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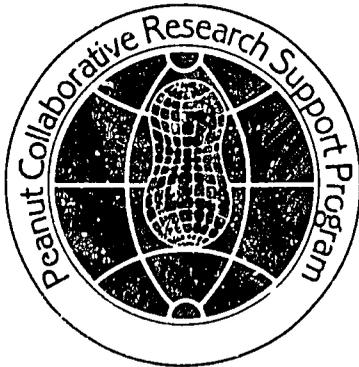
*The Economic Impact
of Peanut CRSP
in Jamaica:
Performance of
CARDI/Payne Cultivar*



PEANUT COLLABORATIVE RESEARCH SUPPORT PROGRAM

On the cover:

Ms. Carol Wilson, Extension Agent, and Dr. Ray Hammons, Peanut CRSP External Evaluation Panel Member, observe farmer's planting of CARDI/Payne peanut cultivar in St. Elizabeth's Parish, Jamaica.



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THE ECONOMIC IMPACT OF PEANUT CRSP IN JAMAICA:
PERFORMANCE OF CARDI/PAYNE CULTIVAR¹

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PREFACE

A major constraint to peanut production in Jamaica has been the availability of adapted, high yielding, and desired quality cultivars for use by the farmers. Through collaborative research supported by U.S Agency for International Development (USAID) Grant No. DAN- 4048-G-SS-2065-00, The Caribbean Agricultural Research and Development Institute (CARDI), and The University of Georgia, an improved cultivar was released for Jamaica and named CARDI-Payne. Cooperative efforts of CARDI and the Jamaica Ministry of Agriculture in St. Elizabeth's Parish have resulted in adoption of the cultivar by farmers. The study reported in this paper was conducted to determine the economic impact of the new cultivar.

The impact study was supported by USAID Grant No. DAN-1310-G-00-0045-00 to Michigan State University, Bean/Cowpea CRSP for impact studies by several CRSPs, and a subsequent subgrant to The University of Georgia, Peanut CRSP.

We acknowledge the cooperation, support, and interest of CARDI in extending to farmers the improved cultivar. Also, appreciation is extended to The Ministry of Agriculture in St. Elizabeth's Parish for efforts in multiplication and distribution of the seed to farmers, especially the work of Ms. Carol Wilson, extension agent. Thanks to Alabama A&M University, The University of Georgia, North Carolina State University, and Texas A&M University for faculty time in designing the survey instruments, and coordinating the on-farm surveys, analyzing the data, and preparing the manuscript.

David G. Cummins
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ABSTRACT

The original research was designed to develop high yielding peanut cultivars. Later research has focused on development of mechanical aids for small scale peanut production, harvesting and marketing, and develop new peanut products. These research initiatives should subsequently improve the nutrition and income of peanut farmers and the polis of Jamaica.

The impact study was limited to evaluation of a new cultivar (CARDI-Payne) developed under the original research program. Data for the impact evaluation was acquired by a detailed survey instrument administered to 100 peanut farmers in the St. Elizabeth Parish of Jamaica. Paired analysis and regression were used in the data analysis.

The paired difference analysis revealed a yield advantage for the CARDI-Payne cultivar of 274 pounds per acre or 42% over the traditional cultivar. The annual value of the estimated yield increase to the economy of Jamaica would be in the range of \$600,000. This is about 10 times the research investment made on cultivar improvement in the total Caribbean program. Most of the benefit will accrue to Jamaica peanut farmers.

Peanut CRSP has been of substantial benefit to the peanut farmers and the Jamaica polis. It may be reasonably conjectured that comparable benefits have accrued to other Peanut CRSP countries especially in the Caribbean and Central America. However, more effort is need in technology transfer and infrastructure development.

INTRODUCTION

Jamaica is one of the larger Caribbean islands located about 1000 miles south of the State of Florida. Jamaica is a member of CARICOM or the Caribbean Community, which includes some 12 English speaking countries from Belize in Central America, Jamaica, through the lesser Antilles to Guyana in South America. The Caribbean Agricultural Research and Development Institute, headquartered in Trinidad, serves much of the agricultural research interests in the region.

Jamaica is typical of the region and most developing countries in that the farms of the region are small, with most of the work done by hand. Most of these farms are low-input/resource poor, with low incomes realized by the farmers. The nutritional levels of many of the people are marginal. Peanut, although a minor crop at this time, promises to partly alleviate these problems by increasing the income of small farmers through sales in local and inter-island markets, and to increase protein and caloric intake of both rural and urban people. Based on these needs and problems, identifiable constraints that could be addressed by research to relieve the problems, the proximity to the United States, and a Caribbean Basin Initiative being developed by the United States; the Peanut CRSP chose CARDI as a collaborative institution for the region. Jamaica is a primary country in the CARDI program, as it is a primary peanut producer of the CARDI countries and has some inherent research capacity.

DESCRIPTION AND PURPOSE

The initial Peanut CRSP project in Jamaica "The International Peanut Evaluation Program", was led by The University of Georgia and Principal Investigators Drs. Ray O. Hammons and William D. Branch and later Craig S. Kvien. Active research began in 1983 when the first support funds were transferred to CARDI. The project was designed to introduce and evaluate advanced lines or cultivars in countries where a breeding program did not exist, but there was interest and capability for this level of a program to develop improved cultivars for farmer use. The project also had components in West Africa and Southeast Asia. (USAID Peanut CRSP Grant).

The first set of seed was sent to CARDI in 1982 for field testing in 1983. More germplasm was introduced in subsequent years. The 1984-1985 planting in Jamaica included a line, ICG 7886 that had been released as Tifrust-2 by the U. S. Department of Agriculture, the University of Georgia Coastal Plain Station, and ICRISAT (Hammons, et al., 1982). Tifrust-2 provides resistance to rust caused by Puccinia arachidis Speg., a problem disease in the Caribbean. The line was collected in Peru, has an erect or bunch growth habit, and relatively small seeds (0.4 grams/seed) with a light tan seed coat color. Tifrust-2 also has moderate resistance to leafspot. Tifrust-2 performed exceptionally well in this first

planting in Jamaica. Further selection and testing of the Tifrust-2 material was conducted in the 1985-1986 season. On-farm testing was added in the 1986-1987 season. The cultivar selection from Tifrust-2 was released in Jamaica in 1987 and named CARDI-Payne. Payne was in honor of the late Mr. Horace Payne, CARDI Agronomist and Peanut CRSP collaborator, who had conducted the research to develop the new cultivar.

The Ministry of Agriculture in St. Elizabeth Parish, a location of the initial on-farm trials, began an active program in 1988 to increase and distribute the new CARDI-Payne cultivar to farmers. Most of the peanut in Jamaica is grown in St. Elizabeth Parish. Based on reports within the Peanut CRSP and observations of the Peanut CRSP External Evaluation Panel in 1989, it appeared that CARDI-Payne would have a significant and positive economic impact on the farmers in Jamaica. The peanut is acceptable to the consumer, especially for peanut butter production. The traditional Valencia type grown in Jamaica is not acceptable for peanut butter production due to a low oil content and distorted appearance of peanut butter caused by red skins if they escape removal in the production process (Peanut CRSP Annual Report 1986/1987).

From the inception of the INPEP project until the release of the CARDI-Payne cultivar in 1987, a total of U. S. \$60,574 in CRSP funds were expended in the region.

CARDI-Payne in Jamaica was chosen for an impact analysis of Peanut CRSP technology because of the early adoption of the cultivar by some farmers in the area, the concentration of the peanut farmers in a relatively small area which reduced the cost of data collection for the impact study, cost effectiveness of the study due the relative proximity to the United States which reduced travel costs, the presence of a strong extension group that aided in the diffusion of the cultivar, assistance that the extension group could provide in conducting the impact study, and the similarity of the farm situation to that in other developing countries for extrapolation of potential impacts of technology in other countries.

The objectives of the socio-economic impact study of the Peanut CRSP in Jamaica included in this report were:

1. Estimate yield increase of CARDI-Payne cultivar compared with the conventional valencia (red) cultivar under field conditions.
2. Estimate the economic impact of the CARDI-Payne cultivar on the home use value and income of small peanut farmers.

Results from additional objectives of the study will be reported in following papers.

METHODOLOGY

The economic impact assessment contained in this report is based on a survey of 100 peanut farmers in the St. Elizabeth parish. Respondents were selected from lists of peanut farmers representative of the production areas provided by the Ministry of Agriculture in St. Elizabeth Parish (equivalent to a county agricultural extension office in the United States).

Ministry of Agriculture personnel assisted the organizing team in locating each potential respondent on the road maps. A detailed survey instrument was developed by a Peanut CRSP impact evaluation team.³ Local personnel in St. Elizabeth parish administered the survey (questionnaire) under the supervision of Dr. Moxley and Mr. Grant Humphrey, Research Assistant with Dr. Purcell at the University of Georgia during July and August 1990.

Method of Analysis

The more conventional method of estimating benefits of research, education and development -- economic surplus and rate of return on public investment -- was not deemed applicable to the peanut sector in Jamaica. Sufficient time has not elapsed to permit widespread adoption of the new cultivar and for it to have extensive impact on the economy.

In that Jamaica is a net importer of peanut and products, and a relatively small player in the international market; the level of production in Jamaica has little or no impact on the domestic price -- that is, Jamaica peanut farmers are confronted with a highly (near infinity) elastic market for their product. Thus, all the output can be sold at prices established in the international market. The Jamaican government also levies a 150% import tariff on peanut and products to protect domestic farmers.

The basic assumption underlying this economic impact analysis is that all increases in yield or productivity attributed to Peanut CRSP will accrue to peanut farmers. The benefits will accrue as increased nutritional value if the additional increment is consumed by the household, or as increased income when the additional increment is sold in the market.

A multiple regression formulation was designed to estimate the yield difference of the CARDI-Payne cultivar relative to the

³The team was composed of Drs. Joe Purcell, Agricultural Economist, The University of Georgia, Bobby Eddleman, Agricultural Economist, Texas A&M University, and Robert Moxley, Sociologist, North Carolina State University. Drs. Purcell, Wheelock, and Moxley visited Jamaica in June 1990 and made plans for the survey and tested the survey instrument.

traditional valencia cultivar. Other variates postulated to impact yield were also incorporated into the multiple regression formulation. Thus, barring any serious violations of the assumptions of the least-squares model -- such as multicollinearity -- the analysis will yield a net impact of the adoption of the CARDI-Payne cultivar.

Due to the extreme variation in peanut yield by location, paired difference analysis (Ostle 1954) was utilized to detect differences in yield between the CARDI-Payne and Valencia in the same location (relatively small district). This procedure does not provide for variation due to factors other than location but is considered valid for the first approximation as production practices on small farms are rather standardized.

RESULTS

Performance of new CARDI-Payne cultivar

Estimates of the impact of selected production practices on peanut yield based on the multiple-regression formulation did not provide significant or meaningful results due to the high degree of variation associated with location, and many locations did not have both cultivars grown near each other. Although the province is small, the elevation changes rapidly resulting in wide differences in microenvironment, particularly rainfall. This necessitated a formulation of paired differences.

Paired differences revealed a yield advantage under field conditions of 274 pounds per acre (42%) attributed to adoption of the CARDI-Payne cultivar; yields from the paired areas compared averaged 921 pounds/acre for CARDI-Payne and 647 pounds/acre for traditional Valencia. However, the range in the difference was substantial from 228 pounds in favor of the traditional cultivar at one site to 666 pounds in favor of the CARDI-Payne cultivar. The CARDI-Payne cultivar yielded higher at eight of the nine paired sites representing 32 fields of CARDI-Payne and 33 fields of Valencia over two growing seasons. The difference in yield was significant at the 0.02 level (Table 1).

Table 1. Comparative yields of CARDI-Payne and the traditional Valencia cultivars. Total of 32 fields of CARDI-Payne and 33 fields of Valencia over two growing seasons in 1989-1990.

Site	CARDI-Payne	Valencia	Difference
		Pounds/Acre	
1	600	828	-228
2	1450	1233	217
3	1600	1000	600
4	446	363	83
5	333	195	138
6	955	489	466
7	888	680	208
8	1466	800	666
9	550	237	313
Avg.	921	647	274

T = 2.97, PR>{T} = 0.0179

Effectiveness

Approximately 83% of the respondents were aware of the existence of the CARDI-Payne cultivar. Through the September (intended) 1990 planting season, 44% of the respondents had planted or tried the CARDI-Payne cultivar. Thus, based on the sample, about 44% of the peanut growers would be expected to shift to the CARDI-Payne by the 1990-91 (Dec-Jan) harvest.

The sequence of adoption of the CARDI-Payne was 3% prior to 1988, 12% during 1988, 17 percent during 1989 and 8% during 1990. As the history of performance of the CARDI-Payne cultivar, under field conditions, is limited to 3 years, the ultimate impact on yields and benefits to peanut farmers are yet to be realized.

Relevance

The peanut area seeded, yield, and production for the 1979-89 decade in Jamaica are shown in Table 2. Area seeded to peanut is small and variable ranging from 4,145 to 6,640 acres during the decade 1979 to 1989. Average yield was low ranging from 424 to 554 kilo per acre. The highest yield was recorded in 1979 and the lowest yield in 1988. Subsequently, gross production varied from 1,761,000 kilos in 1988 to 3,545,000 kilos in 1985. Production is reported quarterly by the Ministry of Agriculture. The data for 1979-89 reveal no discernable trends in area seeded to peanut, yield or production.

Table 2. Peanut: Area Planted, Production Yield, Price and Value, Jamaica 1979-1989

Year	Area	Yield (kilos/ac)	Production (1000 kilos)	Change from 1979 Base	
				Yield	Production
1979	4994	554.67	2770	--	--
1980	4711	533.22	2512	-21.45	-258
1981	4197	547.53	2298	-7.13	-472
1982	4524	551.50	2495	-3.16	-275
1983	5592	511.80	2862	-42.86	92
1984	5876	475.15	2792	-79.51	22
1985	6640	533.89	3545	-20.78	775
1986	4927	476.96	2350	-77.70	-420
1987	6511	485.95	3164	-68.72	394
1988	4145	424.85	1761	-129.82	-1009
1989	5282	507.38	2680	-47.28	-90

Trend in Area: $4783.255 + 72.4727$ (Time) $R^2 = .0787$.

Trend in Yield: $562.8996 + 8.9242$ (Time) $R^2 = .5349$.

Trend in Production: $2682.4363 - 4.2091$ (Time) $R^2 = .0009$.

Source: Jamaica Ministry of Agriculture.

A field survey, conducted in July and August 1990, focused on the rate of adoption and performance of the CARDI-Payne cultivar compared with the traditional valencia under field conditions. The economic impact of Peanut CRSP in Jamaica is limited by a small cropland base and an extremely small area (about 5,000 acres) seeded to peanut. However, cultivar, production, harvesting, storage, and product development technology can be transferred to other tropical countries with comparable climates, soils, and terrain. The CARDI-Payne cultivar can potentially increase peanut production in Jamaica (with no increase in area seeded) by 1,000,000 to 3,000,000 pounds annually into the foreseeable future. With a border price of about \$0.30 per pound, this translates into an increased value of production in the range of \$300,000 to \$900,000 in Jamaica.

Efficiency

Much of the effort of Peanut CRSP during the 1980's in Jamaica was on improved cultivars. Through several selection processes in test plots, a new cultivar of light tan peanut designated "CARDI-Payne" was released to growers during the 1980's. Results of the controlled experiments on both research stations and on farms were highly favorable for the CARDI-Payne cultivar compared with the traditional red skinned valencia cultivar (Annual Reports of the Peanut CRSP 1984, 1985, 1986/87). The potential returns to research cost (\$60,000 for the total CARDI effort) range from 5 to 15 times the investment annually in Jamaica alone. When this

investment is partitioned for Jamaica alone (estimated one-fifth of the total), the eventual annual returns for Jamaica could be 25 to 75 times the total investment.

Sustainability

The CARDI-Payne cultivar was developed in collaboration with the CARDI research unit in Jamaica. Financial constraints in CARDI will probably prohibit development of a substantial peanut research program in the absence of outside funding. Priorities will govern that. A small peanut improvement program would likely remain in the absence of outside funding. CARDI is supported by contributions from member countries and externally from donors such as the U.S. Agency for International Development.

Local institutions in member countries coordinate with CARDI and benefit from research output. Jamaica has a well organized extension service within the Ministry of Agriculture. The office in St. Elizabeth has been actively involved in promoting peanut production, and as stated elsewhere in this report, has led in the seed increase and distribution of the CARDI-Payne cultivar to farmers. Based on this experience, it is evident that the country has the in-country organizational capacity to utilize this and other new technology.

FACTORS INFLUENCING PERFORMANCE

Although the paired difference analysis indicated a substantial increase in yield of the CARDI-Payne over Valencia the yield difference can be substantially enhanced through irrigation, fertilization, and pest management. The CARDI-Payne cultivar performs best, compared with the traditional cultivar, under favorable growing conditions. This is verified by both the test plot data, and a relatively large commercial planting under irrigation and other recommended production practices.

In addition to the yield advantage, the CARDI-Payne cultivar has more desirable physical attributes in the manufacture of peanut butter. The market is not yet well developed but this advantage should eventually be reflected in a price advantage and income enhancement of peanut farmers.

IMPLICATIONS

Research, education and development (RED) are the three necessary components of rising affluence in a society. Superior peanut cultivars are necessary but not sufficient to improve the well-being of small subsistence farmers. The next stage of the process is to demonstrate the superior performance of the new cultivar, including expanding and distributing seed and extending optimum peanut production practices. These two stages alone can improve the level of subsistence and potentially produce a marketable surplus.

The third and most essential stage to incur a substantial improvement in the economic well-being of the polis is commercialization of the food system. Rising affluence stems from specialization and exchange. Commercialization of the food system requires a supporting infrastructure to provide industrial inputs to primary producers and market the product through commercial channels.

Substantial capital investments are necessary to implement emerging technologies. Abundant and uniformly distributed rainfall or irrigation is necessary to insure high peanut yields. Irrigation may be provided by individual production unit types depending on wells or ponds for a source of water, or a larger scale irrigation project to divert water from natural streams to cropland. In both cases a substantial investment is required.

Rising affluence of the polis depends primarily on increasing labor productivity. In the case of primary crop production (including peanut) labor productivity depends primarily on mechanization. The economic feasibility of mechanization depends on large scale production units. Consolidation of small peanut farms into economic size units is necessary to implement mechanization.

Simultaneous spawning of higher order economic activities and employment opportunities are necessary to consolidate small inefficient farm units into larger scale efficient units. Spawning higher order economic activities also requires capital investments. A polis can generate knowledge, skills and capital internally. However, external infusion of knowledge, skills and capital will expedite the development process.

Peanut CRSP has made substantial progress in developing improved peanut cultivars, small scale mechanical aids, and new products. However, diffusion of the new technologies is in its early stages and the full impacts will not be realized until the three stages of RED are near their full potential.

A modest scale irrigation project is needed to exploit the full potential of the CARDI-Payne peanut cultivar in Jamaica. A commercial farm grew four acres of CARDI-Payne cultivar under irrigation in 1990 and produced over 2,000 pounds per acre, two to three times the average farm yields; ten acres are planned for the 1990-1991 season with production contracted to a peanut butter manufacturer. Farmers and the general polis in Jamaica would benefit from a modest scale irrigation project. Farmers in Jamaica can improve their economic lot by increasing the production of peanut or exploiting their comparative advantage in other products to exchange in the international market. A prototype already exists on the south side of Puerto Rico with a comparable climate, terrain and soils.

AID and TRADE must evolve simultaneously in the third world countries in order to bring their farmers into the mainstream of the global food and economic system. Exploitation of comparative advantage and trade is the only avenue to rising economic affluence.

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