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Crop-Animal Systems Research: The Experiences Of CARDI

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INTRODUCTION

The Windward and Leeward Caribbean Islands have a total population (English-speaking) of over 500,000 on a land mass of approximately 2,500 hectares. The economies of these islands are dominated by an agriculture characterized by smallholder populations of low productivity. The traditional smallholder farming system is complex, comprising several enterprises or commodity lines that are grown in various sequences, frequently intermixed or overlapping on the same piece of land. These systems have evolved from experience to fit the availability of traditional resources and local conditions to satisfy the farm families' multiple, and sometimes conflicting, objectives. Although the general nature of these systems is known, little accurate information is available to describe the chronology of events during the year or the frequency or relative importance of the different systems and combinations. There is also an ignorance of the relative importance of the farm families' objectives, e.g., income, cash flow, labor utilization, nutrition, risk reduction, and of the capacity of the numerous systems to fulfill these objectives.

Traditional agricultural research, conducted almost entirely on the experiment station and on single commodities, has proven inadequate in providing answers for small farmers' complex systems. The problem is how to take the bits and pieces of successful biological research and fit them together with economic reality and cultural preferences to meet the needs of systems whose multiple ends are measured in terms different from those used in traditional research.

Over the past four years, CARDI has been doing on-farm research aimed at developing improved cropping systems through adaptive, farm-based research. The goal of this research effort is to increase the value of agricultural production in the Leeward and Windward Islands of the Eastern Caribbean through the improvement of small-farm profitability and small-farmer nutrition, and by generating employment. More specifically, the overall objectives of the CARDI project are:

- to establish cooperative host country-CARDI small farmer systems research programs in eight countries.
- to increase the understanding of smallholder farming systems, resources, and objectives through the creation of an agrosocioeconomic information base, obtained from surveys and on-farm research by multidisciplinary teams.
- to design improved smallholder farming systems based on the integration of proven crop and livestock technology with economic analyses that take into account profitability, cash flow, nutritional contribution, and labor utilization characteristics.

- to transmit information on smallholder characteristics and improved farming systems to extension and credit officers, planners, and other agricultural officials through publications, presentations, and field day activities.

The first part of this overview deals with the objectives of the cropping-systems project, policy and institutional issues, including the types of crop-animal systems being studied and descriptions of some of the small-farm animal production systems. The second part deals with methodology, some results, and an evaluation of previous experiences.

POLICY AND INSTITUTIONAL ISSUES

The CARDI Cropping Systems Research Project, in addition to generating an appreciable amount of baseline data, has forcefully demonstrated the importance of an integrated crop-animal systems approach when the objectives are to improve the profitability of small farms, enhance the nutritional well-being of the farm family, improve the stability of the farm system and generate employment. The importance of the animal component in the realization of these objectives has been clearly demonstrated by:

- the amount of time the farmer spends on his animals, even when the animal component is a supplementary enterprise, and
- the cash value and financial reserve role of the animals in the micro-economy of the small farm.

CARDI has therefore decided to redirect its research efforts to the study of integrated crop-animal systems.

Our approach is primarily geared to the development of the small farm. Thus, the Institute is examining the various milk and beef production models and swine and small ruminant systems appropriate to this target group. This emphasis is important because the meat and milk needs of the Region (Tables 1 and 2) will be met for a long time by the efforts of the so-called small farmers who have traditionally produced these commodities.

Table 1. Milk and Meat Imports into the Eastern Caribbean and Caribbean Community (CARICOM) (metric tons)

	Beef	Milk & Milk Products	Mutton & Lamb	Poultry	Pork
Eastern Caribbean*	1,055	6,342	225	5,006	2,072
CARICOM	14,573	54,790	3,484	33,193	9,438

* Cropping Systems Project Territories.
Source: Archibald, K. A. E. and P. O. Osuji (1977). Prospects for the Improvement of Livestock Output in the ECCM Countries.

Table 2. Milk and Meat Production in the Eastern Caribbean and CARICOM (metric tons)

	Beef	Milk	Mutton & Lamb	Pork	Eggs
Eastern Caribbean	1,277	8	127	468	n.a.
CARICOM	19,000	109	n.a.	n.a.	25,000

n.a. = not available.
Source: Archibald and Osuji (1977).

CARDI's current research activities relating specifically to crop-animal systems have been designed with these new research priorities in mind. Such current research activities include:

- forage legume/grass associations for grazing and cut-and-carry (zero grazing).
- utilization of crop by-products to supplement animal feeds in well-defined production systems.

CARDI has selected forage legumes for their nitrogen economy, yield, and adaptability to various pH and soil moisture regimes, as well as competitiveness with various grasses under different systems of grazing and cut-and-carry. The Institute has been able to bulk and distribute clean seed of recommended selections. An EDF-funded (European Development Fund), three-year Forage Seed Production Project will endeavor to provide the seed to improve a minimum of 700 acres of pastureland annually.

Traditionally, farmers have used a wide range of by-products as animal feed: peels from the kitchen and leftover food, canetops, coconut meal, oilcakes, rice and wheat middlings, bananas, etc. Brewers waste, bagasse, sorrel meal, citrus pulp and citrus meal, and cocoa pod meal also have been used. In an effort to maximize their use, CARDI is developing and testing rations based on these products.

While it is relevant to research these individual and integrated systems, a concerted effort is required to bring adequate evidence of the need for crop-animal integrated systems to planners, farming groups, and their service agencies. Particularly in the Caribbean, it must be recognized that:

- the development of a majority of small farms lies in having both animals and crops.
- these two components should be integrated fully.
- the milk and meat requirements of these small nations can be adequately met (both in quality and quantity) through such small farm systems.
- such systems will have greater <u>stability</u> through reduced risks. They will provide the opportunity for meaningful employment, nutritional improvement, and reduction of the national food-import bill.

The Institute is endeavoring to meet with national agricultural planning bodies to discuss this policy. This is the first step in establishing and implementing strategies for research and development. CARDI works side-by-side with the national governments to achieve these goals.

The Institute is confident that this is the correct approach and has the mandate of the regional ministers to pursue research and development activities on these lines and to provide <u>ad hoc</u> and technical assistance to member governments. However, the implications and usefulness of integrated crop-animal systems research are still not fully appreciated.

The Institute will never have the funds to keep the full complement of staff that such a task will necessitate, and we expect to complement our resources with those of other institutions that have the desired expertise. Such expertise must be available at short notice.

TYPES OF CROP-ANIMAL SYSTEMS BEING RESEARCHED

In this section, we first attempt to describe the types of animal production systems that have been found on the cropping systems research farms in the Eastern Caribbean. St. Lucia will be used as the example. Secondly, we will review some constraints to increasing the contribution of the animal component to the whole farm income, and finally we will give a resume of the forage-based systems that are currently being researched in Guyana and the Leeward Islands.

CARDI Cropping Systems

This research is farm based, thus the crop-animal systems studied are those that happen to be found on the cooperating farms. A list of the major crop-animal systems found on the target farms is presented in Table 3. The crop-animal systems found in the Windward Islands (i.e., the more humid countries of the Organization of Eastern Caribbean States [OECS]) differ from those found in the drier countries of the Leeward Islands. Also, within countries, the crop-animal combinations vary as one moves from the windward (wetter) to the leeward (drier) parts of the Islands.

Table 3. Major Crop-Animal Systems Found in the Windward and Leeward Islands of the Caribbean

Windward Islands	Leeward Islands
1. Bananas - Pigs	1. Root Crops, Vegetables - Cattle, Sheep, Donkeys
2. Bananas, Coconuts - Cattle	2. Vegetables, Root Crops - Cattle, Sheep, Goats, Poultry
3. Coconuts - Cattle	3. Peanuts, Root Crops, Cotton, Pigeon Peas - Cattle, Pigs
4. Root Crops, Vegetables - Sheep	4. Cotton, Peanuts, Vegetables - Cattle, Pigs
5. Scrubland - Goats	5. Sugarcane, Vegetables - Cattle, Sheep, Pigs
	6. Vegetables - Sheep, Goats

Animal Production Systems

Cattle. Among the larger farms, extensive cattle grazing is the main production system, utilizing indigenous pasture species and, occasionally, improved species such as Pangola grass. The main production system used by the small farmers is roadside grazing, cut-and-carry, communal grazing, and combinations of these with tethering. Animals usually are not housed; water is either taken to the animals wherever they are tethered, or animals are taken to watering points on roadsides or in the villages. Castration and dehorning are not practiced as a regular routine (the farmers utilize the horns in restraining the animals and also for tethering). Deworming, though practiced sporadically, is not a regular practice of management, nor is the provision of salt ticks. Often the cattle are kept for both meat and milk. The milk is mainly for home consumption, although some milk is sold by farmers with more than one cow.

Sheep and Goats. Extensive grazing, tethering, cut-and-carry, communal grazing, and the use of crop residues are the main features of sheep production. Goats, when kept, are often on the scrublands, as most small farmers recognize the incompatibility of goats with the major food crops grown by small farmers. Usually, and probably because of praedial larceny, sheep and goats are housed at night in small backyard sheds where additional feed can be provided.

Castration is not a common management feature, nor is dehorning. Small farmers know the value of deworming their sheep and goats, but due to cost and lack of expertise, farmers do not deworm their animals routinely. Attempts are made to rear lambs or kids on milk substitute or cow's milk.

Poultry. A large number of local creole dual-purpose birds are reared in the backyard where they scavenge for food. Some small farmers who grow vegetables in their backyard either have small fenced areas for these birds or small barbed-wire chicken coops. When a coop is provided, kitchen refuse or cracked corn and, occasionally, commercial feeds are fed to the birds.

Commercial poultry production is on the increase and the deep litter system is widely used. Small farmers seldom market dressed chickens, but occasionally sell live chickens.

Pigs. There are two distinct systems of pig production. The local pigs are allowed to scavenge or are tethered in the farmer's backyard. When improved breeds are kept, some form of housing usually is provided, often with a concrete floor. The Lehmann system of feeding is often used on small farms. Farm and kitchen residues, mainly succulents, are fed to the pigs. By-products such as coconut meal and/or wheat middlings and/or some fishmeal are used as protein supplements. One small farmer prepared his own supplement at home by mixing one bucket (about 4 kg) of copra meal with one kg of wheat middlings and about 0.25 kg of fish meal. Only a small amount of fish meal was used because of its high cost and the need to prevent fish flavor in the pork. Some farmers feed whole fish whenever they can purchase it cheaply.

While most small farmers who keep one pig, usually a boar, slaughter it for home use at Christmas, some farmers also keep sows to produce for sale weaner or finished pigs. However, the scarcity and high cost of feed seem to discourage farmers from the finisher operation, except on the few farms where pig production is a major activity.

Rabbits. Rabbit production is a backyard operation. Rabbits are reared in hutches made of cheap, locally available materials. Most of the rabbits produced are used for home consumption, or are sold to other farmers to start a rabbit operation.

Feed Resources. The main feed resources of the small farmer in St. Lucia are (1) crop residues from his farm (at present, relatively fully utilized); (2) copra meal; (3) wheat middlings which, until Hurricane Allen, were available from the local flour mill, now are imported from St. Vincent. Appendix I summa-

rizes the available or potentially available feeds in St. Lucia. The main problem with feeding animals in St. Lucia is the short supply of cheap feed, especially during the dry season when pastures are dry and there is limited vegetable production.

CONSTRAINTS TO ANIMAL PRODUCTION IN THE EASTERN CARIBBEAN

The main constraints to animal production in the Leeward and Windward Islands are:

- poor nutrition due to the seasonality and unavailability of local feed, poor quality pastures, and high feed costs.
- parasitism in animals with both ecto- and endoparasites. Lack of information among farmers plus inadequate supply and high cost of anthelmintics and tickicides have limited the productivity of most animal species.
- the market structure, lack of adequate transportation, wide differences between farm-gate prices and the retail prices, and the absence of market information to farmers. Animals are sold by sight, and pricing policy is consumer oriented.
- distance to processing facilities. The availability of processing facilities may increase the farmer's earnings through the value added to his processed products.
- pasture expansion limited by unavailability of suitable land. Most farmers are willing to expand only if they can obtain access to additional, suitable land.
- lack of suitable breeding stock for animal improvement, especially in ruminants.
- praedial larceny and predation by dogs, especially with small ruminants.
- poor management of animals, especially in housing, nutrition, and health.

METHODOLOGY

Cropping Systems

The methodology used in the Cropping Systems Project can be summarized as follows:

> A baseline survey of representative groups of farms was conducted, and from these groups, a subset of farms was selected for monitoring of inputs, outputs, and inventory changes. Based on the evaluation of the survey results and some of the monitoring outputs, a set of on-farm "interventions" was identified for implementation. The basic aim was to enhance farm productivity and allow for better resource use and improvement in farm income (Henderson & Gomes 1979; Rankine, Gomes, Ferguson & Archibald 1980).

Forage (Grass/Legume) Systems Project

The current CARDI projects in which specific crop-animal systems are being researched is the Forage Production and Utilization Project. Two projects are now

being implemented, one in Antigua (EDF funding) and one in Guyana (IDRC funding). They have similar and/or complementary objectives and approaches.

A production systems approach is used consisting of description, design, and testing activities. The description combines several sources of information into the design of the research or work program. These include:

- description of the existing production systems at Moblissa, Antigua, and on satellite farms, and identification of constraints to increased production and institutional limitations.
- review of existing pasture and milk/beef production research findings to identify component research to evolve technology that can be applied towards improving the existing system.
- use of early research results in subsequent designs to improve production systems.

The research design seeks to develop one or more improved production systems models, which are specified in terms of inputs, operations, and timing of operations required for seed production, pasture production, feed processing, and feed utilization (including grazing methods, concentrate feeding, zero grazing, herd management, and milking methods). As the improved production systems are designed, the needs for additional information on management components will be defined, leading to the component technology research that will be conducted during the next growing season.

The production systems designed will be compared to the existing system, and biological and economic criteria will be used to judge the performance of the system components and the system as a whole. The testing activity also will consist of trials and surveys conducted to test alternative components not yet included in the model systems. These alternatives may include rotational grazing, fertilizer application methods, concentrate supplementation, feed storage techniques, and other aspects considered to have potential for improving the initial specification of the model system.

RESULTS

The cropping systems project has produced much information on the characterization of small farms in terms of human, physical, and input/output activities. Importantly, we have gained a strong appreciation of the need for, and the role of, integrated crop-animal systems on the small farms of the Eastern Caribbean.

Case studies have been done by our cropping systems group. We now have a fuller understanding of small farms and small-farmer practices and needs, and we are better able to design and implement effective improvements on these farms. A set of animal production alternatives that we have identified are presented in Appendices II and III.

The forage systems project not only provided the capability to produce legume and grass seeds, which otherwise would have to be imported at very high foreign exchange costs, but also clearly demonstrated (Tables 4 and 5) the efficacy of using forage legumes as protein banks on small-farm plots. The legumes more frequently recommended are the browse types like Leucaena leucocephala. In the drier territories (Antigua, St. Kitts/Nevis, and Carriacou in Grenada), the use of protein-energy banks has been found to be very useful in helping small farmers deal with the perennial problem of feed scarcity and stock deaths during the dry season. The grass of choice has been Elephant grass (Pennisetum purpureum), but Guinea grass (Panicum maximum) also has been used.

Table 4. Quantity and Species of Legume and Grass Seeds Supplied to Farmers or Institutions

Species	Variety/Accession	Quantity Weight of Cleaned Seed (kg)
A. LEGUMES		
Leucaena leucocephala	"CARDI Cunningham"	60.2
N. wightii	CPI 52614	20.5
M. atropurpureum	"Siratro" & Y61	9.5
Desmodium spp.	CIAT 335	3.9
Centrosema spp.	CIAT 438	0.9
T. labialis	CPI 52793	2.0
Legume mixture	-	3.0
Miscellaneous* (experimental quantities)	-	3.6
B. GRASSES		
P. maximum	"Antigua"	28.5
B. decumbens	CIAT 606	0.3
A. gayanus	CIAT 621	0.3
C. OTHERS		
Azadarachta indica	"Neem"	0.5
TOTAL		133.2

* S. hamata CIAT 118; Codariocalyx gyroides CIAT 3007; S. guianensis "Endeavour"; Macroptilium spp. CIAT 535; Desmodium heterophyllum CIAT 349; Pithecellobium unguis Cati L. leucocephala "Giant Selected".

Table 5. Quantities of Legume and Grass Seeds Supplied to Various Countries

Country	Legume Seed Supplied (kg)	Grass Seed Supplied (kg)	Total (kg)
Barbados	31.0	-	31.0
Dominica	1.0	-	1.0
Jamaica	16.05	0.5	16.55
Montserrat	7.0	-	-
Nevis	11.0	5.0	16.0
Panama	6.25	-	6.25
St. Kitts	6.05	5.1	11.15
St. Lucia	3.82	-	3.82
Tobago	5.0	-	5.0
Tortola	5.0	1.0	6.0
Trinidad	1.35	13.0	14.35
Turks & Caicos Islands	10.05	4.5	15.05
TOTAL	102.6	29.1	133.2

Another important output of our forage-systems project is the successful production of a leucaena leaf-molasses-urea-mineral supplement. We have demonstrated that this supplement (in addition to helping to feed animals during the dry season when they usually lose weight) can yield gains (0.5 kg/day) in Senepol bulls as great as those from a commercial protein block (0.57 kg/day).

APPRAISAL OF CURRENT RESEARCH ACTIVITIES

This project has increased our understanding of the small farmer, his farm systems, and his problems, while highlighting a number of very important issues such as institutional policy and effectiveness. The multicountry location of CARDI staff and projects no doubt creates problems of both logistics and administration. This is further aggravated by the lack of effective, reliable, and rapid communications. The cost and time implications of these are obvious.

In retrospect, we feel that the cropping-systems project would have been improved considerably if there had been fewer farmers and countries involved, thus enabling a more in-depth study of the representative farms. The farm monitoring exercise could have been more effective, even with fewer visits, if a more functional and readily analyzable monitoring schedule were used by a multidisciplinary team. The sheer size and number of farms involved tied up staff time and overloaded our analytical facilities.

More workshops at the planning, project design, and evaluation stages of the project are clearly needed. These workshops, in addition to bringing together the project staff, should also involve specialist resource staff members. Our experience has been put to use in our Forage Systems Project in Guyana, where we have just concluded a very useful project design workshop.

The problems of delays in recruiting suitable staff and the costs involved suggest the need for precise phasing of operations, both within and between countries. In our project, while there was some phasing, we attempted to tackle many countries simultaneously, thus over-extending both our resource and field staff.

There is also a need for adequate biometrics support in the design, implementation, and evaluation of all the survey and test data. Our biometrics services were over-extended by the volume of material to be handled, and future projects must provide for their own biometrics support.

Finally, and probably the most unfortunate part of the cropping-systems project was that it was called "cropping systems" and not "farming systems." The use of the term "cropping" or "multiple cropping" led to very serious misconceptions in the minds of our field staff who thought that animals were not included. This may have caused bias at the ministry level (when lists of farmers were compiled during the baseline survey) and in the emphasis given to the animal component in the monitoring exercises. However, it is reassuring that as a result of our experiences in this project, CARDI has made the policy decision to redirect its

efforts towards the promotion and study of the integrated crop-animal systems among the small farmers of the Eastern Caribbean. This will be the thrust of our future efforts.

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APPENDIX I

Animal Feed Resources of St. Lucia

Feed	Quantity available (tons)	Comments and season when available	Cost/lb (EC cents)
Copra	5,239	Year round	13
Bananas	22,500	Year round	17
Mangoes	8,482	Seasonal (30% wastage)	-
Cocoa	-	Seasonal. Pods could be used for animal feeding	-
Breadfruit	-	Mainly human food	-
Root crops (sweet potatoes, cassava, yam, aroids)	-	Vines and damaged roots available for animal feed	-
Brewers grain	80 metric	One brewery now used at Govt. farm in Veauxfort	
Citrus			
Slaughter house offals	-	Poultry offals available for pig feeding	
Wheat middlings	-	Now imported	21
Fish meal	-	Now imported	60
Leucaena	-	Growing wild	-

APPENDIX II

General Recommendations of Interventions for all Territories

rent Situation	Proposed Intervention	Suggested Procedures
n-Farm		
. Animal Nutrition Undernutrition and malnutrition promote disease susceptibility and inhibit productivity. Energy sources are generally in good supply (except during drought) but protein, minerals and other essential nutrients are often inadequate.	A. Provide balanced rations, esp. protein and mineral supplements to energy resources.	1. Protein sources--legumes, fish by-products, molasses-urea, cottonseed, sweet potato vines, insects. 2. Mineral sources--steamed bone meal, egg shells.
	B. Augment feed resource base with emphasis on ensuring adequate nutrient supplies in all seasons.	1. Feed preservation when available in excess for use in season of scarcity: solar drying, hay making under shelter, steel drum/plastic bag ensilage. 2. Forage harvest from food crops--sweet potato vines, maize thinnings, leaves harvested from growing plants. 3. Catch crops (usually grass/legume) grown between food crop seasons. 4. a. Highly productive grasses on marginal lands, field borders (Napier, Guatemala); frequent harvest schedule essential to good nutrient quality of these grasses. b. Legumes grown on marginal lands, field borders (leucaena). 5. Improve utilization of crop residues and agri by-products (reject bananas, copra, cottonseed).
I. Animal Health Poor nutrition and parasitism are the primary health problems affecting animals on small farms. Future introductions of breeding stocks, increased tourism, and other such contacts with other countries provide opportunity for introduction of disease.	A. Improve nutritional status.	1. Suggested procedures in previous section apply here. Additional attention should be given to nutrition of young stock to improve postnatal survival (e.g. iron supplements to newborn pigs).
	B. Treat for parasitism.	1. Regular drenching for endoparasites (primarily worms) should be instituted. Periodic treatment should coincide with parasite life cycle (often 3-4 weeks.) 2. Regular dipping or spraying for ecto-parasites (primarily ticks). 3. Routine health monitoring of local stocks; quarantine and inspection of all introduced stocks. Maintain stand-by readiness for vaccination and other action in case of major disease outbreak.

Appendix II continued.

Current Situation	Proposed Intervention	Suggested Procedures
III. Genetic Improvement		
Little attention has been given to improving genetic potential for productivity (meat, milk, eggs) under conditions of small farms.	A. Improve genetic potential for production and reproduction traits and eliminate effects of inbreeding. B. Small farmers should have access to these superior breeding stocks on an affordable basis. C. Management interventions should be introduced to ensure that the genetic improvement program is effective. These interventions include nutrition and health interventions to allow attainment of genetic potential, controlled matings to avoid inferior males (also, castration of such males).	1. Improved genotypes should be introduced through AI or importation of males. Initially, improved stocks should be kept in government multiplication centers to ensure proper management. Subsequently, their progeny should be distributed (preferably sold at reasonable prices) to small farmers. 2. Emphasis should be on multiple purpose genotypes (meat-milk, eggs-meat) rathe than specialized types; adaptation to local conditions is a necessary condition to selection for high productivity. 3. Attention should be given to choice of species to be improved as well as the traits to be improved. For example, the feed resource base in some territories is nonruminants. Moreover, the dual-purpose goat may be better suited to the needs of small farmers than the dual-purpose cow. 4. Numbers of females (cows, ewes, does, sows, hens) per small farm will often be insufficient to justify keeping a male for breeding. Communal studs or private studs can maintain superior males to service females on nearby farms.
IV. Animal Management		
Animal and feed resources available to small farmers are limited in both quantity and quality. Management strategies to make optimal use of these limited resources have been given little consideration. Modern advances in knowledge and low cost, practical technology can have significant value to small farm productivity, if applied under good management.	A. Implement improved management strategies and techniques. 1. Feed resources 2. Animal resources 3. Animal products	1. Animals should have access to feed at least 10 hours per day. This will generally require longer grazing periods and cut-and-carry feedings during night confinement for ruminants. 2. Feed resources should be preserved in periods of seasonal excess and stored until needed in periods of scarcity. Care in storage is necessary to preserve nutritional qualities. 3. Housing for rabbits and poultry should be provided to protect against predators, especially rats. Solar-powered electric fencing can provide protection from dogs as well as controlling stock movements. 4. Inferior males should be castrated (or preferably short scrotum) to prevent unplanned matings. 5. Good quality drinking water should be readily available. Hydraulic rams can provide water from otherwise inaccessible sources. 6. Local community or on-farm preservation of animal products: hot water bath pasteurization; smoked, pickled and solar dried meat; home tanning.

Appendix II continued.

Current Situation	Proposed Intervention	Suggested Procedures
Policy and Institutional Interventions		
Factors beyond the small farmers' control are often significant constraints to the improved productivity of the animal component of small farm. These factors are discussed in some detail in the text of the report and are only listed here.	A. Provide mechanisms to ensure that small farmers receive fair market value for animal products.	1. Remove price controls on locally produced animal products. 2. Provide grading standards that allow price differential for different quality. 3. Facilitate communication of fair market prices so that seller is not at a disadvantage to middlemen or other buyers.
	. Develop marketing infrastructure to support animal agriculture.	1. Develop marketing cooperatives, processing facilities, and other means to facilitate marketing of animal products. 2. Improve access to unborn markets, both local and export.
VI. Farm Management	A. Simple farm records	1. Provide simple farm accounting records. 2. Provide simple animal performance records.
	B. Extension, education and information.	1. Provide fact sheets, audio/visual materials, etc., on optimum marketing times, market intelligence, and new technologies. 2. Provide periodic evaluation of farm performance.

APPENDIX III

Suggested Priority Interventions

	Nevis	Antigua	Montserrat	Dominica	St. Lucia	St. Vincent	Grenada and Carriacou
I. Animal Nutrition Interventions A & B (cottonseed in the Windward Islands and bananas in the Leeward Islands)	XXX	XXX	XXX	XXX	XXX	XXX	XXX
II. Animal Health	XX	XXX	XX	X	X	XX	XX
II. Genetic Improvement Cattle Sheep & Goats (Leeward Islands & Carriacou) Pigs (Windward Islands) Poultry	XX	X	X	X	X	XX	X
IV. Animal Management	XXX	XX	XX	XXX	XX	XXX	XXX
V. Policy and Institutional Interventions	X	XX	X	XX	X	XX	X
VI. Farm Management	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Note: The interventions for specific territories have been ranked for purposes of implementation. Highest Priority - XXX; Moderate Priority - XX; Low Priority - X.

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