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# PRODUCTION OF WEST INDIAN HOT PEPPER SEED

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## Abstract

The paper describes efforts in Antigua during the last four years to produce good quality seed of West Indies type hot peppers with both red and yellow fruit suitable for export to Europe and North America. Activities have included characterization of Scotch Bonnet and lantern type peppers, selection for suitable fruit shape, sampling and analysis of plant tissues for virus infection and development of methods for seed extraction. Good yield of high quality seed, treated for TMV type viruses have been produced and made available throughout the O.E.C.S. countries.

## INTRODUCTION

Hot peppers have been grown in the West Indies since pre-Columbian times and were probably brought to this region from the main centres of diversity in Peru and Mexico by the Amerindian peoples as they populated the region (Purseglove 1968). They are an important part of West Indian cuisine and are used either as an ingredient during cooking or processed as pepper sauce. Flavour and pungency are the most important characteristics that determine household acceptance.

Demand for hot pepper within the region can be easily met from local production. In Antigua, 1-2 ha is adequate to supply the requirements of 60,000 people for fresh peppers sauce. Local markets can therefore become quickly saturated.

However, the migration of Caribbean people to the metropolitan countries in North America and Europe in the last few decades has created a significant demand for hot peppers in these temperate countries. This has been further stimulated by the more recent "crossing over" of ethnic foods into the mainstream population with a particular emphasis on spicy foods.

With growing efforts being made to diversify their agriculture, the Organization of East Caribbean States (OECS) countries have been looking for additional crops that have export potential. Hot pepper appears to be one such crop and several countries within the Caribbean have been stepping up production of hot pepper, for export to Europe and North America.

A number of problems were experienced in expanding pepper production in the OECS that appeared to be related to poor seed quality. CARDI was asked to assist in producing good quality seed for the OECS countries and since 1989 has been producing hot pepper for seed extraction. The following report identifies some of the problems encountered and the successes achieved.

#### **Traditional Sources of Seed.**

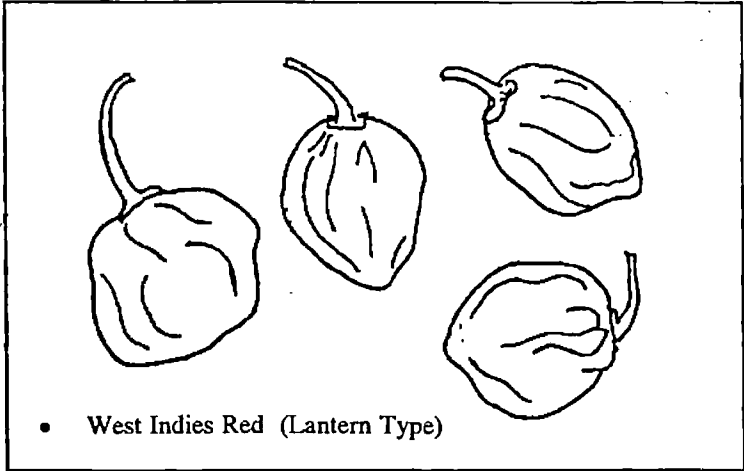
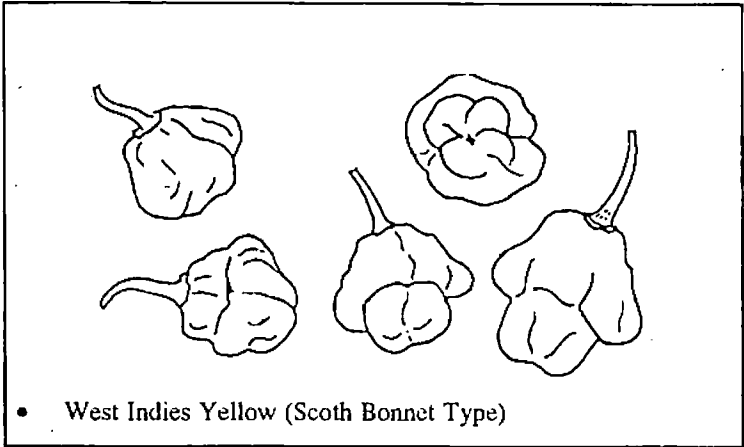
Hot peppers are grown on a small scale by many Caribbean Farmers for local consumption. In addition, Jamaica has a history of pepper production for export. Barbados, Trinidad, Grenada and St. Lucia also have significant exports. However, in all these countries there has been no commercial or organized production of seed. All seed has been farmer produced often with little regard for plant selection or disease and other factors. In some cases, exporting agencies have made seed available to farmers by extracting it from fruit arriving at collection centres or packing stations, where any reference to the mother plants is impossible.

For this reason quality of seed has been very variable in several respects- genetic content, seed health and viability. These aspects will be dealt with in more detail later. In addition, supply has also been very limited and has acted as a constraint to increased production.

#### **Varietal Identification and Selection**

The botanical nomenclature surrounding *Capsicum peppers* is very confusing and there has been considerable disagreement over segregation of species. Some authorities have preferred to group all *Capsicums* into just two species, *C. annuum* and *C. frutescens* (Purseglove 1968), while other authorities have identified several

Figure 1. west Indian hot Pepper types produced in Antigua seed production programme



(Heiser & Smith 1953). The IBPGR has recently accepted five *Capsicum* species (ie. *C. annum*, *C. baccatum*, *C. chinense*, *C. frutescens*, and *C. pubescens* (IBPGR, 1983). Hot peppers are found in at least four of these species. Previously most hot peppers were assigned to *C. frutescens* and this is the name commonly used in the literature. West Indies hot peppers are classified as *Capsicum chinense* (Jean Andrews, personal communication; Pickersgill, 1989).

In the food trade, hot pepper is considered as spice and is generally referred to as chilli pepper. There are many different types of chillies and Jalapeno, Anasheim and Tabasco are examples of well known commercial varieties. West Indian chillies are less common and somewhat atypical, having lantern or bonnet shaped fruit (Figure 1) with strong flavours and aroma as well as a high level of pungency, consequently they occupy a special position in the chilli market. Scotch Bonnet is the only named West Indian pepper in the trade. The commercial pepper variety Habanero is also a *C. chinense* and is frequently linked to Scotch Bonnet pepper. However, the Habanero fruit is not bonnet shaped and although very pungent, does not have the characteristic Scotch Bonnet Flavour.

The authors have been unable to find any descriptions in the literature for any of the West Indies hot peppers and no named varieties are commercially produced. The Scotch Bonnet pepper is perhaps the best known and has been reported in Jamaica since at least the late 18th century, (Miller, 1768). It is also well known throughout the West Indies and in the chilli trade. The name, however, has been used for a wide variety of West Indian pepper types with both bonnet and lantern shaped fruit. In order to avoid confusion, it would be better if the name Scotch Bonnet is used only for the yellow, truly bonnet-shaped peppers with distinctive pungency and aroma.

### Seed Production Activities.

In the absence of any kind of pure lines, red pepper seed production was started in 1989 from a sample of seed obtained from an export agency. Yellow pepper seed (Scotch Bonnet Type) was obtained from Jamaica. Red and yellow populations were grown in isolation. Selections were made from plants with the characteristic of fruit shape, colour, flavour and pungency that we required. Off types were rogued

out and discarded. This process has now been repeated through 4 generations, and we have obtained relatively homogeneous populations of a red lantern-shaped pepper and yellow, bonnet-shaped pepper, which we are calling West Indies Red and West Indies Yellow respectively.

Production of West Indies hot peppers is similar to that of other chillies, but there are some important differences which seem to be related to specific features of *C. chinense*.

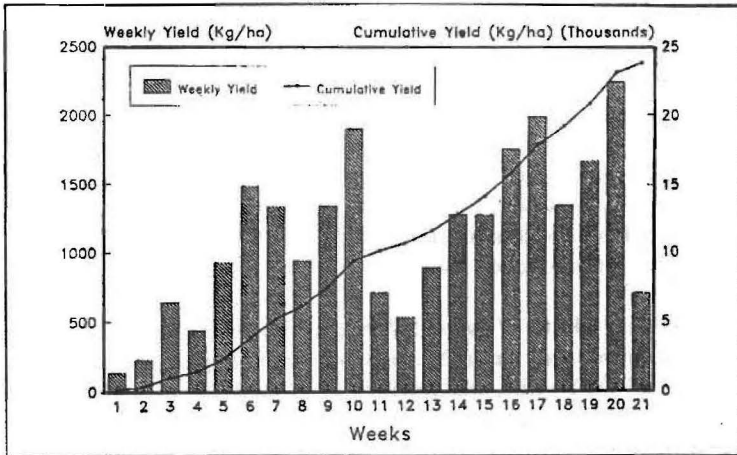
Germination of seeds is slow and complete germination requires more than 14 days. This has been observed in both germination tests and in seedling production with seed of good vigour. Initial growth of seedlings also tends to be slow, especially with Scotch Bonnet and seedlings have regularly taken more than eight weeks to be ready for transplanting.

Harvesting can begin 12 to 14 weeks after transplanting and has continued for at least five months and may last longer, depending on the build up virus infection. Seed production plots have produced the equivalent of 20,000 kg fresh fruit/ha after five months of harvest, of which 30-50% was suitable for seed extraction. Selected fruit yielded about 2% of fresh weight as dry seed. Table 1 shows details of production plots.

Fruit production is not uniform, but fluctuates under rainfed conditions in Antigua with a 3-5 week cycle (Figure 2). Other conditions may produce different behaviour.

**Table 1. Production of fresh fruit from West Indies Red Seed production Plots.**

Crop Number	1	2	3	4
Area (ha)	0.04	0.09	0.09	0.09
Date Planted	January 1989	December 1989	April 1991	October 1991
Harvest Period Commenced	April, 1989	March, 1990	July, 1991	January, 1992
Duration (weeks)	27	26	21	25
Fruit Yield (Kg/ha)	13,300	21,827	23,750	23,325



**Figure 2. Weekly and cumulative yields of whole West Indies Red pepper fruits.**

Since the beginning of the programme, CARDI has produced 50 kg of pepper seed, mostly West Indies Red, which has been sold to several OECS countries, primarily Grenada and St. Lucia.

### **Disease Management/Seed Health**

One of the major concerns at the beginning of this project was the management of pepper virus diseases. Virus diseases in both sweet and hot peppers are common throughout the region (Charles 1976) and both TMV and PVY viruses have been reported on peppers (Phelps and Haque, 1973; Lloyd-Tomas, 1982). When infections build up to serious levels, severe losses can result. Reports indicated that in several instances there were significant levels of virus infection in seedlings produced from farmer saved seed.

For this reason, particular care was taken to monitor the disease situation in the seed production plots. Plants showing signs of leaf curling, distortion or mottling were rogued out as early as possible. In addition, through a linkage with the Tropical Virus Project, funded by the UK Overseas Development Administration (ODA), a virologist at Rothamsted Agricultural Experimental Station in the UK was able



to identify the viruses found in leaf samples taken from the seed production plots. Subsequently, additional samples of seeds and fruit tissue were analyzed.

The results of these analyses have shown that our plots have been generally free of virus up to the beginning of the harvest period. As the crop ages, however, incidence of virus usually increases. For this reason we have not continued our seed crops for more than 5 months, although fruit production was still vigorous at this stage.

Pepper Mild Mottle Virus (PMMV), a TOBAMO virus, has been found in almost all cases of virus infection. Pepper Mottle Virus (PMV), a POTY virus, was found in a few cases (Jones and Cooper, 1991). PMV is not known to be borne, but PMMV is carried on the seed coat and can easily be transmitted by seed. For this reason, we have treated all seed with a 30 minute soak in 10% trisodium phosphate to reduce or eliminate PMMV infection through the seed.

### **Seed Extraction and Treatment.**

Seed extraction has been carried out by hand. Selected fruit are cut, so as to remove the stem end of the fruit. The central placenta is then cut out, leaving as little flesh as possible adhering. A coring machine was constructed in order to assist with the removal of the placenta, but this did not work well and needs modification.

During initial stages of the project, the placentae with seeds attached were placed in the shade or indirect sun to dry. This process takes about 10-14 days, depending on the weather. The seeds were then rubbed off in a hand-operated peanut sheller. This was time consuming and inefficient, and also produced large quantities of very pungent dust.

After the introduction of the trisodium phosphate treatment, it was discovered that direct treatment of the freshly cut placenta resulted in the efficient detachment of the seeds, which, after careful washing, could then be dried in a few hours instead of days. This treatment did not result in any significant decrease in germination percentage and

storage test showed satisfactory germination for up to six months, following this treatment (Table 2).

Using these methods, high quality seeds have been obtained with germination levels of 75-85% and very little impurities. Vigour of seedlings has been good, and fruit production has been excellent. There have been very few reports of seedlings problems. Seeds are treated with Captan and Malathion dust before storage or shipment.

**Table 2 Effect of trisodium phosphate treatment and storage times on germination of hot pepper seed (Average of four replicates).**

Seed Treatment	Storage Time (mths)	Germinating seed Condition (%)				
		Normal	Adnormal	Dead	Fresh	Hard
Control	0	82	8	2	6	2
Sodium Phosphate Treated	3	78	15	2	5	0
	6	65	5	10	20	0
	12	45	20	20	15	0

### Conclusions.

Although the amount of seed production appears small, even by caribbean farming standards, it has made an important contribution to the production of hot pepper in several of the OECS islands. The seed produced and distributed has been sufficient to plant approximately 100-150 ha. While exact statistic are difficult to obtain, this represents a significant proportion of the area presently planted to hot pepper in these countries. A preliminary characterization of the germplasm has been made, but a great deal more remains to be done. Pepper mild mottle virus has been virtually controlled in the seed.

### Acknowledgements

The expertise and assistance of Dr. Phil Jones, Plant Pathologist, Rothamsted Agricultural Experimental Station, UK., in identifying and describing the viruses found in our pepper plots, is very gratefully acknowledged. The assistance of various funding agencies who have

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