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Factsheet

GUIDE TO MAINTAINING A GOOD QUALITY YAM CROP

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A healthy field of virus tested yams.

GUIDE TO MAINTAINING A GOOD QUALITY YAM CROP

The production of high yielding and good quality yam in the Caribbean region is often hindered by the presence of several diseases caused by *viruses*, *fungi*, *bacteria* and *nematodes*.

Growers can maximize yields from their yam crops *only* if they practise sound agronomic techniques and maintain the crop in a healthy state. Insect pests which are a common problem in most crops do not usually seriously affect yams except perhaps during storage. Fungal, nematode and bacterial pathogens can generally be controlled satisfactorily by the use of chemicals. However, a different approach is necessary to combat virus diseases since chemical methods are not effective.

This factsheet describes the main diseases affecting yam production in the region and suggests methods of controlling these diseases and maintaining the crop in good condition. A number of scientific facts have been excluded since the intention is not to burden the extension officer and farmer with excess information, but to make them aware of the disease problems and to assist them in recognising the symptoms.

VIRUS DISEASES

Over the past 10 years field surveys and laboratory research carried out by CARDI have shown that the important species of yam cultivated in the region *D. alata* (e.g. White Lisbon, Coconut Lisbon and Oriental in Barbados and Trinidad), *D. rotundata* (e.g. Negro yam in Jamaica), *D. trifida* (e.g. Cush Cush in Guyana), *D. esculenta* (e.g. Chinese yam in the Windward Islands), and *D. cayenensis* (e.g. Yellow yam in Jamaica) are commonly affected by one or more virus diseases. These viruses do not kill the crop but can reduce vigour, yield, and, in the case of *D. alata*, tuber quality as well. Virus symptoms are widespread throughout the region, but the level of infection varies from country to country and with species and variety.

WHERE TO LOOK FOR VIRUS SYMPTOMS

With all the species of yams grown in the Caribbean, the virus symptoms appear on the foliage of the plant. Several types of symptoms have been recorded on yam leaves during surveys. The series of photographs shown below will assist in the identification of these leaf symptoms in the field.

There is an additional virus symptom known as vein clearing in which the veins are yellow and the interveinal areas are green. This is however much less common than the other symptoms.



Vein banding



Leaf distortion



Mottling of foliage



Severe Mosaic symptoms

If curling of foliage is observed, undersides of leaves should be examined for insect damage which is sometimes confused with virus symptoms.

WHEN TO LOOK FOR VIRUS SYMPTOMS ON FOLIAGE

The ideal time to identify leaf symptoms caused by viruses is at the peak of vegetative growth which can be 3 to 4 months after germination, depending on climatic conditions. Identification should be done when virus affected plants are easily separated from healthy ones i.e. before plants have twined into each other. Of course in unstaked yam fields this separation can present more of a problem than in staked fields.

Another problem with late inspection for virus is the fact that senescence of vines may have started, and the translocation of nutrients from the older to the younger leaves can produce virus-like symptoms in the old leaves, making identification difficult.

Drought conditions can also bring about symptoms which can easily be confused with those caused by viruses. However, drought induced symptoms would tend to be more generalised in the field or would exhibit a gradient from low moisture to high moisture conditions. Low fertility would also bring about similar generalised symptoms.

HOW VIRUSES SPREAD IN THE CROP

Viruses are normally transmitted in crops either by insect vectors or via planting material. It has been shown that the major method of transmission in the case of yam in the region is through infected planting material. It is clear then, that to prevent the carry-over of virus from one season to another and a consequent buildup of the disease over the years it is important to plant only clean material.

VIRUS CONTROL METHODS

"Rogueing" or removing from the field all plants showing severe virus symptoms is the first step towards maintaining a clean crop. It is not a "once for all" cure and should be practised regularly over the years. To begin with, the burden of loss and the labour required may be heavy; but this will decrease with time, and the quality and yield of the crop will improve.

If the number of affected plants in the field is large, the grower can allow them to remain in the field, but it is important that they should be tagged so that they are not retained as planting material, but instead are sold for consumption.

OTHER FOLIAGE DISEASES AND THEIR CONTROL

The other major foliage problems on yams, apart from those caused by viruses are *Leafspot* and *Anthracnose* both brought about by fungal spores borne in the air. In those islands which have a tradition of staking, it is a good idea to pursue this practice since it should help in the control of these fungal diseases.

The *Leafspot* (usually *Cercospora* sp.) often appears late in the season when it may not be commercially feasible to control it by spray applications since yield is not usually seriously affected. However, if the disease, which appears as purplish black spots with grey mycelial fluff on their undersides, occurs early, fields may be sprayed with fungicides like the coppers (e.g. Cuprosan, Kocide, Tri-miltox Forte), benomyl, (Benlate), captan (Captan) or mancozeb (e.g. Manzate 200, Dithane M45) at manufacturers' recommended rates.



Cercospora leafspot

Anthracnose caused by the fungus *Colletotichum gloeosporoides* can seriously affect the yield of a yam crop, particularly in areas where the very susceptible 'White Lisbon' variety is being grown. The 'Oriental' variety is not normally affected significantly although recent resistance tests in Trinidad have indicated that it is moderately susceptible.

The disease first appears as small, brown, slightly elongated spots on the young leaf blades and often the main veins of the leaf. The spots enlarge rapidly and often come together, and eventually turn darker brown to black. In this way, large portions of the leaves become necrotic. Elongated, necrotic spots also appear on the veins which usually die back. When the disease occurs early in the life of the crop, the growth of the plants is severely retarded and tuber production may be reduced or may not occur at all.

There are some varieties of *D. alata* which are reportedly tolerant to *Anthracnose* e.g. Belep and Plimbite from INRA in Guadeloupe and Binugas and Kinampay from the University of Puerto Rico.

In addition, the practice of staking yam vines which is common in the Caribbean should assist to some extent in the control of *Anthracnose*, particularly under wet conditions.

Chemical control of the disease consists of:

- A pre-plant dip
- An in field spray programme
- A post-harvest dip

Good quality material from disease free fields should be selected for planting, and vines from affected fields should be deep ploughed or burned. Planting a yam crop in a field where yams were grown in the previous season should be avoided.

Pre-plant treatment

- Use clean knives dipped in benomyl (Benlate) fungicide to cut seed pieces.
- Dip the seed pieces in benomyl (Benlate) at the rate of 2 tsp/4L (2 tsp/gal) for at least 10 seconds. Diazinon (Diazinon 60E, Basudin) at 1 ml/L (1 1/2 fl oz/gal) may be added if scale insects are likely to be a problem.

During the growing season, it is important to inspect the crop on a regular basis, and to carry out a rigorous spray programme. The method of application of chemicals is important. The use of tractor-mounted boom sprayers or mist blowers, rather than knapsack sprayers is recommended since thorough coverage of the dense foliage is necessary.

In field spray programme

An in field spray programme will assist in controlling nematodes in the yam crop. Where nematode populations are known to be high spraying should be done at least once per month after germination but fields should be monitored closely for early evidence of *Anthraco*se to determine whether frequency of spraying should be increased. This should be done at 2 week intervals in dry conditions and 1 week intervals in wet conditions, since the spores of *Anthraco*se fungus, unlike those of *Cercospora* sp. are spread by rainsplash.



Early symptoms of *Anthraco*se.

Use maneb + benomyl (Peltar) at 2.8kg /ha (2.5 - 3lbs /acre) alternated with 0.5kg /ha (12ozs /acre) benomyl (Benlate) combined with chlorothalonil (Bravo) at 2.9 - 3.5L /ha (2.5 - 3 pts /acre).

Post-harvest treatment

Careful harvesting, and dipping before storage in a solution of benomyl (Benlate) or thiophanate methyl (Mildothane) at 2tsp/4L (2tsp/gal) or maneb and benomyl (Peltar) at 4tsp/4L (4tsp/gal) together with a wetter/spreader for 10 minutes is recommended. The solution should be changed after treatment of 204kg (450lbs) of material.

Tubers should be dry when they are stored and storage sheds should be cleaned with Clorox or Physan solution before storing tubers.

TUBER DISEASES AND THEIR CONTROL

Damage to tubers caused by disease usually appears as brown spots or black streaks in the otherwise creamy white flesh. The black streaks are known as Black Rot caused by the fungus *Rosellinia* sp. a disease which is usually observed at high elevations in poorly drained soils. Rotation with non-root crops, improved drainage and clean planting material will assist in controlling this disease. The other spots observed in tubers are usually brown but must be carefully examined to determine whether they are caused by fungi, bacteria or viruses.

Fungal and Bacterial Rots

Damage to tubers caused by nematodes particularly *Scutellonema bradys* makes tubers more susceptible to secondary fungal and bacterial attacks.

A number of post-harvest rots may follow nematode damage during growth or mechanical damage during harvest. Damage from nematodes and subsequent invasion by *Fusarium* spp. fungi usually results in "dry rot" while bacterial attack results in "wet rot". With "dry rot" small yellowish areas are observed in the flesh of the stored tuber. These become larger and darker with time and eventually appear as dry, dead tissue. The use of a nematicide e.g. carbofuran (Furadan) or ethoprop (Mocap) at planting will assist in controlling nematodes in the yam crop. When nematode populations are known to be high, it is wise to fallow the field for several months or to rotate with crops like legumes, sweet potatoes and many of the vegetables.

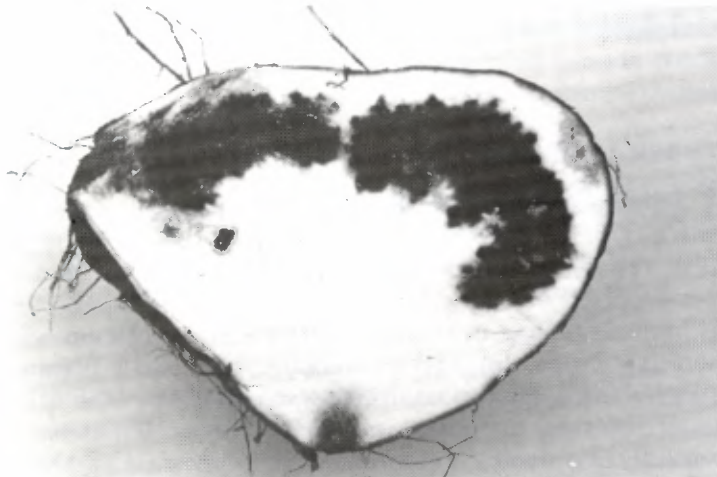
The post harvest dip used in the control of *Anthraco*se should help to reduce storage rots. In addition, cut surfaces of tubers should be treated with white lime before storage.

It is important to note that brown spots in tubers caused by nematode damage, fungal and bacterial rots can always be traced to the outer surface of the tuber. When a brown spot is found in a cut tuber, both sections of the tuber should be examined to determine whether the spot is completely surrounded by healthy flesh or whether it has a connection to the outer surface. This is done by taking a number of thin slices of the tuber. If the spot is hard, disappears after a few slices, and has no apparent connection with the outside, then it is caused not by bacteria or fungi but by a virus. The condition is known as Internal Brown Spotting (IBS) and affects *D. alata* yam.

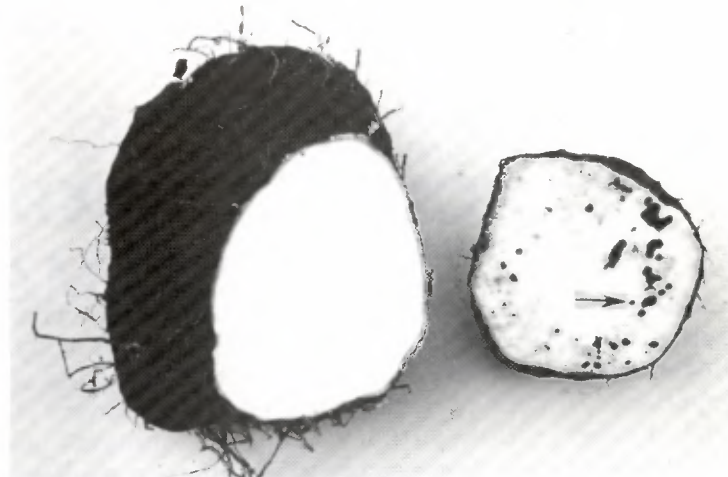
IBS Disease

This disease can have serious effects on a yam industry, particularly on the export trade, since the symptoms cannot be detected on the surface of the tuber and spotted tubers are therefore indistinguishable from spot free ones unless they are cut and examined. In the 1960's losses reached as high as 50% in exports from Barbados to the UK.

As far as control of this disease is concerned care must be taken when preparing planting material, to discard and destroy all tubers with spots. As an additional precaution against possible transmission of virus from tuber to tuber (although no evidence of this type of transmission has been found), cutting knives should be dipped at intervals in a strong solution of bleach during the tuber cutting operation.



Tuber affected by fungal and bacterial rots.



Creamy white flesh of healthy tuber (left) tuber affected by IBS disease. (right)

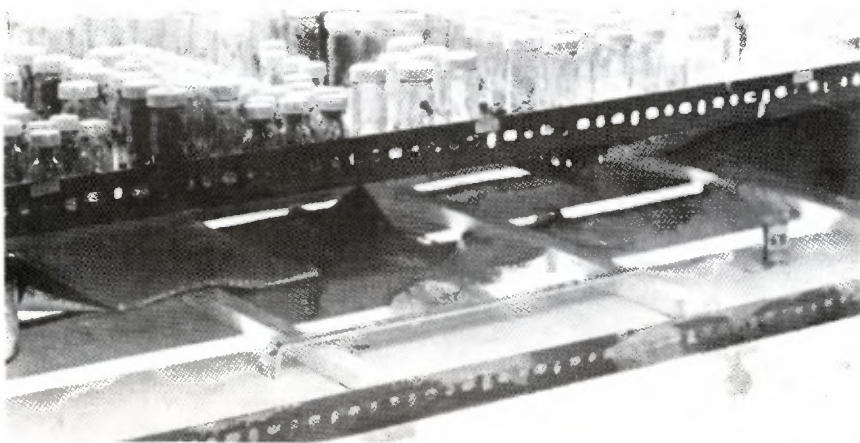
The use of Virus Tested Planting Material

In the case of *D. alata* yams, CARDI has developed techniques to eradicate the viruses mentioned, and clean "virus tested" planting material of the varieties White Libson, and Oriental is available. Ideally, in virus affected fields, planting material should be replaced with virus tested stock, but even where virus tested material is not used, the grower can upgrade the performance of his crop by recognising the virus symptoms, and selecting planting material only from those plants which show no severe symptoms. It is important to note that the use of virus tested planting material has no effect on the incidence of *Anthracnose*, other *Leafspots* and nematode diseases. Control procedures therefore, have to be instituted separately from those carried out to control the virus complex.

For more information on the use of virus tested planting material and *Anthracnose* tolerant varieties, contact CARDI.



Staked yams in St. Vincent



Virus tested yam plantlets growing under controlled laboratory conditions.



Yams grown on ridges in Barbados

SUMMARY OF CONTROL MEASURES FOR VARIOUS YAM DISEASES

VIRUSES

- (i) Use virus-tested material and select only clean IBS free tubers for planting.
- (ii) Rogue fields to remove plants showing virus symptoms on foliage.
- (iii) Dip cutting knives in bleach as a precautionary measure.
- (v) Dip seed pieces before planting.
- (vi) Apply fungicides for control of *Anthracnose* and *Cercospora leafspots*.
- (vii) Avoid mechanical damage to tubers during harvest.
- (ix) Clean storage sheds before storing tubers.
- (x) Treat cut surfaces with white lime before storage.

FUNGI & BACTERIA

- (i) Deep plough or burn crop refuse from diseased fields.
- (ii) Practise crop rotation.
- (iii) Select good quality planting material from disease free fields.
- (iv) Dip planting material before storage.

NEMATODES

- (i) Apply a nematicide (e.g. carbofuran or ethoprop) to fields at planting.
- (ii) Fallow fields where nematode populations are high.
- (iii) Practise crop rotation.



Field evaluation of virus tested material

Acknowledgements

This Factsheet is based on the Nov, 1985 PP F.3-85 Factsheet entitled "Guide to Maintenance of a Good Quality Yam Crop" by S. Q. Haque, Frances L. Chandler, R. H. Phelps and N. D. Singh. It has been revised and expanded to include recommendations based on more recent research carried out on Anthracnose disease by Ministry of Agriculture, Barbados.

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