

PN-AAV-190 4560

0015
reports

CROP PROTECTION PROBLEMS IN CAPSICUM
PEPPERS IN MONTSERRAT

Based on a survey of existing cultivations

July 1980



CARIBBEAN AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE

CARDI is a regional organization serving twelve Member States of the Caribbean Community. It provides for the research and development needs of the agricultural sector in the region as identified in national plans and policies.

This is an output of the CARDI/USAID Project 538-0015

CROP PROTECTION PROBLEMS IN CAPSICUM PEPPERS
IN MONTSERRAT

Based on a Survey of Existing Cultivations

July 1980.

PREFACE

The CARDI Small Farm Multiple Cropping Systems Research Project (538-0015) has as its objectives (a) the understanding of the small farmers systems in the Eastern Caribbean and (b) improvement of these systems through adaptive on farm testing of proven technologies.

As part of this effort, some of CARDI specialists looked at the cultivation of hot peppers in Montserrat. Montserrat is one of the territories in which the project is based and hot pepper is a very important cash crop to the small farmer.

The information will be of use to all persons working with the Small Farmers and seeking to improve their lot, and also to other Research and Development Institutions/Organisations.

A special note has been included on Southern blight (Sclerotium rolfsii) because of its potential as a serious pathogen on a wide range of crops.

This work was funded from the CARDI/USAID Project 538-0015.

S. PARASRAM,
Coordinator CARDI/USAID
Small Farm Multiple Cropping
Systems Research Project.

INTRODUCTION

Hot peppers (Capsicum annuum var.) is an important crop of the small farmers in Montserrat. There are approximately 60 acres (24.3 ha) under this crop and the projection is to increase the area under this crop to 100 acres (40.8 ha). The crop has a ready market in Trinidad and Barbados and also some neighbouring islands. There is some preference by buyers for colour and size but these vary from time to time.

The hot pepper plant is known to be affected by disease pathogens and pests and the department of Agriculture had concerns on the possible effects of increased area and production of this crop vis-a-vis the pest/disease situation.

It was found that there was only one major insect pest species and insects were parasitised to different levels. Several pathogens were noted. Sclerotium rolfsii were present and considered to be potentially serious. There was some Rhizoctonia solani. Anthracose was present but there were no signs of Phytophthora blight. Virus incidence was low. Nematodes are known to be of varying degrees of importance.

Several other agronomic practises were also examined. The report focuses on the major crop protection problems as seen by several specialists and also gives recommendations on improved management of the crop.

The following persons contributed directly to this study:-

Dr. S. Parasram	- Entomologist
Mr. M. Alam	- "
Dr. R. Phelps	- Plant Pathology
Dr. S. Q. Haque	- Virologist
Dr. J. Hammerton	- Weed and Agronomy

Relevant information on nematodes has been extracted from the study done by Dr. C.W.D. Brathwaite (1973).

Other relevant reports were also consulted.

CROP PROTECTION PROBLEMS IN CAPSICUM PEPPERS IN MONTSERRAT

The most widely grown is the 'hot' pepper Capsicum annum though some 'sweet' pepper (C. grossum) cultivations are also to be found. A few plants of 'bird pepper' (C. minimum) are grown around the home. The preferred 'hot' pepper varieties for export are the 'Dutch Cap' and the 'Peggy mouth'.

Land preparation is generally done by tractors provided by the department for which the farmer pays. Standard spacing is 75cm between rows and 45cm in rows. Small amounts of nitrogen fertilizer is applied and no pesticides are applied. Generally weed control in the plots was good but most of the weeding was done by hoe.

The farmer generally selects seeds from his standing crop for establishing his next crop. Many farmers, however, purchase seedlings from the Government nursery. While hot peppers can ratoon, because of the dry season, farmers replant each year at the beginning of the rains. There is no irrigation, so that the cultivation is under rainfed conditions.

A wide range of weed species were identified in the fields and the list of scientific names is given in Appendix I.

Diseases:

(a) Fungal and Bacterial

Based on examination of several plots of young plants at Bethel, Upper Lee's, Tuitt's and Bramble, some not yet in flower, the presence of the following diseases were revealed:-

- (1) Southern blight (Sclerotium rolfsii) - at an average level of 8%. This was considered to be potentially serious as the disease could be expected to spread especially over the remaining months of the rainy season.
- (2) Pepper mosaic virus - at low incidence (see viruses).
- (3) Soil rot (Rhizoctonia solani) - at a level of 1-2%. Examination of unused plants in nursery beds indicated that this disease was moved from nursery to field plots during transplanting. Mild symptoms can go unnoticed when plants are being moved in numbers and the disease continues developing in the field.
- (4) Anthracnose - this disease was present at moderately high levels in maturing plots at Upper Lee's and Bramble (Table 1), a situation that called for early application of fungicidal sprays. Less mature plots at Bethel and Tuitt's were free of the disease.
- (5) Root knot nematode - levels of infestation were no more than 5% and individual root systems were not severely **knotted**. Even in older plants at Upper Lee's and Bramble there was no root distortion or decay (see nematodes).

Details of the diseases mentioned are given area-wise in Table 1.

TABLE 1 Diseases observed in hot pepper plantings in various locations in Montserrat

Locality	Disease	%Infection	% Dead Plants
Bethel (1)	^a Wind defoliation		20-25
	Anthracnose	40	
	Mosaic	1	
	Root knot	3	
Bethel (2)	Mosaic	2	
	Southern blight		8
	Soil rot		2
	Root knot	4	
Upper Lee's	Anthracnose	10	
	Mosaic	3	
	Southern blight		6
	Soil rot		2
	Root knot	3	
Tuitt's	Mosaic	4	
	Southern blight		10
	Soil rot		1
	Root knot	3	
Bramble	Anthracnose	15	
	Mosaic	4	
	Southern blight		8
	Root knot	5	

^a Due to Hurricane Frederick

Several plots of mature plants at Bethel which had already produced (apparently) substantial quantities of fruit had been defoliated by hurricane Frederick and were in the process of some recovery. In most plots plant death considered to be directly attributable to shock from defoliation was estimated at 20-25% (Table 1). Anthracnose infection in surviving plants was moderately severe, in that 40% showed die-back on at least one-third of existing branches and many small fruit were showing typical spotting. At the time of examination new foliage was appearing, but it was not possible to predict the degree to which the plants would actually recover.

There was no evidence of pepper mosaic virus and only low infestation by root knot nematode. No symptoms suggestive of Phytophthora blight were observed in these or other plots.

(b) Viruses

Of the many hot pepper fields visited in Montserrat discernible virus symptoms were observed only in plots in the Corkhill area.

The crop was in the flowering stage and the incidence of severe symptoms was 5% and that of mild symptoms 7%.

Based on earlier studies conducted in St. Augustine the symptoms observed seemed to be similar to those caused by PVY viruses which are known to be transmitted by various species of aphids in the field.

Low level of field infection indicates that vector aphids are not very active.

Experiments in Trinidad have shown that mild strain of PVY virus on hot pepper does not cause cognizable loss in yield. The incidence of the severe strain, however, causes stunting of the plant and almost total loss of yield.

It is recommended that provision be made for extra seedlings at the time of transplanting. The plants showing virus symptoms during the first two-weeks after transplanting should be rogued out and replaced by virus-free seedlings.

PVY viruses are known to be seed-borne in some cases depending on the crop and variety. The seed-borne nature in this case was not ascertainable during the field visit.

(c) Nematodes

Examinations were made at Upper Lee's and Bramble. In 1973 a comprehensive survey was done by Dr. C.W.D. Brathwaite on nematodes. The relevant information on 'Pepper' given in Table 2 is taken from Table 2 also of that report.

Table 2 Population density of plant parasitic nematode genera associated with pepper in Montserrat

District	Estate	Soil Texture	No. Nematode /100c.c. of soil	Ap	He	Me	Rot.	Ty.
North	St. John	Clay Loam	610	-	3	2	3	2
Central	Groves	Sandy Loam	50	-	-	2	-	-
"	Lees	Sandy Loam	380	-	-	3	2	2
Eastern	Farrells	Clay Loam	110	-	-	2	1	-
"	Trants	Loam Sand	480	1	1	3	3	-

1 = 1-10 nematodes/100 c.c. of soil Ap- Aphelenchus
 2 = 10-100 " / " He- Helicotylenchus
 3 = 100-1000 " / " Me- Meloidogyne
 - = NIL Rot- Rotylenchulus
 Ty- Tylenchus

Insect Pests

The most important insect pest of this crop is the pepper flower bud moth - Symmetrischema capsica previously grouped under the genus Gnorimoschema. The pest is widespread in the Caribbean. Parasram (1973) presented a survey of the pest in the Caribbean. The relevant portion is given in Table 3.

Table 3 % Infestation of pepper buds by S. capsicum in Montserrat (1973)

<u>Area</u>	<u>% Infestation</u>	<u>Type of 'pepper'</u>
Cavallah Hill	79.5 %	'Hot' pepper
Rileys	0.0 %	" "
Paradise	84.0 %	Sweet pepper

The life history of this insect has been studied in great detail by W.G. de. Vignes (1979). The eggs are deposited on the youngest shoots near flower buds. The incubation period is generally 4.49 days. Within 2 days, the larva enters the bud. The larval stages are completed in 8-13 days and the insect pupates in the ground or debris but outside the flower bud. A single female lays an average of 62 eggs in her lifetime.

The larva is highly susceptible between hatching and entry into the bud. It is exposed to the elements as well as parasites.

The feeding of the larva in the bud causes it to fall off. Parasram (1973) reported 100% infestation of flower buds in Questelles, St. Vincent (approx. 0.25 acre) with total loss of yields.

Table 4 gives a summary of the infestation in different localities in 1979.

Table 4 Infestation levels of pepper flower-bud moth in Montserrat

Locality	No. flower-buds examined	No flower-buds infested	% Infestation	No. Larvae + pupae collected	No. Parasite cocoons collected	% Parasitism
Richmond District	840	122	14.5	3+14(=17)	4	19%
Upper Lees	606	22	3.6	-	-	-
Bethel	303	33	10.0	0+9(=9)	-	0.0%
St. Patrick (near Radio Antilles)	215	95	44.2	3+0(=3)	11	78.6%
Cork Hill	168	116	69.0	12+5(=17)	1	5.6
Davy Hill	60	40	66.6	1+8(=9)	-	0.0%

Parasites have been recorded from this pest. Table 4 gives the % of parasitism in 1979 in the areas mentioned. The two species recorded in 1979 were Copidosoma and Gudmanella. These species have also been recorded elsewhere in the Caribbean and previously in Montserrat (Dr. F. Bennett (1973) Pers. Comm.)

Recommendations

- (i) PVY viruses are known to be seed borne in some cases, depending on the crop and variety. As a precaution, seeds from virus affected plants should not be used for planting the next crop.

In the meantime, seeds from virus-infested plants must be examined to see if they carry infection.

- (ii) Southern blight (Sclerotium rolfsii) can be expected to spread. It also has a very wide host range. It is advisable to rogue out diseased plants.

- (iii) There is inadvertent transfer of Rhizoctonia solani from nursery to field where it can build up and cause severe 'soil rot'. Seeds beds may have to be fumigated to prevent this spread. Rouging in the field will also help.

- (iv) A small % of pepper flower buds fall off normally even without insect damage. However, heavy infestation must be controlled. A high percentage parasitism has been recorded in some areas. It is advisable prior to use of any of the several effective insecticides to do an infestation count.

- (v) There are several species of weeds which must be controlled and yet is costly in terms of labour and or chemical. It is recommended that intercrop be used to reduce the weed problem.

- (vi) Mulching is recommended and will not only lead to better weed control but retain moisture for longer periods as well as keeping the soil 'cool' and adding nutrients.

- (vii) Fertilizer spacings experiments must be conducted as there are indications that this would increase the production.

CARDI has already began testing several intercrops with 'hot' peppers and these results should be available soon. Much of the testing is being done on the farmers fields.

REFERENCES

- Brathwaite, C.W.D. (1973). A Survey of Plant Parasitic nematode Associated with some economic crops in Montserrat and preliminary recommendations for their control. University of the West Indies, Department of Crop Science. Departmental paper No. 8.
- de Vignes, W.G. (1979). Biology and description of Stages of Symmetrischema capsica (Bradley & Povolny). Jour. of Agric. Soc. of T & T. Vol. LXXIX No. 2 pp 116-126.
- Parasram, S. (1971). Annual Report. Faculty of Agriculture 1971-72, UWI, St. Augustine, Trinidad.
- Parasram, S. (1973). The pepper flower bud moth in the Caribbean. Proc. Carib. Food Crops Soc. Vol. XI pp 466-470.

Appendix I

List of Weed Species found in "Pepper fields

<u>*Achyranthes indica</u>	Devil's house whip
<u>*Amaranthus</u> spp.	Callalõon spinach
<u>Andropogon bicornis</u>	Foxtail grass
<u>Axonopus compressus</u>	Savannah grass
<u>Boerhavia</u> spp.	Hog weed, sow meat
<u>Borreira</u> spp.	White broom, button weed, iron grass
<u>Cassia</u> spp.	
<u>*Cenchrus echinatus</u>	Bur grass
<u>*Chloris barbata</u>	Purple top
<u>*Cleome viscosa</u>	Samob or caia
<u>*Commelina elegans</u>	Water grass
<u>Crotalaria</u> spp.	Rattle weed or bush
<u>Cyperus brevifolius</u>	
<u>Cyperus rotundus</u>	Nutgrass
<u>Dactyloctenium aegyptium</u>	
<u>*Desmodium canum</u>	Sweet heart
<u>Diandrochloa glomerata</u>	
<u>Digitaria</u> spp.	Crab grass, finger grass
<u>Digitaria ascendens</u>	Crab grass
<u>Drymaria cordata</u>	West Indian chichweed
<u>Echinochloa colonum</u>	Jungle rice
<u>*Eleusine indica</u>	Fowl foot or yard
<u>Emilia sonchifolia</u>	Consumption weed
<u>Eryngium foeticlum</u>	
<u>Euphorbia heterophylla</u>	Milk weed
<u>Euphorbia hirta</u>	Milk weed
<u>Euphorbia hypericifolia</u>	
<u>Hyptis</u> spp.	Bachelor's buttons
<u>Heliotropium indicum</u>	Scorpion
<u>Ipomoea</u> spp	Wild slip
<u>Lagascea mollis</u>	Velvet bush

<u>Leonotis nepetifolia</u>	Lion's tail
<u>Mimosa pudica</u>	
<u>Mormodica charantia</u>	Cerasse or serasse
<u>Parthenium hysterophorus</u>	Whitehead or White top
<u>Paspalum fimbriatum</u>	
<u>Phyllanthus amarus</u>	Seed under leaf
* <u>Portulaca oleracea</u>	Purslane or pursley
<u>Priva lappulacea</u>	Clammy bur Fasten-por-Coat, velvet bur
<u>Psidium guajava</u>	Guava
<u>Richardia scabra</u>	
<u>Rottboelia exaltata</u>	Corn grass, itch grass
<u>Setaria poiretiana</u>	Gamalot
<u>Sida acuta</u>	Ballier savanne
<u>Sida spinosa</u>	
<u>Solanum spp</u>	Susumber gully bean, turkey berry
<u>Sporobolus indicus</u>	Wire grass of hay
<u>Vernonia cinerea</u>	iron weed
<u>Wedelia parviceps</u>	

* These species have been identified as being the most important.

Varietal Selection and Maintenance of Seed Stocks

Large fleshy red peppers are apparently preferred by the buyers. Selection of fruit from desirable plants should be made and seed-nurseries established.

Selection should be based on (a) fruit type, (b) plant vigour and yielding capacity. All this will require experience and the selection should be made when plants are 6 months or more old so that vigour and yield can be reliably assessed. Do not select fruit from plants showing virus symptoms.

Mature fruits should be collected from selected plants, ensuring a base of at least 25 plants. It would be desirable to select more than one 'variety' based on fruit shape.

Seed extraction can be most easily done by putting roughly chopped peppers into a liquidiser with an excess of water and running it at a fast setting until most of the fleshy parts are broken down. Sieving, decanting, washing should remove most of the flesh, leaving clean seed. This should be dried on paper towelling in a warm, shady place. Treat seed with a seed protectant fungicide e.g. Thiram.

Peppers show about 16% cross pollination. It would therefore be desirable to grow the 'varieties' in small relatively isolated plots to reduce crossing from extraneous crops. Rouging of off-types should be done in these seed plots. Seed can be supplied to growers as now - in fruit - but it would be desirable to extract seed and maintain stocks. Seeds can be kept for several years in a refrigerator. The 'varieties' will need to be maintained by regular selection. It might be desirable to have the 'varieties' tested for capsaicin periodically to ensure maintenance of pungency.

SPECIAL NOTES

This note is added because of the potential of Southern blight (Sclerotium rolfsii) as a serious pathogen not only of peppers but of a wide range of vegetables. On previous visits to Montserrat our Crop Protection personnel have recorded this pathogen from carrot (Amersham), tomato (Lees) and from pigeon pea (Lees).

In many locations the disease was found in complex with root knot nematode, another important pathogen of vegetable crops in Montserrat.

Southern blight is potentially a very serious disease because of the wide host range of the pathogen and its ability to survive adverse conditions. The fungus can be found in undecayed organic matter even from plants which it does not parasitize. The disease is most severe when the residue from a previous crop is not properly rotted. The fungus is able to spread from plant to plant more easily if weeds are left to rot in the row after hoeing.

The following procedures are recommended for the control of Southern blight:

- (a) Turn under crop residues to a depth of at least 22.5cm and top dress with a high nitrogen fertilizer.
- (b) Avoid leaving weed residues in the row.
- (c) Remove diseased plants from the field and destroy them.
- (d) Rotate susceptible crops with more resistant species, e.g. corn, sorghum.
- (e) With high value annual crops, apply PCNB (Terraclor, Brassical) in the row at the rate of 15-18 lb of 75% WP per acre.