JOINT PROCEEDINGS

TROPICAL REGION

21st Annual Meeting of the Caribbean Food Crops Society and 32nd Annual Meeting of the American Society for Horticultural Science — Tropical Region

technology for agricultural development

Hilton Hotel, Port of Spain, Trinidad
8 - 13 September 1985

Host Institutions

— Caribbean Agricultural Research and Development Institute

— Ministry of Agriculture, Lands and Food Production, Trinidad & Tobago

— Faculty of Agriculture, University of the West Indies

Published by the Caribbean Food Crops Society, Box 506, Isabela, Puerto Rico 00662

THE BACKYARD PRODUCTION SYSTEM
A Solution For Low Family Nutrition in Dominica

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ABSTRACT

The Caribbean Agricultural Research and Development Institute (CARDI), through the USAID funded Farming Systems Research and Development Project, is currently evaluating a model Backyard Production System, designed to improve the nutrition of rural small farm households in Dominica.

The model, which consists of the farm household, livestock pens, feed plot, fenced vegetable plots, seedling nursery and compost heap, provided vegetables and eggs to the household at low cost. Data for 10 months show that additional vegetable consumption was 17.5kg, 62.kg and 14.2kg on Farms 1, 2 and 3 respectively. Egg consumption per month increased from 0 to 7.3, 31.6 and 36.0 and value of production was EC$617.20, $240.44 and $309.20 on Farms 1, 2 and 3 respectively. Establishment costs were EC$716.12, $350.12 and $647.25 whereas monthly operating costs were EC$141.25, $9.91 and $28.92 for Farmers 1, 2 and 3 respectively. Meat production and consumption were neglible.

RESUMEN

El Instituto de Investigación y Desarrollo Agrícola del Caribe (CARDI), a travez del Proyecto de Sistemas de Agricultura de Investigacion y Produccion, auspiciado por la USAID, esta evaluando al presente un modelo prototípo de un Sistema de Producción en los solares, el cual se ha disenado para mejorar la nutrición alimenticia en los hogares rurales de los pequeños agricultores, en Dominica. El modelo, el cual consiste de: la casa de estancia, corrales, parcela de alimentación para los animales, parcelas avalladas, de hortalizas; vivero y area de recolección del estiercol-provee de verduras y huevos al hogar, a un bajo costo. Datos obtenidos durante diez meses, mostrarón que el consumo adicional de verduras fue de 17.5 kg, 62. kg y de 14.2 kg en las fincas 1, 2 y 3 respectivamente. El consumo de huevos por mes subió de 0 a 7.3, 31.6 y 36.0, siendo el valor de la porducción de EC$ 617.20, $240.44 y $309.20 en las fincas 1, 2 y 3 respectivamente. Los costos de establecimiento fueron de EC$716.12, $350.12 y $647.25, mientras que los costos operacionales mensuales fueron de EC$41.25, $9.91 y $28.92 para las fincas 1, 2 y 3 respectivamente. El consumo y la producción de carne fueron negligibles.

The Commonwealth of Dominica, located in the Eastern Caribbean has a total land area of 752 km². It is characterized by mountainous topography, steep slopes, average annual rainfall ranging from 1250mm to 7,500mm, a dry season usually from January to April and average annual maximum and minimum temperatures of 27 and 20°C respectively. Data from the national farm register conducted in 1979 show that only 33% of the 751 km² land area is cropped. Additional cultivation is restricted by the mountainous terrain and heavy rainfall. These factors also influence the distribution of agricultural production.

The island is divided into 20 Agricultural Extension Sub Districts (SD) to facilitate technology transfer. In 1982 SD3 and SD4, north central to north eastern districts, were targeted by the Caribbean Agricultural Research and Development Institute (CARDI) for improvement in the nutrition of rural small farm families.

Of the 1418 ha of assorted vegetables cultivated in Dominica only 2.3% and 0.9% are located in SD3 and SD4 respectively. However, these are the most prominent areas of tree crop, banana included, and root/tuber crop production whereas highest vegetable production is located in SD12 and SD17 near the urban centres of Roseau and Portsmouth. Henderson and Gomes (1979), in their islandwide survey of 120 small farmers, indicated that the most frequent consumed foods were banana and root crops which were produced by the farmers on their holdings. Seventy percent of the farmers examined indicated that they consumed foods high in protein, vitamins and minerals (such as meat, eggs and vegetables) however these amounts were negligible and were purchased from various markets. Small quantities of vegetables were produced on parcels 1.0km to 6.4 km from the household primarily for sale and were not readily available to the farm household. SD3 and SD4 rank 1 and 7 respectively in terms of number of livestock. These animals are not slaughtered on a regular basis to provide meat for the household but were kept by the farmers as a form of security.

CARDI, through the Small Farms Research Project funded by USAID, completed a time series study of 20 farmers throughout the island from March 1982 to March 1983 (CARDI, 1983). Data for two farmers in SD3 and one in SD4 show that consumption of food produced on the farm ranged from 902.7 kg to 1625.9 kg for the period (Table1). An average of 90% were of the foods high in starch such as bananas, plantains, tannia, dasheen, yams, touslemois and breadfruit. Of the food consumed, 0% to 6.4% was meat and the remainder was fruit and vegetables. This diet was suplemented by small quantities of other purchased foods such as rice, flour, potatoes, peas, salted and canned meat and fish. These data were consistent with those reported by the Social Centre and the Food and Nutrition Council in Dominica. They reported that lack of nutritous food was one of the major causes of malnutrition in children, particularly evident in SD4.

The situation described above resulted in CARDI introducing a Backyard Production System or Integrated Production System for the Farm Kitchen model on these three farms in order to alleviate the nutritional problem.

The objectives of the system were:

1. To design and establish a self-sustaining production system which could keep the farm household continuously supplied with fresh meat, eggs and vegetables that are high in protein, vitamins and minerals.

Table 1. Amount (kg) of crops and livestock products produced and consumed by three rural farm households from March 1982 to March 1983.

Extension Subdistrict	SD3	SD4	SD5
Family size	3	4	5
Crops			
Banana	429	684	211
Plantain	45	12	222
Tannia	49	138	70
Dasheen	197	271	45
Yam	88	201	45
Touslemois	-	100	-
Breadfruit	143	95	-
Peas and beans	10	4	2
Tomato	1.5	6	14
Pumpkin	5	45	-
Cucumber	-	-	19
Corn	-	0.9	1.2
Mustard	-	5	-
Avocado	5	-	45
Grapefruit	-	17	31.4
Sugar cane	-	12 meters	-
Other vegetables	8	1	3
Sub-total	975.5	1597.9	902.6
Livestock			
Chicken	15	-	-
Goat	7	22	-
Sheep	45	-	-
Cattle	-	25	-
Sub-total	67	47	0
Total	1,042.5	1,626.9	902.6

Source: CARDI, Small Farm Systems Research Project.

2. To reduce the farmer's expenditure on these foods.

The model is currently being evaluated by the Farming Systems Research and Development Project funded by USAID. Data collected for the period May, 1984 to February 1985 are presented and discussed herein.

Materials and methods

Backyard Production Systems models were established by CARDI in cooperation with three farm households based on the conceptual model described by Adams. This occured over a period of 6 months. CARDI provided the cost of most of the inputs and the farmer provided the labour. The model consisted of:

Fenced vegetable plot: A shade-free area, approximately 65m^2 was selected close to the farm house at each location. Size of 8 to 10 raised garden beds therein ranged from 2.1m to 4.8m long by 1.0m to 1.7m wide. The land was cleared using a cutlass, forked, and organic manure incorporated before planting. These were planted with recommended varieties of vegetables such as carrot, tomato, cabbage, lettuce, celery, dwarf bean and sweet pepper. The area around the vegetable beds within the fence was reserved for planting seasoning herbs and other vegetables such as okra, pussley and bhagi. The vegetable plot was fenced, using chicken wire supported by live gliricidia posts to obviate praedial larceny and livestock damage. Leaves of the gliricidia were fed to the rabbits. The fence supported vining vegetables such as christophene, runner bean, cowpea, lima bean, squash and spinach. The available area was supplemented on one farm by erecting four trays, 2.1m x 1.0m x 0.1m and 1.0m above the ground using discarded zinc sheets and local carapite wood. These were filled with a mixture of compost and soil.

Vegetable seed bed: Either using the design described earlier for the trays or discarded metal containers, small seedbeds 0.12m^2 were erected. These were used primarily to produce seedlings of cabbage, lettuce and tomato, which were transplanted at 4 weeks. The young seedlings were protected against heavy rainfall by coconut leaves placed on the seedbeds.

Livestock and livestock pens: Chickens for eggs and meat and rabbits for meat were consisered appropriate protein sources by the three farmers selected because of familiarity, ease of management, availability of inputs and accessibility to available technology. In addition, one farmer established a pond, approximately 21m^2 in surface area to raise fresh water talapia fish and erected a pen, 1.0m^3 for housing his regular catches of feral agouti and opposum.

Dual purpose pens for chickens and rabbits were erected on two of the farms and separate units on the other. In all cases materials used in pen construction were wood, collected from the neighbouring forest; chicken wire, purchased in Roseau; and either galvanized sheets or discarded tin. In the dual purpose pens, the rabbit cages were placed within the chicken house in an accessible position 1.0m to 1.5m above the ground. Overall pen dimensions were 3.7m x 2.3m x 1.8m and 3.6m x 3.2m x 2.0m for dual purpose pens on Farm 1 and Farm 3 respectively. The front to the pens was 15cm higher than the back. The rabbit and chicken houses on Farm 2 were 3.1m x 1.0m x 0.5m and 3.8m x 3.0m x 1.7m respectively. On all farms the size of individual rabbit cages varied from $0.8m^3$ to $2.7m^3$. Laying boxes $0.5m^3$ were provided in dual purpose pens whereas in the sole chicken house an area 1.7m x 1.3m x 1.0m was set aside for laying. Each farmer was provided with 30 Rhode Island Red chickens and two New Zealand White rabbits from local sources. The males of the poultry were used for meat and the females for breeding and eggs.

Feed plot: An area 7.8m by 5.1m was planted with Desmodium and Guinea grass which were harvested periodically and fed to the rabbits. Cultural practices were similar to those described for vegetables.

Compost heap: Two pits, $0.7m^3$ to $1.0m^3$ were dug next to the livestock pens in order to facilitate easy movement of pen manure. One pit at a time was filled with alternate layers of waste from the kitchen and vegetable plot, and manure from the livestock pens. During filling, the contents were stirred periodically. Occasionally ammonium sulphate was added to assist rotting. Once full, the pit was covered with soil and left for three months, after which the compost was harvested and then distributed to the vegetable plot. Two farmers supplemented this source of manure by collecting decomposed leaves from the nearby banana boxing plant.

Farm household: The three farm households selected had previously participated in the CARDI Survey of 20 Small Farmers. Family sizes for Farmers 1, 2 and 3 were 3, 4 and 6 respectively. The farm household assisted in choice of crops based on tastes, needs, nutritive value and agroclimatological adaptation. The farm household assisted in record keeping and spent a maximum of 2 man hours daily managing the system.

The relationship between components of the model is illustrated in Figure 1. The following parameters are being assessed for evaluation of the model during biweekly visits to the three farms.

1. Establishment costs
2. Maintainance costs
3. Egg production and consumption
4. Meat production and consumption
5. Vegetable production and consumption
6. Expenditure on foodstuffs
7. Revenue from sale of surpluses
8. Labour use
9. Flows between components
10. Production and use of compost
11. Foodstuffs from other parts of farm
12. Economic analysis

To date collection on parameters 9, 11 and 12 has not begun.

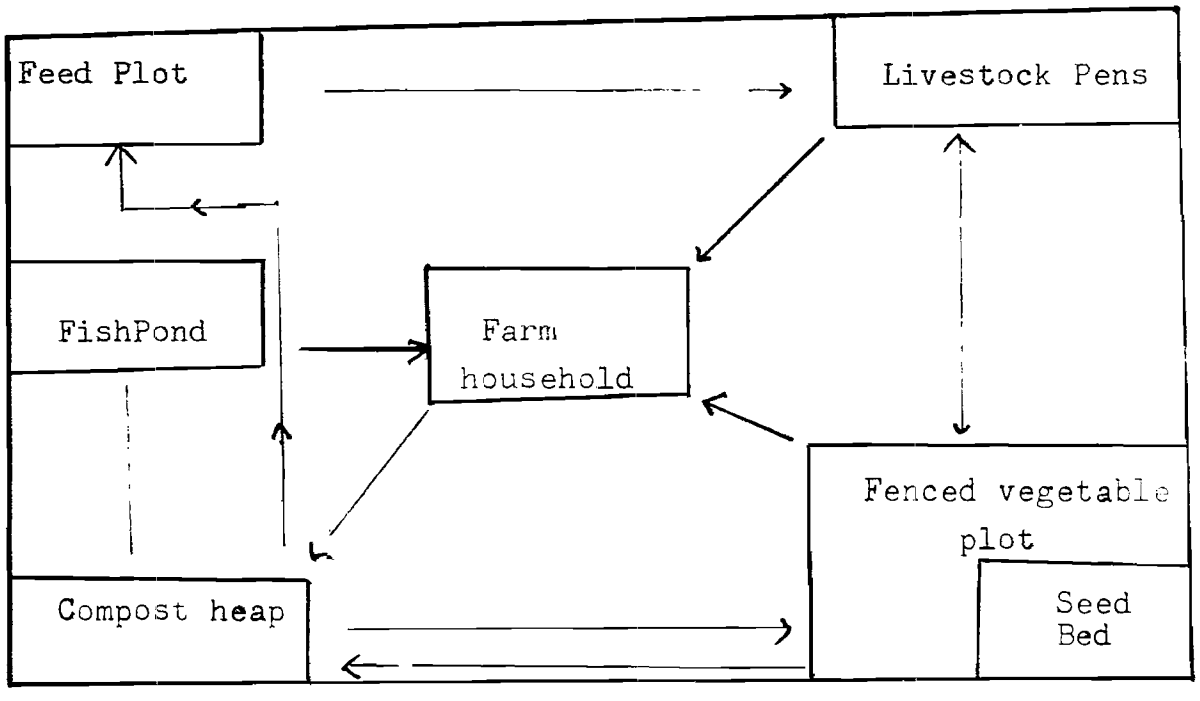

Figure 1: Schematic diagram of model Backyard Production System on three farms in Dominica.

Results and discussion

Results shown in Tables 2, 3, 4, 5 and 6 are summaries of the data collected to date on the Backyard Production Systems. Establishment costs were EC$711.62, $350.12 and $647.25 on Farms 1, 2, and 3 respectively for seeds, fencing, livestock, feed and labour. On all farms fencing was the major cost ranging from 56% to 62% of the total costs. Variation in costs is attributed to differences in size of the various components on each farm and the quality of wire provided on Farm 2 when compared with Farms 1 and 3. During this establishment period, the value of meat, vegetables and eggs produced by the system was EC$700.25, $588.21 and $481.50 on Farms 1, 2 and 3 respectively. These compare favourably with the establishment cost.

Maintenance costs, borne largely by the farmer, were primarily for seed, animal feed, wire, wood and nails for repairs to livestock houses and fences, and labour. Chemical inputs such as pesticides, fertilizer and medicines were negligible as recommended by Adams (1981) in his description of the conceptual model.

Average monthly cash expenditures from September 1984 to February 1985 were EC$41.25, $9.91 and $28.92 on Farms 1, 2 and 3 respectively (Table 3). These are higher than those for the pre-intervention period as Farmers 1 and 3 did not have backyard systems and farmer 2 spent only EC$4.00 providing seed for his vegetable garden over 1 year.

The higher cash expenditure and labour use on Farm 1 was associated with the high cost, $35.21 per month, of repairing the livestock houses and the fence, which also necessitated use of hired labour. Farmer 3 placed more emphasis on poultry for egg production and consequently his main expenditure was for poultry feed which was 79% of the cost of biological materials.

The cost of biological materials also included EC$11.00 and $8.00 for the purchase of fertile eggs to be hatched on Farms 1 and 2 respectively and EC$20.00 for purchase of a pair of rabbits on Farm 3. These expenditures were necessitated because of the high incidence of rabbit deaths and poultry diseases which it is hoped will be alleviated by regular visits by the Ministry of Agriculture Veterinary service and improvement in animal husbandry. The costs of livestock and the structural costs were sporadic whereas seed costs occurred nearly every month as the farmers maintained a steady supply of vegetables to the household.

Other inputs which did not require cash outlays were recorded, for example, decomposed banana leaves, 312.0 kg and 248.0 kg, and rabbit manure 31.0 kg and 15.0 kg, on Farms 1 and 3 respectively, were incorporated into the vegetable beds. Inputs on Farms 2 and 3 included 3.5 kg of feral agouti and 24.0 kg of opposum respectively, caught in the nearby forest.

Data in Table 4 indicate that Farmer 1 was the most committed to the success of the model. Seventy two percent and 81% more time was spent on the Backyard Production System than on Farms 2 and 3 respectively. The majority of labour on all farms was used in the livestock and vegetable components where the wives also assisted.

Variable production and consumption data were recorded for three farms, (Table 5). Egg production ranged from 42.8 per month on Farm 3 to 9.0 per month on Farm 1. Eighty-one percent to 100% of the eggs were consumed by the farm households, and small quantities were sold by Farms 1 and 3. Highest egg consumption per person per month recorded, was 7.9 eggs on Farm 2. Though these figures are low they are an improvement on the pre-intervention period when no eggs were produced by any of the

Table 2. Materials and cost of establishing three model Backyard Production Systems in Dominica

Input	Farm 1 Quantity	Farm 1 Val ($)	Farm 2 Quantity	Farm 2 Val ($)	Farmer 3 Quantity	Farmer 3 Val ($)
Seed	23 pks	11.50	8 pks	4.00	17 pks	6.50
Labour	63 hrs	118.12	23 hrs	43.12	42 hrs	78.75
Fencing	1 roll	400.00	1 roll	204.00	1 roll	400.00
Feed	56.8 kg	82.00	22.7 kg	34.00	77.3 kg	73.00
Chickens	30	60.00	30	45.00	33	69.00
Rabbits	4	40.00	2	20.00	2	20.00
Total		711.62		350.12		647.25

Table. 3 Average monthly cash expended and labour used to maintain three Backyard Production Systems from September 1984 to February 1985 in Dominica

Farmer	Cash expenditure on materials (EC$)			Labour used (Man-hours)		Cost	Total
	Chemical	Biological	Structural	Family	Hired	EC$	EC$
1	0.20	4.17	35.12	20.4	1.3	1.67	41.25
2	0.58	1.83	7.50	4.8	0.00	0.00	9.91
3	0.00	19.96	8.96	4.3	0.00	0.00	28.92

Table 4. Labour (man hours) spent on each component of the Backyard Production System over a six-month period in Dominica

Farmer	Labour (man hours)					
	Veg. plot	Compost	L/Stock	Hunting	Feed plot	Fish pond
1	45.25	12.0	74.5	0	0.25	0
2	12.75	0	9.0	3.0	0	4.0
3	9.5	2.0	7.0	7.0	0	0

Table 5. Average monthly production and consumption from three model Backyard Production Systems from establishment to February 1985 in Dominica.

Farm	Item	Production	Consumption	Sold	Revenue
1	Eggs	9.0	7.3	1.7	0.83
	Meat 9kg)	1.2	1.2	-	-
	L/stock (rabbits)	24.0	0.4	1.1	11.11
	Vegetables (kg)	20.9	17.5	3.4	15.72
	Compost (kg)	15.1	15.1	-	-
2	Eggs	31.6	31.6	-	-
	Meat (kg)	2.2	2.2	-	-
	L/stock (rabbits)	1.8	0.6	0.1	1.2
	Chicken	0	0.4	-	-
	Vegetables (kg)	6.2	6.2	-	-
3.	Eggs	42.8	36.0	6.8	4.10
	Meat (kg)	0.6	0.6	-	-
	L/stock (poultry)	7.4	1.2	-	-
	Vegetables (kg)	14.3	14.2	0.1	1.00

farm households. On Farms 1 and 2, an average of 4.0 and 1.8 rabbits were borne per month respectively, and 7.4 chickens were hatched monthly on Farm 3.

Livestock deaths were not quantified on any of the farms, though these did occur. These losses were attributed to the low level of animal husbandry practised relative to the exotic breeds used. Use of local breeds is now being instituted to solve this problem. These losses were one of the contributing factors to the low average monthly meat consumption recorded, 0.6kg to 2.2kg. On Farms 2 and 3, 0.6kg and 4.0kg of feral meat per month respectively was also consumed. Additional meat was provided from the shop and periodic slaughter of other livestock.

The model provided the farm households with an increased quantity and wider range of fresh vegetables which were more readily available on a daily basis. Average monthly vegetable production was 20.9kg, 6.2kg and 14.3kg on Farms 1, 2 and 3 respectively (Table 5). These figures are greater than those recorded for the same farmers previously, 2.0kg, 5.1kg and 3.3kg per month averaged over 12 months (Table 1). Most of these vegetables were consumed by the farm household. The higher production on Farm 1 was associated with the greater use of labour and use of compost, 15.1kg per month, and decomposed banana leaves collected from the boxing plant. Where neither of these inputs was used, as on Farm 2, production was comparatively low and there was no surplus for sale.

All the farm households sold either livestock, eggs or vegetables. Average total monthly cash receipts were EC$27.66, $1.20 and $5.10 on Farms 1, 2 and 3 respectively. These amounts represented 67%, 12% and 18% of the cash used to operate the systems on Farms 1, 2 and 3 respectively. Though the model was not commercially oriented it was self-sustaining. One contribution of the System to the farm household was savings on food expenses which were measured in terms of the value of the commodities used by the farm household from this system. Based on average local market prices, the value of commodities produced on Farms 1, 2, and 3 were EC$1,371.25, $868.65 and $790.70 respectively. These were higher than establishment plus operating expenses on Farms 1 and 2 by 37% and 112% respectively but less by 4% on Farm 3.

Data from September 1984 to February 1985, show that cash expended on vegetables for the farm household was negligible (Table 6) due to the consistent supply of vegetables from the Backyard Pro-

Table 6. Food expenditure for three farm households, from September, 1984 to March 1985, in Dominica.

Farmer	Beef/chicken/ fish	Cereals/ rice	Legumes/ pluses	Vegetables	Total
1	19.50	2.60	3.60	3.00	28.70
2	1.54	1.30	1.38	-	4.22
3	30.79	1.65	1.42	2.75	36.60

duction System. The highest expenditures were made on meat and fish. Rice and dried peas and beans had to be purchased since the climate of the area was not conducive to their production, however the System supplied green mature peas and beans.

Conclusion

To date the Backyard Production System has been able to increase consumption of eggs, meat and vegetables by the farm household at low cost. These items were either not previously produced by the household for their consumption, as in the case of eggs, or only a limited range was available some distance from the home, as in the case of vegetables. Attention must be directed to improving livestock management and changing consumption patterns, with corresponding changes in nutritional status. Continued evaluation of the model will include economic analyses. The success of the model to date can be measured in terms of its introduction into the South East and North East Extension Districts of Dominica by the Social Centre, Food and Nutrition Council and other extension agents.

Acknowledgements

CARDI wishes to acknowledge the contributions made by Messrs Jefferson Alexander, Wade Bell and Ryborn Williams and their families who assisted in this study. Technical and administrative support from CARDI FSR/D Project and Dominica's Ministry Agriculture and financial support from CARDI CORE and USAID are appreciated.

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