Research on Transference Methodology of Integrated Pest Management Technologies in Honduras *

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RESUMEN

Durante 1985 y 1986 se realizaron ensayos comparando diferentes metodologías de comunicación para la transferencia de tecnología de manejo de plagas en el policultivo maíz-frijol.

El ensayo de 1985 fue realizado en 15 cooperativas del sector reformado y los métodos de extensión utilizados fueron charlas con ayudas visuales (historietas y diapositivas) y charlas sin ayudas. El ensayo de 1986 incluyó un total de 35 grupos, con cooperativas que recibían extensión por primer y segundo año. Los tratamientos fueron charla con diapositivas, charla con historietas, charla sin ayudas, historietas solas (sin intervención de extensionista) y grupo testigo.

Los resultados indican que los distintos métodos de extensión resultan en incrementos significativos en el aprendizaje de los campesinos, pero no hubo diferencias entre el uso de uno u otro. Sin embargo, la charla oral resultó más rentable en la inversión de tiempo, esfuerzo y recursos.

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INTRODUCTION

In the Central American region, important yield losses are caused by insect and mollusk pests in maize and dry bean. Small farmers in the region consider that the major limitation to production is pest damage (Galt *et al.*, 1982).

The capacity of regional institutions to supply up-to-date and efficacious information is limited. Farmers very seldom receive the type of information and assistance needed to be able to protect their crops.

Researchers and agricultural educators often believe that the use of audiovisual aids, circulars, and other publications increase the effectiveness of extension programs. It is argued that lectures are ineffective if they are not reinforced by didactic materials such as audiovisual aids (Sica, 1979; Rubio, 1974; Sánchez, 1981; López y Arévalo, 1976). Those educational publications which have been produced to reinforce technology transfer generally have not been systematically studied to measure their effect or impact. They are used indiscriminately in rural areas, where most of the people are illiterate and largely unexposed to modern media.

Contrary to that approach, the project, Integrated Pest Management in Honduras (IPMH), of the Escuela Agrícola Panamericana, has systematically evaluated the effectiveness of various methodologies and materials for transferring validated pest management technologies to resource-scarce farmers in Honduras. The final goal of the research reported here is to develop, validate and transfer an IPM model outreach program to be used by private and government extension institutions in Honduras and other Central American countries.

CROPPING SYSTEMS AND PRINCIPAL PESTS

Basically, the diet of Honduran small farmers and their families consist of maize and dry beans. The rainy season is from May to November. There is a brief drought in August or September. This dry period divides the two planting seasons, summer and fall respectively. In the summer farmers plant corn, relay cropping dry beans in September, and both crops are harvested in January.

During three years of research the project IPMH has determined the principal pests of the polycultural maize and dry beans system. They are:

MAIZE

— White Grubs *(Phyllophaga* spp.):

The phytophagus larvae of May beetles cause severe damage to the root systems of maize or dry beans, depending whether the life cycle is one or two years. The most important damage is that done to seedlings. Suggested control techniques include cultural controls (deep tillage), application of granular insecticides to the soil to control larvae, and spraying trees where adults feed at night (Andrews y Barletta, 1986a).

— Fall Armyworm *(Spodoptera frugiperda):*

The larvae of this nocturnal moth feed on leaves and ears, but the most important damage they cause is as cutworms. Chemical control is suggested, with directed-spray and granular insecticides applied to the seedlings. The IPMH project has also developed sampling methods and economic thresholds (Andrews *et al.,* 1986b).

— Grass Looper *(Mocis latipes):*

The larvae of this nocturnal moth may severely defoliate pastures, sorghum, rice, and maize. Early weed control is suggested and insecticides may be sprayed on the foliage (Dean *et al.,* 1985).

DRY BEANS

— Bean Slug *(Latipes* spp.):

This nocturnal mollusk defoliator has caused great decreases in acreage of dry beans in Honduras. Preventive controls which are suggested during the maize—growing period include trap trash, quick—burn, early control of broadleaf weeds using herbicides, and baits. During the early dry-bean growing season, bait applications and good tillage practices are suggested. Sampling procedures and economic thresholds have been determined (Andrews y Barletta, 1985a,b,c). The dry-bean slug has also been identified as an important intermediate host of a nematode *(Angiostrongylus costaricensis),* a human parasite, which can be fatal to children.

This is the pest in which the IPMH project has placed the most emphasis and has obtained the most effective solutions.

— Leafhopper *(Empoasca kraemeri):*

Leafhoppers suck fluids from the vascular system on the undersides of the leaves, and inject toxins which may cause leaf curling, chlorosis, and stunted growth that greatly reduce yield or cause complete crop loss. Sampling methods and economic thresholds have been developed, and insecticidal controls suggested (Proyecto MIPH, 1985; Andrews y Barletta, 1986c).

— Bean Pod Weevil *(Apion godmani):*

Adult weevils oviposit on immature pods, and larvae feed on the grains. This is an endemic pest of highland sites. Chemical control is suggested at the beginning of the flowering stage; trash elimination after haverst is also important (Andrews y Barletta, 1985d).

EXTENSION TRIAL 1985

In 1983 and 1984, the project IPMH validated IPM technologies for maize and dry beans. In 1985 project IPMH initiated a long term trial to determine efficacious and economically feasible ways of transferring IPMH technologies to resource scarce farmers. The principal objective of the experiment was to measure the impact and efficacy of extension programs with and without didactic aids (Barletta, 1987; Fisher *et al.*, 1986b).

The null hypotheses tested in the extension trial during 1985 were:

1) The extension efforts do not increase farmers' test scores;
2) Use of teaching aids does not affect farmers' test scores;
3) Use of teaching aids does not affect adoption of technologies;
4) There is no relationship between test score increases and adoption; and
5) Adoption will not take place in the first year.

MATERIALS AND METHODS

The experiment was carried out in 12 agricultural coopera-

tives in three regions (El Paraíso, Olancho, and Yeguare). More than 300 farmers were involved in the trial. Each region had two randomized blocks, and each block contained one replicate of each treatment (extension method). The experiment involved three extensionists; each one was responsible for two blocks. The same technical information was presented at all cooperatives regardless of extension technique. A total of 10 lectures, concerning up to seven pests, were imparted during a seven-month period (May to November). The treatments were:

I) Extension program without teaching aids:

This treatment consisted of training one half of the groups of farmers using only verbal lectures and local resources (such as plants, pests, specimens, and chalk board). Field demonstrations were used when possible.

II) Extension program with teaching aids:

This treatment consisted of training the other half of the farmers through lectures supported by comic-book style publications and slide programs. Demonstration plots were used where possible. The comic books were read in groups of approximately five farmers. A literate farmer coordinated the reading. Subsequently, the extensionist imparted a talk with the help of a slide program.

PRODUCTION OF TEACHING MATERIALS

Illustrators, communication experts, and entomologists were responsible for the production of didactic materials, publications, and slides. Every effort was made to assure that the communication materials presented the concepts and procedures in a clear and concise manner, and as much as possible in the farmers' own language.

After the production of the first draft, materials were evaluated by approximately 20 farmers. Their observations and feedback were used to modify the materials before they were finally incorporated in the extension trial.

EVALUATION PROCEDURES USED

The evaluation procedures used were:

1) Subjective evaluation of materials by national government extensionists, who are the intended users of validated programs and materials.

2) Subjective evaluation of the materials by IPMH extensionists, who used them in the experimental program. They critiqued the content and the format of the presentations with the intention of improving the effectiveness of the lectures and didactic materials.

3) Subjective evaluation of the program by disguised evaluators, who were ostensibly unrelated to the project. To research the farmers' reactions, attitudes, assimilation, and adoption of the technologies; disguised evaluators conducted socioeconomic interviews and informal talks. Great efforts were made to obtain information about the farmers' perception of the importance of the technical assistance provided. Also, evaluators studied the usefulness of the didactic materials and demonstration plots to the farmers, the frequency of interaction among the farmers, and the level of the adoption of the technologies.

4) A postseason workshop was held which involved two representatives of each of the 12 groups of farmers studied during the 1985 extension trial. The degree of acceptance, impact, and utility of the information transferred were evaluated.

5) Technical reports of the lectures were filled out by each extensionist after each lecture. The information recorded included attendance, number of questions asked, and duration of the meetings.

6) The level of the farmers' theoretical knowledge was evaluated by examinations given a week before and one month after the extensionists gave the lectures to the farmers. A minimum of five exams were given in each group of farmers for each of the topics. The questionnaires were filled in by the extensionists who would attend some of the regular group meetings or would visit the homes of the farmers. Two different quizzes of equal difficulty were used, one before and the other after the lectures. These quizzes were evaluated using a 0-100o/o scale.

7) Demonstration plots on the farmers' communal plots allowed for comparisons to be made between the technologies recommended by the IPMH program and those traditionally practiced by the farmers. Data were obtained on agronomic parameters (plant population density, practices, inputs, yield, etc.), economic factors (costs, benefits, prices), and pest population densities.

8) Adoption of technologies was determined through informal interviews made in several groups of farmers. The extensionists focused their questions on the practices that the farmers applied in their individual plots. The goal was to detect changes from the conventional practices, and also determine if those changes were induced by the extension program. A case study was carried out in two very different cooperatives. The first, San Juan de Linaca (El Paraíso) is characterized by a high level of illiteracy, small plots, and use of animal traction. In the other cooperative, La Concepcion No. 2 (Olancho), farmers have a high level of literacy, larger plots, and machine traction (Errázuris, 1985).

RESULTS AND DISCUSSION

1) Subjective Evaluation by Government Extensionists

The impressions of the extensionists (from other agencies) of the materials used were highly positive. A few observed that the caricatures of farmers were uncomplementary. However, our project received requests for the materials from all the agencies consulted.

2) Subjective Evaluation by IPMH Extensionists

According to the extensionists who used the comic book format publications and slide programs, these didactic materials motivated farmers and contributed to their understanding of the technical information. They believed that illiteracy was a constraint to effective use, and that the materials contained too much non-essential information (such as life cycles) and therefore tended to confuse the farmers.

3) Subjective Evaluation by Disguised Evaluators

The information obtained by the disguised evaluators provided several insights. Farmers expressed very few negative opinions regarding the extension progam or the suggested technologies (Table 1). There was some questioning of the priorization of pests selected and the relevance of the pests which were discussed. It was clear that the basic concepts of sampling and economic thresholds remained unclear for virtually all the farmers.

Table 1. Farmers' opinions based on disguised evaluators' observations (extension trial 1985).

Theme	Percent Positive Answers	Percent Negative Answers	Percent Without Opinion	Ratio + / —
Importance of assistance	70	5	25	14:1
Value of the technologies offered	65	2	33	33:1
Relevance of pest selected	49	4	47	12:1
Written materials	48	7	45	7:1
Audiovisual programs	65	3	32	22.1
Demonstrative plots	67	0	33	67:0
Degree of interaction	65	0	35	65:0
Cost of the technologies offered	47	2	51	24:1
Agronomic compatibility of the technologies	64	2	34	32:1

Source: Fisher *et al.*, 1986b.

Illiteracy was mentioned as an important impediment to use of the written materials, although literate family members often read the bulletins to the farmers. Some farmers carefully saved the bulletins; in other households, children were allowed to play with and destroy them. Farmers enjoyed, but felt that they benefited little from the slide shows. Farmers did not criticize the demonstration plots, but they did not seem to generally appreciate their role as a teaching aid. Farmers occasionally referred to the plot as if it belonged to the extensionist and, in general, did not remember which treatments had been applied in the various plots.

Only a few farmers were inclined to apply the new technologies in their own plots in 1985. Several said, however, that they planned to implement certain of the procedures in 1986.

4) Postseason Evaluation Workshop Involving Farmers

During this opportunity for close interaction with the farmers, they communicated to us the importance that they gave to the help provided by the IPMH project, their disposition to adopt the technologies, and their interest in continuing the training. The farmers considered the technical information presented in the cartoon format to be credible. They reported that the publications were desirable because they served as a reference and their children read them. Illiterate farmers consulted the publications with the help of their children or spouse. In addition, it seemed that they preferred the information in a direct, simple and clear form and did not appreciate humor or other distracting elements. They also mentioned that the information transmitted with slides was entertaining but too fleeting and distracting.

5) Extensionists Technical Report of the Lectures

The attendance at the lectures with and without extension aids was not significantly different (Table 2). The use of slides

Table 2. Farmers' attendance at extension sessions in groups taught with and without extension aids (extension trial 1985).

Theme	Mean Attendance (o/o)	
	with	without
Armyworm	84	75
Dry-bean slug (3 lectures)	76	75
Leafhopper	54	76
Pod weevil	70	71
MEAN OF MEANS	73	74

Source: Fisher *et al.*, 1986b.

and comic book publications did not increase the farmers' attendance at the meetings. Instead, in many sites, the slides attracted primarily children and women, rather than more members of the cooperatives. Apparently, the importance of the pests themselves and peer pressure (including fines for non-attendance) were determinant.

The training sessions with extension aids were 16 minutes (25o/o) longer than the conventional lectures (Table 3).

Table 3. Duration of extension sessions in groups taught with and without extension aids (extension trial 1985).

Theme	Mean Lecture Duration (minutes)	
	with	without
Armyworm	110	70
Dry-bean slug 1	90	90
Dru-bean slug 2	90	90
Dry-bean slug 3	100	70
Leafhopper	70	50
Pod weevil	70	60
MEAN	88	72

Source: Fisher *et al.*, 1986b.

No significant differences among the treatments were observed in the number of questions that the farmers asked (Table 4). The aids did not increase significantly the interest and participation of the farmers.

6) Theoretical Knowledge Level

In all the groups and for all topics, the grades obtained after the training were significantly higher than the pretraining grades (Table 5). The results of the first year revealed that there was no significant difference in the assimilation of information by farmers exposed to the two extension methods. Although the net increase in scores was equal, the variance of the average

Table 4. Number of questions asked by farmers during the various lectures in groups taught with and without extension aids (extension trial 1985).

Theme	Mean Number of Questions	
	with	without
Armyworm	13	9
Dry-bean slug 1	15	18
Dry-bean slug 2	15	16
Dry-bean slug 3	16	14
Leafhopper	11	7
Pod weevil	10	6
MEAN	14	12

Source: Fisher *et al.*, 1986b.

grades obtained after the training (199 with, and 58 without) indicated that the effectiveness of the teaching aids varied greatly from farmer to farmer. Some farmers appeared to be able to understand and benefit greatly from the teaching aids; others did not benefit. On the other hand, the scores of farmers taught without aids showed less variation after the training was done; this may reflect that virtually all Honduran small farmers are comfortable and familiar with oral communication. Their response to the method is relatively uniform.

There is a strong negative linear correlation ($r = -0.91$) between the initial grade and the knowledge increase (the lower the initial knowledge, the higher the degree of assimilation). The final grade was about 80o/o, regardless of the initial grades.

No significant differences in final grades or increases in grades were found among regions or extensionists (Table 6 and 7). This indicates that both methods of extension can be implemented equally effectively by different personnel in regions with different cultural and agronomic characteristics.

Table 5. Farmers' test scores for four pests of maize and dry bean before and after the lectures (extension trial 1985).

Theme	Mean grade		Mean increase
	before	after	
Armyworm			
With aids	46	78	32
Without aids	46	73	27
Dry-bean slug			
With aids	49	81	32
Without aids	48	80	32
Leafhopper			
With aids	18	64	46
Without aids	22	68	45
Pod weevil			
With aids	46	66	20
Without aids	48	66	18
MEAN OF MEANS			
With aids	40	73	33
Without aids	41	72	31

Source: Fisher *et al.*, 1986b.

Table 6. Increase in farmers' test scores for one pest lecture (bean slug) in three regions of the country with and without extension aids (extension trial 1985).

Región	with	without
Yeguare	30	28
Olancho	32	38
El Paraíso	40	31
MEAN	34	32

Source: Barletta, 1987.

Table 7. Increase in farmers' test scores for one-pest lectures (dry-bean slug) as a function of the extensionist reported for groups taught with and without extension aids (extension trial 1985).

Extensionist	with	without
1	33	25
2	30	40
3	40	31
MEAN	34	32

Source: Barletta, 1987.

The results of the 1985 trial showed that the initial test scores of the literate farmers were higher than those of the illiterates, but no significant differences were found among the final test scores (Table 8). This may indicate that the extension program can function well with people of different educational levels. Surprisingly, illiteracy was not observed to be a constraint to the assimilation of the information presented; this was true in both treatments.

Table 8. Test scores of literate and illiterate farmers, taught with and without extension aids, for one-pest lectures (extension trial 1985).

Farmers	Teaching aids	Evaluation		
		Before	After	Increase
Illiterate	with	44	84	40
	without	46	83	37
Literate	with	54	84	30
	without	49	82	33
Illiterate (mean)		45	85	40
Literate (mean)		52	83	31

Source: Barletta, 1987.

No linear correlation (positive or negative) was observed between the farmers' age and the assimilation of the information presented to the farmers.

7) Adoption of Technologies

It was observed that there was a high degree of adoption of the information on slug control methods in both cooperatives which were studied in spite of the great economic, technical, and cultural differences between them (Figure 1 and 2). Additionally, in both sites the acreage of private plots planted in dry beans increased noticeably in 1985, as compared to 1984. In La Concepción, Olancho, the acreage increased31o/o; in San Juan de Linaca (El Paraíso) there was a 42o/o increase over the previous year (Figure 3). Since parallel data were not taken in cooperatives which were not exposed to the extension program, it is impossible to conclude positively that the increases were

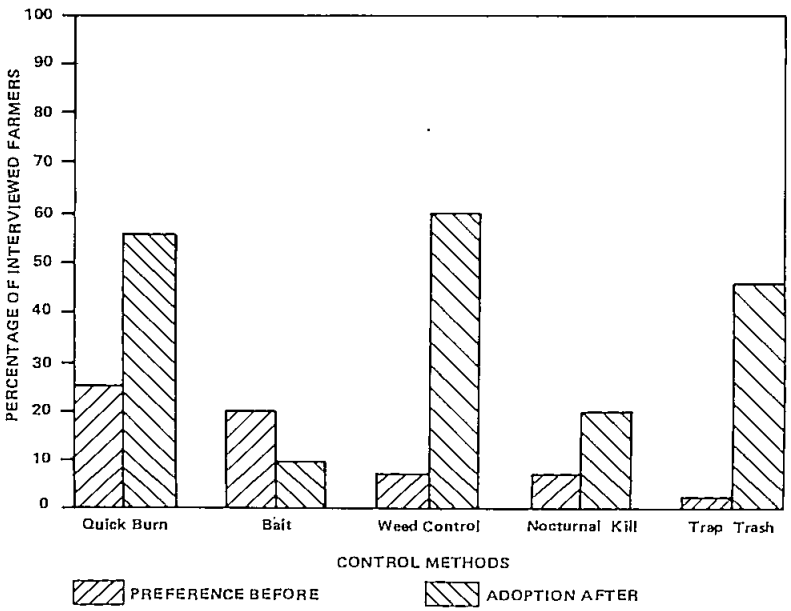

FIGURE 1. PREFERENCE OF CULTURAL AND CHEMICAL DRY-BEAN SLUG CONTROLS. LA CONCEPCION, OLANCHO. (N=20). (ERRAZURIS, 1985).

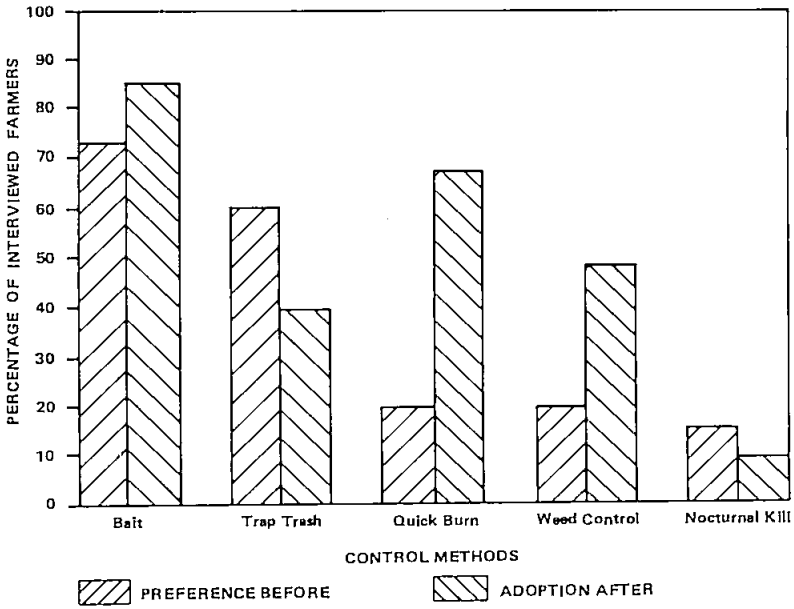

FIGURE 2. PREFERENCE OF CULTURAL AND CHEMICAL DRY—BEAN SLUG CONTROLS. SAN JUAN DE LINACA, EL PARAISO. (N=20). (ERRAZURIS, 1985).

not due to non-pest factors (eg: marketing, climatic). However, farmers did cite a new sense of confidence in their ability to control pests, especially the bean slug, as the cause for the increased acreages.

8) Demonstration Plots

Dry bean yields obtained in the demonstration plots showed the superiority and cost effectiveness of the technologies offered (Figure 4).

9) Economic Analysis of the Two Extension Methods

The lectures given with slides and bulletins induced the same test score increases as did the unaided lectures. The use of teaching aids increased costs by 53o/o, but had the same impact as the unaided procedure (Figure 5).

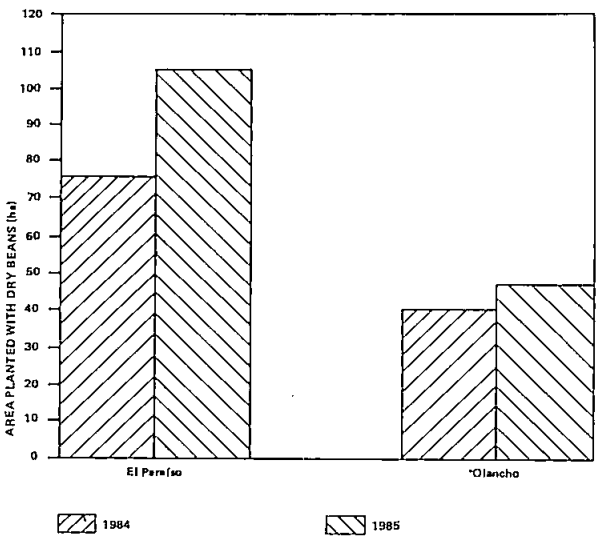

FIGURE 3. INCREASE IN DRY—BEAN AREA PLANTED IN 1985 IN OLANCHO AND EL PARAISO. BASED ON 94 FARMERS INTERVIEWED OF EL PARAISO AND 75 OF OLANCHO. (FISHER *ET AL.*, 1986a).

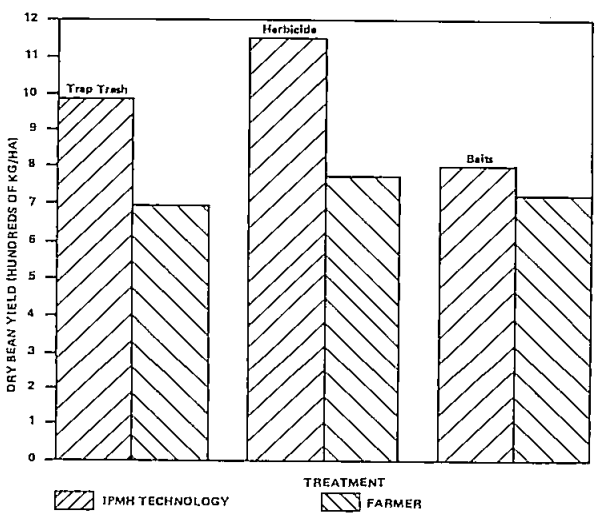

FIGURE 4. DRY—BEAN YIELD USING 3 IPMH TECHNOLOGIES IN 1985 IN HONDURAS. (N=8 FOR EACH TREATMENT). (FISHER *ET AL.*, 1986a).

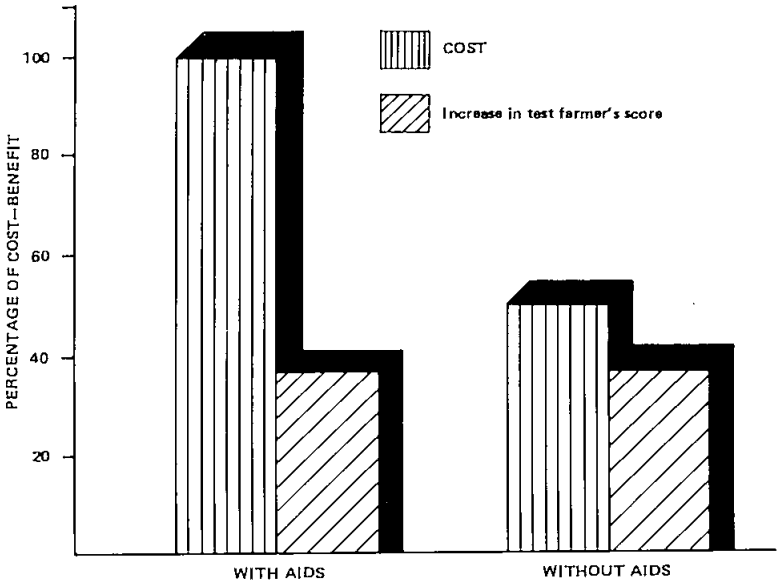

FIGURE 5. COST—BENEFIT RELATION OF TWO COMMUNICATION METHODS. (Barletta, 1987).

EXTENSION TRIAL 1986

Based on the results and the experience obtained during 1985, we modified the experimental design to test additional hypotheses. Null hypotheses (both original and additional) tested in 1986 were the following:

1) There is no difference in farmers' test scores between lectures with or without teaching aids;

2) There is no difference in farmers' adoption of technologies between lectures with or without teaching aids;

3) There is no difference in final test scores among the farmers exposed to the various extension aids;

4) There is no difference in adoption of technologies among the farmers exposed to the various extension methods;

5) Adoption of technologies will not take place in the second year;

6) There is no difference in final test scores between farmers exposed to one or two years of extension;

7) There is no difference in adoption of technologies between farmers exposed to one or two years of extension;

8) There is no difference in final test scores among farmers exposed to various institutions or extension personnel;

9) There is no difference in adoption of technologies among farmers exposed to various institutions or extension personnel;

10) The importance of the pest in the area does not affect the farmers' test scores; and

11) The importance of the pest in the area does not affect the farmers' adoption of technologies.

Based on the results in 1985 we made certain changes in the extension research design.

1) One half of the groups taught in 1985 received a second year of training in 1986. The other half was abandoned, that is, they did not receive any additional formal extension.

2) In those second-year groups which received additional training, the combined treatment of slides and publications was divided in order to measure the individual impact of each aid separately as compared to the conventional method.

3) First—year groups also received either slide or publication-aided lectures, but not both together.

4) Absolute check groups were added to measure changes in the knowledge of farmers that were not involved in the extension program; this was done to measure the effect of other sources of information about pests.

5) The impact of the publications alone (used without the extensionist) was evaluated in certain first-year cooperatives.

6) The efficacy of our materials and technologies when used by private and national (rather than Project IPMH) extension personnel was evaluated in first-year groups.

In summary the 1986 extension program consisted of five treatments involving second-year groups: a) no extension in groups which received unaided lectures in 1985; b) no extension in groups which received aided lectures in 1985; c) slide-aided lectures in groups which received aided lectures in 1985; d) bulletin-aided lectures in groups which received aided lectures in 1985; and e) unaided lectures in groups which received unaided lectures in 1985.

First-year groups studied by project IPMH in 1986 received one of the following treatments: a) slide-aided lecture; b) bulletin-aided lecture; c) unaided lecture; d) bulletin only without lecture; or e) check (without extension).

First-year groups attended by non-project IPMH extensionists received one of the following treatments: a) slide-aided lecture; b) bulletin-aided lecture; or c) unaided lecture. Two cooperating agencies were involved in this part of the test. Vermont Partners of the Americas is a private voluntary organization working in the Sabanagrande area. This group employs non-university trained ex-farmers as extensionists and emphasizes integrated, grassroots development. Natural Resources Management Project is a government group in the Choluteca region which employs university-trained extensionists.

PRELIMINARY RESULTS

Preliminary analysis of the results of the 1986 extension trial showed the same tendencies observed in 1985. The slides and publications do not seem to improve learning when compared with the unaided extension method regarding the extension organization and the number of years exposed to extension (Table 9, 10, 11, and 12).

Improvement of test scores of those farmers who had

Table 9. Mean test scores by extension method for farmers, attended by Project IPMH, in their first year exposed to extension (extension trial 1986).

Extension Method	Mean Test Score		
	before	after	increase
Unaided lecture	36	57	21 a *
Slide-aided lecture	36	52	16 a
Bulletin only, without lecture	38	53	15 a
Bulletin-aided lecture	34	50	16 a
Check (without extension)	36	36	0 b

* Duncan's multiple range test (P=0.05).

Table 10. Mean test scores by extension method for farmers, attended by Project IPMH and collaborators, in their first year exposed to extension (extension trial 1986).

Extension Method	Mean Test Score		
	before	after	increase *
Unaided lecture	36	59	23
Slide-aided lecture	37	58	22
Bulletin-aided lecture	34	53	20

*No significant differences.

Table 11Mean test scores by extension method for farmers, attended by Project IPMH, in the second year exposed to extension (extension trial 1986).

Extension Method	Mean Test Score		
	before	after	increase *
Unaided lecture	51	67	16
Bulletin-aided lecture	59	72	13
Slide-aided lecture	57	71	14

*No significant differences.

Table 12 Mean test scores by extension method for farmers, attended by collaborators, in their first year exposed to extension (extension trial 1986).

Extension Method	Mean Test Score		
	before	after	increase *
Unaided lecture	33	56	23
Slide-aided lecture	37	65	28
Bulletin-aided lecture	35	63	28

* No significant differences.

been given only publications was somewhat inferior to that obtained when the extensionist intervened. However, using this treatment it was possible to obtain a noticeable increase in learning at a very low cost.

No significant increases in test scores were measured in the check groups. This implies that no other extension programs involving pest control technologies were affecting the integrity of our treatments (Table 9).

When comparing groups exposed to one and two years of extension (Table 13) the data show that the knowledge increase was significantly higher in farmers exposed to the first year than in farmers exposed to the second year of extension. That difference is due to the fact that the second-year groups began with a higher level of knowledge because they had received training the previous year and consequently the amount of knowledge that they could assimilate was smaller than the amount that first-year groups could assimilate. In spite of this fact, further research is needed to evaluate the effect of a second year of extension on the effectiveness of the practices adopted by the farmers and on their adoption rate. This evaluation will be the key factor in deciding if a second year of extension is needed and if it is cost effective.

The farmers taught by the collaborating organizations, Vermont Partners of the Americas and Natural Resources

Table 13 Farmers' mean test scores by number of years exposed to extension, for lectures of maize and dry-bean pests (extension trial 1986).

Number of years of extension	Mean Test Score		
	before	after	increase *
1	36	56	20
2	56	66	10

* There is a significant difference.

Management Project, showed a significantly higher knowledge-increase than those taught by the IPMH Project (Table 14 and 15). The results might be due to the fact that the extensionists of the mentioned collaborating organizations had more experience, since they are ex-farmers especially trained to be extensionists. This fact makes communication between farmers and the extensionist easier.

Table 14 Mean test score by extension method and extension organization for nine lectures of maize and dry-bean pests (extension trial 1986).

Extension Method	Extension Organization	Mean Test Scores		
		before	after	increase *
Slide-aided lecture	IPMH	35	52	17
	Collaborators	37	65	28
Bulletin-aided lecture	IPMH	34	43	9
	Collaborators	35	63	28
Unaided lecture	IPMH	37	56	19
	Collaborators	33	56	23

* There are significant differences between extension organizations (IPMH and Vermont Project).

Table 15 Mean test score by extension organization for farmers exposed to one year of extension (extension trial 1986).

Extension Organization	Mean Test Score		
	before	after	increase *
IPMH	35	50	15
Collaborators	35	61	26

* There is a significant difference.

However, we feel that the key parameter of any final evaluation (adoption rate of technologies) cannot be determined before 1987 or 1988.

CONCLUSIONS

The following conclusions are based primarily on complete 1985 data, along with data from 1986 which have been analyzed.

Both unaided and aided programs resulted in highly significant increases in farmers' learning. Based on the mean of increased test scores in the three regions of the country, it seems that the two communication methods could be utilized in regions with relatively different cultural and agronomic characteristics.

Age did not seem to affect the farmers' learning because there was no linear correlation between age and learning.

The learning increase was higher for those farmers whose initial knowledge was inferior. However, the use of slides and comic-book-like bulletins to reinforce the lectures did not improve the farmers' comprehension significantly when compared to the unaided method of extension. Because the variance of farmers' scores exposed to the teaching aids was greater, we hypothesize that certain farmers can understand and benefit from the visual media while others seem to be distracted or unaffected by them. On the other hand, most of the farmers seem to respond homogeneously to oral communication as

indicated by the small variance of test scores of those who were taught using the conventional technique. In effect, the use of novel communication aids seems to exacerbate differences among farmers, while use of unaided lectures results in more egalitarian increases.

The teaching aids seem to be of more utility to the extensionists than to the farmers. Even though the extensionists were enthusiastic about the didactic materials, the increases in farmers' understanding were similar in both methods. Farmers themselves often recognized the inappropriateness of the media used, especially the slide programs. Therefore, the same increase in farmer learning can be obtained with the unaided lectures, which require less time, effort and considerably less capital.

The conflicting conclusions obtained from various sources, using different evaluation methods, are reminders of the need for care in evaluating alternative extension procedures and aids. If only extensionists' and communication specialists' opinions had been considered in the evaluation procedures, it would have seemed that the unaided lectures were inferior to those presented with slides and publications. However, results to date obtained with standardized tests and through the disguised evaluators would indicate that these expensive aids are not cost effective.

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