Successful Crop Diversification in Irrigated Rice Farms: Development of a Cognitive Decision Making Model

Anna Miren Gonzales-Intal and Jaime B. Valera [1]

Abstract

Six groups (cases) of farmers involved in crop diversification after rice were studied to determine the economic and institutional factors behind the successful adoption and continued cultivation of crops other than rice. Some *266* farmers were interviewed. The crops they cultivated were: tobacco, cotton, tomato, onion, mungbean, garlic, corn and peanut. All of the farmers were from Central and Northern Luzon, Philippines.

The decision making process was modeled using Gladwin's **(1983)** method. Several conditions conducive to crop diversification were obtained from the interviews. Among these were: low income from other sources, profitability as seen from other farmers, sufficient rice supply for one's own consumption, availability of seeds, insufficient water supply for rice, experience, perception of high market prices for the crop, presence of technical and institutional support. While a decision-making model could be developed, testing is required on a separate validating sample.

Introduction

Successful crop diversification in irrigated rice lands refers to the situation where farmers in an irrigated area regularly grow one or more non-rice crops during the dry season.

Traditionally, the existence of irrigation in the Philippines has meant two or more croppings of rice monoculture per year. Crop diversification in irrigated farms is the exception rather than the rule in spite of the fact that the profitability of rice farming has not increased proportionately with the increase in rice yield.

Crop diversification is important for achieving stable **food** supplies in the country and **for** earning and/or saving foreign exchange. It is also one **of** the means for increasing farmers' incomes. Hence, the impetus toward irrigated crop diversification. Given this impetus, and given that irrigated crop diversification is relatively new, there is a need to examine areas where irrigated crop diversification **is** being successfully practiced.

Objectives

The study aimed to examine and document six cases of successful crop diversification in irrigated rice lands focusing on the economic and institutional as well as the physical and technical factors that have been supportive to crop diversification.

The six cases examined were: tobacco farming in San Fabian, Pangasinan; cotton farming in Urdaneta and Manaoag, Pangasinan; tomato farming in Sta.Barbara and Mapandan, Pangasinan; mungbean farming in Manaoag and Urdaneta, Pangasinan; onion farming in San Jose, Nueva Ecija; and garlic, corn and peanut farming in Laoag, Ilocos Norte.

A total of **266** farmers were interviewed:40 tobacco farmers, 40 cotton farmers, **40** tomato farmers, **40** mungbean farmers, **40** onion farmers and 66 garlic/corn/peanut farmers.

A major component **of** the research **was** an attempt to model the cropping decision making of

[1]Assistant Professor, Department of Agricultural Education and Rural Studies (DAERS), Associate Professor and Director, National Training Center for Rural Development, U.P. Los Baños, respectively.

the farmers vis-a-vis diversified crops. The model used in this study was a modified version of Gladwin's[2] decision tree model (Figure 1).

The model posited three stages in the cropping decision:

Stage 1 consists of assuring the family's rice consumption requirements. It is hypothesized that a risk-averse farmer will first make **sure** that food for his family, i.e., rice, will not be compromised by planting other crops.

If this **is** satisfied, the farmer then considers the technical **(soil,** topography, water, timing, knowledge) and economic (demand, time, labor, capital, credit) feasibility of planting the diversified crop. **This** constitutes Stage **2.**

If the crop satisfies the technical and economic feasibility requirements, its potential costs and returns (i.e., profitability) **is** then considered (Stage **3).** A decision to plant the diversified crop will' be made if the profitability of the crop is perceived as equal to or greater than the minimum profitability over the traditional crop (rice) for which the farmer is willing to take the risk of planting the diversified crop. The model was tested in each of the six cases.

The Six Cases

Five of the six case studies were in Region I or Northern Luzon (four in the province of Pangasinan and one in Ilocos Norte); the Nueva Ecija case **is** in Region III or Central Luzon. Two of the cases — tomato and cotton — involve contract growing schemes; the farmers grow the crops on their own in the other four cases.

With the exception of the tomato and cotton farmers, other farmers have had long experience in planting diversified crops: the average number of years of growing the crop was 22 years for tobacco farmers, 18 years for mungbean farmers, 21 years for onion farmers, 16 years for garlic farmers, 15 years for corn farmers and 16 years for peanut farmers. Although the tomato farmers had been growing native tomatoes for many years (an average of over 10 years), they started planting the imported variety only in the last one to three years **as** part of the contract growing scheme. The cotton farmers have been planting cotton for an average of only two years.

Tohocco Farmers

The tobacco farmers of San Fabian, Pangasinan planted burley tobacco. The Philippine Virginia Tobacco Administration (PVTA) office in Pangasinan oversees the burley production in San Fabian. Aside from extension services, the PVTA also assists farmers in marketing their produce by supervising licensed traders. PVTA also sponsors the "Outstanding Burley Tobacco Grower of the Year" award.

Most of the tobacco farmers planted only rice during the wet season and only burley during the dry season. Over the years, tobacco growing has been a profitable venture for the farmers — the average ratio of the number of years of positive net to the total number of years the farmers have been planting tobacco was **0.92.** Duringthe 1985/86 dry season, theaveragenetretums abovecashcosts per hectare of burley was **3.48** times the wet season rice crop.

The major buyer/trader of burley tobacco leaves in San Fabian was a Chinese middleman who **also** acts as an informal money and input lender to the farmers. He loaned the farmers money at 6% interest rate per cropping season. The input loans had no stipulated interest rates but their prices were marked-up to include interest costs.

Cotton Formers

The cotton farmers of Urdaneta and Manaoag, Pangasinan were contract growers for the Philippine Cotton Corporation (PCC), a government-controlled corporation. PCC takes charge of undertaking and implementing the commercial production of cotton in the Philippines. PCC technicians regularly visit farmers to convince them to plant cotton. In the contract growing scheme, PCC provides the farmers with technical advice and inputs — seeds for free and fertilizer chemicals and cash loans without interest but the payment of which are deducted from the gross sales. PCC sets the purchase price of cotton before the cropping season. During the 1985/86 dry season, price of cotton was ₱8.00/kg.

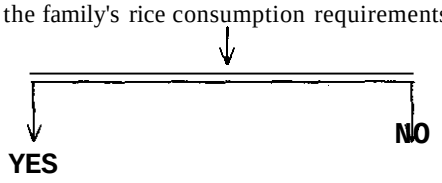
Although rice was the predominant wet season crop and cotton was the predominant dry

[2]Gladwin, C.H. Contribution of decision-tree methodology to a farming systems program. *Human organization*, Vol. 42, No. 2, 1983, pp. 146-157.

Figure 1. A Descriptive Model of Cropping Decision Making.

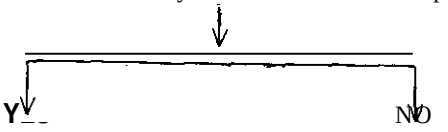
Stage 1. Satisfaction of Basic Needs: Assuring rice consumption requirements

Q: Will the family's rice consumption requirements be set if the farmer plants other crop(s)?



(Move on to Stage 2)

Is (are) there non-rice crop(s) with possible returns that will allow the family to meet its rice consumption requirements?



(Move on to Stage 2) (Plant rice only)

Stage 2. Testing for Feasibility: Satisfaction of technical constraints and economic feasibility'

Technical Constraints:

- soil, topography
  (Does crop X yield well at farmer's soil, topography?) → if no → eliminate crop X
- water requirements
  (Does farmer have irrigation or is the water enough to meet the requirements of crop X?) → if no → eliminate crop X
- timing of farm operations
  (Is the timing of farm operations for crop X acceptable to the farmer?) → if no → eliminate crop X
- knowledge
  (Does farmer know how to plant crop X or will he able to obtain information?) → if no → eliminate crop X

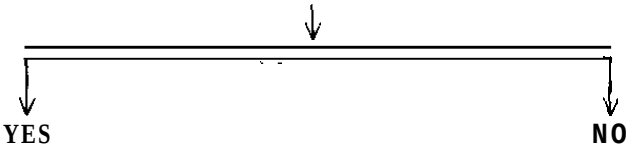
Economir Feasibility:

- Demand
  (Can the farmer sell crop X in a nearby market or to a merchant?) → if no → eliminate crop X
- Time. labor
  (Does the farmer have the available time and accessible labor to help him plant crop X?) → if no → eliminate crop X
- Capital, Credit
  (Does the farmer have the capital or accessible credit to buy inputs for crop X?) → if no → eliminate crop X

Stage 3. Cost-Benefit Analyses

Examination of the expected returns of each alternative crop vis-a-vis costs.

Q: Is returns from crop X n^2 times greater than returns from previous crop (rice)?



Plant crop X

Stick to old crop (rice)

'There is no particular sequence in which the farmer processes each alternative crop vis-a-vis the technical constraints and economic feasibility. Suffice it to say that any alternative crop that fails to meet any one of the above-mentioned four technical constraints or three economic feasibility requirements is eliminated from consideration.

^2n is a value which represents the minimum profitability of crop X over the previous crop for which the farmer will be willing to take risk of planting crop X. n is an empirical value that is greater than 1

season crop of the cotton farmers, many of them planted other diversified crops (i.e., corn, mungbean, tomato, and stringbeans) during the wet and dry seasons.

Cotton growing has been financially rewarding for the farmers: since they began planting cotton, the farmers realized positive net returns from their cotton crop 90 percent of the time. Furthermore, they reported hitting the *jackpot* with their crop from one-third to one-half of the time. During the 1985/86 dry season, the net returns above cash costs of cotton was 2.58 times greater than the previous wet season rice crop.

Tomato Growers

The tomato farmers of Sta. Barbara and Mapandan Pangasinan were also contract growers of the Philippine Fruit and Vegetable Industries, Inc. (PFVII). Contract growing of tomatoes was introduced in the area during the 1983/84 dry season. Under the contract growing scheme, PFVII provides the farmers with technical assistance and credit in the form of seeds, fertilizer, chemicals and cash at an interest rate of 1.5% per month. PFVII buys the produce at a price that it sets before the cropping season. During the 1985/86 dry season, price for tomatoes was ₱0.80/kg.

The farmers planted California variety tomatoes during the 1985/86 dry season. Farmers were given the expectation by the PFVII technicians that the California variety has a potential yield of 40 t/ha. Majority of the farmers also planted other diversified crops in addition to the contract-grown tomatoes during the 1985/86 dry season (e.g., native tomatoes, mungbean, corn, eggplant, gourd, beans, and sugarcane).

The farmers have been growing native tomatoes for an average of over 10 years. Over the years, the native tomato crop has given the farmers good returns: the farmers had positive net returns from their tomato crop 84 percent of the time and hit the *jackpot 20* percent of the time.

However, farmers who planted the California variety during the 1985/86 dry season incurred losses. Of the projected harvest of 40 t/ha, actual yield obtained was 7.7 t/ha which was only 19.4 percent of the PFVII estimates. The low yield was aggravated by the farmers' high fertilizer and chemical usage, the low purchase price set by PFVII, and the failure of PFVII technicians to get the harvested tomato on time from a number of farmers resulting in the rotting of the produce. (This happened after the 1986 snap presidential election and the February Revolution). As a consequence, many farmers owed PFVII money at the end of the cropping season because the gross sales were not enough to pay for the input loans. Considering the poor performance, PFVII decided to discontinue its contract growing scheme in the area. Most of the farmers indicated, though, that they will continue planting the native variety.

Mungbean Farmers

Mungbean has been the traditional dry season crop of farmers located at the border of Manaoag and Urdaneta, Pangasinan. Inadequate irrigation water for rice or other crops during the dry season was a major reason for the widespread cultivation of mungbean. Considering this situation, the National Irrigation Administration (NIA) office in Urdaneta, Pangasinan has been programming the area for mungbean production. During the 1985/86 dry season, over 250 hectares were programmed by NIA for mungbean production.

Mungbean production in Manaoag and Urdaneta was characterized as using low labor and input. Most farmers did not plow their fields before planting. Instead they simply broadcasted the seeds into the field containing the rice stalks, then the field was harrowed. After emergence, little else was done except for the weekly spraying of pesticides. Fertilizers were not applied nor was weeding practiced.

The farmers have been planting mungbean for an average of 18 years. Over the years, farmers have consistently realized net profits from their mungbean crop (the ratio of number of years of positive net returns to total number of years of planting the crop was 0.91). Rarely did farmers' hit the "jackpot" with their mungbean harvest.

Unlike other diversified crops covered in this study, mungbean had much lower cash and non-cash costs than rice. Despite this and the relatively high mungbean price (during 1985/86 dry season price of mungbean was ₱1.00/kg), production was less profitable than rice. Many of the farmers incurred losses from their mungbean crop during 1985/86 dry season. Two reasons explain such losses: very low yields which averaged 0.385 t/ha were obtained due to poor cultural practices employed and high pesticide input which cost 52 percent of the cash returns from the harvest.

The farmers themselves marketed their mungbean harvest. The produce was brought to the Urdaneta Public Market by tricycle and was directly sold to the traders/grain dealers or stall owners.

Onion Farmers

The onion farmers came from San Jose City, Nueva Ecija. The area is known as one of the largest producers of onions during the dry season. The farmers have been regularly growing onions after the wet season rice crop for an average of 21 years.

Farmers in San Jose plant four onion varieties: ***Batanes*** and ***Tanduyong*** which are native red onions and the hybrids ***Red Creole*** and ***Yellow Granex.*** The native varieties, which have been planted more extensively command a higher price and can be stored longer than the hybrids.

Farmers sold their produce to individual traders who in turn sold the onion purchased to trading centers in San Jose City. Trading centers sold the onions in large quantities to owners of storage facilities who were the major buyers. Storage facilities were located in Bongabon and Palayan City, Nueva Ecija.

Over the years, the fanners' onion crop has fared quite well. Farmers realized positive net returns from their harvests 87 percent of the time. The average jackpot ratio was 0.18 which indicated that on the average, farmers hit a ***jackpor*** once in every five cropping seasons. The 1985/86 dry season was considered as one of the 'jackpot" years when farmers realized an average net returns above cash costs, 4.7 times greater than the preceding wet season rice crop.

Garlic Farmers

Farmers in Laoag, Ilocos Norte have been traditionally growing diversified crops during the dry season. Garlic was the major diversified crop grown; other crops grown were corn, peanut, mungbean, watermelon, and vegetables like cabbage and eggplant. Farmers who planted garlic, corn and peanut or a combination of these crops were interviewed. Of the 66 farmers interviewed, 60 have been planting garlic during the dry season for an average of 16 years; 40 have been planting corn for an average of 15 years; and 46 have been planting peanut for an average of 16 years. All farmers have consistently realized positive net returns from their harvests: 90 percent of the time for garlic, 96 percent of the time for corn, and 97 percent of the time for peanut. The crops, however, yielded few "jackpots" — with ratios ranging from 0.10 to 0.14 only.

Price of the 1985/86 dry season garlic crop was quite low at ₱13/kg. Most farmers opted not to sell their produce until a higher market price was reached. As of the interview date in April and May 1986, only 35 percent of the garlic farmers had sold their produce. The farmers blamed the low market price to illegal and clandestine importation or smuggling of garlic in large quantities from Taiwan. Nevertheless, many farmers expressed optimism that the price would soon increase and that they would he able to sell their produce at a satisfactory price.

Positive net returns above cash costs per hectare were obtained from corn and peanut during the 1985/86 dry season. These were higher than the net returns above cash cost of the previous wet season rice crop.

Farmers sold their garlic, corn and peanut to traders and stall owners at the Laoag City public market. Although a number of the farmers used some of their corn harvest for animal feed, the corn was sold in the market for human consumption.

Factors Influencing Adoption

Analysis of the six case studies revealed the conditions that were conducive to the adoption and persistence of irrigated crop diversification during the dry season. The analysis also revealed problems that reduce the viability of crop diversification which need to be addressed.

Lack of sufficient irrigation water for rice during the dry season prompted farmers to diversify. However, once a crop proves profitable, even if there was sufficient irrigation water, farmers persisted to plant the diversified crop.

A lower income obtained from other sources appeared to relate positively to a greater tendency for farmers to diversify during the dry season. A plausible reason for this is: the smaller one's income from other sources is, the greater is the need to maximize the returns from one's farm as well as to spread one's risks. This twin objectives can be best obtained by planting more than one crop during the dry season.

Results indicate that, the smaller the farm size and the fewer the parcels farmed, the greater

tendency was for farmers to plant the diversified crop only (and not rice also) during the dry season. This can be explained by the fact that rice cultivation is not profitable if the area planted is very small.

The datashowed that the farmers were willing to face more risks in crop diversification provided that the crop was perceived as profitable, especially if they have witnessed other farmers' successful experiences, and provided that there was no better alternative crop. Provision of technical assistance, credit for inputs, and marketing mechanisms also enticed farmers to diversify.

The persistence of crop diversification was related to a trend of positive net returns punctuated by occasional "jackpots". As the ability to tolerate a negative net return increased, the longer was the history of positive nets. Thus, long-run averages have influenced the persistence of crop diversification.

Hitting the jackpot was attributed to: (1) high yields due to proper cultural and management practices and (2) high prices. Results suggest that fanners perceived high returns due to their own efforts and not from the vagaries of price fluctuations. Results also indicate a strong sense of personal control which was opposite to the usual notion of fatalism which was often ascribed to farmers. Indeed, hardly anyone in the various samples attributed the hitting of the "jackpot" to luck.

On the other hand, farmers attributed their losses to two major causes: (1) poor yield or crop destruction due to lack of water, typhoons or bad weather, and outbreak of pest and diseases and (2) low market prices.

Results of the Decision Model

The model on cropping decision making found empirical support in the various cases except for the mungbean case which was not really a free choice situation for the farmers given that NIA had programmed the area for mungbean production. This suggests that the model was more applicable to free choice situations where farmers have a number of alternative crops to choose from.

Results from the model on cropping decision making yielded important points to consider on crop diversification. These considerations can be used by change agents as a guide to determine whether or not fanners are ready for crop diversification. Table 1 shows a sample of the model's results which are presented in brief as follows:

1. Farmers are willing to diversify during the dry season if their family's rice consumption requirements for the year are met by their wet season rice crop and other sources of income as this gives the farmer greater leeway to face greater risks during the dry season. This points to paying more attention to the wet season rice crop in efforts at encouraging crop diversification during the dry season.
2. The crop must be perceived as technically feasible by the farmer. In particular, the farmer must perceive it as suitable to the soil and topography of his farm and he must perceive the timing of the cropping season as *right,* i.e., it suits *his* wet season schedule and at the same time has a good chance of hitting the high market price at harvest time. The irrigation water available must also be perceived as being sufficient to support the crop. Nonetheless, the fact that many farmers complained of inadequate water suggests that many farmers planted the diversified crop even if he was not absolutely certain that there would be enough water.
3. The crop must be perceived as economically feasible by the farmer. Sources of credit, if needed, must be readily available. There must also be an assured market for the produce. In this regard, the contract growing scheme is considered a good means of assuring the farmer of the crop's economic feasibility. However, as in tomato and cotton, certain points must be considered for the scheme to succeed. First, a fair market price must be paid for the produce (as in the case of the cotton farmers) because if the price is too low (as in the case of the contract grown tomatoes), the only way for the farmers to realize a profit is to have very high yields which is not very realistic given the conditions under which most farmers operate. Many of the tomato fanners were quite unhappy when their produce was sold at ₱0.80/kg to PFVII when the market price for native tomatoes ranged from 910 to ₱14/kg. *Second,* the yield estimates given to the fanners must be realistic. The 40 t/ha

Table 1. Crop decision making: mungbean versus alternative crop tomato.

	Munghean		Tomato	
Stage 1. Assuring rice consumption requirements				
• Rice consumption requirement met? Yes = 21 No = 19				
• Non-rice crop allows meeting rice consumption requirement? Yes = 8 No = 11				
Stage 2. Testing for feasibility	N	%	N	%
Technical constraints:				
Soil, topography	40	100.0	24	60.0
Water	40	100.0	40	100.0
Timing	40	100.0	38	95.0
Knowledge	40	100.0	39	97.5
Economic feasibility:				
Demand	40	100.0	40	100.0
Time, labor	40	100.0	39	91.5
Capital, credit	40	100.0	40	100.0
Stage 3. Benefit-cost analysis				
• Perceived profitability of crop meets farmer's minimum profitability requirements?				
Yes	21	52.5	9	22.5
NO	19	47.5	31	77.5
Summary				
I. Total number of farmers who passed all conditions of the decision tree:	16	40.0	6	15.0
a. number who planted the crop	16	40.0	6	15.0
h. number who did not plant the crop	0	0.0	5	12.5
2. Total number of farmers who did not pass one or more conditions of the decision tree:	21	52.5	34	85.0
a. number who planted the crop	21	52.5	2	5.0
b. number who did not plant the crop	16	0.0	32	80.0
3. Total number of farmers whose behavior is				
a. consistent with the predictions of the model		40.0	33	82.5
b. inconsistent with the predictions of the model	21	52.5	7	17.5
c. cannot be determined	3	7.5		

potential yield of the California variety tomato given to the farmers by PFVII created false expectations. Had the farmers been given more realistic estimates, they would probably have been more prudent in their input expenditures. Third, the farmers must be given sound advice by the technicians regarding the use of inputs (especially pesticides) and must be aided to be made more aware of their input expenditures during the course of the cropping season.

4. The availability of hired labor was not a crucial economic variable because family labor was used. The heavy use of family rather than hired labor was critical to the overall economic viability of diversified cropping in general, (except in the case of mungbean), as diversified crops are more labor-intensive than rice. This implies that crop diversification is more viable for small farm areas which the family can work on because there is a need to get more hired labor with larger areas which will adversely affect the net cash returns. There is also a positive aspect to the high utilization of unpaid family labor in the growing of diversified crops. Planting diversified crops utilizes excess family labor who would otherwise be unemployed or underemployed during the dry season. Increasing

the practice of exchange labor for labor intensive activities like land preparation and transplanting can greatly reduce the laborcashcost (asinthecaseofthetobacco farmers). In this regard, change agents advocating for crop diversification should direct some attention to helping farmers in adjacent areas organize for exchange labor during these activities. The water-users' association can he agood vehicle fordoing this.

5. Benefit-cost analyses indicated that farmers tend to have high minimum profitability requirements for the diversified crop compared with rice, *so* as to offset high risks involved. This implies that for a farmer to agree to plant a diversified crop during the dry season, he must be sufficiently convinced that it will yield high returns and not just marginally higher returns than rice. Results of the interview showed that farmers were willing to plant crops that require more time, input and labor than rice provided a high profitability is perceived. Farmers were also willing to plant diversified crops that was categorized under the minimum profitability which they would like to realize, if they did not have much choice (e.g., not enough water for planting rice and no other alternativecrops feasible under the circumstances, as in the case of the mungbean farmers) or if the other choices were no better than the crop under consideration, provided profit will he realized from the venture.

Lack of water for the diversified crop was a problem for some farmers during the dry season. Farmers used irrigation water during land preparation, transplanting and fertilizer application and they irrigated theirdiversified crop at certainstages of crop growth (e.g., flowering stage, fruiting stage) and/or at regular intervals (e.g., every 14 days). Other indicators for determining that a crop needs water were: wilting and/or curling of leaves and the dryness/cracking of the soil.

Generally, the water-users' associations had little to do with crop diversification beyond irrigation related matters such as repair and maintenance of canals, irrigation schedule, arbitrating in water-related disputes among farmers, and bringing to the attention of the watermasters or **NIA** the irrigation-related problems of the farmers. In this regard, water-users' associations are potentially good organizational resources to tap in crop diversification programs. In particular, the association could be tapped as a support system for farmers engaging in crop diversification as results show that the influence of other farmers is important in the decision to plant diversified crops. The associations could also be tapped in the marketing of the diversified crop and they could also be used **as** an informal (or even formal) credit mechanism for the farmers.

The need for a good credit mechanism in the promotion of crop diversification must be emphasized as shown in the higher cash costs for the majority of the diversified crops compared to rice. Since most farmers did not have adequate capital to meet the cash needs, a good credit mechanism will encourage farmers to plant diversified crops.

The costs and returns data for all of the cases except the Ilocos region reveal an alarming level in the use of pesticides by farmers. The unnecessary use of pesticides is a function of farmers' averting risk. Farmers were willing to pay the high costs of pesticides as a mitigating measure to crop loss. There is a need to educate farmers on proper pest management practices.

Although farmers expectations of the crop tended not to be too far off the crop's actual performance, nevertheless, farmers usually overestimated gross returns, underestimated cash expenditures, and overestimated net returns above cash costs. From the psychological point of view, this is an *optimism **mechanism*** that helps farmers cope with adverse circumstances that they have to operate in. If farmers are pessimistic, they might as well not try.

One important finding, with respect to the marketing of the produce, was the relatively large volume of sales during harvest time and a few weeks after. The volume of the sales at a time when market prices were low underscored the need for cash during harvest time such that farmers sold large quantities of their produce at less than the potential price which they could obtain at a later date. This was one reason why the diversified crop was not as profitable for the farmer **as** expected. Projects and programs aimed at promoting crop diversification should then direct some of their efforts at establishing viable market mechanisms (e.g., marketing cooperatives) and storage facilities that will help farmers obtain better returns for their produce. The water-users' associations could also be used as an organizational vehicle for this.

Summary

Results of the case studies indicate that the following conditions were conducive to the adoption of crop diversification during the dry season:

- insufficient irrigation water for rice during the dry season
- low levels of income from other sources
- successful and profitable experience of other farmers
- farmers in nearby fields planted the crop
- lack of a better alternative under the prevailing circumstances
- the wet season rice crop and other sources of income were able to provide for the family's rice consumption requirement for the year
- the crop was perceived **as** technically feasible (i.e., it **was** suitable to the soil and topography of the farm, cropping season was on time and sufficient irrigation water was available)
- availability of seeds
- the crop was perceived as economically feasible (i.e., readily available market, credit and labor were available)
- the farmer believed that the crop will yield higher returns and not just marginally higher than rice
- an assured selling price (as in a contract growing scheme) or the market price of the crop does not fluctuate too much (i.e., it is not a price ***risky*** crop)
- presence of support structures technical assistance, credit mechanism and a viable marketing system.

Results **also** indicate that the following conditions were conducive to the success and persistence of crop diversification during the dry season:

- the persistence of crop diversification was strongly related to a trend **of** positive net returns punctuated **by** occasional ***jackpots***
- high yields due to proper cultural management practices
- high prices
- **a** fair market price is paid for the produce **as** in contract growing schemes
- the potential yield estimates given to the fanners were realistic
- less **use** of pesticides; better pest management techniques
- greater awareness among farmers of their input expenditures during the cropping season
- available family labor best suited for **small** farms
- increased practice of exchange labor for labor-intensive activities like land preparation and transplanting
- planting the same diversified crop within the same locality.
- sufficient irrigation water
- good credit mechanism due to higher cash costs of diversified crops as compared with rice
- a viable marketing mechanism that will help farmers obtain better returns for their produce