

Malawi Agricultural Research Project

Center for Tropical Agriculture
International Programs
Institute of Food and Agricultural Sciences
University of Florida

The Department of Agricultural Research
Ministry of Agriculture, Malawi

The U.S. Agency for International
Development

QUARTERLY REPORT

July, August and September

1982

Project No. AFR 06 612-0202

Contract No. AID/afr-C-1653 (Malawi)

M P - 9

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I. INTRODUCTION

The University of Florida technical assistance team is in Malawi as part of the Malawi Agricultural Research Project, AFR 06 612-G202, the purpose of which is to strengthen the Department of Agricultural Research of the Ministry of Agriculture. The project is funded by the United States Agency for International Development (USAID) and the Malawi Government (GOM). The University of Florida (UF) is administering the project as the Title XII contracting institution, under contract number AID/afr-C-1653 (Malawi).

This, the ninth quarterly report, covers the second quarter of the Malawi 1982-83 fiscal year, July - September 1982.

II. HIGHLIGHTS

Strengthening of research programs is a major objective of the project and technical assistance team members continued to concentrate on activities that will contribute to a strengthened research program. Each section was required to prepare work plans and budgets for the 1983-84 GOM fiscal year during the quarter, and team members provided guidance and assistance to the Malawian professional staff in this exercise. It is believed that such planning will lead to more relevant, better designed research that will make the best use of research monies.

The Farming Systems Section conducted two intensive surveys of smallholder households during the quarter and started the process of analysis.

Computer programs were written for the Apple II computers that provided the capability for each researcher to analyze the previous season's experiments so that their results were immediately available for planning the next season's trials and to speed up the process of making recommendations to farmers.

Participant training continued as a priority goal of the project. Another group of prospective participants took the GRE examination in August. Seventeen Malawi Professional Officers remained in the U.S.A. at their various universities. One participant trainee returned to Malawi for a six week period, accompanied by his advisor, to collect data for his research project.

In-service training continued in all sections, under the guidance of the technical assistance team. Three short-term IDY consultants taught in-service courses and seminars during the quarter.

An additional shipment of project commodities arrived during the quarter and word was received that additional shipments had been made in late September by surface and air.

Progress continued on construction of housing at Chitedze, progress was made on site acquisition at Tsangano, and bids were received for construction of the soils laboratory at Evumbwe during the quarter.

A summary of project inputs is presented in Figure 1 below.

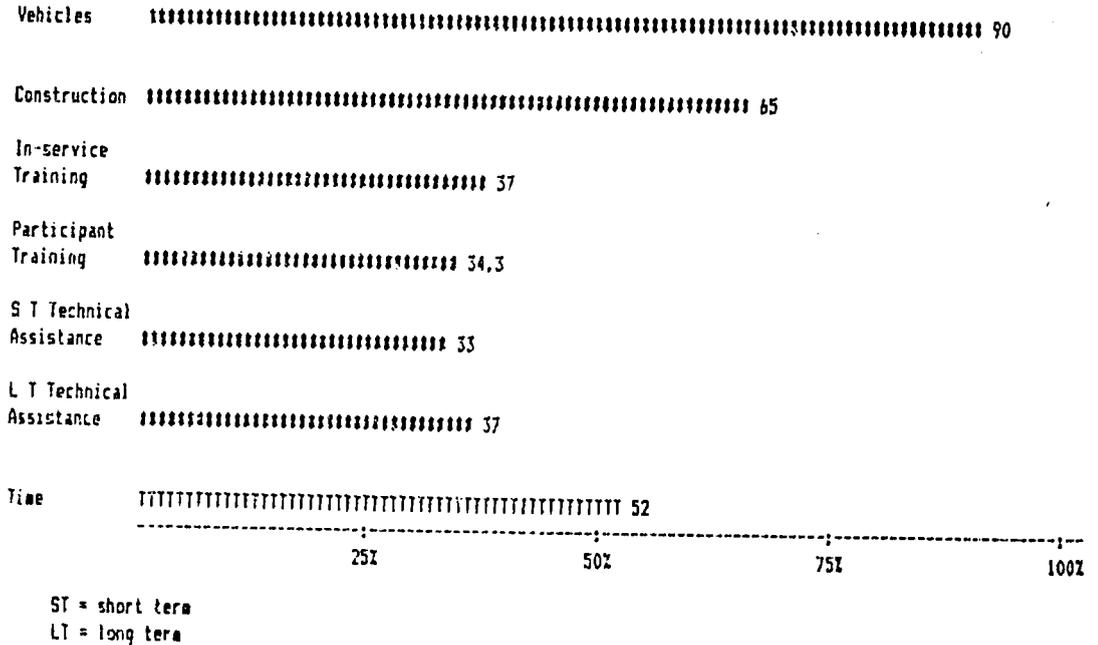


Figure 1. Malawi Agricultural Research Project, Summary of Inputs to September 30, 1982.

III. TRAINING

A. Participant Training

One of the most important goals of the project is to train 33 Malawians for M.S. and Ph.D. degrees so that they will be able to improve the research conducted by the Department of Research. At the close of the quarter, 17 students were studying for degrees in the U.S.A., 10 for the Ph. D. degree, six for the M.S. degree and one for the B.S. degree.

They had completed 303 person-months of training out of the total of 900 allocated for participant training, or 34.3 percent of the total. A list of the participants, along with their disciplines and degree programs is shown in Table 1. It is interesting to

note that the 17 active participants are pursuing degrees in 17 different disciplines.

Table 1

PARTICIPANT TRAINING QUARTERLY REPORT
July 1 to September 30, 1982

Name	Training	Degree Program	Station	Departure	Months Accumulated	Due Back	Funded To	Degree
Chapola G.M.	Plant Pathology	Ph.D.	Bvumbwe	Dec 27 '80	21	Apr 84	Jun 84	
Chigwe C.F.B.	Sorghum Breeding	Ph.D.	Makoka	Dec 28 '81	9	Dec 84	Jun 85	
Chikwana R.	Agricultural Economics	M.S.	Chitedze	Dec 26 '80	21	Dec 82	Jun 83	
Chilembwe E.H.	Fruit Crops	M.S.	Bvumbwe	Dec 27 '80	21	Jun 83	Jun 83	
Chipala E.E.	Soybean Breeding	Ph.D.	Chitedze	Dec 26 '80	21	Dec 83	Jun 84	
Dzowela B.H.	Pasture Agronomy	Ph.D.	Chitedze	Dec 26 '80	21	Jun 84	Jun 84	
Gondwe M.T.	Vegetable Crops	M.S.	Bvumbwe	Dec 28 '81	9	Dec 83	Jun 84	
Khonje D.J.	Soil Microbiology	Ph.D.	Chitedze	Dec 28 '81	9	Dec 84	Jun 85	
Kisyoombi F.	Statistics	M.S.	Makoka	Dec 27 '80	17	Jun 82	Terminated	
Mkamanga G.Y.	Crop Physiology	Ph.D.	Chitedze	Dec 26 '80	21	Jun 84	Jun 84	
Mtambo P.J.	Sred Technology	B.S.	Chitedze	Dec 28 '81	9	Dec 83	Jun 85	
Munthali J.T.K.	Animal Nutrition	Ph.D.	Chitedze	Dec 26 '80	21	Dec 83	Jun 84	
Mzebe C.P.	Irrigation Agronomy	M.S.	Kasinthula	Dec 27 '80	21	Jun 83	Jun 84	
Nqwira L.D.H.	Maize Agronomy	M.S.	Chitedze	Dec 28 '81	9	May 84	Jun 84	
Mtokothe E.M.	Soil Survey	Ph.D.	Lilongwe	Dec 26 '80	21	Jun '84	Jun 84	
Saka A.L.	Soil Physics	Ph.D.	Chitedze	Dec 27 '80	21	Dec 83	Jun 84	
Sibale P.K.	Groundnut Breeding	Ph.D.	Chitedze	Dec 26 '80	21	Jun 84	Jun 84	
Zambezi B.T.	Maize Breeding	M.S.	Chitedze	Jun 4 '81	16	Dec 83	Dec 84	
Total					309			

† Terminated without Degree in May 1982

B. In-service Training

1. Agricultural Economics

During this quarter, Agricultural Economics had one professional officer (Assistant Agricultural Economist) at Chitedze. Her in-service training during this period consisted of:

- preparation and presentation of a paper at the International Conference on Development in Malawi in the 1980's.
- introduction to three major software packages for the Apple II computer: A-STAT, DB-Master, and SUPERTEXT.

- assignment as Acting Head of Section during R&R of the Agricultural Economist.

2. Crop Physiology

With the assistance of John Abbington, Tobacco Research Authority, programs were developed for statistical analysis of research data for use on the HP-85 computer. Informal in-service training on the use of the HP-85 computer was provided to three Malawian professional officers. The secretarial staff was given training in use of the Apple Computer with SuperText for word processing and Malawian staff were trained in use of the HP-41C calculator.

3. Farming Systems

Varied forms of in-service training were carried out during the quarter. In July the two Malawian staff members presented a paper they had co-authored with Dr. Hansen at an international "Conference on Development in Malawi in the 1980s" at Chancellor College in Zomba. The experience gained by researching, writing, public presentation and defense of their research is an essential part of professional training.

Another staff member was hired at the beginning of August, and during August and September all three received intensive on-the-job training in survey design and administration. More details are given below under research.

4. Livestock

Assistance was provided to Malawi staff in use of the Apple II Computer and analysis of data. Assisted the newly recruited Dairy Production Officer, Mr. M. Kumwenda, in becoming familiar with the livestock research section and advised him on development of a work plan. He also was assigned responsibility for supervision of the dairy herd at Chitedze ARS.

5. Pastures

Dr. Hodges accompanied Mr. H. D. Msiska to the 4th Regular Subcommittee meeting for Veld and Pasture, SARRCUS. Venue was Nylsvley Savannah Ecosystems Project where delegates from Swaziland, Lesotho, Namibia, South Africa and Malawi met.

IV. RESEARCH

A. Agricultural Economics

The project objective relevant here is to begin a program of Agricultural Economics research which is relevant to smallholder farmers. The basic activity toward meeting this goal is the development of the human and support capacity for such research. The development of the human capability is discussed elsewhere under training of various types. During this quarter, the development of an Agricultural Economics Data Bank was the main support-development activity. The ability to store, retrieve, manipulate, and analyze large amounts of data is essential for the

work of Agricultural Economists. The framework of this Data Bank consists of three computer programs: A-STAT, DB-Master, and SUPERTEXT. A-STAT is a very versatile data storage and manipulation program which can do multiple linear regression, analysis of variance and other statistical calculations. DB-Master is the program currently used to store information about each file of data in an information storage/retrieval mode. SUPERTEXT is used to prepare and update the Data Base Standards manual.

Four appropriate areas of research have been identified as:

- 1) Evaluation of new technology based on social and economic criteria
- 2) Economics of irrigation for smallholders
- 3) Price policy
- 4) Identification of farming activities which require new technologies.

This quarter, our main activities can be categorized as follows:

1. Evaluation of new technology

- Prepared a response to Dr. Hodges on proposed collaborative livestock/pasture/agricultural economics, research.
- Obtained a large volume of maize fertilizer response data for 5 years and 7 ADD's. This data has been entered into the Agricultural Economics Data Bank and is being analysed in an effort to improve the fertilizer recommendations throughout the country.

2. Economics of Irrigation for Smallholders

- At the request of the Officer in Charge and in order to estimate the cost of irrigating a larger than previously planned area of research land for Chitedze, water requirements for irrigating 20 hectares were estimated.

3. Price Policy Studies

- "A Review of the Effects of Food Price Policies"; a general paper on the basic relationships involved in price policy was prepared and presented at the International Conference on Development in Malawi in the 1980's, held at Chancellor College, July 12 - 14, 1982.

Another piece of disciplinary research was conducted by the Assistant Agricultural Economist, Miss Nthakomwa. It does not fit well into the above categories but should be noted. A paper was prepared and presented by her at the International Conference on Development in Malawi in the 1980's, "Agricultural Economics in Research"

B. Crop Physiology

1. Completed writing the program for the PNUTS simulation model for the Apple II Computer and assisted Gray in Development of a statistical package which will enable the Malawian staff to analyze research data accurately and timely.
2. During the quarter, work continued on development of groundnut physiology work. Simulation models for three new peanut varieties from the POPY 81 experiment were completed.

C. Farming Systems

A project goal is to establish a program in farming systems research. This entails hiring and training staff, establishing methodologies and procedures, and creating precedents and political/professional support. Analyses of farming systems are being conducted using three methodologies. One is via the diagnostic survey, a rapid procedure for combining research, evaluation and extension staff into problem-identifying and problem-solving teams. The section has been involved in five of these since April 1981. A second method is through the compilation and analysis of existing survey data, largely that collected by evaluation units of ADDs. Until now this has primarily been done by the evaluation staff themselves. The third is through longitudinal surveys, i.e., surveys that trace the same people through time to learn how they have changed and why they have accepted and/or rejected possible innovations. This third method is noted in the work plan under establishing base line data. Work on a longitudinal study in the Lilongwe project was begun earlier this year and intensified during this quarter.

August and September were almost entirely occupied in setting up and conducting an intensive survey of two samples of Lilongwe project (LRDP) smallholder households. This was in collaboration with the Women in Agricultural Development (WIAD) Project (also USAID-funded) and a faculty member at Bunda College (for the dietary portion). Sixteen different interview schedules and a form for measuring hectareage were prepared, several of them derived from questionnaires worked out earlier by our section. Twenty Bunda College students were recruited for six weeks as interviewers and garden surveyors. They were housed at Colby College for a week (6-13 August) and trained in how to conduct the survey. The actual survey lasted five weeks (14 August-15 September) with a few garden surveyors working longer. During the survey the Bunda students were supervised by the professional staff of the section and the WIAD Project. As soon as the surveying ended we began to check and code the data.

One of the two samples is a longitudinal one. It was randomly selected from the households identified as descending from the households originally surveyed in 1969/70. This sample of 42 households (six in seven different villages) will be analyzed to identify changes in farming patterns over the past 12 years and any concomitant changes in standards of living. From this we shall be able to learn more about what changes have been occurring, why they seemed to occur, and what have been the

consequences.

The other sample was randomly selected from households which were surveyed by the Evaluation Unit of LRDP for two successive years (1980/81 and 1981/82). This sample of 101 households has three functions: 1) serving as a check on the representativeness of the sample derived from 1969/70, 2) providing more information about a random sample of smallholders today, and 3) providing a solidly documented sample as a base for future farming systems studies in LRDP.

D. Livestock

Activities in the Livestock Section continued to center on long range planning for a strengthened livestock and pastures research program in the Department of Agricultural Research and implementation of the planned research projects.

1. Dairy Cattle Research. Surveyed the Mzuzu Milk Shed Area, accompanied by Mr. Msiska, Pasture Section, to obtain first hand information on problems confronting the smallholder dairy farmers. It was determined that an aggressive pasture research program should be started at Lunyanqwa, and accordingly, it was recommended that an experienced pasture technical assistant be transferred from Chitedze to Lunyanqwa prior to the next growing season.

2. Malawi Zebu Program. Prepared a plan for relocation of livestock research away from Dzalanyama Ranch in written form and had a conference with Dr. Legg and Dr. Mwandemere to discuss the recommendations.

3. Pasture Experiment. Work continued on construction of watering tanks, corral and spray race. This work is aimed to fulfill a major objective of the project, "the determination of pasture productivity in terms of animal performance."

4. Computer Programming. A major effort during the quarter was development of a series of statistical programs which will enable the use of the Apple II computers to analyze most of the experimental data generated at Chitedze and other research stations. Programs developed include the following:

- (1) Two-way Analysis of Variance
- (2) Three-Way Analysis of Variance
- (3) Split-plot Analysis of Variance
- (4) Latin Square Analysis of Variance
- (5) Four-Way Analysis of Variance on a replication/location basis

The programs are "user friendly" and require minimal instruction in their use. Approximately 25 experiments were analyzed during the quarter using these programs, thus enabling the various researchers to use their data to plan next season's work and speed up the process of getting research results disseminated to the farmer, both of which are objectives of the project.

6. Feed and Forage Analysis Laboratory. An additional shipment of equipment arrived, including the centrifuge and fat and oil extraction apparatus. The installation of this laboratory is a major objective of the project, so as to provide the capability for performing "in vitro" digestibility of feed materials, particularly crop residues.

E. Pastures

Emphasis in the Pasture Section during the quarter was on analysis of data from the past season and writing an updated version of the "Pasture Handbook for Malawi" in order to get updated information into the hands of extension personnel.

1. Completed leucaena leaf harvest for experimental rations and pelleting.
2. Harvested grass and legume seed from nursery areas for new plantings at Chitedze and other sites.
3. In cooperation with Dr. Gray, continued development of the grazing trial facility at Chitedze.
4. Tabulated and evaluated forage experimental data for 1981/82.

F. Plant Breeding

1. To improve the quality and appropriateness of maize agronomic research, reviewed past maize agronomic research to: 1) determine if recommendations could be made to farmers without further research; 2) to determine what research could be discontinued in order to save research monies; and 3) to determine what additional research was needed to produce recommendations that would benefit the farmer.
2. Prepared estimates of the response of the varieties MH12 and UCA and farmer's maize to nitrogen fertilizer. These estimates included economic returns as well as biological response and are to be used in making fertilizer recommendations to smallholder farmers in the Lilongwe A.D.D.
3. Prepared plans for maize breeding research for the 1982/83 season. Plans included location and number of trials and the entries to be included in each trial. A major emphasis was placed on conducting as few trials as possible in order to make the best use of research monies. Also, the plans included those breeding areas that will be emphasized. Major emphasis was placed on developing improved varieties for the marginal areas because no suitable varieties are now available.
4. Developed research work plans and budgets for Maize Breeding for the 1983/84 season. To allocate research monies generated by GOM, it is necessary for each research section to forecast their priority needs a year in advance so that the DAF can request said monies from the Ministry of Treasury, GOM.
5. Prepared a long range maize breeding plan for the marginal

areas. This included how material will be selected, how the material will be tested, and how seed multiplication will be done to expedite the release of the varieties to farmers. Presented the plan to CARO, Officer-in-Charge Chitedze ARS, and the Chief-of-Party. All agreed the plan was sound and the quickest way of developing new varieties and that the plan should be implemented.

6. Other activities included duties as Head of the Maize Breeding Section.

V. TRAVEL AND MEETINGS

The USAID purchased vehicles continued to receive heavy use during the quarter by technical assistance team members and Malawian staff. Table 2 gives a summary of the vehicle use for the quarter and for the project to date.

Table 2
USAID Project Vehicle Miles Driven to September 30, 1982

Vehicle	Location	July-Aug-Sept.	Mileage to September 30, 1982
Peugeot			
542D	Chitedze	4,909	32,811
715D	Bvuobwe	5,080	32,810
716D	Chitedze	6,755	31,329
754D	Chitedze	4,568	29,408
Land Rover			
653D	Kasinthula	7,179	53,598
689D	Lunyangwa	4,000	31,570
690D	Chitedze	5,550	44,260
691D	Makanga	6,000	46,888
692D	Chitedze	5,250	40,886
694D	Bvuobwe	3,500	30,511
690E	Mbawa	2,500	2,500
Nissan			
474E	Mbawa/Makoka	2,303	8,303
483E	Chitedze	6,045	7,320
484E	Chitedze	4,414	9,464
485E	Chitedze	6,850	13,131
	Total	74,863	416,989

Team members reported the following mileage on project vehicles during the quarter: Gray 1,355; Hansen 1,565; Hodges 255; McCloud 3,716; Pasley 28; and Pervis 253; for a total of 7,172 miles or 9.6% of the total miles traveled by USAID purchased vehicles. In

addition, 15 motorcycles were used at various research stations.

Team members attended a variety of meetings and conferences during the quarter in Malawi, southern Africa and in other parts of the world. All of the team met with Mr. Darrel Burroughs, Program Auditor, REDSO/Nairobi and attended the review meeting of the ISNAR team draft report. Significant travel and meetings are listed below:

A. Gray

- July 12-16 -Attended the 14th Meeting of the Standing Committee for Animal Production and a Workshop on "Extension Strategies for Increased Animal Production" which was held at Salima, Malawi. Delegates were present from Botswana, South Africa, Lesotho, Swaziland and Malawi.
- July 19-22 -Mbawa and Lunyangwa Research Stations and Mzuzu A.D.D., accompanied by Mr. Harry Msiska, Pasture Agronomist, to survey pastures at the stations and smallholder dairy farms.
- August 6 -Chitala Research Station, with Dr. Hodges, Mr. Msiska and Mr. Mlukuso to survey the pasture situation and make preliminary plans for implementation of a goat research project.
- September 20-L.A.D.D, Veterinary Laboratory and Veterinary's Livestock Production Office to coordinate various activities related to research.
- September 21-Dzalanyama Ranch to discuss budget requests for 1983-84.
- September 23-Conference with Dr. Legg and Dr. Mwandemere to discuss recommendations on relocation of livestock research away from Dzalanyama Ranch.
- September 24-Chitala Research Station to discuss budget requests for 1983-84.
- September 27-29-Lunyangwa and Mbawa Research Stations, accompanied by Dr. D. E. McCloud to review livestock research programs.

B. Hansen

1. Nineteen days in July were spent on R/R, and most of August and September were spent attending to the survey.
2. Am a member of the working group revising the work plan of the Agro-Economic Survey, which met during the quarter at the Ministry of Agriculture.
3. Represented DAR to the Data Users Group of the Ministry of Agriculture which is revising the new Annual Survey of

Agriculture.

C. Hodges

1. With Mr. H. D. Msiska, attended the 4th Regular Subcommittee Meeting for Veld and Pasture, SARCCUS, Nylsvlei Ecosystems Project, South Africa.

Dr. Hodges represented Malawi as a reserve delegate (in the absence of Mr. B. Dzwela who is on study leave in the USA). The meeting included demonstrations of plant evaluations on veld (upland) and vley (dambo) sites and reports of current research and development in participating countries. How the subcommittee activity could benefit the SARCCUS countries (the theme of this meeting) was discussed. Forage nursery and plant introduction problems were considered; the possibility of a natural forage survey to define the opportunities and needs in Malawi was discussed with a range management specialist who is on a USAID project in Lesotha.

Following the SARCCUS meeting, a day was spent with staff at the Animal Production and Dairy Research Center at Irene, near Pretoria. This included a discussion of crop residue evaluation with Dr. Stroebel Hofmeir and visits to the energy and the "in vitro" digestion laboratories.

2. Attended the SARCCUS Livestock Production Symposium at Salima in July.
3. Visited forage plantings and forage feeding project at Bunda College, conducted by Professor Martin Rutterworth.

D. McCloud

During the quarter, Dr. McCloud traveled 3,716 miles which included visits to Tsangano, Makoka, Evumbwe, Kasinthula, Lunyangwa and Mbawa Research stations and 46 trips to DAR and USAID Headquarters in Lilongwe.

E. Pasley

1. Traveled to IITA in Nigeria and CIMMYT in Mexico to (1) evaluate IITA maize germplasm for suitability in Malawi; (2) establish closer working relationships with both International Research Centers and (3) determine the quality of training received by maize breeding students at CIMMYT. Trips of this nature are called for in the Project Document in order to make better use of the services offered by the International Research Centers.
2. To Chitala ARS to determine progress in the off-season nursery located there. By using an off-season nursery, the time required to produce new maize varieties can be decreased by half.
3. Met with an FAO team to discuss the necessity of a Regional Maize Improvement Center. One of the criticisms of the International Research Centers has been that their material is not adapted to East Africa because it was selected elsewhere. If a

maize improvement center was established in East Africa, the materials developed could probably be included in National Programs without extensive selection. This should make an impact on maize production because many National Programs lack trained personnel.

4. Met with Dr. Kingman of CIMMYT to discuss need for improved wheat varieties and traveled to Tsangano Hill Station to evaluate CIMMYT material. Because Malawi does not have a wheat breeding program, it is necessary to screen varieties developed by CIMMYT and by neighboring countries to identify those best adapted here.

5. Attended the 11th Variety Release Committee, GOM, to consider release of new sorghum and pearl millet varieties to farmers. During the meeting, gave a report on the suitability of considering the maize variety Tuxpeno I for release. This activity results from my assuming the duties of the Malawi Maize Breeder who is in graduate school in the United States.

6. R & R taken in July and August.

F. Pervis

July - Ministry meeting on revision of evaluation surveys.

July - Met with FAO representatives regarding availability of production data.

July 12-14-Attended International Conference on Development in Malawi in the 1980's

VI. SHORT-TERM TECHNICAL ASSISTANCE

Dr. Suresh Rao.

Dr. Suresh Rao, Soil Physicist from the University of Florida, accompanied by his graduate student, Mr. A. Saka, arrived in Malawi on 7 August 1982 and departed 21 August 1982. During his stay, he and Mr. Saka conferred with Dr. Jam. Maida, OIC Bvumbwe, on Mr. Saka's Ph.D. program at UF and plans for his future research at Bvumbwe. They also visited part of central and southern Malawi to set up field plots for data collection.

He also gave two seminars on "Quantitative Aspects of Water and Agrochemical Management in Crop Production" at Chitedze ARS on 16 August 1982 and at Bvumbwe ARS on 23 August 1982. About 40 people attended the first seminar and 45 the second.

Dr. James Jones.

Dr. James Jones, anthropologist from the University of Florida Farming Systems Research and Extension Program, arrived 26 September to begin preparations for an October course on the design and analysis of on-farm trial data.

Dr. Dale Hicks

Dr. Hicks, Professor of Agronomy, University of Minnesota consulted with the Maize Breeding and Agronomy Sections from 16 August to 17 September 1982. The objectives of his consultancy were to:

1. Evaluate past maize production research, evaluate maize production practices, and make recommendations for maize production practices research, data collection and data analysis.
2. Conduct in-service training sessions at Chitedze and Bvumbwe with research and extension personnel on experimental design, data collection, and data analysis and interpretation.

Among his recommendations for maize production practices research were: (1) Studies on Ridge Management, (2) Legume Interplanting, (3) Phosphorus and Potassium Response Surfaces, (4) Rates of Nitrogen Application, (5) Irrigation, (6) Crop Choice for Low Rainfall Areas, (7) Chemical Weed Control, and (8) Production Factors such as Plant Density and Spacing Arrangements.

He taught two Experimental Design and Research Methodology courses. The first was at Chitedze ARS (September 6-10, 1982) and the second at Bvumbwe ARS (September 13-16, 1982). Approximately 27 people attended the first and 32 people the second course. The project has printed a set of course papers for distribution within Malawi.

VII. ADMINISTRATION

1. Prepared a TDY request for Dr. Dale Hicks to come to Malawi to consult on maize production practices and assist in a course in analysis and interpretation and analysis of research data.
2. Obtained approval for purchase of three manual typewriters.
3. Obtained customs clearance for computers and laboratory equipment.
4. Met with the ISNAR team to explain the Malawi Agricultural Research Project.
5. Met with Legg and Gausi for preliminary screening of the In-service Training Proposals.
6. Attended a Plant Protection Research Project meeting at Bvumbwe
7. Prepared R/R vacation leave for the Fervis'.
8. Prepared a home leave request for Mrs. McCloud.
9. Met with Legg and agreed on the postings for the returning participant trainees.

10. Requested clarification of the Gray's R/R status.
11. Prepared excess baggage requests for Rao and Saka.
12. Prepared a request for Mrs. Ntokotha and her three children to join her husband in the U.S.A.
13. Attended a Station Heads meeting called by CARO to consider Work Plans and Budgets of the DAR.
14. Attended an Irrigation Planning Meeting to consider a K 2 million irrigation proposal.
15. Prepared a list of all arrivals and tours of duty for the technical assistance team in Malawi.
16. Prepared revised Receiving and Inspection reports for all project equipment.
17. Met with the REDSD Program Auditor to explain program and financial matters on the project.
18. Prepared a request for Mrs. Dzowela to join her husband in the U.S.A.
19. Sent out notices of the On-Farm Trials Course that Drs. Hildebrand, Jones and Hansen will give at Chitedze.
20. Prepared an educational advance for A. Hansen.
21. Prepared and sent to USAID the second request for two horticulturists to be stationed at Evumbwe.
22. Traveled to Lunyangwa and Mbawa Research Stations to discuss research programs and to instruct the Officers in Charge in the use of the HF-41C calculator.
23. Arbitrated the matter of medical clearance for Dr. Spring.
24. Participated in meetings to discuss the ISNAR draft report on agricultural research in Malawi.
25. Requested financial information from the University of Florida to make decisions on project extension.
26. Requested UF to procure Jojoba seeds for Malawi, as per the request of USAID.
27. Prepared and sent to USAID and MA the TDY requests for Hildebrand and Jones.
28. Requested from MA confirmation of Arnold for the Horticulturist position at Evumbwe.
29. The vacancy of the Executive Officer for general duties remains as a serious problem. The administrative load of the Chief-of-Party has increased to the point where this situation

is critical and the position needs to be filled as soon as possible. Housing at Chitedze is the limitation on filling this position. The space needs for the Administrative and Support Staff for the project will be alleviated when the new USAID office building has been completed. We expect to move into the building by November 1, 1982.

VIII. FINANCIAL

Table 3 shows transactions from the University of Florida Local Account for the period July 1, 1982 through September 30, 1982, while Table 4 summarizes the expenditures by program for the quarter and for the project to date.

Table 3

Transactions-University of Florida-IFAS Local Account July, August and September, 1982

Date	Details	PK	PK
July			
1	Balance Brought Forward		86,338.54
1	McLean hotel accommodation with family	612.96	
1	Manica-freight and telexes	1,938.28	
1	National Statistical Office-publications	5.00	
12	D. E. McCloud-reimb. rubber stamp, computer plug, passport postage stamps, computer supplies	176.73	
12	Securitor-services for July	510.65	
19	D. W. Pervis-travel reimb., per diem and misc.	228.53	
29	McLean-utilities, electricity	38.22	
20	McLean-telephone	92.60	
20	Utilities-water	27.50	
20	Utilities-electricity & telephone	819.26	
21	Manica-freight and telexes	3,837.30	
21	D. W. Pervis-travel reimb. Zomba + misc. receipt	344.67	
26	D. E. McCloud-reimb. for screenwriter	147.39	
28	Conference-Malawi Library Assoc. attended by Mr. Katsonga	60.00	
30	Securitor-services for August	543.55	
30	Manica-telexes	77.20	
30	Utilities-electricity	507.65	
August			
10	Utilities-water	64.40	
11	R. C. Gray-travel reimb.	553.96	
12	Mrs. McCloud air ticket for home leave	2,755.00	
17	R. C. Gray-reimb. misc.	119.82	
September			
1	A. Hansen-educational advance	2,616.00	
1	Securitor-services for September	494.20	
1	Manica-freight and telexes	2,994.56	
1	A. Hansen-reimb. for maps	11.75	
7	D. E. McCloud-reimb. GRE req.	339.00	
13	Gesletner Ltd.-contract services on copier and duplicator	340.00	
13	Utilities-elect. and telephone	562.57	
14	Malawi Govt.-Reimbursement 7th claim	20,578.58	

Table 3 (continued)

Date	Details	MK	MK
15	Utilities-water	48.56	
15	Malawi Govt.-Reimbursement 8th claim	15,253.14	
18	Check book	3.00	
21	D. E. McCloud-reimbursement Data Factor 5.0	257.43	
23	S. F. Pasley-Reimb. travel and per diem, Zimbabwe, Nigeria, Mexico	1,134.20	
129	J. C. Jones-travel advance	100.00	
130	Securicor-services for October	510.65	
130	Manica-freight and services	1,347.54	
170	Utilities-electricity and telephone	418.16	
		60,683.51	86,358.34
	Less unrepresented checks†	2,376.35	
		58,307.16	58,307.16
	Balance Carried Down		58,307.16
	Balance as per bank statement		28,051.18

Table 4

Summary of Expenditures for the University of Florida-IFAS Local Account by Program

July-August-September 1982

Program	Quarterly Expenditures July - Aug - Sept	Total Expenditures since project began
	MK	MK
Maize, Breeding and Agronomy	4,980.45	19,375.85
Groundnut, Breeding and Agronomy	417.61	3,181.84
Pasture Agronomy	2,973.75	12,048.30
Livestock	6,897.37	11,032.03
Horticulture, Fruits and Vegetables	3,366.82	11,608.11
Agricultural Economics	4,374.50	5,481.77
Farming Systems	3,382.65	9,445.93
Soil Fertility	7,212.42	8,217.76
Research Coordination	898.57	9,189.43
Library	60.00	1,659.12
Participant Training	99.45	8,298.30
In-service Training	580.00	30,438.18
Vehicles First Purchase	-----	141,087.64
Overhead† Not Assignable by Program	16,608.67	77,648.02
TOTAL	51,852.26	337,714.49

† Overhead should be divided among the following programs: Maize, Groundnut, Pasture, Livestock, Horticulture, Agriculture Economics, Farming Systems and Research Coordination (12.5% each).

Table 5 gives expenditures under the contract from 5/30/80 through 9/30/82 and expenditures for the current quarter.

Table 5. Fiscal Report
July 1, 1982 to September 30, 1982

Contract No. AID/afr-C-1653 (Malawi)
Between the Agency for International Development and the University of Florida

Category	Contract Amount 5/30/80-11/30/84	Budget Amount 5/30/80-5/30/82	To Date 6/30/82	This Period 7/1/82-9/30/82
Salaries and Wages:				
Home Office		\$ 112,102.00	\$ 94,952.68	\$ 15,190.99
Field Office		419,477.00	430,986.51	71,698.05
Indirect Costs:				
Home Office		49,773.00	47,896.32	1,994.66
Field Office		288,926.99	254,572.23	40,710.90
Allowances		92,817.50	39,207.43	6,341.67
Travel and Transportation		172,533.00	273,879.67	26,929.78
Expendable equipment and materials		149,300.00	81,449.36	24,175.57
Non-expendable property		619,600.00	86,213.75	22,552.48
Participant costs		286,515.00	354,968.85	17,541.01
Other direct costs (4,254.85)		11,440.00	17,192.16	
GRAND TOTAL	\$ 6,237,029.00	\$ 2,231,963.00	\$ 1,680,318.96	\$ 255,880.32

Computation of indirect costs:

On Campus: $44.4\% \times 13,133.05 = 5,831.07$

Off Campus: $31.6\% \times 133,675.10 = 42,241.34$

*Indirect costs not taken on equipment items over \$500 each or training costs.

IX. PUBLICATIONS

Ithakomwa B.R. "Agricultural Economics in Research." A paper presented at the International Conference on Development in Malawi in the 1980's, held at Chancellor College July 12 - 24, 1982. June 1982 Mimeograph.

Pervis D.W. "A Review of the Effects of Food Price Policies " A paper presented at the International Conference on Development in Malawi in the 1980's, held at Chancellor College July 12 - 24, 1982. July 1982 Mimeograph.

Appendix A

AGRICULTURAL ECONOMICS IN RESEARCH**B. R. Nthakomwa****Introduction**

The purpose of this paper is to introduce Agricultural Economics within the Department of Agricultural Research. Agricultural Economics is not a new discipline in Malawi but until recently, it has not been contributing to the work of the Department of Agricultural Research. The new section is based at Chitedze Agricultural Research Station and is being organized as part of the United States Agency for International Development (USAID) technical assistance project with the University of Florida. The section started by the arrival of a University of Florida Agricultural Economist in September 1981.

Aims

The section has been introduced to help the Department of Research address small farmer's priorities. The following are some of its aims:

- 1) Evaluate new technologies and production packages recommended by the biological and technical sciences.
- 2) Carry out small farm management studies to understand how farmers make decisions and then identify constraints to good decision making.
- 3) Carry out studies of the input marketing and credit, and product marketing systems for small farmers with the aim of recommending adjustments to improve efficiency and usefulness to the small farmer.
- 4) Study the technical input/output relationships of crops and varieties of crops.
- 5) Participate in studies of various policies to estimate their effects on small farmers for evaluation by policy makers.
- 6) Assist in setting research priorities and in the management of research station resources.

Present Involvements

The section is taking a multidisciplinary approach and has been involved in a number of activities.

The first activity ties with the fourth aim. We have set out

an experiment to estimate the response surfaces of two homogeneous maizes, hybrid MH12 and composite UCA and the heterogeneous maize known as local maize to various levels of nitrogen and phosphorous. The objective is to estimate the deterministic optimum level of fertilizer to apply. Appropriate data will be generated to derive production functions that would include climatic factors as well as various inputs and cultural practices. At present this experiment is located only at Chitedze and any results will be relevant only for the Chitedze area. In the future we expect to conduct similar trials in other parts of the country so as to provide recommendations for different climatic and soil conditions. This experiment has included maize breeders, maize agronomists, and soil scientists.

A second activity ties with aim 5. This is a small survey on "Price Effect." It was conducted within Kasungu Agricultural Development Division in Mchinji Development Project, EPA 6. Twenty farmers were selected at random. Its objective was to ascertain if a recent price rise of maize from 6.6 t/kg to 11 t/kg has been an incentive to farmers to increase maize hectareage. We are still in the process of writing up a report on the survey.

And finally, we have been involved in carrying out economic evaluation of Farm Machinery equipment to determine if they are economically feasible to our Malawian farmers.

Future Proposals

Due to a severe shortage in staff, the section must limit its scope of activities. Nonetheless, plans are being made on the basis of the country's needs.

Currently our main focus is on socio-economic aspects of small farmers. Basically we accept the well documented premise that farmers are acting rationally within their social, cultural, economic institutional environment. Therefore, the problem of increasing productivity is in both the environment and availability of new technologies. Both must be improved or neither will succeed. Hence we would try to identify and assess factors constraining production increase. Along with these thoughts the section plans to carry out a small farm management survey. This is planned to be in conjunction with the Agro-Economics Survey Department. The survey has the aim of understanding the models used by farmers to develop expectations, information sources, etc. available to farmers under conditions experienced in the villages. Also it is important to understand how the biological and physical factors affect farmer's decisions. This would assist greatly in identifying changes that are likely to be adopted.

The section plans to have links with other disciplines in the Extension Department. This would assist in the improvement of research/extension liaison procedures. The improvement of the extension system generally would involve the improvement of communication systems among three groups: researchers, extension people and farmers. The procedures for interaction and communication should permit:

- 1) Quick transfer of new technology from researchers to extension workers.
- 2) Efficient and appropriate modification and transfer of technology from extension workers to farmers.
- 3) Efficient and frequent feedback of both problems of farmers experiences with new technology, from the farmer to the research personnel.

We also hope to work hand in hand with Farming Systems, a popular concept with considerable potential for multi-disciplinary research.

On the point of evaluating new technologies and production packages recommended by the scientific experts at the station, we would be expected to predetermine the probable and economic consequences of newly developed technological changes.

Efficient allocation of research resources is the priority of research station management. This is an activity in which agricultural economics can play a useful role because economists have available analytical tools for assessing efficiency of allocation.

Apart from emphasizing small farmer's production needs, the section plans to have links with other institutions both in government ministries and educational for general sharing of essential data and information about the country's economic situation.

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**A REVIEW OF THE EFFECTS OF
FOOD PRICE POLICIES**

Presented at the International
Conference on Development in Malawi in the 1980's
Held at University of Malawi, Chancellor College, Zomba
July 12 - 24, 1982

by
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July 1982

A REVIEW OF THE EFFECTS OF FOOD PRICE POLICIES

INTRODUCTION

In response to a felt need to modify the resource allocation or distributional consequences of open market prices, many countries develop food price policies consisting of one or more of the available policy instruments. Either production is felt to be increasing too slowly and therefore needs encouragement beyond what the open market provides; or the retail price is felt to be too low, thus excluding an unacceptably large portion of the population from a commercial food source. These two basic and competing goals of price policy can be summarized as:

- to increase agricultural production, and
- to maintain low retail prices.

The policy instruments available to achieve these goals include:

- decreed prices in retail or producer markets in the form of:
 - fixed levels
 - ceilings, or
 - floors
- price subsidization on the input market
- state marketing agencies
- government managed stocks.

In the past, direct intervention in the price making mechanism through decreed prices has been the policy instrument of choice in many countries. Decreed prices have been used at different times in efforts to attain both goals of price policy. When it is used to encourage production, the farm price is fixed above the open market equilibrium level. When it is used to maintain low retail prices, the fixed retail price will be below the open market equilibrium level. Similarly, price floors and price ceilings have been used to encourage production and maintain low retail prices, respectively. The main difference between these policies and fixed prices is that they allow for limited dynamic shifts in supply or demand.

Another approach is often used in an effort to avoid the mutual exclusiveness of the two goals of price policy. By subsidizing the prices of agricultural inputs, farmers are believed to be encouraged to produce more which they can sell at a lower price. This approach does not discourage food production and permits the food markets to function efficiently, but there are significant public costs involved in providing the subsidy.

State marketing agencies and government stocks can take many forms and serve many purposes, but the important feature is that they need not have counterproductive effects by overriding the price making market mechanism. They can act as just another market participant, albeit with considerable market power. State marketing agencies are often set up to try to reduce the marketing margins occurring in the open, but allegedly not competitive,

market.

Government managed stocks can be implemented as the only legal food storage institution or alternatively as a storage facility which is complementary to the private storage facilities. Responsible and competent management of complementary government food stocks can be effective in reducing price fluctuations and can also provide a national food reserve which is often desirable for national security reasons.

In the remainder of this paper I would like to examine the policy instruments noted above and indicate how simulation modelling can be used to develop a price policy which is "tailor-made" for a specific country. The review of the policy instruments will take the open market result as a base and examine the deviations caused by various policy instruments. Each policy will have some effect on the problem it is designed to alleviate but will also have other undesirable effects. A good price policy set will obtain the highest net benefit possible, based on a political evaluation of the relative importance of all its effects (good and bad).

DECREED PRICES

Prices may be decreed in an effort to achieve either of the two goals of price policy (increased production or low retail price levels) and may be implemented in any one of three forms noted above (fixed levels, ceilings, or floors).

In order to maintain low retail prices the government decreed prices take the form of fixed levels from which prices may not legally vary or ceilings above which retail prices may not legally rise but may fall below. If it is possible to administer such price restrictions, they would logically be at levels below the open market equilibrium prices and shortages can be expected. These shortages are indicated by the situation of P_1 in Figure 1, where the amount of produce supplied, Q_{s1} , is less than the amount effectively demanded, Q_{d1} and also is less than the amount that would be consumed, Q_e , if the open market price prevailed. If the product is a critical one for the population, the shortages may be unacceptable and the country will have to import the difference ($Q_{d1} - Q_{s1}$), thus using up valuable foreign exchange and incurring a trading loss if the import price is above P_1 .

A ceiling is very similar in effect to a fixed price except that it allows for the possibility of dynamic fluctuations in supply and demand over time resulting in fluctuations in the open market price below the ceiling. In Figure 2, P_c is the ceiling price. At harvest time supply can be expected to be high (S_1) and the open market price will fall to P_h , lower than the ceiling price. The legal market price under this situation is P_h , however; during the pre-harvest period when food stocks are low, supply can be expected to be at S_2 and the open market price would be P_p . But the legal price would be P_c . The imposition of a price lower than the open market price results in more people able to demand food but shortages occur and less is actually consumed than if P_p was the prevailing price. If imports are purchased, the deficit $Q_{dp} - Q_{sp}$ represents the necessary amount.

In order to maintain high farm prices to encourage production the decreed prices may be fixed, or provide a floor below which the open market price may not legally fall. Such prices would be

above the open market farm prices and surpluses can be expected. These surpluses are shown in Figure 3 where the amount of produce supplied, Qs_1 , is greater than the amount effectively demanded, Qd_1 . In fact, the amount demanded at P_1 is less than it would be (Q_e) at the open market level P_e . The difference $Q_e - Qd_1$ represents the amount of food that people cannot buy because of the high price. In this situation the only way to increase consumption and still maintain a high producer price would be to implement an expensive policy of buying high from the farmer and selling low to the consumer. If the prices are chosen correctly the quantities purchased and sold can be equated but the government will be providing a substantial subsidy. An attempt to increase production through price levels which are above the open market price will either require substantial subsidies or have the effect of actually reducing consumption but with a high priced surplus.

In summary, for a closed economy any attempt to increase consumption by reducing retail prices or increasing farm prices by decree, will actually reduce consumption and exacerbate the problem that the policy was designed to alleviate.

Another reason for instituting decreed prices is based on the price risk of farm management. In a market where the product flows at a constant rate and demand does not fluctuate widely, there is little price risk involved in the open market prices; however, this is not the nature of agricultural production and marketing. Farmers must make their production decisions at the beginning of the growing season when open market prices are normally high, relative to their levels at harvest time. The only prices which the farmers can be sure of, when crucial decisions must be made, are the prices of inputs purchased at planting time. The output price is very uncertain. It is theorized by many researchers, although not shown conclusively, that most farmers are risk averse and tend to reduce production under conditions of uncertainty. To the extent that this theory is true, guaranteed farm prices can assist in increasing production; but the problem remains to determine the appropriate price to guarantee (the floor price). This type of policy is one of stability rather than level so the floor price should be some estimate of the long term trend price on the open market.

PRICE SUBSIDIZATION ON THE INPUT MARKET

This policy instrument is often used where there is a desire to accelerate production by increasing the incentive for using more modern inputs. As Krishna points out:

"If product prices are raised, peasants may or may not take to improved cultivation. They may simply spend the extra income on consumption, and government expenditure on support will be wasted. If, on the other hand, inputs are subsidized the benefit of government expenditure can be derived by peasants only in proportion to their use of improved inputs. Input subsidization also avoids raising food and raw material prices

against a growing industrial sector." (1)

Krishna also points out that input subsidization may have little or no effect because:

- the improved input with the subsidy may be unfamiliar to the farmers,
- the provision of subsidies cannot ensure against downward fluctuations in the product prices and these are the more important risks from the farmers' point of view,
- they do not encourage (or discourage) better use of traditional inputs,
- they cannot target individual products.

In a recent study by Rosegrant and Herdt, an estimate is made of the effect of a fertilizer subsidy with a credit program, on the total yield of rice in the Philippines. They found that the importance of a concurrent credit program was not the lower interest rate that it provided but simply the greater quantity of credit available regardless of the interest rate. They conclude that with a major constraint on credit, the input subsidy alone (which varied from year to year) would increase production less than 7.6% but if the credit constraint was removed it would increase production by about 26.6%. This result emphasises the advantages of increasing the amount of credit available in addition to any input subsidization that might be implemented.

Another study (2) examines the supply-demand relationships of various input and product price policies in view of a politically acceptable minimum level of food consumption. That study concluded that if a country is near its lowest politically acceptable level of food consumption, then input price subsidization is preferable to any price policy directly affecting the farm product price or the retail food price. These conclusions are based on the effects of the fixed prices on the amount of food consumed (available and in demand at the fixed price levels). No account is taken of new technology, price risks, the efficient use of traditional inputs or any desire to target individual crops.

STATE MARKETING AGENCIES

Many countries have set up state marketing agencies in response to one or more felt needs. Abbott has noted some of these as follows:

- to obtain funds for sales promotion, research and extension,
- to raise the bargaining power of agricultural producers on the domestic and export markets,
- to improve marketing organizations and methods by:
 - regulating standards of quality and packing, marketing procedures, or sales practices,
 - raising the scale of operation and setting up needed marketing and processing facilities,
 - facilitating more precise adjustments of the

quantities and types of produce sold on particular markets.

It is often believed that by instituting a state marketing agency, the consumer price can be reduced. Most such agencies are able to survive financially only if they are total legal monopolies. When they are placed in fair competition with the private market channels, deficits occur which must be made up by government subsidies. It follows that a legal government monopoly which is not subsidized will actually have to increase the price of food above the level that would result from the private market. If it is subsidized, lower prices may result but at a cost to the public purse. Similarly, a government marketing agency which is in competition with the private channels will also require subsidies to maintain its position in the markets. These comments are based on the experiences of these institutions. Abbott has found that:

"Tentative observation suggests that such boards (marketing) can facilitate the assembly of working capital on favourable terms; achieve a greater standardization of quality, packing, etc.; permit access to economies of scale in processing, transport and sales activities and assist in the stabilization of supplies and prices; and can be a means of raising prices to particular groups of farmers. On the other hand, their efficiency can be prejudiced by varying standards of political and individual integrity and by all the defects, such as reduced pressure to minimize expenses or to modify procedures under changing conditions, to which an officially protected organization is susceptible..." (3)

Under these conditions the benefits of state marketing agencies are often outweighed by inefficient operation and cannot compete with private market operators whose income is directly affected by their level of service and the fairness of their prices.

It should be noted that the appropriateness of state agencies can vary from one country to another or from one time to another in the same country. In a country where there is no strong entrepreneurial tradition, a state agency may perform a necessary function while marketing skills are developed in the private sector. Rarely is a legal state marketing monopoly an appropriate institution for promoting efficiency.

GOVERNMENT MANAGED FOOD STOCKS

Another approach to price policy for increasing production through price stabilization has been closely related to the desire for national food security. The idea of a government managed buffer stock of food (normally grain) has received much interest and a growing volume of literature is being built up.

The operation of a buffer stock is normally under the authority of a parastatal agency which stands ready to purchase from the open market whenever the price reaches a predetermined

lower level, and to sell to the open market whenever the price reaches a predetermined upper level. This allows for a range within which prices may vary without any intervention and in all cases allows the market to equate supply and demand at the market price.

In 1974 Turnovsky examined, in considerable detail, the distribution of benefits and costs from a price stabilization policy. Based on previous work and his own, he concludes that the benefits received by farmers and consumers depend on:

- how farmers' price expectations are generated, and
- the statistical properties of the price fluctuations (autocorrelated or independent).

Generally, the following conditions were found:

- producers lose (gain) from price stability if the source of instability is random shifts in demand (supply),
- consumers lose (gain) from price stability if the source of instability is random shifts in supply (demand),
- where both demand and supply are random, the gains to each group depend on the relative sizes of the variances of the fluctuations in supply and demand and on the slopes of the demand and supply curves,
- the net gains from stabilization are always positive with gainers, in principle, able to compensate losers.

The details of Turnovsky's work will not be discussed here but any attempt to devise a price stabilization policy should be based on a consideration of his findings.

In 1967 Reutlinger, Eaton, and Bigman (4) reported on the results of a simulation of an investment in grain reserves, calculating its efficiency, equity, trade and stabilization impacts on a developing nation. They concluded:

"In summary, a decision by a less developed nation to carry buffer stocks may find limited justification on traditional economic grounds, such as profitability and economic efficiency. The strongest rationale for a reserve may rest, therefore, on its effect on a government's financial ability to secure minimally adequate consumption of grain for the entire population at all times and its incremental stabilization effects for prices, supplies and the balance of trade, which are not priced on the market."

In a 1979 article, Bigman and Reutlinger report further on the results of their simulation model. The flexibility of this tool of analysis has permitted them to remove many of the restrictive assumptions made by previous researchers. They concluded that for most countries, international trade would be a good way to stabilize domestic food markets, but both trade and buffer stocks are effective alternatives. They find that while buffer stocks, sufficiently large to stabilize supplies, can be

very costly, the trade option has its own costs in the form of significant foreign exchange needs in times of shortfalls in domestic food production or high world prices.

RESEARCH FOR DEVELOPING A FOOD PRICE POLICY

A government wishing to develop a price policy may select one or more of the policy instruments discussed in this paper or develop other imaginative policy instruments. Even the small set noted in this paper can be combined and implemented in a number of ways, making the total number of possible policies very large. The most effective policy set from an economic and political point of view depends on:

- the particular economic characteristics of the country, which in turn determine
- the effects of the various combinations of policy instruments on the economy, and
- the political evaluations of each of these effects.

Broad generalizations can be made about the effects of price policies but each country must be studied separately to tailor a policy which is best for its current circumstances. The simulation approach used by Bigman and Reutlinger to study one particular policy instrument could be used to study the effects of combinations of policy instruments on a model representing the relevant characteristics of a particular country.

The development of a simulation model is an attempt to do formally, what managers and policy makers do informally in their minds. The informal mental models include a considerable number of intuitive estimates and informed opinions. A very general approach to system simulation also accepts this type of data (when precise measurements are too expensive to obtain) as a Bayesian element in estimation. (5)

Eleven steps can be identified as constituting the methodology of system simulation:

- System identification
- Observation of the real system
- Developing the conceptual model
- Data needs identification
- Data acquisition
- Mathematical model development
- Computer model development
- Data base development
- Model tuning
- Model testing
- Projection and policy evaluation

Once the model has been developed, tested and judged to be an acceptable representation of the relevant relationships in the real system, the policy variables can be changed to reflect different price policy sets. The simulated effects of the policy variables on the performance variables of the model are estimates of the effects of real policies on the real system.

The development of an appropriate price policy set for a particular country involves more than model building and running. Policy is (or should be) dynamic; that is, under constant revision as a country develops. Different price policies will be appropriate at different stages of development. Three conditions are necessary if price policy is to be kept up-to-date and gains under one set of policies are to be captured and built upon by new or adjusted ones:

- a currently valid model structure
- a currently valid data set as input to the model
- a currently valid set of values on which to judge the performance variables of the model.

The first two of these conditions can be met by a team of research professionals from several disciplines including agricultural economics/economics, agronomy, animal science, sociology, anthropology, system science, computer science, and others needed to abstract the complex relationships linking the policy instruments with the performance characteristics of the real system and maintain an up-to-date model of them. The third condition is often more difficult to attain because it requires an interaction between the professional team maintaining and running the model, and the policy makers/politicians. It is they (the policy makers) who take the ultimate responsibility for the consequences of policy, so it is they who must evaluate the relative goodness or badness of the changes in the policy variables of the model. Such interaction may be described by the following steps:

1. Current policy testing (Model)
2. New policy testing (Model)
3. Performance evaluation (Political)
4. New policy acceptance or rejection (Political)
 - if accepted go to step 6
 - if rejected continue
5. Formulation of new policy set and go to step 2 (Model and political)
6. Policy implementation on the real system (Administrative)
7. Evaluation of results (Political)

Such a procedure requires that the policy makers have sufficient knowledge of the model that they feel confident about the results and understand the implications of the assumptions underlying it.

- (1) See Krishna, p. 526.
- (2) Pervis, "An Approach to Integrating Political and Social Factors into Economic Research."
- (3) Abbott, p.379.
- (4) USDA-ERS Report no. 634 p.13.
- (5) For a more detailed exposition of simulation modelling see, Pervis, "Simulation of a Parastatal..." pp.59-67.

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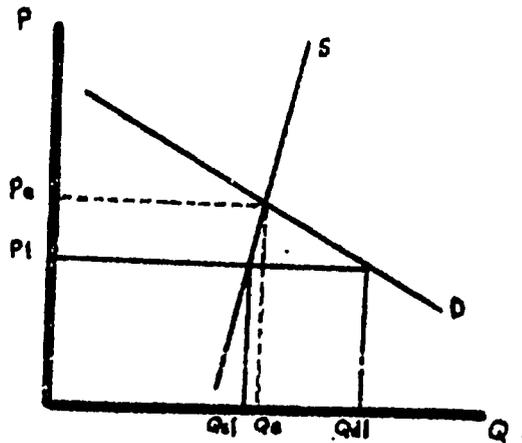


Figure 1. Fixed price on retail market.

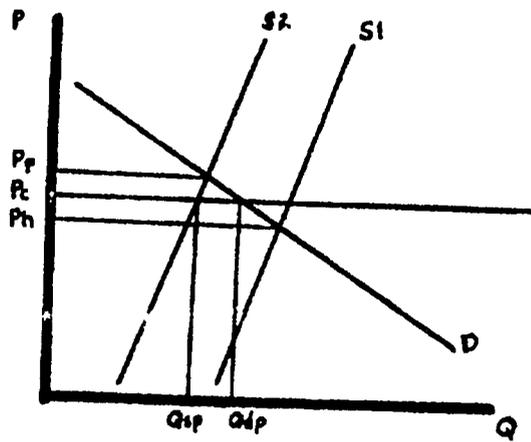


Figure 2. Ceiling price on retail market.

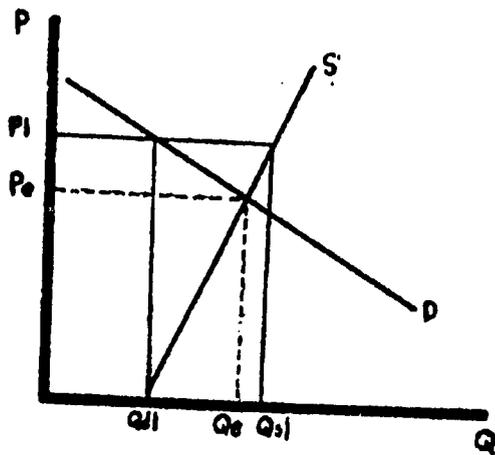


Figure 3. Fixed price on farm gate market.