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Agriculture Intensive dans les Iles de la Caraïbe : enjeux, contraintes et perspectives
Intensive Agriculture in the Caribbean Islands : stakes, constraints and prospects
Agricultura Intensiva en la Islas del Caribe : posturas, coacciones y perspectivas

INVESTIGATIONS INTO FUSARIUM WILT (*Fusarium solani* (Martius) Sacc.) OF WHITE POTATO IN ST. KITTS.

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ABSTRACT

The White Potato development programme in St. Kitts has progressed at an exceptionally rapid rate, with the annual production increasing 16 fold over six years. The yields too have increased significantly, and new disease problems have also surfaced. Fusarium Wilt (*Fusarium solani* (Martius) Sacc.) was observed island-wide in february 1992 with a 14% incidence in surveyed fields. Details of the survey and laboratory findings, along with a managment strategy for Fusarium diseases are discussed.

KEY WORDS: White Potato: *Fusarium solani*

INTRODUCTION

The estimated annual demand for White Potato in the Federation of St. Kitts and Nevis is 578,000kg (THOMAS 1992). As a source of carbohydrates for human consumption White Potato is a major import of 334,000kg into the island in 1991. The recent diversification programme of the St. Kitts and Nevis government identified White Potato as a crop to be developed with the objective of satisfying 50% of the domestic requirement by 1990.

Large scale White Potato production started in St. Kitts in the early 1970's and declined in 1976/71, the last year of large scale production. The crop was reintroduced in 1985 on a large scale and a 20 fold increase in production was obtained between 1986 and 1990 with slight reductions experienced in 1991 and 1992. The acreage cultivated

also increased from six acres in 1986 to 55 acres in 1992.

Yields of White Potatoes in the tropics are much less than yields in the temperate climates. Ten tons per hectare is an estimate of tropical yields (HOOKER 1990). In St. Kitts, yields have fluctuated somewhat but generally there have been very significant yield increases and the current yields in St. Kitts which exceed 5,100kg per hectare (THOMAS 1992) are considered high for the Region.

With the reintroduction of White Potato in 1984/85 problems of disease were observed as production expanded. In the Nevis trials Lowery (1985) made mention of extensive "browning up" of leaves with consequent yield reduction. The surveys of TORIBIO in 1986 and BALDWIN in 1981 gave an indication of the potential problems to be encountered in the White Potato expansion programme.

FLETCHET (1987) mentioned his concern over the consistent predominance of soil borne wilt organisms in the potato cultivation of St. Kitts, Nevis and Montserrat from 1983 to 1987. Such pathogens as Erwinia sp., Fusarium oxysporum, Rhizoctonia solani and Scierotium rolfsii were apparently very prevalent. It is also of great significance to note that the variety Desiree was stated as showing greater tolerance to the wilt diseases.

The Present Disease Problem:

In february 1992 an unidentified disease was reported to be occurring in the Potato cultivation islandwide. A survey was mounted by CARDI to :

- a) determine the level of infection
- b) identify the causative agent of the disease and to determine the stages of plant susceptibility, and....
- c) make recommendations for the control of the disease.

Description of the Disease Symptoms on variety Desiree

Plants appeared wilted but retained the green colour. External symptoms were co-identical with Bacterial Wilt - the extremity was wilted and tended to flag.

The stem Was soft when squeezed, and hollow when cut open.

The cavity extended up the entire stem and might terminate abruptly at the meristem region. The tissue around the cavity was necrotic with a grayish brown colour.

In some instances the cavity extended into leaf petioles which branch from the main stem. What appeared like exit holes were sometimes seen at leaf abscission points.

On removal of the epidermis of the stem typical *Fusarium oxysporum* symptoms were observed. Vascular bundles were discoloured as dark brown streaks extended up the stem into the branches and into the growing point. There was, however, the minimum of chlorosis even after the base was extensively rotted.

The area with the most advanced tissue degradation and discolouration was the base of the plant at the attachment of the stem to the seed potato.

MATERIALS AND METHODES

Survey of Potato Farms In St Kitts

Potato farmers in the island were grouped according to the size of their cultivation into four categories (Table 1). A total of 37 farmers from St Kitts was selected as a sample to determine the prevalence of the disease. Personnel from the Extension Division Department of Agriculture, St. Kitts were trained in data collection and with assistance from the Quarantine Unit and the St. Kitts Sugar Manufacturing Corporation (SSMC-Integrated Pest Control Unit) the survey was initiated island-wide on Thursday February 20, 1992.

Vertical and horizontal transects were made in each field. Transects were spaced approximately 10 metres apart, and sampling commenced along each transect from a random spot 0-10 metres from the border and extended for 10 metres. Twenty plants within every 10 metre swat were assessed for the disease and the number of diseased plants in each sampled swat was recorded.

Identification of the Disease

Specimens of diseased plants were collected from farms across the island. Diseased plants from Nevis and Montserrat were also made

available. Isolation was done from Desiree variety grown in St. Kitts, Nevis and Montserrat and from variety Bartina in St. Kitts and variety Baley from Nevis.

Longitudinal sections, cross sections and excised vascular bundles from stems, along with sections from tubers, were plated on Potato Dextrose Agar and Water Agar. Pure cultures of the most consistently occurring organisms were prepared and submitted to the International Mycological Institute for confirmation of identification.

RESULTS AND DISCUSSIONS

Disease Survey

Information was only obtained from 19 of the 37 farms that were surveyed. In the majority of cases where no information was gathered the fields were either harvested or were in such advanced stages of maturity that accurate diagnosis of disease could not be done.

There was no significant difference ($P=0.05$) in infestation levels among fields grown with Desiree, Bartina or Mixed varieties (Desiree and Bartina). However, in fields where Desiree was the sole variety grown, the level of infection was higher than in fields of Bartina or in Mixed fields (Table 2).

The size of the farm and the time of planting did not prove to be significant in influencing the level of infestation. However, infestation at the medium elevation (500ft-999ft) was significantly higher ($P.05$) than at the low or high elevation (table 3).

In these analyses, the number of observations in each category was few. No firm conclusions can now therefore be drawn as regards the effect of Variety, Farm size and Altitude on the incidence of the disease. It was however firmly established that 14% of the White Potato plants that were sampled in 1992 were infected with a common disease .

IDENTIFICATION OF THE DISEASE

From the laboratory cultures of diseased tissue (stem and tuber) Fungal and Bacterial growths were both prevalent (Table 4).

There was no consistency in the morphology of the bacterial colonies. *Fusarium* spp. were isolated from all of the varieties examined. The *Fusarium* conidia were also morphologically different. Four isolates were distinguished by the morphology of the conidia.

Isolate 1 from variety Bartina, was mostly single-celled with the occasional multi-celled conidia and few chlamydospores.

Isolate 2 from excised vascular bundles of variety. Desiree, produced conidia that were mostly 4-celled with the occasional 6-celled type. Conidia were of the characteristic canoe shape with somewhat blunted ends. The cell contents were very granular.

Isolate 3 from the meristematic region of variety Desiree produced 1 to 4-celled conidia with few chlamydospores. Conidia were canoe shaped and hyaline.

Isolate 4 from variety Desiree grown in Riley, Montserrat was similar to Isolate 2 in size and shape. The conidia were however, more pointed at the ends.

Isolate 1 was confirmed by the International Mycological Institute (IMI) to be *Fusarium moniliforme* Sheldon var. *intermedium* Neish & Leggett.

Isolates 2 and 4 were confirmed as *Fusarium solani* (Martius) Sacc.).

Isolate 3, a *Fusarium* sp. could not be identified specifically to species. There was some degeneration in the morphology through storage.

CONCLUSION AND RECOMMENDATION

The presence of *Fusarium moniliforme* (Isolate 1) in the culture cannot not be properly accounted for. This pathogen is normally a pathogen of grains and not likely to be the organism that caused the disease that was commonly observed in the Potato crop of 1992 in St. Kitts.

The most consistently isolated organism was *Fusarium solani* which causes a wilt disease with symptoms somewhat similar to those described before.

Fusarium wilt caused by *Fusarium solani* (Martius) Sacc. is

therefore concluded to be the disease that infected 14% of the plants that were examined from the St. Kitts White Potato Crop of 1992.

Fusarium is a very persistent fungus in soils hence until varieties are prescribed that are tolerant to the identified species it is recommended that White Potato not be grown for a period of at least two years in fields that were infected with the disease.

Care should be exercised to ensure that soil from infected fields is not transferred to uninfected fields during land preparation.

The pathogen is seed borne. All seed material entering the country should be adequately sampled and examined to determine the level of occurrence of pathogens.

No chemical is recommended for use on the crop for control of this *Fusarium* wilt disease. The effect of chemicals, would be minimal and uneconomical.

Crop rotation is one strategy that is most likely to be effective. Cabbage, Carrot, and Cucurbits could be grown without being infected.

Priority should be placed on the assessment of varieties for tolerance to *Fusarium solani*.

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Table 1 : groupings of white potato farmers according to size of cultivation, 1992

Category	size of cultivation	number of farmers	
	(hectares)	total	sampled
X - large	> 0.8	8	8
Large	> 0.4 < 0.8	6	4
Medium	> 0.2 < 0.4	9	5
Small	< 0.2	78	20

Table 2 : incidence of fusarium wilt in three potato varieties grown in St. Kitts

Variety	no. of farms	No of plants	no. of plants	%
		sampled	infected	infected
Desiree	2	260	150	57.7
Bartina	4	680	51	7.5
Mixed	10	5,480	491	8.9

Table 3 : the incidence of fusarium wilt at three elevations in St. Kitts

	low	medium	high
	elevation	elevation	elevation
Total plants sampled	320	660	4,600
Total plants infected	7	348	435
Percentage infected	2.29	52.7	9.5
S.E. (0.38)			

Table 4 : summary of isolations from white potato

Total Number of Bacterial Colonies	100
Total Number of Fungal Colonies	79
Total Number of Fusarium Colonies	67