PN-AAG-884

TESTING OF A DELIVERY SYSTEM

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SMALL FARMERS IN LDC'S

An Interim Report of the Ghana Experience

PRAIRIE VIEW A&M UNIVERSITY

Prairie View, Texas

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An interim report of the Ghana Experience

by

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August, 1979

Contributions of the College of Agriculture, Prairie View A&M University, Prairie View, Texas 77445, and the Soil Research Institute, Government of Ghana. This work was supported by a grant from the Agency for International Development, U. S. Department of State under Project AID/csd 2836.

TESTING OF A DELIVERY SYSTEM TO TRANSFER AGRICULTURAL TECHNOLOGY To SMALL FARMERS IN LDC'S

INTRODUCTION

This brief paper is intended to serve as an interim report on all major events and results of testing the Prairie View Model delivery system in Ghana from the period September, 1977 through August, 1979, covering 4 growing seasons. Other reports have already been disseminated. These covered most of the subject areas in much greater detail, through the period ending August, 1978. A final report on the project will be released after August. This will give a more detailed account of the many intricacies involved in the procedures as well as in the results obtained.

THE PRAIRIE VIEW MODEL

Briefly this model consists of using an indigenous para-professional to introduce technological innovations and to teach small-scale farmers on a one-to-one basis the skills required to use them.

The para-professional is a more successful farmer who received intensive training from professional extension personnel and, therefore, bridges the gap between the professionals (who are limited in both number and available time for one-to-one training) and the numerous farmers who require this type of approach due to illiteracy, distrust of outsiders or of professionally trainer persons.

To ensure maximum cooperation and effectiveness the para-professional is paid for his services - that is, he is engaged full time on a job. The key feature of the Model is that para-professionals are employed in their home villages where their assistance is readily available to their neighbors and where their influence on farmers is more intense and effective.

TESTING THE MODEL IN GHANA

With financial assistance provided by the United States Agency for International Development, Prairie View A&M University modified and then tested the delivery Model in Ghana for four growing seasons. The Soil Research Institute of Ghana's Council for Scientific and Industrial Research was selected to assist in testing the Model. A memorandum of agreement between the Institute and the University was jointly developed. The Institute's Director and a District Extension Officer from Ghana's Ministry of Agriculture received orientation at Prairie View A&M University on the programs operation and on other matters related to the project. The Extension Officer was assigned full-time to the Institute where he served as a Counterpart to the University's Extension Program Specialist.

A. Selection of Villages and Farm Leaders

Due to the amount of time required to purchase and ship a motor vehicle from the United States and because the Soil Research Institute's vehicles could not be used extensively for the project, three villages within a 12 mile radius of the Institute were initially selected for testing the Model. Visits were made to the proposed villages where the program was explained to the Chiefs and farmers. Approval of the program in the villages was secured. Testing began during the minor season, 1977. Two additional villages were chosen to extend testing during the two-year period.

Farm leaders (para-professionals) for the villages were selected from persons recommended by village councils based on announced qualifications.

All appointees had prior farming experience, are literate and possess most of the essential qualifications listed in other reports on this project.

B. Training the Farm Leaders

Initially, training of para-professionals (farm leaders) was concentrated on the technical aspects of crop production. The leaders were taken on tour of successful farming operations, further orientated on the purpose of the program, then given on-the-job training in applying the modern techniques for the initial stages of the cropping cycle such as laying out rows and planting maize. As soon as these techniques were mastered on demonstration plots in each village, the leaders then began teaching these methods to participating farmers. Subsequently, farm leaders were instructed on each additional cultural practice while carrying out the practices on the demonstration plots. They in turn taught farmers the intricacies of these modern practices. Other aspects of their training included methods to gain confidence of the farmers, to fully explain the program to farmers and to convince farmers to try the modern methods on their farms.

C. Modern Practices and Cropping System

The modern practices introduced to farmers through this program consisted of a system of technological innovations. Initially, the program was to introduce a system of producing maize in pure stands or monoculture, but farmers were very reluctant to try it as it was far different from their traditional polyculture or intercropped system.

A package of modern practices was then assembled for application to a polycultural system of maize, cocoyam and cassava. Maize being the first crop established in the system was treated as follows:-

a. Planted in 3-foot rows at 2-foot spaces, 2 plants per hill (actually 3 seed, then thinned to 2 plants as necessary).

b. Use of improved varieties (Composit 4 or La Posta, developed in Ghana).

c. Use of fertilizer in recommended amounts at planting and before tasseling.

d. Proper scheduling of planting, weed control, thinning, etc., and also harvesting early to avert weevil infestation and bird damage.

e. Growing maize during the minor season by controlling stem borers with insecticides.

Other crops in the system were established and treated as follows:-

a. Cocoyam in this area grows voluntarily from plant stock remains from previous seasons. However, a process of thinning over-populated areas and transplanting vacant areas was undertaken. Generally, the plant population and spacing of the cocoyam were similar to that of maize. Transplanted stock was placed between the maize rows.

b. Cassava was planted between the maize rows after maize had grown to about 3 to 4 feet in height. Proven techniques of planting stock selection and placement in the soil were used.

The stock was spaced 3 feet apart between the maize rows and thinned to two plants per location. Specific fertilizer requirements for common varieties of this crop have not been ascertained.

D. Introduction of Practices to Farmers

Initially, farmers were solicited for participation in the program on a voluntary basis because adequate foundation had not been established for the farm leaders to individually convince any farmer in the villages to enter the program as normally sought by methods of the Model. A total of 16 farmers participated in the program during the first season. They were convinced to establish and treat up to one-half of their plots in accordance with practices of the modern technological package while leaving the remainder to their traditional practices for comparison. The farm leaders provided continuous instruction and supervision to each farmer during each farming operation; teaching farmers the skills necessary to lay out rows, to properly plant seed at the recommended spacing and rate, to properly mix, measure and place fertilizers, to select and remove excess plants, to remove weeds on a timely schedule without damaging crops and other skills required throughout the growing season and during harvesting.

In this delivery system emphasis was also placed on disseminating and perpetuating the use of these practices among farmers. Participating farmers were informed of the many sources of aid available to them and how to obtain these from various governmental agencies. Such aids inlude improved seeds, fertilizers, insecticides, and technical and

financial assistance.

Demonstration plots were established along well travelled roads and footpaths near each village to expose other farmers to this improved farming system and its good results. The aim was not only to generate interest but also to quickly convince additional farmers into joining the program. These plots also served as training areas for the farm leaders and helped to establish the leaders as competent farmers who had acquired skills which could be transmitted to others.

Schools of various levels in each village also participated in the program. Teachers became so convinced about the good crop yields obtained that they encouraged their students to actively participate in each farming operation. It is hoped that through the students many of their parents will learn about the program and eventually opt to follow the improved practices being introduced.

All activities were closely monitored by the Ghanaian Extension Officer and the American Counterpart. Problems encountered were taken to the Soil and Crops Research Institutes and other governmental agencies for possible solutions.

RESULTS

The project has been very successful thus far. The technological package produced extremely good results during each of the four seasons of testing. The number of participating farmers increased each season. (Table 1).

A. Number of Participating Farmers

Initially 15 participants were sought in each of the 3 original villages. However, due to the lack of experience in implementing such

a program in Ghana and attendant problems in training ordinary farmers to be leaders, the goal of 15 was generally not obtained until the major season of 1979 (Table 1). It is noteworthy to mention that the program grew much more rapidly in the new villages added later in 1978 and 1979. This is an indication that improved training and other methods developed later during the program proved more successful in convincing farmers to participate. Table 1 also shows that the goal of 15 farmers for each village was greatly exceeded in two of the villages during the major season of 1979. Initially, the goal was 75 farmers but the program proved to be so successful that during the final season 82 farmers became involved. If there had not been limitations on the amount of materials available for the program, many more farmers would have participated.

B. Success of the Technological Package

A major factor contributing to the success in getting farmers to participate in the program is the success of the modern practices introduced in the program. During the first season of testing (minor season, 1977) only a small number of farmers could be convinced, since there was no pictorial evidence that maize could be so successfully grown during the minor growing season especially by using insecticides to control the stem borer. The tremendous results obtained during this season was largely responsible for the general increase in farmer-participation during the following seasons. Maize yields from the modern portions of the 15 original farms generally yielded 4 to 5 times as much as the traditional portions of the farms; an increase of 300 to 400 per cent (Table 2.). If the traditional plots had not been sprayed to control the stem borer, the yields from these plots would

have been negligible.

Statistically, the increase in yields by use of these innovations is (of course) very highly significant. Economically, it is also very significant (Table 5).

1. Economic Success

It is estimated that the major costs involved in producing one acre of maize by the modern method used in this project total to about 238.20 cedis, and about 200.00 cedis per acre for the traditional method (Tables 3 and 4). The difference accounts for the cost of fertilizers and labor.

Based on the data for the minor season of 1977, the average participating farmer increased profits from growing maize by nearly 860 per cent. The modern method costs about 25 per cent more in material and labour inputs than the traditional method (harvesting and marketing charges not considered due to the lack of reliable estimates) and will produce an average of almost three times the amount of maize shown in Tables 2 and 5.

In the worst case situation, net profits were increased by at least 163 per cent and by nearly 900 per cent in the best case situation. These two cases were defined only in terms of the smallest and largest differences between modern and traditional yields such that some indication of the illustrative value of the plots could be estimated. Other factors to be considered here are the amount of material and labor inputs actually applied to each plot. Extremely low yields from the traditional plot in the best case situation could represent an abandoned crop, or inadequate spraying to control stem borers.

It must be emphasized that the data in Table 3 and 4 used for compiling Table 5, are estimates of the major costs of producing maize by the methods used on the test plots. Other details such as labor for harvesting and marketing are not included due to lack of reliable estimates. The cost of these items, of course, are expected to be somewhat more for the modern plots since the yields are greater, but not in proportion to yield. It is very doubtful that any substantial portion of the 600.49 cedi per acre mean additional profit resulting from the use of modern technology will be eroded by the cost of harvesting and marketing the addition 48.27 (mean) bushels of maize.

The "best case farm" in Table 5 shows a negative profit from the traditional plot. Probably this adverse situation did not occur because it is doubtful that all the recommended inputs of labor and insecticides were actually used and still resulted in less than 8 bushels of maize per acre. The modern plot on this same farm, however, was among the highest producers.

It is interesting to note that at the 1977 market value of maize, the cost of the technology applied to the modern plots could be borne by just over 3 bushels of maize (on a one-acre basis). Again harvesting and marketing charges are not included. The break-even points based on these data are estimated to be about 12 and 15 bushels per acre for the traditional and modern plots, respectively. Failure to break even only occurred in three cases, all on traditional plots.

More recent data collected from the major season of 1978, also show very highly significant yield differences between modern and traditional plots. Taken as a worse case situation, as defined in Table 5, modern plots on two farms during the major season of 1978 yielded 56.1 per cent

(23.45 bushels) per acre more than the exceptionally good traditional plots. This difference, of course, has been found to be statistically significant. At the 1979 market value of 34.11 cedis per bushel (134.00 cedis per bag), this worse case difference would amount to 799.87 cedis per acre. Again considering the extra costs involved in the application of modern practices, it is noted that tremendous profits were still realized by farmers in this program. In a best case situation, the differences are estimated as astronomical.

2. Intercropping

Another major factor contributing to the success of these trails is that the technological package included intercropping. While farmers in many areas of the world have realized advantages of intercropping for thousands of years, modern scientific research has had other concerns and has, generally, ignored the primary advantages of these systems. However, on non-mechanized farms, the practice is attractive because it greatly reduces labor and land requirements. It also provides protection against complete plot failure in case one crop fails. One primary disadvantage often considered in the case of intercropping is that, yields are reduced due to shading of lower crops and excessive competition for nutrients and water by heavy feeding plants.

During the conduct of this project, experimental plots have shown that maize yields are not significantly reduced by the presence of either cocoyam or cassava, though mean yields were slightly lower. Certainly, any realizable loss in maize yields will be overly compensated by the yields from other crops in intercropped systems.

3. Growing Maize in Rows

The practice of growing maize in rows is probably the most apparent innovation of the package, since fertilizers and other material inputs are not highly visible. From the first season, other farmers in and near the test villages began copying the practice of growing maize in rows, hoping this practice alone would produce the results they had observed on plots of participating farmers. This practice has been widely received and is accredited to facilitate weed control and most other cultural practices, including harvesting and to give farms a nice neat appearance.

C. Voluntarily Seeking Aid

After participating in the test program for only one season, many of the farmers began requesting fertilizers from project personnel and information on how to obtain enough fertilizers for their entire farms. Farmers in these areas are also requesting information on how to obtain improved seed and cassava planting materials, sprayers and insecticides and technical assistance for other agricultural enterprises.

D. Problems

Many of the problems encountered in carrying out this program were related to the relative immaturity of the Model's development for use in Ghana and the problems of transport prior to the arrival of the project vehicle from the United States. Regular visit could not, therefore, be made to the villages to complete training of the farm leaders

as quickly as planned. Most of these problems, however, did not severely affect the major objectives of the program. It is felt that the lack of suitable transport constituted the major cause for not being able to interest the initial anticipated 15 farmers from each village as early as the first major season to participate in the program.

SUMMARY AND PROJECTIONS

Prairie View A&M University Model has been successfully tested in selected villages in Ghana for four growing seasons. Results of these tests show that traditional farmers are interested in, and will eventually adopt technological innovations to improve their output if the various inputs are made readily available and the innovations are introduced by a project-trained leading farmer in their villages.

The goal of 15 farmers per village was exceeded in all but one of the 5 villages (the first season the village participated) during the fourth season of testing the Model. As results of the modern system became known to neighboring farmers, many began requesting information and wanted to participate in the program.

Demonstration plots established in each village served well to train the farm leaders, to show methods and results to groups of farmers and to accredit the farm-leader as an expert on the farming methods used. Intercropping experiments on these plots showed that maize yields are not significantly reduced when it is interplanted with cocoyam or cassava.

Although some farmers will continue to request technical and material assistance to further improve their enterprises, the period of testing this Model was too brief to determine the percentage that will

permanently modify their practices. Also, since all technical and material assistance used in this test program was provided free of charge, some farmers may not be willing to risk their own money on these materials, though the additional profits are tremendous (almost 800.00 cedis per acre more). The overall success of this project may be best measured by the percentage of farmers who continue to use these methods over long periods of time.

In order to more fully evaluate the impact and success of this program, both monitoring of these areas and further testing of the Model should be continued in villages which have been in the program for less than three seasons. It will also be desirable to expand the program to include some additional villages in order to more fully evaluate the recently developed methods of not only effectively training village farm leaders but also to more quickly implement the program in new areas.

TABLE 1

NUMBER OF FARMERS PARTICIPATING IN THE MODEL TESTING PROGRAM FROM EACH VILLAGE DURING EACH SEASON

Village	1977 Minor Season	1978 Major Season	1978 Minor Season	1979 Major Season
Kotei	8	9	11	19
Jachie	3	10	14	15
Bwidiem	5	4	12	21
Adjamesu	-//-	-//-	2	15
Gyankobaa	-//-	-//-	-//-	12
Totals	16	23	39	82

In addition to participating farmers, 5 schools also maintained farms in accordance with methods introduced by this program.

-//- Program not initiated during the periods.

TABLE 2

YIELD DATA FROM TEST PLOTS, 1977

VILLAGE FARMER	MAIZE YIELDS -++- (bushels/acre)		% YIELD INCREASE DUE TO USE OF MODERN TECHNOLOGY
	Modern Plots	Traditional Plots	
Hwidiem			
J.K. Taah	70.72	15.72	350
Kofi Afari	86.42	15.72	450
Stephen Mensah	62.86	23.57	170
Nana Awuah	47.14	27.50	70
A.B. Salutu	55.00	15.72	250
Kotei			
Adwoa Badu	62.86	15.72	300
Anthony Wiafe	86.43	23.57	270
Ama Nuto	78.57	15.72	400
Akua Nkrumah	78.57	15.72	400
Yaa Afram	55.00	23.57	130
Nana Sarfo	58.93	23.57	150
Adu-Gyamfi	62.86	15.72	300
Abena Manu	27.50	11.79	130
Jachie			
Yam Pensek	62.86	7.86	700
Yam Mmorosah	78.57	7.86	900
*Secondary School	74.64	-	-

*Demonstration plot. Data for traditionally cultivated portion not supplied.

-++- Data originally reported in number of bags per acre and rounded to nearest one-quarter bag (about one bushel). Errors of this magnitude may occur in data.

TABLE 3

*ESTIMATED MAJOR COSTS FOR PRODUCING ONE ACRE OF MAIZE IN THE FORESTED REGION IN GHANA BY SMALL FARMERS USING LIMITED MODERN TECHNOLOGY

ITEM	1 COST (GHANAIAN CEDI)
Clearing Trees	
4 men x 3 days x 4.00 cedis per man day	48.00
Final Land Preparation	
4 men x 2 days x 4.00 cedis per man day	32.00
Planting	
6 men x 2 days x 4.00 cedis per man day	48.00
Transport of Fertilizer and Seed	5.00
Fertilizer Application	
2 men x 1 day x 4.00 cedis per man day	8.00
Weeding (2 times)	
4 men x 2 days x 4.00 cedis per man day (1st time)	32.00
4 men x 1 day x 4.00 cedis per man day (2nd time)	16.00
Sidedressing Application	
2 men x 1 day x 4.00 cedis per man day	8.00
Spraying	
2 men x 1 day x 4.00 cedis per man day	8.00
Seed	5.20
Fertilizer	13.00
Sidedressing	5.00
Insecticide	10.00
TOTAL ESTIMATED MAJOR COSTS PER ACRE	198.20

*These estimates are based on costs occuring on test plots during the minor season, 1977, as given by Mr. Opoku and Mr. Acquaah of SRI, Kumasi, and used in this report for comparative purposes only.

TABLE 4

*ESTIMATED MAJOR COSTS FOR PRODUCING ONE ACRE OF MAIZE IN THE FORESTED REGION IN GHANA BY SMALL FARMERS USING TRADITIONAL METHODS

ITEM	1 COST (GHANAIAN CEDI)
Clearing Trees	
4 men x 3 days 4.00 cedis per man day	48.00
Final Land Preparation	
4 men x 2 days x 4.00 cedis per man day	32.00
Planting	
6 men x 2 days x 4.00 cedis per man day	48.00
Weeding (2 times)	
4 men x 2 days x 4.00 cedis per man day (1st time)	32.00
4 men x 1 day x 4.00 cedis per man day (2nd time)	16.00
Spraying	
2 men x 1 day x 4.00 cedis per man day	8.00
Seed	5.20
Insecticide	10.00
TOTAL ESTIMATED MAJOR COSTS PER ACRE	159.20

*These estimates are based on costs occuring on test plots during the minor season, 1977, as given by Mr. Opoku and Mr. Aequaah of SRI, Kumasi, and used in this report for comparative purposes only.

TABLE 5

COMPARISON OF ECONOMIC FACTORS OF MODERN

AND TRADITIONAL PLOTS, MINOR SEASON, 1977

	TRADITIONAL PLOT (CEDIS)	MODERN PLOT (CEDIS)	% INCREASE OF MODERN OVER TRADITIONAL
[1]Mean value of harvest from one acre maize (Market value = 13.24 cedis/bushels)	229.05	868.54	279.2
[2]Cost of production one acre maize	159.20	198.20	24.50
Mean net profit per acre	69.85	670.34	859.69
[3]Net profit per acre "worst case farm"	161.90	425.93	163.08
[4]Net profit per acre from "best case farm"	-98.13	842.07	958.11

[1]Mean yield achieved from all test plots during Minor season, 1977 (Table 3).

[2]Only major costs from Tables 3 and 4 considered.

[3]Worst case farm assumed to be farm with lowest difference between modern and traditional plot yields.

[4]Best case farm assumed to be farm with largest difference between modern and traditional plot yield. Negative profit may not have actually occurred due to suspected omission of inputs, thus decreased production costs.