international economics concerning bananas, because bananas have been a major, certainly a political issue over the years. Because - the title speaks for itself, bananas are a multi-million pound, or multi-million dollar, sorry both, business. It is one of the, in terms of international trade in fresh fruits, bananas are, if not the biggest, one of the biggest. Perhaps citrus maybe equals it. About 12 million tonnes of bananas are exported on what we call the international banana trade. That is, meaning, that bananas are harvested in their country of origin, put on a ship, almost always on a ship and then exported to the countries of, in the northern hemisphere, to United States, throughout Europe and Japan. The export south is less developed. But it is a big trade and as I say about 12 million tonnes annually are exported.

That's not to neglect another sort of 70 or 80 million tonnes of bananas which are grown in the countries and consumed within those countries or perhaps exported within a region. So the majority of the bananas that are actually grown don't feature on the international trade. But the international trade is big, it's big business, it means big money for many companies. I believe - there is a statistic I gleaned from The Observer food magazine 2 or 3 years ago that Tesco, one of our big supermarkets, makes a million pounds a week purely on its sale of fresh bananas, so it's big money.

There are a number of issues that I would like to explore during this talk concerning the business. I think one of the issues that concerns me the most is that here in front of me I have some bananas - not very good quality ones, but this is a banana that we here in Britain know as a banana. It's a dessert banana, we don't eat it, we buy it fresh, as you know, in the supermarket, and every supermarket has them. Sometimes I do a test going round the supermarkets and do a price test to see how different supermarkets or how bananas are packaged. I do have some statistics which I think I will show you on one of the slides. Just to show you how actually the marketing company then package this fruit to meet different demands. Of course there is a price implication there.

As a biologist, or an agriculturalist the concern to me is that the entire banana, international banana trade, in this fruit, is based only on one variety. So you will

go to Tesco or Asda or Sainsbury's and you will buy bananas and they are all the same, it's a variety called Cavendish. There are a number of differently named clones, but essentially geno-typically, that is to say, the plant that produced it, or the plants that produce it, are almost identical. And that is a serious constraint from a pest and disease point of view, that a whole industry is dependent on just one variety. I'll come back to that point I expect during my talk.

I have quite a lot to get through and we have to be out by five to eleven. So I will get started. Just to put it in context there are a number of major export crops. The traditional ones that again many of you are obviously very familiar with, then we have the ones, the perishable fruits including bananas and citrus and even new crops including flowers and vegetables. More and more the flowers and vegetables are being sold in our markets, and we can more or less have every vegetable available in our supermarkets, every day of the week, every week of the year. It wasn't so 30 or 40 years ago and as you, if you do walk in to any of the supermarkets you will see that there are beans, okras and things that either have been grown in Kenya or India or Guatemala, wherever. So this is a developing trade. But the trade in bananas has been with us for over 100 years. The banana trade started when, with the development of refrigeration and the development of faster shipping, through steam shipping basically. And the banana trade started in about 1880-1890 and has developed since then.

## Part 2

I don't know if I should spend too much time on this. There are a number of features of tropical export crops. We are not talking about production by small peasant farmers here.. more and more throughout my career, my activities have been directed towards what we call the poor farmers resource for the farmers. The people who produce bananas are not the poorest of the poor. They are people who have some economic strength and probably a reasonable amount of education as well. Often these growers will form co-operatives which enables you to take advantage of these various points which I have listed there. But we are dealing - it's a major export crop and the companies that deal in bananas are, expect to produce or expect to buy, and market to us in the shops perfect quality fruit. Fruit such as this which is more or less blemish free - these are also Cavendish bananas but I just bought those half an hour ago on the Wokingham Road and they are beginning to get past their best in most peoples eyes. But generally the quality of the fruit that is on the supermarket shelves, and many of you have probably have noticed this, and my even have remarked to yourselves, that they are in more or less perfect condition. As you would expect in a sophisticated market, the marketing organisations like the supermarkets, quality is so important.

I mentioned that over the years I have been doing a sort of a cost study in one of our supermarkets, in Waitrose, the Waitrose here at Woodley. Just giving you an idea of how prices can vary depending on how the product is presented or maybe how the product has been grown. But perhaps the most important point there is you notice in 3 years from 2003 to 2006 the basic cost of what we call loose bananas, bananas you can just buy loose off the shelves in the shops, hasn't changed. But I can assure you to the grower, the costs have increased substantially. The other point I want to make is that all of those bananas that I

have listed there are the same Cavendish banana that I mentioned. All the same variety, and yet if you grow it organically say, like they do say in the Dominican Republic, the companies will sell them for a £1.70 a kilo, and then if you then just buy them loose, not necessarily organic, that means that they have been grown with a fair amount of pesticide applications during the course of their growth, they are that much cheaper. Quite a big price differential for essentially the same product.

Ok, now I'm going to do, inflict a little bit of botany in general on you. I don't suppose there are many, any of you here are botanist, or agricultural botanists? No. A few scientist, ok, good. Bananas form within the genus *Musa*, and there are several hundred named clones, which some of you who must come from banana producing countries which see on my next slide. You are probably aware of it. We in Britain only actually, as I say, are aware of one variety, one banana, one particular type. As I say, which we know as Cavendish. But there is a huge diversity out there. And one of the points I always make in this lecture is the sadness that the market only accept or only deal with one type, and ignores the enormous diversity of this crop. The majority of consumers never, are completely unaware of.

In the centre of origin of banana, there are two major species, *Musa acuminata* and *Musa bulbisiana*. And it is from these two wild species, as it were, all of the clones, the clones, the varieties that are now being grown, are derived. The clones may be diploid, triploid or tetraploid and those non-scientists, that means that the number of chromosomes that they have. We won't go into the whole question of plant genetics. But the diploid is a normal number of chromosomes so any, most living organisms have. But in the plant world, you can get, increased numbers of chromosomes, including triploids and tetraploids. But we won't labour this point too much.

What I would like here, I would just like to point out to you where bananas originate, and the centre of origin of the crop, as you see is over there, is probably in a region where many of you come from, which is the region from the Western Pacific through to north eastern India. It's in this area that there exist lots of wild species of banana, truly wild plants that grow in the natural forest. Several thousands, several millennia ago, thousands of years, there would have occurred, and we don't know when, there would have occurred a number of natural mutations that is, that is changes that occurred naturally to the plant that led to a number of beneficial characters that we now take advantage of.

### Part 3

One of the first mutations was the development of sterility. A banana doesn't have any seed. Has anyone felt that they, when they have eaten a banana, they've come across the seed? There is no seed in a banana, not in an edible banana. I wonder if any of you have actually seen a banana seed, if not, have a look - would you like to pass those around? You can open them up and have a look at them if you like. Those are true seeds from those wild species that occur in the forest in the south east Asian region. So several, thousands of years ago some natural events occurred, not man made. There wasn't any sort of GM being practiced then. There would have been some natural hybridisations between

some of these different species, and there would have been a number of mutations as well. We don't know when they occurred but the mutations led to sterility and they also led to a condition known as *parthenocarpy*. That means that there was no sexual pollination of the flowers, but still the fruit developed. So that was a chance, and a very fortunate mutation, which presents us here with a fruit, which has all the pulp that we eat but doesn't have any seed in it. Because it doesn't have any seed in it, that plant is not going to reproduce in any other way other than what we call vegetative propagation meaning that you can cut off side shoots from the plant and grow those, but it doesn't produce any seed again.

So from the time these sterile plants first appeared in the forests, this plant have ceased to evolve you might say, there has been no further genetic transfer which is the basis of the success of most living organisms. The ability to exchange genes and adapt to new conditions. The banana actually has reached its end point evolutionarily. Some chance mutations may occur but they are not necessarily going to have a significant effect on them. You can get differences in shape, and perhaps flavour and so forth, minor differences.

So these major events are fortunate for us, perhaps less fortunate arguably, less fortunate for the plant, in which these natural events produced these plants which occurred in the forest and the original inhabitants, thousands of years ago would have found these plants, seen the fruit, or eaten the fruit, realised that it was a potential source of food, and thereafter propagated the plants by cutting away side shoots from them. And that's how bananas have spread, they've spread from whatever points or origin in these countries, in this region.

At some point they crossed the Indian Ocean and we don't actually know when but it's probably in recorded times meaning in 2 or 3 thousand years, probably not long before then. It is believed, not proven, that these fruit - or these plants would have been taken across the Indian Ocean and entered Africa through Madagascar. Thereafter they have spread throughout Africa. So I don't know, those of you from Africa believing that bananas are native to Africa, it's not so. It may seem so, and they have become so much a part of many of the cultures in Africa, they are not, they are still an introduced crop.

And their - the arrival of bananas in South America, the Caribbean and South America coincided with the colonial expansion if you like, of the Europeans into that region in the 15<sup>th</sup> and 16<sup>th</sup> centuries. So bananas didn't reach Latin America until relative, in fact very recent times. But interesting as an export crop, bananas are exploited the most in the countries of the Caribbean and Central and South America. That's where bananas are really being grown most for the international export trade.

These, the notations you see where I have out A's and AB's and so forth refers to those two major wild species, *Musa acuminata* and *Musa balbisiana*, from which most of the varieties that we do eat nowadays are derived. I have talked about the Cavendish type which is a triploid, it doesn't produce any fertile pollen and it cannot be used, it can't be bred. It's reached its evolutionary end point as I said. There are other types, now I wonder if any of you here knows what these are? Bananas, alright in a generic sense you are absolutely right. They are all bananas, but this is a particular type of banana which I know as a plantain. It's a cooking banana, correct, but I like to go a little bit more specific there. It actually is what

is called a plantain. Those of you, anyone from ...Latin Americans here? Colombianos anyone else? No, no. You also see them in Africa as well but this is a ...what we call the plantain. I was very familiar with it in the Caribbean it's a cooking banana, and it is a true cooking banana because you cannot eat it without cooking it. OK. If any of you have gone to the shops and bought these, you may, looking at that - decide it's the last thing you would buy. But I can assure you this plantain is in tip top condition to eat. It's just how it should be. This is still very green and can be left to ripen quite a long time. These are plantains and can only be eaten when cooked. The interest from them is that they actually derive partly from the other species *Musa balbisiana* which has more starchy qualities about it.

To add to the confusion there are lots of varieties which have this bi-specific origin. And many of those are eaten as cooking bananas. If you come from East Africa cooking bananas are a major component of the diet. And there are some of them which actually ripen naturally to this sort of colour and are eaten as a dessert fruit. And there are dozens and dozens of cultivars like that and certainly in India, and Thailand, Vietnam you will find lots and lots of varieties which could be derived purely from *Musa acuminata* which is a Cavendish or could be derived from *Musa acuminata*, *Musa balbisiana* hybrids such as our plantain. But there is only one plantain and that is the one that can only be eaten cooked.

#### Part 4

A bit complicated, sorry about that but just to summarise the different uses that there are of what we call the dessert and cooking types. And you can see the A's and the B's, and the numbers of A's and B's referred to their genomic constituents and you can see that there are quite a huge range and lots of different combinations. And thus we do have literally hundreds of named varieties which, some of you I am sure, in this audience know of, or know of some of them. Those of us probably from Britain only know the one, and that's the dessert AAA type which is called Cavendish.

And just pictorially, I will show you some examples, this is a photograph I took in Cameroon a few years ago, showing, giving you an idea of the huge diversity there is in the different shapes, sizes and even colours of the banana fruit. Here, I don't know - any of you familiar with the red banana fruit? It's got quite a nice deep red skin. We occasionally buy them, some shops will buy them here in the U.K. I have seen them, but they are not commonly seen. These are wild bananas, very small fingers and probably almost certainly full of seed and these, perhaps are the future for us because these wild bananas that are still reproduced with seed, there are still many of those which plant breeders still have, could potentially make use of. But as a commercial fruit, they have no value whatsoever. So, you see some fruits, short fingers quite stocky, some with larger fingers, a bit like plantains. There are some with very very long fingers, which is, this is actually one variety that has been used by plant breeders. To try and genetically improve the banana crop, which is a subject I'd love to talk about but I'm afraid time is not going to allow me.

There, that's just giving you an idea, I mentioned how the wild bananas contain seed, you have seen the seed that's coming around the class. And that just shows you a longitudinal section there, of a banana fruit with seed in it. And you can see

a fruit like that is not going to be selected as a fruit to eat. You can't really eat that fruit.

Just summarising the different types, here again are plantains there, which can't be eaten as a dessert fruit. This is our standard Cavendish, better quality than the ones I've got there on the table. And this is the variety in the Caribbean, they call it the *fig*, I think in India, it's called *silk*. And almost certainly any of you recognise it will have a clone name particular to our own, particular countries. Nice bananas, they don't taste like Cavendish does, slightly perhaps flowery, have different flavours and I think are marvellous. What disturbs, what upsets me is that we the consumers in Northern Europe are never exposed to these bananas. Well, that isn't true. Occasionally some of the supermarkets are beginning to try and introduce them. But on the whole, we do not see them here. And we are being deprived of a huge diversity of flavours that I think that potentially the producing companies could take advantage of. But I'm going to be biased, aren't I, because I have to live up to my reputation as being the banana man.

I wonder if this is of interest to you, those of you involved in finance and international trade. I've tried to summarise there, how banana uses and markets could be expanded in places where probably the market is fully exploited, too much here for you to take in I know. I think the point I'm making there is that dessert, the Cavendish type I showed you, probably the market is fully supplied. If I were a politician say, trying to advise the government as to whether we should go into the dessert bananas, I think I would say no, not in a new country. I wouldn't advise it because the existing market is fully supplied, all those countries that have been producing bananas have been doing so for a long time. And I would say the market opportunities are not good.

But I think the market opportunities for the other varieties are quite good. Even the plantain, which most Britons don't know, but we have a large diaspora of other cultures here in this country, who love plantains. I'm married to a West Indian, and she will be very pleased that I take this home today because plantain is really a good fruit, and I see with all international people moving much more nowadays that I do see a future for some of these other varieties eventually. And that is a challenge of the marketing companies I think, and opportunities for countries, for home countries to begin to produce these. So, I summarise that I'm showing you that I'm saying it's a quite - expansion is possible in the cooking varieties. And I think in the medium long term, over the next 10, 15 years, here in Britain, we will begin to see a wider diversity of bananas on offer.

Just to, those of you who might be interested in growing the crop, I have just given you just a few statistics about it. Obviously it's a tropical crop it will thrive only in warm temperatures or it thrives best in those temperatures, tropical temperature. It needs a reasonable amount of rainfall, it needs flat land, it needs good soil, all these are rather obvious. You plant them at about just under 2000 plants per hectare, that's quite a high density really. I'm looking at the productivity, those of you in the economics business. One banana plant will produce a bunch every 10 to 12 months. And per hectare, if you are a really good banana producer, you've got good conditions, you've got the ideal growing conditions, it's not impossible to produce between 40 to 60 tons per hectare per year. And I've been on plantations in Central American and South America that are producing that sort of yield, of export fruit. So you can see it can be a

profitable business. Unfortunately, the islands of the Eastern Caribbean where I've also worked don't have such good growing conditions and probably their yield are probably only about 10 or 12 tonnes per hectare, significantly less.

## Part 5

And this is giving you, the next few slides give you a pictorial idea about where the bananas are grown. This is the island of St. Lucia in the Caribbean, and the flat valley land there, it's full, it's planted with bananas. And then in a neighbouring island, St. Vincent showing you the rather difficult conditions that some farmers, commercial banana farmers, these are Cavendish bananas being grown for the British market, being grown on those very steep slopes there. That is hard work, that is hard labour to produce good quality fruit in situations such as that. And it is for this reason that the banana producers of the Windward Islands and Jamaica are really suffering in the international banana trade, some might say the international banana wars that have been imposed by the World Trade Agreements and so forth.

Best quality - bananas can be produced most economically - well, choose my words, most productive - banana producing areas, are probably the flat lands in Columbia, Panama, Costa Rica, areas where good climate, plenty of flat land and probably cheap labour, dare I say exploited labour, that can produce fruit at a relatively low price such that they can still sell it at 89p per kilo here, and the price has been stuck for a number of years. The eastern Caribbean producers can't match that and I fear that eastern Caribbean producers are sadly on the way out. But this is partly a political decision because those producers in the eastern Caribbean, were all signatories to the Lomey Agreement and I don't know if any of you are familiar with Lomey, one of the European Union initiatives which was set up many years ago to protect the agricultural exports of countries of the Caribbean Pacific and Africa. The Lomey Agreement, signed I can't remember when. But under the Lomey Agreement bananas were brought into Europe or most of the European markets preferentially to the bananas from Costa Rica and Panama.

Of course the Costa Ricans and Panamanians didn't like that, perhaps understandably. But this protection which was linked historically to colonial associations as well because the French were very big into this also. The Lomey convention did protect many of these smaller producers and the poorer countries in the sale of their principal crop. But unfortunately with the new world trade agreements these preferential tariffs had to be abolished as you understand offended those rules so now it's a level playing field in terms of price. And so some producers are going to lose.

This is a banana plantation in west Africa, in Cameroon and again showing the ideal areas where bananas are grown, and this is - these are bananas being grown in plastic tunnels in the Greek islands. So in Greece bananas, say in Crete, is one example - and I did take this photograph, was taken in Crete. Bananas are grown in large plastic houses like that purely for, in this case, the Greek trade. They would be taken to Athens probably. Not an economic way of producing bananas, but just another example of where the crop is being grown. Greece - you

wouldn't think of Greece or the Canary Islands or some of those northern or Mediterranean areas, not the ideal locations for growing bananas because the winter temperatures drop too much. And bananas therefore cease to grow and if they have a frost of course they will die.

Just as a contrast here are some bananas being grown in western Uganda, but these bananas are being grown purely for cooking, to eat as a cooked banana and in the districts around Lake Victoria in Uganda, Kenya, Rwanda, Tanzania; bananas are a staple crop. The fruit is harvested green, it's steamed, it's mashed, you know what I mean 'mashed', pounded, and eaten as a starch crop really much as many of you would eat rice, or many Britons would eat potatoes. Fundamental to the diet, and to the economy indeed of countries like Uganda, and this is an example of a very well managed banana plantation where the fruit is actually being grown for local consumption.

I think I must really move really quite fast now. This is another example I've been involved in with a fair amount of experimentation with the banana crop and here in Uganda we were testing the benefits of using a mulch, bananas like mulch. Mulch is a word, it's used to describe vegetated materials of any sort which you spread around a plant and it helps - it's a soil conditioner, it keeps the soil stable, it provides - as it rots, provides organic matter which goes into the soil and is good for the soil. Bananas have a very superficial root system, meaning most of the roots are in the top 15 - 20 cm depth, and so this thick protection on top of the soil makes a better environment for root growth and thus you get very healthy, vigorous plants. This was a replicated experiment that we were doing, and my student here had a treatment without mulch, and where he allowed a local grass, a local millet to be grown, and as you can see the banana plants did not like that. They are not thriving at all well.

Again another example of mulching in Uganda, this time using another waste and being quite sensible. This is the waste from coffee; many of these producers in this region would be producing a multitude of different crops and coffee would be one. Then the husks from the coffee berries is a waste product that can be used usefully in a banana plantation.

## Part 6

This is a banana trial, just next slide or two will show you how - give you an idea of the growth of the crop. This was an experiment that I planted many years ago in St. Lucia, using banana suckers, it was a trial, to try and control a particular group of pests, and I planted this at the density that I mentioned about 2000 plants per hectare. And this was, I planted with, what we call suckers, conventional pieces of vegetated material and those - that was probably taken four or five weeks after I planted, so the plants had begun to establish very quickly. During the course of the growth of a crop, this goes for all fruit that has brought to the international market, you have to treat them with pesticides. Bananas suffer from a lot of major pests. The pest that I was studying is a group of pest called nematodes. And these nematodes burrow into the root systems. I'm afraid the only way of combating these pest is to use chemicals. And to this this day, commercial bananas estates around the world, those that are exporting to the major markets, will be using products such as this. It's not really



acceptable, I worked, 20 years ago I was working with those, in the last 10-15 years I haven't been working with these chemicals because - I won't say they have gone out of fashion - but they are still being used by the growers. But from the research sponsors, by the donor's point of view, we are trying to move away from high pesticide inputs for all of our crops. But it isn't always going to work because there is no alternative growers still have to use them.

I'm going to move on quite quickly. That is a fruit, bananas are harvested when they are still green, because they have to be, and somewhat immature because they have to survive 3 or 4 weeks in transit from the point of production, to the point of sale. Also you may be puzzled why is the fruit sitting in this plastic sleeve - that helps to protect from another type, other types of insects. Little microscope insects called thrips, which will cause damage to the fruit peel and cosmetically will make the fruit less attractive. So, all farmers, producing for the export trade, have to go through this laborious process when the plant flowers, of putting these plastic sleeves on them. OK I'm going to move quite quickly.

I talked about these nematodes which damage the root system, this was my first job overseas in Jamaica, way back in 1970, and my job was to look for resistance to this group of pests in some different banana varieties. Those are the symptoms of damage - the plant falls over. Clearly growers don't want their plants falling over and they need remedies to prevent that. These parasitic nematodes burrow into the roots of a banana and you can see the lesions there, they are caused by the damage. This perhaps shows it rather better, you can see these lesions, these are the worms that I work with. I am a specialist - by training, I am a plant nematologist. These are nematodes they are microscopic animals less than a millimetre long, plant parasites, living in the soil and then invading plants and causing damage to the roots. And in the case of the banana a severely damaged plant falls over.

And these are examples of the damage. This nematode, this pest, actually originates in the same place that the bananas originate, south-east Asia and southern India. And there is no doubt that the pest was carried around the world many years ago on planting material. This is the planting material we call them suckers, water suckers, in Spanish *ehos* and that is the conventional planting material. Bits of material like this would have been taken across the Indian Ocean or taken across the Atlantic Ocean and were used to start new plantations.

Yes, I think I must move because I am conscious we only have 7 or 8 minutes left. Recently I have done quite a bit of work with new varieties of banana. These bananas as I say that go on the market cannot be produced without a high input of synthetic pesticides. Now, more and more we consumers, we the general public, don't like this. And the search is on for ways to combat that. There is one issue of developing new varieties. It is hard to breed bananas - and I can talk for an hour about that and send you all to sleep - but breeding bananas is possible and it has been done. A variety here called *Fia 25*. *Fia* was produced by a research organisation in Honduras - any Hondureenas here? No. Honduras in Central America There is a well known institute there that breeds bananas. Just the point I want to make from this is that I was interested in resistance to nematodes and there are a number of new varieties that have been bred which are not necessarily resistant to nematodes but they are tolerant to nematodes because they produce much more vigorous root systems. Here is *Fia 25* a banana which has

a much more vigorous growth habit than do the other varieties. And *Williams* here, another variety of the same Cavendish. It's a variety that was first discovered in Australia and is still widely grown. But you can see there plants of the same age, there is quite a significant difference in root mass.

## Part 7

I think I have to move quite quickly just to make one or two more points. This point I want to make is that in the last 25 years, new technology has arrived in banana cultivation. And this new technology is called tissue culture or micro-propagation. That's the system where the meristematic cells of plants can be put onto a defined medium with growth hormones and nutrients, and you can get these cells to proliferate and produce lots and lots of new plants. It's a brilliant new technique, as I say, it was discovered sort of in the 1960s, 1970s, and banana is one crop subject that is really very well adapted to this technique of mass-production. And there you can see some plants had been started off in sterile conditions in jars in a laboratory and can end up ready for planting out in the field. And the advantages of these are that they are disease-free. They've been produced from a few cells, no pests or pathogens with them and you can produce a large number of plants, very uniform in size, relatively quickly. I won't say inexpensively, but laboratories are now developing to mass-produce these plants. And as I say it's a new technology, which is being adopted in many countries. There are 2 or 3 laboratories producing bananas like this in Uganda, for instance.. I put there as, shall we say, one of the triumphs of science, if you like, so one of the new adaptations of new scientific methods.

I am going to move on here because we are really running out of .... Whoops *what have I done*. I talked about the reason why we put sleeves, plastic sleeves around the bunches, and I mentioned these microscopic insects called thrips. I don't know if any of you are familiar with that, but this brown staining on the ripened tissue is caused by thrips. You and I, probably most of us here think that it really has no effect and you are probably not interested. But in terms of quality the big companies and then the supermarkets don't want to be dealing in blemished fruit like this. And so fruit that has this amount of staining on it normally would not go on to the market. Nothing wrong with it taste-wise but cosmetically it does not look good. So the producers have to find some way of combating that and the way they do that is to put these sleeves on the banana flower as it emerges.

I am going to move, those of you from south east Asia, this is a similar sort of pest, a moth, a scab moth and the larval stages of that cause this sort of scarring on the fruits. I suspect some of you may have seen that. Again it has no effect of the quality, on the taste of the fruit whatsoever,. You may agree that cosmetically, visually, it doesn't look - it looks perhaps less attractive.

I shouldn't finish the lecture really without just mentioning a disease called the Black Sigatoka a fungus disease which is devastating banana production throughout the world. It is a disease which has spread from south-east Asia and is now causing a lot of trouble everywhere. And it can only be controlled with fungicides and chemicals and we don't really like that. OK - I'm afraid I really, probably should come to an end about that as we are short of time. This gives you an example the fruit after it has been harvested goes into a ship and then has

to survive in a green state at 13 degrees centigrade in a ship for 2 to 3 weeks until it gets to its point of sale. Such as say, a market here in Bonn in Germany. Those are top quality fruit, do you see. Here a market in Faisalabad in Pakistan, less attention to quality there. I did take this slide several years ago - but relatively less sophisticated markets if you see what I mean. And there's fruit in Egypt.

My final two slides - in Africa in Uganda they go, they don't necessarily eat the fruit although there is a cooked vegetable but they can actually make a drink from it. They make two or three drinks. But the final, the more potent drink is a spirit and this was on-farm distillation system on a farm, this was in a farmer's backyard. He was cooking ripened banana which had been fermenting, cooking it up, distilling it, condensing it in his condenser here, and pure spirit was being dropped there to what looks suspiciously like a pesticide bottle, or a herbicide bottle. That was called *mwenge* and they call in banana gin. OK and I think probably its five to and we have to be out at 11. I'm sorry I have had to rush it.