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Findings of Surveys on Yam (*Dioscorea* spp.) Production in the Grande Anse Department, Haiti

by

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Executive Summary

Surveys were conducted on yam production in 18 localities in the Moron and Dame Marie regions of the Grande Anse Department of Haiti. The objectives were to identify the areas in which yam is grown, identify and characterize the varieties and species of yam grown, describe the production system and identify the constraints facing yam production in the region.

Farmers in Moron and Dame Marie cultivate a large number of yam varieties, representing five species: *Dioscorea alata, D. rotundata, D. cayenensis, D. trifida* and *D. bulbifera*. Around 40 varietal names were recorded by various researchers. A precise count of the number of varieties grown cannot be determined because some varieties may have more than one name, while a given name may be used to describe more than one variety. Nevertheless, the large number of named varieties grown speaks to the importance of yam to the region.

Some varieties are widely grown across the two regions, some varieties are found in only one or two localities, and some that were once widely grown are now becoming scarce. The varieties, Ginin, Fran (Jòn), Bangoule (Jòn), Plinbit, Bakala and Toro were present in all 18 localities surveyed. Many of the best quality yams are among the most scarce. Insects, diseases, weather and declining soil fertility are among the reasons attributed to the decline and loss of yam varieties.

Most yams are planted between January and June. February and March are the months in which planting is most intense. Most varieties are harvested between December and May, although some (Bangoule, Fran) are harvested all year. Most varieties mature in 8-12 months, except for Ginen, which has a cycle o f 6 - 8 months, and Adigwe, which has a cycle of 5 - 7 months.

The primary production constraints, according to farmers in Moron and Dame Marie, are the *moroca* larvae, a black rot disease, locally called *gâle*, low yield, wilting and stress attributed to wind and excess rain (*boulaison*), and tuber rot. Ants, rats, birds and snails were also cited. The *maroca* larvae bore channels through the tubers and render them inedible. Yellow varieties are considered by some farmers to be more tolerant of *maroca*, or may avoid a more serious infestation by having a shorter life cycle than other varieties. The crowns of infected tubers are stored in the field, allowing the larvae to reinfest the soil. Yam may also be grown repetitively on the same land, allowing the pest to proliferate in infected fields.

A large number of products are used in an attempt to control *moroca*, but most remedies are not judged to be effective and 58 % of farmers do nothing to control the pest. The most commonly cited remedies were naphthalene, animal manure, several plants that have a strong odor (pine, vetiver grass, lemon grass) and insecticide. Manual control and use of pigs to rut out larvae were also mentioned. Additional research on control of *maruca* larvae is needed.

Yam is a crop with good potential for both the domestic and export markets. The Grande Anse, with its history of yam production and large numbers of varieties grown stands to benefit from development of the yam market. Yam production in Grande Anse faces serious constraints due to *maroca* infection and disease that must be taken into consideration in any production and marketing effort. These pests and diseases have the potential to undermine any marketing effort by rendering tubers unmarketable, as well as by reducing yields. Research and training is needed to develop and extend integrated management practices to control the major pests and diseases, improve yields and maintain soil fertility. Steps should also be taken to collect, propagate and distribute high quality yam varieties that are in danger of disappearing in the region.

Rezime

You ankêt sou pwodiksyon yanm te mennen nan 18 lokalite Moron ak Dammari nan rejyon Grand'anse peyi Dayiti. Objectif travay sa a se te: idantifie zon kote yo kiltive yanm, chêche limiè sou variete ak espès yanm yo, dekri systèm pwodiksyon yanm yo ak chache konnen tout kalite kontrent ke kilti yanm genyen nan zon sa yo.

Peyizan nan Moron ak Dammari kiltive ampil yanm ki reprezante 5 espès: *Dioscorea alata, D. rotunda, D. cayensis, D, trifida* ak *D. bulbifera*. Anketè jwenn prèske 40 nom yanm nan lokalite yo. Yo pa kapab ekri ak presizyon kombyen variete yanm ki egziste nan zon yo, paske varite yanm yo kab gen pliziè nom e you nom ka batize pliziè variete yanm. Sepandan gran kantite nom sa yo montre klè kombyen yanm impotan nan rejyon Grand'anse.

Gen variete yanm yo jwenn nan tou 2 rejyon yo, gen lot se nan you sèl lokalite anketè yo jwenn yo e gen lot ki te trè koni ki kounie ya vin trè ra. Si la yo ki rele yanm Ginen, Yanm Fran (jon), yanm Bangoul (jon), yanm Plenbit, yanm Bakala ak yanm Toro retrouve yo nan 18 lokalite ankèt la kouvri a. Ampil yanm ki gen bon kalite retrouve yo pami si la yo ki pira yo. Ensèk, maladi, pwoblem la pli ak lesec, tè mèg fê pati de rezon ki fè ke variete sa yo ap fin depafini ou ap fin disparèt.

Peyizan yo plante yanm ant mwa Janvie ak mwa Jwen. Men se nan mwa Fevriye ak mwa Mas ke yo plante yanm piplis. La plipa variete yanm yo, bon pou rekolte ant mwa Disanm ak mwa Me. Sepandan, yanm bangoul ak yanm Fran rekolte tout lane. Yanm yo an jeneral pran 8 a 12 mwa pou yo donnen, sof yanm Ginen ki rekolte sou 6 a 8 mwa, ak yanm Adigwe ki donnen apre 5 a 7 mwa.

Peyizan Moron ak Dammari eksplike ke pi gwo pwoblem yanm se lav maroca, maladi pouriti nwa ke peyizan yo rele gal, ba donnenzon, fletrisman ak estrès ke van pote ak ampil lapli (boulezon) ak pouriti tibèkil. Yo site tou nom rat, poud bwa, zoazo ak kalmason. Lav maroka yo fouye you twou nan didan yanm nan e yo vin pa ka manjel. Variete jon yo samble pi toleran a maroka ke lot yo. Yo kab evite domaj maroka paske yo pran pi piti tan pou yo donnen. Peyizan yo kite nan jaden a kouron tibèkil infeste yo sa pèmèt lav maroka yo reinfeste sol yo. Yanm kon tou plante chak sezon menm chan an, pratik sa a tou pèmèt parazit yo miltipliye e infeste jaden yo.

Peyizan yo kon itilize ampil pestisid pou kontwole maroca, men yo pa eficaz ditou epi 58% peyizan ankete yo pa fê okenn kontwol. Pwodwi ke peyizan yo site piplis se: naphthalene, fimie bèt, plant ki gen odè fò tankou Pen, Vetivê, sitwonèl ak ensektisid. Yo itilize tou, kontwol ak men, kochon pou detere lav maroca yo. Plis travay rechèch dwe fèt sou kontwol maroka nan yanm.

Yanm se you kilti ki gen ampil bon potansièl pou mache nasyonal ak lot bo dlo. Grand'anse ak pase li nan pwodiksyon yanm e ampil variete yanm ke li genyen ta dwe benefisye de sa ampil. Pwodiksyon yanm nan Grand'ans gen de serie pwoblem maroka ak maladi ke yo dwe pran an konsiderasyon nan bon jan jefò kap fèt pou leve eskamp figi pwodiksyon yanm peyi Dayiti paske parazit sa yo kap mine tout jefò sa yo, lè yo rand tibèkil yo envandab ak tou redwi randman yanm nan. Gen ampil nesesite pou travay rechèch ak fomasyon pou devlope ak vilgarize bon jan pratik entegre pou kontwole pest ak maladi epi ameliore randman yanm ak kenbe grès tè. Travay doue fè tou pou kolecte, miltipliye ak distribiye bon kalite variete yanm ki an danje de disparisyon nan rejyon Grandans la.

Preface

This report is based primarily on the work of two final year students at the Faculty of Agriculture and Veterinary Medicine (FAMV), National University of Haiti, Gasner Demosthene and Jean Jocelyn Dufreine, who, in 1996, conducted surveys on yam production in the Department of Grande Anse, Haiti. These students received logistical support from CARE and technical support from SECID Agronomist Yves Jean. Publication of these results for the PLUS Project is in conformity with a memorandum of agreement (Protocol d'Entente) between SECID, CARE and FAMV in which SECID agreed to publish the findings of these surveys. The individual hand-written reports[1] of the two students are combined here to avoid redundancy. These reports were supplemented by information gleaned from a report on a rapid reconnaissance survey conducted by CARE staff in 21 localities in Moron, Grande-Anse, and information sheets written by Agronomist Laurent Cuvelier. I was not unable to locate the full reference. Where no author is indicated, the reader may assume that the data was taken from the reports of Demosthene and Dufreine. Responsibility for the final product and any additional interpretations are my own.

Publication of this report was hampered by the termination of the SECID On-farm Adaptive Agronomic Research Program and the Information Clearinghouse in 1996. Because I believe the information obtained from these surveys are sufficiently important for future work in yam, I have taken it on myself to translate, transcribe and integrate these findings, in order to ensure that the information is available to future projects in agriculture in Haiti. Additional delays were brought about by unsuccessful attempts to contact the former students and obtain clarifications on results reported and feedback on the draft report. Because I have not been able to obtain their consent, I have not included their names as co-authors.

This is the second SECID/Auburn PLUS Report dealing with yam production. In 1994, SECID/Auburn University designed a trial to test management practices to reduce the incidence of black rot disease on yam, caused by *Rosellinia bunodes*, in farmers' fields in Plaisance. The trials were implemented by PADF with technical support from SECID's On-farm Applied Research Program, under Agronomists Yves Jean and Frank Brockman. Results of these trials are presented in SECID/Auburn PLUS Report No. 42 (Jean *et al.*, 1996).

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[1] Etude sur la production de l'igname dans la Grande Anse. Raison de la dévastation des tubercules d'igname par les larves de Coléoptères "marocas" et recherche de méthodes naturelles de lutte. Par Jean Jocelyn Dufreine, Avril 1997.
Identification des ignames dans les systèmes de culture de la Grand'Anse. Rapport trimestriel par Agr. Gasner Demosthene, Juillet 1997.

It is my hope that the information contained in this report will be used to further the development of yam production in Haiti. Information on the yam varieties and species cultivated in the Grande Anse region of Haiti will be useful in developing agricultural markets in this high value crop. As USAID's Hillside Agriculture Marketing Program contemplates development of an export market for yam, close attention must be paid to addressing the production constraints identified in this report.

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Acknowledgments

This report is result of collaboration on the part of several organizations and individuals. I am particularly grateful to CARE for the support provided the students. I am also grateful to Yves Régis and Gerit Bartels for supplying me with information from their original surveys conducted by CARE. Yves Jean, formerly of SECID, played an important part in facilitating this activity and providing technical support to the students.

The students, Gasner Demosthene and Jean Jocelyn Dufreine, in their draft reports, thanked those who contributed to the realization of this study, especially, Agronomist Yves Jean of SECID, Agronomist Yves L. Régis of CARE-Jérémie, Agronomist Athus Pierre of CARE in Port-au-Prince, Agronomist Karl Charlemagne of CARE at Dame Marie and all the personnel of CARE in the Grand-Anse. They also thanked the farmers of the localities affected by the PLUS project for their collaboration.

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Introduction

Yam[1] production in Haiti is estimated at 170,000 tons (Pierre-Jean and Tremblay, 1985). It is considered a high value crop (Jean *et al.*, 1996) and interest has been shown in its potential as an export crop. A knowledge of the production system, varieties and species grown, and the principal constraints are important to any attempt to increase the production of this economically important crop.

The Grande Anse Department is one of the major yam growing areas of Haiti, where it is an important source of revenue to farmers, and an important part of the diet, but aspects of local yam production, including varieties and species grown and production methods and problems are not well documented. Nevertheless, CARE staff reported that farmers frequently complained about a pest called *maroca* that attacked the tubers, rendering them unmarketable and sometimes inedible. They also complained of diseases and the disappearance of the best varieties.

The objectives of this study were to identify the areas of the Grande Anse in which yam is grown, identify and characterize the varieties grown, and describe the production system and major problems faced by yam farmers in the Grande Anse. The work was conducted by two students at the Faculté d'Agronomie et de Medecine Vétérinaire (FAMV) of the University of Haiti, with support from CARE and assistance from SECID. Jean Jocelyn Dufreine concentrated on the production system, while Gasner Demosthene concentrated on yam varieties and species.

Specific objectives of the yam production study were to:

1. identify the localities where most of the yams were being grown in Grande Anse,
2. determine the cultural calendar for each yam variety grown,
3. inventory the problems of yam cultivation, specifically related to *maroca*[2]
4. determine, if possible, the yam varieties most tolerant to *maroca*
5. determine if plot history, position or topography has an effect on *maroca* development
6. determine traditional methods of *maroca* control and the degree of effectiveness.

Specific objectives of the yam variety study was:

7. identify the yam varieties most cultivated and why,

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[1]Readers should not confuse yams of the genus, *Dioscorea*, with sweet potato (*Ipomoea batatas*), also sometimes referred to as "yam" in the United States. Both are found throughout the tropics, but the name, "yam," is generally reserved for *Dioscorea* spp.

[2]*Maroca* is the local name for grubs that attack the roots of yam, plantain and bananas. It should not to be confused with *Maruca testulalis*, a major pest of cowpea, attacking flowers and pods.

8. identify the yam varieties least cultivated
9. identify and class yam varieties and species according to the guidelines of the International Board for Plant Genetic Resources (IBPGR).

Only limited information was reported with respect to Objectives 5 and 9.

To avoid repetition in reporting by Dufreine and Demosthene, results from the two reports are combined. These reports were supplemented by reference to reports by Laurent Cuvelier on a survey conducted in parts of Grande Anse for the Food and Agriculture Organization during the same period, and a report by CARE staff in Grande Anse on a survey conducted prior to those conducted by Dufreine and Demosthene. Except where indicated otherwise in the text, the information was obtained by Dufreine and Demosthene. I have also added my own comments and interpretations.

Materials and Methods

The survey document was developed based upon documentation available for regions of intervention by the PLUS Project. The PLUS Project works in Moron/Chambellan, Dame-Marie/Anse d'Hainault and Abricots/Bonbon. Because CARE had just recently begun work in this latter area, baseline information, such as agroecological zones were not available, and the survey was not conducted in this area. The Moron region covers localities from Marfranc to Dos-Camp. The Dame-Marie region includes Dos Camp and extends to the Commune of Irois (*Figure 1*).

Localities were selected according to their ecological conditions and the presence of "rare" varieties, according to resource persons. This was done by having lists of varieties made up by resource persons (*Appendix B*) from 41 localities within the two regions. Those localities retained are listed in *Table 1*.

Table 1. Localities selected according to agroecological zone

Agro-ecological Zone	Localities
Very Humid Mountain	Montagnac, Jorgue
Humid Mountain	Désormeaux, Lacoude, Jardin, Mathieu, Gabriel, Dos Camp
Semi-humid Mountain	Astier, L'Assise, Gira
Humid Plain	Mahotière, Mandou, Lahatte
Semi-humid Plain	Lafitte
Coastal Zone	Ti-Cahouane, Bariadelle, Plomquette

Within each locality, 10 % of heads of households were interviewed. Individual farmers were selected at random from a list of all farmers made up by the local field agent. If an

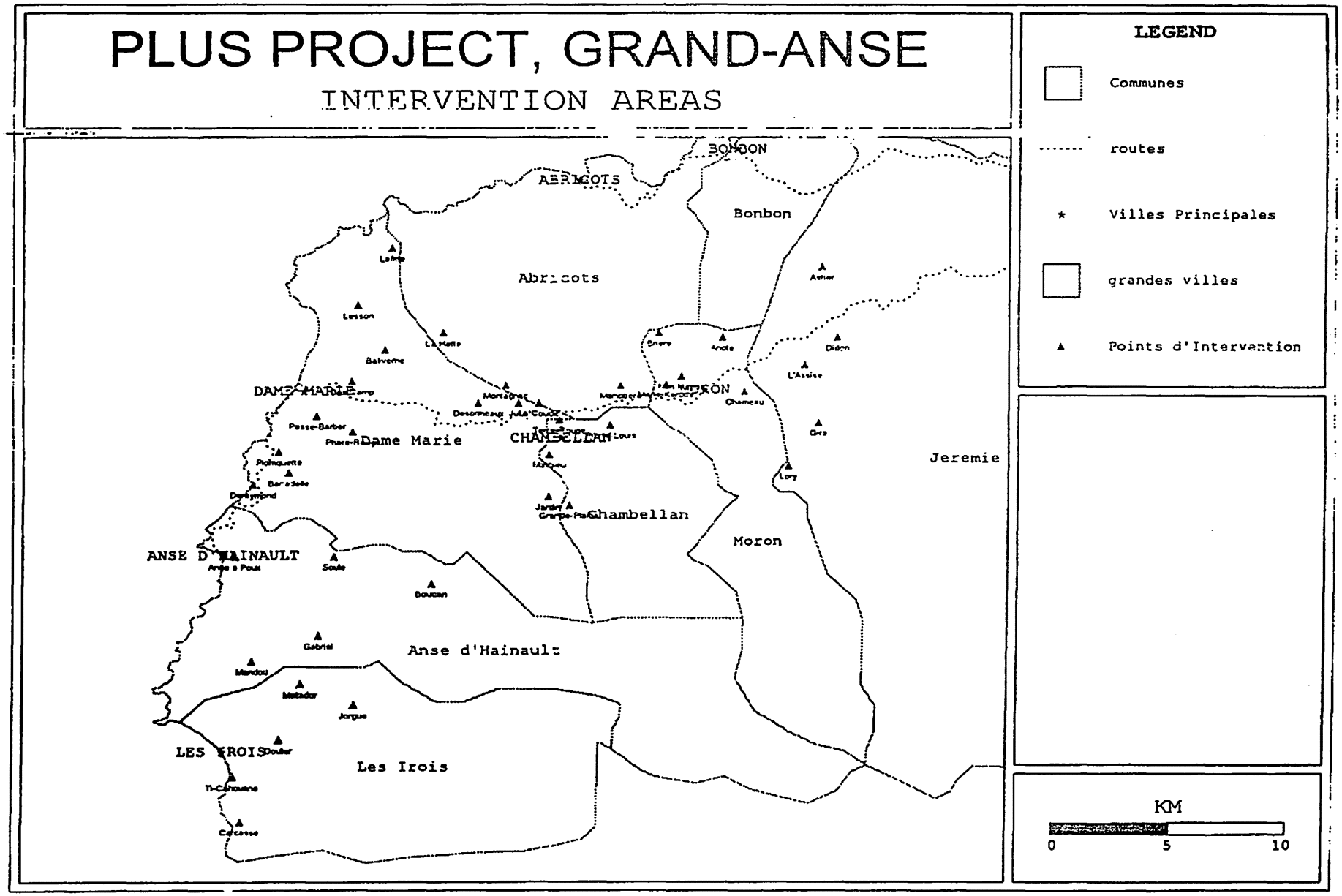

Figure 1. PLUS Project Intervention areas in Grande Anse, showing localities in which surveys were conducted.

individual farmer was not located, another was selected at random from the list until the desired total was obtained. A total of 159 farmers were interviewed in Moron and 100 in Dame Marie. The number of farmers interviewed by locality are indicated in *Tables 2 and 3.*

Table 2. Number of farmers interviewed in Moron region.

Localities	Number of Households	Farmers Interviewed†
L'Assise	298	30
Gira	256	26
Jardin	97	10
Astier	233	23
Mathieu	69	7
Lacoude	125	13
Désormeaux	116	12
Montagnac	155	16
Mahotière	223	22
Total	1572	159

†10 % of total

Table 3. Number of farmers interviewed in Dame Marie region.

Localities	Number of Households	Farmers Interviewed†
Dos Camp	134	13
Lahatte	153	15
Lafitte	109	11
Plomquette	20	2
Bariadelle	103	10
Gabriel	136	14
Mandou	86	9
Jorgue	146	15
Ti-Cahoune	112	11
Total	999	100

†10 % of total

Information was collected by month on time of planting and harvest in order to create the cultural calendar for each variety. Additional information was collected on the cropping system and information permitting an informal description of the varieties. Crop associations were obtained from a preliminary survey conducted in the region by CARE. The variety lists were analyzed in terms of frequency of occurrence of variety names with respect to number of localities, with respect

to total number for the region and with respect to number of responding farmers. Field visits were used to determine method of field preparation, evaluate yields at harvest, observe storage methods and to describe some of the yam varieties.

Results and Discussion

Physical Environment and Farming System

The region is mountainous and is primarily on limestone parent material. Soil pH was reported to be acid at high elevation, neutral on lower slopes and alkaline on the calcareous alluvium[3]. Rainfall is well distributed with rainfall varying from 900 mm to 2300 mm. The wettest months are May, June, October and November. Driest months are January, July, August, Sepember and December.

The countryside is characterized by wooded upper storey of fruit and forest trees. Cultivated crops include coffee, cocoa, breadfruit, orange, grapefruit trees and bean, yam, sweet potato, cassava, maize, taro and *mazoumbel* (*Xanthosoma sagittifolium*), malanga (*Colocasia esculenta*) and sugar cane. Rice is not cultivated and cassava is somewhat rare. Root crops, especially malanga and yam are the major crop components following a two to four year fallow. Banana follows, sometimes accompanied by *mazoumbel*, in more humid areas. However, yam occupies the largest area. In some areas, production has intensified and there is no fallow. Food crops cover a larger area than do coffee and cocoa.

Yam Cultivation

Yam cultivation begins with land clearing, referred to as *balisage* or *bois neuf*. Trees are pruned and debris of all sort is often burned. In cocoa and coffee plantations, the trees are not pruned, but the plots are weeded. This is followed by mounding. Mounds are constructed in two ways: 1.) the first consists of turning the soil with a steel rod (*pince* or *louchette*) to form mounds of 40 - 45 cm in height and 50 cm in diameter. Stones are removed from the soil during this operation. This method is used for all types of yam. 2.) The second consists of digging a pit to knee or waist deep (0.5 - 1 m). The diameter of the hole varies. The pit is filled with straw and covered with the removed soil, in order to make a mound. This technique is used for the variety, Toro, which requires a deep rooting zone for its tubers.

With either method, certain products are placed near the surface of the mound as prevention against *maroca*. Among these are the bile organ from an animal, vetiver grass, matches, etc. (see *Maroca*, below).

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[3]Soils are often assumed to be acid based upon their classification. In fact, many highly weathered soils which might otherwise be acid, tend to be close to neutral in pH or only moderately acid because of the presence of limestone fragments. Soil testing is needed to determine the extent to which acid soils occur within this region.

Whole tubers or tuber cuttings, usually from the upper or crown area of the tuber, are used as seed yam. Seed yam may be obtained from one's own production or purchased from a neighbor. These are placed under a tree and allowed to germinate before planting. Planting takes place at full moon. Depending upon their size and quality, two to five cuttings are placed in the mound. On the same mound, one can associate cuttings of different varieties, except for the variety, Toro, which farmers say will "destroy" the other varieties by shading them out. Toro grows very fast and has a large leaf area, and its leaves are spread to receive maximum solar radiation. It even dominates the trees that serve as trellis for the yam. Thus Toro is always planted alone on the mound.

Yam is often grown in association with other crops, such as common bean, peas and maize, on the top of the mound, and cassava, sweet potato on the sides, with malanga, *mazoumbelle* and taro being planted at the bottom of the mounds. Other typical associations are pigeon pea, sweet potato, malanga, *mazoumbel* and yam, or maize, pigeon pea, sweet potato, taro and yam.

Following planting, the principal operation is trellising. This consists of orienting the stems toward a tree or a trellis placed to hold the stems. The plot may be weeded, depending upon the type of crop association being practiced.

Harvest is generally spread over time. It is done with a stake of wood and a machete, depending upon the soil type. For example, the machete is used in the sandy soils of Pierre-Louis. Immediately upon harvest, the tubers are sun dried to prevent rotting. The harvested tubers are consumed or sold in the market or stored. Storage is in the rafters, under straw or in a corner of the house. Some of these tubers will serve as seed yam for the next growing season.

Yam Varieties Grown

An analysis of crop varieties simply by common names must be taken with caution because of the possibility of different names being applied to the same variety at different locations and the same name being given to different varieties. For example, within the same locality, the variety Toro may also be known as Riral, Iral, Touspik, Tègal, Palmis and Garo (see *Appendix C)*. Given the inherent weaknesses of such an analysis, the survey of yam varieties in the Grande Anse nevertheless demonstrates a richness in the germplasm available to farmers there and the importance given to the crop by farmers.

Twenty-nine yam varieties were reported across the 18 localities (*Tables 4 and 5*). A large number of varieties are grown in each locality. The highest number of varieties were recorded for Montagnac in the Moron region and Bariadelle, Gabriel, Dos-Champ and Mandou in the Dame Marie region, with 16 varieties each. A large number of varieties were common across localities in both regions. The varieties Ginin, Fran (Jòn), Bangoule (Jòn), Plinbit, Bakala and Toro were present in all 18 localities surveyed in the two regions. The varieties Tiapousèl, Keston and Makak were also widely distributed.

Among the varieties that were not widely distributed were Perin and Palmis, only found in Mandou; Babat, only found in Ti-Cahouane; Blanch, only found at Dos-Camp; Posèk, only found at Gabriel: Mèsiyas, only at Bariadelle; Wouj, only found at La Coude; Chin and Koulèv at Astier; and Kouchkouch at L'Assise (*Tables 4 and 5*). Three varieties mentioned by the field agents (*Appendix B*), Sipousèl, Pèlerine and Péril, were not encountered during the survey. The CARE team (1996) also reported varieties by the names of Pélerine, Fran, Kasi, Kapousèl, Sipousèl, Angle, Peril and Riral. With the exception of Pélerine, these names are either listed as synonyms of names already listed (*Appendix C*) or variants of names already listed. Other varieties reported by Cuvelier (1997a,b) were Tizra, Ticodine and Pakala Violette. The remaining names appeared to be variations on names already given.

Table 4. Occurrence of yam variety by locality in Moron region.										
Variety Names†	Locality									% of Localities
	L'Assise	Gira	Jardin	Astier	Mattieu	Lacoude	Désormeaux	Montagnac	Mahotière	
Ginin	X	X	X	X	X	X	X	X	X	100
Jòn (Fran)	X	X	X	X	X	X	X	X	X	100
Bangoule (Jòn)	X	X	X	X	X	X	X	X	X	100
Plenbit	X	X	X	X	X	X	X	X	X	100
Bakala	X	X	X	X	X	X	X	X	X	100
Toro (Garo, Riral)	X	X	X	X	X	X	X	X	X	100
Makak	X	X	X	X	X	X	X	X	X	100
Tyapousèl	X	X	X	X	X		X	X	X	89
Keston (dlo)	X	X	X		X	X	X	X	X	89
Blanch	X	X	X		X	X	X	X	X	89
Sèl	X	X	X		X	X		X	X	78
Bagou	X	X			X			X	X	56
Akanm		X		X		X		X		44
Gabriyèl						X	X	X	X	44
Périn	X	X	X						X	44
Prens					X		X	X		33
Franse		X			X				X	33
Matinik				X				X		22
Wouj						X				11
Chin (dlo)				X						11
Koulèv				X						11
Kouchkouch	X									11
Total Varieties	14	15	12	12	14	13	12	16	15	
% of 22 varieties	64	68	55	55	64	59	55	73	68	

†Variety names in parentheses are alternate names. Note also, many of the names may be clues to the origin or characteristics of the variety. Ginen - Guinea, an old name for the savanna of West Africa or West Africa in general. *Dioscorea rotundata* is known in West Africa as the white guinea yam. Jòn - yellow; dlo - water. *D. alata* is known as the water yam, because of its higher water content compared to the guinea yam. Plenbit - fills mound, Makak - monkey, Sèl - salt or saddle, Blanch - white, Wouj - red, Matinik - Martinique, Chin - China?, Koulèv - snake, Toro - bull, Riral - rural, Akanm - the Akan tribe in Ghana?, Ibo - a tribe in Nigeria, Kouchkouch - could it refer to the Cush-Cush yam (*D. trifida*)? Several other names appear to have African origins (Bangoule, Bakala, Adigwe).

Table 5. Occurrence of yam variety by locality in Dame Marie region.										
Variety Names†	Locality									% of Localities
	Bariadelle	Gabriel	Dos-Champ	Jorgue	Plomquette	Mandou	LaHatte	LaFite	Ti-Cahouane	
Ginin	X	X	X	X	X	X	X	X	X	100
Jòn (Fran)	X	X	X	X	X	X	X	X	X	100
Bangoule (Jòn)	X	X	X	X	X	X	X	X	X	100
Plenbit	X	X	X	X	X	X	X	X	X	100
Bakala	X	X	X	X	X	X	X	X	X	100
Toro (Garo)	X	X	X	X	X	X	X	X	X	100
Keston	X	X	X	X	X	X	X	X	X	100
Tyapousèl	X	X	X	X	X	X	X	X	X	100
Prens	X	X	X	X	X		X	X		78
Sèl	X	X	X		X	X		X	X	78
Makak		X	X		X	X	X	X		67
Koulèv	X		X			X	X		X	56
Wouj (San)			X				X	X	X	44
Bari	X	X			X	X				44
Franse (Dlo)		X					X	X		33
Bago (Bagou)	X		X	X						33
Majistra		X				X			X	33
Koun	X	X		X						33
Gabriyèl (Ibo)							X	X		22
Akanm	X		X							22
Adigwe							X		X	22
Périn						X				11
Palmis (Koulèv)						X				11
Blanch			X							11
Babat									X	11
Posèk		X								11
Mèsiyas	X									11

Total Varieties	16	16	16	12	11	16	14	14	14	
% of 27 varieties	59	59	59	44	41	59	52	52	52	

†Variety names in parentheses are alternate names.

The yam varieties most cultivated were listed in descending order of importance with respect to their presence in the field (*Tables 6 and 7*). The variety Ginen was the most cultivated in Montagnac, Jòn (Fran) was the most cultivated in L'Assise, Gira, Mattieu and Mahotière, while Jòn (Bangoule) was the most commonly grown in the four localities in Dame-Marie for which the analysis was conducted. Other commonly-grown varieties were Bakala, Keston, Plenbit and Toro. These varieties are widely grown because of the availability of seed yam at reasonable price and their economic importance. Jòn (Fran) and Jòn (Bangoule) are popular because they are sold at a high price and because they can be harvested several times. Toro is popular because it brings a high price and because it is resistant to drought and to several diseases. Other yam varieties are not widely grown because of the scarcity and high cost of planting material.

Table 6. Yam varieties most widely grown in selected localities in Moron.

Locality	**Yam Varieties (by descending order of popularity)**								
Montagnac	Ginen	Jòn (Fran)	Jòn (Bangoule)	Keston (dlo)	Plenbit	Bakala	Toro (riral)	Tyapousèl	Akanm
L'Assise	Jòn (Fran)	Jòn (Bangoule)	Bakala	Toro (riral)					
Gira	Jòn (Fran)	Jòn (Bangoule)	Bakala	Toro (riral)	Perin				
Matthieu	Jòn (Fran)	Jòn (Bangoule)	Keston (dlo)	Plenbit	Bakala	Toro (riral)	Tyiapousel		
Mahotière	Jòn (Fran)	Jòn (Bangoule)	Plenbit	Bakala	Toro (riral)				

Table 7. Yam varieties most widely grown in selected localities in Dame Marie.									
Locality	**Yam Varieties (by descending order of popularity)**								
Bariadelle	Jòn (Bangoule)	Jòn (Fran)	Toro (Garo)	Bakala					
Gabriel	Jòn (Bangoule)	Jòn (Fran)	Plenbit	Toro (Garo)	Bakala	Tyiapousel			
Dos-Camp	Jòn (Bangoule)	Jòn (Fran)	Plenbit	Toro (Garo)	Ginen	Bakala	Keston	Blanch	
Mandou	Jòn (Bangoule)	Jòn (Fran)	Plenbit	Toro (Garo)	Ginen	Bakalaa	Keston	Tyiapousel	Majistra

The yam varieties considered to be the best quality were seldom those that are widely cultivated (CARE, 1996). The best quality varieties in CARE's survey were listed as Jòn, Blan, Sèl, Kenston, Ginen, Toro, Bangoule, Dlo, Franse and Tyapousèl. They reported that Blan was so highly valued, that it is sold by the slice in Jérémie when it is available.

According to Cuvelier (1997b), the most preferred varieties are Kenston and Tizra. The variety, Français (Franse), also was highly desired, and the most preferred in Port-au-Prince, but it was not even available in the market. Prices of seed yam (heads or crowns) of eight varieties were listed by Cuvelier (1997b). The most expensive variety was Blanche (450-500 Gourdes per barique of 35-40 heads), followed by Kenston and Tizra (400-500 Gdes). Seed yam of these varieties was 10 times that of Toro (40-70 Gdes), the least costly yam. Pakala was also low in price. Jaune and Guinée were intermediate.

According to CARE staff (1996), the best varieties are disappearing. *Table 8* lists the varieties reported as disappeared or disappearing in the CARE staff survey of 21 communities. Most often cited as disappeared or disappearing were Franse, Kenston, Blanc, Makala, Makak, Dlo and Plinbit. Some of those less often cited as having disappeared, such as Chin, are not widely reported (*Tables 4 and 5*), so may have disappeared long ago or never been widely grown. Cuvelier (1997a) reported that the variety Français (Franse), has become rare due to anthracnose and "hurricanes."

The main cause of disappearing varieties, according to CARE (1996) was the lack of planting materials. Yam tubers are often sold whole in the market, which leaves nothing for the farmer to plant in the next season, especially with major field losses that occur. Hurricanes were given as the second most common cause. Additional causes listed by farmers were *mawoka* (*maroka*) larvae, ants, snails (*colimaçon*), wind, lack of training, lack of work method, *gale* (probably black rot - see p. 18), dominance of variety, Toro, over other varieties (described as allergy), loss of forest or wooded areas, and loss of fertility. CARE staff consider *maroka* to be a primary cause of the decline of yam production, followed by lack of planting material, disease, ants, reduction in fertility, excess humidity, drought (sunburn), hurricane and *gale*.

Table 8. Yam varieties that have disappeared or are in process of disappearing in Grande Anse.		
Variety	Already Disappeared	Disappearing
	Number of Localities	Number of Localities
Franse	16	1
Kenston	7	7
Blan	6	3
Makak	5	1
Ginen	3	
Sèl	3	2
Dlo	1	4
Gabriel	1	1
Tyapousèl	1	1
Chine	1	
Bakala		11
Plenbit		5
Jòn		2
Bagou		1

Source: adapted from CARE, 1996.

Description and Tentative Taxonomy of Selected Varieties

An informal description of leaves stems and tubers was conducted by Gasner Demosthene on selected varieties (*Table 9*). Based upon the characteristics observed, the varieties Ginen, Jòn (Fran) and Jòn (Bangoule) were judged to be from the complex *Dioscorea rotundata - D. cayenensis*[4], Akanm was classed as *D. bulbifera*, Toro as *D. alata* and Sèl as *D. trifida*. Although not all the features included in the key by Purseglove (1988) are described below, these classifications are in conformity with the descriptions provided by Purseglove, as well as by Martin (1974, 1976), Martin and Degras (1978) and Martin and Sadik (1978). The varieties, Jòn (Fran) and Jòn (Bangoule) differ from Ginen by the lack of shine on their leaves and their tubers, which are long and few. Based upon their respective growing cycles (See Cropping Calendar, below), it is likely that Ginen is *D. rotundata* and Fran and Bangoule are *D. cayenensis*. Toro is distinguished from the preceding three by its winged stems and occasional bulbils in the axils. Akanm differs from the preceding four by its round stem without spines or wings. Sèl differs from all the others by its trilobed and five-lobed leaves, quadrangular stems and many small tubers.

D. trifida is indigenous to the Caribbean, whereas *D. rotundata* and *D. cayenensis* were introduced from Africa and *D. alata* from Asia. *D. bulbifera* is indigenous to both Asia and Africa. Examination of the shape of the bulbils would provide a clue to the origin of local varieties.

More descriptive information on some of these varieties is found in the report by Cuvelier (1997a), who classed the varieties as shown in *Table 10.* He also equates the varieties Jaune (Jòn) with Anglais and Siguine. Cuvelier did not assign species names to Toro, Français, Du Vin (Rouge) or Pacala Violette.

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[4]Tubers of *D. rotundata* have white flesh and mature in 7-8 months, while those of *D. cayenensis* have yellow flesh, broader leaves mature in 10-12 months and have a higher rainfall requirement. Intercrossing appears to occur and taxonomists disagree as to whether the two forms make are one species or two (Martin and Sadik, 1977). Since both yellow and white tubers are reported for the same variety, it could be that some varieties may be the result of hybrids between the two forms or that more that one variety is receiving the same name.

Table 9. Informal description of yam varieties.			
Variety	**Leaves**	**Stems**	**Tubers**
Ginen	Large, twisted, entire, no lobes, shiny	Round, spiny, no wings	Short, fairly numerous. Flesh yellow or white
Jòn (Fran) or Jòn (Bangoule)	Large, twisted, entire, no lobes. Tranversal nerves not prominent	Round, spiny, no wings	Long, few. Flesh yellow or white
Toro	Simple, entire, not lobed. Occasional bulbils formed in axil	Quadrangular or polygonal, winged	Single tubers of various forms.
Akanm	Large, simple, entire, not lobed, shiny, strong transversal nerves, large aerial bulbils	Round, not winged, no spines	polygonal tubers, aerial bulbils
Sèl	Entire, 3 to 5 lobes	quadrangular, smooth, winged	Numerous small tubers with beginning traces of rootlets

Table 10. Classification of yam varieties in Grande Anse based on Cuvelier (1997a).	
Species	**Varieties**
D. rotundata†	Guinée, Macaque
D. cayenensis†	Jaune (same as Anglais, Siguine), Mangoulé (Bangoulé), Cassi, Franc (Anglais).
D. alata	Plimbite, Keston (Gabriel), Dlo‡ (Blanche), Tizra, Pacala (Bakala?), Prince, Ti Codinne, Pierrine
D. trifida	Sel (Cousse-couche)
D. bulbifera	Makam (Akam, Massoko)

†Cuvelier referred to these as *D. rotundata cayenensis*. I have separated *D. cayenensis* from *D. rotundata* based on color.
‡Dlo is used in Chambellan and Moron to refer to all types of water yam *(D. alata)*.

Cropping Calendar

Planting and harvest months for each variety are given in *Tables 11 and 12*. Most yams are planted during the period of January through June or July. February and March are the most important months for yam planting (*Table 13*). However, the yellow yams, Bangoule and Fran, are planted all year long. They are referred to in Creole as *yamn tout tan* (all season yam). The varieties, Prens and Perin were planted mostly within the two-month period, while about half the plantings of Ginen, Akanm, Sèl, Bagou, Blanch, Gabriyel, Wouj, Bakala and Koulèv took place within that period. Only a small percentage of the time were the varieties, Keston, Toro, Bari and Majistra, planted during the months of February and March. This percentage is smaller than that for Bangoule and Fran, the varieties planted all year long. The researcher did not report when most of the planting took place for these four varieties.

Harvest is generally spread over time, according to the needs of the planter, although Cuvelier (1997b) notes that traditionally, yam harvest begins on Christmas day. Most varieties are havested from December through May, and sometimes beginning in October and November, and extending into June and July (*Tables 11 and 12*). Bangoule and Fran are harvested all year. Ginen, which has a short growing cycle, is harvested from July through November. A noted exception is the variety, Adigwe, which is planted from January to March and harvested from June through October. Adigwe appears to be the earliest maturing variety. It also appears to be fairly rare (*Tables 4 and 5*). The variety, Ginen, also appears to be earlier than most, with some tubers harvested in September. The majority of varieties mature in 8-12 months, except Ginen, which has a cycle of 6-8 months and Adigwe, 5-7 months.

Cuvelier (1997b) reports that yellow and guinée yams (*D. cayenensis* and *D. rotundata*) are harvested three times during a season. A first harvest, referred to as *cassage*, is made four to five months after planting and a second, sometimes occurring four months after the first. Although not stated by the author, this is done by removing soil from one side of the tuber and slicing the tuber below the crown, being careful not to damage the crown and lateral roots. The lower part of the tuber is removed, and the crown is covered up and the tuber allowed to regrow. The final harvest is done 11 - 12 months after planting.

Table 11. Cropping calendar for yam varieties in the Moron region of Grande Anse.												
Variety	Month											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Ginen	P	P	P	P	P				H	H	H	H
Jòn (Fran)	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH
Jòn (Bangoule)	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH
Keston (Dlo)	PH	PH	PH	PH	PH	PH	P				H	H
Plinbit	PH	PH	PH	PH	PH	PH	P			H	H	H
Bakala	PH	PH	PH	PH	PH	PH	P				H	H
Toro (Riral)	PH	PH	PH	PH	PH	PH	P				H	H
Makak	PH	PH	PH	PH	PH	PH						H
Tyapousèl	PH	PH	PH	PH	PH	PH	P				H	H
Prens	PH	PH	PH	PH	PH	P	P				H	H
Akann	PH	PH	PH	PH	PH							H
Sèl	PH	PH	PH	PH	PH	PH	P				H	H
Bagou	PH	PH	PH	PH	PH							H
Blanch	PH	PH	PH	PH	PH	P					H	H
Gabriyèl	PH	PH	PH	PH	PH						H	H
Matinik	PH	PH	PH	P							H	H
Wouj	H	PH	PH								H	H
Chine (Dlo)	H	PH	PH	P	P							H
Koulèv	H	PH	PH	PH	PH	PH						
Perin	PH	PH	PH	PH	PH	PH						H
Franse	PH	PH	PH	PH	PH	PH					H	H
Kouch Kouch		PH	PH									

Note: P = Planting, H = Harvest

Table 12. Cropping calendar for yam varieties in the Dame Marie region of Grande Anse.												
Variety	Month											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Jòn (Bangoule)	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH
Jòn (Fran)	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH	PH
Prens	PH	PH	PH	PH	PH	PH	PH					H
Plinbit	H	PH	PH	PH	PH	PH					H	H
Toro (Garo)	PH	PH	PH	PH	PH	PH	PH				H	H
Ginen	PH	PH	PH	P	P				H	H	H	H
Makak	H	PH	PH	P	P	P					H	H
Gabriyèl Ibo	H	PH	PH	PH	PH	PH					H	H
Franse (Dlo)	PH	PH	PH	PH	PH	PH					H	H
Bakala	PH	PH	PH	PH	PH	PH	PH				H	H
Keston	PH	PH	PH	PH	PH	PH					H	H
Wouj (San)	H	PH	PH	PH	P							H
Sèl	H	PH	PH	PH	P						H	H
Tyapousèl	PH	PH	PH	PH	PH	PH						H
Koulèv	H	PH	PH	P	P							H
Bari	H	PH	PH	PH	PH	PH						H
Majistra	PH	PH	PH	PH	PH	H					H	H
Perin	H	PH	PH	P	P						H	H
Adigwe	P	P	P			H	H	H	H	H		
Palmis (Koulèv)	H	H	P	P	P							
Bago (Bagou)	PH	PH	PH	P	P	P						H
Babat	PH	PH	PH	PH	PH							H
Koun	PH	PH	PH	P	P	P						H
Akanm	H	H	PH	PH	PH							H
Posèk	H	PH	PH	PH	P	P						H
Mèsiyas	PH	PH	PH	PH	PH	PH						
Blanch	H	PH	PH	PH								H

Note: P = Planting, H = Harvest

Table 13. Proportion of planting that takes place in February and March, by yam variety.			
Variety Name	**Fields Planted in February & March**	**Total Fields Planted**	**Percent Planting in February-March**
Ginen	61	118	52
Bangoule (Jòn)	60	201	30
Fran (Jòn)	30	108	28
Keston	7	122	6
Plenbit	42	183	23
Bakala	96	235	41
Toro	43	250	17
Tyapousèl	24	89	27
Prens	39	53	74
Akanm	13	24	54
Sèl	25	43	58
Bagou	7	14	50
Blanch	16	28	57
Gabriyel	11	21	52
Wouj	16	29	55
Chin	1	2	50
Koulèv	7	15	47
Perin	28	39	72
Franse	6	26	23
Kouchkouch	1	1	100
Bari	1	7	14
Majistra	2	13	15
Palmis	1	4	25
Posèk	1	2	50

Note: Data combined for two regions.

Constraints Associated with Yam Cultivation

Farmers were asked to identify constraints to yam production. The complete list of responses is given in *Appendix D* and summarized in *Table 14.* The most frequently mentioned constraint (56 % of all respondents) was the insect larvae, or grub, commonly referred to as *maroca.* A condition referred to as "scab" (*gâle*) ranked second. Yam tubers with this condition were described as having of a black skin, with darkened outer layers of flesh which eventually turn black. However, the non-affected parts of the tuber are still edible. This description is not consistent with scab, but is consistent with the description of black rot of yam (*Rosellinia bunodes*), described by Nowell (1923). This disease causes important losses in the Plaisance area of Northern, Haiti, where SECID and PADF successfully collaborated in trials of cultural practices to reduce the incidence the disease (Jean *et al.*, 1996). It is not known if the rot, mentioned separately from *gâle* is the same or a different disease.

Table 14. Principal Problems in Yam Production Cited by Farmers in Moron and Dame Marie areas of Grande Anse, Haiti.

1. *Maroca* larvae (*Coleoptera*)
2. Black rot (*gâle*)
3. Low yield
4. Wilting and stress due to wind and excess rain (*boulaison*)
5. Tuber rot
6. Deformation of tubers (*kakachwal, Masòkò*)
7. Ants, *razemò* (another insect)
8. Other animals (rats, *soude* reptile, *palmiste* bird, *madam sara* bird, snails)
9. Destruction of other yams by Toro yam (competition)
10. Tuber too long
11. Theft
12. Labor shortage
13. Agronomic problems (poor adaptation, lack of soil conservation, poor soils)
14. Holes and cracking in tubers
15. Waste, loss of yams

These constraints are similar to the list provided by field agents (*Appendix E*), although the latter mentioned some problems not mentioned by farmers (*pyan, pichon, Madan Kléné*) and did not mention birds as a problem. *Pian* is a rotting spot; *pichon* may refer to insect and/or aphid infestation (L. Isaac, personnal communication). But it is difficult to know whether these are different problems from those provided by the farmers or different terms for the same problems. Cuvelier (1997b) characterized *pian* as black flesh within the tubercule, suggestive of *R. bunodes.* He also distinguishes between "*pian* de Duranton" and "*pian* de Chambellan" (1997c). The former he attributes to nematodes.

Birds and snails eat yam buds as they emerge from the ground (Cuvelier, 1997c), and the palmist bird can kill the young plants by repeatedly eating emerging buds. Snails were deemed to be a serious problem in Moron (Cuvelier, 1997b).

Other constraints cited by Cuvielier (1997b,c) include the high cost of planting material, reduced soil productivity, steep slopes, and anthracnose disease, which is not recognized by farmers to be a problem. Also cited were rats that break yam stems while making their nests and eat tubers in storage, pigs and goats that eat the crop in the field, thieves, vendors who sell infected planting material, drought and hurricanes. However, the most important, according to Cuvelier (1997c) are cost, declining soil fertility and *maroca*.

Maroca

Maroca causes extensive losses. Of three mounds harvested in one plot at Pierre-Louis, the farmer was not able to find one piece of yam that was edible. The tubers were filled with holes (*galeries*), with many more at the base. In the holes was a yellow substance, some of which tended toward brown and others had become brown. Such tubers are not edible. However, the top or crown of some yams that have been attacked by *maroca* are stored under a tree for eventual use as planting material, a practice which may contribute to spread of the pest. The larvae do not stay in the chopped tubers.

Description of the *Maroca* larvae

A larvae from the site mentioned above was described by Dufreine. Its body is soft, ringed, apodal (without feet), cream colored with small white hair. Its head is covered with a hard covering of reddish-brown and has two antennae of cream color. He was not able to see the black products accumulated at its rectal pouch as described by Wolcott (1927).

Varietal Sensitivity to *Maroca*

According to information gathered by the surveyors, all yam varieties are attacked by *maroca*, provided that the soil is infested, but certain varieties are more susceptible than others. Varieties most sensitive to *maroca* are those with white flesh, such as Ginen, Toro, Keston, Plenbit and Bakala. Farmers gave numerous reasons for why certain varieties are more attacked than others (*Appendix F*). Many answers turned around preference factors, such as sweetness or physical factors such softness, moisture thickness of epidermis, amount of fiber. One interesting observation was that the head does not rot easily, therefore lasting longer in the soil. The implication is that this will enable the pest to persist longer in the soil and perhaps reproduce more.

Some responses suggest that Ginen, "Jon" (Bangoule, Fran) and Toro are more tolerant of *maroca* attack than other varieties. In certain localities, farmers consider yellow yams as tolerant, since after attack, the tuber is not completely lost. The reasons mentioned by farmers regarding tolerance are diverse (*Appendix G*), relating to depth of tubers, bitterness, smell, hardness of

epidermis, and soil characteristics. Farmers referred to one variety that does not make tubers underground. Since *maroca* is a soil-borne pest, the variety, Akanm, whose tubers are formed above-ground, is not affected. Length of time in the ground may be a factor (*li pi dire nan tè, li kase pi ta*). The variety, Ginen, may avoid attack because of its relatively short cycle of five to eight months. The references to taste and smell may relate in some way to preference factors that farmers believe may repel or attract the larvae in some way.

Agronomic factors affecting *maroca* infestation

Some of the answers provided by farmers relate to agronomic considerations. Lack of rotation was cited (*yo fè kilti yanm sa pi souvan*). Comments relating to *maroca* attack being greater under food crops (here apparently referring to cocoa and coffee) is logical because of the increased moisture one would encounter under tree canopy is favorable to *maroca* (Scutt, 1990).

Because the number of seasons during which yam is planted in the same field or the interval between yam crops is important in yam attacks (Scutt, 1990), a sample of farmers was interviewed to determine the history of fields over the previous five years (1992 - 1996). Fields were also localized within the topography, and also in relation to coffee and cocoa canopies (*Appendix H*). Cases of severe attack were reported in plots where yam was cultivated constantly, as well as those plots in which yam was alternated with other crops or with periods of fallow. No data were presented.

Traditional methods of *maroca* control

Farmers use certain locally-available products and instruments in an attempt to control *maroca* (*Table 15*). Most of the solutions attempted involve products that have a strong odor. They are applied inside the mounds or on the surface. The exceptions include the use of pigs, mechanical destruction of the larvae and burning. Burning of crop residues may destroy a few larvae, although the practice is not recommended by the agronomists in the area. Mechanical destruction of *maroca* larvae is done during mound construction as the larvae are exposed by tillage. One must assume that many of the larvae are not detected during this operation.

The use of pigs is the most interesting. Pigs are placed in a field before creation of the mounds. The animals dig through the soil with the snouts in search of food, and thus consume some of the *maroca* larvae. According to the report, pigs may also be brought into the field at the beginning of tuberization.

The large number of products tried seem to suggest desperation on the part of the users. Yet fully half of the respondents do nothing to control *maroca*. Of 319 farmer responses, only 27 reported a decreased number of *maroca* larvae and 6 reported that their methods destroyed *maroca* (*Table 16*). The report does not indicate which methods were effective or the means of assessment of their effectiveness. However a summary report indicated that only the use of pigs had some effect at reducing *maroca* infestation.

Another method of control not included in *Table 15* is the use of leaves from the African tulip tree (*Spathodea campanulata*?), locally known as *tipise*. The leaves are believed to attract ants that predate on the larvae. However, the presence of the ants render harvest difficult. Cuvelier (1997c) referred to "straw" (leaves?) of various trees, including cocoa, being used by some farmers to control *maroca*.

The almost general failure of traditional methods of *maroca* control demonstrate the need for research to identify ways to effectively control the *maroca* larvae in yam. This needs to begin with collection and identification of the *maroca* insect, its life cycle and any possible alternate hosts in order to be able to propose an integrated approach to controlling the pest. This is particularly important when it applies to rotations. Among the many methods practiced by farmers, there needs to be an assessment of those that appear to be most viable, that might be improved upon and combined with other approaches.

Table 15. Methods of *maroca* control mentioned by farmers.		
Control Method	**Frequency**	**Percent**
Animal manure (*fyèl bèt*)	19	6.0
Naphtalene (*alkali*)	46	14.4
Compost or manure	2	0.6
Pine wood	14	4.4
Vetiver grass	2	0.6
Insecticide (powder, Seven, Moka, DDT)	9	2.8
Lotion (*rèv dò* perfume)	2	0.6
Pigs	2	0.6
Matches	8	2.5
Pine with lime	1	0.3
Mechanical control with machete, stick (*pikèt*)	6	1.9
Lime	2	0.6
Burning straw (*boule pay*)	1	0.3
Fish liver (*fwa gwo pwason*)	1	0.3
Citronelle grass	2	0.6
Leaves of *Inga vera* (*sikren*) with soap	1	0.3
Straw	7	2.
Chlorox (*klowòks*)	1	0.3
Salt	5	1.6
Sand with sea water (*sab ak dlo lanmè*)	1	0.3
Klerin (an alcoholic beverage distilled from sugar cane)	1	0.3
Urine	1	0.3
Nothing	185	58.0
Total	319	100

Table 16. Effectiveness of *Maroca* control methods, based upon farmer reports.		
Results	**Number of Responses**	**% of Responses**
Reduced Numbers of *maroca*	27	8.5
Death of *maroca*	6	1.9
None	286	89.7
Total	319	100.0

Conclusions

A knowledge of the production system for yam, the varieties and species grown, and the principal constraints are important to any attempt to increase the production of this economically important crop. The information contained in this report provides a picture of the importance yam in the Grande Anse. Across the regions of Moron and Dame Marie, farmers cultivate up to 40 named yam varieties. These varieties are of diverse characteristics and genetic background from at least five species of *Dioscorea*. The simple fact that farmers know the varieties by name is already an indication of the importance that farmers attach to the crop. That up to 16 different varieties are grown in a single locality is further evidence of its importance. These varieties differ in agronomic characteristics, such as cycle and ecological adaptation, and apparent tolerance to insect pests. They undoubtedly differ in culinary characteristics, such as color, taste and starch quality. So many varieties within a single locality or village would not be true of most other staple crops in Haiti. This diversity is a national heritage that should be collected, maintained and utilized to increase and diversify yam production in other areas.

While a tentative list of varieties has been compiled, there is more work to be done to validate the work done so far. A variety may have several names, and more than one variety may bear the same name. This leads to confusion that can only be clarified by careful study. For example, the variety, Ginen, is described as having both white and yellow flesh, characteristics sometimes used to distinguish between species of yam. All the varieties should be classified as to species and described, both in terms of botanical characteristics, and also agronomic and culinary qualities and names should be standardized to avoid confusion.

Yam production in the Grande Anse appears to face serious constraints due to *maroca* infestation as well as at least one important disease. Based on the limited description provided, this disease appears to be the same as that affecting yam production in Plaisance, *Rosellinia bunodes*. An important research and extension effort is needed to develop and extend integrated management practices to mitigate these constraints. Yam is a crop with great economic potential both as a high-value staple crop for local markets and as an export crop for the ethnic market in the United States. Further effort to develop this crop is warranted in order to obtain high yields of high quality tubers, free of damage by *maroca* and free of insect pests and diseases.

Recommendations

Extension

- Training should be provided to farmers in field sanitation and crop rotation, in order to protect against *maroca* and diseases such as *Rosellinia bunodes*, both of which intensify with continued cultivation on the same plots
- field staff should be trained in rapid multiplication techniques with mini-setts in order to provide farmers sources of scarce and highly desired yam varieties.
- information should be provided on best management practices for yam

Research

- A crop botanist should study the yam varieties of the Grande Anse and elsewhere in Haiti to classify them as to species, and describe the distinguishing features of different varieties.
- A collection should be made of all yam varieties. This collection should be maintained by the Ministry of Agriculture for the purposes of research and for multiplication and distribution to farmers.
- Further investigation should be conducted to determine which varieties are most appreciated by consumers and the qualities that command a good price in the market. These should be multiplied for further distribution.
- Research should be conducted by qualified entomologists to properly identify the species known as *maroca* and to characterize its life cycle and alternate hosts.
- Research on methods for control of *maroca* should be conducted, including those local control methods that appear to have some effect, as well as others using locally-available products and cultural control methods.
- the diseases affecting yam in the Grande Anse should be identified and control methods recommended.
- More information on the cropping practices, including agroforestry and soil fertility considerations are also need.
- Variety testing and agronomic research is needed

Institutional Considerations

The issue of yam production in the Grande Anse provides an opportunity for collaboration between the USAID's Hillside Agriculture Program and local institutions including the Ministry of Agriculture (MARNDR) and the Faculty of Agriculture and Veterinary Medicine (FAMV), especially in the areas of yam variety identification, and research on control of pests and diseases. Some expertise in these areas presently exists in both FAMV and CRDA. Technical assistance can best be achieved with the assistance of U.S. Land Grant Universities, in collaboration with these institutions. SECID institutions can provide technical assistance in the areas of entomology, pathology and agronomy, as well as training at the graduate level. The NGOs, Association Haitienne

pour la Maitrise des Eaux et des Sols (ASSODLO) and Organization for Rehabilitation of the Environment (ORE) have carried out activities to collect and multiply yam varieties, and could also be used for similar activities in HAP.

In addition to the Land Grant Universities, the International Institute of Tropical Agriculture (IITA) can also serve as a resource. IITA has the world mandate for yam research within the CGIAR system and can provide germplasm of improved varieties and training in various aspects of yam production and research methodology.

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Appendices

Appendix A. Resource Personnel Who Facilitated Farmer Contacts

Moron Region	Dame-Marie
Wisthly Signifils. Astier	Bruno Antoine. Ti-Cahouane
Frianance Hyppolite. Désormeaaux	Philippe Lessage. Mandou
Neptune Phamito. Lacoude	Bien-Aimé St. Hélène. Plomquette
Raymonde Jean-Louis. Montagnac	Fritz Erassaint. Lafitte
Onet Marcelin. L'Assise	Jérôme Louis. Jorgue
Christian Thezna. Gira	Roosevelt Martial. Bariadelle
Raynald Léon. Jardin	Genèse St. Mervil. Lahatte
Jean-Louis Chevalier. Mathieu	Sinmilca Neptune. Dos-Camp
Claudel Germain. Mahotière	Charles Clerveau. Gabriel

Appendix B. Yam Varieties in Grande Anse

Table B.1. Principal yam varieties in Moron region, as reported by field agents.

Localité	Common names of yam varieties											
Anote	Toro	Sèl	Bakala	Blan	Angle	Keston	Ginen	Plenbit	Franse	Tyapousèl		
Astier	Toro	Kasi	Bakala	Matinik	Dlo	jòn	Kapousèl					
Brieux	Toro	Bakala	Plenbit	Angle	Keston	Bangoule						
Chameau	Sèl	Toro	Bakala	Blan	Keston	Tyapousèl						
Désormeaux	Toro	Bakala	Ginen	Plenbit	Keston	Koulèv	Makak	Franse	Chin	Pélérine	Tyapousèl	
Didon	Toro	Sèl	Bakala	Blan	Makak	Angle	Jòn					
Gira	Toro	Sèl	Bakala	Dlo	Ginen	Plenbit	Akanm	Jòn	Tyapousel			
Grande-Plaine	Toro	Bagou	Bakala	Sèl	Ginen	Prens	Plenbit	Franse	Riral	Jòn		
Jardin	Toro	Bakala	Sèl	Perin	Keston	Ginen	Plenbit	Koulèv	Franse	Jòn	Tyapousel	Bangoule
L'Assise	Toro	Dlo	Bakala	Blan	Perin	Ginen	Plenbit	Franse	Jòn	Tyapousèl		
Julie	Toro	Bakala	Sèl	Blan	Keston	Ginen	Franse	Bangoule	Tyapousèl			
LaCoude	Fran	Toro	Bakala	Sèl	Blan	Keston	Ginen	Plenbit	Koulèv	Makak	Jòn	Tyapousel
Lory	Toro	Sèl	Bakala	Blan	Dlo	Ginen	Franse	Jòn	Tyapousèl			
Mahotière	Toro	Sèl	Bakala	Blan	Ginen	Keston	Plenbit	Franse	Jòn	Tyapousèl		
Manyòk	Toro	Blan	Bakala	Jòn	Tyapousèl							
Mapou	Toro	Bangoule	Bakala	Blan	Ginen	Plenbit	Keston	Jòn				

Table B.1. (cont.)												
Localité	Common names of yam varieties											
Marie-Kérotte	Toro	Blan	Bakala	Tyapousèl	Plenbit	Franse	Keston	Jòn				
Mathieu	Toro	Bagou	Bakala	Sèl	Blan	Prens	Keston	Sipousèl	Ginen	Plenbit	Franse	Péril
											Jòn	Gabrièl
Montagnac	Fran	Toro	Bakala	Bangoule	Sèl	Prens	Keston	Blan	Ginen	Plenbit	Jòn	
Pierre-Louis	Toro	Sèl	Bakala	Tyapousèl	Blan	Jòn	Keston					
Terre-Rouge	Sèl	Blan	Bakala	Tyapousèl	Ginen	Angle	Plenbit	Franse	Jòn			

Table B.2. Principal yam varieties in Dame-Marie region, as reported by field agents.

Localité	Common names of yam varieties												
Ti Cahoune	Toro	Bakala	Keston	Ginen	Sèl	Babat	Franse	Adigwe	Albèno	Tyapousèl			
Jorque	Toro	Bakala	Jòn	Keston	Ginen	Plenbit							
Douter	Toro	Bakala	Jòn	Keston	Plenbit	Fran							
Anse-à-Poux	Toro	Bakala	Jòn	Bangoule									
Gabriel	Toro	Bakala	Jòn	Keston	Ginen	Plenbit	Makak	Koun	Bangoule	Tyapousèl			
Boucan	Toro	Bakala	Jòn	Ginen	Plenbit	Prens	Sèl	Bari	Tyapousèl				
Mandou	Toro	Bakala	Jòn	Ginen	Plenbit	Palmis	Tyapousèl						
Carcasse	Toro	Bakala	Jòn	Keston	Ginen	Plenbit							
Bariadelle	Toro	Bakala	Jòn	Keston	Ginen	Prens	Bari						
La Hatte	Bakala	Jòn	Keston	Ginen	Plenbit	Prens	Sèl	Gwopo	Makak	Garou	Koulèv	Gabriyel	Ibo
LaFitte	Toro	Bakala	Jòn	Keston	Ginen	Plenbit	Frans	Prens	Angle	Makak	Gabriyel	Dlo	
Baliverne	Toro	Jòn	Keston	Ginen	Plenbit	Prens	Dlo	Blan					
Plonquette	Toro	Bakala	Jòn	Keston	Ginen	Plenbit	Prens	Makak	Sèl	Garo	Bagou	Akanm	
Lesson	Jòn	Keston	Plenbit	Fran	Garo								
Phare-Rouge	Toro	Bakala	Keston	Ginen	Prens	Angle	Palmis	Blanch	Bangoule				
Passe-Barbier	Toro	Bakala	Jòn	Keston	Ginen	Plenbit	Prens						
Déraymond	Toro	Bakala	Jòn	Keston	Ginen	Makak							
Dos-Camp	Toro	Bakala	Jòn	Keston	Ginen	Plenbit	Prens	Makak	Wouj	Koulèv	Gabriyel	Sèl	
												Blanche	

Appendix C. Principle Yam Varieties and Synonyms

1.	Jòn	- Fran, Kasi, Kasyis pousyè. Angle, Paranse
2.	Bangoule	- Jòn, Angle, Salomon, Dous
3.	Ginen	
4.	Keston	- Dlo
5.	Plenbit	
6.	Bakala	
7.	Toro	- Garo. Garou. Touspik. Iral. Riral. Tégal
8.	Makak	
9.	Tyapousèl	- Kapousèl
10.	Prens	
11.	Akanm	
12.	Sèl	
13.	Bagou	- Bago
14.	Blanch	- Blan
15.	Gabriyèl	- Gabriyèl Ibo
16.	Matinik	
17.	Wouj	- San. Divin, Bon
18.	Chin	- Dlo
19.	Koulèv	- Bakala
20.	Perin	
21.	Frans	- Dlo
22.	Kouchkouch	
23.	Bari	
24.	Majistra	
25.	Adigwe	
26.	Palmis	
27.	Babat	
28.	Koun	
29.	Posèk	
30.	Mèsiyas	

Additional Synonyms listed by CARE (1996) in addition to those cited above:

Toro:	Garulou, Bagou, Polestè, Pa pou fanm
Jòn:	Kouchkouch, Kasius, mangle
Kenston:	Blan
Sèl	Kouchkouch
Kasi	Fran
Angle	Kasius

Appendix D. Constraints Reported by Yam Farmers.

Table D.1. Groups of problems mentioned by farmers and their frequency.

Problems	Number of Cases	%
Maroca	536	26.2
Scab† (Black rot)	46	2.3
Low yield	132	6.5
Wind & rain (*Boulaison, "chode"*, i.e. wilt, immature tubers)	68	3.3
Rot	24	1.2
Deformed tubers (*kakachwal, Masòkò*)	26	1.3
Other insects (ants, *rasemò*)	10	0.5
Other animals (rat, *soude, palmiste* bird, snails, etc.)	94	4.6
Competition ("destruction" by Toro yam)	1	-
Tuber too deep	7	0.3
Maroca, scab (black rot)	85	4.2
Maroca, low yield	160	7.8
Maroca, wind & rain	89	4.4
Maroca, rot	72	3.5
Maroca, deformed tubers	10	0.5
Maroca, other insects	19	0.9
Maroca, other animals	8	0.4
Maroca, competition	3	0.1
Scab (black rot), low yield	10	0.5
Scab (black rot), wind & rain	7	0.3
Scab (black rot), deformed tubers	1	-
Scab (black rot), other insects	1	-
Scab (black rot), other animals	28	1.4
Scab (black rot), competition	2	0.1
Problems	**Number of Cases**	**%**

Table D.1 *(cont'd)*. Groups of problems mentioned by farmers and their frequency.		
Problems	**Number of Cases**	**%**
Low yield, wind, rain	15	0.7
Low yield, rot	10	0.5
Low yield, deformed tubers	4	0.2
Low yield, other insects	2	0.1
Low yield, other animals	3	0.1
Holes and cracking	4	0.2
Wind & rain, rot	1	-
Wind & rain, deformed tubers	1	-
Wind & rain, other animals	3	0.1
Wasting	1	-
Labor	1	-
Deformed tubers, other insects	1	-
Deformed tubers, other animals	3	0.1
Disappearance	1	-
Other insects, other animals	4	0.2
Other insects, competition	3	0.1
Maroca, tuber too deep	1	-
Maroca, low yield, scab (black rot)	8	0.4
Maroca, scab (black rot), wind & rain	3	0.1
Maroca, scab (black rot), rot	2	0.1
Maroca, scab (black rot), deformed tubers	1	-
Maroca, scab (black rot), other animals	8	-
Maroca, low yield, wind & rain	41	2.0
Maroca, low yield, rot	17	0.8
Maroca, low yield, other animals	1	-
Maroca, wind & rain (note: already mentioned)	27	1.3
Maroca, labor	9	0.4

Table D.1 *(cont'd)*. Groups of problems mentioned by farmers and their frequency.		
Problems	**Number of Cases**	**%**
Maroca, other insects and animals	4	0.2
Scab (black rot), low yield, rot	6	0.3
Scab (black rot), wind & rain, deformed tubers	1	-
Scab (black rot), rot, other animals	2	0.1
Scab (black rot), deformed tubers, other animals	2	0.1
Agronomic problems, *maroca*	9	0.4
Low yield, wind & rain, rot	12	0.6
Low yield, rot, competition	3	0.1
Other animals, tubers too deep	2	0.1
Other animals, theft	3	0.1
Tubers too deep, scab (black rot), other animals	1	-
Maroca, scab (black rot), theft	2	0.1
Maroca, scab (black rot), low yield, wind & rain	12	0.6
Maroca, scab (black rot), low yield, rot	4	0.2
Maroca, scab (black rot), low yield, other animals	2	0.1
Maroca, wind & rain, deformed tubers	1	-
Maroca, low yield, deformed tubers, other animals	2	0.1
Maroca, wind & rain, agronomic problems	2	0.1
Scab (black rot), rot, wastage	5	0.2
Agronomic problems, holes and cracking	5	0.2
Maroca, scab (black rot), low yield, rot, other animals	1	-
No problems	345	16.9
Total	2043	100

†*Gâle*, meaning scab, in original text probably refers to Black Rot (*Rosellinia bunodes*). See discussion under "Constraints Associated with Yam Cultivation".

Appendix E. Constraints to Yam Production Cited by Field Agents

Table E.1. Constraints to yam production in Moron region, according to Field Agents	
Locality	**Constraint**
Mattieu	*maroca*, scab†
Désormeaux	*maroca*, scab, leaves "burned" by rain
Chameau	low yield, due to excess rain and sun
Manioc	*maroca*, snail, holes, *pichon*, excess rain and sun
Terre-Rouge	scab, *maroca*, excess rain and sun
Lory	ants, "*pyan*", scab, *pichon*
Anote	*maroca*, scab
Mapou	*maroca*, scab
Lassise	*maroca*, *boulaison*‡
Julie	*maroca*, "*chode*"§
Grande Plaine	*maroca*, scab
Pierre-Louis	*maroca*, snail, ants, scab, *boulaison*, holes, excess rain and sun
Marie-Kérotte	*maroca*, scab
Mahotière	*maroca*, scab, rot
Gira	*maroca*, "*koukouj*", scab, *boulaison*
Didon	*maroca*, scab
Astier	scab
Lacoude	*maroca*, scab, *boulaison*
Jardin	*maroca, pichon*
Montagnac	*maroca, boulaison*, rot, "*chode*"
Brieux	scab

†*Gâle*, meaning scab, probably refers to black rot (*Rosellinia bunodes*). See "Constraints Associated with Yam Cultivation" in main text.
‡wilting due to wind and excess rain
§immature tubers

Table E.2. Constraints to yam production in Dame-Marie region, according to Field Agents.	
Locality	**Constraint**
Gabriel	ants, *maroca*, scab†
Plonquette	*maroca*, caterpillars, ants, scab, *pichon*, *chode*§
Lafitte	excess wind and sun
Jorgue	*maroca*, scab, wind, excess rain and sun
Bariadelle	*maroca*, *chode*, *pichon*
Mandou	*maroca*, scab
Lesson	*maroca*, *chode*
Phare-Rouge	*maroca*
Passe-Barber	*maroca*, *pian*, scab
Baliverne	*maroca*, excess rain, wind
Déraymond	*maroca*, burning of leaves
Carcasse	*maroca*, scab, excess rain and sun
Boucan	*maroca*, scab
Anse-à-Poux	*maroca*
Douter	*maroca*, scab, excess rain
LaHatte	*maroca*, burning of leaves
Dos-Camp	*maroca* (Madan Kléné), excess rain and sun, lack of plants
Ticahouane	*maroca*, rats, *pichon*, drought, poor soil.

†*Gâle*, meaning scab, probably refers to black rot (*Rosellinia bunodes*)
§immature tubers

Appendix F. Reasons Varieties are Susceptible to *Maroca*.

Table F.1. Farmers explanations as to why certain varieties are more attacked by *maroca* than others.	
Li dwe pa anmè	It must not be bitter
Li donnen fon nan tè	it yields [makes tubers] deep in the soil
Li pa konnen	He doesn't know
Li pa renmen l	It doesn't like it
Li gen bon gou pou li	It tastes good to it
Po li pi fin	Its skin is thinner
Li pi fasil pou li	It is easier for it
Li pi dous	It is sweeter, or better tasting
Li pa anmè	It is not bitter
Li pi mou	It is softer
Li gin gwo san	It is nervous
Yanm sa-a fèt anba danre	The yam is grown under food crops
Maroka la plis enba danre	*Maroca* is found more under food crops
Li bon pou li	It is good for it
Li jwen you grès la dan l	It finds fat [food] in it
Li gen lè jwenn you bonte landan l	It seems to find goodness in it
Li kase pi ta, li pi douce	It forms later, it is sweeter, or better
Se li li jwenn pi plus nan tè-a	It finds more of it in the ground
Li pi dire nan tè a	It lasts longer in the soil
Tè ya pa nourisan	The soil is not nutritious (rich)
Yo fè kilti yanm sa a pi souvan	They cultivate this yam more often
Tèt li pa pouri fasil, li pi dire nan tè	The head does not rot easily, it lasts longer in the soil
Li pa gen fil, se sak fè li renmen l konsa a	It does not have string [fibers], that is why it likes it like that
Li dwe jwenn kèk vitamin ladann	It must find some vitamins in it
Li pi sèk, se pou tèt sa li manje l pi plis	It is drier, that is why it eats it more
Viann li ka twò mou	Its meat (flesh) may be too soft
Li pi fenyan, li pi bon pou li	It is softer, it is better for it
Maroka manje tout yanm menm jan	*Maroka* eats all yam alike

Appendix G. Reasons Why Certain Yams are Attacked Less by *Maroca*

Table G.1. Responses by farmers as to why some yams less attacked by *maroca*	
Response in Creole	English
Li pa desann fon nan tè	It (tuber) doesn't grow deep in soil
Li pa konnen	He does not know
Li anmè	it is bitter
Li gen lè gen fòs	it must be strong
li pa donnen pre bit	it does not yield close to the mound
li pa donnen a tè	it does not make [tubers] in the ground
li gen lè pa renmen l	it must not like it
se yon towo	it is a bull (implying it is strong and bad)
odè li ka pi fò ke lòt yo	its smell must be stronger than the others
li gen lè pi rezistan	it must be more resistant
po li gen lè pi di ke lòt yo	its skin must be stronger than others
tè ya pi gra nan zòn li a	the soil is richer where it is growing

Appendix H. Topographical Positions used in Survey

Nan fon	valley bottom
Sou do mòn	mountain top
Nan plèn	on plain
Bò dlo	along side stream
Sou plato	on plateau
Tè pandye	sloping land
Sou do mòn anba kafe ak kakawo	on hilltop under coffee and cocoa
Nan fon anba kafe ak kakawo	valley bottom under coffee and cocoa
Tè pandye anba kafe ak kakawo	sloping land under coffee and cocoa
Lòt kote: nan plèn anba kafe ak kakawo, nan gòj....	Other place: on plain under coffee and cocoa, in gorge, etc.