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PRODUCTION AND CONSUMPTION ASPECTS OF TECHNOLOGY TESTING IN PESCADOR, COLUMBIA; A CASE STUDY.

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PRODUCTION AND CONSUMPTION ASPECTS OF TECHNOLOGY TESTING IN PESCADOR, COLUMBIA

SECTION I

INITIAL DIAGNOSTIC

One morning in December 1984 a group of senior scientists on the research staff of the International Center for Tropical Agriculture (CIAT) and the International Center for Fertilizer Development (IFDC) met to plan activities for the February planting season, which would launch a new project on Farmer Participation in Technology Assessment. The project aimed to implement participatory research to involve small farmers in the assessment of agricultural technologies.

The objectives of the participatory approach were to integrate farmer management strategies and farmers' criteria for identifying acceptable innovations into the identification of promising technologies by involving farmers directly in the planning, execution and evaluation of farm trials. By establishing a process of dialogue with farmers about what should be tested, how it should be tested, and what conclusions should be drawn from results of testing, the project hoped to demonstrate that client (farmer) participation in agricultural technology development was a feasible and efficient technique for fine-tuning adaptive research to address farmers' location-specific circumstances and needs.

This approach had evolved after ten years of research in which promising recommended varieties had had a mixed record of adoption.

Follow-up studies had shown that non-adoption was related to very specific characteristics of the varieties such as an unacceptable two week delay in harvest. The participatory approach was intended to provide earlier and more specific information to breeders and minimize non-adoption.

The intent of the meeting was to identify which among many improved varietal materials of the CIAT bean breeding program might be included in the project, along with promising new fertilizer technologies developed by the IFDC phosphorus research program.

The group included a soil scientist, a breeder, an agronomist and two social scientists -- an economist, and a sociologist. All shared a concern with developing on-farm research methodologies to assist national agricultural research programs in developing improved production technology for small farm systems, an important component of the mandate of International Agricultural Research Centers.

The sociologist presented to the group a summary socio-economic characterization of farms from an exisiting survey of a small farm system in Pescador, Colombia, which appeared promising as a site for the project: farms were small, owner-operated, family concerns; farming of coffee and cassava, the principal crops, was cash-oriented, and while beans were not a major crop, most farmers grew some beans for sale. Moreover, small farmers were intensifying production, as evidenced by the rapid adoption of relatively new crops in the farming system such as bush beans and tomatoes in the past three years. Use of fertilizers was correspondingly becoming widespread, particularly on new crops such as bush beans, due to the poor quality of the soils.

The soil scientist supported the feasibility of the site,

presenting data on soil chemical analysis and yield response of beans to phosphorus (P) at this site. These data showed acid soils very low in phosphorus which indicated promising conditions for testing rock phosphate fertilizer materials of the IFDC phosphorus research program.

The group began to discuss what type of bean varieties farmers in this system might be most interested in.

- Would climbing beans or bush beans be the most appropriate? asked the breeder.

- What were farmers' interests in intensive vs. "minimum input" management of the bean crop? asked the agronomist.

The economist asked what were farmers' preferences as to bean grain types? Small farmers in Colombia were producing beans for sale and thus consumption by a rapidly urbanizing population with specific cultural preferences for a large, opaque red-colored type of bean. In view of the importance of grain size in determining bean prices it would be important to test varieties which had high probabilities of acceptance in the market and higher prices than less preferred grain types.

The breeder pointed out that the central objective of the bean breeding program was to breed high-yielding disease resistant varieties. It had proved problematic to combine high-yielding characteristics with the preferred large, red opaque grain type for varieties adapted to the altitude and climatic conditions of the proposed research site. For this reason, the program's improved varieties adapted to the agroclimatic zone tended to be somewhat inferior in grain type to the currently available varieties grown by small farmers in Colombia. However, he identified ten promising materials which he ranked in order of acceptability. He placed a medium-sized, red opaque grain type

(A-36) first, as most likely to be acceptable to farmers; and a very small red opaque (BAT-1297) as the least likely to be acceptable. The social scientist proposed that the first step in the farmer participation methodology would include asking farmers to select from among these ten varieties, three or four that were acceptable from evaluating samples of the grain types. Farmers could then also evaluate these varieties in field trials.

In view of the short time available for planning experiments for the February planting season, the group decided to go to the field with a rapid diagnostic survey to describe bean cultivation practices in the proposed site, in order to answer some of the questions raised in the group.

In early January, a field research team consisting of the social scientists and agronomist began this diagnostic research by conducting informal interviews with key informants who were farmers with experience in growing beans in Pescador. They soon identified a list of farmers who inluded beans in their cropping system. The initial key informant interviews very quickly showed that there was a division of labor in the farming system between field crop production activities, carried out by men, and domestic activities carried out by women and children. For example, when the researchers visited farms, children often led them to the fields to interview men. When interviewed at home, men took the leading role in the informal interviews. Women disappeared into the kitchen to prepare food and drink for the visitors. A formal questionnaire on bean production activities was therefore administered with 40 male heads of household. The responses were quickly tabulated to provide a picture of farmers' current bean production technology.

The survey results showed that indeed, the large, red opaque grain type was the most commonly grown, whether of bush or climbing bean varieties. The results also showed that climbing beans were grown mainly in subsistence-oriented system intercropped with maize and that few farmers applied fertilizer to climbing beans. Bush beans were monocropped mainly as a cash crop, although most farmers retained part of the harvest for seed and household consumption purposes. All farmers applied fertilizer to bush beans.

The rapid diagnostic survey found that 50 percent of farmers applied chicken manure using a standard measure of a tinful ("macarela") in each planting site. Chicken manure was sold locally in 50 kg bags at a price of Col $230 per bag at the time of the survey, for delivery at the farm gate by vendors who pass through the area with truck loads of manure obtained from industrialized chicken producers located nearby. Another 35 percent of farmers customarily applied smaller quantities of chicken manure, measured in handfuls, and in some cases farmers were experimenting with handfuls of chicken manure mixed with a compound fertilizer, 10-30-10.

Although the standard practice used for planting was 2-3 seeds per planting site, there was considerable variation in distances between planting sites used by farmers, which they related to the fertility of the plot and the type of land preparation. As a result, fertilizer rates varied considerably, ranging from as little as 1000 Kg/ha of chicken manure to more than 5000 Kg/ha. However, the most common practice of applying chicken manure in a tinful at a planting distance of 60 cm between planting sites and 80 cms between furrows or rows gave an estimated rate of 5000 kg/ha of chicken manure, at a cost of

Col $23,000 per hectare. Farmers universally stated that without fertilization, bush beans could not be grown in the region. The availability of chicken manure had increased in a five year period to the diagnostic survey, and this innovation appeared to have stimulated plantings of bush beans in the area.

Concurrently with the survey research activities, the field research team began to implement the farmer participation methodology. Key informants were asked to identify a group of farmers among bean farmers in Pescador who were known in the community to be experimenting with different ways of growing beans. The sociologist and agronomist interviewed these sixteen innovative farmers about their objectives in growing beans: what aspects of bean production were they attempting to improve, and why? The researchers showed each farmer the samples of the ten new bean varieties and asked him to select six out of the ten that he would be most interested in trying with respect to grain type. Each farmer ranked his six preferred grain types in order from most to least preferred.

The researchers made a content analysis of the open-ended discussions with the group of innovative bean farmers about their production practices. They found that these farmers expressed a concern with cutting the high costs of fertilizer entailed in growing bush beans on their poor soils. Traditionally, the more fertile plots were reserved for climbing beans. Farmers were attempting to cut bush bean production costs by mixing purchased chicken manure and chemical fertilizers and applying these mixtures at reduced rates compared to usual bush bean fertilization practices in Pescador. At the same time, some were increasing labor inputs to production, primarily by spraying

their bean crop with greater frequency to control pests and disease. Some farmers expressed interest in disease-resistant varieties that would require less spraying; others said they did not care about the extra work so long as varieties of beans had a superior grain quality for the market.

Farmers' ranking of the ten bean varieties was tabulated. While farmers appeared less concerned with grain color than expected, the results confirmed the judgement of the breeder that large grain types would be preferred, with one surprising exception. The very small red opaque type, BAT-1297, which the breeder had placed tenth in his ranking was not so decisively rejected by farmers, who ranked it overall in sixth place. As they reviewed the interviews on a case by case basis, the researchers found that in several instances BAT-1297 had been ranked as high as third place. They tried to recapture what had occurred in the interviews to produce this deviation from the normal range of preferences, and realized that these interviews took place in situations where the farmer and his wife had both examined the grain samples -- often because the discussion had occurred at the farm house, instead of in a meeting with the farmer in one of his fields. Interview notes showed that some women had claimed to recognize the very small red grain as a traditional variety which had disappeared from the locality, but which was high yielding and very flavorful.

PRODUCTION AND CONSUMPTION ASPECTS OF TECHNOLOGY TESTING
IN PESCADOR, COLUMBIA

SECTION I

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TABLE 1.1

Farm Size Distribution
Pescador, Columbia

Farm Size Category		Percent of Farms
Large	> 15 ha	16
Medium large	> 10-15 ha	23
Medium small	> 5-10 ha	21
Small	< 5 ha	40
Total		100

TABLE 1.2

Land Use in Pescador, Columbia

Land Use Category	Average Area (ha)
Coffee	1.56
Cassava	1.75
Beans	0.33
Other minor crops	0.22
Pasture/Fallow	5.16
Average farm size	9.02

TABLE 1.3

CALENDAR OF PRINCIPAL CROP PLANTING AND HARVESTING ACTIVITIES, PESCADOR, CAUCA, COLOMBIA.

MONTH / CROP	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.
1/ Cassava					Planting					Planting		
Bush Beans	Planting				Harvest			Planting				Harvest
Climbing 2/ Beans		Harvest						Planting				
3/ Maize				Harvest				Planting				
Coffee		Harvest				Weeding					Harvest	
Sugar Cane		Planting	Harvest				Harvest					
4/ Tomatoes	Planting				Harvest		Planting		Harvest			

1/ Cassava is harvested between 14-17 months, depending on market prices for fresh cassava.

2/ Climbing beans intercropped with maize.

3/ Maize monocrop, or maize intercropped with climbing beans.

4/ Tomato harvest begins 60-70 days after trans planting and is continuous for up to two months.

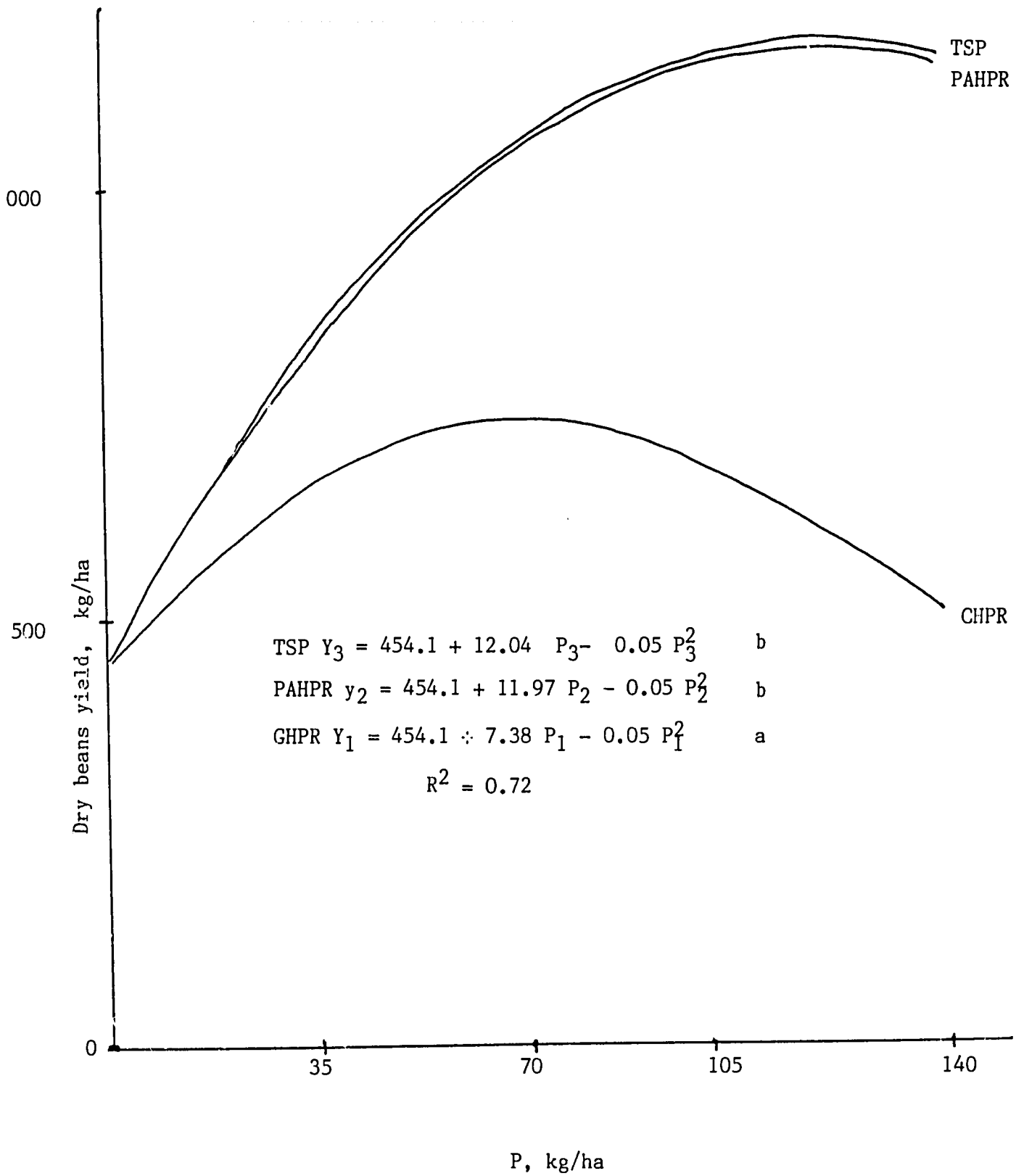

Figure 1 Response of beans to P sources and rates, grown in fourteen sites in Pescador, Cauca. First crop. 1982. Pairs of response functions with the same letters are not significantly different at the 0.05 level of significance.

TABLE 1.4

Chemical analysis of soil samples from 46 farmers' plots, Pescador, Cauca, Columbia.

Properties of Soils	Range	Percent of Samples
Pppm (Bray II)	0.1 - 1.5	53
	1.5 - 3.3	47
K meq/100 g	0.1 - 0.15	37
	0.15 - 0.35	63
Organic Matter (%)	3.7 - 10.0	63
	10.0 - 20.0	37
Aluminum Saturation (%)	26.7 - 50.0	37
	50.0 - 93.0	63
pH	4.4 - 5.0	63
	5.0 - 5.3	37

TABLE 1.5

Agroclimatic Data Pescador, Columbia	
Altitude	1,600 msnm
Temperature	
Annual average	18 C
Maximum	23 C
Minimum	15 C
Rainfall	
Annual average	1,682 mm
Dry seasons	June-August December-February

Source: Federacion Cafeteros Estudio de Zonificacion y Uso Potencial del Suelo en la Zona Cafetera del Departamento del Cauca, FEDECAFE 1978.

TABLE 1.6

Consumer preferences for bean grain types in selected Latin American countries.

Country	Grain Type Characteristics	
	Size	Color
Colombia	Large	Red opaque
South Brazil	Small-medium	Black
North-east Brazil	Small-medium	Cream
Costa Rica	Small	Black
Guatemala	Small	Black opaque
Honduras	Small	Red brilliant
Peru	Large	White-yellow

TABLE 1.7

Breeder's ranking of ten new bush bean lines and varieties in terms of likely acceptability to farmers, according to grain type.

Rank	Bean Variety	Grain Size and Color
1	A-36	Medium, red opaque
2	A-486	Large, pink opaque
3	AFR-205	Large, purple mottled
4	HORSEHEAD XYC 206	Small, red opaque
5	ANTIOQUIA 8L-40	Small, red opaque
6	G 7223 x BAT-1276 C	Small, red opaque
7	PVAD-1261	Medium, red opaque
8	G 4453 x BAT-1386 C	Small, red opaque
9	ANCASH - 66	Medium, white
10	BAT-1297	Very small, red opaque

Note: Rank 1 = most acceptable; 10 = least acceptable.

TABLE 1.8

Division of labor for different farm activities.

	Exclusively or Mainly		Shared	Children Participate	
Activity	Male	Female	Both Sexes	Male	Female
Agricultural					
Purchase ag. inputs	M				
Land preparation	M				
Planting	M				
Weeding	M				
Harvesting			S	C	C
Post-harvest processing		F	S	C	C
Storage					
Marketing crops	M				
Livestock care	M				
Milking			S		
Livestock marketing	M				
Domestic					
Water carrying			S	C	C
Fuel collection			S	C	C
Housework		F			C
Meal preparation		F			C
Child care		F			C

Note: M = Male; F = Female; S = Shared; C = Children.

TABLE 1.9

Results of rapid diagnostic study of bean cultivation:
Bean varieties grown by farmers, Pescador, Columbia.

Bean Variety	Size and Color of Grain	Percent of Farmers Growing
Bush beans		
Calima	Large, red opaque	62.9
Cuarzo Rayado	Large, red opaque	24.2
Cuarzo Rojo	Large, red brilliant	6.9
Cuarzo Amarilli	Large, yellow opaque	6.0
		100.0
Climbing Beans		
Sangre Toro	Large, red brilliant	45.8
Cuarzo de Vara	Large, red brilliant	10.4
Revoltura	Mixture of types	20.8
Miscellaneous	Also found in mixtures	23.0
		100.0

TABLE 1.10

Results of rapid diagnostic study of bean cultivation: Distances between planting sites, bush beans, Pescador, Cauca Department Columbia.

Distances between Planting Sites	Percent of farmers using
80 cm	8.7
70 cm	4.3
60 cm	26.1
50 cm	8.7
40 cm	21.7
30 cm	8.7
25 cm	8.7
20 cm	8.7
10 cm	4.3
Total	100.0

TABLE 1.11

Results of rapid diagnostic study of bean cultivation:
Quantities of fertilizer applied to bush beans, Pescador, Cauca Department Columbia.

Fertilizer	Farmers' rate per planting site	Measured equivalents in Kg/ha N	P	K	Cost per hectare Col $/ha
Chicken Manure (CM)	1 tinful	315	14	129	23,000
Chicken Manure (CM)	1 handful	236	8	97	17,250
Chicken Manure (CM)	1/2 handful	118	4	48	8,625
Mixture: CM+10-30-10	1/2 handful CM + pinch 10-30-10	145	39	71	15,300

TABLE 1.12

Results of rapid diagnostic study of bean cultivation: percent of farmers using fertilizer on bush and climbing beans.

	Percent of Farmers Growing	
Fertilizer Type	Climbing Beans	Bush Beans
Chicken manure	25.9	74.1
10-30-10	21.2	0
Chicken manure and 10-30-10 mixed	0	22.2
Farm yard manure	4.7	3.7
Other chemical fertilizer	4.8	0
Do not apply any fertilizer	43.4	0
	100.0	100.0

TABLE 1.13

Results of innovative farmer evaluation of grain quality of new bush bean lines and varieties proposed for on-farm trials, February, 1985, Pescador, Cauca, Columbia. N = 16.

Bush Bean	Grain Type	No of farmers who selected	Total Score
AFR-205	Large, purple mottled	16	68
A-486	Large, pink opaque	14	56
A-36	Medium, red opaque	13	51
ANCASH - 66	Medium, white	12	46
PVAD-1261	Medium, red opaque	8	28
BAT-1297	Very small, red opaque	7	21
G 4453 x BAT-1386 C	Small, red opaque	7	19
HORSEHEAD XYC 206	Small, red opaque	8	19
G 7223 x BAT-1276 C	Small, red opaque	7	18
ANTIOQUIA 8L-40	Small, red opaque	4	10

Note: 1. Farmers were asked to select six preferred grain types out of the total ten.

2. Each farmer ranked his six preferred types in order from most preferred (score = 6) to least preferred (score = 1).

STUDY QUESTIONS: SECTION I

1. What are the objectives of each of the researchers: breeder, agronomist, soil scientist, economist, sociologist? What kind of diagnostic information on intra-household variables would be useful to them?

2. What should be the main components of an experimental program in February in terms of (a) varieties, (b) fertilizer use, and (c) farmer management?

3. How can farmer participation in the experimental program be maximized?

PRODUCTION AND CONSUMPTION ASPECTS OF TECHNOLOGY TESTING IN PESCADOR, COLUMBIA

SECTION II

PRODUCTION AND CONSUMPTION ASPECTS OF TECHNOLOGY TESTING IN PESCADOR, COLUMBIA

SECTION II

EXPERIMENTATION

As the February planting season fast approached, the field research team of the project sat down with their colleagues to review the information they had obtained from diagnostic research. They concluded that one objective of on-farm experimentation for testing new bean varietal materials and rock phosphate fertilizers should be to follow up on farmer experimentation with fertilizer mixtures. They saw a need to evaluate varietal-fertilizer interactions utilizing mixtures of rock phosphate with other nutrient sources, including the chicken manure purchased locally by farmers. The soil scientist proposed to evaluate a large number of fertilizer mixtures on-station in greenhouse experiments, and to test one of the potentially most promising of these mixtures in an exploratory on-farm trial.

In order to plant trials in February, the soil scientist wanted to use monocropped bush beans as the test crop because climbing beans could not be planted until September.

The researchers identified two types of farmer management strategy from the results of the diagnostic research. They suggested that given the potential of the new bean varieties for improved disease resistance, it would be important to evaluate varietal-fertilizer interactions under representative farmer management conditions for the control of pest and disease problems as shown by the rapid diagnostic survey. Moreover, most farmers expected less disease stress in the second planting season in August-September, so it would be important to repeat evaluations in

both planting seasons. The interviews with innovative farmers, which were intended to provide scope for farmer input into how new technology was tested, had indicated that some farmers were adopting more intensive methods of pest and disease control. This level of management should also be included in the trials, they suggested.

At this stage in the discussion, the potential research design for on-farm experimentation included three levels of the proposed fertilizer mixture and two levels of pest and disease management. These were designed to simulate the two farmer strategies found in the diagnostic research:

a) "Typical Farmer" management, which aims for minimum input control of pest and disease; is interested in disease resistant varieties; and tends to apply high levels of fertilizer for beans.

b) "Innovative Farmer" management, which aims for optimum pest and disease control including more labor; wants increased productivity from varieties; but wants to reduce overall cash expenditures mainly via reduced fertilizer costs.

The question remained of which bean varieties to test. In order to keep the trials simple, the agronomist and soil scientist preferred to include only one or two varieties. However farmer participation in the selection of preferred grain types during the initial diagnostic research had produced an intriguing result: an apparently unattractive small grain type, BAT-1297, had been selected by some farmers.

The sociologist argued that the selection of BAT-1297 when women took part in these discussions was potentially an important clue to the existence of a broader range of preferences than were being tapped by

the interviews with farmers who were male heads of household. The social scientists and agronomist had retabulated the "miscellaneous" category of bean varieties identified in the rapid diagnostic survey, and found that a diversity of grain types were in fact grown in the semi-subsistence oriented, climbing bean production system of Pescador. Apparently "inferior" grain types were utilized in subsistence production and thus might still find acceptance if women were included in the evaluation process.

Based on this argument the team decided not to discard varieties which had been ranked low by the farmers as a group, but to include some of the apparently less-favored varieties in the agronomic trials.

The final experimental design for exploratory trials which the team drew up from this discussion to test fertilizer-varietal interactions with two levels of management, proposed to address the following objectives:

1. To identify fertilizer responsive and disease resistant varieties suitable for "typical farmer" (or minimum input) management of pest and disease.
2. To identify varieties which responded to "innovative farmer" (or high input) management of pests and disease, at lower fertilizer rates and costs compared with a farmer fertilizer check treatment.
3. To select a reduced number of varieties for further testing in regional trials to be carried out subsequently.

The social scientists then raised the question of how compatible was this experimental design, given its complexity and large number of treatments, with the objective of the project of implementing farmer

participation in the assessment of new technology. Moreover, the design required a large-sized plot relative to the size of most farmers' bean plots, as shown by the initial diagnostic. The team then decided to establish this design as an exploratory trial with only two farmers, and to implement farmer participation in a larger number of farmer-managed trials. These trials would superimpose the new varieties onto a range of farmer management and fertilization practices to enable farmers to become familiar with and evaluate the varietal materials, and to participate in the selection of varieties which would enter into subsequent fertilizer trials.

Farmers who planned to plant beans in February were contacted. The social scientist and the agronomist selected thirteen farmers from among them to take part in the farmer managed trials. These farmers were selected to represent a range of socioeconomic resources, identified in terms of indicators such as farm size, ownership of livestock, non-farm employment, and whether their management style for the bean crop would be "typical" or "innovative." The exploratory trial (Table 2.1) was established in fields of two farmers with an agreement that each farmer would implement one crop spraying to represent traditional or minimum input management of pest and disease control on two replications in the trial at the time he judged appropriate. Innovative or high input management would include additional crop spraying of the remaining two replications, implemented at the judgment of the agronomist responsible for overall management of the trial and based on his observation of how "innovative" key informants in the vicinity were treating their bean crop.

The farmer-managed varietal trials were designed to be as simple as

possible so that the eleven cooperating farmers could implement planting and could readily evaluate several varieties. The lay-out for the trials was staked out by the agronomist's assistant in a field destined by each farmer for planting that season's bean crop. Each farmer was provided with seed of each variety in separate labelled packets. Farmers planted one packet of seed or one variety in each parcel staked out in his field starting at the top end of a parcel and planting as far as seed lasted. He marked the last row of the variety with another stake. The remainder of the field was planted on the same day using the local variety of his choice. The farmer was to carry out his usual management operations for the whole bean plot.

Data on labour and other inputs, including fertilizers and chemicals for fumigation applied by each farmer, were recorded. Each farmer had a simple record-keeping sheet for entering labor inputs and purchased inputs as applied to the whole bean field, including the trial.

Approximately sixty days after planting, the first stage of the farmer evaluation of the farmer managed trials took place. The agronomist and sociologist went with the farmer on a visit to the bean trial and asked him to evaluate, visually, the appearance of the different treatments. Farmers' comments on plant architecture, disease susceptibility or other characteristics of the bean plants were noted.

While the agronomic trials were being planted in farmers' fields, the social scientists began to conduct further diagnostic research to discover what role women's preferences might play in technology adoption and how these could be given scope in the testing and evaluation of the technology.

The sociologist decided that the informal survey approach to diagnostic research which utilized random meetings with farmers in their fields had excluded the researchers from contact with women, whose activities were centered around the farmhouse and domestic sphere. Meeting farmers in their fields may have biased some of the earlier findings. However, efforts to interview women in visits to their homes were consistently frustrated by the perception of the women themselves that the men of the household were the relevant informants in an interview situation. Women were "too busy" to sit and talk, a situation in which they were evidently ill at ease, particularly in the presence of men of the household.

To overcome these problems, a different approach was devised. The sociologist selected ten families participating in the farmer-managed trials with which to conduct case studies. Participant observation methodology was utilized to spend part of a day each week helping out in the kitchen of each household alongside the women for a period of six weeks. The sociologist observed women's activities while taking part in their tasks and their conversations. She shared in the family meals and other activities (such as husking maize, packing tomatoes in cases or sorting coffee beans) in which the whole family took part. In this way the problem of access to woman as informants was solved as the researcher became integrated into these domestic activities.

This methodology very rapidly showed, in the course of a few weeks, that women's participation in production activities had been underestimated in the initial diagnostic interviews with male key informants. Women's involvement was found in a broad range of activities outside the domestic sphere.

Observing women at work showed that women spent a major part of their time in the kitchen preparing meals, and carrying them to the fields. Most families hired some laborers who had to be fed three times a day. The use of hired labor is an integral feature of the farming system, not only for the main cash crop, coffee, but for other cash crops such as cassava, sugar cane, bush beans, tomatoes. Cauca Department, where Pescador is located, is one of the lowest wage areas of Columbia, and labor migrates seasonally to higher wage areas. As a result, laborers outside the pool of workers, constituted by the extended family and neighbors, is almost impossible to obtain at local wage rates.

Family labor, such as when sons work for their fathers, is customarily paid the going wage. Hired laborers are typically the young adult men from farm families in the community, and providing these youngsters with employment to keep them living at home and to discourage them from migrating elsewhere is part of the motivation for the use of hired labor among local farmers.

The social scientists discovered that the preparation of meals drew on a wide variety of foodstuffs available from the farm. Some of these were brought to the farmhouse from outlying plots by the men, and stored in the farm storeroom. An important source of foodstuffs in daily demand was the "huerta" or homestead plot, close by the farmhouse, usually an agro-forestry garden of coffee, plantains, fruit trees, cassava, medicinal herbs, cucurbits, and minor root crops, cared for by women. Sometimes the "huerta" also included a small fenced area where maize, beans and vegetables were cultivated. Crops found in the homestead plot represented many of the ingredients found in the

traditional "sancocho" or stew that is basic to the local cuisine.

Although the contents of the daily "sancocho" prepared by women for family and laborers were varied, there were some ingredients that were considered an indispensible component of meals which represented part of the hired workers' remuneration. Local wages were Col $200 per day with meals, or Col $400 per day without meals. The quality of meals could be a factor in the ability of farmers to attract laborers; and farmers without women in their family to prepare meals either could not obtain labor, or had to hire someone to prepare meals. Farmers explained that they preferred to hire laborers on a wage basis that included meals, not only because it involved less cash outlay, but most importantly because laborers would turn up for work earlier in the day and stay longer if meals were provided.

One of the vital ingredients in laborers' meals was beans. Several farm women explained that beans could be used as a substitute for meat to accompany the rice and soup in the customary "sancocho" prepared for field laborers' meals. When the farm housewife had a stock of beans produced on the farm, savings could be made on meat which otherwise had to be purchased.

An aspect of women's influence on production decisions was their part in managing consumption. It was customary for the adult men in farm families to contribute a certain amount of the farm product in kind as well as cash to the household expenses. These cash and kind resources were managed by the women. The amount of this contribution might be decided by the men, but women had a significant influence on determining what food stuffs should be provided from the farm, and this appeared to affect decisions about what should be planted.

Decision making in the household about resource allocation did not take place in clearly demarcated gender-related spheres of influence. Women's influence on production decisions might be indirect: for example, by insisting certain resources of cash be devoted to school expenses or medical care for children, women indirectly influenced cash availability for purchasing agricultural inputs. In such cases, women's influence on farm management was the result of a negotiated or bargaining process of decision making that included sometimes several adults in the family network, such as the husband and wife, their parents, and other relatives or neighbors whose resources might be involved in production decisions. In other cases, women had direct influence on production decisions, by expressing preferences for specific types and varieties of crops which would be used for consumption purposes.

Participant observation showed that although women seldom directly managed the inputs and output of field crop production, they actively expressed an interest in production practices, and discussed among themselves and with men which crops and varieties were high yielding or profitable. Some of the younger farm women explained their concern with these issues in terms of their perception that providing food and income from a farm was a partnership between husband and wife, who shared the responsibility of providing for their family. Young women could migrate to the city, and in many cases had done so before marriage to work as a domestic servant. Women who could earn an income did not have to stay on the farm. These women were interested in making an economic contribution which the men had to recognize and respect and often took out credit and hired labor to work on plots of land which were legally

theirs through inheritance, or belonged to their parents. Newly married daughters living in the extended family household were loaned or given plots of land to cultivate by their parents to enable them to accumulate capital towrd setting up their own household. These young women and their husbands were often the most actively interested in trying out new crops, such as bush beans or tomatoes, and new techniques which would enable them to maximize income and savings toward setting up their own independent households.

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SECTION II

TABLES AND FIGURES

Table 2.1	Experimental Design for Exploratory On-Farm Trial
Table 2.2	Retabulations of Bean Varieties Grown by Farmers
Table 2.3	Division of Labor for Different Farm Activities
Figure 2	Types of Plots, Pescador

TABLE 2.1

Experimental design for exploratory on-farm trial

Treatment Number	Management	Fertilizer Mixture Rate (kg/ha)	Product rate kg/ha		
			RF	CM	S
1 - 8	TF	1153.8	195	945	15.6
9 - 16	TF	2307.7	390	1890	31.2
17 - 24	TF	3461.5	585	2835	46.8
25 - 32	IF	1153.8	195	945	15.6
33 - 40	IF	2307.7	390	1890	31.2
41 - 48	IF	3461.5	585	2835	46.8
49 Farmer check	TF	2307.7	0	2307.7	0
50 Farmer check	IF	2307.7	0	2307.7	0

1 Each fertilizer treatment repeated with 8 bush bean lines: AFR205, A486, A36, A66, PVAD1261, BAT1297, ANTIOQUIA-8L40, CALIMA (local check).

2 Management. TF: "Traditional" farmer management; IF: Innovative farmer management.

3 RF: Rock phosphate; CM: Chicken manure; S: Sulfur.

TABLE 2.2

Retabulation of bean varieties grown by farmers, Pescador, Columbia.

Bean Variety	Size and Color of Grain	Percent of Farmers Growing
Bush beans		
Calima	Large, red opaque	62.9
Cuarzo Rayado	Large, red opaque	24.2
Cuarzo Rojo	Large, red brilliant	6.9
Cuarzo Amarilli	Large, yellow opaque	6.0
		100.0
Climbing Beans		
Sangre Toro	Large, red brilliant	45.8
Revoltura	Mixture of types	20.8
Cuarzo de Vara	Large, red brilliant	10.4
Liberal	Small, red brilliant	6.2
Care Vaca	Medium, red-white opaque	4.2
Bolon Rojo	Medium, red brilliant	2.1
Mortino	Large, purple opaque	2.1
Algarrobo	Medium, red-yellow opaque	2.1
Blanquillo	Medium, white opaque	2.1
Conejo	Small, brown opaque	2.1
Novillona	Medium, red-white	2.1
		100.0

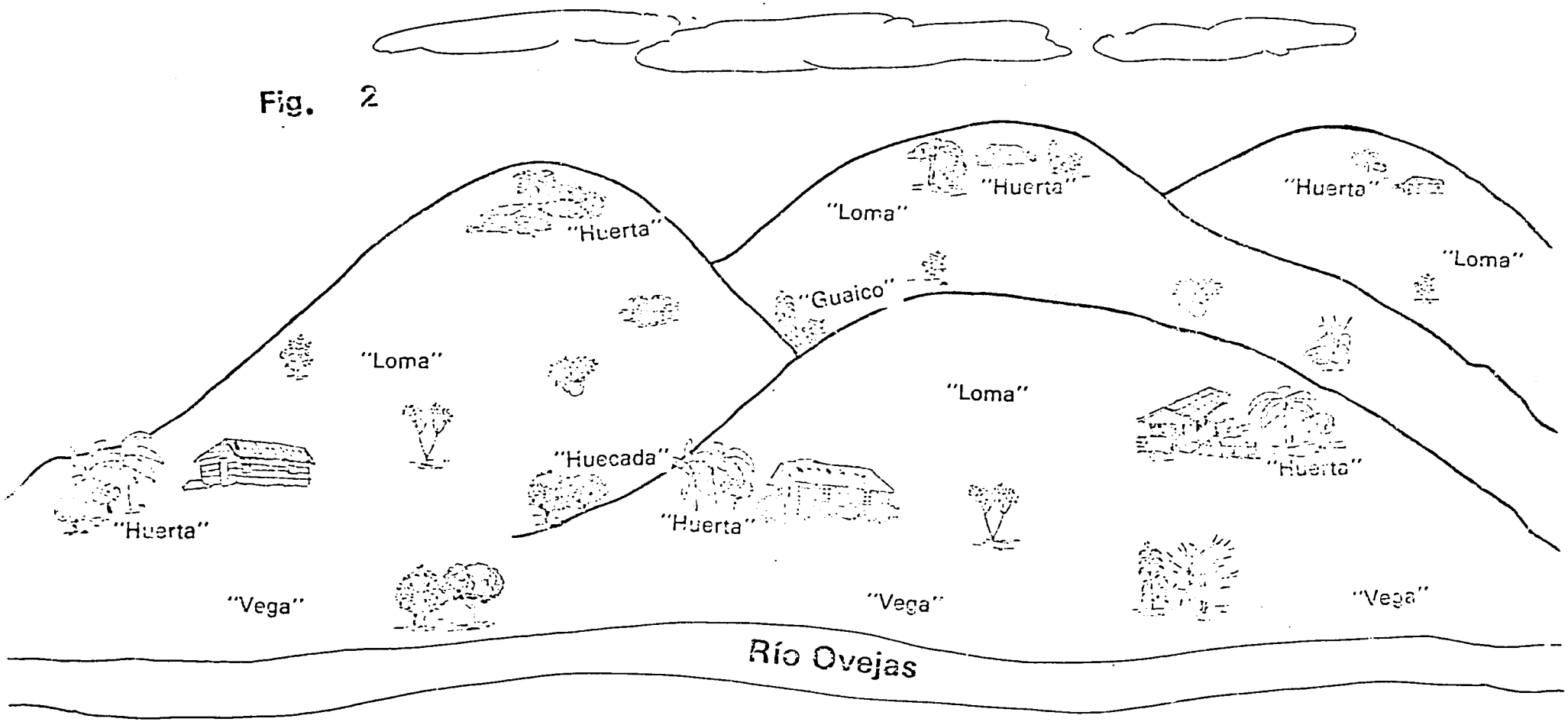
TABLE 2.3

Division of labor for different farm activities.

	Responsibility for carrying out activity				
	Exclusively or Mainly On Own Account		Shared	Children Participate	
Activity	Male	Female	Both Sexes	Male	Female
Agricultural					
Purchase seed/fertilizer	M				
Arrange formal credit	M	F			
Arrange to rent land-in	M	F			
Rent land out	M	F			
Contract laborers	M	F			
Land preparation	M				
Planting	M	F			
Weeding	M			C	C
Harvesting	M				
Shelling, husking			S		
Seed selection			S		
Seed storage		F			
Crop storage		F			
Consumption of stored crops		F			
Processing on-farm			S		
Marketing field crops			S		
Marketing fruit, vegetables		F			
Medicinal plants		F			
Care of vegetable garden		F			
Livestock					
Small animal/poultry care			S	C	
Small animal/poultry marketing			S		
Cattle herding	M			C	
Milking (small scale)		F			
Milking (large scale)			S		
Cattle marketing	M				
Domestic					
Water carrying			S	C	C
Fuel collection			S	C	C
Housecleaning, laundry		F			C
Pre-school child care		F			C
Weekly marketing	M				
Meal preparation (family)		F			C
Meal prepzration (farm laborers)		F			C
Cash management (housekeeping)			S		
Savings			S		
Extraordinary expenditures			S		

Notes: 1. Children less than 10 years of age.
2. Beans, potatoes, vegetables, fruit-trees, coffee seedings
3. More than 1 cow.
M = Male; F = Female; S = Shared; C = Children.

Fig. 2



LEGEND: Types of plot in Pescador, Cauca

"Vega":river valley bottom, used for sugar cane, maize, climbing beans
"Loma": hill slope, use for cassava, beans, vegetable crops
"Huecada": fertile lower slope, for coffee
"Gaico": ridge bottom, used for maize, climbing beans
"Huerta": homestead plot, agro-forestry garden of coffee, cassava, vegetables, bean , fruit trees.

PRODUCTION AND CONSUMPTION ASPECTS OF TECHNOLOGY TESTING IN PESCADOR, COLUMBIA

SECTION III

PRODUCTION AND CONSUMPTION ASPECTS OF TECHNOLOGY TESTING IN PESCADOR, COLUMBIA

SECTION III

EVALUATION

Harvest time arrived and the results of the on-farm trials were evaluated by the research team. Data from the exploratory trial were processed with an analysis of variance to evaluate fertilizer and variety effects under two management strategies. The results showed that under traditional or minimum input management of pest and disease, fertilizer accounted for 45 percent of bean yield variation, and varieties accounted for 12 percent. Under innovative or high input management the order of the results was reversed: varieties accounted for 42 percent of total yield variation, while fertilizer accounted for 28 percent. These results confirmed the farmer strategies identified by the diagnostic. Farmers using traditional management relied heavily on fertilizers, while innovative managers of the bean crop were experimenting with the effects of a reduced investment in fertilizer complemented by more intensive pest and disease management.

Several response function models (quadratic, semilog and linear) were tested for the range of fertilizer rates used. The response function analysis found that under traditional or minimum input management, only two varieties showed significant response to fertilizer (BAT-1267 and PVAD-1261). Under innovative or high input management, all the varieties with the exception of one had significant response to fertilizer although a much lower proportion of variation in yield could be explained by the model.

In summary, the analysis of the exploratory trial indicated that the four best varieties for inclusion in further trials would be BAT-1297, A-36, A-486 and PVAD-1261. However, BAT-1297 was the lower quality, small grain type of bean. The question remained, would farmers accept this variety if recommended?

After harvesting the varietal trials, the researchers took samples of each variety to local middlemen and asked several farmers to do the same. In this way, they estimated a price for each variety and found that, as expected, the small grain type BAT-1297 received a significant price discount. A simple partial cost-benefit analysis was conducted with each farmer, utilizing the grain yield from each variety in his trial, the cost of fertilizer he had applied, and the estimated prices. BAT-1297 was consistently the most profitable variety when grown in farmers' fields. Farmers then selected three or four preferred varieties, ranked in order of preference. The results showed that the two varieties selected in first order of preference by farmers were consistent with the earlier predictions of the breeder: A-36 and A-486 were the top-ranking varieties.

However, the social scientists felt that the findings of the diagnostic research, which showed the role of beans in the management of household food supplies by farm women, suggested that consumption aspects of the varieties required evaluation. The sociologist began a series of interviews with women in the families participating in the trials to find out what criteria women utilized to define an acceptable bean variety. Women told her that they looked for several features when cooking beans: flavor; color of the broth; softness of skins; quickness

in cooking time; and most importantly, that the bean should swell and "yield in the cooking pot" so that a small quantity of beans would provide a substantial number of servings.

The sociologist identified two groups of women who took responsibility for organizing social get-togethers in the community for religious festivals and other communal events, and asked them to collaborate in a cooking test of the eight bean varieties, including the locally preferred variety. Each variety was assigned a letter from A to H; the women cooked each one in quantity in a separate cooking pot, using a local recipe, over a wood fire. This cooking test was carried out on two separate occasions. The women gave each variety a score on the quickness of cooking and yield in the cooking pot. They invited their families along, and everyone tasted the beans one by one in small amounts, and the women assessed each variety on flavor, color and softness. They recorded their three most preferred varieties and ranked them in order. The results showed that when women evaluated cooking characteristics of the varieties, a different order of preference emerged from that identified in the post-harvest evaluations, conducted with the men, which had considered exclusively yield, profitability and marketability. In the evalation with women, three varieties including BAT-1297 were preferred to A-36, the variety ranked highest by the men.

Given the results of the agronomic evaluation from the exploratory trial and these two sets of preferences, the researchers confronted the question of which varieties would ultimately find widest acceptance in the farming community? Which varieties should be excluded from further testing? What combination of variety and fertilizer technology would be

feasible? By now the second planting season had arrived, and it was time to re-establish the exploratory trials and farmer managed trials to evaluate the performance of the technology in different seasonal conditions, as planned.

In an effort to clarify the selection of a preferred variety for inclusion in future trials, the social scientists decided to carry out a follow-up study to see which varieties were being disseminated as seed or replanted by the families who had participated in the varietal trials. In September at the beginning of the subsequent planting season, they visited families to ask both men and women which varieties they had replanted, given away or sold to neighboring farmers. The results showed that varieties preferred for their consumption characteristics in the evaluations conducted with women were being most widely replanted after the conclusion of the on-farm trials. Notably the variety BAT-1297, which the breeder had anticipated would find little acceptance, was reported by farmers as popularly in demand among neighbors. The researchers met other farmers in the community who had heard of BAT-1297, that it was high-yielding and very tasty, and even if not readily sold on the market, it was very useful for household consumption purposes. For these reasons, they were anxious to obtain the seed and often requested it. The follow-up study suggested to the researchers that evaulation of the varieties by women was proving influential in the dissemination of seed material after the trials.

The social scientists decided to re-analyze varietal preferences expressed by men, based on the trial results in the households selected for case study analysis conducted earlier. They found that farmers

which ranked large-grain varieties high in the trial evaluations formed a group distinct from those who ranked small grain varieties. By examining differences in age, family size and family structure, the farmers who preferred large-grain varieties (A-486, AFR-205) could be characterized as either unmarried or recently married, and living in extended families. They were members of large households, including their parents or in-laws, where several adults were engaged in farming in a mixture of co-operative arrangemnts for sharing land, as well as independently owned and managed plots. These families included entrepreneurial young men and women, or couples, who were spear-heading the introduction of tomatoes and horticultural crops into the farming system. Many belonged to a self-proclaimed group of tomato growers which had formed in the community to share experiences with tomato production technology, and which was attempting to set up a co-operative to obtain technical assistance and to market tomatoes. These young people typically had access to capital, often from non-farm employment, but limited access to land. They were often motivated towards maximizing cash income with the objective of getting married and/or setting up independent households. Their agricultural activities were heavily market oriented in "new" crops such as beans and tomatoes, perceived as risky in the community. Their investment in risky, market oriented enterprises appeared to be viable because they typically contributed cash to the extended household, and they did not have obligations to provide traditional subsistence crops for household consumption or even a regular input to the weekly hosekeeping budget. The extended family provided for these needs, and so functioned as a

"safety-net" for young people to experiment with new technology. Both young men and women in this position in extended families were interested in the new large-grain bean varieties because of their profitability, and because they were aggressively seeking new market outlets for their production outside the local community.

Farmers who had an expressed interest in small grain varieties, in particular BAT-1297, were in a different position in their domestic life cycle and in their family structure. This group included young farmers who had set up their separate households and were heads of household of a nuclear family with infants and/or school-age children. Also included in this group were farmers who were heads of household of extended families. Their preferences for bean varieties were related to both market and household consumption objectives. The men were interested in a bean type which had an established niche in the market, and which they could rely upon selling. However in such families there was an explicit recognition of different preferences of women towards the new varieties. As one farmer put it: "I want to plant A-36, but my wife insists that she will plant BAT-1297 in her garden because she wants these beans for housekeeping purposes." It appeared that women who were responsible for managing household consumption in the nuclear or extended family were influential in establishing preferences for varieties that directly addressed consumption rather than market oriented objectives, whereas women who were junior members of an extended household did not have this same responsibility or set of preferences. Indeed, the preferences of young women in an extended household had more in common with those of young men, often their husbands, with a focus on marketing aspects of bean varietal selection.

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Table 3.1	Content Analysis of Farmers' Visual Evaluation of Farm Trials
Figure 3.1	Men's Responses to "Which variety would you rank first?"
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Table 3.2	Analysis of Variance to Evaluate Fertilizer and Variety Under Two Management Strategies
Table 3.3	Follow-up Study: Percent of Times Each Variety Replanted and/or Seed Given by Farm Trial Participants

TABLE 3.1

Content analysis of farmers' visual evaluations of farm trials: Percent of farmers mentioning each characteristic of bean plants.

	BEAN VARIETY CHARACTERISTRIC							
Variety	High Yield	Low Yield	Early	Late	Disease Resistant	Infected	Upright Plant	Sprawling Plant
Most Preferred								
A-486	100	-	22	-	11	22	22	-
PVAD-1261	100	-	-	11	22	11	44	-
BAT-1297	77	-	-	11	22	-	-	44
A-36	55	-	-	11	11	11	-	11
Least Preferred								
Calima	55	-	-	-	11	44	-	-
ANTIOQUIA	-	11	-	55	11	33	-	11
ANCASH-66	-	11	-	55	33	11	-	44
AFR-205	-	11	-	-	11	44	-	11

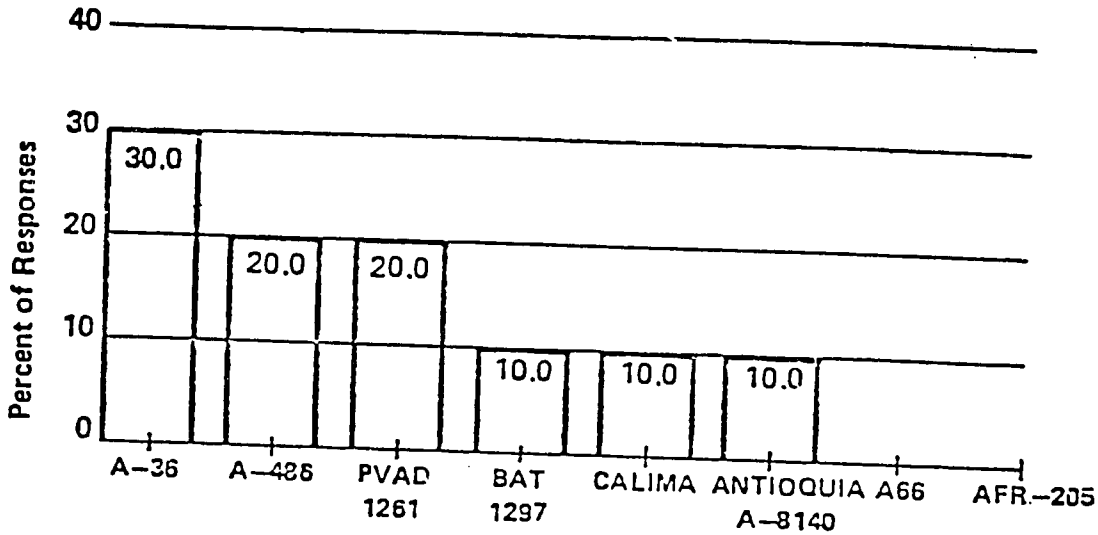

Figure 3.1 Men's responses to "which variety would you rank first?" Cost-benefit evaluation of farm trials, Pescador, Colombia, Spring, 1985.

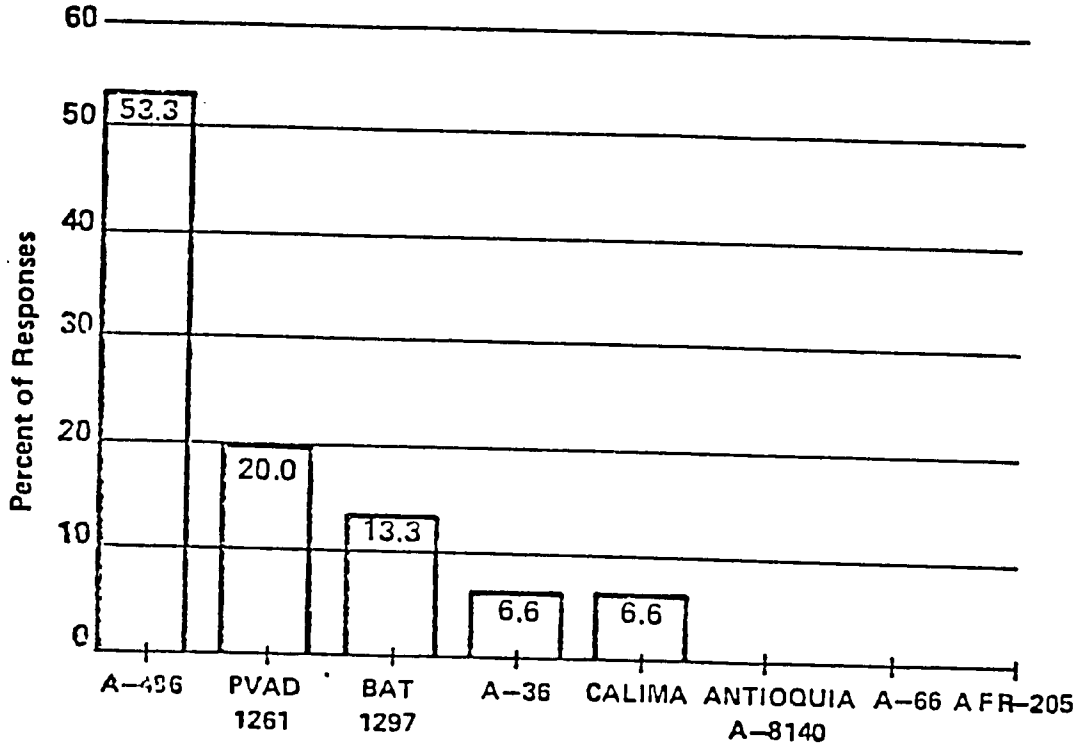

Figure 3.2 Women's responses to "which variety would you rank first?" Consumer Evaluation, Pescador, Colombia, Spring, 1985.

TABLE 3.2

Analysis of variance to evaluate fertilizer and variety under two management strategies.

Bean variety		Percent	
Source of variation	Degrees of Freedom	Dependent Variable: bean yield	
		Traditional Management	Innovative Management
		--percent of sums of squares--	
Replications	1	0.8 NS	3.90 NS
Fertilizer	2	44.83***	27.78***
Variety	8	12.20*	41.60***
Variety x Fertilizer	14	24.68*	11.82 NS
Error	24	18.21	14.90
Total	49	100.00	100.00

Note: * Significant value at 0.05 probably level
** Significant value at 0.01 probably level
*** Significant value at 0.001 probably level

Source: J.A. Ashby and J. Henao, 1986. "Farmers' experimental strategies as a diagnostic tool for design of on-farm trials," (in preparation).

TABLE 3.3

Follow up study of on-farm trials; percent of times each variety replanted and/or seed given to other farmers by farm trial participants.

Bean variety	Percent
A-486	30.2
BAT-1297	23.2
A-36	13.9
PVAD-1261	9.3
ANTIOQUIA	9.3
ANCASH 66	6.9
AFR-205	6.9

STUDY QUESTIONS: SECTION III

1. What are appropriate research domains or preference groups with respect to bean production?

2. How could you characterize their management practices and bean preferences?

3. How are farmers and users included in each of the IFDC/CIAT research activities?