Low-external Input Rice Production (IIRR, 292 p.)

Farm management

A guide to decision-making for technology adoption based on production costs

Production costs are those expenses which farmers encounter while producing a crop. These costs include fixed costs (i.e., irrigation fees, land rental, etc.) as well as variable costs (i.e., seed, fertilizer, labor, etc.). Fixed costs are paid by farmers just to begin farm operations; in other words, you have to rent land and pay for irrigation to be able to begin to sow a crop. Variable costs, as the name indicates, vary according to the mode and scale of production. Therefore, variable costs of farm operations provide the best opportunity to small-scale farmers to modify their mode of production and thus reduce their cash expenses. If a farmer has high production costs, but has limited capital he/she can be

caught in a cash-flow squeeze, especially during rice-producing months.

The LIRP technologies outlined in this kit are labor or knowledge-intensive rather than capitalintensive. increased labor requirements or the introduction of integrated management techniques are offered as alternatives to capital-poor farmers who may not have access to capital resources for investment in farm technologies (i.e., equipment, more land, hired labor, etc.). The costs of those capital resources, in an informal credit system, comprise a hidden cost of production and can reach 40-50% in four months. Any reduction in production costs can be assumed to save an additional 25-30%, at least, since many farmers use informal credit arrangements.

Since the cost of capital is high and may not be available to small farmers, labor must be substituted to maintain or increase production. However, the opportunity cost (the peso value of that labor if used in an alternative activity, i.e., day labor, driving a jeepney, etc.) of that labor may also be high, as a farmer may value time for leisure or family activities or may require time for other income-generating activities. If a farmer has an option to earn income from an off-farm source, even if the income earned is low, the farmer may opt to earn that income because it is IMMEDIATELY available. Thus, the opportunity cost to an LIRP technology may be high and this fact must be considered when making a decision to adopt (or not to adopt) a technology. For example, if a certain technology requires extra labor at a time when a farmer needs to earn disposable cash (i.e., to purchase food or medicine, pay school fess, etc.), then the technology will not be implemented by the farmer in that situation.

This paper will present actual production cost data from Cavite, Philippines, farmers. Using these data as an example, areas of rice production in which costs can be reduced or eliminated and in which potential yield increases lie will be identified. Pages are included which divide the LIRP technologies into groupings based on rice production activities. Therefore, if a farmer decides that he/she is spending too much on weed control, for

example, and would like to reduce those costs, this quick reference can be used to identify those specific technologies which might be adopted in order to reduce weed control costs. Once a certain technology has been selected, a farmer can then use partial budgeting to determine if the introduction of that technology would be advisable, from a purely economical viewpoint. A partial budget example on the use of Azolla as a bio-fertilizer will be presented.

Using actual rice production costs of Philippine (Cavite Province) farmers, the following cost of production framework can be established:

Fixed Costs	**Pesos (P)/Ha.**
Irrigation	500.00/harvest
Land Rental	500.00/year

Variable Costs (per cropping)

Seed Bed Preparation	3 days @ P40/day		P120.00
Seed	125 kg.		625.00**
Land Preparation	3 days (with hand tractor @ P340/day	P1,020.00	1,300.00
	7 days (with carabao) @ P40/day	280.00	
Transplanting	30 days @ P40/day		1,200.00**
Fertilizer Costs			570.00**
Fertilizer	2 1/2 bags @ P220/bag	500.00	
Labor	1/2 day @ P40/day	20.00	
Weed Control			812.00**
Labor for Manual Weed Control	14 day @ P40/day	560.00	

Labor for Manual Weed Control	[illegible]	[illegible]	
Herbicides	1 liter	232.00	
Labor for Spraying	1/2 day @ P40/day	20.00	
Pest Control			260.00**
Pesticides	1 liter	240.00	
Labor	1/2 day @ P40/day	20.00	
Harvesting	(10% of harvest)		1,700.00
Threshing	(10% of harvest)		1,700.00

**** Highest variable cost/ha.**

Those areas with the highest production cost/ha. (based on the data presented) are seed, land preparation, transplanting, fertilizer, weed control and pest control. While the actual figures and relative rankings may vary (even widely) across regions or countries, these areas of production costs can be reduced or even eliminated using LIRP technologies. Some cost-reducing strategies for each of the six areas are presented here as alternatives to existing high-external input modes of production.

SEED:

Many farmers are currently using about 125 kg. of seeds per hectare, more than double the recommended seeding rate of 60-75 kg/ha. The expense for seed in our example is more than P600 for the 125 kg of seeds. Oftentimes, these seeds may be of poor quality, particularly with a low germination rate. Farmers can reduce their seed costs in two ways: cut in half the amount of the poor quality seed they use or buy (savings of more than P300); or only buy 60-75 kg good quality seed. With the use of a drum seeder, seed requirements for one hectare can be reduced to 50-100 kg.

LAND PREPARATION:

The land preparation costs of over P1,000 presented in our example can be reduced by a variety of strategies. Minimum tillage can potentially cut tillage costs by one-third. Zero-tillage would almost completely reduce tillage costs and offers the potential for producing an early crop. A zerotillage test with no fertilizer or pesticide yielded 2.2 T/ha.

TRANSPLANTING:

One of the most labor-intensive activities in rice production is transplanting. In areas where labor is costly or unavailable, farmers can reduce production costs by using a manually-operated rice transplanter. In our example, transplanting costs are equal to P1,200 per cropping or P2,400 for 2 croppings. Assuming 6 mandays of labor per cropping (6 mandays x 2 croppings x P40/md) and P900 depreciation, transplanting costs using a manually-operated transplanter can be reduced to P1,380, almost half the cost of traditional transplanting methods. In areas where labor is plentiful and/or inexpensive, the introduction and use of a transplanter could have negative social ramifications.

FERTILIZER:

Savings on fertilizer costs probably hold the most immediate and promising potential for reducing production costs. In our example, farmers have spent almost P600 for fertilizer and the cost of labor for application of that fertilizer. Two-thirds of fertilizer costs (almost P400 for our example) can be saved through the use of big-fertilizers. Sesbania rostrata as a green manure, for example, can easily supply more than 75% of the Nitrogen (N) needed by one rice crop. Many tests show that it can produce all of the necessary N.

Azolla can provide nearly all the Nitrogen needed for a rice crop when multiplied and complemented with enough phosphorous fertilizer. Azospirilla has demonstrated fertilizer savings of one-third. Fertilizer costs can easily be reduced (by 20% or more) without

compromising yields by purchasing less fertilizer, but managing it more efficiently. Integrating legumes into the farm system can reduce fertilizer costs by as much as 50%, as well as providing food, fodder and/or fuel.

The LIRP technologies offer a variety of alternatives to reduce the amount or entirely forego the use of petroleum-based chemical fertilizers.

WEED CONTROL:

Over P800 was spent by the farmers in our example to control weeds in the rice paddy. Most of this cost accounted for labor (almost P600), but over P200 was spent in the purchase of herbicides. By using a rotary weeder, all cash outlays for herbicide can be saved, although the use

of labor will increase. The weeder will also aid in building soil fertility by incorporating weeds (and azolla, if used) into the soil to decompose and provide organic matter. However, the non-use of herbicides will allow the return of aquatic life such as frogs, fish, etc. The artificial culturing of fish in the rice paddy also becomes possible.

PEST CONTROL:

Pest control costs can be cut in half simply by using the sequential sampling method of pest control. For the farmers in our example, that could mean a savings of almost P150. Botanical pesticides, biological control techniques and soil amendments can almost eliminate the need for costly chemical pesticides. Selecting the proper chemicals, using them at the minimum required rate and practicing need-based rather than calendar-based spraying will also reduce pest control costs.

POTENTIAL YIELD INCREASES:

The potential exists for increased yields using the interventions described above not only with lowland rice but also with upland crops following rice. The increase in organic matter plus improved management practices can double yields over the average (300 kg/ha of mung bean, for example, increased to 600 kg/ha) with minimal cost.

Additional components of a rice-based farming system also hold potential for increasing income. Integrating animals such as fish, duck and milk/draft animals into rice-based systems offers the opportunity for a more stable income as well as providing a food/income "cushion" in case of crop failure. Adding a vegetable component can help ease cash flow problems and improve family nutrition. Additional savings can be realized in the form of labor and/or time spent collecting fodder and fuelwood. With sample supplies available from under-utilized areas of the farm, the family will spend less time in search of those farm inputs. By eliminating the use of inorganic pesticides, free food for the family can be realized as natural populations of frogs, mudfish, catfish, etc. return to the rice paddies.

PARTIAL BUDGETING:

Partial budgeting is a simple, useful method used in estimating the returns received from introducing a new technology which affects only a part of the overall farm enterprise. The partial budget can show a farmer whether an increased cost (in capital or labor) will be offset by the value of the expected increase in yield (or production). A planned change should be implemented only if the value of the expected increase in yield (or production) is greater than the expected increase in costs.

For example, a farmer has looked at his cost of production structure and has determined that his fertilizer costs are too high. He has used the LIRP kit to identify the use of azolla as a fertilizer alternative and would now like to calculate the estimated change in his income due to the use of azolla as a big-fertilizer.

COLUMN I		COLUMN II	
Added Costs		**Added Returns**	
1. Multiplication Pond		1. Azolla as hog feed; savings in feed (kg)	P125
Land preparation (1/2 day)	P20		
Fertilizer (2 1/2 kg)	5		
Fertilizer application (1 /2 day)	20		
Seeding azolla (1/2 day)	20		
2. Incorporation			
Land preparation and rotary weeding (5 days)	200		
Sub-total	P265		
Reduce Returns		**Reduced Costs**	
1. Decreased yield		1. Fertilizer	P550
80 kg @ P3.50/kg	P280	2. Labor to fertilizer	20
		Sub-total	P570
TOTAL	P545	TOTAL	P695

Estimated change in income (if positive, a gain in income; if negative, a loss in income) = Column II Less Column I

P150 = P695 - P545

This example shows that while a farmer using azolla as a big-fertilizer would encounter added costs of P265 (almost entirely labor costs) and a decreased yield of 80 kg, the cost would be offset by additional savings in chemical fertilizer and hog feed. (It is also worth-mentioning that decreased yields as a result of using azolla will usually only be

experienced in the first or second croppings. Then, yields will, in fact, surpass those from inorganic fertilizers.) Therefore, if this farmer is comfortable with increasing his labor input to the farm, his actual cash outlays can be reduced by over P400.

ALTERNATIVES FOR REDUCING PRODUCTION COSTS OR CAPITAL NEEDS

SEEDS
· Reducing Seed Needs
- Drum seeder/Direct seeding
- Dapog/Wet-Bed
- Straight row planting
- Regrowth (dapog)

· Producing Own Seeds/Selecting Varieties
- Traditional vs modern varieties
- Seed selection techniques
- Clonal propagation
· Improving Storage and Germinability
- Seed dormancy
- Seed storage

TRANSPLANTING
1. Manually-operated transplanter
2. Line markers/straight-row planting

WATER MANAGEMENT

· Conserving Water
- Water management for drought-prone areas
- Sorjan· Blue-green Algae

- Increase organic matter with green manures
- Water impounding
· Obtaining Better Production from Available Water
- Integrated cropping systems
- Rice-fish culture
- Crop rotations
- Weed control

WEED CONTROL

· Cultural Management Practices
- Crop rotation/intercroppig/relay cropping
- Increasing organic matter
- Water management
- Mulching
- Thorough land preparation
- Row spacing
· Low-Cost Weeding "Tools"
- Rotary weeder
- Straight row planting
- Azolla
- Ducks

LAND PREPARATION

1. Using carabao for draft
2. Straight-row planting
3. Sesbania slicer for weedy areas
4. Reducing land preparation time by keeping land covered with "plants" not "weeds"

minimum tillage
zero tillage
5. Rice straw utilization
6 Ratooning

FERTILIZER
· Green Manures and Green Manure Utilization
- Azolla
- Indigofera
- Crotalaria
- Sesbania aculeata or other locally available legumes
- Sesbania rostrata
- Leucaena leucocephala
· Nitrogen Fertilizer Management
· Animal Manures
· Farm Wastes
- Rice straw
- Rice hull
- Composts
· Azospirillum
· Intercropping/Relay Cropping/Crop Rotation
· Nutrient Cycling
· Off-Season Planting Legumes
(mung bean cowpea soybeans)

PEST CONTROL

· Cultural Management Practices
- Synchronized planting

- Crop rotation/intercropping/relay cropping
- Sanitation
- Fertilizer management
- Water management
- Plant spacing
- Botanical control
- Low-cost control of Golden Snail
- Planting of resistant varieties
· Major Insect Pests and Their Economic Threshold
- Beneficial insects
- Safe usage of pesticides (need base spraying affected areas only)
- Spot treatment (spraying)

Cost-benefit analysis for low-input rice production (LIRP) technology

Cost-benefit analysis is an important and essential tool in measuring the net effect of a certain technology. Farmers will adopt a technology only when the benefits derived from it will compensate for their labor and other costs. However, environmental and social costs and benefits must also be considered.

Cost-benefit analysis

A guide for technicians, farmers and other agriculture enthusiasts to determine the costs as well as the benefits of components that are included in the technology is presented here.

QUALITATIVE ANALYSIS:

A. COSTS

The costs of the LIRP will perhaps involve slightly decreased rice harvests at least in the beginning and during the transition period to a less chemical-dependent farming system. Labor demand at harvest may also decline slightly .

Another cost will be an increase in labor requirements in crop establishment and maintenance. This can be seen as both a cost (less leisure or alternative production or more work days for the farmer/farm family) and as a benefit (increases in demand for agricultural labor to benefit landless families in the area).

B. BENEFITS

The benefits we foresee include economic, environmental and social aspects. The economic benefits are most obvious.

1. Economic benefits

· Increased net incomes to farmers through reduced cost of production, even in the face of possible slight decreases in crop yield.
· In the long run, improved soil condition and farming practices should lead to increased gross harvests.

· Maximum utilization of scarce resources through improved farming practices. Use of credit, capital, fertilizers (both organic and inorganic), labor, herbicides and pesticides as needed will be maximized.
· Savings in expenditures for family health maintenance and improvement due to reduced potential pollution and improved incomes.
· The development of linkages for small equipment repair, production of non-chemical inputs within the community, encouraging local resource use.

2. Environmental Benefits

· Reduction of pollution of streams, ground water and soils through minimal use of petroleum-based chemical fertilizers, herbicides and pesticides.

· Improvement in soil conditions due to use of green manure, crops which improve soil consistency and minimization of soil damage due to rice monocropping.

· Improvement in the health and nutrition of farm families due to declines in potential chemical poisoning hazards, increases in healthy farm produce and increases in net income.

· Presentation and reintroduction of environmentally important indigenous seed varieties of rice, as well as other crops and livestock grown as a part of an integrated farming system.

· Optional use of scarce water resources.

3. Social Benefits

· Perpetuation of traditional beneficial farming tradition encouraging the stewardship of the land among farm family members.

· Encouragement of family participation in farming activities leading to closer family ties and relationships within the family unit and across generations -- preserving advantages of extended family relationships.

· Encouragement of bayanihan (mutual help/sharing) within the community.

· Greater community self-reliance and less dependency on outsiders.

· Greater control over own resources can stimulate greater political awareness and power resulting from improved economic condition and revival of other community organizations (i.e., marketing cooperative) due to new organizational relationships.

QUANTITATIVE ANALYSIS:

A. METHODOLOGY

1. Production yield

· Gross production

- Gross yield -- Total harvest or produce in terms of weight or its equivalent
- Gross income -- Cash value of the harvest
- Land area cultivated.

· Production share (For those areas in which harvesting and threshing costs are paid as a share of total production.)

- Harvester's share
- Thresher's share -- Thresher share as payment for services.

· Farmer's share of production

- Difference between gross income (yield) and production share [gross income (yield) less production share].

2. Farm expenses

· Farm inputs

- List all inputs that have been used:

-- crop production (seed, fertilizer, pesticide, equipment, etc.)
-- livestock (stock, feed, medicine, equipment, etc.)

- All farm inputs should be specified and quantified (actual purchase cost).

· Labor expenses

- List all activities conducted during the production phases of rice, fish, vegetables, green manures, livestock, fodder, etc.
- Labor should be quantified (days or hours) and costed (actual expense).

· Other expenses

- List all other incurred expenses not grouped under farm inputs or labor expenses (e.g., rentals, transportation, storage, irrigation fees, permits, etc.).

· Total farm expenses (farm inputs plus labor expenses plus other expenses).

3. Net farm income

· Difference between farmer share of production (gross income less production share) and total farm expenses (farm inputs plus labor expenses plus other expenses).

B. DATA ANALYSIS AND INTERPRETATION

· Consolidated data should be presented in tabular form (except for technology profile which should be presented in a separate sheet).
· Two types of analyses should be executed:

a. Financial analysis (see sample format): cost benefit analysis
b. Immediate impact analysis: effect of the technology in terms of social and environmental benefits.

· Further analysis of economic data can be conducted through the use of simple formulas to calculate farm returns using the LIRP technology. Listed below are three basic formulas which show farm returns to specific farm resources (materials and labor).

· Returns to labor can show a per hour (or per day) value of labor inputs; in other words how much return is received for every unit of labor invested.

Returns to labor = (gross production (income) - farm inputs and other expenses) / labor expenses

· Returns to farm family labor can show the amount of return received for every unit of family labor invested. This calculation can be computed only when the amount and cost of family and off-farm labor is differentiated.

Returns to family labor (hours or days) = (gross production - farm inputs and expenses - cost of hired labor) / amount of family labor (hours or days)

· Returns to farm resources can show the amount of return received for the amount of on-farm resources invested. This calculation can help a farmer to place special emphasis on the value of on-farm resources used within the system.

Returns to farm =gross production (income) - Resources /ha expenses of non-farm resources

SAMPLE FORMAT

COST-BENEFIT ANALYSIS
(Technology Title)

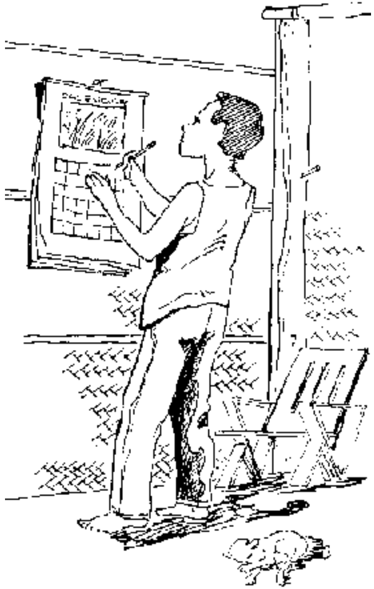
PRODUCTION DATA	QUANTIFY	AMOUNT
1. Production Yield		
A. Gross Production		
1. Gross Yield		
2. Gross Income		
3. Land Area Cultivated		
B. Production Share		
1. Harvester's Share		
2. Thresher's Share		
C. Farmer Share of Production		
II. Farm Expenses		
A. Farm Inputs		
1. Seed/Seedlings		
2. Fertilizer		
· Inorganic (specify)		
· Organic (specify)		

· Organic (specify)		
3. Pesticides		
· Inorganic Pesticide (specify)		
· Organic Pesticide (specify)		
4. Other Farm Inputs (specify)		
B. Labor Expenses		
1. Land Preparation		
· Plowing		
· Harrowing		
· Levelling		
2. Seed bed/box preparation		
3. Seed drying, soaking and incubation		
4. Seed broadcasting/direct seeding		
5. Pulling of seedlings		
6. Transplanting		
7. Spreading of green manure		
8. Fertilizer application		
- top dressing		
- side dressing		
- basal		
9. Pesticide application		
10. Weed control		
11. Harvesting		
12. Threshing		

12. Threshing		
13. Others (specify)		
C. Other Expenses		
1. Transportation		
2. Hauling		
3. Irrigation fees		
4. Land rental		
5. Storage costs		
6. Others (specify)		
D. Total Farm Expenses		
III. Net Farm Income		

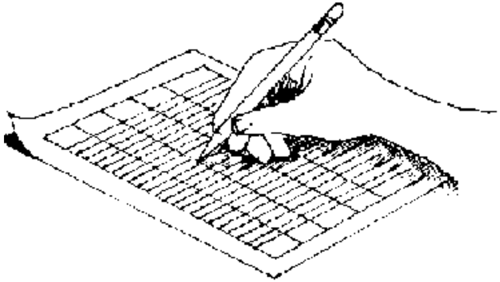
Simple record-keeping for LIRP

Keeping accurate farm records allows a farmer to monitor expenses, inputs and labor which are invested into the farm and the production, yield and income generated from that investment. The importance of keeping records is emphasized by the need for farmers to have accurate information about cash expenses and incomes channeled through the farm.



Simple record-keeping for LIRP

Farmers have traditionally kept written farm records by recording events, activities, income and expenses on large wall calendars. Also, future farm activities i.e., harvesting, fertilizer applications, etc.. have been noted by farmers using this method.



Writing

Building on this traditional practice, a simple record book/ calendar can be designed which will allow farmers to more systematically record fundamental farm information, thus aiding them in decision-making. Two sample formats are presented here.

The inclusion of important astronomical events, i.e., lunar phases, solstices, or equinoxes in the calendar can facilitate making farming decisions for those farmers who use those events as guides. By using one of these sample formats, a farmer or group of farmers can modify the design in order to specifically tailor the components/information to be recorded to their specific production system.

A checklist of LIRP activities to be monitored/recorded in a record-book may include the following:

- **Azolla multiplication**
- **land preparation (plowing, harrowing, levelling, plot preparation)**
- **seedbed preparation**
- **use of compost**
- **transplanting seedlings**
- **direct seeding**

- **straight row planting**
- **incorporation of green manures/animal manures/straw**
- **fertilizer application**
- **botanical/chemical pesticide application**
- **weed control practices**
- **vegetable production (bed preparation, planting, maintenance, weeds, pests, harvesting)**
- **fish culture practices (rice-fish-clams, rice-duck-fish, rice- pig-fish)**
- **Iivestock/animal production**
- **harvesting/threshing/storage**

Rice production using LIRP technologies will bring about two major changes in the farming system -- increased savings to the household (through on-farm production of household consumption items and through decreased cash outlays for production costs) and increased demand for farm labor (through the use of labor-intensive technologies). Therefore, to accurately assess the impact of LIRP technologies, a farmer should take extra effort to record the variety of farm savings as well as the amount of increased labor requirements.

While at times difficult to quantify or measure, to the extent possible, materials/resources generated on and derived from the farm, the farm should be assigned a certain value and recorded. For example, posts produced from trees on the farm, fertilizer equivalents from green and animal manures, the amount of fish consumed from a fish pond, or the value of botanical pesticides used in place of chemical-based pesticides should all, be recorded as income to the farm, even though they do not actually generate cash.

To compute monthly returns to the farm, total expenses should be subtracted from gross income (including valuation of the resources saved).

JULY 1990

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	FULL MOON  JULY 8	LAST QUARTER  JULY 15	NEW MOON  JULY 22	FIRST QUARTER  JULY 29

Sample format of simple record book

JULY 1990

DATE	ACTIVITY	EXPENSES (ACTUAL COSTS)	MATERIALS	LABOR (HOURS)	INCOME
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
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Sample format of simple record book

Workshop to develop the low-external input rice production technology information kit

The Low-External Input Rice Production (LIRP) Technology Information, Kit is the result of an inter-agency collaboration made possible through the use of an innovative workshop process developed by the International Institute of Rural Reconstruction (IIRR). During a two-week workshop conducted on July 15-30, 1990, IIRR brought together at the Silang, Cavite headquarters, 44 individuals from 10 organizations. Organizations represented included government agencies and institutions, such as the University of the Philippines at Los Baos (UPLB), the Philippine Rice Research Institute (PhilRice) and the Department of Agriculture (DA); non-governmental organizations, such as AGTALON, the Quirino Livelihood Center, the Philippine Rural Reconstruction Movement (PRRM) and IIRR; and research institutions, such as the International Rice Research Institute (IRRI), Cornell University and the University of California at Davis. Participants represented a variety of disciplines, including researchers, agricultural field technicians, rural development managers, farmers, artists, editors and graphics layout persons. While participation involved a variety of organizations and individuals, the logistical arrangements and workshop management was handled by IIRR. The Rockefeller Brothers' Fund (RBF) and the German Agro-Action provided funding support to IIRR for the field experiences which were presented in the kit, while RBF provided financial support for the workshop proper.

This technology kit attempts to accomplish the primary objective of providing and

presenting technological options for rice production systems. The technologies presented are proven technologies based on a variety of sources including institutional research, farmer-level field experiences and/or traditional knowledge practices and systems. The kit is comprised primarily of single-page concept sheets which present individual topics. These sheets are designed to stand on their own, i.e., to be reproduced and distributed in a training session; or can be used as a technical resource package to farmers, technicians or researchers. A systematic effort has been exerted to use a science-simplification approach which allows for assessing technical information and repackaging it in a user-friendly and non-threatening format.

The workshop process involves a number of steps and the participation of several people from diverse backgrounds and disciplines. This process allows for participation of several people for review and assessment of the materials to be included, while allowing for a rapid compilation and production of the materials.

First, relevant topic areas are identified; resource persons who would participate in the workshop are identified; and, specific topics are then matched to the resource persons. Prior to the workshop, they are asked to prepare an initial working draft (two to four pages maximum) of their topic. The draft should include graphics and text and should be written to and for farmers or technicians, not researchers. Care should be taken to ensure that resource persons understand that a formal "scientific paper" is not being presented, but rather a "science-simpilfied" paper.

During the workshop, all invited resource technical persons, as well as editors, artists and layout technicians, attend the presentation sessions. The text and graphics are presented (using overhead projection) to the group. Then, all participants critique, provide input and conduct a peer review of the presentation. Suggestions, changes and revisions are noted and the materials are revised according to the comments in order to incorporate the changes. This process involves the

lay-out specialists, the editors, the artists and, of course, the resource person. The revised draft is again shared with the larger group and approved for final publication. Camera-ready materials are then produced, using desk-top publishing capabilities.

The LIRP Technology Kit was the first kit produced by IIRR involving the heavy use of desk-top publishing capabilities. High-quality, camera-ready materials were produced by IIRR staff in Silang; thus improving the quality of the materials while reducing the printing and production costs normally incurred in materials production.

Once again, the technology kit workshop has enabled IIRR and other agencies to produce a relevant field technology kit which is available for wider sharing to farmers, planners and technicians. While this process can be costly and time-consuming, the workshop method has allowed for cost and time reduction without sacrificing quality.

Rice production situationer in the Philippines

INTRODUCTION

Rice is one of the most important food crops of the world. It is the life blood of more than 90 percent of the people living in Asia who are dependent on rice as a staple food item. It accounts for over 70 percent of the daily calorie intake in countries such as Bangladesh, Cambodia, Laos and Myanmar (table 1).

TABLE 1. THE TOP TEN RICE PRODUCERS.

COUNTRY	RICE OUTPUT[a] ('000 T)	POPULATION[b] (MILLION)	YIELD[b] (T/HA)	RICE IN TOTAL CALORIE SUPPLY %[c]
China	174704	1104	5.3	38
India	92422	835	2.3	31

Indonesia	40525	185	4.1	59
Bangladesh	22710	115	2.2	70
Thailand	19241	56	2.0	55
Vietnam	15435	67	2.7	69
Myanrnar (Burma)	13983	41	3.0	74
Japan	13421	123	6.1	26
Brazil	10868	147	1.9	15
Philippines	8919	65	2.7	41

a 1986-88.
b 1989.
c 1985.

Source: IRRI Rice Facts, 1989.

Rice is planted on about 145 million hectares - 11 percent of the world's cultivated land. Wheat covers a slightly larger land area, but a sizable proportion of the wheat crop is fed to animals. Rice is the only major cereal crop that is consumed almost exclusively by humans.

By the year 2000, the world will need more than 600 million tons of rough rice in order to keep pace with the current population growth rates. (Table 2)

TABLE 2. PROTRACTED INCREASES IN POPULATION AND

NECESSARY RICE PRODUCTION IN SELECTED COUNTRIES, 1985-2020.

COUNTRY	POPULATION (MILLION)				RICE REQUIREMENT ('000T)			
	1985	**1989**	**2000**	**2020**	**1985**	**1989**	**2000**	**2020**
Bangladesh	101	115	153	230	20300	23294	32183	51238
China	1060	1104	1292	1523	157127	164672	195807	237794
indict	759	835	1043	1375	74982	84480	112590	167157
Philippines	54	65	86	131	7673	9330	13013	22069
Vietnam	60	67	86	121	13656	15545	20993	32271
WORLD	4837	5234	6323	8330	420000	455169	564012	781354

Source: IRRI Rice Facts, 1989.

Southeast Asian countries, like the Philippines, will have to intensify rice production within the next 20 years to keep up with rapidly growing populations. By the year 2000, more than 86 million Filipino will have to be fed (3 percent yearly increase) and the country must be able to produce more than 13 millions tons of rice.

The Philippine average rice yield per hectare for the past five years (1985-1989) was 2.7 tons. From 1985 to 1987 the area planted to rice was about 3.4 million hectares (43 percent irrigated lowland, 45 percent rainfed and 12 percent upland area respectively). Eighty-seven percent of this area was planted with modern rice varieties. Meanwhile, expansion of riceland is not possible, ail land suited for rice is already being cultivated; and, urban expansion is steadily forcing more land out of production.

TRENDS IN RICE PRODUCTION IN THE PHILIPPINES.

Three distinct phases characterize the trends in the Philippine rice production, over the postwar period (Fig. 1). Since the 1950s, self-sufficiency in rice has always been a

continuous national program. Rice production increased annually at 2.2 percent, a rate below that of population growth. Between 1965 and 1980, after the introduction of the new seed-fertilizer technology, the annual growth rate doubled to 4.5 percent. This growth was achieved primarily through greater productivity rather than through area expansion. With this growth performance, the country turned from being a net importer of 5 to 10 percent of its annual rice requirements, to being marginal rice exporter by the late 1970's.

Table 3 shows the yield increases on paddy production, harvest, areas and yields by crop type, for crop years 1961-1980. The substantial gains in production from 1974-1979 (Masagana 99 years) and analysis of average annual growth rates in production, yields and hectarage are summarized in Table 4.

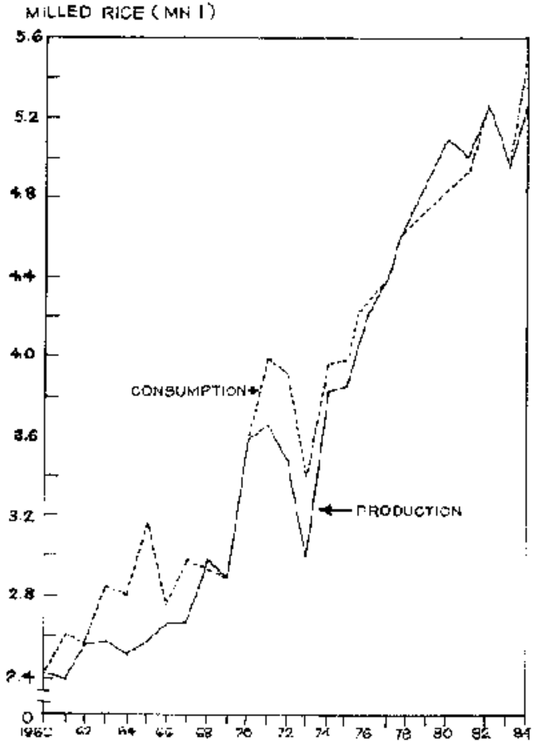

Figure 1. Trends in rice production and apparent consumption (production + imports - exports) in the Philippines, 1960-1984.

	PADDY PRODUCTION				AREA HARVESTED				YIE	
YEAR	IRRIGATED	NON-IRRIGATED	UPLAND	TOTAL	IRRIGATED	NON-IRRIGATED	UPLAND	TOTAL	IRRIGATED	NON-IRRIGATED
	thousand tons				thousand tons					tho
1961	1,450	1,840	415	3,075	960	1,560	678	3,198	1.51	1.11
1962	1,509	1,877	524	3,910	987	1,510	682	3,179	1.53	1.24
1963	1,589	1,812	566	3,967	1,013	1,451	697	3,161	1.57	1.25
1964	1,525	1,824	494	3,843	930	1,530	627	3,087	1.64	1.19
1965	1,578	1,914	500	3,992	958	1,607	634	3,199	1.65	1.19
1966	1,743	1,901	437	4,072	960	1,543	606	3,109	1.81	1.23
1967	1,004	1,659	372	4,094	1,171	1,460	445	3,096	1.59	1.25
1968	2,270	1,894	397	4,561	1,309	1,514	481	3,304	1.73	1.25
1969	2,545	1,549	351	4,455	1,483	1,407	441	3,332	1.72	1.10
1970	2,761	2,049	423	5,233	1,346	1,355	412	3,113	2.05	1.51
1971	2,931	2,038	374	5,343	1,471	1,277	365	3,113	1.99	1.70
1972	2,617	2,170	313	5,100	1,332	1,548	366	3,246	1.96	1.40
1973	2,344	2,344	342	4,415	1,241	1,436	435	3,111	1.89	1.20
1974	3,015	2,194	385	5,594	1,494	1,534	409	3,437	2.02	1.43
1975	3,034	2,242	385	5,660	1,412	1,674	453	3,539	2.15	1.34
1976	3,370	2,449	340	6,159	1,495	1,695	390	3,580	2.25	1.45
1977	3,494	2,535	427	6,456	1,490	1,657	400	3,547	2.35	1.53
1978	3,934	2,497	464	6,895	1,515	1,581	413	3,509	2.60	1.58
1979	4,026	2,706	465	7,197	1,466	1,581	422	3,469	2.75	1.71
1980	4,151	2,732	475	7,358	1,472	1,535	420	3,427	2.82	1.78

Estimates only
Source: Bureau of Agricultural Economics
FAO Monthly Bulletin of Statistics, Vol. 1, February, 1978.

Table 3. Paddy production, area harvested and yield, 1961-1980.

TABLE 4. GROWTH RATES OF PADDY PRODUCTION, YIELDS, AND HARVEST AREAS, 1960-1979.

	% GROWTH RATE PER ANNUM		
	1960-66	1967-73	197479
PRODUCTION			
1. Total	1.5	1.6	8.8
2. Irrigated	2.8	4.9	9.9
3. Rainfed Lowland	2.7	(0.1)	8.0
4. Upland	(4.2)	(2 7)	5.9
YIELDS			
1. All crop type	2.5	1.5	6.8
2. Irrigated	3.9	(0 9)	6.5
3. Rainfed Lowland	2.0	0.7	6.3
4. Upland	(1.3)	2.3	6.2
HARVEST AREAS			
1. Total	0.9	0.1	1.9
2. Irrigated	(0.8)	6.4	3.3
3. Rainfed Lowland	0.7	(0.7)	1.7
4. Upland	(3.3)	(3.7)	2.8

Source: Bureau of Agricultural Economics.

Since 1974, rice production increased by 63 percent, with an average growth rate of 8.8

percent - a record accomplishment compared with 1.6 percent annual growth in total production from 1967-1973. The disparity is due primarily to the 28 typhoons that occurred within a period of four months in 1971, the disease infestation in 1972 and floods that reduced the production for the year by 13 percent.

Since 1980, rice production has grown at the negligible rate of 0.1 percent leading to rice imports in 1984 and 1985 (Fig. 1). Strong typhoons damaged the 1980 crop in Central Luzon and Cagayan. The sharp reduction in 1982-1983 rice production was due to severe drought from November 1982 to June 1983, particularly in the Visayas and Mindanao. Drought also affected the 1983-1984 crop as planting in the 1983 wet season was delayed and the low water levels in many Luzons reservoirs limited supply of water during the dry season of 1984.

SOURCE OF YIELD GROWTH

Among the factors accounting for past yield growth were: adoption of modern varieties, increased use of fertilizer and expansion of irrigation. Within five years of the introduction of modern varieties in 1966, 50 percent of the rice was already planted to modern varieties. Adoption continued to increase in the subsequent period.

Irrigated area expanded from 35 to 47 percent from 1965 to 1980. Growth in irrigation investments was much more rapid because a significant share of this was for rehabilitation to increase quality of irrigation.

Fertilizer per hectare used in rice increased from about 10 kgs. of NPK per hectare in 1965 to almost 40 kgs. by the early 1980s. Fertilizer use rose steeply as modern rice varieties were rapidly adopted and irrigated area expanded.

Despite the unfavorable weather and problems with irrigation quality from 1980 to 1984, average yields continue to increase at a high rate (Table 5). The high growth rate in

upland yields in the 1980-1984 may not represent a true picture since the substantial increase occurred only in one year, 1984. It is in the rainfed areas where yield performance appears to have steadily improved as growth in yields rose to 4.5 percent. The yields of rainfed rice in 1984 are nearly 70 percent higher than those in the late 1960s when the size of rainfed crop area was about the same.

TABLE 5. GROWTH RATES OF PADDY PRODUCTION, AREA AND YIELD IN IRRIGATED, RAINFED AND UPLAND AREAS IN THE PHLIPPINES, 1955-1984..

	OUTPUT	AREA	YIELD
Irrigated			
1955* - 65*	5.4	5.3	0.1
1965* - 80*	7.0	3.5	3 5
1980/84	2.2	1.0	1.2
Rainfed			
1955* - 65*	0.8	1.0	-0.2
1965* - 80*	2.9	0.3	2.6
1980/84	-1.4	-5.9	4.5
Upland			
1955* - 65*	-1.0	-1.6	0.6
1965* - 80*	-1.8	-3.8	2.0
1980/84	-10.0	-13.0	3.0

*** Three-year average centered at year shown.**

Source of basic data: Bureau of Agricultural Economics, Philippines.

GOVERNMENT RESPONSE TO PRODUCTION INSTABILITY

The Agricultural Credit Program

The extension of agricultural credit to farm produce has been a policy instrument used to stimulate growth of rice farm incomes. Granting farmers access to institutional sources of credit at liberal terms promotes adoption of innovative practices and increases farm productivity and income.

Significant to reach Philippine farm producers with institutional credit commenced in 1952. Due to a threatening political situation in Central Luzon, the Agricultural Credit and Cooperative Financing Administration (ACCFA) was established under Republic Act (RA) 821 to extend unsecured production loans to rice farmers. Low repayment of loans threatened the existence of the institution. In 1962, it was reorganized into the Agricultural Credit Administration (ACA), to serve the credit needs of land reform beneficiaries. Also in 1952, RA 720 was passed in response to the needs of small farmers.

The Supervised Credit Approach

The approach widely used to reach rice farmers has been institutional credit. The scheme provides production loans according to a farm plan and budget and technical guidance and supervision of the borrowers by the production technicians.

The experience gained in this approach marked the beginning of wide adoption of the supervised credit in the stimulating agricultural development, including the national drive for rice self-sufficiency represented in the Masagana 99 program.

The Masagana 99 Program

In 1973, the Masagana 99 was launched to increase rice farm productivity and income. It

was a government-supported rice production program involving a package of technology, supervised credit, seed productivity and distribution, fertilizer allocation and distribution system, intensified extension services, intensified pest and disease control campaign and massive information and educational campaign.

Rice farm production increased with the program. In the Masagana 99 years (1974-1979), rice production grew at the rate of 8.8 percent per annum against the traditional growth rates of 1.5 percent 1.6 percent from 1960-73. The country achieved self-suffiency in rice during the program years. In addition, the country reversed its position in the rice market from a traditional importer to an exporter four years after the inception of the program. The country exported rice starting in 1977 and reached an export level of 190,000 metric tons in 1979.

In the 1980's, the world rice market and domestic economic conditions were entirely different. There was a minor rice production shorfall in 1980. Total rice consumption remained below total production and average per capita availability was maintained without importing. To help farmers affected by the unfavorable weather condition, the National Food Authority distributed rice on credit by drawing on the large stocks accumulated through the late 1970s. This approach prevented rice prices from rising and prevented farmers from increasing production.

In 1982-1983, a more serious production shortfall occurred. Government stocks were already at a low level. More limiting factors were the serious balance of payments, foreign debt, inflation and public deficit problems confronting the nation. The country imported rice to maintain per-capita availability to consumers. Foreign exchange constraints reduced and delayed fertilizer imports. Expansion of irrigations and other farm support were affected. The prices of fertilizer, labor, agricultural chemicals and other farm inputs were much less favorable in 1980-1984 compared to the period 1970-1979.

An intensified Rice Production Program (RPEP) was launched in 1984 followed by the Rice Action Program (RAP) to provide cheap credit but disbursed only 15 percent in real terms of what was disbursed at the peak of the Masagana 99 program in 1974. These factors have limited profitability of rice farming and prolonged the period of recovery from the 1980's weather problems compared to the 1973-1974 period.

TRENDS IN RICE PRODUCTION IN THE FUTURE

Clearly, there is a need to intensify rice production in existing cultivable lands. Crop area in rice continues to decline and is currently equal to the rice crop area in the early 1960s when population was only 60 percent of current levels. The main concern over the next two decades will be how to grow more rice on less land. The productivity of existing rice land must be increased but, simultaneously, its fertility must be sustained and the environment protected.

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