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RELATIONSHIPS BETWEEN BEAN MARKETINGS AND BEAN PRODUCTION TECHNIQUES: A STUDY OF FIFTEEN FARMS IN THE PREFECTURE OF KIGALI

by

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SERVICE DES ENQUETES ET
DES STATISTIQUES AGRICOLES

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Serge Rwamasirabo
Director of SESA

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EXECUTIVE SUMMARY

A multiple visit survey was conducted on fifteen farms. The purpose of the survey was to explore bean cultural practices in farms that buy beans, farms have few transactions in beans, and farms that sell beans, and to provide some insights useful in suggesting hypotheses and questions to be asked by survey researchers in the future. The fifteen farm sample was divided evenly between net buyers of beans, farms which have few transactions in beans, and net sellers of beans.

Clear patterns of land and labor use differences between bean buyers, bean self-sufficient farms, and bean sellers appear to exist in the sample. Methods of planting, seed selection criteria, and farmers' perceived production constraints also appear to be related to family net position in beans. Bean yields seem to be higher on farms where the family is a net bean buyer.

There is some indication that bean yields may be declining for the farms in the sample, which may be one reason that almost all of the interviewees had recently adopted new soil fertility maintenance techniques. The majority of farms reported having no bean storage losses.

Given the restricted sample used in the course of the study, it is suggested that the relationships highlighted in this document be explored with a larger sample, to enable formulation of more statistically valid statements, which could in turn be used to redirect ongoing bean production research.

SURVEY PARTICIPANTS AND SURVEY FOUNDATION

This paper describes results of a survey conducted jointly by SESA and CIAT researchers. The purpose of the survey was to provide some insights useful in suggesting hypotheses and questions to be asked in further survey research.

The International Center for Tropical Agriculture (CIAT), based in Cali, Colombia South America, initiated a regional bean improvement program in the Great Lakes region of Africa in October 1983. The objective of CIAT's regional bean improvement program is to work with national scientists and organizations to increase average bean (phaseolus vulgaris) yields in the Great Lakes region of Central Africa. This region encompasses the countries of Rwanda, Burundi, and the Kivu region of Zaire. The program's principal strategy is helping national bean research programs introduce more productive bean varieties and more efficient cultural practices into farmers' cropping systems. The target group is the small farmer, and emphasis is placed on

minimal input technology. In the Great Lakes Region, CIAT is working together with PNL, Zaire (Programme Nationale Legumineuse), ISABU (Institut des Sciences Agronomiques du Burundi), and ISAR (Institut des Sciences Agronomiques du Rwanda).

Since 1981, the Agricultural Survey and Statistical Service (SESA) has conducted a series of national surveys aimed at improving baseline knowledge of Rwandan agricultural production and rural household characteristics. In 1984, SESA fielded its first baseline survey, with a sample of over 2000 Rwandan households, covering a wide range of topics. Since the last half of 1985, SESA has continued to collect production data on a 1092 household sample along with farmer opinions of the size of each upcoming harvest in its Crop Forecasting Survey.

In late 1985, SESA added a new dimension to its ongoing production and forecasting surveys. A new interview schedule was added to record farm level bean and sorghum transactions. As this new data began to come in and be analyzed, it became apparent that trade in beans is fairly important in the rural Rwandan economy, with three basic types of households emerging:

1. Net Bean Buyers. Almost all of these households produce beans, but not enough to satisfy family consumption requirements, so they purchase beans to supplement their own production.

2. Bean Self-Sufficient Households. Households which rarely buy or sell beans.

3. Net Bean Sellers. This type of household produces enough for family needs, and earns supplemental income by selling its surplus beans.

It was felt that these three types of households might differ not only in terms of their net position in bean purchases, but also in their bean production methods. SESA and CIAT researchers decided to work together to develop and field a survey of fifteen farms, which would allow them to test in a limited way some preliminary hypotheses about differences in cultural practices between net bean buyers, self-sufficient, and net bean sellers. This document reports the results of that survey.

Readers should interpret these results carefully, as the sample size and the fact that the sample was drawn from one agro-ecological zone do not permit extrapolation of the data to the farm population as a whole.

The rest of this section is laid out as follows: the methods sub-section lays out the schedule of surveys and their content,

as well as outlining basic household characteristics which were used to draw the sample. The methods sub-section is followed by a description of the results obtained by the various surveys. Finally, a conclusions sub-section formulates hypotheses which the authors recommend be tested on a larger, more representative sample of farm households.

METHODS

Field testing of the initial interview schedules revealed that the questions to be asked were too numerous to attempt in a single visit to the farm, as interviewee fatigue would set in. Thus, a multiple-visit approach was devised. Researchers made three field visits. In addition, SESA enumerators visited the farms to collect supplementary data. Table 1 below describes the data collected on each visit.

Table 1
Schedule of Field Activities

Visit One (Researchers)

A. Cultural Practices Interview Schedule, Part One

- -Crops which compete with beans
- -Soil conservation practices
- -Bean production constraints
- -Agronomic practices
- -Importance of pests and diseases

B. Family Labor and Budget Characteristics Interview Schedule

- -Number of hours worked by each family member in preceeding week
- -Number of hours worked by hired labor in preceeding week
- -Food items purchased and sold in preceeding week

C. Bean Field Identification and Observation

- -Seed types by field
- -Field distance from home
- -Intercropping
- -Rotation
- -Soil fertility

Visit Two (Researchers)

A. Cultural Practices Interview Schedule, Part Two

-Changes in cropping patterns over past five years
-Bean seed sources
-Bean storage methods

B. Bean Field Observation.

-Bean plant densities
-Disease/insect observations
-Soil sampling

Visit Three (Researchers)

A. Cultural Practices Interview Schedule, Part Three

-Agronomic Practices
-Bean Storage Practices

B. Family Labor and Budget Characteristics Interview Schedule

Other Visits (SESA Enumerators)

A. Measurement of Surface Area Planted in Beans
B. Measurement of Production

All fifteen farms chosen for the sample are part of SESA's 1092 household Crop Production, Forecasting, and Transactions survey. It was necessary to choose respondents who were already a part of SESA's sample in order to be able to classify them according to their net transaction position in beans.

1. Basic Characteristics of Farms Surveyed

Drawing the Sample

The sample was divided equally among farms that were deficit, self-sufficient, and surplus in beans according to November 1985 through July 1986 data from SESA's transactions survey. It should be noted here that this method of classifying farms is not 100% foolproof. First, family net position in beans may change from one year (or season) to the next due to changes in land and labor available to the family unit, or to changes in the number of persons consuming beans in the household. Second, transactions data from only a nine month period were used to make the classification, because data for a full year were not yet available at the time the sample was drawn. Transactions made in

the third quarter of the year might change some farmers' classification. Since the largest bean harvest comes at the beginning of the year, it is possible that farms that appear to be net bean sellers or self-sufficient in the November to July transactions data are actually net bean buyers when the entire year is considered.

In order to minimize the amount of field time required to mount the survey, all fifteen farms were drawn from two sectors in Kigali: Gikomero Sha (four farms), and Gikoro Mununu (eleven farms).

Table 2

Selected Characteristics of Farms Surveyed

Farm Number:	Net Bean Purchases (kilos)	Dry Bean Production (85b + 86a) kilos	Number of Actives	Number of Actives per Person
Bean Buyers				
40901	153	274	1	.25
40907	132	225	2	.40
50501	71	147	2	.25
50505	50	470	3	.38
50504	23	657	4	.36
Self-sufficient				
40911	5	78	2	.33
40904	0	59	2	.40
50502	0	236	1	1.00
50503	0	323	5	.50
50513	-1	500	4	.57
Bean Sellers				
50514	-26	676	7	.58
50511	-29	431	4	.36
50506	-49	833	6	.60
50518	-93	392	4	.40
50515	-105	951	6	.75

Notes: 1. Negative net purchases indicate net sales. Farm numbers correspond to SESA's identification system to facilitate future inquiries.
2. Actives are defined as persons living in the household between the ages of 15 and 64.
Farm Bean Production, Bean Purchases, and Family Size

Table 2 summarizes some characteristics of the households that were known from previous SESA surveys at the time the sample was drawn. The data in this table reflect a general pattern in SESA's national data: farm bean production is related to, but is not the only explanatory variable in determining a farm family's net position in beans. The number of active household members in relation to the total number of people in the household may also be an important explanatory variable.

Surface Area Planted in Beans.

Table 3 shows the total surface area planted in beans by farm. In interpreting this table, several points should be taken into consideration. First, total surface area in beans was measured regardless of bean plant density or type of association in the field. Second, the bean surface area data reflect the more important September to January (1987A) season, while farm position in beans was determined with data from the period November 1985 to July 1986. Farm size, family size, and relative importance of various crops may have changed between seasons. For example, farm family number 40901, the most deficit in the sample for the period November 1985 to July 1986, stated that some family members had moved off the farm in the middle of 1986. The amount of mobility between bean transaction classes one would find on a national scale is difficult to estimate, given the dearth of longitudinal studies of the Rwandan economy.

Surface area planted in beans is obviously related to production class, but farm numbers 40901 (buyer), 40907 (buyer), 50502 (self-sufficient), and 50506 (seller) do not seem to fit the general pattern. Differences in soil fertility, in plant densities, in bean consumption habits, or changes in family situation are all possible explanations for these outliers. For example, farm number 50502's plant density was the highest of any farm observed in the survey. Since farmers plant more densely on soil that is infertile, this may be an indication that this farmer's soil is very infertile.

All but one farmer harvested much less beans in 1987a than in 1986a, with the total harvest in dry beans down 64% from the previous year because of the late planting rains. Thus, yields presented in this table may be unrepresentative, although some of this difference in quantity harvested is evidently due to decreases in acreage planted, as farmers attempted to substitute drought resistant crops for beans. It should also be noted that these yields were calculated without respect to intercropping. Still, some patterns are evident in the data, with bean buyers and bean self-sufficient farms showing higher yields than bean sellers. The high value presented for farm number 50501 is probably due to an error in measurement, but even without this farm, average yields for bean buyers and bean self-sufficient

farms were over 100 kg/ha higher than average yields for farms selling beans.

Table 3

Surface Area Planted in Beans, Yield, and Average Bean Plant Density First Season, 1987

Farm Number:	Farm Size (36b) (ha)	Square Meters Planted in Beans	Yield kg/ha	% of Farm in Beans	Average Bean Plant Density (unweighted)
Buyers					
40901	0.4	2001	599	50%	270
40907	0.4	2182	334	54%	290
50501	3.1	378	4074	1%	245
50505	1.9	229	699	1%	230
50504	3.3	882	1292	3%	260
Self-sufficient					
40911	0.9	487	657	5%	290
40904	0.1	676	1198	67%	255
50502	7.2	888	495	1%	510
50503	4.3	1159	276	3%	250
50513	4.1	1519	967	4%	260
Sellers					
50514	3.2	4761	399	15%	230
50511	4.1	3668	262	9%	290
50506	1.6	1193	1685	7%	250
50518	1.2	3117	122	26%	295
50515	3.6	6263	494	17%	295

N.B.: Farm numbers correspond to SESA's identification system in order to facilitate future inquiries.

Table 3 also shows another interesting trend: bean purchasers and farms self-sufficient in beans either devote a very large or a very small proportion of their total surface area to beans, while the percent of the farm occupied by beans in farms which sell beans tends to be in the mid-range. This may mean that some farms which purchase beans (particularly those very small total farm size) have specialized in beans to reduce purchases, while others (those with somewhat larger farms) have moved away from beans in favor of other crops.

2. Crop Competition for Farm Resources.

Farmers were asked to name the most important crops they grew to feed their families. Up to four responses were recorded, with some families naming only two crops. Beans were identified most frequently as an important crop by all three bean transaction classes, as shown in Table 4. The data in Table 4 indicate that bean sellers may be more diversified in their selection of crops than the bean buyers, as sellers tended to mention more crops as important (19 responses total) than either families which buy or self-sufficient families (15 and 16 responses respectively).

Table 4
Crops Mentioned
as Important in Feeding Respondents' Families
by Bean Transaction Class

	Bean Transaction Class (15 respondents, 5 per class)			
Crop	Buyers	Self-suff.	Sellers	All Farms
Beans	4	5	5	14
Manioc	5	3	5	13
Sw. Potatoes	4	4	5	13
Sorghum	2	2	2	6
Bananas	0	2	1	3
Potatoes	0	0	1	1
Total Responses Obtained	15	16	19	50

In order to get a picture of the costs and constraints facing each family if they wanted to increase production of important crops, for each crop mentioned as important in response to the prior question, families were asked: "If you planted more of this crop, would you have had enough beans this year?"; and further, "If yes, why didn't you plant more beans this year?" In cases where beans were the crop mentioned as important to feeding the family, the question "Why didn't you plant more beans this year?" was asked.

The planting rains were very late for the 1987a season in the sample area. Many responses of "I would have had enough of crop X if I had planted more beans, but I didn't plant more beans because the rains were late" were recorded for each class. Due to the irregular rainfall problem present in this season, other constraints on other farm resources such as insufficient land, labor, or seed were overshadowed.

Negative responses to the question "Would you have enough of crop X if you had planted more beans?" did show an interesting pattern. Four out of five families which purchase beans answered "no" for at least one crop, three out of five self-sufficient families answered "no" for at least one crop, and only two out of five families which sell beans answered "no" for at least one crop. Thus we see that increased bean production may be more likely to come at the expense of other crops in bean purchasers than in other types of families.

Another interesting pattern in the "No, I wouldn't have enough of crop X if I had planted more beans" responses is that of the twelve responses of where the family felt they wouldn't have enough of another important crop if they increased bean production, sorghum was mentioned three times, while the other nine times either sweet potatoes or manioc production would have been insufficient given increased bean production. This is an indication that beans may compete more with root crops than they do with other types of crops.

3. Soil Fertility Maintenance Methods.

Composting and Rotation

Farmers were asked how they used compost to maintain their soil fertility. Vegetable and animal compost were mentioned with roughly equal frequency with respect to the entire sample. Some differences in bean transactions classes are to be noted: animal compost may be less important among self-sufficient farmers than it is for the other two classes. It is also interesting to note that fallow was only mentioned once, by a farmer in the bean surplus category.

More bean buyers in the sample planted their beans in the same plot in succeeding seasons than those who did not buy beans. All the respondents who rotated their crops followed their beans with sorghum.

Table 5

Treatment of Bean Plant Material After Harvest
By Bean Transaction Class

Method	Bean Transaction Class			
	Buyers	Self-suff.	Sellers	All Families
Coffee Field	2	2	4	8
Compost Pit	3	3	1	7
Leave in Field	2	1	0	3
Fodder	1	0	1	2
Banana Field	0	1	1	2
Total Number of Responses	8	7	7	22

Treatment of Bean Plant Waste After Harvest

Table 5 shows that some differences in bean plant debris usage between transaction classes are evident. More bean sellers used bean plant debris as mulch under their coffee trees, while net buyers and self-sufficient farms used the debris for composting. Few families that sold beans composted the plant debris. In contrast to bean buyers and families self-sufficient in beans, no bean sellers buried uncomposted plant debris in the field.

The practice of burying uncomposted bean plant debris combined with no crop rotation may provide a source of innoculum for plant diseases. The benefits of introduction of organic material into the soil through the plant debris may therefore be negated by loss of yield through diseases.

4. Evolution of Cultural Practices.

A series of retrospective questions were asked which attempted to determine whether farmers' methods of bean production had changed over the past few years.

There were no clear cut differences between responses of farmers in the three transactions classes concerning changes in

the quantity of beans harvested over the past five years. Across the whole sample, four farmers (27%) said they harvest more beans now, two (13%) harvest the same quantity now as they did five years ago, four (27%) harvest less beans, and five (33%) said the quantity harvested varies from year to year. Among farmers who reported a change in the size of the harvest, surface area, rainfall, and labor were most frequently mentioned as reasons for the change. Only one farmer (a net bean seller) cited a technological consideration (compost) as a reason for increased harvest size.

All of the farmers interviewed reported that they planted beans in association with the same crops now as they had five years ago, and that their planting methods had remained unchanged during that period. All but one farmer (buyer) said they changed their soil fertility maintenance methods over the past five years by the recent adoption of anti-erosion ditches and composting.

Table 6
Changes in Surface Area Planted in Beans Over Last Five Years

	Bean Transaction Class (n=5 per class)			
Type of Change:	Deficit	Self-Suff.	Surplus	Total
Larger Area Now	3	1	3	7
Same Area Now	2	2	2	6
Smaller Area Now	0	2	0	2

Table 7

Reasons for Change in Surface Area Planted in Beans

Reason:	Farmers Which: Plant More Now (n=7)	Plant Less Now (n=2)
Adopted Hoe With Teeth	1	0
Labor	0	1
Change in Surface Area Available	2	1
Change in Land Use Pattern	4	0

60% of the farmers which buy beans reported planting a larger surface area in beans currently than they did five years ago (Table 6), as did surplus farmers. If one looks at the entire fifteen farm sample in Table 6, it appears that the tendency over the last five years is towards more surface area being planted in beans, with 87% of the farms reporting the same or a larger surface area planted in beans. Over half of the farms which had increased surface area planted in beans said they planted more due to changes in land use pattern (Table 7). Changes in land use pattern cited were: reduced fallow, reduced manioc fields, and increased association with bananas. The two farmers who mentioned having a larger surface area available to plant were both bean sellers.

Note that while thirteen out of fifteen farmers claim they plant the same or a larger surface area than they did five years ago, only 40% indicated that they harvested the same amount or more beans in comparison with five years ago. This may indicate that bean yields have declined over the last five years.

5. Factors Affecting Farmers' Net Bean Supply.

Bean Production Constraints

Drought was the most frequently mentioned constraint to increased bean production (Table 8). This is true not only for

the total sample, but within each bean transaction class as well. Responses to this question were influenced by the fact that the planting rains came late in the first season of 1987.

Next to drought, soil fertility was the most frequently mentioned bean production constraint, with this response coming in greater proportions from self-sufficient and seller farmers than from buyer farms. Conversely, lack of land was seen to be a problem more frequently by farms buying beans than by net sellers or self-sufficient farms. Lack of labor was listed as a bean production constraint in roughly equal proportions across the three classes. Insects and pests came up much more often as a problem among net sellers, with four out of five families mentioning this problem. When asked directly if they had insect problems, 100% of the farmers in all classes responded affirmatively. However, the relative importance of insect and pest compared to other constraints appears to be greater for families selling beans than for other transaction classes.

Table 8
Farmer Opinions on Principle Constraints
To Increased Bean Production

	Bean Transaction Class (n=5 per class)			
Constraint	Buyers	Self-suff.	Sellers	All Families
Soil Fertility	2	2	3	7
Drought*	4	4	4	12
Too Much Rain	2	1	1	4
Lack of Labor	2	1	2	5
Lack of Land	3	1	0	4
Insects/Pests	1	0	3	4
Other	1	1	1	3
Total Number Of Responses	15	10	14	39

* Responses to this question may have been influenced by the fact that the planting rains were late in the first season of 1987.

Methods of Increasing Bean Production

Table 9 shows that farmers' perceptions on how they could increase their bean harvest did not vary much between bean transaction classes, with most farmers mentioning both compost and increased surface area.

Table 9:

Farmers' Opinions as to How They Could

Increase the Size of Their Bean Harvest

	Bean Transaction Class (n=5 per class)			
Method:	Buyers	Self-Suff.	Sellers	All Families
Compost	4	3	4	11
Increase Area in Beans	4	4	5	13
Anti-Erosion Ditches	0	0	1	1
Insecticides	0	1	0	1
Don't Know	1	0	0	1
Total Responses Obtained	9	8	10	27

Care of Bean Plants

When a bean plant first emerges, two leaves generally appear out of the stalk. These first leaves are called primary leaves or cotyledons. As the plant matures, the stalk grows, and larger leaves grow out from the stalk. The larger, mature leaves are called trifoliates. Some farmers pluck the cotyledons off of the plant after the appearance of the trifoliates. The utility of this practice is not yet fully understood, but it has been hypothesized that these cotyledons may be detrimental to the mature plant, perhaps by increasing the disease population. Table 10 (below) shows that 53% of all the farmers interviewed remove the primary leaves, but that only one of the five bean surplus farms interviewed engages in this practice. This is interesting, particularly when considered together with the data in Table 8, which show that bean sellers mentioned insects and

pests much more frequently as a constraint to production than did the other categories of farms. Note also that bean buyers tended to have higher yields than bean sellers. It may be that farms which grow more beans lack the labor inputs necessary to be able to perform prophylactic tasks on their beans.

Table 10

Number of Farmers in Sample Who Remove Emergence Leaves

as the Bean Plant Matures

Transaction Class	Number (n=5 per class)
Buyers	4
Self-sufficient	3
Sellers	1
All Families	8

Farmers who remove the cotyledons after plant maturation gave varied reasons for doing so. Four said the process makes the plant bigger or stronger, two said it encouraged budding, one said it prevented leaves from yellowing, and one didn't know why they removed the primary leaves. All of those that remove cotyledons do so at the same stage in the plant cycle: before flowering.

When asked directly if they had problems with insects and pests in their fields (as opposed to the open ended question reported on in Table 8 where farmers were asked to list their principle constraints to production), all the interviewees said "yes". Table 11 gives frequencies of farmer estimates of the degree of their problems with insects and pests.

Table 11

Farmers' Degree of Problems with Insects and Pests

	Bean Transaction Class (n=5 per class)			
	Buyers	Self-Suff.	Sellers	All Fam.
Small	3	0	3	6
Medium	0	0	1	1
Large	2	5	1	8

Planting Methods and Season

Three basic methods of planting beans have been observed in Rwanda. One consists of placing the bean seed in the ground by hand and covering the seed immediately. The second involves broadcasting the seed over a large area, and then turning over the earth with a hoe to bury the seed. The third, not practiced by any of the farmers interviewed in this study, involves placing the seed in the farmers' mouth, spitting it into the ground, and then covering the seed immediately. Farmers were asked to describe their planting methods in both the A and the B bean season. With one exeception, farmers planted in exactly the same fashion in the A and in the B season. Bean buyers and self-sufficient farmers were roughly evenly divided between those who place the seed in the ground, and those who broadcast, while all of the bean sellers practiced the broadcasting method at least some of the time. Broadcasting is probably not very efficient in terms of seed use, so farmers who are low on seed are less likely to use the method.

Sources of New Varieties of Beans.

Roughly half of the families interviewed had tried new varieties of beans at some time. The percentage of families who had tried new bean varieties does not appear to vary much according to bean transaction class.

The seven farmers who said they had tried new varieties were asked where they obtained the new varieties. The following responses were recorded:

Response	Times Recorded	% of Total Responses
Family	2	17
Neighbors	2	17
Merchant	3	25
Open air market	5	42

Families which bought beans were the only ones to mention family and neighbors as sources of new bean varieties. Farmers in all three transaction categories mentioned merchants and markets as sources of new bean varieties. Thus it may be that bean purchasers are more likely to be late adopters of new seed varieties, because they are less likely to obtain seed from outside the community.

Farmer Opinions on Seed

All but two of the farmers interviewed thought they could increase their bean harvest with improved seed. None of them used improved seed, because they had never had the opportunity to acquire such seed. All but one of the farmers interviewed said they thought they could improve their harvest by multiplying bean seed in a small fertile plot, but only two of them actually practiced this method of seed multiplication.

Farmers were asked if they could improve their bean harvest by choosing their seed from plants with many pods and few black marks on the leaves and pods. Half of the net buyers and self-sufficient farms said they thought this technique would improve yields, while all of the farmers which sell beans thought the method would increase their harvest. Further, all of the net bean sellers use number of pods on the plant and degree of black marks in seed selection, while only 40% of the net buyers and 0% of the self-sufficient farms use these criteria in seed selection.

Bean Storage Practices.

Table 12

Farmers' Evaluation of

Bean Storage Losses

	Bean Transaction Class			
	Buyers	Self-suff.	Sellers	All Families
Lose a lot	1	1	0	2
Lose a little	3	1	1	5
Don't lose any	2	3	4	9

Nine of the fifteen farms reported no bean storage losses. More farms which buy or which are self-sufficient in beans reported losses than did farms which sell beans. Lack of more concrete empirical data makes interpretation of this finding difficult, as farms which buy beans may be more sensitive to storage losses than other types of farms. All farmers who reported storage losses said these losses were caused by insects.

Table 13 indicates that chemicals are the most popular bean storage treatment regardless of transaction class. Other storage treatments varied according to production class. Only farms which buy beans reported using cow urine and pili-pili as a seed treatment. Both buyers and self-sufficient farmers used ash, but only bean sellers used kaolin. Effectiveness against bruchid attack of seed storage with kaolin versus ash, pili-pili, and cow urine needs to be examined, although information reported on in other SESA documents indicates that storage is not a very high priority research area in Rwanda.

Table 13

Farmers' Methods of Treating Beans

For Storage

	Bean Transaction Class (n=5 per class)			
Treatment:	Buyers	Self-Suff.	Sellers	All Fam.
Chemicals	4	4	3	11
Ash	1	2	0	3
Kaolin	0	0	2	2
Pili Pili	1	0	0	1
Cow Urine	2	0	0	2
Total Responses Obtained:	8	6	5	19

Farmers were asked if they stored seed separate from their stocks destined for consumption. Nine of the fifteen (60%) store seed separately from food stocks, and the rest (40%) do not keep their seed in a different place/container. More bean sellers store their seed stock seperately than do bean buyers or self-sufficient farms. Table 14 below summarizes the types of containers farmers used to store their beans. The most common storage container for both food and seed stock in the families interviewed is a basket lined with manure. If food and seed stocks are stored separately, a clay pot is used more frequently for seed storage, whereas a sack is used more frequently for food storage. The effectiveness of these storage containers against bruchid attack warrants further study.

Table 14
Farmer Bean Storage Containers

Storage Containers for Farmers that:	Don't Store Seed Separately	Do Store Seed Separately	
		Seed	Food
Basket Lined w/Manure	5	6	7
Clay Pot	1	4	1
Sack	1	4	5
Total Responses Obtained:	7	14	13

6. Labor and General Household Transactions

Labor Use

To get some perspective on use of labor at different times of the season, two visits were made in which households were asked to list all persons working on their fields in the previous week, and the number of hours worked per person. The first visit ocurred in mid-December 1986, while the second took place at the end of February 1987. Most farmers were in the process of weeding their fields during the mid-December visit. Planting was taking place at the time of the February visit. There were no remarkable differences in labor use between the two reference periods. Bean sellers in the sample made much more extensive use of hired labor during both periods than did farms in the other two transaction classes. Family adult labor use was also higher on a per household basis for bean sellers than for the other two classes. This tendancy is probably related to the larger total farm size of the households which sell beans.

Household Transactions

On the same visits during which labor data were collected, households were also asked what they had purchased and sold during the previous week. Patterns exhibited by the responses to these questions were weak. One point of interest is that farmers from all three transaction categories bought beans during the December visit (one or two months before the major bean harvest). This serves to underline that the categories used in the survey are net categories, and that some families are selling at certain periods of the year, and buying back at other times of the year.

Family behavior with respect to bean purchases may also have been influenced by the exceptionally late planting rains and the poor harvest prospects for the 1987a crop.

7. SUMMARY AND CONCLUSIONS

Paragraphs 7.1 through 7.9 summarize major findings of the survey.

7.1. Net bean purchasers appear to devote either a very large or very small proportion of their fields to beans. Not surprisingly, the land constraint appears to be greater for net bean purchasers and families with few transactions than for net bean sellers. Tubers appear to be beans' major competitor for family land.

7.2. Net bean buyers in the sample were more likely to plant beans in the same field in successive seasons than other types of farms, who rotated their bean fields. Two out of five net bean buyers leave bean debris in the field. The practice of burying uncomposted bean plant debris combined with no crop rotation may provide a source of innoculum for plant diseases.

7.3. All but one farmer (a net bean buyer) said they had changed their soil fertility maintenance methods over the past five years by the recent adoption of anti-erosion ditches and composting.

7.4. It appears that the tendency over the last five years is towards a larger surface being planted in beans, with 87% of the farms in the sample reporting the same or a larger surface area in planted in beans as compared to five years ago. Only 40% of farmers indicated they harvest the same or a larger quantity of beans in comparison to five years ago. This may be an indication that bean yields have declined over the last five years.

7.5. Next to drought, soil fertility was the most frequently mentioned bean production constraint, with this response coming in greater proportions from self-sufficient and seller farmers than from buyer farms. Conversely, lack of land was seen to be a problem more frequently by farms buying beans then by net sellers or self-sufficient farms.

7.6. Nine of the fifteen farms reported no bean storage losses. More farms which buy or which are self-sufficient in beans reported losses than did farms which sell beans. All farmers who reported storage losses said these losses were caused by insects. Chemicals are the most popular bean storage treatment regardless of transaction class. Only farms which buy beans reported using cow urine and pili-pili as a seed treatment, and only bean sellers used kaolin. The most common storage container for both food and seed stock in the families interviewed is a basket lined with manure.

7.7. Roughly half of all farmers interviewed remove emergence leaves from the maturing bean plant, but only one of the five families which sell beans engages in this practice. Net bean

sellers may lack sufficient labor to perform this prophylactic task.

7.8. Bean buyers and self-sufficient farmers were roughly evenly divided between those who place the seed in the ground, and those who broadcast, while all of the bean sellers practiced the broadcasting method at least some of the time. This seems logical given that placing the seed in the ground is probably more efficient in terms of seed use.

7.9. All of the net bean sellers use the number of pods on the plant and degree of black marks in seed selection, while only 40% of the net buyers and none of the self-sufficient farms use these criteria in seed selection.

What conclusions can be drawn from this exercise? First, that division of farms into categories of net bean buyers, farms that transact beans infrequently, and net bean sellers is a useful tool in studying farmers' bean production practices.

Second, that researchers and extension services should take net transactions position into account in establishing target groups. Research based on "progressive farmers" chosen on the basis of inappropriate criteria may prove maladapted to more typical farmers whose basic strategies differ from the "progressive farmer". For example, suppose that a research group directed its efforts to farmers with largest land holdings in the area on the grounds that these farmers would be most open to experimentation. A labor intensive variety such as climbing beans might prove unacceptable to these types of farms (labor constraint), while the majority of farmers might find such an innovation profitable (land constraint). Such a research group might end up dropping a potentially useful variety on the basis of its first on farm trials.

Third, that efforts to identify differences in constraints and in cropping techniques between farmers would be worthwhile to expand to a sample large enough to allow statistically valid conclusions to be drawn. This would help researchers throughout the country to determine if their current direction of research is appropriate.

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