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## FIELD TRIALS ABOUT YAM ANTHRACNOSIS

by

J. Fournet, L. Degras, R. Arnolin and G. Jacques.

CRAAG-Petit Bourg Guadeloupe

### INTRODUCTION

In the West Indies, on Dioscorea alata, several leaf spots may be observed, caused by various fungi, the most frequent of which are:

- Helicoctonia solani, a soil fungus which causes during wet periods or in damp conditions severe leaf die-off. On the rapidly enlarging lesions two sorts of sclerotia may be found. microsclerotia spread by splashing, and macrosclerotia, probably the conservation stage of the fungus.

- Sclerotium rolfsii a soil fungus too, causing large lesions covered by a white, radiating mycelium (rhizomorphs), which often give rise to radish seed-like sclerotia.

- Cercospora carbonacea, the attacks of which are characterized by black, rectangular-shaped spots limited by the veins covered beneath with a thin velvety, grayish layer of sporangioophores and spores.

- Collectotrichum gloeosporioides (probably the f. sp. alatae) causing irregular-shaped spots, very often initiating on veins, and leading to leaf die-off.

On some clones of the "Pacala" type a very severe stem blackening and die-off is often observed, which has long been somewhat puzzling. Very simple trials carried out about two years ago have shown that this symptom is also caused by Collectotrichum gloeosporioides. On the susceptible clones, the symptom occurs about 3 to 4 months before harvest.

In order to determine the importance of losses caused by anthracnosis (which should be done in our opinion, in every case before studying any disease), and to find out efficient field treatments, two trials were simultaneously carried out:

- (1) A fungicide trial
- (2) A variety trial, in which 16 different clones were compared.

As Bénomyl revealed itself to be the most efficient of the fungicides tested, it was feared that it might be stored in the tubers, and so the Bénomyl content of tubers was analysed.

### METHODS

#### (1) Fungicide trial

Propineb and Mancozeb were combined in a factorial pattern with Bénomyl, in three blocks. Each block contained the following treatments: Control, propineb, Mancozeb, Bénomyl, Bénomyl + Propineb, Bénomyl + Mancozeb. Each plot was split into two clones (plants/clones):

- Sainte-Catherine, a "leaf-spot" clone
- Pacala Dominique INRA, a "leaf-spot and stem die-off" clone.

The trial was set up on April 10, 1973.

The inoculation (June 18 and September 10) occurred by hanging short *Solanum torvum* stem segments on which the parasite had been grown *in vitro* (our usual inoculation technique).

Treatments:

Every fortnight from July 23 to December 24 (one treatment omitted on September 3 because of the threat of a hurricane).

Doses : about 750 cm<sup>3</sup>/plant of the following suspensions:

Propineb	210g/hl (active material)
Mancozeb	150g/hl ( " " )
BénoxyI	50g/hl ( " " )
Propineb 210 g/hl + BénoxyI	50g/hl
Mancozeb 150g/hl + BénoxyI	50g/hl

Disease ratings:

Two ratings of stems and leaves symptoms were carried out on October and November 20, according to the following scales:

<u>Stems:</u> (2 ratings/plot)	0 = healthy stem
	1 = some small spots
	2 = some large spots
	3 = blackening of some stems
	4 = general blackening of the stems.

<u>Leaves:</u> (10 ratings/plot)	0 = healthy leaf
	1 = some small spots
	2 = many small spots or 1-3 large spots
	3 = 4 and more large spots
	4 = leaf almost completely necrosed.

Harvest January 16 and February 2 (1974).

(2) Variety trial

Sixteen clones from the Plant Breeding Station collection were compared in a split plot 3 blocks design : Panéji hds, Barbados, Pacala Dame-Jeanne, V<sub>7</sub> B/2, Oriental, Lupias, Gordito, Pacala commune, Mété-Bété, Bélep, Nélemaque, Saint-Vincent Sainte Rose, Goana, Florida, Pacala -station, Pacala 72. Each plot was split into a treated and an untreated part (Propineb 210g/hl weekly, plus BénoxyI 50g/hl every fortnight from July to December 3). Uniform inoculation occurred monthly using the technique described above. Two similar notations were carried out. Harvest occurred on January 21 (1974).

Statistics:

Harvest (in kg) was analysed directly ; but the variance of symptom notes was dependent upon mean value. Therefore the mathematical transformation.

$Y = \log (x + 1)$  was used, where x is the note.

Bénomyl residues in the tubers was investigated only on some Sainte-Catherine tubers from the fungicide trial, using the technique described by NESTER, TOURNE & CAMPO (1971) : Optical density of the purified ethylacetate extract at 282 nm. measured by an U.V. spectrophotometer.

## RESULTS

### Fungicide trials:

The results are summarized in Table 1.

Leaf spots: analysis of variance shows that Bénomyl, alone or mixed with Propineb or Mancozeb provides a highly significant control of leaf spots in both varieties. The effects of Propineb and Mancozeb are not significant. No interaction may be pointed out.

Stem symptoms: same conclusions, but a highly significant interaction Bénomyl x Variety shows that Bénomyl was more efficient on Sainte-Catherine.

Yields: the results are not quite satisfactory, probably due to the small size of plots (high co-efficient of variation). Nevertheless the effect of Bénomyl on yields, by reducing anthracnosis, is highly significant; yields are increased respectively by 72% and 88% in Sainte-Catherine and Pacala. Figures 1 and 2 show the regression of yields in both varieties, respectively, upon leaf and stem notes. The high values of r (correlation co-efficient between yields and stem notes) show that stem lesions are probably more damaging to yield than leaf lesions, particularly in the case of Pacala, a clone of the "stem-blackening" type.

### Variety trial:

Results are given in Table 2 where the varieties are listed according to decreasing leaf susceptibility; it should be noticed that there is an obvious correlation between leaf and stem susceptibility ( $r = 0.94$ ) which can be assumed not to be due to the method of notation. On the contrary, no correlation may be pointed out between potential yields and leaf or stem susceptibility, which means that high yielders may be susceptible (for example Goana or Punéji his) or resistant (Gordito, Bélep, Pacala-station).

It should be noticed that yields are increased by the treatments mostly in varieties of the "stem-blackening" type or at least in varieties, the stem and leaf notes of which are superior to 2 without treatment.

In susceptible varieties, the mean yield is increased by about 100% by the treatment.

Nevertheless, the rather low accuracy of the trial raises apparent discrepancies: in some varieties (for example Barbados) the yields are significantly increased by the treatment, although there is no significant action upon leaf and stem symptoms. The reverse is true in some slightly susceptible varieties (Florida, Gordito); the latter effect may be to some extent explained by late attacks.

The "Pacala" group shows a very high heterogeneity as to the susceptibility to anthracnosis.

In some clones (Bété-Bété, Pacala commune, Oriental), Bénomyl seems to have a somewhat phytotoxic effect; this point requires further investigation if necessary.

#### Bénomyl residues:

An analysis carried out on some Sainte-Catherine tubers from the fungicide trial has shown that the B M C residues were quite negligible (0.03 mg/kg tuber, corresponding to 0.045 mg/kg, expressed in Bénomyl), and probably did not even reach the threshold of sensitiveness of the method used. This result agrees with our knowledge of Bénomyl transportation in plants.

#### DISCUSSION

Yam anthracnosis may be considered a disease to be feared only on certain varieties, i.e. mostly on those which show the "stem blackening" symptom, and those with a very high leaf-susceptibility. In the case of cultivation of such varieties (which should not be recommended, except in certain instances, as stated below), Bénomyl can provide a good control of the disease, even at a fortnightly treatment rate; yields may be then raised by over 70% (up to 100%). In moderately susceptible varieties, i.e. in varieties which never show more than a few large, or many small leaf-spots, and some stem-spots, the disease can be assumed not to be worth any treatment.

At any rate, the possibility of treatments against Yam anthracnosis presents some significance in certain instances:

- Some of the clones studied in the Caribbean for mechanised cultivation because of a favourable tuber shape may be very susceptible to this disease, and may present stem-blackening; it would be difficult to grow them on a large extent, the more so as hybridization and therefore combination of characters is still almost impossible in Dioscorea alata.

- Some clones found in collections, which may be interesting to practical or theoretical research purposes may be highly susceptible to anthracnosis, and therefore difficult to keep in good condition.

#### REFERENCES

MESTRES, R., TOURTE, J. & CAMPO, M. (1971). Dosage des résidus de Bénomyl dans les fruits et les légumes. Trav. Soc. Pharm. Montpellier, 21, 49-56.

TABLE 1. Summarized results of the fungicide trial.

Treatments Disease ratings		No Benomyl			Benomyl			Co-efficient of variation
		Control	Propineb	Mancozeb	Benomyl alone	+ Propineb	+ Mancozeb	
Mean rating of a leaf (0-4)	S.C.	2.62 fg	1.98 cdef	1.82 bcdef	.68 a	.92 a	1.02 ab	11.3%
	Pac.	4.00 g	2.57 efg	2.30 defg	1.33 abcd	1.27 abcd	1.02 ab	
Mean rating of a stem (0-4)	S.C.	2.42 bcd	1.83 b	2.17 bc	.50 a	.92 a	.67 a	12.2%
	Pac.	3.83 e	3.67 de	3.00 cde	2.42 bcd	2.33 bc	2.42 bcd	
Mean yield per plot (kg)	S.C.	9.20 b	11.50 b	9.73 b	15.00 a	15.80 a	21.67 a	40.3%
	Pac.	3.47 c	7.75 bc	3.87 c	4.10 bc	7.57 bc	7.03 bc	

(Variance analysis followed by Duncan multiple range test, P = 0,05)

S.C. = Sainte-Catherine - Pac. = Pacala-Dominique INRA

TABLE 2. Summarized results of the variety trial - Varieties listed according to decreasing leaf susceptibility.

Variety	Origin	Tuber shape	Cooking qualities	Mean note of a leaf (0-4)		Mean note of a stem (0-4)		Mean yield per plot (kg)	
				NT	T	NT	T	NT	T
Sainte-Vincent Sainte-Rose	Guadeloupe	short flattened wide	Good	4.00 ≠ 1.28	*	4.00 ≠ 1.58	6.00 ≠	15.90	
Pacala- Dame-jeanne	Guadeloupe	rather short flattened	Good	3.83 ≠ 1.36	*	4.0 = 2.08	1.49 ≠	10.17	
V <sub>7</sub> B/2	IRAT collection	short cylindrical	Good	3.78 ≠ .78	*	3.83 = 2.00	3.36 =	6.33	
Barbados	Trinidad	short cylindrical	Good	2.40 = 1.23	*	3.41 = 1.83	7.43 ≠	13.87	
Punóji bis	Oceania	long conical	Rather good	2.00 ≠ .00	*	3.00 ≠ 1.00	9.59 ≠	17.23	
Florida	Puerto-Rico	short cylindrical	Very good	1.85 ≠ .45	*	3.16 ≠ .58	9.00 ≠	13.23	
Goana	Oceania	long cylindrical	Good	1.71 = .88	*	3.00 ≠ 1.16	13.30 ≠	22.00	
Gordito	Puerto-Rico	long irregular	Rather good	1.16 ≠ .00	*	1.58 ≠ .33	23.10 =	23.63	
Bélep	Oceania	rather short conical	Very good	.68 ≠ .25	*	1.33 = .75	19.30 =	20.27	
Oriental	Trinidad	short cylindrical	Rather good	.45 = .21	*	1.50 ≠ .50	19.33 =	15.23	
Bété-Bété	Ivory Coast	rather short flattened wide	Good	.40 = .16	*	1.33 = .91	15.63 =	11.63	
Lupas	Oceania	short cylindrical	Good	.38 = .18	*	2.16 = 1.00	10.93 =	12.33	
Pacala 72	IRAT collection	long cylindrical	Very good	.25 = .10	*	1.41 = 1.16	13.20 =	13.86	
Télémaque	Martinique	long irregular cylindrical	Very good	.25 = .08	*	1.50 ≠ .33	7.82 =	7.77	
Pacala commune	Guadeloupe	long irregular cylindrical	Good	.13 = .05	*	1.50 = .58	13.73 =	12.50	
Pacala station	Guadeloupe	long irregular cylindrical	Very good	.13 = .03	*	.75 = .58	15.77 =	18.93	

NT = untreated. T = treated. The symbols ≠ and = are used to indicate respectively significant and non-significant benefit obtained from the treatment. \* Stem-blackening and die-off.