Socioeconomic Issues in Irrigation Management for Rice-Based Fanning Systems in the Philippines

Policarpio B. Masicat
Research Assistant, Social Sciences Division
International Rice Research Institute, Los Baños, Laguna, Philippines

Salvador Salandanan
Systems Management Department, National Irrigation Administration
EDSA, Diliman, Quezon City, Philippines

Carlos Pascual
Associate Professor and Chairman, Department of Agricultural Engineering
College of Agriculture and Forestry, Mariano Marcos State University
Batac, Ilocos Norte, Philippines

INTRODUCTION

DESPITE DECLINING PROFITABILITY of rice production, diversification into nonrice crops has not occurred rapidly in the Philippines. Systems where successful dry-season diversification has been observed are ones in which nonrice crops had been grown historically, and are not recent innovations. Where diversification is being promoted recently, the experience has not been satisfactory due to both soil-physical and socioeconomic constraints faced by the farmers.

This paper provides a synthesis of the Philippine studies examining these constraints to diversification out of irrigated rice production. It addresses three basic issues in imgated crop diversification: (1) physical and socioeconomic constraints to diversification out of rice; (2) the relative profitability of nonrice crop production; and (3) social issues in managing irrigation systems with crop diversification during the dry season.

CONSTRAINTS TO CROP DIVERSIFICATION

In the Philippines, it is argued that imgation systems were designed solely for rice production and are, hence, not suitable for nonrice crop production (Schuh et al. 1987; Levine et al. 1988; Rosegrant et al. 1987). For most of the Philippine systems studied, this argument does not seem to hold for the middle and lower sections of the irrigation systems. Although dry season diversification is becoming common, some systems such as UTRIS, LVRIS and TASMORIS have been practicing diversifying for a long time.

Tables 1 to 3 enumerate factors influencing farmers' crop choice. Family consumption or meeting the family's rice requirement is one factor which ranked first and second in two locations or irrigation systems studied. When wet-season rice crop is not enough to meet the family's rice requirement, then most likely fanners will plant a dry-season rice crop. Other factors include availability of irrigation water, availability of inputs, previous dry-season nonrice crop experience and market demand of the produce, among others. These factors are important in the decision making of farmers on what crops to be planted in the dry season.

Table 1. ***Factors* considered *by farmers under BARIS in determining* what crop *to plant, 1986/87 and 1987/88 dry* seasons.**

Factors	Rank					
	Irrigated rice		Irrigated corn		Rain-fed corn	
	1986/87	1987/88	1986/87	1987/88	1986/87	1987/88
For family home consumption	1	1		2		
Availability of water	2	2	1	1		3
Marketability of the produce	3		3		2	
Familiarity of the farmers in growing the crop			2		1	1
High returns perceived					3	
Suitability of crop		3				2
Ease of management				3		

Table 2. Factors influencing fhe choice and area planted, UTRZS, 1968/87 and 1987/88 d y seasons

	1986/87				1987/88			
	Onion (n=50) averag rank (a	% (b)	Rice (n=10) averag rank (a	%	Onion n=80) verage ank (a)	%	Rice n=28) verag	%
Choice of crop								
Perceived to provide highest returns	1.32	88	220	100	1.93	85	1.75	43
Previous experience	2.66	88						
Technology known to farmers	2.70	86					2.40	54
Ready market			2.71	70	2.93	88		
To meet rice requirement			2.89	90			1.84	89
Availability of water					2.88	64		
Area planted								
Availability of planting materials and other inputs	1.31	52	1.67	90				
Size of market	2.12	50	2.20	100	2.11	100	2.w	82
Previous experience	2.49	98			2.56	80	2.75	71
Availability of water			250	100	2.66	98	1.72	89

(a) Most important = 1, less important = higher value of rank
(b) Proportion of respondents reporting.

Source: Marzan (In Valera 1989).

Table 3. Factors considered by farmers under ARIP in determining what crop to plant, 1986/1987 and 1987/1988 dry season.

Factors	Rank				
	1986/198	1987/88			
	Irrigated rice	Irrigated rice	Irrigated corn	Rain-fed corn converte	Rain-fed corn
Availability of water	1	1	1	1	1
For **family home consumption**	2	2			
High returns perceived	3	3			
Less production expenses				2	
Shorter cropping seasons				3	
Availability of seeds and other inputs			3		3
Climatic condition			3		2

Soil-physical constraints. Cropping pattern is influenced by soil type, water availability or by the nature of the available water, i.e., whether the area is irrigated or rain-fed (Tables 4 and 5). There is a distinct soil type bias in cropping pattern, i.e., rice is grown in heavier clay soils, while nonrice crops are generally grown on sandy loam soils (Pingali et al. 1988).

Table 4. Characteristics of the samples being studied.

Characteristics	Lateral A	Lateral B	MCs
Number of farmers	7	11	12
Number of parcels	8	15	22
Distance from irrigation canal			
- near	4	6	8
- far	3	5	4
Cropping pattern			
- rice-rice	6		2
- rice-onion	1	8	5
- rice-onion+vegetable		3	2
- rice-rice+onion			3
Soil type			
- galas		11	6
- lagkit	6		4
- mestizo lagkit	1		2
Dry **season water stress**			
- yes	7	10	8
- no		1	4

Source: Pingali et al. (In Valera 1989).

Table **5.** *Clopping* ***patterns of farmas*** **under** ***ARIP*** *I,* **1995 *to* 1988.**

Type of farm	'85/86						1987188		
	Wet	Dry	%	Wet	Dry	%	Wet	Dry	%
Irrigated rice	ir	ir	58	ir	ir	93	ir	ir	99
	rr	rr	11	rr	rr	5	r/rc	ir	1
	rc	rr	6	rc/ir	rc/rc	2			
	rc	rc	12						
	rc	ir	4						
Rain-fed corn	others		3						
(converted)	rc	rc	62	ir	RC	28	ir	rc	15
	ic	rc	10	ir	ir		ir	rc	75
	ir	ir	15	rc	rc	8	irc	rc	5
	rc	f	5	irc	f	5	ir	irc	5
	irc	irc	2	others		19			
	ir	rrc	2						
	ıthers		4						
Seepage corn	sc	sc	8	sc	sc	13	ir	sc	100
	ir	ir	38	ir	ir	44			
	rc	rc	46	ir	rc	12			
	fallow		8	rc	rc	31			
Rain-fed corn	rc	rc	81	ir/rc	ir/rc	13	r/rc	ir/rc	19
	ir	ir	6	rc	rc	65	rc	rc	55
	rc/rc	.r/rc	6	ir	ir	6	thers		26
	others		6	others					

Legend: ir - irrigated rice. ire - irrigated rice+corn. rr - rain-fed rice. rrc - rain-fed rice+corn. rc - rain-fed corn. sc - seepage corn.

Source: Bacayag (In Valera 1989).

The distance of the rice field to the water source and the relative position of the rice field to other rice fields also somehow influence the choice of crop to be planted. At the main canal turnouts of UTRIS where farmers have to grow onion and rice side by side, onion is planted at the higher fields. In Lateral A which is lower than any other section of the system, rice is grown throughout the year. In Lateral B, the middle section, onion is the main crop grown during the dry season. In general, land utilization in the dry season is less than in the wet season, and the TASMORIS 1987/88 dry-season land utilization is higher due to the government's massive corn production campaign (Table 6). On the other hand, LVRIS showed a decreasing land utilization by crop and by position/distance of the rice field to the source of water (Table 7).

Cropping Pattern	1986/87		1987/88	
	Wet season	Dry season	Wet season	Dry season
Rice - Rice	98	72	98	99
Rice - Nonrice	100	58	100	90
Rice - Rice + Nonrice	91	58	92	76

Table 7. *Average cropland* **utilization by** *crop and cropping* **pattern,** *LVRIS, dry season 1988-1989.*

Items	Head	Middle	Tail
	(in hectares per farm)		
Available cropland	.94	1.45	1.26
Effective cropd area			
rice crop1	.54a (57.55)	.90b (62.00)	.49ac (38.80)
garlic-mungol	.30a (32.00)	.26ab (17.59)	.47c (37.63)
garlic-crop1	.16a (17.22)	.12a (8.28)	.18a (14.60)
mungo-crop1	.14a (14.78)	.14ab (9.31)	.29c (23.02)

[a] **Proportion of the available cropland utilized for individual crop namely: rice, garlic and mungo and** the **rice-fallow and garlic-mungo patterns.**
Numbers in parentheses are percentages of effective crop area.

[1] **ANOV procedure to test the joint hypothesis of differences in means among** the three types of farms **was significant.**

Means by type **of farms followed by the same letters are** not **significantly different**

Source: Esteban, Z.H. 1990.

Credit. Generally, farmers do not have the needed capital for crop production especially for nonrice crops l i e hybrid corn, garlic and onion. These crops need almost three times more capital than rice. Whenever farmers do not have savings from wet-season rice crops and need a sizeable amount for producing nonrice crops, then a credit scheme is necessary. Most farmers have outstanding balances from previous government loan programs like `Masagana 99,' 'KKK,' and `Maisagana 100,' etc. Of course, banks charge lower interest rates from borrowers on these programs, but because of unpaid loans and collateral requirements fanners prefer nonformal sources of credit like traders, millers, relatives and friends. But high interest charge is often the common problem with these nonfonnal credit sources (Bacayag 1989). In the case of onion fanners at UTRIS, lenders who are usually traders do not charge interest but they have the exclusive right to purchase all output at market price during harvest. Trader-lenders benefit substantially from the significant price increase between harvest and postharvest months. The price increase more than offsets the foregone interest charges and storage cost (Pingali et al. 1988). Also in UTRIS, fanners' loan for onion production was four times as much for rice production in the 1988 dry season (Table 8). In the 1989 and 1990 dry seasons, fanners' loan for onion production was twice as much as the loan for rice production (Tables 9 and 10). Usually fanners take a loan in kind such as seeds, fertilizers and pesticides from the dealer who is also often a trader or a miller. The situation is also true in MCIS, BARIS, and ARIP (Bacayag 1989) and in other areas where crop diversification is practiced, and even in rice-rice cropping pattern areas.

Table 8. Amount of loan by crop and by source, UTRIS dry season, 1988.

Source of loan	Pesos/ha	Interest (%)
Traders/private lenders		
Palay	2,125 (3)	108
Onion	9,663 (8)	84
Banks		
Palay/onion	1,146 (1)	12
Traders/relatives	3,791 (6)	0

Table 9. Amount *of loan* by *crop and* by *source, UTRIS, dry season, 1989*

Sources	Crops					
	Pa/		Onion		Palay/Onion	
	Amount	Interest	Amount	Interest	Amount	Interest
	Pesos/ha		(Pesos/ha		Pesos/ha)	
Traders/private						
lender	1,922 (2)	97.5	2,869 (2)	45	3,333 (1)	120
Friends/relatives	3,333 (1)			90	2,222 (1)	120
			4,142 (2)	0	20,000(1)	0
Cooperatives			1,550 (2)	20	2,308 (1)	20

() no. responding

Table 10. Amount of lam by crop and bu source, 1990 UTRIS dry season

Source of loan		
Millers/traders		
Cooperatives		
Millers/traders	7,006 (2)	105
Cooperatives	3.085 (5)	20
Friends/	4,416 (5)	63
Relatives	8,000 (1)	0
	Palay/onion/vegetables	
Cooperatives		
Friends/relatives		

in LVRIS, labor use by location/distance to water source has been found to be significantly different. Farmers at the head of the system or lateral use more labor than those at the tail-end section (Table 11). Material input use in the head is also higher than the material input use in the lower section of the system (Table 12).

Onion production in UTRIS is, therefore, highly labor-intensive and, compared to rice it uses four times as much labor (Table 13 and 14). Increasing efficiency of labor use is one important development in the area. For one, the yield-labor ratio for onion has increased from 28 in the 1988 dry season to 33 in the 1990 dry season, and from 49 in the 1988 dry season to 105 in the 1990 dry season for palay. Farmers at the UTRIS area have, hence, been increasing their efficiency of labor use for both crops.

Table 11. Labor use by cropping pattern and by location, LVRIS, dry season, 1988-1989.

Crop/cropping pattern	Head	Middle	Tail
	(inman-day	ıan-animal day per hectare)	
Rice			
Total labor	181a	120b	126ab
Land preparation	28a	19ab	16b
Planting/transplanting	74a	46ab	36b
Irrigation	3a	2ab	8c
Care of the crop	20a	14a	21a
	55a	39a	45a
By source			
Family labor	10%	68b	77ab
Hired labor	77a	52a	49a
By type			
Man-days	155a	102b	IIIab
Garlic-mungo			
Total labor	486a	499a	343b
By activity			
Land preparation	100a	84a	5%
Planting	102a	102a	78b
Irrigation	15ab	16a	10b
Care of the crop	94a	114a	66b
Harvesting/postharvestin	175a	182a	132b
By source			
Family labor	388a	409a	25%
Hired labor	98a	90a	86a
By type			
Mandays	%la	480a	319b
Man-animal days	25a	19a	24a
Garlic			
Total labor	371a	418a	275b

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Crop/cropping pattern		Head	Middle	Tail
		in man-day,	an-animal d	per hectare:
By activity				
	Land preparation	79a	71a	42b
	Planting	101a	97a	74b
	Irrigation	12a	13a	9a
	Care of the crop	79a	103a	56b
	Harvesting/post harvesting	100a	134b	94ac
By source				
	Family labor	287a	338a	199b
	Hired labor	84a	80a	76a
By type				
	Man-days	365a	413a	265b
	Man-animal days	6ab	5b	10a
Mungo				
Total labor		115a	81b	68bc
By activity				
	Land preparation	21a	13b	14bc
	Planting	l a	5b	4b
	Irrigation	3ab	4a	2b
	Care of the crop	14a	10a	10a
	Harvesting/postharvestir	76a	49b	38bc
By source				
	Family labor	101a	71b	58bc
	Hired labor	14a	10a	10a
By type				
	Man-days	96a	68b	54bc
	Man-animal days	19a	13b	14ab

• **ANOV procedure to test the joint** hypothesis **of differences** in **means among the three types of farms was significant.**

Means by type of farms followed by the same letters are not significantly different.

Source: Esteban, Z.H. 1990.

Table 12. Material *use by crop/cropping pattern and* by *location, LVRIS, dry* season 1988-1989 [a].

Crops/cropping pattern	Head	Middle	Tail
		pesos/h	
Rice			
Total material use	2,346a	1,632b	1,869ab
Seed	303a	280a	311a
Fertilizer	1,801a	1,219b	1,455ab
Chemical	242a	133b	103bc
Garlic-mungo			
Total material use	26,496a	26,909ab	37,960c
Seed	24,119a	24,240ab	34,159c
Fertilizer	1,447a	1,516ab	2,521c
Chemical	929a	1,153a	1,280a
Garlic			
Total material use	25,296a	25,493ab	36,398c
Seed	23,307a	23,325ab	33,077c
Fertilizer	1,447a	1,516ab	2,521c
Chemical	542a	652a	800a
Mungo			
Total material use	1,200a	1,416a	1,562a
Seed	813a	915a	1,082a
Chemical	387a	501a	480a

[a] ANOV procedure to test the joint hypothesis of differences in means among the three types of farms was significant.

Means by type of farms followed by the same letters are not significantly different

Source: Esteban, Z.H 1990.

Table 13. Labor inputs/ha, onion, *UTRIS, dry season.*

Activities	m-days (total cost)		
	1988	1989	1990
Land preparation			
Plowing and harrowing			
Machine	0.92	0.64	053
	(550.00)	(300.00)	(426.192)
Animal	6.04	6.63	3.945
	(302.00)	(236.37)	(68.023)
Harrowing			
Machine	1.12	0.68	0377
	(515.00)	(236.37)	(68.023)
Animal	6.56	7.58	4.78
	(338.00)	(379.00)	270.353)
Seedbed preparation/seeding	1029	22.30	161316
	(205.80)	(55750)	(354.875)
Pulling seedlings	30.00	1823	14.767
	(600.00)	(410.15)	(354.875)
Tran	80.00	78M	63.43
	(1600.00)	(1768.50)	(1753372)
Mulching	16.00	12.73	5.93
	(320.00)	(31825)	(215.606)
Application of fertilizer	4.33	2.51	2.078
	(86.00)	(50.20)	(66.252)
Application of insecticide	5.10	3.49	3.437
	(102.00)	(87.25)	(130.625)
Weed control			
Hand weeding	61.58	51.18	25.698
	(1231.60)	(115155)	(699.696)
Chemical weeding	126	0.99	1.686
	(25.20)	(19.80)	(50.581)
Irrigation Management	1128	12.90	52
	(225.00)	(322.50)	(156.00)
Harvesting, bunding, drying	88.50	83.60	58.842
	(1170.00)	1881.00)	1740.998)
Total	323.18	302.06	206.724
	(7270.60)	(839192)	(6609.949)

Table 14. Labor inputs/ha, palay, UTRIS, dry season

Activities	ME lays (total st)		
	1988	1989	1990
Land preparation			
Plowing and harrowing			
Machine	5.14	5.57	5.325
	(1028.00)	(1110.00)	(663.844)
Animal	8.25	15.5	1.942
	(41250))	(797.75)	(126.25)
Seedbed preparation	1.59	1.10	1.073
	(39.75)	(65.55)	(32.19)
Pulling seedlings	0.44	1.04	3.215
	(105.00)	(159.78)	(116.18)
Transplanting/direct seeding	17.64	7.83	6.647
	(352.80)	(195.75)	192.22
Application of fertilizer	1.63	1.44	1.849
	(32.60)	(36.00)	(59.19)
Application of insecticide	2.24	0.60	1.03
	(44.80)	(15.00)	(41.192)
Weed control			
manual	398		
chemical	0.74	(0.54)	0335'
	(13.50)	(10.05)	
Irrigation Management	12.22	6.334	nil**
	(78.86)		
Harvesting	21.01	28.74	18.662
	(420.00)	(1275.41)	(1111.505)
Threshing			
manual			
thresher	21.00	3.66	3.701
	(819.00)	(1483.85)	(779.59)
Hauling	3.47	2.08	0.502
	(150.00)	(157.36)	(133.875)
Total	80.35	74.44	44.281
	(3743.25)	(4388.71)	3266.086)

* Contract: paid 7 cents/bundle in 1988; paid 8 cents/bundle in 1989/90

** Direct seeding increase, yes but pays application of fertilizer and chemicals by contract labor, so job is done faster, usually less than 8 hours of the whole day for Pesos 30.00/day.

Table 15. Summary of *mean* returns *above variable cost (pesos/ha)* of irrigated and rain-fed crops

	Rice		Mungbean		Hybrid		Native		Garlic		Onion	
	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
Irrigated crops												
LVRIS	6890	5807	5493	3865			-	-	8123	400[illegible]	-	-
BP#2	5630	5656	3404	6185			-	-	9060	724[illegible]	-	-
TASMORIS	4374	4930	4 2	-404	4371	7572	-	-	-	-	-	-
UTRIS	8185	6463					-	-	-	-	1676[illegible]	41082
ARIP	6021	7120				3288	-	2488	-	-	-	-
BARIS	5657	6240			3282	5309	3152	-	-	-	-	-
Rain-fed crops (within or near the systems												
						-	-					
						-	-					
TASMORIS					1407	-	-					
UTRIS						-	-					
ARIP						1993	-	2187				
BARIS					1815	3332	2041	3142	-			

Source: Adriano (In Valera 1989)

PROFITABILITY

Another issue which farmers have to face in order to diversify is the profitability of the crop to grow. It has been known that if water is sufficient to support a rice crop, then low resource farmers will certainly plant rice. But in areas where water is limited during the dry season, it is a choice between planting nonrice crops or fallowing. Again, if credit is available, farmers will plant nonrice crops. But due to high input and labor costs, especially for garlic and onion, farmers may plant only a small portion of the field and rent out the other portion. In extreme cases where seasonal farmers are not available, that portion remains unplanted.

Garlic and onion are the most profitable crops planted by farmers. In LVRIS and BP#2 the net returns to garlic is twice as much as the net returns to rice in the dry season (Table 15). Onion farmers in UTRIS had a net income per average harvested area that was three times as high as that of rice farmers in the 1988 dry season, although most farmers planted both crops. In the 1989 and 1990 dry season, rice had a higher net income per average area harvested (Table 16 and 17). As perceived by farmers, this is due to a decline in the yield and price of onion brought about by a hailstorm in the middle of March 1989 and by a virus infestation in 1990. These affected the quality of onion produced and hence lowered its price.

Irrigated corn in TASMORIS had a higher gross return than rice in the 1988 dry season (Table 18). In all the other systems being studied in the 1987 and 1988 dry seasons, other crops except garlic and onion had lower net returns compared to rice (Table 15). In LVRIS, the upstream farmers had relatively higher yield than the downstream farmers (Table 19). With regard to farm income per hectare, rice farmers in the head got significantly higher income per hectare than rice farmers in the tail section of the system. Garlic and mungo farmers have the same farm income per hectare irrespective of location/distance of the rice field to the water source (Table 20).

Table 16. ***Relative costs and*** return to *onion* production: ***UTRIS, dry seasons, 1988, 1989,1990.***

Inputs	Year		
	1988	1989	1990
	Pesos/ha		
seeds*	6087.04	524839	2561.89
Fertilizer	2470.71	2901.36	2984.77
Insecticide	715.33	532.45	563.48
Herbicide	262.08	392.61	348.84
Rice straw	141.67	800.00	680.23
Labor cost	7629.80	791257	6609.23
Irrigation fees	367.20	39720	464.68
Land rent	4960.10	5055.22	1728.48
Total	22633.93	23239.80	1594232
Average yield (kg/ha)	9063.00	6796.05	6918.67
Gross income (Pesos/ha)	71751.00	43226.39	26041.89
Net income (Pesos/ha)	49117.07	1998659	10099.57
Average area harvested	0.49	0.65	0.66
Net income per average harvested area [Pesos)	24067.36	12991.28	6665.72

* By 1990, *very* few got loans in terms of seeds; they get loans m cash and pay for the seeds. What they get in kind are fertilizer and chemicals, especially those who are members of cooperatives.

Table 17. Relative costs and returns to palay production: dry season 1988, 1989 and 1990

Inputs	1988	1989	1990
	Pesos/ha		
Seeds	644.20	936.87	718.79
Fertilizer	1149.53	1130.79	1090.10
Insecticide	351.96	135.62	262.26
Herbicide	80.57	45.76	61.96
Rice straw			
Labor cost	3743.00	5388.81	3266.086
Irrigation fees	612.00	584.67	590.25
Land rent	1707.83	3347.02	1248.01
Total	8289.09	11569.54	7237.456
Average yield (kg/ha)	3967.00	5052.50	4627.73
Gross income (Pesos/ha)	13863.00	21870.41	23754.13
Net income (Pesos/ha)	5573.91	10300.87	16516.674
Average area harvested	1.43	1A6	1.36
Net income per average harvested area (Pesos)	7970.69	15039.27	22462.68

Table 18. Total yield, average price and gross returns of farms *in TASMORIS, 1986/87 and 1987/88 dry* seasons.

	1986/87			1987/88		
	Total yield (kg/ha)	Price Pesos/kg)	Gross returns (Pesos/ha)	Total yield (kg/ha)	Price (Pesos/kg)	Gross returns (Pesos/ha)
Irrigated rice	3165	2.84	9131	2814	3.15	8856
Irrigated corn	2361	3.63	8557	3475	3.43	11876
Semi-irrigated mungbean	126	9.13	1241	100	10.00	998
Rain-fed mungbean	207	9.50	1972	124	9.83	1241
Rain-fed corn	1096	4.15	4308	-	-	-

Source: Bacayag (In Valera 1989).

Table 19. Average yield by crop and by location, LVRIS. dry season, 1988-89.

Crop	Head (kg/ha)	Middle (kg/ha	Tail (kg/ha)
Rice			
Total production	4,013.33	2,848.50	2388.35
Garlic			
Total production	1,687.82	2,063.27	1,981.04
Mungo			
Total production	518.25	419.23	396.66

1 ANOV procedure m test the joint hypothesis of differences in means among the three types of farms was significant.

Source: Esteban, Z.H. 1990.

Table 20. Farm income by crop/cropping pattern and by location, LVRIS, dry season, 1988-1989.

Crop/	Head		Middle		Tail	
	Perfarm	Perha	Per farm	Per ha	Per farm	Perha
	(in pesos)					
Rice						
Net cash farm income	1,555.83a	2,851.95a	686.12ab	321.47ab	-351.54b	-900.1%
Net noncash farm income	1,699.47a	1,209.44a	3,311.30b	4,505.52a	1,237.31ac	1,936.77a
Return above variable cost	3,255.30ab	4,061.39a	3,997.42a	4,726.99a	855.7%	1,036.59b
Garlic-mungo						
Net cash farm income	9,519.88ab	52,852.25a	7,149.36b	52,930.24a	12,619.50a	63,200.47a
Net noncash farm income	3,589.19a	24,415.91a	4,995.17a	44,700.68b	4,191.43a	23,476.87ac
Return above variable cost	13,108.27a	77,268.16a	12,144.52a	97,631.02a	16,810.94a	86,677.34a
Garlic						
Net cash farm income	9,244.73ab	51,542.46a	7,011.00b	52,483.80a	12,233.33a	62,480.48a
Net noncash farm income	3,674.23a	25,266.96a	4,884.26a	44,395.27b	4,373.54a	24,451.97bc
Return above variable cost	12,918.96a	76,809.41a	11,895.26a	96,879.07a	16,606.87a	86,932.45a
Mungo						
Net cash farm income	274.35ab	1,309.79a	138.77b	446.54a	386.18a	719.99a
Net noncash farm income	-85.04a	-851.05a	110.90b	305.41b	-182.11ac	-975.11ac
Return above variable cost	189.31a	458.75a	249.26a	751.96a	204.07a	-255.11a

[1] ANOV procedure to test the joint hypothesis of differencesin means among the three types of farms was significant.

Means by type of farms followed by the Same letters are not significantly different.

Source; Esteban. Z.H. 1990.

Water **use *efficiency.*** It has been found that upstream farmers use more irrigations than downstream farmers without a significant yield advantage. Tables **21 to** 23 show farmer yields by distance from irrigation canals and frequency of irrigation. There is no significant yield difference between farmers with **5-7** irrigations and those with more than 7 irrigations. In this case the potential for water use efficiency is high. One measure to **increase** water **use** efficiency for the head or upstream farmers is to alter irrigation fee payment based on actual **use** instead of **using fixed** rates. Further down the lateral, farmers use supplementary irrigation from shallow well pumps. Pump **users** ought to be efficient in their water **use,** applying only a maximum of four irrigations (Tables **24** to 26), and still get a comparative yield with those having more irrigation coming from the canal.

Table 21. Dry-season onion: Frequency of irrigation and distance from irrigation canals, *UTRIS, 1988.*

Lateral	Distance from irrigation canal	1	2			6	7	8	9	10	11	12
B	Near	1	1									
	Far	3										
MCs	Near				1(10838)			1	1(8936)	1	1	
	Far		1	2				1(9853)	B			

( ) mean yield

Table **22.** *Dry-season onion:* ***Frequency*** *of irrigation and distance from irrigation canals, UTRIS, 1989,*

Lateral	Distance from irrigation canal	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	Near	1(5800)														
B	Near			1	2	1(8174)										
	Far	1	1	2	2	1(9903)										
MCs	Near		1		1	1(8649)		1		1	1	,	1	3	1	(7267
	Far		1		(7328)1	1					1	1	(5408)			

( ) mean yield.

Table 23. *Dry-season onion:* Frequency d irrigation and *distance from irrigation canals: UTRIS,*

Lateral	Distance from iDistance Canal	2	3	4	5	6	7	8	9	10	11	12	13	14	5	16
A	Canal Near			1(10095												
B	Near	1		1(10095												
	Far	1		2	1	!(13528)a										
MCs	Near					1(7905)b			1(7382)							
MCs	Near Far	1				1	1	1(4887)		2	1	2	2	1(7236		
	Far	1					1	1	8179)2	!(6270)			1(10095)			

( ) mean yield.
[a] one farmer with pump.
[b] with pumps.

Table 24. Frequency of supplemenfay irrigation using pumps, *UTRIS* 1988, *dry season*.

Proximity to irrigation canal	Lateral B					
	0	1	2	3	4	5
Near	4		2			
Far	1		1	1	2	

Table 25. Frequency of supplementary *irrigation* using pumps, *UTRIS* 1989 dry season.

Proximity to irrigation canal	Lateral B					
	0	1	2	3	4	5
Near	4	1	-	-	-	-
Far	1	1	3	1	-	-

Table 26. Frequency *of supplementary* irrigation using pumps, UTRIS 1990 *dry* season.

Proximity to irrigation canal	Lateral B					
	0	1	2	3	4	5
Near	3				1	
Far	3	1	1		1	

* Two farmers do not farm in B anymore (seasonal). Their farms in Lateral B are actually owned by P. Manzano, another cooperator.

SOCIAL ISSUES

Farmers' participation in planning and scheduling of water distribution is a key factor in a successful irrigation system management. The National Irrigation Administration (NIA) recognizes this, so that whenever possible they organize "Irrigators' Associations" in almost all national and communal systems in the country. Tables 27 and 28 provide a listing of Irrigators' Associations organized in UTRIS and LVRIS. They also show the year each was organized, number of members and area served. Cablayan et al. (1989) found that Irrigators' Associations have been helpful not only in smooth and satisfactory water distribution but also in collecting irrigation fees. The 1990-2000 NIA corporate plan showed a current account collection of 39.72 percent and a 50.87 percent total collection (Table 29). In UTRIS, payment of irrigation fee is from 40 percent to 50 percent with more farmers further from the canal paying the fees (Table 30). Wickham (1973) showed the same trend and the logical reason is to ensure timely and adequate water supply. Farmers near the canal or water source can get water even if they do not pay their irrigation fees, so fanners further from the canal in effect bear the burden of irrigation cost while at the same time receiving less benefit from the system (Pingali et al. 1988). Although it is difficult to achieve equity in water use, it seems that there is a chance to improve irrigation fee collection efficiency. If farmers near the canal can be made to pay irrigation fees, by altering or changing the irrigation fee payment structure, then the efficiency of water use at the upstream section could be increased. An Irrigators' Association may help in this activity, but in some cases, although a collective action is desirable sometimes it is not usually feasible. Organizing farmers further from the water source where there is not enough water during the dry season will prove futile. The best these farmers can do is to invest in shallow well pumps.

Table 27. Organized farmers irrigators' associations. Upper Talavera River Irrigation System, Upper Pampanga Integrated Irrigation Systems, Central Luzon, Philippines.

FIA Name	Canal/lateral	Members	Area (ha)	Year Organized
San Agustin IA**	SAE	546	776	1979
Cristamakita IA*	Main canal	604	691	1982
Catanaca IA*	Lateral B	218	212	1986
Tusita IA***	Main canal	241	339	1984
Camacalo IA***	Main canal and Lateral C	335	437	1984
Dalangirin IA***	Drainage reuse anc Lateral E	140	194	1984
Sto. Pag-Asa	Main canal and Lateral F-Extra	183	356	1990
Sitosan IA	Laterals F and F1	139	288	1990
CSSR IA	Laterals D, D1 and D2	228	336	1990
Dica IA***	Laterals D and D3	321	446	1984
Talipa IA	Laterlas D and D4	213	331	1990
Total		2,054	2,812	

* R[illegible]gi[illegible]d [illegible]ith Securities and Exchange Commission and have ISF collection contract.
** Registered with Securities and Exchange Commission and have both ISF and canal maintenance contract.
'R[illegible] i[illegible] and reactivated in 1990

Source: Cablayan, et al. 1990.

Name of IA	Location	Area covered (ha)	No. of farmer-members	Year organizesed / registered
Degulla-Bubuisan Sonson-Narpayat IA	Lateral A	82	160	1982
San Roque-Lubnac IA	Lateral B	64	112	1982
Labasa IA	MC downstream Laterals E, G, F and H	1967a	14472	1979
Total area under IAs		2113	14744	

* Distributed by division as follows: Division 1 - 248 ha; Division 2 - 685 ha; Division 3 - 381 ha: and Division 4 - 653 ha

Source: Cablayan, et al. 1990.

Table 29. Irrigation fee collection and collection efficiency, 1979-1989.

Year	Total Collection (M)	Back Account collection as% of back account collections	Current account collection as % of current account collectibles	Total collection as % of current account collectibles
1979	43.35	4.94	31.53	41.50
1980	59.24	4.99	38.29	53.25
1981	52.74	3.86	35.60	44.89
1982	58.43	3.97	44.26	55.94
1983	72.72	3.65	41.57	53.13
1984	98.95	4.75	42.95	55.76
1985	143.28	5.36	39.85	49.19
1986	179.90	4.44	40.28	50.79
1987	173.97	3.34	40.89	51.75
1988	181.79	2.48	39.14	48.65
1989	213.83	2.92	42.60	54.75
Average		4.05	39.72	50.87

Source: NIA, Corporate Plan, 1990-2000.

Table 30. Payment *of irrigation fees.*

			D				Wet	Wet		
	Paid			Not paid			Paid		Not paid	
Distance	88	89	90	88	89	90	18	89	88	89
Lateral A Near	1	0	0	2	2	3	0	1	2	1
	2	2	0	2	2	4	1	0	3	4
Lateral B Near	2	1	I	4	4	3	I	I	2	2
	3	1	2	2	5	1	3	1	5	3
Lateral B Near	3	0	I	5	1	9	2	2	8	8
	3	2	3	1	4	4	2	4	4	3
Total	14	6	7	16	21	24	0	9	24	21

SUMMARY AND CONCLUSIONS

A change in the cropping pattern of farmers under an irrigated environment is hindered by factors as soil physical constraints, credit support facilities, and labor availability should farmers expand areas for nonrice crops. These constraints vary to some degree from irrigation system to system in the country. Government intervention in policies and support services governing credit constraints in the countryside will definitely help farmers meet their financial requirements in planting nonrice crops. Farming equipment and tools designed for nonrice crops are a welcome development when labor becomes a critical constraint in expanded areas of crop diversification.

Profitability issues between rice and nonrice crops somehow hide the real issue of water scarcity during the dry season. Although it is important to know which crops are more profitable than rice in specific areas or systems, all other crops planted by farmers during the dry season are still profitable relative to a rice-fallow pattern. Therefore, it is imperative for fanners to plant during the dry season because sources of nonfarm income in these areas like cottage industries and other livelihood programs may not be able to accommodate all farmers.

Irrigators' Associations, as envisioned by NIA in solving water scheduling and distribution issues at the farm level, have for some years now contributed to a smooth and better management of irrigation water, as well as in irrigation fee collection. Sustaining an Irrigators' Association, hence, needs constant advice and follow-up in order not to fizzle out, so that reorganization will not be necessary. In some cases, organization of Irrigators' Associations is somehow not possible (like when there is practically no water to manage), which usually happens in the tail section of the system during the dry season. As such, while collective action is desirable, it is just not feasible.

Some 40 to 50 percent of the farmers pay irrigation fees, most of whom have farms further from the canal. They have to pay to ensure timely and adequate water supply for crop sustenance. In contrast, farmers near the canal can easily get water resulting in inefficiency of water use. Altering the irrigation fee payment structure to reflect the number of irrigations as the basis rather than the fixed rate, may increase the efficiency of water use in the upstream area of the system. In effect, more water will be available downstream, increasing the area irrigable during the dry season.

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