Implications For Policy of the Studies on Profitability of Irrigated Non-rice Crop Production: A Synthesis

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Abstract

Economic aspects and profitability of irrigated diversified cropping during the dry season are presented herein. Results of cost and returns analyses in the production of different crops during the 1986/87 and 1987/88 dry seasons showed garlic as the most profitable non-rice crop for farms in the Laoag-Vintar River Imgation System and Bonga Pump No. 2 Irrigation System. The returns to garlic production exceeded that of irrigated rice. Increases in the yield as well as in the returns to hybrid corn production under the Tarlac-San Miguel-O'Donnel Irrigation System indicate the potential of hybrid corn as an alternative crop to rice. Likewise, the returns to onion production under the Upper Talavera River Irrigation System have been greater than that of irrigated rice. Planting irrigated rice under the Allah River Irrigation Project was more profitable than planting irrigated hybrid or native corn. On the other hand, corn production under the Banga River Irrigation System performed better than irrigated corn under the Allah River Irrigation Project.

Implications and recommendations for policy considerations focus on the provision of support services designed to give farmers more incentives to grow the crops identified lo have a comparative advantage in the area. A credit facility/relending program for diversified cropping is essential to provide farmers the needed production loans. The total variable cost in the production of garlic and onions ranged from two to four times higher than that incurred in irrigated rice. Higher production costs may either prevent farmers from planting these crops or may force them to plant a very limited area as compared with rice. It is further recommended that the relending program charge market interest rates since the problem of farmers is more on access to credit rather than the magnitude of the interest rate charged. There is a need to provide post-harvest facilities for the storage and/or secondary processing of corn, onions and garlic. The private sector is expected to own and operate these facilities. The government will provide the support services related to institutional strengthening of cooperatives, soliciting sources for technical and capital assistance on the management/operations of the facilities, and research and development (R&D) on post-harvest processing technologies. R&D activities may include: survey and identification of non-rice crops which can be produced at a comparative advantage; the breeding of open-pollinated corn and new varieties of peanuts with shorter growth period; and the design of farm tools for labor-intensive non-rice crops such as onions and garlic. A strengthened extension program should help bridge the gap between agricultural research and the utilization of research results by the farmers. The national infrastructure program must also include the requirements of a crop diversification program. The private sector, with the full support of the government, must be encouraged to develop the local market and to explore foreign markets for diversified crops. Coherent and consistent government policies are needed to give impetus to diversified cropping, which must be considered only as a starting point of a more general and encompassing agricultural diversification program.

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Introduction

The findings reported in this paper are part of an interim report on the "Study on Irrigation Management for Diversified Crops" submitted in September 1988 by the International Irrigation Management Institute (IIMI) to the Asian Development Bank (ADB). The study is a technical assistance grant (TA 859 PHI) to the Government of the Philippines, primarily funded by the ADB. The research was conducted by IIMI in collaboration with the National Irrigation Administration (NIA), the consortium of state colleges and universities which form part of the research network coordinated by the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), and the Department of Agriculture (DA). This report presents the economic aspects and profitability of irrigated diversified cropping. It draws heavily from research results obtained from the state colleges and universities, namely: Mariano Marcos State University, Pampanga Agricultural College, Central Luzon State University, and University of Southern Mindanao. The paper is divided into three sections: (1) the profitability of selected irrigated crops during the dry season; (2) the economic constraints to the adoption of diversified cropping; and (3) the implications and preliminary recommendations for policy consideration.

Profitability of Irrigated *Diversified* Crops

The profitability of irrigated diversified cropping in the six irrigation systems covered are discussed. The Mani Communal Irrigation System is being rehabilitated and has been excluded from the seven irrigation systems as originally planned. Results of the study presented include the cost and returns analysis by crop within each irrigation system for the 1987/88 dry season; a comparison of the cost and returns of rice and diversified crops between the 1986/87 and 1987/88 dry seasons; and a comparison of the profitability of the crops across some of the irrigation systems.

Tables 1 and 2 show the mean yield and mean returns above variable cost[2], respectively, of irrigated and rainfed crops planted under the different irrigation systems during the 1986/87 and 1987/88 dry seasons. The significant results of yield and returns comparison of different crops within each system and across systems for 1986/87 and 1987/88 dry seasons are summarized in Table 3. A comparison of farmgate prices, by crop, in the different irrigation systems during the two dry seasons is presented in Table 4.

Table 1. Summary of mean yield (kg/ha) of irrigated and rainfed crops planted in the different systems during the 1986/87 and 1987/88.

	Rice		Mungbean		Corn				Garlic		Onion	
					Hybrid		Native					
	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
					Irrigated *Crops*							
LVRIS	5013	3034	880	537	—	—	—	—	1700	754	—	—
BP#2	3361	4159	636	763	—	—	—	—	2418	933	—	—
TASMORIS	3165	2814	126	100	2361	3475	-	—	—	—	—	—
UTRIS	3172	3238	—	—	—	-	—	—	—	—	10660	9557
ARIP	4400	4016	—	—	—	3713	—	2283	—	—	—	—
BARIS	3802	3874	–	—	4303	3997	2863	—	—	—	—	—
					Rainfed Crops *(within* or near *the systems)*							
LVRIS		—	734	365	—	—	—	—	—	—	—	—
BP#2	—	—	734	365	—	—	—	—	—	—	—	—
TASMORIS	—		207	124	1096	—	—	—	—	—	—	—
UTRIS	—	—	—	—	—	—	—	—	—	—	—	—
ARIP	–	—	—	—	–	2741	—	I748	—	—	—	—
BARIS	—	—	—	—	3924	3458	2614	2491	—	—	—	—

[1]The term *returns* used in subsequent paragraphs refers to mean returns above variable cost. Similarly, the term *yield* and *prices* used in the text refer to mean yield and mean prices.

Table 2. **Summary** of mean returns above variable cost (₱/ha) of irrigated and rainfed crops planted in the different **systems during** 1986/87 and 1987/88 dry seasons.

	Rice		Mungbean		Corn				Garlic		Onion	
					Hybrid		Native					
	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
Irrigated Crops												
LVLRIS	6890	5807	5493	3865	—	—	—	—	8123	14006	—	—
BP#2	5630	5656	3404	6185	—	—	—	—	9060	17249	—	—
TASMORIS	4374	4930	-62	-404	4371	7572	—	—	—	—	—	—
UTRIS	8185	6463	—	—	—	—	—	—	—	—	16766	41082
ARIP	6021	7120	—	—	—	3288	—	2488	—	—	—	—
BARIS	5657	6240	—	—	3282	5309	3152	—	—	—	—	—
Rainfed Crop (within or near the systems)												
LVLRIS	—	—	3578	2311	—	—	—	—	—	—	—	—
BP#2	—	—	3578	2311	—	—	—	—	—	—	—	—
TASMORIS	—	—	686	43	1407	—	—	—	—	—	—	—
UTRIS	—	—	—	—	—	—	—	—	—	—	—	—
ARIP	—	—	—	—	—	1993	—	2187	—	—	—	—
BARIS	—	—	—	—	1815	3332	2041	3142	—	—	—	—

Preliminary results of the cost and returns analyses in the production of the different crops in the six irrigation systems during 1986/87 and 1987/88 dry seasons are **as** follows:

- Garlic is the most profitable non-rice crop for farms in the Laoag-Vintar River. Irrigation System (LVRIS) and Bonga Pump No. 2 Irrigation System (BP#2). Yield and returns to garlic production under BP#2 have been higher than those under LVRIS during the 1986/87 and 1987/88 dry seasons. Generally, garlic farmers under BP#2, apply more farm inputs and pay about ₱900 more per hectare for irrigation. Farmers also have better control over irrigation water, which accounts for higher yields and profitability of farms in BP#2. Under LVRIS and BP#2, the returns to garlic production exceeded that of rice. Since garlic is planted only in irrigated areas, it is indeed an alternative crop to irrigated rice.

- Increases in the yield **as** well **as** in the returns to hybrid corn in the Tarlac-San Miguel-O'Donnel Irrigation System (TASMORIS) during the 1987/88 dry season compared with the previous year, indicate the potential of hybrid corn **as** an alternative crop to rice. No significant difference between the returns to irrigated corn and irrigated rice were observed during the 1986/87 and 1987/88 dry seasons.

- The returns to onion production under the Upper Talavera River Irrigation System (UTRIS) were greater than that of rice for the past two dry seasons. In spite of the 10% decrease in the yield of onions during the 1987/88 dry season, the 217% increase in its price still made production more profitable than rice. Even at the 1986/87 price level and with the 10% reduction in yield in 1987/88, farmers would still have a positive returns of ₱6,116/ha. Therefore, irrigated onions can he an alternative crop to irrigated rice.

- A dry season rice crop under the Allah River Irrigation Project (ARIP) is more profitable than a crop of either hybrid or native corn. In terms of yield and returns, rice under ARIP performed better than rice

Table 3. Summary of significant t-test results for yield and returns above variable cost of different irrigated (Ir) and rainfed (Rf) crops within each system and across systems.

System	Crops Compared	Differences	
		Yield (kg/ha)	Returns above variable cost (₱/ha)
	Crop Year 1986/1987		
Within the System			
TASMORIS	Ir. Rice vs. Ir. Mungbean	na	4436**
	Ir. Munghean vs. Ir. Corn	na	-4433**
BARIS	Ir. Rice vs. Ir. Hybrid Corn	na	-2167**
	Ir. Hybrid Corn vs. Rf. Hybrid Corn		1632*
	Ir. Hybrid Corn vs. Ir. Native Corn	1439*	
	Rf. Hybrid Corn vs. Rf. Native Corn	1310*	
Across Systems			
BARIS/ARIP	Ir. Rice vs. Ir. Rice	-597**	
	Crop Year 1987/1988		
Within the System			
LVRIS	Ir. Rice vs. Ir. Garlic	na	-8199**
	Ir. Garlic vs. Ir. Munghean	na	10141**
BP#2	Ir. Rice vs. Ir. Garlic	na	-12853**
	Ir. Garlic vs. Ir. Mungbean	na	12324**
	Ir. Munghean vs. Rf. Mungbean	397*	
UTRIS	Ir. Rice vs. Ir. Onion	na	-34918**
TASMORIS	Ir. Corn vs. Ir. Mungbean	na	7975*
ARIP	Ir. Rice vs. Ir. Hybrid Corn	na	3832**
	Ir. Rice vs. Ir. Native Corn	na	4632**
	Ir. Hybrid Corn vs. Ir. Native Corn	1420**	
	Ir. Hybrid Corn vs. Rf. Hybrid Corn	962*	
	Rf. HybridCorn vs. Rf. Native Corn	993*	
BARIS	Ir. Hybrid Corn Vs. Rf. Hybrid Corn		1977**
	Rf. Hybrid Corn vs. Rf. Native Corn	967**	
Across Systems			
BP#2/LVRIS	Ir. Rice vs. Ir. Rice	1125**	
	Ir. Garlic vs. Ir. Garlic	178**	
	Ir. Munghean vs. Ir. Mungbean	225**	2320**
ARIP/BARIS	Ir. Rice vs. Ir. Rice		880*
	Ir. Hybrid Corn Vs. Ir. Hybrid Corn		-2021*
	Rf. Native Corn vs. Rf. Native Corn	-744*	

** = significant at 1%
* = significant at 5%
na = not apphcable

under the Banga River Irrigation System (BARIS) during the two years of the study. However, BARIS conditions are more ideal for corn production - irrigated hybrid corn and rainfed hybrid and native corn as well, compared with ARIP.

Table 4. Comparison of farmgate prices (₱/kg) of different crops planted within each system during 1986/87 and 1987/88 dry seasons.

System	Crop		Price 1986/87	Price 1987/88	Difference
LVRIS	Rice	Mean	2.58	3.50	-0.92**
		SD	0.31	0.55	
	Garlic	Mean	10.33	34.31	-23.98**
		SD	3.25	9.28	
	Ir. Mungbean	Mean	9.71	10.70	-0.99**
		SD	1.99	0.88	
	Rf. Mungbean	Mean	9.28	11.07	-1.79**
		SD	0.55	0.79	
BP#2	Rice	Mean	2.88	3.50	-.62*
		SD	0.83	0.00	
	Garlic	Mean	8.19	37.87	-29.68**
		SD	3.48	9.98	
	Ir. Mungbean	Mean	9.68	10.66	-0.98**
		SD	0.55	0.65	
	Rf. Mungbean	Mean	9.28	11.07	-1.79**
		SD	0.55	0.79	
TASMORIS	Rice	Mean	2.84	3.15	-0.31**
		SD	0.37	0.20	
	Ir. Corn	Mean	3.63	3.43	0.20**
		SD	0.05	0.17	
	Ir. Mungbean	Mean	9.13	10.00	-0.87 ns
		SD	2.29	0.25	
	Rf. Mungbean	Mean	9.50	9.83	-0.33 ns
		SD	0.45	0.55	
UTRIS	Rice	Mean	3.07	3.49	-0.42**
		SD	0.27	0.34	
	Onions	Mean	2.92	6.35	-3.43**
		SD	1.01	2.15	
ARIP	Rice	Mean	2.41	2.%	-0.49**
		SD	0.43	0.26	
BARIS	Rice	Mean	2.36	2.87	-0.51**
		SD	0.48	0.29	
	Ir. Hybrid Corn	Mean	2.49	2.29	0.20*
		SD	0.39	0.31	
	Rf. Hybrid Corn	Mean	2.29	2.08	0.21*
		SD	0.37	0.45	
	Rf. Native Corn	Mean	2.33	2.09	0.24 ns
		SD	0.45	0.53	

**=significant at 1%,
*= significant at 5%
ns = not significant

Economic Constraints to the Adoption of Diversified Cropping

Constraints in adopting diversified cropping in the six irrigation systems are classified into four broad areas of considerations: land utilization/cropping patterns, labor availability, credit/financing, and post-harvest handling/marketing.

Land Utilization/Cropping Patterns. A wet season crop of rice has been traditionally part of

the cropping patterns employed by farmers under the irrigation systems covered. Rice has been traditionally planted as a wet season crop because: (1) the farmer wants to be assured of meeting the rice requirements of his farm household, even that of his married children and (2) the location and level of his field relative to other farms is such that it is bound to receive both rain and irrigation water in excess of what a non-rice crop would require. In cases when the harvest from the wet season rice crop is not enough to supply the rice requirement of the household, farmers may opt to have a dry season crop of rice. In general, non-rice crop production is feasible only during the dry season.

Experience, knowledge of the technology on the production of the non-rice crop, and perceived profitability are crucial factors in the fanner's decision to plant a particular crop. Such case hold true with onion fanners under UTRIS, garlic fanners under LVRIS and BP#2, and corn farmers under BARIS.

Planting of diversified crops was more popular among farmers under LVRIS and BPR. Farmers under TASMORIS were the least knowledgeable and least experienced with regard to planting a non-rice crop during the dry season. The limited water supply under TASMORIS often forces farmers, especially at the tail-end of laterals, to leave their farms fallow after the wet season rice crop.

The onset of rainfall triggers the start of land preparation for the wet season rice crop. Rainfall supplements the water supplied by the irrigation system. Accordingly, timeliness in farm operations is not entirely within the farmer's control. A late wet season planting means less turn around time for land preparation and subsequent delays in the harvest of the first dry season crop. The chain of delays may cost a farmer his second dry season crop. Such a case happened to fanners who followed a rice-rice-mungbean cropping pattern under LVRIS during the 1987/88 dry season.

Establishment of the dry season crop may be delayed due to the time required to drain the field before it becomes suitable for land preparation. Problems on drainage, heavy clay soils, seepage from surrounding fields, and a previous rice crop, deter an early and timely land preparation for the next crop. Under such circumstances, the fanner may instead decide to plant rice, if he can be assured of irrigation water, rather than wait until his field becomes workable.

Availability of Labor. Labor was the least limiting among the constraints to diversified cropping. Farmers engaged in the production of onions and garlic which are both labor-intensive crops, did not encounter any problem on the supply of labor. Hired labor provided by migrant workers from nearby rainfed areas augmented the labor needs for such crops.

However, high material cost (e.g., seeds, fertilizers and chemicals) for onions and garlic limited both the size of the plots planted and the number of farmers engaged in the production of thesecrops. Should the size of the area be expanded as a response to the provision of an agricultural credit facility and/or a more attractive export market, labor will become a problem in the production of these labor-intensive crops. Furthermore, as more agricultural lands are irrigated, the usual flock of migrant workers from what used to be rainfed areas will no longer be available as a supplementary labor force.

Credit/Financing. Most of the fanners indicated their preference for banks as their source of credit/financing for their production loans, followed by relatives, friends/neighbors, and traders. However, majority of the farmers finance their crop production through informal lenders, i.e., friends/neighbors, relatives and traders. Except for some onion farmers under UTRIS, whose source of financing are banks, most farmers do not borrow from the banks for their financing needs in spite of their preference for banks and the lower interest rates charged for bank loans. Because of past arrearages incurred in previous government programs (e.g., Masagana 99 and Maisagana program), some farmers are no longer elegible to borrow from the banks, although their number cannot be determined.

Among the informal sources of credit, traders were the least preferred/approached by farmers. Farmers believed that in addition to the high interest rates charged by traders, the prices paid for their harvest were lower than what others would usually pay. Moreover, fanners felt obliged to sell their produce to traders who financed their production loans.

The availability of financing for crop production partly determines the kind of crop to plant (whether input-intensive as in garlic and onions) and the size of the area allocated for the crop. A number of financing arrangements have emerged in the production of onions and garlic. Repay-

ments for loans were denominated in terms of cavans (50 kg) of palay per ₱100-loan, or a sharing based on the quantity of seeds (for onions) or seed pieces (for garlic) loaned to farmers at planting time.

Post-Harvest Handling/Marketing. Post-harvest handling of onions and garlic poses more problem than corn and palay due to their perishable nature. Moreover, post-harvest technology for these crops is not as established as the technology for grains. like rice and corn. Primary processing (drying) of grains, in general, appears to be a problem only during the wet season when not enough post-harvest facilities are available.

The perishable nature of non-grain crops result in greater price fluctuations even during the harvest season (Table 4). Abrupt changes in the prices of onions and garlic continue to accrue after the harvest season, as compared to the stable prices of rice and corn. Similarly, price fluctuations between the years were more pronounced in non-grain crops.

Implications and Preliminary Recommendations for Policy Consideration

Once the crops which can he profitably grown in a specific area have been identified, the government and private sectors can encourage crop diversification through the provision of support services designed to give incentives to farmers. The kind of support services to he provided will depend on the degree of adoption of the crop in the locality.

(I) A ***credit facility/relending program*** for diversified cropping is essential in order to provide the farmers the needed production loans for crops identified to have a comparative advantage in the area. Credit availability is a constraint in the production of hybrid corn in BARIS, onions in UTRIS, and garlic in **LVRIS** and BP#2. The total variable costs in the production of garlic and onions ranged from two to four times greater than the total variable costs in the production of rice. An incremental difference of ₱7,000 to ₱8,000 per hectare in total variable costs may either prevent farmers from planting garlic or onions, or may force them to plant a much smaller area compared with that for rice. Sizes of farm plots planted to garlic in LVRIS averaged only 39% of the plot size planted to rice. Likewise, farm plots planted to onions in **UTRIS** averaged only 55% of the size of rice farm areas.

Total variable costs ranging from ₱12,000 to ₱16,000 per hectare in the production of garlic and onions, when borrowed from informal credit lenders, would be a sizeable amount in terms of sourcing it and in repaying the loan inclusive of interest. It is, therefore, recommended that the relending program charge market interest rates since the problem of farmers is more on access to credit rather than the magnitude of the interest rate charged. Furthermore, a market interest rate of about 18% are much lower than the more than 100% annual interest rate paid by farmers to informal lenders. While the government may initially provide the credit relending program, direct lending should be through the privately owned rural and commercial/development banks.

(2) There is a need to provide ***post-harvest facilities*** for the storage and/or secondary processing of corn, onions and garlic. Aside from prolonging the shelf life of these crops, product diversification through processing will increase the incomes of farmers. Farmgate prices in March-April 1988 for garlic at **LVRIS** and BP#2 were ₱34.31/kg and ₱37.87/kg, respectively. Most farmers sold their garlic within a month after harvest due to the need to repay loans, to meet household expenditures, and lack of storage facilities. The retail price of garlic in Metro Manila, barely four months after harvest, had increased to ₱168/kg. While farmgate prices at harvest cannot be compared with Metro Manila retail prices four months later, the difference in the prices shows who profits most from garlic production. Similarly, farmers under **UTRIS** received only ₱6.35/kg of onions during the time of harvest while retail prices for onions was ₱26/kg five months later in Metro Manila. Local traders/retailers of these commodities make more profits than the farmer producers, who have to overcome more risks in growing the crops. A complementary component to the post-harvest facilities would be a ***quedan*** guarantee fund scheme which would issue negotiable warehouse receipts. Farmers, based on their financial needs and the prevailing prices, could decide to monetize/sell the warehouse receipts if and when necessary.

In line with the privatization program of the government, the post-harvest facilities and the ***quedan*** guarantee fund could be established through private initiative with the government providing the support services related to institutional strengthening of cooperatives, sourcing of technical assistance on the management/operations

of the facilities and in further research and development on post-harvest processing technologies. The ownership and operations of post-harvest facilities is expected to be a private sector endeavor. Government may temporarily engage in this endeavor only in the absence of a willing private investor and when the facilities are deemed as necessary support components.

(3) Research and development *(R&D)* efforts from both the government and private sectors covering different areas of concern can boost the adoption of diversified cropping, such as the following:

- Survey and identification of crops other than rice which can be produced at a comparative advantage in specific localities in the country, with emphasis on profitability. ast government efforts have tended to equate increased production with improved productivity and profitability;

- Breeding for improved varieties of native corn, which appears to be a profitable crop in BARIS and which has total variable costs of only *58%* of what is needed for hybridcorn. The cost of native corn seeds in BARIS and ARIP is only **14%** the cost of hybrid corn seeds. Furthermore, farmers can produce their own seeds of native corn while hybrid seeds have to be bought every planting season;

- Design of new farm tools and/or modification in the design of existing tools for the cultivation of crops identified as suitable for diversified cropping. The amount of family labor involved in garlic production is two to three times the amount incurred in rice production. Similarly, contribution of family labor in onion production is about four times greater than in rice production. The use of appropriate tools in the cultivation of onions and garlic, both labor-intensive crops, would reduce the drudgery of farm operations involved and the labor required; and

- Generation of technologies for primary and secondary post-harvest processing of non-grain crops, including the design of appropriate storage facilities/equipment.

(4) A *strengthened extension program* should help bridge the gap between agricultural research and the utilization of research results by the farmers. Past government extension programs were focused on the production aspects of grain crops, specifically rice and corn. **A** broader extension program, which includes the production, post-harvest processing and marketing of other potentially profitable crops, would offer farmers the opportunity to consider other alternative crops. Farmers must have access to an agri-business approach to crop diversification.

(5) There is a need to include the *infrastructure* requirements of a crop diversification program in the national infrastructure program. Aside from irrigation, infrastructures like farm-to-market roads, telecommunication facilities and markets will encourage farmers to produce crops other than rice. The agricultural and industrial sectors must closely coordinate with each other in determining their respective priority projects. The choice as well as the phasing of the implementation of the projects must complement each other for optimum benefits to the target clientele.

(6) The private sector, with the full support of the government, must be encouraged *to* develop the local market and to explore foreign markets for diversified crops. There cannot be a better incentive for farmers to produce a specific crop than an assured market. The Philippine embassies abroad are in a position to help the local exporters make the necessary contacts with potential importers.

(7) *Coherent* and consistent *government policies* are needed to give impetus to diversified cropping. There has to be a realization of the basic need to reallocate resources as part of the development process in agriculture. The decrease in the real prices of rice during the past decade indicates a need for such adjustments which should not be met through support measures designed to artificially keep rice prices above their market-clearing levels. Increasing the flexibility of cropping systems through diversified cropping can provide a less costly adjustment or response to changing domestic and world market conditions'.

(8) Diversified cropping may be only a starting point to a more general and encompassing *agricultural diversification program*. This program should

'Schuh. G.E. and S. Barghouti. Agricultural Diversification in Asia. Finance and Development. June 1988. International Monetary Fund and the World Bank, Washington, D.C.

include other relatively more income-elastic agricultural products like livestock, poultry and fruits, which would have better market demand and higher potential for increasing farm incomes.

The Integrated Rural Financing (IRF) program of the Department of Agriculture, which considers the credit requirement of the entire farm household instead of the production of only one crop for one season, may be considered an agricultural diversification program. The IRF program may provide credit for a combination of livestock-crop farm enterprise for one to three years.

It is also recommended that a multi-disciplinary approach be undertaken towards a crop diversification program. No single government or private agency nor one discipline is in a position to plan and implement the program. Relatedly the concerned sectors **must** consolidate their efforts, build on gains from experiences, and continue to design an appropriate crop diversification program.