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ECONOMIC DATA COLLECTION AND ANALYSIS FOR FIELD TRIALS IN CROPPING SYSTEMS RESEARCH

The objective of this paper is to present a simple set of guidelines to the collection and early analysis of cropping systems trials in farmers' fields. In the interest of making the outlined procedures easy to use certain liberties have been taken with economic theory and definitions. A person with little or no economic training should be able to follow the procedures outlined and end up with a fair understanding of the economic implications of his research. The guidelines given here in no way replace the analysis that an experienced economist could make and it is recommended that one be involved in the research from the very beginning of the work.

The paper has two major sections. The first section discusses collecting data and its use, emphasizing problem areas and possible alternatives. The second section works through an example using actual data.

FIRST SURVEY

There is a practice in cropping systems program to make the first study of a new site a complete baseline survey. The survey takes a month or more to complete and the analysis is finished 6 months to a year later. As a result its only real use is an estimate of what characteristics the village had when the program started. What is needed is a quick study completed in three weeks which will help the researchers make rational decisions regarding the first year's work.

The first survey should take no more than one week leaving two weeks for analysis and some verification. No village is an unknow. People living in the village and associated with it have considerable knowledge of it. The first study draws on this knowledge. The head of the village, merchants, government officials, and a few farmers can give a fairly complete general understanding of a village. Truly accurate data only comes after the confidence of the people is secured.

The first study or picture of the village is like a sketch with only a few very important features clearly outlined the rest showing general features. Later after much work a complete picture of the village can be drawn.

The first survey should identify the following:

<u>Physical characteristics</u>

- Soil type and characteristics
- Rainfall pattern
- Watertable rainy season, dry season
- Topography

Social characteristics

- Family size
- Schooling
- Farm work done by women and children
- Exchange labor patterns

Cropping pattern: major cropping patterns

- Yield of crops
- Dates planted and harvested
- Varieties
- Fertilizer
- Insecticides
- Herbicides

Do large medium and small farmers grow same pattern. If not what pattern.

Different patterns on different topography

The major crops describe all activities used in their production and expected yields.

Power source

Livestock owned

What caused lowering of yields in last few years.

Economic characteristics

Off-farm work: When, where, pay, who?
Credit sources and use
Market infrastructure
Prices received for crops last year
Prices paid for inputs
Farm sizes
Land tenure and sharing arrangements

The results of the first study are put together in the form of a report which describes the major characteristics of the village but has no or very little quantitative data or analysis. Within three weeks the researchers have an idea of resources, characteristics, constraints, current cropping patterns classified by a few economic and physical characteristics and a knowledge of what changes the farmers want.

Later studies will have to be carried out but each study can be designed to answer a specific question. Each small study can be carried out in a short time and the analysis completed before another study started. In this way the collection of data can be kept under control and balanced against analysis ability and time.

A single coding system can be used for numbering farmers and fields so if at some future date an integrated analysis is wanted there will be a minimum of trouble. It is recommended that the same group of farmers be interviewed for specific studies so cross tabulated analysis is possible. If a specific study on credit is finished it can be cross tabulated with cropping pattern, soil type, etc. without having to ask the farmer all those background questions. However, it should be stressed that any further survey should be in response to a specific problem and the analysis completed before starting to explore interesting side effects and possible interactions.

In designing specific studies it is strongly recommended that the questionnaire be coded so each answer has a specific number or group of numbers. There should be a different code for no answer, don't know and zero as all three usually get a blank or zero and so are impossible to separate later.

CROPPING PATTERN TRIAL

In the cropping pattern trial daily log all resources used on the trial plot are recorded and in conjunction with the crop record sheet quantified. Labor can be standardized for some operations. Which time data is to be collected should be decided before the data collection starts. Prices and other data required will be discussed later.

Recording the activities

In this section the collection of data for each operation, material supply, power source and the product will be outlined. Since labor is a major variable input with a high degree of variability the discussion will start with it.

Man-hours. There are many methods used to record labor use. The simplest method is to sum the hours of work and multiply by the number of people working. Three people working two hours equals six labor hours. An implicit assumption in this approach is that anyone working at that particular job does the same amount of work. If this assumption is not acceptable, man equivalents can be used but must be used in the whole study. In collecting labor hours there is a question of what hours to collect. A man leaves his house at 6 a.m. and gets to the field at 6:30 a.m. He plows until 9:30 a.m., rests for 30 minutes and continues plowing until 11:30 arriving home at noon. How many hours has he plowed? The answer can range from 4.5 to 6 hours. The normal procedure is to record starting and finishing times including normal breaks and rest periods. In the example record 5 hours. Man-days is a subjective standard that is accepted at 8 hours of labor. If some other number is used be sure to state this but there is really little to be gained by choosing another standard and a great deal of confusion could result.

Man-equivalents are based on ability to do hard physical work. Many operations in the production of a crop do not require great physical strength. The use of man equivalents can lead to a serious under estimation of labor requirements. Many fourteen year old girls can transplant and harvest as much rice as a man in a normal working day. Except for land preparation by hand there are many advantages for using man hours as the unit of measuring labor.

Operations

Clearing residues. Record the time required to clear the field and charge it to the next crop.

Plowing, harrowing and seedbed preparation. Record the actual hours including normal rest periods. The number of plowings or harrowings is subjective but a simple approach is to assume one plowing includes any number of passes as long as there is not a time break of three or more days. In the analysis total hours will be used unless management is being considered in which case the land is left a few days for weed growth or a change in soil moisture condition.

Planting and transplanting. These operations have less variation in them and standard times for the particular type of planting can be established and used.

Replanting and thinning. Actual time is needed.

Fertilization. Hours spend fertilizing make up such as small percent of total hours that three standards are sufficient, basal, early topdressing and late topdressing.

Chemical application. When the crop is small one standard labor requirement and a second when the crop is larger is adequate.

Non-chemical pest control. Actual time is needed.

All other operations should have actual labor hours recorded.

Harvesting time should include cutting or pickling, bundling and carrying product from the field. It should not include threshing, winnowing, sorting or any subsequent operation.

Materials

The materials used should have standard price usually dealer quoted even if there was a shift in price during the year. The % A.I. should be noted when the chemical is used.

Power

The number of hours should include rest time if animals but not time travelling to and from field. If the work is hired the cost of labor should be subtracted off power and added to labor. It should be noted whether power is animal or type of tractor under TYPE. If the animal power is hired and price includes labor subtract and put the labor under labor hours and cost.

Production

Amount per plot can be obtained two ways, sample or measure yield from whole plot. Usually the sample or crop cut is 10 to 20% higher than total plot yield. Whichever method is chosen all plots must be handled the same way. The product price to farmer is farm gate price, market price minus cost of transportation. Market price at time of harvest can also be used. Even if the product is not sold at harvest use market price at harvest. A later price measures storage costs and possible speculative gains or losses.

ANALYSIS

Although the cropping pattern tested may be profitable it may have a high cash risk. Assume two cropping patterns have been tested with the following results:

	Pattern	
	I	III
Material	500	3,000
Labor and power	2,500	3,000
Variable cost	3,000	6,000
Gross return	5,000	9,000
Net return	2,000	3,000

Pattern II has 50% more net return than pattern I and appears the one to choose. These figures are based on a good crop. Assume a bad crop where there is no yield. The next year can the farmer pay his debts and make money assuming interest at 10%.

The calculation is:

1st year		
Material	500	3,000
2 years interest	100	600
2nd year		
Material	500	3,000
Labor & power	2,500	3,000
Sum of costs	3,600	9,600

Return	5,000	9,000
Net over summed costs	1,400	- 600

This example assumes the farmer supplies his own labor and power. If Pattern II has a failure it takes the farmer at least 3 years to recover while pattern I allows him to recover the next year. Pattern II is a high risk pattern and is not likely to be accepted by small poor or conservative farmers.

Stability of a pattern is important. If the C.V.'s calculated on the summary pages are very high, that is the first sign that the pattern may not be stable. If the high variability occurs in an input the researcher should be able to explain it and decide if it is acceptable or needs further research. If the yield or gross returns have high variability the pattern is usually not acceptable. The net return variability is a combination of variability of costs and gross returns. It is a good test of the pattern but does not indicate where the variability comes from.

There is a basic principle of ratios used in many economic analysis. If we are discussing yields it is per hectare, that is, the denominator is land. We can change the denominator and use each of the factors involved in the production of a crop. Some ratios to consider are yield/ha, yield/man-hour, yield/animal-hour, yield/cash input, yield/cm rain, yield/cm irrigation water, yield/day. Each of these ratios can only be used for a single crop. When considering a pattern with different crops do not add the yields. Convert the yields to gross returns by multiplying each yield by the price the farmer receives then add. Then each of the ratios can be calculated for the pattern. If food value is important another method of analysis is to convert each crop to carbohydrate and protein production per hectare. Carbohydrate and protein values of crops can be found in nutrition handbooks such as Morrisons, Feeds and Feeding or Food Values of Indian Feed Stuffs. The values for different crops in a pattern can be added and compared in absolute values or in ratios such as those mentioned above.

The flow of resources into and out of a cropping pattern often prove very useful in analysis. A bar graph showing labor use by week or month can easily demonstrate labor peaks which may be a constraint. Cash requirements of a pattern in a bar graph clearly show when credit will be needed. A bar graph showing production value over time indicates when the income occurs and so when the credit can be paid back. A further step is to record all income and expenses of a family to produce a cash flow graph over one year. This may show that family expenses may take all the product of the first crop and debts cannot be paid until the sale of the second crop. Credit requirements would thus be very different.

If all the above analysis are run comparing two patterns each will show certain advantages over the other. To make a decision a set of criteria with priorities is required. Usually net profit is first. If one pattern has a loss the other is likely to be more acceptable to farmers. Does one pattern require more of a single resource than the

farmer has available. But remember the farmer can usually rent a resource for a price. Does it pay to rent this resource at current rental values, such as hiring labor or borrowing money. In the test of cash risk would a crop failure cause a farmer who borrowed money to lose his farm. There is no one test which decides which pattern is better. Each test shows one aspect and the final decision is subjective. The more time spent on analysis the more the researcher comes to understand the pattern and so the more likely to make better decisions.

If nine months have been spent growing a cropping pattern and recording data the researcher owes it to himself and those who put their time and money into the test to give as complete an analysis as possible.

Example of Data Recording and Analysis

In this section data from a cropping pattern in Iloilo will be followed through to analysis. The cropping pattern was rice (IR26) followed by sorghum (Cosor 3). First the cropping pattern trial daily log will be reviewed explaining some of the problems encountered and how they were handled. The cost and returns of cropping pattern trial plot summary follows with the review of assumptions and calculations. These data are then transferred to the cost and returns of cropping pattern trials pattern summary and the labor requirements of cropping pattern trial crops summary. The section ends with further analysis procedures using the data of this example.

Cropping Pattern Trial Daily Log

On the second and third of the 16th week (2 and 3/16), the land was plowed. Since the field is only 960 m^2, it is clear several passes were made but for economic and management use, this is considered one plowing. The field was left for 16 days and plowed again. On the 6 and 7/10 the field was harrowed many times to break up the clods. The field was left 21 days then plowed again. Since we do not have a cost for seedlings we have put the cost of the nursery into seedbed preparation. The seeds used in the nursery plus some other activity (including the small amounts of fertilizer) all within the 24th and 25th week have all been put under seedbed preparation. It is much better to use cost per seeding after taking the actual calculations from several nurseries. The farmer left the field 3 weeks and then plowed again in the 25th week. This is the fourth plowing. By the 26th week adequate water was available and the farmer was busy leveling the field up to the 27th week. On the third of the 27th, 12 man-hours were spent pulling the seedlings; normally this would have been included in the cost of seedlings. They were then planted the same day and fertilizer applied. Note that 6.5 labor hours were used in putting out the strings and sticks to ensure the rice was seeded in straight rows. One week after the field was seeded the farmer harrowed it many times taking 8 hours. Although the field records show this as a leveling operation it is quite likely that it was also to control weeds. Leveling was chosen to follow what the field records stated, but a follow-up question should be made.

The field reparis on the 4/27, 4/29, and &30 are all repairing the bunds of the field. The fertilizer and insecticides applied show that near the end they were receiving considerable insect damage. Note that 3 weeks before harvest an insecticide was applied.

After the harvest of rice the farmer left the field for 6 weeks before the first plowing for the sorghum crop in week 47. In that week the farmer went over the fields both plowing and harrowing many times and it was really arbitrary as to the number of plowings and the number of harrowings. The final activities are relatively straightforward -- the farmer fertilized, planted, used insecticide, herbicide, had to replant two weeks later, put more fertilizer on week after replanting, did a little bit of cultivation, finally used Azodrin 4 weeks before harvest, and harvested in the 9th week.

Cost and returns for cropping pattern trial plot summary

First, we will consider the labor cost. The first plowing occurred in the week 16 and the plowing which occurred on the second and third days have been combined to give a total of 8 hours per plot. Since the plot is 960 sq m or .096 ha, we divide it by .096 and get approximately 83. Throughout this example we have assumed that labor costs 1 peso per hour for both animal and human labor. Later in the analysis different prices of human labor will be discussed. In this example, first plowing required 83 man-hours/ha and cost 73/ha. The second plowing is very straightforward. It occurred in the 6th day of the 18th week, took 3.5 hours or 37 hours/ha and so cost 37/ha. The first harrowing occurred on the 6th and 7th/19 and took 10.5 hours for the plot or 109 man-hours/ha. Since there was no intertillage we have used that line to put in the third plowing which occurred on the 22nd week and the fourth plowing under other on the 25th week. As the data on seedling cost was not collected our seedbed preparation figure becomes quite large. The rationale for taking this approach is that none of the major management factors of land preparation such as plowing and harrowing have been lost and the total land preparation comes out the same at 90.5hours for the plot or 942 hours/ha. The planting or transplanting is relatively straightforward occurring in week 27 and can be found directly on the daily log. The replanting occurred in week 21 and took 1 hour. At the same time that the replanting was done a small amount of handweeding was done. The application of fertilizers, insecticides and herbicides has been shown here in the actual figures. The first fertilization took .2 hours or 12 minutes. If a farmer's neighbor had come over to chat with him for a few minutes, the time spent on fertilization could have easily been doubled. It is much better on activities which take only a few minutes to use a standard as the reliability of field data unless it is accurately recorded with a watch under supervision is likely to be erroneous. The second insecticide application in week 37 took one hour using granules. A different standard will be used for spraying and applying granules. The harvesting on the 41st week completes the labor hours for the crop of rice.

The approach taken in combining the same activity which occurs on different dates is that we are looking at it as a single operation until completed. The farmer was out to plow a field to get the soil to a cer-

tain condition. He may have to plow the field on three consecutive days to get it to that stage in which case we will consider this as one plowing. He may have made several passes or many passes but it is a single plowing to achieve a certain soil condition. By using this approach, we do not know the number of passes that had been made on the field and the assumption is, this information is extremely difficult to get accurately, and so we are better off not to pretend that we are getting something we are not.

On the right hand side of the labor page is the sorghum crop. All of the plowing activities had been put into 1 row under week 47. Actually plowing occurred on 4 separate days and harrowing on 4 separate days. The farmer really went out to the field on the first day of the 47th week and proceeded to work the land nearly everyday until he had a proper seedbed in which to start planting, thus it has been one continual operation and has been combined to show this. The harrowing was separated into two as the final harrowing occurs 4 days after the previous plowing which may have given some time for weed growth. The planting and cultivation which occurred on the sorghum are straightforward direct transfers from the daily log as are fertilization and insecticide application.

The total labor use is the summation of total land preparation, total planting, total weeding, total other care and total harvesting for both rice and the sorghum crop.

On the opposite side of the page under material, it is relatively straightforward to take daily log data and transfer it to the appropriate columns such as seed use of 8 kg divided by .096 to give 83 kilos/ha. The cost per 1 kilo is multiplied by the amount of seed/ha and that gives the cost per ha. The one area which may lead to some confusion is under total N, total P, and total K. The only column which is filled in is active ingredient per ha. The calculations for rice were made in the following manner:

For N:	.12 x 32.5	=	3.9
	.16 x 100	=	16.0
	.21 x 166	=	34.86
			54.76
For P:	.12 x 32.5	=	3.9
	.20 x 100	=	20.0
			23.9
For K:	.12 x 32.5	=	3.9

The only column which is summed under total material is the last column cost/ha which in this case comes to 816. Under power in this example the farmer only uses animal power. So we have simply summed all of the plowing giving 15.5 hours for the plots or 161 hours per ha costing 161. If both animal and tractor power had been used you would not sum the hours per ha.

The final production is simply the yield/ha times the farm price per unit giving the total value of the crop or the gross returns.

The summary of costs and returns per ha in the final block is simply transfering data from the other side of the page to this side to get an initial understanding of how the crop has performed economically. The yield is taken directly off production as is the value which is in the second column called gross returns. The third row is labor and power costs which is the summation of 2,320 for labor and 630 for power giving 2,950. The material cost is transferred from above, total material 816. Total variable cost is the summation of labor and power cost plus material cost giving 3,776. Returns above variable cost are gross returns minus total variable cost in this case giving a loss of 26. Returns to labor and power cost are gross returns minus the material cost taking that anser and dividing it by the total labor and power cost. This gives you the average return on one unit spent on labor and power. The final column is returns to material cost, which is gross returns minus labor and power cost that answer divided by material cost which gives you a return per one unit spent on materials. In both cases the answer is less than one. One is a break-even point meaning that you put in one unit and you got 1 unit. Here we put in 1 unit and on labor and power got back .99 while on material we put in 1 unit and got back .97. Even though there was loss it appears that labor was used a little more efficiently than material in the production of rice. In comparing with the second crop, sorghum, there was a positive return above variable cost of 397, but in this case the return to material cost was higher than the return to labor and power indicating that materials were used more efficiently.

Labor Requirements on Cropping Pattern
Trial Crop Summary

On this page we summarized all of the cost for all of the crops grown in a single trial, that is, all the rice crops grown in a test pattern are put on this page for comparison and analysis. On the first page with rice plot, row 1 is taken from the summary cost and returns data.

Land preparation, the first item is number of plowings, the second column is number of harrowings and then we have total land preparation time, 942, and the total cost. Since we used the rate of 1 per hour it is 942. Planting is taken directly of total planting time on the cost and returns plot summary, 328. All of the information is transferred to get single line for plot no. 1. At the bottom of the page, we summarized the data for the pattern using the total hours, the number of observations, the mean standard dviation and coefficient of variation. The last row is percent of total. This row cannot be calculated until all of the information has been filled in. Using total time or the mean time for the base find the percent for each of the activity. Thus for harvesting it is 983 divided by 2,252 times 100 to give 44. In this case since the cost per unit is 1, the time and cost are identical. If we had used a different wage rate for different activities, the two would not be the same. Harvesting and land preparation used 84 percent of the total labor involved in

production of this rice crop. From this page you start to get an erstanding of which activity in the production of a crop are relatively ble and which vary a great deal. In our example weeding has a very high . over 100 percent indicating that there is a great variation on the erimental plots in regard to weeding. The term share value under vesting has been added in case the harvesters receive a share of the . If this is the case the harvested share may not have been included iously and here can be added as a monetary unit. On the second labor irement crop summary sheet for sorghum the first plot is again copied the example being used. All of the data comes directly from the crop and returns patterns trial plot summary. In this example 63 percent abor went to harvesting and only 25 percent to land preparation. The l printed sheet cost and returns of cropping pattern trials pattern ary is again taken from the cost and returns plot summary. Plot No. 1 aken from our example, the other four are added to show how the numbers he bottom of the page are arrived at. The first crop is rice and the ers can be taken directly from the crop plot summary. Labor and power che summation taken from the summary. This page gives a summary of how whole pattern did. The third set of numbers is the summation of crop and two. On this page we are particularly interested in the stability he system, that is how high are the cv's, in addition to the mean profits the whole pattern. From this we can then compare 1 pattern to another.

her analysis

Usually in cropping systems we are comparing one pattern with another. me that the farmer's existing pattern has the following characteristics: rows one crop of rice each year with the yield of 2,300 kg; he applies g of nitrogen per ha and sprays twice with Azodrin. He has limited preparation and his harvest cost is far less due to lower yields. His l labor and power cost come to 1,360 per year. In the following data ompare the two cropping patterns and analyze the cash risk characteristics he two patterns:

	R-S	R
Gross return	7,232	2,070
Material cost	1,893	205
Labor and power	4,620	1,360
Net return	716	505
1st year		
Material cost	1,893	205
2-year interest	379	41
2nd year		
Material cost	1,893	205
Interest	189	20
Labor and power	4,620	1,360
Sum of costs	8,974	1,831
Gross return	7,232	2,070
Net	-1,742	239

Gross returns on the pattern that we have studied came to 7,232 while the farmer's present pattern is only 2,070. The net returns, however are only 211 different. What is the effect of a crop failure. This is one quick analysis of the cash, risk characteristics of cropping patterns. We see that by the end of the second year the total cost of the rice-sorghum pattern comes to 8,974 while the single rice crop comes to 1,831. The net return shows a very great difference in the two patterns. The rice-sorghum pattern has lost the farmer 1,742 while the rice system is still profitable. This would be one further test to find if the farmer is likely to be interested in the new pattern as it is currently being tested.

Another simple analysis we can make is the break even price of the two crops. If we look first at the rice crop the total variable cost was 3,509 divided by the yield of 4,022 gives a break-even price of .87. If the price of rice drops .03, there will be no profit. The rice in this pattern has a very close margin and cannot stand any price reduction at all. On the crop of sorghum the break even price is .75. This indicates that the price can drop from .9 to .75 before a loss occurs. Thus sorghum has greater price flexibility than the rice crop. In the example above using just a rice crop alone, the total cost come to 1,565 baht divided by 2,070 equals .75. With the farmer's current system, he could withstand a price reduction of .15 before he would start to lose money. Sorghum and the farmer's traditional rice system have greater stability than the first rice crop in the rice-sorghum pattern. The break even price that has been calculated above is also the cost of producing 1 kg of each of the commodities.

Another simple analysis is the number of hours that it takes to produce one unit of production. In our first crop on the rice-sorghum pattern we have 2,320 hours of labor to produce 4,156 kg or rice. Dividing the number of hours by the kg of product and multiplying by 60 gives 34 minutes, that is, it requires 34 minutes of labor to produce 1 kg of rice. The sorghum required 23 minutes of labor to produce 1 kg. In the farmer's example where he is only growing 1 crop of rice he spent 900 hours of labor and got a yield of 2,300 kg so his present pattern requires 39 minutes of labor to produce 1 kg of rice.

STANDARDS

Actual man-hours from labor use studies conducted in the area are the best source of man-hours standards. If none are available for the area where the cropping systems site is located other studies within the country conducted on a similar soil are the second best source. If none of these area availaboe the following list gives labor hours per hectare for various operations based on Philippine data.

	Hours per hectare
Plowing with two animals	36 - 72
Harrowing two animals, harrow 1.5 m	15 - 35
Furrowing two animals 1.5 m	20 - 35
Leveling puddled field two animals 2 m	10 - 25
Hand spade or hoe	350 - 500
Transplanting rice	200 - 350
Fertilization basal	4 - 12
Broadcast rice	4 - 8
Planting corn hills	35 - 60
Planting other in rows	30 - 60
Fertilization topdress broadcast	5 - 12
Fertilization topdress band	10 - 20
Spraying insecticide (dependent upon foliage)	6 - 40
Broadcasting granules	5 - 15
Harvesting rice panicles	200 - 300
Harvesting rice sickle	60 - 140
Harvesting corn	40 - 80
Harvesting mung	300 - 500
Harvesting peanuts	400 - 600
Harvesting cowpea (green)	500 - 1,000
Harvesting sorghum	150 - 250

These data should only be used as a guide and actual data obtained as early as feasible.

COST AND [illegible] MATERIALS
[illegible]

Country _____ Program _____ Site _____
Farmer _____ Plot _____ Plot [illegible] _____

ITEMS	1st crop:					[illegible]				
LABOR	wk no	wk plot	[illegible]	[illegible]	[illegible]	wk no	[illegible]	[illegible]	[illegible]	[illegible]
Plowing 1	16	0.8	83	1	83					
Plowing 2	18	3.5	37	1	[illegible]	47	27.2	283	1	283
Harrowing 1	19	10.5	109	1	109	[illegible]	6.8	71	1	71
Harrowing 2						48	5	52	1	52
Seedbed prep.	27	.49	512		512					
Intertillage Plowing 3	22	2	20	1	20					
(Other) Plowing 4	25	2	20	1	20					
Fixing bunds	29	15.5	161	1	161					
TOTAL LAND PREPARATION		90.5	942		942		39	406		406
Planting/Transp.	27	30.5	318	1	318	48	4	42	1	42
Replanting	31	1	10	1	10	51	.7	7	1	7
Thinning										
TOTAL PLANTING		31.5	328		328		4.7	49		49
Handweeding 1	31	2	20	1	20					
Handweeding 2										
Cultivation 1						1	4	42	1	42
Cultivation 2										
(Other)										
TOTAL WEEDING		2	20		20		4	42		42
Fertilization 1	27	.2	2	1	2	48	.9	9	1	9
Fertilization 2	32	.2	2	1	2	52	3.8	40	1	40
Insecticide Ap. 1	28	.2	2	1	2	48	1	10	1	10
Insecticide Ap. 2	37	1	10	1	10	05	3.1	32	1	32
Herbicide Ap. 1	28	.2	2	1	2	48	3	31	1	31
Herbicide Ap. 2										
Nonchem. Pest Cont.										
Mulching										
Watering										
Draining										
Canopy manipulation										
(Other)Fert. 3	36	.2	2	1	2					
Insect	38	.2	2	1	2					
TOTAL OTHER CARE		2.1	22		22		11.8	123		123
Harvesting 1	41	96.6	1006	1	1006	09	97	1010	1	1010
Harvesting 2										
Harvesting 3										
TOTAL HARVESTING		96.6	1006		1006		97	1010		1010
TOTAL LABOR		222.7	2320		2320		156.5	1630		1630

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[illegible]	1st crop					2nd crop				
MATERIAL	kind	amt. plot	amt. ha	A.I. ha	Cost ha	kind	amt. plot	amt. ha	A.I. ha	Cost ha
Seed										
Fertilizer 1										
Fertilizer 2										
Total N										
Total P										
Total K										
Insecticide 1										
Insecticide 2										
Herbicide 1										
Herbicide 2										
Fungicide 1										
(Others)										
TOTAL MATERIAL										
POWER	TYPE	hrs/plot	hrs/ha	cost/hr	cost/ha	TYPE	hrs/plot	hrs/ha	cost/hr	cost/ha
Plowing 1										
Plowing 2										
Harrowing 1										
Harrowing 2										
(Others)										
TOTAL POWER										
PRODUCTION	Gr.	Amt/Plot	Amt./ha	Price/Unit	Value	Gr.	Amt./Plot	Amt/ha	Price/unit	Value/ha
Harvest 1										
Harvest 2										
Harvest 3										
TOTAL PRODUCTION										

SUMMARY OF COSTS AND RETURNS PER HECTARE

	1st crop	2nd crop	All Crops
Yield			
Gross Returns			
Labor & Power Cost			
Material Cost			
Total Variable Costs			
Returns Above Variable Costs			
Returns to Labor & Power Costs			
Returns to Material Cost			

COSTS AND RETURNS OF CROPPING PATTERN TRIALS
PATTERN SUMMARY

Country _____ Program _____ Site _____ Year _____ Pattern _____

	FIRST CROP: pice								SECOND CROP: Sorghum								ALL CROPS						
		COSTS PER HA			RETURNS					COSTS PER HA			RETURNS				COSTS PER HA			RETURNS			
PLOT NO	YIELD /HA	LABOR POWER	MATE-RIALS	TOTAL VAR	GRO. /HA	NET /HA	TO L&P	TO MAT	YIELD /HA	LABOR POWER	MATE-RIALS	TOTAL VAR	GRO. /HA	NET /HA	TO L&P	TO MAT	LABOR POWER	MATE-RIALS	TOTAL VAR	GRO. /HA	NET /HA	TO L&P	TO MAT
1	4156	2950	816	3776	3740	-26	1.01	.97	4177	2015	1347	3362	3759	397	1.20	1.29	4965	2163	7138	7499	361	1.07	1.17
2	4002	2638	930	3586	3601	33	1.01	1.04	3950	1887	998	2885	3555	670	1.36	1.67	4525	1928	6453	7156	703	1.16	1.36
3	3864	2402	685	3087	3478	391	1.16	1.57	3870	1790	960	2750	3483	733	1.41	1.76	4192	1645	5837	7061	1124	1.27	1.68
4	4122	2780	803	3583	3710	127	1.05	1.16	4065	1940	1150	3090	3659	569	1.29	1.49	4720	1953	6673	7369	696	1.15	[illegible]
5	3970	2810	720	3530	3573	43	1.02	1.06	4002	1890	1054	2946	3602	656	1.35	1.62	4700	1776	6476	7175	699	1.15	1.59
TOTAL																							
NO.	5																						
MEAN	4022	2716	790	3509	3620	124	1.05	1.16	4012	1904	1102	3006	3611	605	1.32	1.57	4620	1893	6515	7232	716	1.16	1.39
S.D.	118	202	95	254	106	155	.06	..24	116	82	154	233	104	130	.03	.13	286	196	468	208	271	.07	.18
C.V.	3	7	12	7	3	125	6	21	3	4	14	8	3	21	6	11	6	10	7	3	38	6	13

LABOR REQUIREMENTS ON CROPPING PATTERN TRIALS
CROP SUMMARY

Country _____ Program _____ Site _____ Year _____ Crop Rice

PLOT NO	LAND PREPARATION				PLANTING		WEEDING				CHEM. AP.		OTHER CARE		HARVESTING					
	NO PL	NO. HA.	TOTAL TIME	TOTAL COST	TOTAL TIME	TOTAL COST	NO. HAND	NO. CULT	TOTAL TIME	TOTAL COST	TOTAL TIME	TOTAL COST	TOTAL TIME	TOTAL COST	TOTAL TIME	TIME VALUE	SHARE VALUE	TOTAL TIME	[illegible]	[illegible]
1	2	3	942	942	328	328	1	0	20	20	22	22	0	0	1006	1006	0	2320	2320	1
2	3	3	900	900	285	285	0	0	0	0	27	27	0	0	980	980	0	2192	2192	1
3	2	2	780	780	300	1	0	40	0		10	10	0	0	797	797	0	1927	1927	1
4	2	4	988	988	335	335	0	0	0	0	20	0	0	0	1100	1100	0	2443	2443	1
5	2	3	912	912	312	312	1		110	110	12	12	0	0	1034	1034	0	2380	2380	1
Mean	2.2	3	904	904	312	312	.6	0	34	34	18	18	0	0	983	983	0	2252	2252	1
TOTAL																				
NO.																				
S.D.	.45	.71	77	77	20	.20	.5		45	45	7	7			113	113		204	204	
C.V.	20	24	9	9	6	6	83		132	132	39	39			12	12		9	9	
% TOT			40	40	14	14	0		1	1	1	1			44	44		100	100	

LABOR REQUIREMENTS ON CROPPING PATTERN TRIALS
CROP SUMMARY

Country _____ Program _____ Site _____ Year _____ Crop Sorghum

PLOT NO	LAND PREPARATION				PLANTING		WEEDING				CHEM. AP.		OTHER CARE		HARVESTING			ALL LABOR		
	NO PL	NO. HA.	TOTAL TIME	TOTAL COST	TOTAL TIME	TOTAL COST	NO. HAND	NO. CULT	TOTAL TIME	TOTAL COST	TOTAL TIME	TOTAL COST	TOTAL TIME	TOTAL COST	TOTAL TIME	TIME VALUE	SHARE VALUE	TOTAL TIME	TOTAL COST	COST PR
1	3	1	406	406	49	49	0	1	42	42	123	123	0	0	1010	1010	0	1630	1630	1
2	3	1	388	388	42	42	0	1	56	56	81	81	0	0	884	884	0	1451	1451	1
3	2	1	364	364	44	44	0	1	30	30	30	30	0	0	840	840	0	1308	1308	1
4	2	2	375	375	46	46	0	1	75	75	150	150	0	0	1080	1080		1726	1726	1
5	3	1	410	410	43	43	0	1	38	38	78	78			976	976		1545	1545	1
Mean	2.6	1.2	389	389	49	49	0	1	48	48	92	92	0	0	958	958		1532	1532	1
TOTAL																				
NO.																				
S.D.	.55	.45	20	20	3	3	0		18	18	46	46	0	0	97	97		161	161	
C.V.	21	38	5	5	6	6			38	38	50	50			10	10		10	10	
% TOT			25	25	3	3			3	3	6	6			63	63		100	100	

CROPPING PATTERN TRIAL DAILY LOG

Country ____ Program ____ Site ____ Farmer ____ Plot ____ Crop ____ Crop position in pattern ____ Week ____

Supply information on field operations done since last visit, using the codes listed at the bottom of the page. If more than one operation has been done, use additional lines for the same date of visit.

Date of visit (xx/xx)	Time a.m. (xx)	Time p.m. (xx)	Rain since 6 a.m.? (x)	Soil moisture: Cracking scale (x)	Soil moisture: Moisture scale (x)	Soil moisture: Water depth (cm) (xxx)	Soil moisture: Wilting scale (x)	Sub-plot (no.) (xx)	Operation code (xxx)	On-going? (x)	Materials used: Code (xxxxxx)	Materials used: Amount (no., kg, cc) (xxx.xxx)	Materials used: Cost (P) (xxx)	Manpower: Time (h) (xx.x)	Manpower: Cost (P) (xxx)	Animal power: Time (h) (xx.x)	Animal power: Cost (P) (xxx)	Tractor/machine: Code (xxx)	Tractor/machine: Time (h) (xx.x)	Tractor/machine: Cost (P) (xxx)	Production: Apt (xx)	Production: [illegible] (xxx)	Unusual events, Remarks
2/16									PL1					4		4							
3/16									PL1					4		4							
6/18									PL2					3.5		3.5							
6/19									HA1					4.5									
7/19									HA1					6									Breaking clods
7/22									PL3					2		2							Breaking clods
2/24									SEE		Seed	8 kg		.4									
7/24									SEE					.45									
7/24									SEE					1									
2/25									SEE					7		6							
3/25									SEE					6		6							Leveling
3/25									SEE		12-12-12	3.12kg		.1									Leveling
7/25									PL4					2		2							
5/26									SEE					8		8							
6/26									SEE					8		8							leveling
1/27									SEE					8		8							leveling
																							leveling

OPERATION CODES

- CLEaring residue
- FIEld repairs
- PLowing 1
- PLowing 2, etc.
- HArrowing 1
- HArrowing 2, etc.
- SEEdbed prep.
- PLAnting and transplanting
- REPlanting
- THInning
- FERtilization
- INsecticide appl. 1
- INsecticide appl. 2, etc.
- HErbicide appl. 1
- HErbicide appl. 2, etc.
- nonchemical PESt control
- handWEeding 1
- handWEeding 2, etc.
- CUltivation 1 for weeds
- CUltivation 2 for weeds, etc.
- MULching
- WATering
- DRAining
- interTILlage for relay crop
- CANopy manipulation
- haRVesting 1
- haRVesting 2, etc.
- OTHer, specify under remarks

MATERIAL CODES (Enter first six letters of brand name of pesticides, or 6-digit formula of fertilizers, following the examples below. Leave blanks after short names.)

Fertilizer	*Insecticides*	*Herbicides*	*Other*
450000 162000 141414	AZODRIn FOLIDOl LANNATe FURADAn AGROXIde AGROCIde ENDRIN	MACHETe SATURN d 24D	ZNSO4 FESO4 ENDOX SEEDS SEEDLIngs
Fungicides			
BENLATe FUNGITox HINOSAn			

TRACTOR/MACHINERY/EQUIPMENT CODES

- TILler
- SMAll tractor
- LARge tractor
- ROTovator
- SEEdavator
- MCCormick thresher
- motorized PUMP
- OTHer, specify under remarks

(Optional items)

- MANual pump or apparatus
- WINd mill
- rotary WEEder
- SPRayer

CROPPING PATTERN TRIAL DAILY LOG

Country ____ Program ____ Site ____ Farmer ____ Plot ____ Crop ____ Crop position in pattern ____ Week ____

Date of visit (xx/xx)	Time a.m. (xx)	Time p.m. (xx)	Rain since 6 a.m.? (x)	Soil moisture: Cracking scale (x)	Soil moisture: Moisture scale (x)	Soil moisture: Water depth (cm) (xxx)	Soil moisture: Wilting scale (x)	Sub-plot (no.) (xx)	Operation code (xxx)	On-going? (x)	Materials used: Code (xxxxxx)	Materials used: Amount (no., kg, cc) (xxx.xxx)	Materials used: Cost (P) (xxx)	Manpower: Time (h) (xx.x)	Manpower: Cost (P) (xxx)	Animal power: Time (h) (xx.x)	Animal power: Cost (P) (xxx)	Tractor/machine: Code (xxx)	Tractor/machine: Time (h) (xx.x)	Tractor/machine: Cost (P) (xxx)	Pesticide: [illegible] (xxx)	Pesticide: [illegible] (xxx)	Unusual events, Remarks
2/27									SEE					4		4							Breaking clods
3/27									PLA					12									Pulling seedlings
3/27									PLA					12									
3/27									FER		162000	9.6 kg		.2									
3/27									PLA					6.5									Staking guides
4/27									FLE					8									[illegible]
7/27									HA3					8		8							Leveling
4/28									HE1		Machete	2.4		.15									
4/28									1N1		Furadan	3.2 kg		.15									
4/29									F1E					3									
7/30									F1E					3									
4/31									WE1					2									
4/31									F1E					1.5									
4/31									REP					1									
7/32									FER		21-0-0	7.98 kg		.2									
1/36									FER		21-0-0	7.98 kg		.15									

Supply information on field operations done since last visit, using the codes listed at the bottom of the page. If more than one operation has been done, use additional lines for the same date of visit.

OPERATION CODES

- CLEaring residue
- FIEld repairs
- PLowing 1
- PLowing 2, etc.
- HArrowing 1
- HArrowing 2, etc.
- SEEdbed prep.
- PLAnting and transplanting
- REPlanting
- TIInning
- FERtilization
- INsecticide appl. 1
- INsecticide appl. 2, etc.
- HErbicide appl. 1
- HErbicide appl. 2, etc.
- nonchemical PESt control
- handWEeding 1
- handWEeding 2, etc.
- CUltivation 1 for weeds
- CUltivation 2 for weeds, etc.
- MULching
- WATering
- DRAining
- interTILlage for relay crop
- CANopy manipulation
- haRVesting 1
- haRVesting 2, etc.
- OTHer, specify under remarks

MATERIAL CODES (Enter first six letters of brand name of pesticides, or 6-digit formula of fertilizers, following the examples below. Leave blanks after short names.)

Fertilizer	*Insecticides*	*Herbicides*	*Other*
450000 162000 141414	AZODRIn FOLIDOI LANNATe FURADAn AGROXIde AGROCIde ENDRIN	MACHETe SATURN d 24D	ZNSO4 FESO4 ENDOX SEEDS SEEDLIngs
Fungicides BUNLATe FUNGITox HINOSAn			

TRACTOR/MACHINERY/EQUIPMENT CODES

- TILler
- SMAll tractor
- LARge tractor
- ROTovator
- SEEdavator
- MCCormick thresher
- motorized PUMp
- OTHer, specify under remarks

(Optional items)

- MANual pump or apparatus
- WINd mill
- rotary WEEder
- SPRayer

[illegible] PATTERN TRIAL DAILY LOG

Country _____ Program _____ Site _____ Farmer _____ Plot _____ Crop _____ Crop position in pattern _____ Week _____

Date of visit (xx/xx)	Time a.m. (xx)	Time p.m. (xx)	Rain since 6 a.m.? (x)	Soil moisture: Cracking scale (x)	Soil moisture: Moisture scale (x)	Soil moisture: Water depth (cm) (xxx)	Soil moisture: Wilting scale (x)	Sub-plot (no.) (xx)	Operation code (xxx)	On-going? (x)	Materials used: Code (xxxxxx)	Materials used: Amount (no., kg, cc) (xxx.xx)	Materials used: Cost (P) (xxx)	Manpower: Time (h) (xx.x)	Manpower: Cost (P) (xxx)	Animal power: Time (h) (xx.x)	Animal power: Cost (P) (xxx)	Tractor/machine: Code (xxx)	Tractor/machine: Time (h) (xx.x)	Tractor/machine: Cost (P) (xxx)	Production: Yield (kg) (xxx)	Production: Value (P) (xxx)	Unusual events, Remarks
4/37									IN2		AZODRI	40 kg		1									
2/38									IN3		SEVIN	.03 l		.2									
2/41									RV1					96.6									
1/47									PL1					4.5		4.5					39[illegible]	39[illegible]	
2/47									PL1					5		5							
3/47									HA1					2									
4/47									HA1					2									Breaking
4/47									PL2					9		9							Breaking
7/47									HA1					1.8		1.8							
7/47									PL3					8.7		8.7							Breaking
4/48									HA2					1									
4/48									HA2					4		4							Breaking
4/48									FER		21-0-0	12.96kg		.3									Furrowing
4/48									FER		Phosph	28.8kg		.4									
4/48									FER		16-20-0	9.6 kg		.2									
5/48									PLA		SEED	4.8 kg		4									

Supply information on field operations done since last visit, using the codes listed at the bottom of the page. If more than one operation has been done, use additional lines for the same date of visit.

OPERATION CODES

CLEaring residue
FIEld repairs
PLowing 1
PLowing 2, etc.
HArrowing 1
HArrowing 2, etc.
SEEdbed prep.
PLAnting and transplanting
REPlanting
THInning
FERtilization
INsecticide appl. 1
INsecticide appl. 2, etc.
HErbicide appl. 1
HErbicide appl. 2, etc.
nonchemical PESt control
handWEeding 1
handWEeding 2, etc.
CUltivation 1 for weeds
CUltivation 2 for weeds, etc.
MULching
WATering
DRAining
interTILlage for relay crop
CANopy manipulation
haRVesting 1
haRVesting 2, etc.
OTHer, specify under remarks

MATERIAL CODES (Enter first six letters of brand name of pesticides, or 6-digit formula of fertilizers, following the examples below. Leave blanks after short names.)

Fertilizer: 450000, 162000, 141414

Fungicides: BENLATe, FUNGITox, HINOSAn

Insecticides: AZODRIn, FOLIDOl, LANNATe, FURADAn, AGROXIde, AGROCIde, ENDRIN

Herbicides: MACHETe, SATURN d, 24D

Other: ZNSO4, FESO4, ENDOX, SEEDS, SEEDLings

TRACTOR/MACHINERY/EQUIPMENT CODES

TILler
SMAll tractor
LARge tractor
ROTovator
SEEdavator
MCCormick thresher
motorized PUMp
OTHer, specify under remarks

(Optional items)
MANual pump or apparatus
WINd mill
rotary WEEder
SPRayer

CROPPING PATTERN TRIAL DAILY LOG

Country ____ Program ____ Site ____ Farmer ____ Plot ____ Crop ____ Crop position in pattern ____ Week ____

Date of visit (xx/xx)	Time a.m. (xx)	Time p.m. (xx)	Rain since 6 a.m.? (x)	Soil moisture: Cracking scale (x)	Soil moisture: Moisture scale (x)	Soil moisture: Water depth (cm) (xxx)	Soil moisture: Wilting scale (x)	Sub-plot (no.) (xx)	Operation code (xxx)	On-going? (x)	Materials used: Code (xxxxxx)	Materials used: Amount (no., kg, cc) (xxx.xxx)	Materials used: Cost (F) (xxx)	Manpower: Time (h) (xx.x)	Manpower: Cost (F) (xxx)	Animal power: Time (h) (xx.x)	Animal power: Cost (F) (xxx)	Tractor/machine: Code (xxx)	Tractor/machine: Time (h) (xx.x)	Tractor/machine: Cost (F) (xxx)	Protection: [illegible]	Protection: [illegible]	Unusual events, Remarks
5/48									IN1		FURADAN	3.2		1									
6/48									HE2		MACHETE	248		3									
1/51									REP		SEED	.4		.7									
1/52									FER		21-0-0	25.4		3.8									
3/01									CV1					4		4							Hilling up
5/05									IN3		AZODRI	80		3.1									
3/09									RV1					97							401	301	

OPERATION CODES

CLEaring residue
FIEld repairs
PLowing 1
PLowing 2, etc.
HArrowing 1
HArrowing 2, etc.
SEEdbed prep.
PLAnting and transplanting
REPlanting
THInning
FERtilization
INsecticide appl. 1
INsecticide appl. 2, etc.
HErbicide appl. 1
HErbicide appl. 2, etc.
nonchemical PESt control
handWEeding 1
handWEeding 2, etc.
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CUltivation 2 for weeds, etc.
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WATering
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interTILlage for relay crop
CANopy manipulation
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Other: ZNSO4, FESO4, ENDOX, SEEDS, SEEDLIngs

TRACTOR/MACHINERY/EQUIPMENT CODES

TILler
SMAll tractor
LARge tractor
ROTovator
SEEdavator
MCCormick thresher
motorized PUMp
OTHer, specify under remarks

(Optional items)
MANual pump or apparatus
WINd mill
rotary WEEder
SPRayer