Comparative Economic Analysis of Diversified Crops Under Irrigated and Rainfed Conditions and their Irrigated Performance versus Irrigated Rice

Margarita P. Caluya and Charito G. Acosta [1]

Abstract

A comparison of the profitability of selected diversified crops under irrigated and rainfed conditions and their irrigated performance with that of irrigated rice under the Laoag Vintar River Irrigation System (LVRIS) and Bonga Pump No. 2 (BP#2) was done during the dry cropping seasons 1986-88.

Predominant cropping patterns identified were rice-garlic-mungbean and rice-rice-mungbean.

The study found that:

- Under LVRIS. material costs for irrigated garlic was higher than irrigated rice during the 1986/87 dry season. During the 1987/88 dry season, gross returns, total family labor, materialcosts, total variable costs, and returns above variable cost for irrigated garlic were higher than for irrigated rice. Under BP#2, results were almost similar during both cropping seasons.
- Under LVRIS and BP#2, no significant differences were observed between the economic parameters of irrigated rice and irrigated mungbean during the 1986/87 dry season. During the 1987/88 dry season, however, gross returns, labor and power costs, material costs, totalvariablecosts. and returns Io material costs were higher for irrigated rice than for irrigated munghean.
- Material costs and total variable costs were higher for irrigated garlic than irrigated rice under both systems during the 1986/87 dry season. During the 1987/88 cropping at LVRIS and BP#2, gross returns, total family labor, labor and power costs. material costs, total variable costs, and returns above variable costs was higher, while returns to material costs was lower for irrigated garlic than for irrigated mungbean.

A follow-up survey is recommended for more conclusive results.

Introduction/Significance

Ilocano farmers have been traditionally planting diversified crops in irrigated areas. However, the socio-economicviability of this practice is still vague. Thus, data on production (e.g. resource use, cropping systems, farm inputs and yield) and economic iactors (e.g. prices, marketing practices and systems, credit, etc.) must be gathered, analyzed and documented. Data gathered will serve as baseline information in determining farm profitability and will also serve as a tool in guiding farmers in decision-making for agricultural production. Government agencies can also refer to this study in formulating policies relevant to irrigation systems and management.

Objectives

The study aimed to compare the profitability of selected diversified crops under irrigated and rainfed conditions, and their performance with irrigated rice. Specifically, the study aimed to: (a) identify existing cropping patterns and compare their profitability; (b) identify the most efficient means of utilizing family labor; *(c)* determine the net returns to family labor and investment; and (d) identify the economic factors affecting crop diversification.

[1] Chairman. Department of Agricultural Economics and Assistant Professor, Department of Agricultural Engineering, College of Agriculture and Forestry, Mariano Marcos State University, Batac, Ilocs Norte.

Methodology

Two hundred seventy three farmers under the Laoag Vintar River Irrigation System (LVRIS) and Bonga Pump No. 2 (BP#2), 49 farmers with rainfed crops, and 14 wholesalers/retailers operating in the area were interviewed during the 1986/87 dry season.

Sample size was predetermined during the 1987/88 dry season survey. The questionnaire used was similar to the one used during the 1986/87 survey except for the section on traders which was disregarded in the later survey. The survey covered (a) 120 farmers practicing Rice-Garlic-Mungbean cropping pattern (R-G-M CP) and 40 farmers practicing Rice-Rice-Mungbean cropping pattern (R-R-M CP) under LVRIS; (b) 40 farmers practicing R-G-M CP and 40 farmers practicing R-R-M CP under BP#2; and (c) 40 farmers planting rainfed mungbean crop.

Demographic and socio-economic characteristics, capital assets, cropping patterns, credit and marketing systems were determined and compared. Economic parameters were compared separately among crops (e.g. irrigated rice and irrigated garlic, irrigated mungbean and rainfed mungbean, etc.) and among the three irrigation systems using t-test.

Results and Discussion

Most farmer-respondents in irrigated areas were 45-57 years old. In rainfed areas, majority of the farmers' ages ranged between 50-62 years. Wives on the other hand, were 45-57 years old and 24-36 years old in irrigated and rainfed areas, respectively. Majority of the children and relatives' ages were from 1-21 years old in both areas (Table 1).

Table 1. Demographic characteristics of farm households, 1986/87 and 1987/88 dry seasons.

Characteristics	Irrigated			Rainfed		
	Range; Bracket	(%)	[No.)	Range; Bracket	(%)	(No.)
Age Structure						
Farmers	45-57	40	513	50-62	37	49
Wives	45-57	35	449	24-36	37	43
Children/relatives	1-21	71	1928	1-21	73	183
Educational Attainment[b]						
Farmers	01-06	48	513	01-06	71	49
Wives	01-06	72	449	01-06	46	43
Children/relatives	01-06	38	1928	01-06	35	183
	11-15	26	1928	00	24	183
Household Size	4- 6	50	513	4- 6	55	49
	7-10	27	513	7-10	24	49
No. of Years in Farming	28-40	29	513	41-53	24	49
	15-27	25	513	48-40	34	49
Annual rice requirement[a]						
Minimum, cavans	12-20	58.6	273	12-20	53.1	49
Maximum, cavans	15-25	56.0	273	15-25	49.0	49

[a] data for 1986/87.

[b] 00 no formal schooling/pre-schooling
01-06 Grade I to Grade VI
07-10 First year to Fourth year high school
11-15 First year to fifth year college

Most of the farmers and their wives, children and relatives finished elementary grade school, although considerable number reached or even finished high school.

Average household size in both areas ranged from 4-6 members. Minimum annual rice requirement per family ranged from 600-1000 kg while maximum rice requirement per family ranged from 750-1250 kg.

Farmers in rainfed areas had longer farming experience (28-53 years) than farmers in irrigated areas (1540 years).

Choice of crop planted and farm size. Farmers considered some factors in choosing the kind of crop to plant during the dry season. Availability of water ranked first, especially among farmers whose farms were located at the tail end of the lateral. Next in rank were availability of market, credit, seeds/planting materials and the perceived high returns from the crops as well as risks involved. Experience in the previous dry season was also considered.

Farm size planted to a particular crop was also determined on the following in the order of importance: amount of available water, market demand for the crop, and experience during the previous dry season. Risk involved, availability of labor, credit and planting materials were least considered.

Table 2. Inventory of tools, equipment and infrastructure of farmers in irrigated and rainfed areas, 1986/88 cropping seasons.

Farm Buildings, Equipment and Tools	Irrigated Owner	N=513 Percent	Rainfed Owner	N=49[a] Percent
Bodega	213	42	20	41
Carabao/cow shed	297	58	38	78
Sled (1-2)	318	62	21	43
Cart (1-2)	290	56	43	88
Sprayer (1-2)	212	53	35	71
Drying materials (1-5)	426	83	39	80
Spade (1-2)	410	80	39	80
Hoe (1-2)	221	43	15	31
Bolo (1-2)	513	100	49	100
Scythe (1-10)	513	100	49	100
Sacks (1-300)	513	100	49	100
Carabao (1-4)	293	57	9	18
Cow (1-4)	269	52	42	86
Plow (1-4)	490	96	47	96
Harrow (1-3)	456	89	41	84
Rolling board	56	11	5	10
Plaining board	241	47	16	33
Tractor tiller	19	4	0	0
Irrigation pump	61	12	34	69
Thresher/samberga	226	44	19	39
Others (basket, hose, "karadikad")	226	52	3	6

[a] 1986/87 data.

Family contribution to various farm activities. Farm activities were shared between family members. Wives, children and other relatives contributed mostly in planting, weeding, harvesting and threshing operations. However, farmers themselves took the lead role in all farm activities.

Farm inventory. An inventory of farm tools, equipment and buildings was made. All farmer-respondents had most of the basic tools like bolos, scythes, plows, harrows, spades and draft animals. Only a few owned equipment which involved high capital investments (Table 2).

Production problems. Table 3 shows the production problems encountered by farmers. Under LVRIS, occurrence of pest and diseases was the foremost problem while farms located at the middle and tail sections of the laterals were beset with inadequate water supply. Charging high irrigation fees was a problem to farmers under

BP#2. Other problems considered were high cost of chemicals, lack of capital, high cost of land rent or sharing percentage, and high cost of seeds.

Cropping patterns (CP). During the 1986/87 survey, various cropping patterns were identified. Farmers planted as many as five different crops during the dry season (November to May). Predominant cropping patterns identified were Rice-Garlic-Mungbean and Rice-Rice-Mungbean. These cropping patterns were the bases of selecting farmer-respondents for the 1987/88 survey, especially for garlic and mungbean.

Comparison of irrigated rice with selected diversified crops. A summary of yield, gross returns, total cost of production and net returns of rice and two selected diversified crops under LVRIS and BP#2 during the 1986/87 and 1987/88 dry seasons is presented in Table 4

- Irrigated rice versus irrigated garlic
  - LVRIS. During the 1986/87 dry season, material cost for irrigated garlic was higher than for irrigated rice. During the 1987/88 dry season, total family labor, gross returns, material cost, total variable cost and consequently, the returns above variable cost were higher for irrigated garlic than irrigated rice. Total variable cost for irrigated garlic was higher due to an increase in material cost on account of material needed for mulching (Table 5).

Table 3. Production problems encountered by farmers during the 1986/88 dry seasons

Problems	Rank			
	LVRIS			BP#2
	Head	Middle	Tail	
Inadequacy of water supply	2	1	1	
High cost of chemicals	2	2	3	2
Attack of pest and diseases	1	1	2	2
Lack of capital	3	3	3	
Lack of seeds		2	2	
High interest rate on borrowed capital		1	2	
High irrigation fees				1
Delayed releases of loans		3		
High cost of land rent or sharing percentagr	3	3	3	3
High cost of seeds		3	3	

Table 4. Yield, cost and returns of selected diversified crops under LVRIS and BP#2, 1986/87 and 1987/88 dry seasons.

Crops	Cropping Season	Sites	Yield (kg/ha)	Gross Returns (₱/ha)	cost of Production (₱/ha)	Net Keturn (₱/ha)
Rice	1986/87	LVRIS	5013	12804	5915	6890
	1987/88		3034	10628	4821	5807
	1986/87	BP#2	3367	10486	4849	5630
	1987/88		4159	14558	8992	5656
Garlic	1986/87	LVRIS	1700	17711	9588	8123
	1987/88		754	25596	11590	14006
	1986187	BP#2	2418	20019	11410	8609
	1987188		933	34987	16478	18509
Mungbean	1986/87	LVRIS	880	8448	2956	5493
	1987/88		557	5732	1867	3865
	1986/87	BP#2	636	6111	2707	3403
	1987/88		763	8112	1927	6185

BP#2 Total family labor, gross returns, labor and power cost, material cost, and total variable cost were higher for irrigated garlic than for irrigated rice during the 1986/87 dry season. Except for labor and power cost, the same results were observed during the 1987/88 dry season (Table 5).

- Irrigated rice versus irrigated munghean.
  -- LVRIS. No difference in the mean values of economic parameters considered between irrigated rice and irrigated mungbean was observed during the 1986/87 dry season. During the 1987/88 dry season, gross returns, labor and power cost, material cost, and total variable cost were higher for irrigated rice than for irrigated muogbean. However, returns to material cost was lower for irrigated rice (Table 6).

Table 5. Comparison of economic parameters between irrigated rice and irrigated garlic under LVRIS and BP#2, 1986/87 and 1987/88 dry seasons.

	Difference			
	LVRIS		BP#2	
Parameters	1986/87	1987/88	1986187	1987/88
Average farm size (ha)	0.3 **	0.3 **	0.3 ns	0.2 **
Yield (kg/ha)	3314	2280	949	3227
Total family labor (md/mad/mmd)	–124 ns	–172 **	–250 *	95 **
Gross returns (₱/ha)	–4907 ns	–14968 **	–9533 •	–20429 **
Labor and power cost (₱/ha)	–156 ns	–252 ns	–1653 *	310 ns
Material cost @'/ha)	–3517 **	–6517 **	–4908 **	–7886 **
Total variable cost (₱/ha)	–3674 ns	–6769 **	–6561 **	–7576 **
Returns				
Above variable cost (₱/ha)	–1233 ns	–8190 **	–2978 ns	–12853 **
To labor and power cost (₱/₱)	–16.1 ns	–6.1 ns	29.6 ns	–5.5 ns
To material cost (₱/₱)	1.4 ns	0.7 ns	0.7 ns	–0.5 ns
To family labor (₱/md)	37.3 ns	–10.7 ns	15.4 ns	–52.6 ns

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

Table 6. Comparison of economic parameters between irrigated rice and irrigated nungbean under LVRIS and BP#2, 1986/87 and 1987/88 dry seasons.

	Difference			
	LVRIS		BP#2	
Parameters	1986/87	1987188	1986/87	1987188
Average farm size (ha)	0.3 **	0.24 **	0.3 ns	0.2 **
Yield (kg/ha)	4133	2497 **	2732	3397
Total family labor (md/mad/mmd)	26 ns	14 ns	–33 ns	34 ns
Gross returns (₱/ha)	4356 ns	4896 **	4375 ns	6446 **
Labor and power cost (₱/ha)	1995 ns	1593 **	1099 ns	3645 **
Material cost (₱/ha)	964 ns	1361 •	1043 ns	3330 **
Total variable cost (₱/ha)	2959 ns	2954 **	2142 ns	6975 **
Returns				
Above variable cost (₱/ha)	1397 ns	1943 ns	2227 ns	–529 ns
To labor and power cost (₱/ha)	–80.0 ns	–10.1 ns	–49.3 ns	–7.2 *
To material cost (₱/₱)	-0.7 ns	–1.8 **	0.3 ns	–7.0 **
To family labor (₱/md)	11.8 ns	15.9 ns	8.5 ns	-24.4 ns

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

— BP#2. During the 1986/87 and 1987/88 dry seasons, the same trend that was observed at LVRIS was observed at BP#2. However, returns to labor and power cost was lower for irrigated rice than for irrigated mungbean (Table 6).

- Irrigated garlic versus irrigated mungbean
  — LVRIS. Materialcost and totalvariable cost for irrigated garlic were higher than for irrigated mungbean during the 1986/87 dry season. During the 1987/88 dry season, family labor, labor and power costs, material costs, and gross returns were higher for irrigated garlic than for irrigated mungbean. However, returns to material cost for garlic was lower than for mungbean (Table 7).
  — BP#2. Similar results as that in LVRIS were observed during both dry seasons under BP#2, except material costs and returns above variable costs due to the unexpected increase in the price of garlic (Table 7).
- Irrigated mungbean versus rainfed mungbean.
  — LVRIS. No differences in the economic parameters between irrigated and rainfed mungbean were observed during the 1986/87 dry season (Table 8). During the 1987/88 dry season returns to material cost and family labor were higher for irrigated mungbean than for rainfed mungbean.
  — BP#2. Yield during the 1986/87 dry seasondidnotdiffer. During the 1987/88 dry season, yield, gross returns, returns to labor and power, returns to material cost, and returns to family labor were higher for irrigated mungbean than for rainfed mungbean (Table 8).

Performance of rainfed and irrigated mungbean did not differ because the crop can efficiently use the residual moisture after rice.

Limitations

- Depreciation costs of tools and equipment were not considered because farmers did not know the exact dates of purchase, costs, etc.
- Profitability of the different cropping patterns were not compared because of sudden increases in the price of garlic.

Table 7. Comparison of economic parameters between irrigated garlic and irrigated mungbean under LVRIS and BP#2, 1986/87 and 1987/88 dry seasons.

Parameters	Difference			
	LVRIS		BP#2	
	1986187	1987188	1986187	1987/88
Average farm size (ha)	0.0	-0.1 ns	0.0	0.0
Yield (kg/ha)	817	217	-1783	I70
Total family labor (md/mad/mmd)	150 ns	193 **	-218 •	128 **
Gross returns (₱/ha)	9263 ns	19864 **	-13908 **	26875 **
Labor and power cost (₱/ha)	2151 ns	1845 **	-2752 **	3335 **
Material cost (₱/ha)	4481 **	7878 **	-5950 **	11216 **
Total variable cost (₱/ha)	6632 **	9723 **	-8703 **	14551 **
Returns				
Above variable cost (₱/ha)	2630 ns	10141 **	-5205 ns	12324 **
To labor and power cost (₱/₱)	-63.9 ns	-4.0 ns	78.9 ns	-1.7 ns
To material cost (₱/₱)	-2.1 ns	-2.4 **	0.4 ns	-6.5 **
To family labor (₱/md)	-25.5 ns	26.8 ns	6.9 ns	28.2 ns

"significant at 1%
'significant at 5%
ns=not significant

Table 8. Comparison of economic parameters between irrigated and rainfed mungbean under **LVRIS** and BP#2, 1986/87 and 1987/88 dry seasons.

Parameters	Difference			
	LVRIS		BP#2	
	1986/87	1987/88	1986/87	1987/88
Average farm size (ha)	−0.3 **	0.1 ns	−0.2 ns	0.1 ns
Yield (kg/ha)	146	172	−99 ns	397 *
Total family labor (md/mad/mmd)	72 ns	−42 ns	44 ns	−55 *
Gross returns (₱/ha)	1541 ns	1772 ns	−797 ns	4103 *
Labor and power cost (₱/ha)	−867 ns	309 ns	−1082 ns	460 ns
Material cost (₱/ha)	496 ns	−140 ns	460 ns	−231 ns
Total variable cost (₱/ha)	−374 ns	168 ns	−622 ns	229 ns
Returns				
Above variable cost @'/ha)	1915 ns	1534 ns	−174 ns	3874 ns
To labor and power cost (₱/₱)	197.8 ns	12.0 ns	70.1 ns	7.5 *
To material cost (₱/₱)	0.1 ns	1.9 **	−1.8 ns	5.7 **
To family labor (₱/md)	−78.4 ns	52.6 *	86.0 ns	110.8 **

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

Comments, Suggestions and Recommendations

- Yields of all crops studied during the 1987/88 dry season were lower compared with the yields during the 1986187 dry season due to unfavorable weather conditions. It is recommended that the same study be conducted during the 1988/89 dry season for more conclusive results.
- At BP#2, diversified crops using R-G-M cropping pattern did not use irrigation water from the system since farmers used pumps to irrigate garlic and mungbean.

Summary and Conclusions

Profitability of selected diversified crops under irrigated and rainfed conditions and their irrigated performance was compared with that of irrigated rice in the Laoag-Vintar River Irrigation System (LVRIS) and Bonga Pump No. 2 (BP#2) during the 1986/87 and 1987/88 dry seasons. Specifically, the study identified existing cropping patterns and compared their profitability; identified the most efficient means of utilizing family labor; determined the net returns to family labor and investment; and identified economic factors affecting crop diversification.

Two hundred seventy-three farmers under LVRIS and BP#2; 49 rainfed farmers and 14 wholesalers/ retailers were interviewed during the 1986/87 dry season.

The 1987/88 dry season survey included 120 farmers with R-G-M CP and 40 farmers with R-R-M CP under LVRIS; 40 farmers with R-R-M CP and 40 farmers with R-G-M CP under BP#2; and 40 farmers planting rainfed mungbean.

Demographic and socio-economic characteristics, capital assets and cropping patterns were analyzed.

Predominant CPs identified were R-G-M and R-R-M.

Economic parameters between irrigated rice and selected diversified crops were compared and analyzed.

At LVRIS, during the 1986/87 dry season, material costs for irrigated rice was lower than for irrigated garlic. During the 1986/87 dry season, only material cost differed while during 1987/88 dry season, gross returns, total family labor, material costs, total variable costs and returns above variable cost were higher for irrigated garlic. The same results were obtained in farms under BP#2 during both dry seasons.

During the 1987/88 dry season, gross returns, labor and power, material and total variable costs were higher for irrigated rice than irrigated mungbean in both systems.

Material and total variable costs were higher for irrigated garlic than for irrigated mungbean in both systems during the 1986/87 dry season. During the 1987/88 dry season, gross returns, total family labor, labor and power cost, material cost and total variable cost were higher for imgated garlic than for irrigated mungbean in both systems. Also returns above variable costs was higher and returns to material costs was lower for irrigated garlic than for irrigated mungbean.

No difference between irrigated and rainfed mungbean was observed because of the crops' ability to use residual moisture in the soil.

Economic factors which affected crop diversification were:

- Market supply and demand;
- Unstable prices;
- High cost of input; and
- Quality of product.