TRIP REPORT OF THE INTEGRATED CROP PROTECTION STUDY TEAM VISIT IN THE REPUBLIC OF CAMEROON AND THE INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE IBADAN, NIGERIA

USAID Contract No. DSAN-G-0203

CONTENTS

THE REPUBLIC OF CAMEROON

INTRODUCTION

The Republic of Cameroon was visited from May 3 until May 14 by Drs. Jack Drea, Entomologist and Team Leader, Barbara Yates, Rural Sociologist, T. T. Hebert, Plant Pathologist, and J. D. Paschke, Entomologist and ICP Planning Coordinator. Subsequent to the visit in Cameroon the team travelled to Nigeria to visit with the staff at the International Institute of Tropical Agriculture (IITA), Ibadan. Because of airline difficulties the team spent only two days at IITA.

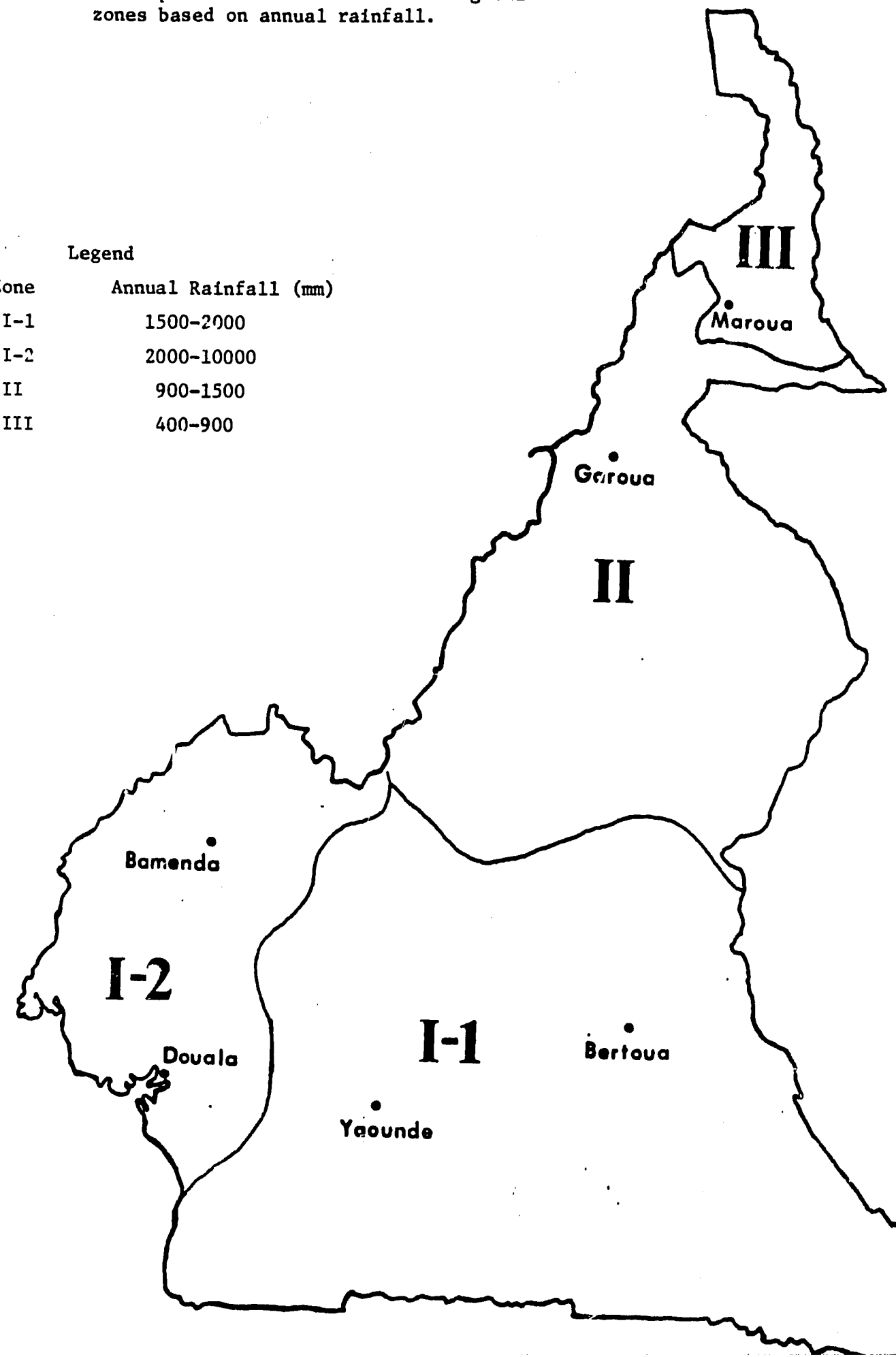
Our visit in Cameroon was hosted by Dr. B. D. Perkins, USAID Regional Food Crop Protection Project. Dr. Perkins had developed an extensive itinerary for our short visit and a copy of the itinerary is presented in Appendex I. A list of persons visited in Cameroon and IITA will be found in Appendices II and III.

The team met with policy level people at Yaounde, the capital, in the Ministry of Agriculture and other relevant administrative offices as well as USAID Mission personnel. At the Provincial centers the team met with provincial delegates and with middle level personnel associated with the USAID Regional Food Crop Protection Project, 625-0928. While in the field the team had the opportunity to meet various donor agency officials such as USAID field officers connected with other AID projects, Food and Agriculture (FAO) representatives, Peace Corps personnel, and the project director of the International Union for the Protection of the Child.

ECOLOGICAL REGIONS

The Republic of Cameroon covers about 183,500 square miles in west-central Africa forming an irregular wedge (chicken shape) extending from the Gulf of Guinea (2^{o} N) to Lake Chad (13^{o} N) 700 miles inland (Figure 1). Behind the south-western coastal zone the land rises to mountains and plateaus extending more than 500 miles inland before descending to a flat plain of moderate elevation in the far north.

Fig. 1. The Republic of Cameroon.
The map is divided into four ecological zones based on annual rainfall.



Cameroon may be divided into four ecological regions based on the milimeters of annual rainfall, which in turn impacts on vegetational types and therefore related cropping systems. Natural vegetation in the south and southwestern coastal regions is dense, tall evergreen rain forest. On the southern and southwestern plateaus, about 100 miles from the southern border, and equidistant from the southwestern coast, the natural cover is a mixture of evergreen and deciduous forests. Deeper inland at about 6^{o} N the natural vegetation is wooded savanna which gradually changes into open grassland and fewer trees as one progresses northward. Much of the northern plain produces few trees, scrub and sparse grasses and is more typical of the Sahelian region.

As a result of the diversity of ecological conditions, Cameroon offers a great potential for research in a variety of tropical farming systems and on a diversity of crop production constraints.

PRIORITY FOOD CROP SYSTEMS

Generally, planting, maintenance and harvest of the food crops are women's business, men entering only in the initial phase of clearing the bush. Men's agricultural activities are mainly concerned with the production of export (cash) crops such as cacao or coffee. There is a tendency for men to enter into the sphere of food crop production but only for those crops which are grown for the market, eg. plantains, maize, tomatoes. Women sometimes have small plots of food crops grown for market and they frequently sell surpluses from their main food crops.

Western and Northwestern - In those places where the team had access to small farm food crop production the traditional multiple cropping systems were extant. However, the team was informed that some monocropping is practiced in the region though such was never observed first hand. Apparently there is an attempt to monocrop maize. In many places traditional slash and burn, shifting cultivation is practiced. However, because of the more densely populated areas this practice has been given up due to the lack of sufficient arable land for farmers to continue the shifting cultivation system.

No reliable data are available on the areas of land in different crops. The occupation of the land is permanent or semi-permanent. The fertile soil of the Bafoussam district have maize and coffee as the major crops. In the less fertile areas less maize is grown and tuber crops dominate along with coffee and bananas.

The typical small farm multiple cropping system is usually less than a hectare in size and is intercropped with a variety of plants. The soil is arranged in a series of high crowned mounds and in each of these mounds are interplanted corn,

cassava, taro, cocoyam, beans, yam, sweet potatoes and peanuts. All or a portion of the above may be intercropped in combination with bananas and/or plantain.

In addition banana and/or plantain with coffee and intercropped with an understory of yam and/or sweet potatoes, taro, and cocoyam were observed. In this situation an export crop (coffee) is incorporated into the food crop farming system. It is possible that similar export crops (cacao, tea) may be grown together with food crops but this was not observed by the team members.

In some areas paddy rice is grown but because of the time of year the team did not observe rice stands in the field. In those rice growing areas observed, and which were cropped the previous year, it was apparent that these fields were monocropped. This was a limited observation and whether or not paddy rice fields are multicropped was not determined. Rice is utilized by the local population and is also exported.

A study of cropping systems and cropping densities suggests four basic field types:

1. Coffee interplanted with food crops
2. Pure food crop fields, often found near the farmers dwellings, carrying a wide variety of commodities
3. Fields mainly planted to maize and groundnuts
4. Mainly groundnuts with low densities of other crops

The dominant food crop of 1 and 2 above in the Bafoussam district is maize. In other districts tuber crops, especially yams (O. dumetorum) are more dominant.

The following is a rank order in terms of value of crops grown in the Northwest Province. Ranked from highest to lowest they are: cassava, cocoyam, taro, beans, maize, arabica coffee, yams, groundnuts, bananas.

The most important export crops in the province in terms of value, high to low are: arabica coffee, beans, maize, irish potatoes, groundnuts, robusta coffee, and rice.

The major cash crops marketed locally in terms of value from high to low are: cassava, taro, yam, bananas, tannia, beans, groundnuts, plantain, sweet potatoes, maize, and irish potatoes.

The above data on valuation of crops is taken from Agricultural Marketing in the Northwest Province, United Republic of Cameroon, edited by John Van G. Lewis, Office of World Development and Development Adm., DSB, USAID. pgs. 36-37.

Not listed in the above export crops are tea, cacao, and palm oil. Other important crops not listed in the above are fruits such as mango, papaya, citrus, guava, pineapple, cola, tomatoes, plantain, and the vegetables cabbage, carrots, leeks, cucumber, lettuce, cauliflower, eggplant, parsley, onion, red pepper and bell pepper,

beans, ngon, and cowpeas. All of the above are found in the local markets in varying abundance.

The main planting season is at the beginning of the rains in March or April. In some areas of the Western Province this is practically the only planting season, the fields being left to the tuber crops after the harvest of the short cycle crops. In and around Bafoussam the fields are generally planted again in the second half of the rainy season, mainly to cowpeas and sometimes tobacco. Because of the sloping terrain most fields are planted along contours. Food crops grown as an understory to coffee benefit from fertilizer provided the latter. Little or no burning of crop residues is practiced and household refuse and kitchen ashes may be added when fields are near houses or women will collect leaves elsewhere and add to their fields. Beds are shifted each year to cover the previous year crop debris.

In both of the above areas fallow fields may be found primarily at the top of the slope where the soil is generally of a poor quality. In the first growing season after fallow groundnuts in monoculture or groundnuts mixed with low densities of maize and yams are planted. With reasonable production these fields will be planted with a more complete association the following year.

This area of Cameroon denotes an advanced stage in the evolution of food crops growing under humid conditions and high population pressure, as judged by the adjustment made by the people to their environment. The soil is considered a scarce asset and a concerted effort is made to safeguard productivity.

Soil erosion is a serious problem even though farmers practice contouring. Much of the black top soil will be found in increasing depth as one descends the slopes.

Center South Province - As in the case of the Western and Northwestern Provinces no reliable data are available of the total area of arable land. An estimated 70% of the land is arable and it is calculated that the available land for food crop production is 1.2 and 1.0 hectare per individual including fallow. It has been shown by Guyer (1977) that an average woman of the area has to feed four persons (including herself), and she plants 30 ares of food crop fields per year or 7.5 ares per person. With 1.0 hectare per person this results in an average cycle of cropping and fallow of 13 years. With the cropping period of the principal food crop field (groundnut plus associates lasting up to two years), the average cycle would be two years of cropping and 11 years of fallow if all were in groundnuts. Because of irregularities in population distribution, variations from shorter to longer cycles are to be expected from area to area. In general this region is considered to be under "semi-permanent agriculture" or more frequently "recurrent cultivation" based on Allan's land use factor (Allan, 1965). A "semi-permanent agriculture" system is generally

considered detrimental to soils which results in reduced yields in the humid tropics unless measures are taken to reestablish fertility from external sources. It is judged that where semi-permanent practices are employed the production will soon be critically short.

In this area of Cameroon there are mainly two types of food crop fields. They are:

1. "groundnut fields"
2. "ngon fields"

Ngon is Cucumeropsis mannii utilized as a fruit vegetable. There is no English or French equivalent. Ngon is a climbing vine, planted for its seeds, which are rich in protein, and which belongs to the Cucurbitaceae.

Groundnut fields are planted in areas cleared and burned by men. The women work the field to a shallow depth using the traditional short handled hoe and they are planted more or less simultaneously. Generally all crops are planted at the same time. Cassava may be planted after the groundnuts are well established. Planting dates of different fields may vary up to a month.

A variety of commodities may be observed growing in groundnut fields and these are listed in Table I. The relative densities of these crops vary in the various fields of the area but the predominant crops are groundnuts, the most important, cassava, tannia (Xanthosoma), maize, and plantains.

According to Mutsaers et al. (1978) the surface of each field, as far as worked by the same woman, average 15-20 ares. In some cases much larger fields, up to 40 ares are encountered (Guyer, 1977) as well as much smaller ones, the latter belonging to the elderly.

The fields are weeded once or twice during the first season, often not more than a few weeks prior to groundnut harvest, which apparently facilitates the harvest. Tannia leaves may be trimmed to avoid competition for light with groundnuts.

After harvest of the groundnut the field is left to the remaining crops, mainly root crops and plantains. Maize may be planted again between tubers or tannia and cassava may be added if tuber density is low.

Harvest of tuber crops commences at the earliest 9 months after planting but the main harvest of these crops takes place after a year. Tubers are dug as needed and may be replanted immediately and leaf vegetables are harvested throughout the growing period starting about two months after planting. Young cassava and tannia leaves are used similarly for vegetables. Plantains do not start producing until a year and a half after planting.

TABLE I Food crop species occurring in groundnut fields (after Mutsaers et al, 1978)

	Scientific name	Vernacular names			Uses
		Ewondo	French	English	
1	Allium cepa		oignon	onion	vegetable
2	Amaranthus sp.	folong	amaranthe	amaranth	leaf vegetable
3	Ananas comosus		ananas	pineapple	fruit
4	Arachis hypogea	Owondo	arachide	groundnut	grains
5	Capsicum frutescens		piment	chilly	spice
6	Carica papaya		papaye	pawpaw	fruit
7	Citrus spp.		agrumes	citrus	fruit
8	Colocasia esculenta	Mobuda	taro	cocoyam	tuber
9	Corchorus olitorius		corette petagère	jute	leaf vegetable
10	Cucumeropsis mannii	Ngôn			fruit vegetable
11	Cucurbita sp	Mindzeng			leaf vegetable
12	Cucumis sativus	Ongbalag			leaf vegetable, grains
13	Dioscorea spp		igname	yam	tuber
14	Elaeis guinensis		palmier à huile	oilpalm	oil
15	Hibiscus esculenta		gombo	okra	fruit vegetable
16	Ipomoea batatas		patate douce	sweet potato	tuber
17	Lycopersicon esculentum		tomate	tomato	fruit vegetable
18	Manihot esculenta	Mbong	manico	cassava	tuber
19	Musa (AAA) 'Gros Michel'		banane	banana	fruit
20	Musa (AAB, Plantain)		plantain	plantain	fruit
21	Nicotiana tabacum		tabac	tobacco	tobacco
22	Saccharum officinarum		canne à sucre	sugar cane	sugary juice
23	Solanum nigrum	Zom			leaf vegetable
24	Solanum tuberosum		pomme de terre	potato	tuber
25	Solanum sp.	Zom			leaf vegetable
26	Solanum sp.	Zong			fruit vegetable
27	Talinum sp.				leaf vegetable
28	Xanthosoma sagittifolia	Mecaba	macabo	cocoyam	tuber
29	Zea mais	Fon	maïs	maize	grains

Ngon fields - Undergrowth is cut and most trees are felled during the dry season. The refuse from the cutting operation is burned and the crops are planted at the beginning of the rainy season between the fallow debris and without tillage. The principal crop is ngon interplanted with maize or with maize and plantain, or sometimes with cassava and tannia. The forest debris serves as natural stakes for the ngon plants and a good crop is considered a sign of high fertility. The plant is rarely planted on lands other than newly cleared forest areas although sometimes isolated plants may be found climbing up the odd oil palms of groundnut fields. Ngon fields are usually larger than groundnut fields averaging 0.3 hectare (Guyer, 1977).

After harvest of ngon the field is fully or partially planted to groundnuts and associates either immediately or in the following season if no plantains were planted with the ngon. Renewed burning and clearing of the field is necessary.

Where tuber crops and plantains have been intercropped with ngon the field is left to the tuber crops and plantains after ngon harvest and may be planted to groundnuts and associates a few years later. When ngon is intercropped with tannia both crops are harvested after seven months and groundnuts are grown the following year, and thus will enter into the groundnut field system. These fields will not return to very long fallow periods again. Much of the foregoing description of farming systems of the Western, Northwestern and Center South Provinces is based on an analysis by Mutsaers et al. (1978).

Northern Province - The narrow neck of the Northern Province is among the northernmost areas reached by the moisture bearing winds from the equatorial rain belt. These southerly winds may bring as much as 100 milimeters of rain to the area of Garoua and about 75 milimeters, more or less, to the area more northerly. Most of the rainfall is concentrated into a five month period from May to September in the Garoua area and into a shorter period near Lake Chad. During the remainder of the year the northern region is dominated by the northerly drying winds from the Sahara Desert.

An important sub-region of the province is the flood plain of the Chari and Logone rivers which for part of the year supports marsh grasses and a variety of other swamp plants which subsist in the waterlogged flood plain. Similar but smaller areas exist East of Garoua on the Benoue River and its major tributary, the Mayo Ke'bi.

Under optimum conditions the fields are planted at the beginning of the rainy season with a mixture of different food crops characteristic of the region. Often the fields may require replanting because of an erratic rainfall pattern which has interferred with proper seed germination and establishment of a suitable stand.

In the Northern Province sorghum, millet, cowpeas, and rice (food grains) and groundnuts are the main food crops and are grown on more than 80% of the areas under

cultivation. Sorghum is produced in the wetter areas while millet replaces sorghum in those areas with minimal available moisture.

Additional food crops include onions, pimento, tomatoes, sorrel, eggplant, carrots, lettuce, and the fruits, mangoe, guava, citrus fruits. Bananas are grown but only minimally as contrasted to the southern provinces.

The food grains are generally planted as a monoculture or interplanted with groundnuts or cowpeas. Little or no cultivation of the soil takes place and planting is done by dropping seeds in a hole made by a sharpened stick. It is assumed that vegetable crops are intercropped but this was not determined as no crops were planted during the period the team visited the Northern Province.

Cassava is also a main subsistence crop and is interplanted with sorghum or millet in some areas. Maize and paddy rice are grown along the Logone River but most people of the north rely on drought resistant sorghum and millet.

FOOD CROP PRODUCTION CONSTRAINTS

Pest Related

The team was left with the impression that in many food crops the pest complexes have not been identified and that only the most obvious are recognized as problems. When questioned regarding specific problems our Cameroonean hosts lacked specific information regarding the less than obvious pests. However in visiting local markets it was evident that insects damaged much of the produce being marketed. Preharvest damage was observed on most commodities and ranged from minimal to severe.

Pest related constraints are considered here only as indicative of some of the problems and they will be presented as they were identified in each of the regions visited.

Western, Northwestern and Center South -

Insects - Unidentified insect damage on roots and stem borers (Chilo and Sesamia sp.) are of major importance on maize. Beetles are important on the tubers of cocoyam. Thrips are a problem on onions. We noted damage due to lepidoptera on cabbage and other vegetable crops in local markets. Sweet potato weevils (Cylas sp.) are important where sweet potatoe is grown.

Beans and cowpeas are attacked by flower thrips (Megalurothrips sjostedti) and are judged one of the most important pests of cowpea, frequently responsible for complete loss of the crops. The legume pod borer (Maruca testulalis) is a serious pest and widely distributed pest of beans and cowpeas. The brachids, Callosobrachus maculatus, and Acanthoselides obtectus are serious field to storage pests and may cause 30-70%

loss within six to nine months after storage. The cowpea aphid, Aphis craccivora, is not only important to cowpeas but is also a serious pest to groundnut. It also transmits cowpea mosaic virus.

Cassava mealy bug (Phenacoccus manihoti) was apparently introduced into East Africa from Asia and has rapidly spread to most cassava growing areas of Africa. It is considered a serious constraint to cassava production. The cassava green spider mite is also considered a major pest, the attack most serious on young plants and during dry periods of the year. Grasshoppers may seriously damage cassava by defoliation and stripping the bark. Nymphs initially feed on Eupatorim sp. and other weeds and later moving to cassava during the fourth instar.

Diseases - Blast (Pyritularia oryzae) is a major disease problem of rice. Leaf diseases such as blight (Helminthosporium turcicum) and rust (Puccinia sorghi) as well as smuts and maize streak are serious problems of maize. Wheat is a crop which is becoming more important in Cameroon and one which may become a plantation crop. The principal disease problems on wheat are rust, Septoria, and Helminthosporium. If wheat is produced in extensive monoculture these diseases will undoubtedly become more severe. Cocoyam has a serious disease identified as Pythuim debaryanum but this is a questionable diagnosis.

Supposedly a Cercospora leaf spot disease has essentially erradicated citrus on the Ndop plain. This was reported from other areas of the region too. The organism was identified as C. angolensis. It is unusual for Cercospora to kill trees and whether or not the organism was responsible for the epiphytotic can't be determined from the reports.

There are unidentified root diseases of plantain and it is questionable how much attention is paid to pests of plantain. A number of yam diseases were alluded to and they included mosaic (virus), Anthracnose (Colletotricham sp.), and other diseases such as "die back".

Anthracnose in cowpeas and beans and caused by Colletotrichun lindemuthianum is a widely distributed and serious pathogen particularly where the hosts are monocropped. The disease may be spread from diseased seed or disease in plant debris.

Groundnuts are infected by the aphid transmitted virus causing a rosette disease. The disease apparently varies in its severity.

Cassava Mosaic is apparently caused by a virus and is considered a serious disease. There is evidence that the causual agent is transmitted by whiteflies of the genus Bemisia or by planting diseased cuttings. Other diseases of lesser importance are bacterial blight and anthracnose of cassava.

Nematodes - Nematodes were indicated as serious pests of vegetables. A number of root knot species (Meloidogyne sp.) are known to be serious pests of cowpeas. Apparently these root knot nematodes are spread throughout the tropics and may become serious pests in a short time under conditions of monoculture and irrigation in the drier areas. In the humid tropics they are a continual pest. Species other than root knot nematode are known or suspected pests of crops in the humid tropics.

Weeds - A number of species of weeds appeared to be important namely a bracken fern which infested range and cultivated lands, Eupatorium sp., sedges (Cyperus sp.), and a number of unidentified species of Echinochloa and Imperata annual and perennial grasses, were indicated as pests. It was reported that the bracken fern had only recently become an abundant weed species. It appeared that grasses were the major weed problem existing in the multiple cropping systems observed. Striga was indicated as a most serious pest parasitic weed.

Birds and Rodents - Many indications that birds and rodents are pests. No significant information was provided concerning losses or the species involved. There may not be the same problems in these provinces as found in the north.

Northern Province -

As above, the pests are given as they were indicated through our contact with local specialists. There are probably fewer species of pests in the north because of the reduced diversity in cropping systems and because of the reduced rainfall with long periods of dry fallow.

Insects - The cowpea aphid, Aphis craccivora, is a serious pest because it transmits viruses as well as building up in high density populations. The team was told that aphids have severely attacked groundnuts and that they have caused high losses (50%). It was stated that rosette is minimal and that the abundance of aphids was causing plant mortality. Furthermore, aphids seemed to build up on plants grown on poor soils and the severity of attack by the aphids seemed to be increasing in frequency. It was not determined what physical relationship the groundnut fields had with cotton fields, but the treatment of cotton with insecticides (9-10 times/yr.) may be causing an indirect effect on the abundance of aphid predators in groundnut fields.

Bruchids as already mentioned are important field infesting storage pests of cowpeas as in other areas where cowpeas are grown for storage. Aphids are important on cowpeas as pointed out above.

Termites are a major pest to field grown cassava and waneou attacking young as well as older plants and are difficult to control. We were informed that termites were a problem on other crops, including sorghum, but this was not discussed in detail.

Grasshoppers are considered as pests of sorghum, millet, rice and cassava. Whether or not these pests are in periodic outbreaks was not determined but apparently they are in damaging numbers each year.

Diseases - In general diseases are less important in the arid areas of Cameroon. Smuts and rusts are important diseases of sorghum and rusts are important on wheat. The smuts and rusts of sorghum were not identified specifically but Sphacelotheca sorghi and Puccinia spp. are responsible for these diseases on sorghum and wheat respectively. Rice blast is considered a problem in those areas where rice is grown and where maize is produced maize streak caused by a leafhopper vectored virus is a problem. An unidentified "yellowing" of rice may result from insect or nematode infestation.

As pointed out above groundnut rosette caused by a virus which is transmitted by the aphid Aphis craccivora does not seem to be of great importance. Rosette occurs in groundnut fields but is not believed a serious constraint to groundnut production in this area of Cameroon.

Leaf diseases of tomatoes were reported as damaging as was Cercospora sp. infecting and killing of citrus. This limiting factor of citrus production requires further examination to determine the role of Cercospora in tree mortality.

Weeds - Striga is the most important weed of upland rice, sorghum, millet and maize. Other weeds were not specifically mentioned but annual grasses are believed to be important. Unfortunately, the team could not observe weeds in the field because of the timing of the visit.

Nematodes - Not mentioned specifically by Cameroonians in our discussions were problems caused by nematodes. However it is known from discussion with Dr. Fields Caveness (IITA) that nematodes can be important in these arid areas. Of those mentioned the root knot nematode is probably most important. The white tipped nematode which attacks upland rice may be important but can be controlled by rotation and clean seed.

The root knot nematodes will probably be a severe problem as irrigation is developed in the area.

Birds - The birds, Quelea quelea, Ploceus cucullatus, and Passer buteus devastate sorghum, millet and rice fields and are probably one of the most severe pests in grain production. Other species may be important too as it was pointed out that some migratory species are a problem. It was underlined that bird problems are difficult to control because they fly across political boundaries.

Non-pest Related

As already mentioned, in some areas of Cameroon traditional shifting cultivation has been restricted by the increasing density of populations. In the Northwest and Western Provinces arable acres are becoming acutely short requiring continual farming

system operations. Obviously the fertility levels of continued farming without the addition of adequate fertilization causes reduction in the productivity of food crops. Undoubtedly, but not as yet documented for Cameroon, such practices will allow the build-up of soil arthropods which may in turn further reduce crop yields.

In the Northern Province the lack of adequate rainfall, particularly in the recent drought years, limits agricultural production. Irrigation would alleviate the problem and allow increased production of food crops.

One of the major non-pest related production constraints, and perhaps the most important, is the agricultural policy of the Cameroonian government. It was the impression of the study team that the main policy constraint to the production of food crops has been the emphasis on export crops, both during the French colonial period, and more recently since Independence. The Republic of Cameroon has been in a fortunate position of not having to import important food crops and as a result have emphasized export crops in order to generate foreign exchange to purchase capital equipment, etc. from western Europe and America.

The emphasis on export crops became obvious to the team as discussion with Cameroon administrative personnel progressed. Support of export crops takes the form of advice to the farmer, supplies of seed, fertilizer, and pesticides, etc. through parastatal companies such as Sodécoton. No such infrastructure appeared to be available for the producer of food crops and apparently no plans are in progress to accommodate this fundamental agricultural system.

Related to the above policy is the apparent lack of an effective extension service to assist in the deffusion of available information on new agricultural techniques to the small scale food producer (women). Where the producer of export crops (men) have the benefit of the most up to date information concerning production techniques, the food crop producer has little or no assistance.

Lack of credit is another important production constraint for the producer of food crops. Small food crop producers operate with virtually no accumulated capital and it is therefore necessary to have title to land or some other collateral which loans are made, or the producer must belong to a cooperative, characteristically the parastatal companies, which provides credit for the necessary cropping inputs.

Similarly, the disorganized marketing structure for food crops is an important constraint to increased food crop production. The parastatal companies provide organized stabilized marketing for export crops but the organization of anything similar for the small scale food producer is of most recent origin and limited in scope. Organized plans for the regular supply of food stuff to market have not been made.

Directly related to the marketing problem is the problem of transport. The available literature suggests that up to now there has been little cooperation

between women producers in terms of transport and marketing. By and large, supplying the provincial markets and supplying Yaounde and Douala is the function of small scale women traders. Douala, being the principle city of Cameroon, is supplied through an organized transport system and regular supply to the city has been accomplished on a somewhat larger scale than for the provincial markets and Yaounde, the second largest city. In general there is no organized means of transport of commodities to local markets.

Similarly because of the lack of organization, marketing prices tend to flucuate greatly depending upon supply of commodities.

Land tenure is another apparent constraint to production. Given the social structure and the easiness of divorce, women are reluctant to invest in the improvement of land since upon divorce or death of the husband they don't inherit the land. In general women do not own land in Cameroon.

There is also a general reluctance to expand cultivated land due to periodic or continual labor shortages. The extent of land which the women can farm is limited by fixed household tasks such as care of children, food preparation, etc. In addition school attendance has meant the intermittent loss of child labor which is extra-ordinarily valuable on the small farm. Women are tending to assist men in cultivation and harvesting of export crops which limits the amount of time available for food crop production which infringes on increasing the area under cultivation.

SOCIO-ECONOMIC COMPONENTS OF THE FARMING SYSTEMS

The goals of the small farmers of Cameroon were not adequately determined during the short visit by the study team. However, the tendency of the small farmer to put an exceedingly high value on security and stability is a fact and one which must be appreciated by those who plan changes to improve the small farmer's conditions. Furthermore it is assumed that the small farmers of Cameroon desire to raise their standard of living. Some bits of evidence substantiate the assumption: the increased use of kerosene lamps, the increase in the numbers of young farmers involved with the farmer training program sponsored by the International Union for the Protection of the Child, and the buying habits of the local population, i.e. portable transistor radios.

However the goals of the farmer might be better stated as the "goals of the government" for the farmers. It is apparent that the long term goal of the government

for the agricultural sector is increased productivity on the part of the farmer. The short term goal, and with the most support, is the development of a stable export cropping system for the purpose of generating foreign exchange to pay for the importation of capital goods.

The small farmer involved with the production of food crops relies on the family for the major labor inputs into the farming operation on the family farm. Labor is utilized in all phases of the farming operation with little or no means other than human endeavor in the production of food crops. As pointed out above, food production is by and large the responsibility of women. Cash crops, such as coffee, cotton, cacao, tea, and palm oil are planted, cared for, and owned by the men, while women may assist in the cultivation of these crops. The women and her children (daughters) have the responsibility for planting and caring for the food crops. Because of increased school attendance child labor may not be available. Many times peak labor loads occur when the least labor is available. The cost of hired labor is a heavy burden which most of the small farmers cannot support, but hired labor is utilized in the situation where farmers are more affluent. The cost is high and the supply is short.

The role of women in terms as managers or as a part of the family enterprise is a difficult question to answer. "Family" in the West African sense is not the nuclear monogamous family usually considered by the developed countries of the western world. In the Northwest province monogamy does tend to prevail but it is an extended, not nuclear family. That is, there will be other relatives such as grandparents, aunts and uncles, cousins, etc. residing within a single household. The farming operation is a "family enterprise", but for the food crop production it will be done by the women with the assistance of the children. Not only is the family not nuclear as in the western sense, but marriages are made far more for reasons of economics or politics, politics in the sense of joining important families together through marriage, the difference being that, in the Western developed countries one marries for more of emotional or psychological reasons. In west Africa marriage is based on economic reasons. The ties in west Africa are by blood rather than husband-wife. That is, the one most important relationship is with ones' brothers and sisters and their children. This is true for the man as well as for the woman. Inheritance of land, however, is patrilineal, that is it passes from the husband to one or several of his sons, depending on the tribe. Who manages the farm, that is who makes the decisions as to what is to be planted, when it is to be planted, how much, etc. is unclear at this point. Further review of the literature will probably show there is some variation by ethnic or tribal groups.

The following comments apply to the Northern Province, and relate to customs of acquiring and administering land rights and then to the inheritance of land. These are

general observations. Practices of ownership and acquisition of land and its administration vary by tribe. First of all ownership can be based communally, that is shared by members of the tribe according to whatever their customs are. Ownership can also be individual.

There are at least four ways of acquiring more land. First of all, through inheritance and which is true in every tribe. Secondly, the north has been settled by a series of migrations and for many years squatters rights, that is clearing the land and developing it and which has been accepted by custom as entitling one to the use of the land. This is true for most tribes in the north of which there are at least 20 such groups. A minority do not recognize such kinds of squatters rights. Of the 20 tribes or ethnic groups it is not possible to purchase land and have the transaction recognized. However there are five or six exceptions. In all cases it is possible to rent or borrow land. Land is administered by a variety of means. The most prevalent would be the individual. That is, whoever is working the land is able to decide what to plant on it or what to graze on it, etc. In some cases, the religious leader or the traditional chief will make those kinds of decisions, again, this varies with the ethnic groups. Typically, if the owner is communal or tribal then the religious leader or chief will make the decision as to what is planted or grazed. In terms of land inheritance, out of the 20 groups noted only one allows women to inherit land and that is the Foulbe. Male inheritance varies. Sometimes it is primogentic, but in other cases it is all male children and in several tribal cases the youngest. The preceding material was taken from Resource Inventory of North Cameroon, Africa. Published by the USDA, Soil Conservation Service in cooperation with AID. Without date, but estimated mid-1970. pages 170-171.

We have considered agricultural policy with regard to marketing, transportation, and cash crops under non-pest related food crop production constraints. As far as incentives are concerned one considers for the most part the export crops. In this case the sole incentive is cash received. If the farmer has to produce a "clean" commodity in order to sell it for cash to the parastatal company, he'll use any pesticide he is required by the company to apply. The farmer does receive advice and he does have access to equipment and supplies to do the necessary operations, but this is in reality quality control on the part of the parastatal company which is exporting the commodity. Stabilization of the commodity price by the company is by fixing prices for given products. The follcwing are comments on the potential in the future for the export of food crops from Cameroon , and taken from Agricultural Marketing in the Northwest Province, United Republic of Cameroon, pages 80-81.

The possibility for export food stuff in the future is limited by at least two primary factors. One, Cameroon does not have a competitive price advantage at least in its major food crop of maize grown in the Northwest province. In recent years the price of maize has been 50% above the world price of maize. It does not appear likely that neighbors such as Nigeria which are short in some food crops, would want to buy from Cameroon when they can buy more cheaply on the world market. However, it is suggested that perhaps there are trade opportunities in areas further from the coast where there would be heavy transport charges if the world market maize was used. For example, the eastern parts of Nigeria on the Northwest Cameroon border, or Chad, for example, or the Central African Empire. The possibilities for exporting other food crops apparently need further investigation. The second major constraint is the reluctance on the part of the Cameroon government to risk having domestic food shortages and therefore increase inflation in Cameroon, particularly when the marketing system for food crops is not well organized. Apparently this is a fairly risky business to encourage exportation at this time.

On conferring with the local people most said the Cameroonians are well fed. Well fed in this case does not necessarily mean that they are getting much more than minimal, or probably below minimal caloric intake on the average. In addition they may be below or above the minimum caloric intake and that doesn't present any indication of what they receive with regard to nutritional balance in the diet.

The expense of nutritional studies which are by and large quantitative, and which have been done on the Cameroon, indicate that in comparison with other tropical African countries the nutritional level is fairly high in the Cameroon. However, the greatest problem is the lack of calories particularly at certain periods of the year and for reasons to be discussed. Secondly, the quality of proteins in the diet, as many groups consume a low percentage of meats or fish. The reasons for the lack of calories or the quality of proteins are several. First of all, the increase in the amount of food stuff that enters the market for cash income frequently results in a high proportion of the harvest being marketed rather than being consumed. In this sense it points out that increased productivity will result in increased percentages of harvested food stuff sold on the market for cash income, which highlights the fact that increased food productivity does not always lead to a higher standard of living when considering nutrition as one of the components of a higher standard of living. Another reason for the lack of calories, the quality of proteins, or the inbalance in diets, has to do with the multi-purpose role of women. Women are the primary food preparers and the peak times of harvest frequently requires that the women be out in the fields in order to get the crops in on time, particularly since the pattern of land holding is such that plots may be scattered, sometimes up to 20 miles away from the home. At

certain periods of the year women will have to be out on these plots, frequently with the children accompanying them, harvesting the food crops. Another reason for nutrition deficiencies results from the cultural reluctance to consume new kinds of foods. This was pointed out to the team at Bamboui and at other places visited. For example, in the north sorghum and millet come in different colors and people become attached to one color or attached to the flavor or consistency, and it is very difficult to get them to change to a different variety with different characteristics. Another reason, of course, is the lack of information. The people have no idea what the caloric content, or the vitamin content, or the protein and carbohydrate content of foods are and they simply eat what they like rather than a balanced diet. Another reported cultural reason for inbalanced diet, particularly for example for the north, is that different people in the family consume different things. For example, in polygamous families, it is reported that there is a good deal of competition between wives, and one of the ways that is shown is to feed the husband something better, and this frequently means that the women and children get the short end of the diet from the nutritional standpoint. The male family head and other males typically eat separately from their wife or wives and the children. The extent of the claims of cultural divisions within the family frequently go unnoticed in studies because they tend to be quantitative studies asking "how much does the total household consume" so that one is not always sure what the adult male or the children and the adult female intake may be. Another cultural reason is that many of the tribal ethnic groups have food taboos. For example, pregnant women aren't supposed to eat certain kinds of food which may be high in protein content because it is alleged that the child will not be healthy or it won't be a son or whatever the reasons. As a result of believ in certain kinds of cures associated with eating (or not eating) particular foods men will consume a diet which leads to or is partially responsible for a nutrition deficiency.

The following is a summary of comments on social structure in the northern province as described by C. Burgett, USAID contractor. Class structure plays a role in task allocation as well as income for both men and women. He divided the local Foulbe into three social classes based on income and task. The highest income group own numerous cattle, that is, the men own numerous cattle. Frequently they sub-contract out the care of these cattle to smaller farmers. In general the women are kept in the house. They do not go out to get water, they do not farm, etc. but are kept as outchecks of conspicuous consumption. Similarily, American men in the past, if well off, didn't want their wives to work. The same thing is true all over the world. The second group, which might be called the intermediate level, (the first

group he estimated comprised 4% of the population) comprise 30-40% of the population. In this intermediate grouping the women are permitted outside the home, and they market, get water, and are given a small piece of land to farm on their own. The majority, or lower grouping comprise 60-70% of the population. In these households the wives work at everything, farming, getting water, marketing, etc., essentially all of the household and family tasks.

CURRENT PESTICIDE PRACTICES

As far as the small farmer is concerned, essentially no pesticides are used on food crops. This is undoubtedly due to economic reasons as well as a poorly developed technology and lack of a system of information transfer.

It was apparent that the parastatal companies are heavily involved in pesticide applications. As previously mentioned the team was informed that cotton in the Northern province was treated 9-10 times during the growing season with as yet unidentified insecticides. The team unfortunately did not have adequate opportunity to visit with the staff of any of these companies to ascertain the types of pesticides used or the means by which they are applied.

The team did not determine what regulations were in place regarding import, manufacture, formulation and application of pesticides. Presumably there are few, if any. None of the people contacted were aware of any attempts to monitor pesticide residues.

There has been an attempt to develop varieties which are resistant to various pests. Most, if not all, of the varieties adapted in Cameroon have been developed elsewhere, many by IITA. No overt efforts are made to establish programs for non-pesticide control of food crop pests, but the multiple cropping system employing intercropping of a few to many plant species undoubtedly affords a certain degree of crop protection against diseases and insects.

Virus diseases appeared to be important in the multiple cropping system and may be more important to a variety of crops than insects. Striga is an important pest of multiple cropping systems and is a severe weed pest. Weeds as pests are extremely important in the intercropped plantings because of the lack of choices to be used for control, even if adequate controls were readily available and judged to be economically feasible. The only practical means of weed control in the intercropped system is manual labor.

RESEARCH, EXTENSION AND EDUCATION ORGANIZATION

Research in Cameroon is conducted by the Institute of Agriculture Research (IRA) as a part of the General Delegation for Scientific and Technical Research, the latter formerly known as the National Office for Scientific and Technical Research (ONAREST) and only underwent reorganization. A partial organizational chart is presented in Table II. It was understood by the study team that reorganization of the units is taking place and that the offices as described are subject to change of name and function. It is with the IRA that any collaborative research will be conducted.

In addition to the IRA the Ministry of Agriculture (Table III) functions more or less independently and provides certain training programs, the Crop Protection Service, which is involved with some research as well as regulatory functions, and an ineffective extension service.

The team did not determine the extent or levels of funding available for agricultural research. This information was not forth coming through discussion and the team used discretion and did not pressure for data. However, the team was informed by Dr. D. B. Perkins that the Cameroon government had committee 300,000 dollars to the USAID Regional Food Crop Protection project and that to date they have provided an excess of a million dollars. It appears that the Cameroon government is interested in providing financial support to worthwhile research programs.

As the team progressed with their interviews with administrators at various locations in Cameroon it became obvious that there is a significant lack of trained scientists practicing their expertise on food crops. Most trained personnel are involved at an adminstrative level or are employed on export crop production problems.

The people contacted by the team seemed to be genuinely interested in the ICP program and the potential for a collaborative effort. This was apparent when talking with administrators as well as the few trained scientists encountered. No scientific counterparts were identified. It is possible that the team did not make the proper contacts but Dr. Perkins indicated a lack of trained professionals working in research.

It appeared to the study team that most ongoing work involved the screening of resistant varieties of food crops obtained from various regions of the globe and that there was no concentrated, well developed research effort.

The following is a list of USAID bilateral projects, some of which relate to food crop production.

(1) North Cameroon Seed Multiplication (on-going) concerns establishment and institutionalization of a system for the production, distribution and use of improved peanut and sorghum seed.

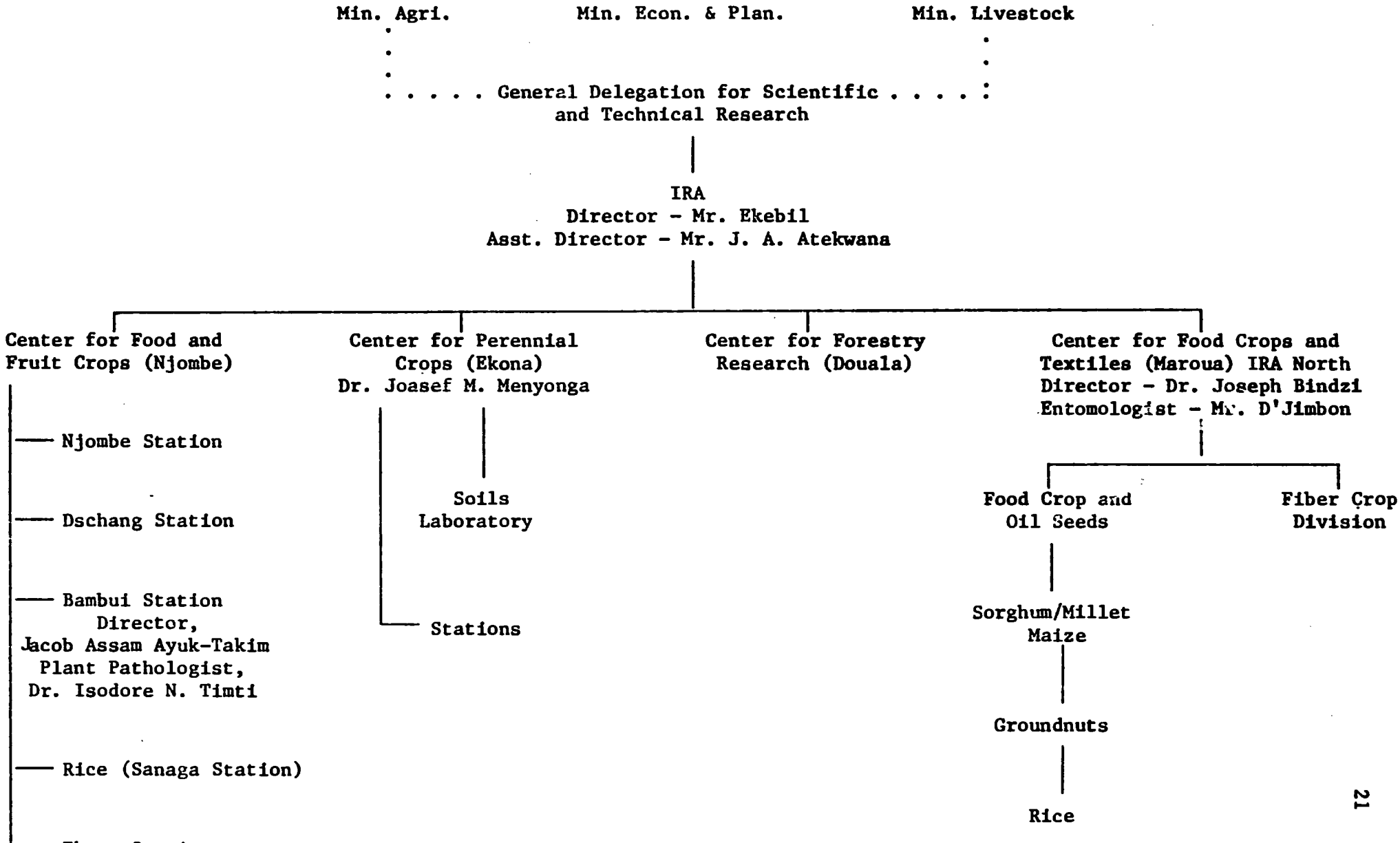


TABLE II. Organization of the Research Programs of Cameroon.

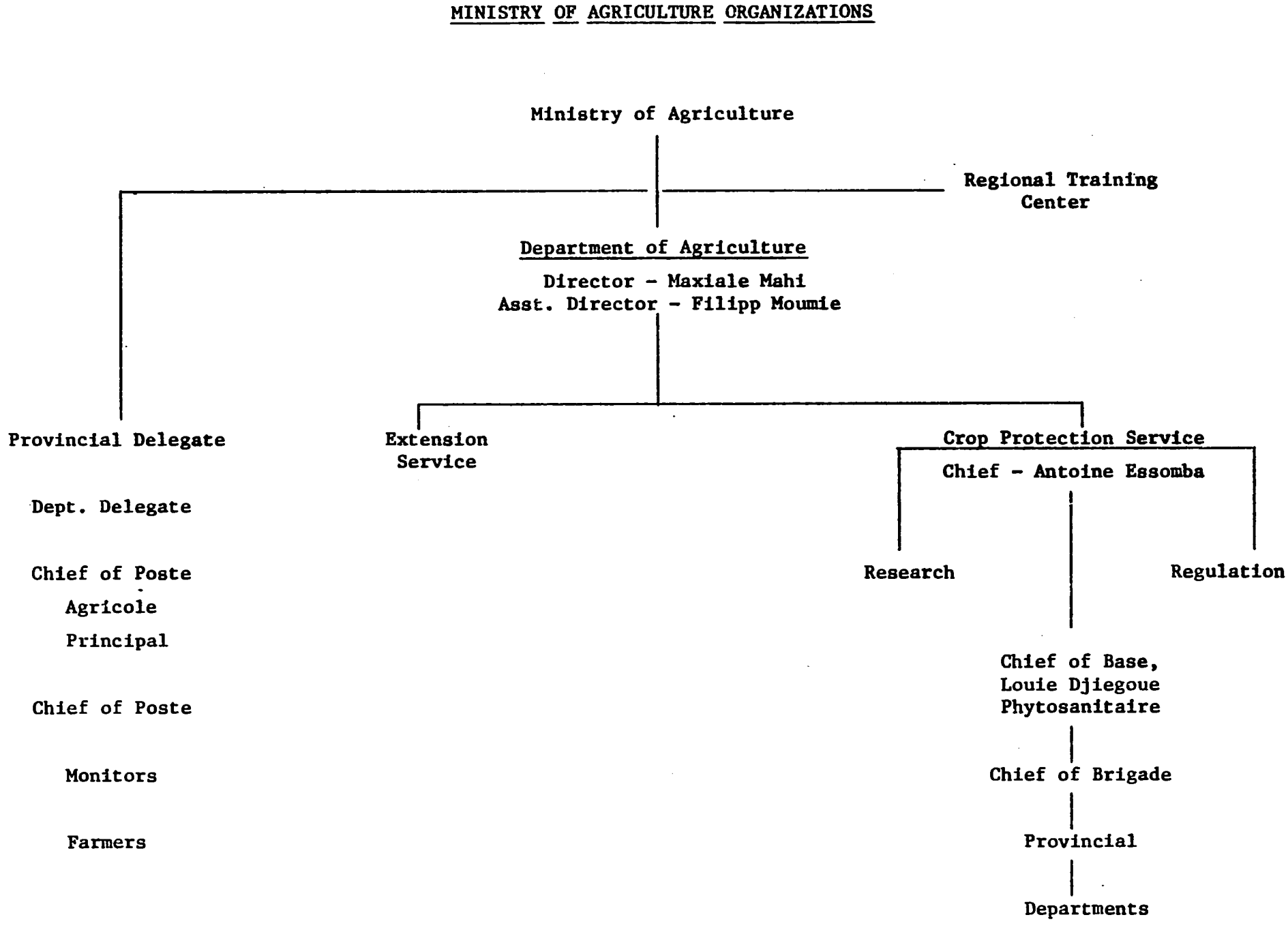


Table III. Organization of the Ministry of Agriculture of Cameroon.

(2) National Seed Service (proposed) will expand the North Cameroon Seed Multiplication project and establish a national seed service. To be effective, the seed service must be supplied with improved varieties of seed suited to the various ecological zones. A seed service relies on research stations for the provision of seed stock.

(3) Centers for Training Farm Families (on-going) provides assistance in establishing a region-wide network of agricultural innovators in the northern most four departments of Northern province. These farmers will play a key role in executing field test/demonstrations for the sorghum and millet research program.

(4) North Cameroon Livestock and Agricultural Development (starting up) demonstrates the effectiveness of a number of integrated actions for improving livestock and agricultural production. The research results will be incorporated into extension programs used by this project.

(5) Agricultural Management and Planning (starting up) will institutionalize a planning unit with the Ministry of Agriculture to plan, design and evaluate projects in the rural sector. It will provide crucial statistics on prices and production to enable decision makers to identify the appropriate targets for agricultural research, production, marketing, etc.

(6) Cooperative Development (proposed) will upgrade the managerial capacity of the agricultural cooperatives in Cameroon in order to meet the marketing, credit and production needs of small farmers. Cooperatives will provide a key link in field trial/demonstration surveillance, and will benefit from research results.

(7) Social Science Research and Training (starting up) will develop a center for economic and social science research in Cameroon, as well as carry out research, collect data and disseminate social-economic analyses for development programs in Northern Cameroon. This project will develop data which can be used to facilitate adoption of improved agricultural technologies, as well as indicate areas for further research.

(8) Higher Education for Development (proposed for FY-1980) will support university programs in training, research and extension for agriculture and business administration. This project will, inter alia, provide badly needed manpower for implementing agricultural research.

(9) National Cereals Research and Extension (starting up) concerns the development of institutional capacity to provide high quality research on maize, rice, sorghum and millet. Additional objectives of the project are to develop trained manpower to carry out a research program in Cameroon.

Other AID Regionally and Centrally Funded Projects relevant to food crop production include:

(1) Regional Food Crop Protection (on-going) will strengthen the plant protection units' ability to combat plant pests and will provide farmers with information on pest management practices. The IRAF researchers will work closely with plant protection units and will develop resistant and tolerant varieties as well as agronomic methods which reduce crop loss from pest damage.

(2) Major Cereals (phasing out) strengthens the applied agricultural research capabilities of 16 West African countries within a regional framework, particularly the development, dissemination and multiplication of high yielding varieties of staple cereals (corn, millet, sorghum). The Cameroonian maize research program already uses varieties of maize developed by the project.

(3) SAFGRAD (starting up) will develop and strengthen regional research and testing programs for cereals (particularly sorghum and millet, but also maize), grain legumes (cowpea and peanut) and related cropping systems for the sudanian savanna and sahelian zones.

(4) WARDA (on-going) is a multinational program which concentrates on testing and introducing new varieties of rice into West Africa. NCRE will use rice varieties screened by the WARDA program.

(5) CRSP for Grain Sorghum/Pearl Millet (starting up). This centrally funded project is being implemented by a consortium of U. S. universities. It conducts research on problems which limit grain sorghum and pearl millet production. USAID/Y has indicated its interest in having some research carried out in Cameroon, particularly in the area of breeding and plant pathology in the Lake Chad basin.

(6) CRSP for Legumes and Cowpeas (starting up). This centrally funded research project on legumes should eventually contribute varieties and practices which improve the effectiveness of successive and interplanted cropping systems, that include cereals.

Other donor agencies involved with food crop production programs in Cameroon are as follows;

(1) SEMRY I and II are IBRD and French Government-supported projects for the mechanized production of irrigated rice. SEMRY II contains assistance for applied rice research, and may receive some eventual benefit from research done under NCRE to benefit small farmers. SEMRY also includes some operational research on sorghum, which farmers grow for their own subsistence.

(2) Western Highlands Rural Development Project is a new IBRD-financed integrated agricultural development project, which has both research and extension components.

It includes maize extension and has an evaluation component that may facilitate coordinated farmer field trials.

(3) The ZAPI-East project of IBRD is an integrated agricultural development program which includes applied research and extension of food crops.

(4) The proposed IBRD Center North Rural Development Project includes support of IRAF-North and agricultural extension activities within the framework of an integrated agricultural development project. It is also closely related to SAFGRAD.

(5) UNDP/FAO Soils Research Project includes the development of the soils laboratory and testing program at Ekona, which will be used to test soils of fields used in the field test demonstration program. The AID sponsored Benchmark Soils Project (Hawaii) will also be doing soils research in conjunction with the Ekona station.

(6) The Canadian Government is financing research on improving yields, disease resistance, nutritive value and agronomic practices on root crops at Njombe, using an integrated cropping systems approach.

(7) The West Germans and the European Development Fund intend to start an integrated Rural Development Project for Northwestern Province, the first phase of which will be feeder roads. It will eventually provide a means of conducting field trial/demonstrations.

(8) The French Government provides agricultural researchers and extension personnel to General Delegation for Scientific and Technical Research and to various development corporations. It has also provided capital assistance to SEMRY, the Upper Noun Valley, and the Mbos Plain Rice Cultivation Corporation.

(9) The Upper Benoue Valley Development Agency is in charge of the regional rural development program in that area of Northern Cameroon. The European Development Fund and the French are financing a wide variety of crop trial work and socio-economic studies to determine potential for settlement in this sparseley populated area.

Presumably there would be linkages between USAID funded projects as well as other donor country projects if a collaborative ICP research effort were to be mounted in Cameroon. Significant effort upon the part of a Title XII contractor would be required to assure that the proper linkages were incorporated into the project.

An important shortcoming in the current administration of agricultural research programs dealing with food crop production is the transfer of research personnel from research on food crops to the parastatal companies dealing with export crops. An example cited was the transfer of an entomologist that was working with maize. Positions with the parastatal companies are highly competitive because they are better salaried positions.

In addition some research personnel are more or less forced into administrative roles with the benefit of additional salary compensation. The team was informed that one of the primary dissatisfactions with the current system is the lack of statutes laying down the conditions for employment, particularly whether or not they may stay in a research position and be adequately compensated for their efforts.

Potential for Training and Education - One of the problems which immediately came to the attention of the team was the lack of equivalency of degrees between the English, French, and American educational systems. This is one major problem encountered by the Cameroonian educated in the U. S. and holding a BS degree. The U. S. baccalaureate degree is not considered as a higher academic level than the French baccalaureate i.e. academic high school degree. This is very obvious to those Cameroonians better trained in the U. S. and whose compensation is the same as the person trained in France. In addition, those persons trained in France many times have the advantage in promotions. Therefore, the cost-benefit ratio is very low for those undertaking four years of additional training in the U. S. to acquire a BS degree. With either degree the employees hold responsible positions comparable to our "professional" degree holders, i.e. those without the M.S. or Ph.D.

The potential for in-country education (univeristy) is limited to the agricultural school of the University of Yaounde and associated with the agricultural school at Dschang. The team did not have the opportunity to visit with either of these institutions. Currently the agricultural school is undergoing relocation to Dschang under a USAID contract with the University of Florida. Ongoing programs include two which are below the university level and one which is at a "university level" in the French sense of the words. After the reorganization study by the University of Florida the structure of programs will undoubtedly be quite different and the potential for training locals may be much greater than at the present time. There is no provision in ongoing programs for training at the graduate level and Cameroon students are obliged to seek graduate training elsewhere. The team was informed that there are four or five Cameroon students studying for higher degrees in American universities.

In addition it was pointed out by a Cameroon entomologist, not currently employed in his home country, that the training he received was based on the French system and which he believed, based on his U. S. experience, to be inferior to the more structured course work available in U. S. universities.

The team did not learn what resources, such as faculty, funding, libraries, etc. are available for higher education, but presumably they are few. The report developed from the University of Florida Project should elucidate the information desired.

The USAID Regional Food Crop Protection project actively trains extension type technicians in integrated pest management and it appears to be an excellent program.

This program, under the direction of Dr. John Franklin and Cameroon counterpart, should be continued at the termination of the AID project if an upgrading of the Cameroon agriculture extension program in crop protection is to be continued. Whether or not the Cameroon government is committed to continuation was not determined.

Other education at the vocational level is available at institutions in various locations but these were not adequately identified.

Availability of Policy Analysis - The team did not explore with anyone the means by which agricultural policy is set. Presumably there is a policy making organization somewhere in the higher echelon of government. They have four year plans, one of which will currently expire in 1981. The summary of this four year program was not particularly impressive. The summary more or less explicitly stated that the strategy was to (1) further expand the export agricultural sector, plantations, including small holdings, in an effort to increase export revenue in foreign exchange and (2) to help the traditional sectors. This is about as much as the team determined about agricultural marketing policy, etc. in Cameroon.

POTENTIAL FOR COUNTERPART COLLABORATIVE RESEARCH EFFORTS

The team was genuinely impressed by the attitudes of those persons that were contacted in the Republic of Cameroon. It became apparent that the Camerooneans have a very positive attitude with regard to developing their research on pest problems of food crops and that they realize the need to put considerable effort into the solutions of these types of problems. They are intending, or at least discussing, the planning and building of new facilities and expanding their research in food crops. How soon this will be in place was not made clear. There is currently some research ongoing in this area but the team could not determine the extent of these programs. There is apparently some collaboration with IITA and we were told that there were some Belgians also involved in this program and perhaps this is a start with supervision by Belgian scientists They are apparently attempting to get farmers to plant improved varieties by making contact with missionary farms and with school children that are involved with persons in farming activities. The latter is part of a root crop project. This is an indication that they have some ideas about what they would like to accomplish.

It appeared to the team that there was enthusiasm for our suggestion of a collaborative research program in integrated pest management (ICP) and the attitude toward such a program was positive in most places that we visited. However, in summary, it seemed to the team that there were not many counterparts with whom a collaborative research program could be initiated, and this the team believed to be a significant problem with developing such a program in Cameroon. However, it may be that the team was not exposed to all research activities actually ongoing. This may be an artifact of the way our visit was arranged and not the true picture of the research personnel.

Also it was pointed out by Dr. David Perkins that they have a definite shortage of trained people so that our impression of lacking counterparts is probably correct and most certainly it is true with research on food crops and food crop protection. The team felt that there is essentially no ongoing pest related research in food crops with the exception perhaps of utilization of varieties which are being introduced from institutions such as IITA, ICRASAT, WARDA, or donor countries.

The potential for successful conduct of an integrated crop protection program in Cameroon appears to be low and with little chance of being productive in the collaborative sense. If trained researchers were available, and a collaborative research program were put into place in Cameroon, there is still a very significant problem in the system of transfer of knowledge from the research program down to the farmer level. Essentially the lack of significant extension service to transfer research results to those involved with production is a serious limitation which needs considerable attention from the Cameroonian government as well as assistance from outside donor countries.

RECOMMENDATIONS CONCERNING INTEGRATED CROP PROTECTION RESEARCH

In the above discussion we have identified pest problems associated with food crop production in the Republic of Cameroon. Which of these identified pests are most important to food production was not determined as data regarding losses was not available to the team and only rough estimates of losses were mentioned during our discussions with scientists in Cameroon. Certainly some of these pests are to be considered extremely damaging but which ones are most serious cannot be stated at this time. Research on losses caused by pests is of the highest priority.

Actually it seemed to the team members that there was a general lack of information concerning pests of food crops and that the Cameroonians that we contacted did not know which of the many pests were most severe on food crops. Apparently they have a very good knowledge of those pests of export crops and they also have the means for controlling many of these.

Nematodes are a serious problem, but not investigated adequately to determine the extent of injury. Stem borers on maize and sorghum are important pest problems as is the streak virus disease on maize. In addition rice blast certainly is important in some areas and causes severe losses. Birds are considered to be one of the most serious pest problems particularly in the north and sub-saharian region.

Without more information being available to the team it is difficult at best to suggest which key pests should be investigated in an integrated crop protection system. To more adequately define the key pests problems of Cameroon one should conduct an intensive review of the literature pertaining to pest problems in Cameroon as well as neighboring countries by thorough review of the available literature at the IRAT and allied tropical research institutes in Paris. These institutes have a wealth of information in reports, isolated publications, and the like, and which are not available elsewhere. In addition a visit and search of similar literature available at GERDAT in Montpellier in southern France would be worth considering. During the search of the available French literature on tropical agriculture, or at least immediately afterwards, there should be a complete survey of the pests associated with food crop production.

It became obvious to the team that any effort with regard to a collaborative research program should be based on a complete study of the farming systems employed in the production of food crops. A thorough understanding of the rationale for current practices, and the effects of those practices on pest problems is a pre-requisite to manipulation of the system in order to achieve integrated crop protection. There is a definite danger in manipulating the currently employed farming system without first having a complete understanding of the dynamics of plant growth and the associated pest populations.

The concept of a research study designed to determine the effects of changing from a multicropping system to a monocropping system on the development of pests populations appears to be an area which deserves attention. Food production is limited by the area that could be weeded by the family and it has been suggested that to make any sizable increase in food production it will be necessary to employ monocropping systems so that herbicides can be used in the reduction of weed pests.

More information on the effect these types of changes have on pest development is required. As far as diseases are concerned an increase under a system of monoculture would be expected, particularly with those pathogens which depend on aerials spread. However, powdery mildew of cowpeas seems to be less severe under single cropping than when interplanted with sorghum. Presumably this is due to the shading effect of the sorghum since cowpeas grown in shade are more susceptible to powdery mildew than cowpeas grown in full sun. Other problems of similar nature concerning insects and nematodes need to be explored and better understood.

Another area which deserves attention is that of exploitation of plant resistance or tolerance to the various pests on food crops. International agricultural research centers and other organizations have identified resistance or tolerance to some of the major pests in several crops. However, it will be a number of years before a sizable proportion of the small farmers can benefit from most of these sources of resistance. Varieties or advanced selection of some crops are available but for other crops only segregating populations or resistant parental germ plasm is available. The task of evaluating or developing resistant varieties that will meet the needs of the farmers in different geographical areas of each country is tremendous. Programs to accomplish this are already underway for some crops. It is recommended that entomologists and plant pathologists would work best as members of teams with other scientists on particular crops. Because resistance to all major pests in one variety is unlikely, and there are usually some pests for which no satisfactory resistance is available, there will be a need to develop alternative control strategies for some of these pests. These can be worked out in an integrated cooperative manner for each crop.

The average per capita GNP in Cameroon is about 270 US dollars. Rural incomes are lower and range from 80 to 140 dollars in the forest and central savannah zones and decrease even further in the northern plains to about 70 or 80 dollars. Agricultural production accounts for 35-40% of the GNP and 75% of the total value of exports. The principle exports as mentioned earlier on are coffee, cacao, cocoa, palm oil, tea and cotton. Except for rice and wheat of which imports have been increasing in recent years Cameroon is self-sufficient in food crops. However, population growth is at 2% according to a World Bank report. The increase in productivity of food crops is just slightly above the population growth rate. Over 85% of agricultural production is produced on small farms and the rest is produced on government owned estates, primary purpose of which is the production of export crops.

With the population increase that is current in Cameroon, and the slight increase in the major food crops being produced on small farms, it becomes very obvious a definite food shortage will exist in the not too distant future. It is imperative that

some means be made to avoid such a catastrophe.

The lack of trained research people in Cameroon was identified as a significant constraint to increasing the production of food. Advanced training programs should be offered and sponsored by USAID which will help alleviate the shortage of research scientists. In addition training of personnel in non-degree programs such as offered by IITA should be expanded to be utilized as a source of technical assistants in support of research programs. There are a number of advantages in non-degree training, one of the advantages being lower cost and therefore more people may benefit from such training. In addition there is less difficulty with long separations from families, the chances of the participants returning to Cameroon for employment are much more certain, and there are more opportunities to work with crops which are similar to those grown in Cameroon. Degree candidates doing course work in the United States should do their research and thesis in conjunction with projects at international centers such as IITA, or perhaps ICRASAT, or WARDA. Some of the advantages to this approach are similar to those above, particularly when considering the type of research and the crops on which the advanced degree student is working. It would also be advisable that conditions of later service for the government be arranged in writing with the trainees and the relevant ministries prior to initiation of training. Any training component would be most effective if it precedes the arrival of collaborating U. S. specialists.

Recommendations - The team believes that the lack of trained scientists in Cameroon would act as a deterrent to the successful implementation and completion of a collaborative research program (CRSP). If trained personnel are available it would be advantageous to initiate a CRSP with the Republic of Cameroon because of the following:

(1) Future needs as mentioned above are going to be extreme within the next 20 year period.

(2) Attitude on the part of the Cameroon government and the scientists contacted is very positive towards a CRSP.

(3) The diverse ecology and therefore the resulting variations in crops make it advantageous to establish a program in Cameroon.

(4) Ongoing bilateral programs offer available linkages for an integrated crop protection program.

It is recommended that further study of the potential for collaborating scientists in Cameroon should be made prior to making the final decision on the recommendation to include Cameroon as a West African country to be involved in a CRSP.

Training of researchers should be carried out prior to or as a part of a CRSP.

This training should be conducted in Africa, with the exception that the coursework be conducted in the United States, an approach to which there are definite advantages. In addition, assurances should be made by the GURC that trained personnel would remain in research on the integrated crop protection of food crops. Training should be supported and conducted regardless of the initiation of a CRSP. USAID should support, with a significant expenditure, the training of advanced degree students that will be the future basis for the research effort in food crop production. Further, an increase in the physical plant and equipment of these laboratories should be considered during the developmental stages of a CRSP mode with the Cameroon government.

The team departed Yaounde 1135 hours May 14 arriving Lagos 1930 hours. Overnight in Lagos at the IITA guest house. On May 15 the team departed Lagos enroute Ibadan and IITA. Arrived IITA 1030 hours and were greeted by the Coordinator of Special Programs at IITA. We arranged visits with the scientists that were available. Unfortunately because of our delayed departure Yaounde and lack of communication to IITA many of the Institute personnel were unavailable for consultation. However we did have the opportunity to speak with as many people as possible in our reduced allotted time. A list of persons contacted may be found in Appendex III.

Of the team members only Dr. Hebert had visited IITA previously. The balance of the team was very impressed with the facilities for research, the library, and the housing for visiting scientists as well as students.

It was interesting to discover that the Institute supports applied science with strong basic research programs such as virology and microbiology. The virology program has made an excellent start in identifying the viruses infecting cowpeas, maize, yams, and cassava utilizing sophisticated analytical immunological tools. The one major problem which became apparent is the quanrantine regulation prohibiting the sending of diseased plant material to IITA from outside of Nigeria, for example Cameroon. The only means of collaborating on diagnostic problems with other countries is by transporting antisera to the problem area and attempting to make a diagnosis in the affected country. This is a definite shortcoming of the present system and needs to be corrected in order to provide diagnostic service to a larger number of countries. Samples to be diagnosed could be handled under quarantine and safely without endangering Nigerian agriculture.

The team discussed nematode problems with Dr. Fields Caveness. IITA has been collecting nematodes over the past ten years and 115 species have been identified (not all from Nigeria). The collection is housed with the USDA, Beltsville, Md. Root knot nematodes are severe pests and will be, as mentioned previously, a major problem if and when monocropping practices are put into place. The impact of nematodes on food crop production has not been adequately determined.

In discussion with Dr. M. J. Luckefahr it became apparent that he, as well as some of his collegues, have a negative attitude regarding integrated crop protection for the small farmer involved with multiple cropping systems in Africa. His point was a reiteration of what is reported in the literature - the small farmers have evolved a workable system of low risk as far as the production of food is concerned, and he questioned what can be done to improve on the system. Furthermore, to reinforce

the negative, he maintained ICP can't be put into place because there is no effective extension service nor are there monitors to check fields, and no suitable way to communicate inforamtion. Dr. Luckefahr has been involved in making recommendations to IITA staff and administration that IPM (ICP) was not a good approach for the small farmer. Undoubtedly more serious pest and related problems will develop if this attitude prevails when considering food crop protection.

On the other hand Dr. S. R. Singh is an enthusiastic supporter of ICP and the potential of the approach for helping small farmers of Africa. He believes that more attention needs to be brought to ICP programs at the administrative level. In addition he maintained, and the team agrees, that African farmers are already practicing the principles of ICP because they are not using monoculture. Multiple cropping practices minimize pest problems, and uniform planting dates as determined by rainfall also assists in management of pest problems. Dr. Singh is planning a workshop on ICP to draw awareness to the approach by bringing in people from local government as well as local scientists, to be made aware of integrated pest management philosophy and technology by scientists from the U. S., in an attempt to develop a public image for ICP programs. His main thesis centers on the fact that the U. S. has had an umbrella of pesticides and which we are now trying to reduce in number, while in Africa he believes they should attempt to avoid ever getting into a similar situation since pesticides are not commonly employed, thus avoiding problems faced by developed countries. In addition the small farmer can't afford pesticides for crop protection. Singh further emphasized that some modification of the intercropping system currently employed may well be the multiple cropping system of the future and he was emphatic that monoculture is not a viable production system in the tropics.

Dr. Ivan Buddenhagen however, is a strong supporter of the monoculture system as a solution to Africas' food problem. Dr. Buddenhagen is heavily involved with breeding for resistance or tolerance in maize and rice. He has had some success in developing maize varieties tolerant of maize streak virus and these varieties are soon to be released. In addition he has rice varieties which show promise as blast resistant. He is attempting to select for insect resistant varieties of maize, particularly stem borers. The team was impressed by his enthusiasm for breeding programs and his inclusion of resistant varieties as a main feature of ICP programs. Dr. Buddenhagen believes that germ plasm for new rice varieties, particularly upland varieties, should be based on those varieties which are historically African varieties. His work to date has utilized local upland rice as a basis for resistance, incorporating

desirable characteristics from other sources. In looking over his trials it appeared that he had been quite successful. Current field data should support this observation. Unfortunately Dr. Buddenhagen will be leaving IITA at the end of the current growning season.

Dr. Yates of the study team had the opportunity to discuss with Dr. Goodman the possible training aspects of an implemented ICP in West Africa. The number of places for advanced students are limited but students could be selected for participation.

The training program at IITA has two basic phases. They provide individualized programs that are research oriented or they can provide training for groups on non-degree research related programs. The latter are usually people who come from agricultural ministries or other collaborating institutions or universities. These are vacation student research scholarships, the long vacation frequently comes at the end of the senior year, particularly in British West African countries. The individual programs can be as short as a week or as long as nine months. Typically in a year IITA accepts about 250 students for training programs. The fee in September, 1979, was US $600 monthly which covered costs of food, laundry, accident insurance, and medical care at the IITA medical unit. Such training would by all means assist the programs of the Republic of Cameroon.

The library at IITA is rather small, the best coverage being that of periodicals. The library subscribes to 1400 periodicals related to tropical agriculture, the exception being animal science. The collection on Cameroon is not extensive in terms of books, not more than three dozen entries in the card index.

Inclusion of IITA in the design and implementation of a CRSP seems advisable particularly if considering West African countries. This is especially true from the training standpoint because there are definite advantages for the advanced degree student that can conduct research at the Institute. The advantages of training at IITA have been pointed out in the recommendation concerning training of Cameroonians. In addition collaborative research efforts should hasten the solution to some of the key pest problems of food crops. The main drawback will be lack of collaborative effort if negative attitudes regarding integrated crop protection become dominant.

ITINERARY FOR PURDUE UNIVERSITY TEAM FOR INTEGRATED PEST MANAGEMENT RESEARCH IN CAMEROON

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Saturday May 3, 1980	Team arrives in Yaounde at 0930 Tickets to North arranged and Crop Protection personnel contacted. Overnight in Yaounde at Novotel.
Sunday May 4, 1980	0700 - Team departs Yaounde via vehicle accompanied by NGANDEU of the Crop Protection Service and PERKINS of USAID. Overnight in Bafoussam or Bamenda.
Monday May 5 to May 6, 1980	Field observations, discussions with officials, Ndop, Bambui, Bamenda. Overnight Bamenda.
Wednesday May 7, 1980	0700 - Team departs Bamenda via vehicle. Arrives Yaounde about 8 P.M. Overnight Yaounde.
Thursday May 8, 1980	0825 (Be at airport 0725) Depart Yaounde (UY 786) with NGANDEU and PERKINS for Garoua. Arrive Garoua 0935 - Meet with Provincial Delegate, Departmental Delegate, Chief of Base, his assistant, Chiefs of Poste in this area. Overnight in Garoua.
Friday May 9 to May 10, 1980	Garoua (and Maroua if vehicle can be arranged). Field observations and discussion with officials.
Sunday May 11, 1980	Depart Garoua 1705 - arrive Yaounde 1910 (UY 793). Overnight Yaounde.
Monday May 12, 1980	0730 - 1230 : Meet with Training Center personnel 1430 - 1800 : Meet with USAID personnel
Tuesday May 13, 1980	Team departs Yaounde.

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Dr. Jack Drea, Leader	USDA/SEA, European Parasite Laboratory, Severes, France
Dr. J. D. Paschke	ICP Project Coordinator, International Programs in Agriculture, Purdue University, West Lafayette, Indiana
Dr. T. T. Hebert	Department of Plant Pathology, North Carolina State University, Raleigh, North Carolina
Dr. Barbara Yates	Educational Policy Studies Department, University of Illinois, Urbana, Illinois

PERSONAL CONTACTS IN CAMEROON

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May 1

Mr. Jonas B. N'Gandeu	Chief of Bureau, Crop Protection
M. Antoine Essomba	Chief of Crop Protection Service
Mr. Maxiale Mahi	Director, Dept. of Agriculture, Yaounde
M. Filipp Moumie	Asst. Director, Dept. of Agriculture, Yaounde

May 5

Louis Djiegoue	Chief of Base, Plant Protection, Bamenda
M. Jacob Assam Ayuk-Takim	Director, IRA, Bambui Station
M. Isadore N. Timti	IRA, Phytopathologist Research, Bambui

May 6

Mr. Tafong Tata	Provincial Delegate for Agriculture, Bamenda (plant breeding)
Mr. Jacob Zombou	Assistant to Provincial Delegate, Bamenda

May 7

Mr. Ahmadow Bilali	Chief of Post Agricole GACHIGA (village)
Mr. Gourlemond	Provincial Delegate for Agriculture of the North
j. Jackson	AID, Project Manager for Agriculture, Yaounde
Eric Watts	Senior Agric. Advisor
James Williams	Chief of Mission

May 9

Dr. Joseph Bindzi	(Soils) Station Director, IRA-North, Maroua
Christopher Henry	VIPE, Maroua (Young Farmers)
Bud Lane	Seed multiplication project - MIDEVIB
Cal Burgett	Livestock production

CONTACTS (continued)

May 10

Mr. Joseph Elang	Director, MIDEVIV
Mr. Moise NJoe-Sam	Director, Agricultural School, Maroua
Mr. Charles Lontchi	Seed Project
Mr. Elil Sani	Departmental Delegate for Agriculture for the Department Diamare (a department of Cameroon)

May 12

Eng. S. E. NJoman	Director, Regional Plant Protection Training Center
John Franklin	Regional Officer Food Crop Protection Program, AID
Dr. Mbondji	Agricultural Research Center of Nkolbesson, Yaounde
Mr. J. A. Atekwana	Technical Advisor, Delegate General to the Recherche Stintifique et Technique, Yaounde
Dr. B. D. Perkins	Yaounde, Cameroon, Dept. State, Washington, DC, 20520

PERSONAL CONTACTS AT
INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE

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Administration

B. N. [illegible] igbo	Deputy Director General
D. [illegible] Goodman, Jr.	Assistant to the Director General (special projects)

Farming Systems Program

B. T. Kang	Acting program leader and soil fertility specialist
F. E. Caveness	Nematologist
C. Garman	Agricultural engineer

Grain Legume Improvement Program

S. R. Singh	Entomologist
M. J. Luckenfahr	USDA
L. Jackai	Entomologist

Root and Tuber Improvement Program

E. R. Terry	Pathologist

Cereal Improvement Program

V. L. Asnani	Maize breeder
I. W. Buddenhagen	Pathologist

Virology Unit

H. R. Rossel	Virologist
G. Thottappilly	Virologist

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