DOCUMENT RESUME

ED 043 826 AC 008 545

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TITLE Factors Associated with the Adoption of Agricultural Practices; Kampong Bukit Kapar, Selangor, Malaysia.
INSTITUTION College of Agriculture, Serdang, Selangor (West Malaysia).
PUB DATE Dec 67
NOTE 45p.

EDRS PRICE EDRS Price MF-$0.25 HC-$2.35
DESCRIPTORS *Adoption (Ideas), *Agricultural Occupations, Agriculture, Attitudes, *Developing Nations, *Diffusion, Extension Agents, *Farmers, Food, Individual Characteristics, Information Sources, Participation, Questionnaires, Research, Statistical Analysis, Values
IDENTIFIERS *Malaysia

ABSTRACT

The focus of this study was to procure data about adoption behavior of Malaysian smallholders (farmers) that would be useful in the instructional program in extension education at the College of Agriculture, Malaysia. Students interviewed 76 persons in a rural village of two hundred families, all engaged in agriculture. The major sources of income were rubber and pineapple; other activities included fruit-growing and the production of the family food supply (to a limited extent). Principle objectives of the study were to: establish the level of practice adoption among the smallholders; determine factors associated with adoption proneness; and procure data on the diffusion of a specific practice through a village. Those who adopted first tended to be better educated, have larger size holdings, be middle-aged, and participate more in organizations. The pattern of diffusion took time; primary sources of information were neighbors for all respondents and extension workers for the earlier adopters. Adoption rates for some practices, requiring little outlay of money, were in excess of half of the respondents. (The questionnaire is included.) (EB)

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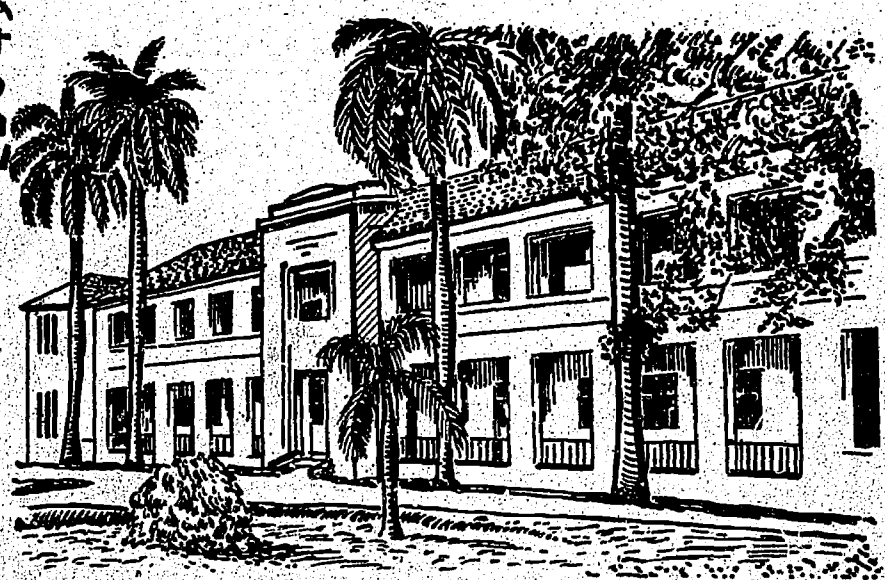
ED043826

FACTORS ASSOCIATED WITH THE ADOPTION OF AGRICULTURAL PRACTICES

KAMPONG BUKIT KAPAR, SELANGOR, MALAYSIA



COLLEGE OF AGRICULTURE MALAYA
SERDANG, SELANGOR, WEST MALAYSIA

Extension Research Publication No. 1
College of Agriculture, Malaya
Serdang, Selangor, Malaysia,
December, 1967.

AC008545

ED043826

ACKNOWLEDGEMENTS

The author is grateful to many people for their cooperation and assistance in making this study possible. Expressions of gratitude are due to Tuan Haji Iskandar Shah the Ketua Kampong (Village Headman) of Kampong Bukit Kapar for allowing us to interview the people of his village and for making the necessary arrangements; to Enche Mohd. Ismail s/o S. Ahmad, Lecturer in Farm Management at the College, for making the necessary contacts to conduct the study and for cooperating in developnig the interview schedule and collecting the data; to Mrs. Patricia Chan Rivera, Assistant Lecturer in Home Economics at the College, for assisting in the conduct of the study; Enche Wan Chee Keong, Assistant Lecturer in the Farm Department at the College, for information on recommended practices; to Dr. E. W. Gassie, Specialist (Training) and Associate Professor of Co-operative Extension Education, Louisiana State University, Baton Rouge, Louisiana, for processing the data through the Computer Research Center of Louisiana State University; to the third year students, College of Agriculture, Malaysia, for conducting the interviews; to Enche Mohd. Rashid bin Ahmad, Farm Director at the College, for his helping suggestions to the students and to the author; to Dr. Mohd. Rashdan bin Baba, Principal of the College, for the administrative support and encouragement necessary for this project; and to the Ford Foundation under whose support the author was assigned in Malaysia.

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FACTORS ASSOCIATED WITH THE ADOPTION OF AGRICULTURAL PRACTICES, KAMPONG BUKIT KAPAR, SELANGOR, MALAYSIA

by LYNN L. PESSON[1]

INTRODUCTION

This study was designed as an empirical project, based upon some already established concepts relating to social and educational change. The primary focus was to procure data that would be useful in the instructional program in extension education at the College of Agriculture, Serdang, Selangor, Malaysia, so that the students could more readily apply the concepts to Malaysian conditions. By having relevant data about the adoption behavior of Malaysian smallholders (farmers) in hand, it would then be possible to focus the learning experiences of the students more realistically upon the problems of leading a program of educational change among Malaysian people engaged in agriculture.

Extension Education

The academic discipline of Extension Education is an applied area, having its roots in the basic social sciences. As an applied discipline, applicable basic concepts from relevant disciplines are applied to the problems of conducting an informal education program among people engaged in agriculture so that production levels may be raised, economic efficiency increased, standards of living improved, and hopefully so that a higher proportion of benefits will lead to a healthier, happier, more productive life for people. People, however, do not always respond to innovations in the same way or with the same speed. It is imperative, therefore, that the professional extension educator must have a solid conception of some of the processes that go on among people in response to attempts to introduce change as the basis for designing and implementing effective programs.

This study, consequently, was conceived as an attempt to apply selected concepts from the disciplines of rural sociology and educational psychology to Malaysian conditions so that Malaysian students could develop conceptualizations under realistic circumstances, thereby promoting more efficient and effective learning among the students. The study also should provide additional insights as to the degree to which these concepts apply in yet another set of cultural circumstances.

[1] At the time of this study, Dr. Pesson was a Visiting Professor in Extension Education at the College of Agriculture, Malaya, as part of the Louisiana State University team assigned to the College through Ford Foundation support.

Location of the Study

This study was conducted in Kampong Bukit Kapar, a rural village, containing about two hundred families, all engaged in agriculture, either on a part-time or full-time basis. Bukit Kapar is located about seven miles north of Klang in the State of Selangor. Thus, the village is located reasonably close to a major urban center, since the Capitol of Malaysia, Kuala Lumpur, is approximately thirty miles away, and the City of Klang itself is also a major urban center in the valley of the Klang River, Malaysia's most industrialized area. The village, therefore, was not an isolated one.

The smallholders in the village had two major sources of agricultural income; rubber and pineapple. Other agricultural activities included fruit-growing and the production of the family food supply, but only to a limited extent. The main food of the Malaysian populace, rice, was not produced in the village, but had to be purchased at the time of the study.

The people in the village at the time of the study were Malays, but they were not the typical indigeneous Malays of the country since they were immigrants from Java of fairly recent origin. In this sense, their customs and traditions do tend to vary from those of the indigeneous Malay people. Like the indigenous Malays, however, they are of the Muslim faith and do use the Malay language as their native tongue.

REVIEW OF RESEARCH FINDINGS

An extensive number of research studies have been conducted on factors affecting the adoption of new ideas and practices in a number of different cultural circumstances. Lionberger[1] in a book of recent origin presents an exhaustive reveiew and attempts to synthesize some of these findings. Among the factors he reports as related to adoption are age, education, income and size of farm. In general, younger farmers adopt innovations earlier, but these are not necessarily the youngest farmers. Persons with higher levels of income are more prone to early adoption and similarly persons with larger farms are more prone to adoption. Higher levels of income were also related to time of adoption. Another important index related to adoption was that of the participation index in activities and organizations, particularly with respect to participation outside the community. The community with which one lives and the formal and informal social systems to which one belongs were found to be related to adoption. Those communities and systems in which people place high value on new technology generally exhibited higher and faster adoption rates than those which did not.

Beal and Bohlen[2] report that there is a time lag between what is known through research and what is adopted by farmers. This time lag varies, extending from a few to many years. Their report suggested that individuals go through a five stage process, awareness, interest, evaluation, trial and adoption, in moving from first knowledge to adoption and there is a differential rate among people in the speed with which they go through this process. In moving through this process two important processes take place, according to Lionberger,[3] information—seeking and decision-making. The report suggests that for all farmers, neighbors and friends are important sources of information, but for the earlier adopters, the agencies conducting education work are important sources of information. For later adopters, neighbors and friends are by far the most important source. In decision-making, neighbors and friends are the most important source with the professionals, the representatives of educational agencies, serving as referents in decision-making primarily for the very early adopters.

The simpler practices, particularly those that require only changes in materials or equipment, are adopted quicker, according to Beal and Bohlen.[4] Where change is more complicated, adoption is more difficult to achieve through programs of change. Rogers[5] reports that practices that display

[1] N.F. Lionberger. *Adoption of New Ideas and Practices* (Ames: Iowa State University Press, 1960).
[2] George M. Beal and Joe M. Bohlen. *How Farm People Accept New Ideas*, Special Report No. 15, Agricultural Extension Service (Ames: Iowa State College, 1955).
[3] Lionberger, *op cit.*
[4] Beal and Bohlen, *op. cit.*
[5] E. M. Rogers, *Diffusion of Innovations* (New York: Free Press of Glencoe, 1962).

a high relative advantage over the old, existing practices, those that are easily divisible and communicable, those that are simple, and those that are compatible with the existing culture are more quickly adopted by people.

The research findings in this area suggest, therefore, that the diffusion of new ideas among people takes time and the time that it takes people to adopt is affected by many different factors including the nature of the practice that is being introduced, the person and/or agency that is espousing change, the environment in which people live, and the characteristics of the individuals themselves. There are many important variables, consequently, that must be understood and utilized if the process of change is to be speeded-up.

RESEARCH DESIGN

Objectives of the Study

The major objectives of this study were threefold. These objectives and the related subsidiary objectives are as follows:

1. To determine the degree to which production practices for the two major crops were adopted by the smallholders, as well as selected live-at-home practices.
2. To determine the factors which were related to the adoption of the recommended practices by the smallholders. The factors included:
   (*a*) the characteristics of the smallholders.
   (*b*) the specific practices which were related to adoption—proneness among the smallholders.
   (*c*) the relationship of the smallholders with extension education agencies.
   (*d*) the concepts which the smallholders held about selected practices.
   (*e*) selected values and attitudes of the smallholders.
3. To determine factors that were related to the diffusion of a selected innovation among the smallholders.

Design of the Interview Schedule

In relation to the objectives stipulated for the study, an interview schedule was developed for the purpose of collecting the necessary data from the interviewees. Questions were designed so that responses would be procured

from the interviewees in relation to the following areas: (1) the acreage in the smallholding and the usage of the area, (2) the pineapple production practices used, (3) the rubber production practices used, (4) the usage of live-at-home practices, (5) their contacts with and opinions of extension education agencies, (6) the time sequence, sources of information and evaluation of a specific practice, the use of hormones to stimulate fruiting in pineapples, (7) their opinions and beliefs in relation to four selected practices, (8) their personal, social and economic characteristics, and (9) certain selected values and attitudes. In addition, where feasible certain observations were made by the interviewers in regard to the condition of the fields and the home site.

Sample Selection

In planning the study, particularly since student interviewers were involved, it was decided to sample only one village where a homogenous group of respondents could be found. By doing this, it was then possible to attempt to assess the flow of information among the smallholders and to be uniform in the persons who would be responding.

The village contained about two hundred families, according to the Ketua Kampong (Village Headman). The particular village was selected because there was a large enough population from which to select a sample and because there was a high degree of uniformity in terms of the cash-crops grown, pineapple and rubber. The farms were rather typical for the area in terms of size and crops grown.

Baed on a plot plan submitted by the Ketua Kampong, it was possible to ascertain the location of the homes of the potential respondents. It was decided, therefore, to attempt to get every other farmer to respond to the study. For sampling purposes, the village was divided into six blocks (areas), each containing from thirty to thirty-five homes. The objective was to interview every alternate farmer. By drawing from a hat, it was determined that the students would begin their interviews with the first house at the Southeast corner of the block. From that point the students proceeded West, then North, then East, and finally South, until the interviews were completed. When the potential respondent was not available, then the student team proceeded to the next house. If this person was not available, then they were to return later in the day and again attempt to find the original smallholder at home. Using this technique, seventy-six usable schedules were procured.

Data Collection

The interviews with the smallholders were conducted by the third year students (final year) of the College of Agriculture, Malaya. All of the

students were enrolled in the Extension Education subject at the College and had had training in research and evaluative techniques in three different subjects at the College; Research Techniques and Farm Management, as well as Extension Education. The interview schedule was explained carefully to the students so that all of the sixty-seven students who participated understood the type of responses the questions were designed to elicit.

The students conducted the interviews in pairs, and in one instance three students formed a team. The kampong (village) was divided into six blocks, based on a map of the village procured from the Ketua Kampong (Village Headman). Either five or six teams were assigned to each of the six blocks, and each of the groups of teams assigned to a block was under the leadership of a student interviewer so that the sampling plan would be followed.

The respondents for the study were interviewed at their homes or in the fields, depending on where they could be located. The interviews were conducted in the National Language of Malaysia (Malay), with the interviewers translating the responses into English for recording purposes. The respondents were urged to be objective in their responses and were assured that the responses would be kept confidential. It was also emphasized to them that the data would be used by the College for the purpose of student training. After the interview was completed, the interview team compared notes, edited the schedule, and turned it in to the researcher.

Analysis of the Data

The data were transferred from the interview schedules to punched cards for electronic computation, based upon a pre-determined coding system. Frequency distributions were calculated through the facilities of the Computer Research Center, Louisiana State University, Baton Rouge, Louisiana, U.S.A.

Preliminary to the analysis, calculations were made to determine practices that should be utilized by a particular smallholder and then determining which of these practices the smallholder was actually utilizing in his farming operation. For example, if a smallholder was producing rubber which was not yet at the tapping stage and pineapple, then the calculation was made on that basis. For all smallholders, five live-at-home practices were checked. These included vegetable gardening, fruit-growing, poultry production, the raising of tapioca and other root crops, and the raising of livestock. All of these practices were selected because of their value in nutrition, since they could serve as sources of nutrients for a well-balanced diet in a live-at-home program, serving as supplements to the staple food, rice.

The indices ranged from zero to eighty-eight per cent. Based on this range, the smallholders were divided into two groups, the higher (55 per cent and over) and the lower (54 per cent and lower). Thirty-one of the respondents were in the higher group and forty-five of the respondents were in the lower group. These groupings, therefore, became the major dependent variable of the study, serving as the focal point of the analyses.

In order to determine relationships between the dependent variable, the adoption group, and each of the independent variables bing tested, the Chi-Square (X^2) statistical test was used. The reason for selecting this test was that the data being analyzed involved grouped data, both the dependent variable and the independent variables. Since the data were discrete and not continuous, it would suffice, therefore, to use a non-parametric test. It was felt that the Chi-Square test would provide sufficient statistical bases for determining the extent to which the data represented the entire population and to determine the extent to which statistically significant relationships existed. In determining the level of significance (P), it was felt that the .20 level of confidence would insure a sufficiently high probability of finding the same relationships or associations again between the dependent variable and the independent variables. Although the .05 level of confidence is often used, this was more of an empirical than a theoretical study so it was felt that the .20 level would suffice as a basis for determining relationships.

ANALYSIS OF THE DATA

The main focus of this study was to determine the factors that were related to adoption-proneness. In this study, adoption-proneness was measured by an index that indicated the extent to which a particular respondent had adopted all of the applicable agricultural and live-at-home practices that were recommended in Malaysia[1], based on research data and current practice. The respondents in this study were divided into two categories; the high group (31 respondents) who had adopted 55 per cent or more of the recommended innovations applicable to their particular circumstances, and the lower group (45 respondents) who had adopted less than 55 per cent of the applicable innovations.

The analyses are divided into eight major sections as follows: (1) characteristics, (2) pineapple production practices, (3) rubber production practices, (4) live-at-home practices, (5) relationships with extension education agencies, (6) concepts related to selected practices, (7) selected values and attitudes, and (8) factors related to the adoption of a selected practice.

[1] The recommendations were based on the material taught in the applicable subjects at the College of Agriculture, Malaya.

Characteristics of the Respondents

Data pertaining to the characteristics of the respondents are presented in Table I. Included are data on age, level of education, income, farming status, participation in organizations, and area of the village in which the respondents lived.

The data in relation to age indicate that a relationship existed between age and adoption-proneness, as indicated by the Chi-Square value of 7.69 at the .20 level of confidence with four degrees of freedom. The major differences occurred in the under thirty years of age category where 22 per cent of the lower group fell as compared with 9 per cent of the higher group, in the forty to forty-nine years and the fifty to fifty-nine years categories where 26 per cent of the higher group fell into both categories, compared with 15 cent and 9 per cent, respectively, for the lower groups in the two categories. These data indicate, therefore, that higher adopters were more likely to be found in the middle-age categoris.

Related to level of education, a strong association existed between this factor and adoption-proneness. This is evidenced by the fact that a significant difference existed at the .01 level of confidence, based on a Chi-Square value of 11.53 with three degrees of freedom. Th major differences between the two groups occurred at the level of none (Higher group—26 per cent and lower group—49 per cent) and the three—four years category (higher group—32 per cent and lower group—4 per cent). Of significance also is the fact that about six out of ten had some education, indicating that there were sufficient numbers of literate people in the village who could understand written material such as circular letters.

The data on size of holding indicate that this factor was highly associated with adoption-proneness, as indicated by a significant difference at the .01 level of confidence (Chi-Square value—13.23) with two degrees of freedom. More of the higher group (39 per cent) as compared with the lower group (11 per cent) had holdings, ranging from 3-4.9 acres, while more of the lower group (51 per cent) had holdings of less than 3 acres when compared with the higher group (16 per cent).

TABLE 1

A Comparison of the Higher and Lower Groups of Adopters of Agricultural Practices as to Their Characteristics Kampong Bukit Kapar, Selangor, Malaysia, 1967

Characteristic	*Percentage by Adopter Categories* *High Group N = 31*	*Low Group N = 45*	*Total N = 76*	X^2	*P*
Age of Smallholder					
Under 30 years	9	22	17		
30–39 years	26	27	26		
40–49 years	26	15	20		
50–59 years	26	9	16		
60 years and over	13	17	21		
TOTAL	100	100	100	7.69	.20
Level of Education					
None	26	49	39		
1–2 years	13	16	15		
3–4 years	32	4	16		
5 years and over	29	31	30		
	100	100	100	11.53	.01
Size of Holding					
Less than 3 acres	16	51	37		
3–4.9 acres	39	11	22		
5 acres or more	45	38	41		
	100	100	100	13.23	.01
Total Income					
Less than M$400	10	16	13		
M$500–1400	55	44	49		
M$1500 and over	25	9	16		
Not reported	10	31	22	2.95*	N.S.
	100	100	100		

Farm Income					
Less than M$400	39	32	34		
M$500–800	19	24	22		
M$900 and over	32	20	25		
Not reported	10	24	19	1.29*	N.S.
	100	100	100		
Farming Status					
Full-time	39	33	35		
Part-time	51	36	42		
Questionable	10	31	22		
	100	100	100	.18*	N.S.
Participation in Organizations					
None	39	58	50		
One or more	61	42	50		
	100	100	100	2.66	.20
Activeness in Organizations					
Not a Member	39	58	50		
No Participation	19	11	15		
Attends Meetings	29	24	26		
Active Leader	13	7	9		
	100	100	100	2.83	N.S.
Area of Community in Which They Live					
Area 1	13	22	18		
Area 2	13	22	18		
Area 3	13	11	12		
Area 4	26	7	15		
Area 5	26	16	20		
Area 6	9	22	17		
	100	100	100	9.42	.10

* The not reported and questionable responses were eliminated in computing the X^2 factor.

The data relative to income, both farm and total income, indicated that this factor was not associated with adoption-proneness. This finding deviates from other reported studies in other areas of the world as reported by Lionberger.[1] One possible explanation for the deviance lies in the fact that no responses were elicited from 10 per cent of the higher group and 31 per cent of the lower group. It is also of importance to note that over half of the higher group (58 per cent) and the lower group (56 per cent) had farm incomes of eight hundred dollars (Malaysian) or below per year.

The same observation could be made for farming status as for income, since there was not a significant difference between the two groups. About equal numbers of both groups were in the higher and lower adopter groups.

Participation in organizations was related to adoption-proneness, but activeness in organizations was not associated. The data on participation indicated that 61 per cent of the higher group belonged to one or more organizations, compared with 42 per cent of the lower group. This difference was significant at the .20 level of confidence as indicated by a Chi-Square value of 2.66 with one degree of freedom. As to activeness, the Chi-Square value of 2.83 with three degrees of freedom was not significant at the .20 level of confidence, even though more of the high group (42 per cent) were active participants or leaders as compared with the low group (31 per cent).

Kampong Bukit Kapar was divided by roads into six distinct areas. The areas in which the respondents lived was associated with adoption-proneness as indicated by a Chi-Square value of 9.42 which was significant at the .10 level of confidence at five degrees of freedom. More of the higher adopter group were found in areas four and five, each area having 26 per cent of the respondents in the higher group. On the other hand, more of the lower group were in areas one, two, and six, with each area having 22 per cent of the respondents in the lower group.

Pineapple Production Practices

Seven practices on pineapple production were included (Table II). An important practice, however, was omitted; the use of improved varieties (planting materials). All of the respondents were using recommended varieties which are native to Malaysia. This factor, consequently, was not a factor that could be related to adoption-proneness.

The use of hormones to stimulate uniform fruiting of the plants was recommended as one of the husbandry practices. Almost all of the higher group (77 per cent) who raised pineapples had adopted this practice, while only a small proportion of the lower group (29 per cent) had also done so.

[1] Lionberger, *op. cit.*

For the total group, about two-thirds of those engaged in pineapple production had adopted this practice. A statistically significant difference was found between the two groups at the .01 level of confidence, indicated by the Chi-Square value of 20.89 at one degree of freedom. The use of hormones in pineapple production, therefore, was highly associated with adoption-proneness.

Fertilizer usage in pineapple production was another recommended practice. The acceptance of this practice was at a rather low level, since only 22 per cent of the 80 per cent of the total sample who raised pineapples had used inorganic fertilizers on their pineapple crop. A much higher proportion, however, of the higher group (39 per cent) had used fertilizers, compared with the lower group (11 per cent). A significant difference was found between the two groups at the .01 level of confidence as evidenced by the Chi-Square value of 7.69 at one degree of freedom. The use of inorganic fertilizers, therefore, was highly associated with adoption-proneness.

Another recommended practice involved the replacement of the pineapple plants at least every five years by cutting out the old plant and replacing it with a new plant. This practice was associated with adoption-proneness, since there was a statistically significant difference at the .10 level of confidence, indicated by a Chi-Square value of 3.33 at one degree of freedom. The direction of the difference was in favor of the higher group, since more of the higher group (58 per cent), compared with the lower group (36 per cent), had adopted the practice. For the total sample, slightly over half of those engaged in pineapple production had adopted the practice.

For the two practices, disease treatment and insect control, statistical differences could not be computed because only very small proportions of the sample had adopted each of the practices; 4 per cent for disease treatment and 1 per cent for insect control. The data indicate that much educational work needs to be done on the problems of insect and disease control.

The practice of cutting out the old crown of the pineapple plant so that new suckers could grow was another one that was recommended. A much larger proportion of the higher group (55 per cent) than the lower group (29 per cent) had adopted this practice. For the total sample, about one-half had adopted the practice. The differences between the two groups were statistically significant at the .05 level of confidence, indicated by a Chi-Square value of 4.74 at one degree of freedom.

Mulching around the pineapple plant with old pineapple leaves was another recommended practice. An association was found between the use of this practice and adoption-proneness, since there was a statistically

TABLE II

A Comparison of the Higher and Lower Groups of Adopters of Agricultural Practices as to Adoption of Pineapple Production Practices Kampong Bukit Kapar, Selangor, Malaysia, 1967

	Percentage by Adopter Categories				
Practice	*High Group N = 31*	*Low Group N = 45*	*Total N = 76*	X^{2**}	*P*
Use of Hormones to Stimulate Fruiting					
Yes	77	29	49		
No	7	49	31		
No Pineapples	16	22	20		
	100	100	100	20.89	.01
Uses Fertilizer					
Yes	39	11	22		
No	45	67	58		
No Pineapples	16	22	20		
	100	100	100	7.69	.01
Age of Plants					
5 years or under	58	36	45		
Over 5 years	26	42	35		
No Pineapples	16	22	20		
	100	100	100	3.33	.10
Disease Treatment					
Adequate	10	0	4		
Inadequate	48	69	61		
No Disease Problem	26	9	15		
No Pineapples	16	22	20		
	100	100	100	*	
Insect Control					
Adequate	3	0	1		
Inadequate	29	31	30		
No Insects	52	47	49		
No Pineapples	16	22	20		
	100	100	100	*	

Crown Cutting					
Yes	55	29	39		
No	29	49	41		
No Pineapples	16	22	20		
	100	100	100	4.74	.05
Mulching					
Yes	71	31	47		
No	13	47	33		
No Pineapples	16	22	20		
	100	100	100	12.44	.01

* Chi-Square values were not computed because the expected value in some cells was below five.

** The no pineapple responses were eliminated in computing the Chi-Square value.

significant difference at the .01 level of confidence as indicated by the Chi-Square value of 12.44 at one degree of freedom. About two-thirds of those engaged in pineapple production had adopted it, with a much larger proportion of the higher group (71 per cent) adopting the practice than did the lower group (31 per cent).

Rubber Production Practices

As with pineapple production practices, the planting of recommended varieties was not included in the analysis. Rubber production, of course, involves a perennial plant, the rubber tree. Many of the trees were in the thirty year age category. It was impossible to ascertain, in many instances, the particular clone (variety) that was planted. The data, however, do indicate adoption levels for nine selected practices (Table III).

Fertilizer usage was an important recommended practice. A high level of adoption for the use of inorganic fertilizers was found for rubber production (56 per cent), particularly when compared with the data for pineapple production (Table 11–22 per cent). An important factor contributing to this difference was the provision of fertilizer to the rubber producers under the replanting schemes. The pineapple producers, however, received no such grants. This fact may have helped to account for the fact that the use of fertilizers in rubber production was not associated with adoption-proneness as indicated by the Chi-Square value of .52 at one degree of freedom which was not significant at the .20 level of confidence.

TABLE III

A Comparison of the Higher and Lower Groups of Adopters of Agricultural Practices as to Adoption of Rubber Production Practices Kampong Bukit Kapar, Selangor, Malaysia, 1967

Practice	*Percentage by Adopter Categories* *High Group N = 31*	*Low Group N = 45*	*Total N = 76*	X^{2**}	*P*
Use of Fertilizers					
Yes	65	51	56		
No	22	27	25		
No Rubber	13	22	19		
	100	100	100	.52	N.S.
Use of Latex Stimulant					
Yes	0	0	0		
No	87	78	81		
No Rubber	13	22	19		
	100	100	100	*	
Disease Treatment					
Adequate	13	9	11		
Inadequate	29	42	37		
No Disease	45	27	33		
No Rubber	13	22	19		
	100	100	100	*	
Insect Treatment					
Adequate	7	7	7		
Inadequate	7	20	14		
No Insect Problem	73	51	60		
No Rubber	13	22	19		
	100	100	100	*	

Raises Cover Crops					
Yes	6	2	4		
No	81	76	77		
No Rubber	13	22	19		
	100	100	100	*	
Cleans Rubber Area					
Yes	87	64	73		
No	0	14	8		
No Rubber	13	22	19		
	100	100	100	*	
Tapping System					
Recommended	23	16	19		
Not Recommended	19	44	33		
Not Tapping	45	18	29		
No Rubber	13	22	19		
	100	100	100	2.96	.10
Processing of Rubber					
Home Processing-Smoke	13	0	4		
Home Processing-Not Smoked	19	36	29		
Sell as Latex	10	24	19		
Not Tapping	45	18	29		
No Rubber	13	22	19		
	100	100	100	*	
Marketing of Rubber					
Rubber Dealer	29	42	37		
Cooperative	13	18	15		
Not Tapping	45	18	29		
No Rubber	13	22	19		
	100	100	100	.06	N.S.

* Chi-Square values were not computed because the expected value in some cells was below five.

** The no rubber and the not tapping responses were eliminated in computing the Chi-Square values.

For six of the rubber production practices, Chi-Square vaules were not computed. Since the validity of the test is questionable when the expected value of a particular cell is less than five, computations were not made. For four of the practices, adoption rates were very low. No one had adopted the practice of using latex stimulant on old trees, only 7 per cent adequately controlled insects, 11 per cent adequately treated diseases, and only 4 per cent raised cover crops in the inter-row bands between the rows of trees. The reverse was true for the fifth practice, cleaning the rubber area of weeds, particularly along the band where the row of trees stood. Only 8 per cent did not follow this practice. The sixth practice, presented such a diverse picture that the calculations could not be made. The two most desirable practices, home processing and smoking and selling as latex, were adopted by 4 per cent and 19 per cent of the total sample, respectively.

The use of the recommended tapping systems for the rubber trees was adopted by 19 per cent of the total sample. The type of tapping system that was recommended varied by the age and size of the tree, but it was recommended that it never be more often than every other day and that it included no more than a half spiral of the bark area in the tappable portion. A much higher proportion of the lower group (44 per cent) were not tapping properly, compared with the higher group (19 per cent). This difference was statistically significant at the .10 level of confidence, evidenced by a Chi-Square value of 2.96 at one degree of freedom.

The practice used in marketing of rubber was not associated with adoption-proneness. The Chi-Square value of .06 at one degree of freedom indicated that there was not a statistically significant difference between the two groups at the .20 level of confidence. Virtually the same proportions of the two groups were doing the same thing. Thirty-seven per cent of the total sample were selling to rubber dealers and 15 per cent were selling to the rubber cooperative maintained in the area.

Live-at-Home Practices

Five live-at-home practices were included in the study because it was felt that under the small-holding system of agriculture it was necessary for people to grow as much food at home as possible in order to have a fairly well-balanced diet. Data regarding these practices are presented in Table IV.

An extremely low proportion of the total sample (16 per cent) grew vegetables for home consumption. In order to be included as an adopter, a respondent had only to grow one vegetable; thus 84 per cent grew no vegetables whatsoever. More of the higher adopter group (23 per cent) did grow one or more vegetables as compared with the lowr group (11 per cent). This difference, however, was not significant at the .20 level of

confidence as indicated by the Chi-Square value of 1.81 at one degree of freedom. There was no association, therefore, between growing vegetables and adoption-proneness.

In regard to poultry-raising, it was felt that at least thirty head were necessary to insure a fairly adequate amount of meat and eggs for the family. Most of the respondents had some poultry, and all of the poultry were native, poorly developed breeds that were allowed to run free. Losses from disease were high, and productivity from the birds very low. Only 12 per cent of the total sample had thirty head or more of poultry. Since the expected value in some cells was less than five, the Chi-Square value was not computed and no association could be declared.

The raising of livestock was another practice that was studied. If a farmer had one or more head of livestock, either cattle or goats, he was included among the respondents who had adopted the practice. Twenty-five per cent of the total sample had livestock, with more of the higher adopter group (39 per cent) than the lower adopter group (16 per cent) being included among the adopters. This difference was statistically significant at the .05 level of confidence, evidenced by the Chi-Square value of 5.18 at one degree of freedom. Raising livestock, therefore, was associated with adoption-proneness.

Having a dusun (fruit orchard) around the home is a traditional Malay custom among smallholders. Further evidence is provided by the fact that 85 per cent of the total sample had a dusun. The differences among the two groups were minor and not statistically significant at the .20 level of confidence, indicated by the Chi-Square value of .12 at one degree of freedom. Having a dusun, consequently, was not associated with adoption-proneness.

The raising of tapioca and other root crops like sweet potatoes was recommended as sources of human food and fodder for livestock. A much larger proportion of the higher group (68 per cent)) raised such crops, when compared with the lower group (31 per cent). For the total sample, less than half (46 per cent) raised such crops. The differences between the two groups were statistically significant at the .01 lever of confidence, based on the Chi-Square value of 9.85 at one degree of freedom. An association existed, as a result, between the growing of root crops and tapioca and adoption-proneness.

Relationships with Extension Education Agencies

Data pertaining to the relationship of the respondents with the two main extension education agencies, the Department of Agriculture and the Rubber Research Institute, are presented in Table V. Each of these two agencies

TABLE IV

A Comparison of the Higher and Lower Groups of Adopters of Agricultural Practices as to Adoption of Selected Live-At-Home Practices Kampong Bukit Kapar, Selangor, Malaysia, 1967

Practice	*Percentage by Adopter Categories* *High Group N = 31*	*Low Group N = 45*	*Total N = 76*	X^2	*P*
Grows Vegetable Garden					
Yes	23	11	16		
No	77	89	84		
	100	100	100	1.81	N.S.
Raises Poultry					
5 head or less	10	34	24		
6–30 head	80	53	64		
30 head or more	10	13	12		
	100	100	100	*	
Raises Livestock					
Yes	39	16	25		
No	61	84	75		
	100	100	100	5.18	.05
Has Dusun (Fruit Orchard)					
Yes	87	84	85		
No	13	16	15		
	100	100	100	.12	N.S.
Raises Tapioca and Other Root Crops					
Yes	68	31	46		
No	32	69	54		
	100	100	100	9.85	.01

* Chi-Square values were not computed because the expected value in some cells was below five.

maintains a field staff that has the function of extension educational work among smallholders.

In terms of knowing the Department of Agriculture workers in their area, 29 per cent of the total sample were able to identify one or more, with a much larger proportion of the higher group (48 per cent) able to do so, compared with the lower group (16 per cent). This difference was statistically significant at the .01 level of confidence, based on a Chi-Square value of 6.78 at one degree of freedom. An association existed, as a consequence, between knowing the Department of Agriculture extension worker and adoption-proneness.

With reference to knowing the Rubber Research Institute extension worker, 30 per cent of the total group were able to identify him by name, with 42 per cent of the high group and 22 per cent of the lower group able to do so. An association existed between knowing the Rubber extension worker and adoption-proneness by virtue of a statistically significant difference at the .20 level of confidence which was indicated by a Chi-Square value of 2.53 at one degree of freedom.

With respect to level of contact with the extension workers with both agencies, significant differences at the .05 level of confidence were found. This is evidenced by the Chi-Square value of 6.99 at two degrees of freedom and 6.28 at two degrees of freedom for level of contact with Agricultural and Rubber extension workers, respectively. In both instances, the direction of the association was in favor of higher levels of contact being related to adoption-proneness. For example, 26 per cent of the higher adopter group had three or more contacts with the agricultural extension worker in the past year, compared with only 9 per cent of the lower group. With respect to contact with rubber extension workers, 45 per cent of the higher group had one or more contacts during the past year as compared with 29 per cent of the lower group.

There were substantial numbers of respondents, however, who had not had any contact with extension workers during the past year. Sixty-eight per cent of the respondents had not had contact with an agricultural worker and 46 per cent had not had any contact with a rubber worker.

In relation to opinions about the work of the two agencies concerned, statistically significant differences were found that indicated an association between favorable opinions and adoption-proneness. For the Department of Agriculture, 52 per cent of the higher group indicated favorable opinions, while only 20 per cent of the lower group responded likewise. The difference was statistically significant at the .01 level of confidence, based on a Chi-Square value of 10.000 at two degrees of freedom. The difference in opinion

TABLE V

A Comparison of the Higher and Lower Groups of Adopters of Agricultural Practices as to Relationships with Extension Education Agencies Kampong Bukit Kapar, Selangor, Malaysia, 1967

	Percentage by Adopter Categories				
Agency Relationship	*High Group N = 31*	*Low Group N = 45*	*Total N = 76*	X^2	*P*
Knows Department of Agriculture Worker					
Yes	48	16	29		
No	52	84	71		
	100	100	100	6.78	.01
Level of Contact with Workers of Department of Agriculture in Past Year					
None	52	80	68		
Once or Twice	22	11	16		
Three Times or More	26	9	16		
	100	100	100	6.99	.05
Opinion of Work of the Department of Agriculture					
Favorable	52	20	33		
Critical	19	18	19		
Indifferent	29	62	48		
	100	100	100	10.00	.01
Knows Rubber Research Institute Worker					
Yes	42	22	30		
No	45	56	51		
No Rubber	13	22	19		
	100	100	100	2.53*	.20
Level of Contact with Workers of the Rubber Research Institute in Past Year					
None	42	49	46		
Once or Twice	26	4	13		
Three or More	19	25	22		
No Rubber	13	22	19		
	100	100	100	6.25*	.05
Opinion of Work of the Rubber Research Institute**					
Favorable	36	16	23		
Critical	3	4	4		
Indifferent	48	58	52		
No Rubber	13	22	19		
	100	100	100	3.25*	.10

* The no rubber responses were eliminated in computing the Chi-Square values.

** In computing the Chi-Square value, the critical and indifferent categories were combined.

for the Rubber Research Institute was also statistically significant, but at the .10 level, based on a Chi-Square value of 3.25 at two degrees of freedom.

An important fact to note, however, is that large proportions of the respondents were indifferent. Forty-eight per cent of the total sample were indifferent to the work of the Department of Agriculture and 52 per cent were indifferent to the work of the Rubber Research Institute. It is also important to note that at this stage in the development of agricultural programs in Malaysia there is a severe shortage of trained personnel to do extension-type work. Most often the Malaysian extension worker may have the responsibility for reaching five to ten times the number of farmers, compared with the typical American extension worker.

Concepts Related to Selected Practices

From an educational stan-point, the understanding of concepts[1] is an important consideration. In relation to four selected practices, a determination was made as to the extent the respondents understood the basic intellectual ideas associated with each specific practice. Data in relation to concept understanding are presented in Table VI.

With respect to an understanding of fertilization of rubber trees, two-thirds (66 per cent) indicated good understanding, with more of the higher group (81 per cent) having a good understanding as compared with the lower group (59 per cent). A significant difference was found at the .10 level of confidence, based on a Chi-Square value of 3.51 at one degree of freedom. Understanding of the concept of fertilization, therefore, was associated with adoption-proneness.

When the data about understanding the concept of fertilization are compared with the data on the adoption of the practice of fertilizing rubber trees (Table III), it is interesting to note that slightly more of the total sample understood the concept (66 per cent), compared with adoption levels (56 per cent). These data would seem to indicate that concept understanding and practice adoption are related to each other.

The data on the understanding of the concept of crown-cutting in pineapple production also indicate a significant difference, but at the .20 level of confidence, based on a Chi-Square value of 2.67 at one degree of freedom. In this instance, 39 per cent of the higher group had a good understanding, compared with 20 per cent of the lower group. When the data on concept understanding are compared with practice adoption (Table II), more of the total sample (39 per cent) had adopted the practice, compared with those who understod the concept (27 per cent).

[1] A concept is defined for the purposes of this study as the basic intellectual idea involved in the practice.

TABLE VI

A Comparison of the Higher and Lower Groups of Adopters of Agricultural Practices as to Concepts related to Selected Agricultural Practices Kampong Bukit Kapar, Selangor, Malaysia, 1967

	Percentage by Adopter Categories				
	High Group $N = 31$	*Low Group* $N = 45$	*Total* $N = 76$	X^2	*P*
Understanding of Concept of Fertilization of Rubber Trees					
Good	81	59	66		
Poor	6	19	15		
No Rubber	13	22	19		
	100	100	100	3.51**	.10
Understanding of Concept of Crown Cutting of Pineapples					
Good	39	20	27		
Poor	45	58	53		
No Pineapples	16	22	20		
	100	100	100	2.67**	.20
Understanding of Concept of Good Tapping Practice					
Good	23	11	16		
Poor	19	49	36		
Not Tapping	45	18	29		
No Rubber	13	22	19		
	100	100	100	5.22**	.05
Understanding of Concept of Stimulating Flow of Latex in Rubber Trees					
Good	6	8	8		
Poor	6	25	17		
No Knowledge	30	27	27		
No Rubber	13	22	19		
Not Tapping	45	18	29		
	100	100	100	*	

* Chi-Square values were not computed because the expected value in some cells was below five.

** The no rubber, no tapping or no pineapples responses were eliminated in computing the Chi-Square values.

In relation to understanding the concepts involved in good rubber tapping practice, 23 per cent of the higher group, compared with 11 per cent of the lower group, understood the concepts involved. A significant difference existed at the .05 level of confidence which was based on a Chi-Square value of 5.22 at one degree of freedom. An association existed, consquently, between understanding the concepts involved in good tapping practice and adoption-proneness.

When the data on the understanding of the concepts involved with good tapping practice are compared with the adoption of recommended tapping practice, it was noted that almost equal numbers of the total sample understood the concepts (16 per cent) and adopted the practice (Table III—19 per cent).

In regard to the concept involved in stimulating latex flow in rubber trees by the use of a stimulant, only a very small proportion of the total sample (8 per cent) understood the concept. Because of the very small number, the Chi-Square value was not calculated. When compared with the practice adoption data (Table III), there were no adoptions of this practice, and only 8 per cent understood the concept.

Selected Values and Attitudes

In an attempt to determine some values and attitudes that might affect extension education programs, certain questions were asked of the respondents. Data pertaining to these responses are presented in Table VII.

The respondents were asked to name the three best farmers in the community as a means of establishing whether or not they had reference points, especially in terms of a model to look toward. Forty-eight per cent of the higher group and 22 per cent of the lower group named such persons. The differences in response were statistically significant at the .05 level of confidence as indicated by the Chi-Square value of 5.69 at one degree of freedom. Of those who did not answer, most respondents indicated that all of the farmers were about equal or that they did not know.

Following the question regarding the naming of the three best farmers, the respondents were asked what did they consider to be the characteristics of good farmers. Three basic types of answers were given. Twenty-six per cent of the higher group and 18 per cent of the lower group responded, good maintenance of the holding. The difference between the two groups was significant at the .10 level of confidence, based on a Chi-Square value of 2.81 at one degree of freedom. A second response, indicating good yields, was elicited from 26 per cent of the higher group and 7 per cent of the lower group, with a significant difference between the two groups indicated at the .05 level of confidence at one degree of freedom. The

TABLE VII

A Comparison of the Higher and Lower Groups of Adopters of Agricultural Practices as to Selected Values and Attitudes Kampong Bukit Kapar, Selangor, Malaysia, 1967

	Percentage by Adopter Categories				
	High Group $N = 31$	*Low Group* $N = 45$	*Total* $N = 76$	X^2	*P*
Named Three Best Farmers					
Yes	48	22	33		
No	52	78	67		
	100	100	100	5.69	.05
Characteristics of Good Farmers Indicated					
Hard-Working	16	11	13	.39	N.S.
Good Maintenance	26	11	18	2.81	.10
Good Yields	26	7	15	5.38	.05
Named Problems					
Crop Production	68	58	62	.75	N.S.
Farming as a Whole	71	56	62	1.81	.20
Family	58	56	56	.05	N.S.
Community	65	56	59	.58	N.S.

third response, hard-working, was given by 16 per cent of the higher group and 11 per cent of the lower group, with no statistical significance being found at the .20 level of confidence, as evidenced by the Chi-Square value of .39 at one degree of freedom.

The most important aspect of these responses was the lack of response from so many of the respondents. These data would seem to indicate that there is certainly not a well-defined value among many of the village people as to what a good farmer should be.

Another set of questions was designed to get a response as to some of the felt needs that people might have in certain areas. With respect to crop production, 68 per cent of the higher group and 58 per cent of the lower group indicated some problem areas. This difference was not significant at the .20 level of confidence, based on a Chi-Square value of .75 at one degree of freedom. For farming as a whole, 71 per cent of the higher

group and 56 per cent of the lower group suggested some problems, with the difference between the two groups being significant at the .20 level of confidence, as indicated by a Chi-Square value of 1.81 at one degree of freedom. In relation to family needs, 58 per cent of the higher group and 56 per cent of the lower group indicated problems. This difference between the groups was not significant at the .20 level of confidence, based on the Chi-Square value of .05 at one degree of freedom. In relation to identification of community problems, 65 per cent of the higher group and 56 per cent of the lower group mentioned some. The difference between the two groups was not significant at the .20 level of confidence, based on a Chi-Square value of .58 at one degree of freedom.

The main problems, mentioned by 10 per cent or more of the sample, were as follows: (1) diseases and insects attacking the crops, (2) prices received for their products, (3) lack of capital and/or credit for their farming operations, (4) low level of income from farming, (5) high cost of living, (6) need for improved services to the village—bus service, roads, etc., and (7) low yields obtained from their crops. This listing, plus many more which were listed by only small proportions of the sample, indicate that many people feel a desire for improvement of conditions. Yet, there was a sizeable proportion of the total sample, approximately 40 per cent, who indicated that they had no problems.

Diffusion of the Hormone Practice

The diffusion of one specific practice, the use of hormones to stimulate fruiting in pineapples was studied in the village in order to determine how the use of this practice spread through the village. This practice was selected because it was simple, easy to use, cost very little, and its use was spread by normal means, rather than by government support through free materials and regulations.

The data in Table VIII indicate that the practice was first introduced into the village about twenty-five years ago during the occupation of Malaysia by the Japanese. As recently as six years ago, only about 10 per cent of the respondents were using the practice. The preponderant number of adopters accepting the practice, 57 per cent, adopted the practice during the last three years. These data indicate that a pattern approximating the normal statistical curve is being exhibited in the diffusion of the practice in village. Someone innovated the practice, a very few adoptions followed, then a much larger number followed in adopting the practice within a relatively short period of time.

The data reveal that there were two main sources of information in the spread of the idea. First, and most important, were neighbors, with 46

TABLE VIII

Selected Factors Relating to the Adoption of the Practice of Using Hormones to Stimulate Fruiting in Pineapples by Smallholders, Kampong Bukit Kapar, Selangor, Malaysia, 1967

	Adopters of Practice	
	Number	*Percentage*
First Use of Hormones		
One-Three years ago	21	57
Four-Six years ago	8	21
Seventy-Twenty-Two years ago	3	8
More than Twenty-Two years ago	1	3
Do not remember	4	11
	37	100
Source of Knowledge		
Neighbor	17	46
Family	2	5
Commercial Source	2	5
Extension Worker	13	35
Japanese	1	3
Mass Media	1	3
Do not remember	1	3
	37	100
Holding Where Hormone Use First Observed		
Neighbor	18	49
Family	1	3
Own Holding	10	27
Do not remember	5	13
Farm Outside Villege	3	8
	37	100
Source for Discussion of Practice		
Neighbor	21	56
Family	1	3
Extension Worker	1	3
No One	10	27
Person Outside Village	1	3
Do not remember	3	8
	37	100

TABLE IX

Selected Factors Relating to the Non-Adoption of the Practice of Using Hormones to Stimulate Fruiting in Pineapples by Smallholders, Kampong Bukit Kapar, Selangor, Malaysia, 1967

	Adopters of Practice	
	Number	*Percentage*
Aware of Practice		
Yes	18	78
No	3	13
No response	2	3
	23	100
Source of Knowledge		
Middleman	2	9
Family	3	13
Neighbor	9	39
No One	2	9
Not aware	2	9
No response or don't know	5	21
	23	100
Source for Discussion of Value of Practice		
Family	3	13
Neighbors	8	35
Farmer outside Village	1	4
No One	5	22
No response or Don't Know	3	13
	23	100
Opinion of Discussant		
Favorable	12	52
No Opinion	1	4
Not aware	3	13
Did not discuss	3	13
No response or Don't Know	4	18
	23	100
Opinion of Non-Adopter		
Favorable	11	48
Unfavorable	5	22
Not aware	3	13
Use, if government suplies	1	4
No response	3	13
	23	100

per cent of the adopters naming neighbors as the principal source. The second major source was extension workers. Thirty-five per cent indicated that extension workers were their main source.

In terms of observation of the results of the practice, 49 per cent of the adopters indicated seeing the results from the use of the practice on a neighbor's farm. Twenty-seven per cent, however, indicated that they had not seen it on anyone's farm before they adopted it.

In making the decision to adopt the practice, neighbors again were listed as the principal source, being named by 56 per cent of the adopters. On the other hand, 27 per cent indicated that they had not talked to anyone in making the decision. It is also important to note that only 3 per cent named extension workers as influentials in the decision-making process.

With respect to the non-adopters, data are presented in Table IX that depicts the diffusion process. The preponderant number of the non-adopters, 78 per cent, were aware of the practice. The principal sources of knowledge about the practice were neighbors (39 per cent) and family members (13 per cent). In terms of decision-making, neighbors were again the most often named source (35 per cent), followed by no one (22 per cent) and family members (13 per cent). With respect to the opinions of the discussant, 52 per cent indicated that their source for discussion had given a favorable opinion. As to the opinions of the non-adopters themselves, 48 per cent thought the practice was good, while 22 per cent had reservations about the value of the practice.

Of special interest, is the fact that not one of the non-adopters indicated an extension worker as a source of information or as a source in decision-making. The sources named were basically within the confines of the village.

SUMMARY AND CONCLUSIONS

This study was designed as an empirical project, based upon some already established concepts relating to social and educational change, and done for the purpose of providing data useful in the instructional program in extension education at the College of Agriculture, Malaya. The principal objectives of the study were as follows: (1) to establish the level of practice adoption among the smallholders, (2) to determine the factors associated with adoption-proneness, and (3) to procure data on the diffusion of a specific practice through a village.

The study was conducted in Kampong Bukit Kapar, Selangor, Malaysia, and involved a sample of 76 smallholders, selected on an area sample basis. The interviews were conducted in the National Language of Malaysia by

third-year (Senior) students at the College who had been trained for this purpose. An adoption index score was developed for each respondent, based on the applicable practices in farming and living-at-home that he should have adopted, with the adoption index score representing the extent to which he had adopted all of the practices that applied to his situation. The adoption scores ranged from zero to eighty-eight per cent. The respondents were then divided into two groups for analysis purposes; the higher group (adoption index of fifty-five and over) and the lower group (adoption index below fifty-five). In addition, for the diffusion data, related to a specific practice, the findings were presented in tabular form, but not related to the adoption index. Thirty-one respondents were in the higher group and forty-five in the lower group.

Summary of the Findings

Characteristics of the Respondents. With respect to the characteristics of the respondents, the following factors were found to be associated with adoption-proneness at the specified level of confidence:

1. Age of the respondent (.20 level of confidence)—middle-age (40–59 years of age) farmers were more likely to adopt larger numbers of practices.

2. Educational level of the respondent (.01 level of confidence)—Persons with higher levels of education (three years or more) were more likely to adopt larger numbers of practices.

3. Size of the holding (.01 level of confidence)—Farmers with the larger holdings (three acres or more) were more likely to adopt larger numbers of practices.

4. Participation in organizations (.20 level of confidence)—Persons who were members of one or more organizations were more likely to adopt larger numbers of practices.

5. Area of community lived in (.10 level of confidence)—The persons who live in one area of the community as compared with another tended to adopt larger numbers of practices.

The following factors were not found to be associated with adoption-proneness at the .20 level of confidence: (1) total income, (2) farm income, (3) farming status—full or part-time, and (4) activeness in organizations.

Pineapple Production Practices. In relation to pineapple production practices, the following is a resume of the practices that were associated with adoption-proneness and the level of adoption by the total sample:

1. Use of hormones to stimulate fruiting (.01 level of confidence)—about 60 per cent adoption.
2. Use of fertilizers (.01 level of confidence)—about 30 per cent adoption.
3. Age of Plants—5 years or under (.10 level of confidence)—about 55 per cent adoption.
4. Crown-cutting (.05 level of confidence)—about 50 per cent adoption.
5. Mulching (.01 level of confidence)—about 60 per cent adoption.

There were no pineapple practices that were found not to be associated with adoption. For two practices, however, the rate of adoption was so low that Chi-Square values to determine association could not be calculated. These practices were disease treatment (about 6 per cent adoption) and insect control (about 3 per cent adoption).

Rubber Production Practices. Only one rubber production practice was found to be associated with adoption-proness. The practice, use of the recommended tapping system (.10 level of confidence), was adopted by about one-third of the applicable respondents. Two practices were not associated with adoption-proneness at the .20 level of confidence; use of fertilizers (about 65 per cent adoption) and marketing outlets where only 15 per cent were selling to the rubber cooperative.

For six of the practices, Chi-Square values could not be calculated because of the distribution of the responses, with expected frequencies in some cells below five. These practices and the levels of adoption are as follows: (1) use of latex stimulant—no adoptions, (2) disease treatment—11 per cent adoption, (3) insect control—7 per cent adoption, (4) use of cover crops—4 per cent adoption, (5) cleaning rubber area—73 per cent adoption, but only 8 per cent—non-adopters, (6) rubber processing—19 per cent selling as latex and 4 per cent home processing, plus smoking.

Live-at-Home Practices. Two live-at-home practices were associated with adoption-proneness as follows: raising livestock (.05 level of confidence)—25 per cent adoption, and raising tapioca and other root crops (.01 level of confidence)—46 per cent adoption. Two practices were not associated with adoption-proness (.20 level of confidence), and these practices were growing vegetables—16 per cent adoption, and having a dusun—85 per cent adoption. For the fifth practice, the raising of poultry, the Chi-Square value could not be calculated because the expected value was less than five in some cells, with only 12 per cent raising 30 head or more.

Relationships with Educational Agencies. The three factors tested for the two important extension education agencies in agriculture were all found

to be associated with adoption-proneness. These factors, related to the agencies are as follows:

1. Department of Agriculture—
   (*a*) Knowing the Extension worker (.01 level of confidence)—29 per cent knew him.
   (*b*) Level of contact with extension worker (.05 level of confidence)—32 per cent had contact with him in the past year.
   (*c*) Opinion of Department (.01 level of confidence)—33 per cent favorable, 48 per cent indifferent.
2. Rubber Research Institute—
   (*a*) Knowing the Extension worker (.20 level of confidence)—30 per cent knew him.
   (*b*) Level of contact with extension worker (.05 level of confidence)—54 per cent had contact with him in the past year.
   (*c*) Opinion of the Institute (.10 level level of confidence)—23 per cent favorable, 52 per cent indifferent.

Concept Understanding. The understanding of three selected concepts was associated with adoption-proneness as follows: (1) understanding of concept of fertilizing rubber trees (.10 level of confidence)—66 per cent good, (2) understanding of cutting pineapple crowns concept (.20 level of confidence)—27 per cent good. (3) understanding of concepts involved in good tapping practice (.05 level of confidence)—16 per cent good. For a fourth concept, understanding of concept of stimulating latex flow in rubber trees, an association could not be established because of expected values below five in some cells, with only 8 per cent having a good understanding. The level of concept understanding and adoption levels for each of these four practices were much the same.

Selected Values and Attitudes. The willingness to identify the three best farmers in the village in their opinion was associated with adoption-proneness (.05 level of confidence), with 33 per cent willing to do so. The remainder tended to identify all farmers as being equal or expressed no opinion. The three major characteristics of good farmers and the percentages that indicated them are as follows: (1) hard-working—13 per cent, (2) good maintenance of the farm—26 per cent and (3) good crop yields—26 per cent. The percentage of respondents who named problems in four areas are as follows: (1) crop production—62 per cent, (2) farming as a whole—62 per cent, (3) family life—56 per cent, and (4) community life—59 per cent.

Diffusion of a Practice. The diffusion of one practice, the use of hormones to stimulate fruiting in pineapple was studied. The time of adoption followed the normal statistical curve, a few adopting at first, followed by an increasing number, with the time span from innovation to 57 per cent adoption involving about twenty-five years. The principal sources of knowledge were neighbors (46 per cent) and extension workers (35 per cent) for the adopters. For the non-adopters neighbors (39 per cent) were the principal source of knowledge. On decision-making, neighbors were the principal source for the adopters (56 per cent) and the non-adopters (35 per cent), although a sizeable number, 27 per cent of the adopters and 22 per cent of the non-adopters, indicated no one had been involved in the decision-making process other than themselves. Of the non-adopters, 78 per cent were aware of the practice.

Conclusions

The adoption behavior of Malaysian smallholders was much like the behavior of farmers in other cultures as reported by Lionberger[1], Roger[2], and Bohlen and Beal[3] in the sense that diffusion through a system of people followed a normal predictable pattern. Those who adopted first tended to be those who were better educated, had larger size holdings, were middle-aged, and participated more in organizations. The pattern of diffusion of new practices took time, perhaps more than would be preferable, and the primary sources of information, neighbors for all respondents, and extension workers for the earlier adopters, followed the customary pattern. In decision-making, the primary source was neighbors in the typical pattern. There was, however, a strain of independence among these farmers, exemplified by the sizeable proportion who did not indicate anyone as sources in decision-making and in seeing the results to be achieved on some villager's holding.

The levels of practice adoption identified in the study prove conclusively that Malaysian peasant farmers will change. For some practices, adoption rates were in excess of half of the respondents. In general, however, adoption rates of this level were achieved with practices that required little, if any, outlay of money. Where money was a factor, adoption rates tended to be lower as illustrated by the low adoption of fertilizer usage in pineapples. On the other hand, where the government intervened by providing fertilizer for the respondents, adoption rates and levels of understanding about the benefits to be obtained from the practice were rather high. Admittedly, the level of sophistication of practice adoption was not high, since adoption behavior was expressed in simple terms, like merely the use of fertilizers

[1] Lionberger, *op. cit.*

[2] Rogers, *op. cit.*

[3] Beal and Bohlen, *op. cit.*

rather than the application of recommended rates of nitrogen or complete fertilizers. Yet, one must consider that this study was conducted in a rather primitive area, compared with many of the highly commercialized agriculture industries like the rubber estate industry here in Malaysia.

Many important problem areas were identified as the bases for extension education program. Concept understanding as related to a specific practice was closely related to practice adoption levels. Of course, what is meant is that smallholders must grasp the basic ideas involved, perhaps best expressed by a Malaysian co-worker who used the connotation, "meat makes meat", in attempting to gain understanding about the value of protein in the diet among villagers. It is not reasonable to expect that levels of understanding can reach high levels of intellectual expertise. but rather to impress upon villagers the importance of some rather fundamental ideas. For example, this study revealed that there are extremely few people who use modern methods of insect and disease control, and what's more, that they have almost no conception of what is possible in the way of control of insects and diseases. It is important, therefore, for extension workers to develop among villagers some basic understandings about new technology as part of the change process from primitive to modern methods. Concept development should go hand-in-hand with change efforts, and in fact may be a necessary prelude to change.

The data in this study also indicate that contact with professional workers is closely associated with change. As important sources of information, it is necessary to provide more and more opportunity for villagers to come in contact with trained persons in agriculture. One of Malaysia's basic problems in agricultural development at the present time is the serious shortage of trained agriculturists for work among smallholders. The government is making a determined effort to increase the supply of trained manpower, so perhaps this problem will be alleviated over time. It is imperative, consequently, for institutions like the College of Agriculture to produce a high-quality product who understands not only agricultural technology, but who also understands relevant concepts and possesses basic skills in the process of moving people toward change. When this is done, perhaps the "time-lag" from innovation to adoption can be reduced greatly.

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APPENDIX

Schedule No.....

Enumerator.....

I Farm Data

1. Name of Farmer:
2. How many acres in your farm?
3. How many acres are owned? Rented?
4. What crops do you grow?

Crop	*Acreage*

5. What fruits do you have in your dusun?

Fruit	*No. of trees*	*Age of trees*

6. Do you grow any vegetable or root crops? If yes, what crops?

Crop	*No. of plants (approximate)*

7. Do you have any livestock? If yes, what kind?

Livestock	*No. of Head*

II Pineapple Production

1. What planting materials (variety) are you using?

Material	*Acreage*	*When Planted*
.....	.....	.....
.....	.....	.....
.....	.....	.....

2. What preparation did you make of the soil before planting?
3. In what form, did you plant? (suckers, crowns, etc.)

4. Did you fertilize the plants? If yes, what type of fertilizer did you use? How much did you apply? How often? When?

5. Did any diseases attack the pineapples? What diseases?
   If yes, did you treat the plants? With what material? How much did you apply? When? How often?

6. Did any insects or pests attack the plants? If yes, what insects or pests? Did you treat the plants? What what material? How much did you apply? When? How often?

7. Did you cultivate the crop? If yes, how? How often?

8. At what stage do you harvest the fruit?

9. Where do you sell your pineapple?

10. Do yo ubelong to the Farmer's Association in the kampong?
    (*a*) If yes, why do you belong to it?
    (*b*) If no, why don't you belong to the Farmer's Association?

11. Do you cut off the old crowns to allow the suckers to form a new plant?
    (*a*) If yes, why do you do it?
    (*b*) If no, why don't you do it?

12. Do you leave the leaves taken off the plants between the rows so that a mulch is formed?

13. Did you use hormones to stimulate fruiting of the plant this year?
    (*a*) If yes, when did you first use hormones?

From whom did you first learn about this hormone? (Name & Title)

On whose holding, did you first see the results of using the hormones (Name and title)

With who did you discuss the value of this practice?

(Name and Title)

What is your opinion of the practice?

13. (*b*) If no, have you heard of this practice before? From whom? (Name & Title) When?

Did you talk with anyone about the use of this practice? With whom? (Name & Title)

What was his opinion of the practice?

What is your opinion of the practice?

14. With whom do you usually discuss problems in pineapple production? (Name & Title)

15. Do you know the AA or JAA for the Department of Agriculture in this area? If yes, what are their names?

16. How many times during the past year have you talked to him about agricultural problems? Had him inspect your pineapple holding? Attended a meeting where he gave a talk? Received any materials or publications from him?

17. What is your opinion of the work of the Department of Agriculture?

III **Crop—Rubber**

1. What planting materials are you using?

Material	Age	Acreage	Producing Latex

2. Have you made any new plantings or replantings?

	Acreage	When	Producing Latex
New planting			
Replantings			

3. At present, how many acres are you tapping?
   How often do you tap? What tapping system do you apply?

4. Why do you use this tapping system?

5. Do you use a latex stimulant? Why do you or don't you use it?
   If you use it, how often do you use it? When do you apply it? How much of it, do you use?

6. Where do you process your rubber?
   Do you smoke your own rubber?
   Have someone smoke it for you?
   Or sell it unsmoked?

7. Where do you sell your rubber?
   Why do you sell it there?

8. What grade of rubber do you sell?

9. Have you had any diseases attack your mature rubber?
   Immature Rubber? What diseases?
   If yes, how did you treat the trees?

10. Have any insects or other pests attacked your trees?
    What pests? If yes, what did you do about the problem?

11. Have you used any preventive measures against diseases and pests? If yes, what measures?

12. Do you fertilize your rubber?

If yes, what type of fertilizer do you use?

How often is it applied? How much is applied?

Where do you apply it?

13. Do you feel that the use of fertilizer gives good results?

Why?

14. What is the topography of your rubber land?

Have you had any drainage problems? If yes, what have you done about them?

15. What number of trees do you have per acre?

16. Have you established cover crops in your immature rubber area?

17. Do you clean the rubber area? How often?

What do you use to clean the rubber area?

If chemicals are used, what chemical do you use?

When do you apply it? How often? At what rate of application? How do you apply it?

18. What is the latest clone being reccommended by R.R.I.?

(*a*) If *yes*—what do you think of this clone?

Where did you first hear of it?

From whom (Get name & title, if any)

Did you discuss the value of this clone with anyone?

If yes, with whom? (list name & title)

Have you planted any of this clone? If yes, how much?

(*b*) If no, what do you think of the new clones developed by R.R.I.?

19. When you have problems with rubber production, who do you go to for advice usually? (list name and title, if any)

20. Do you know the Rubber Instructor or Assistant Rubber Instructor for this area? (Have him give names)

21. How many times during the *past year* have you talked to him? Had him inspect your ruber holding? Attended a meeting where he gave a talk? Received any materials from him like publications?

22. What is your opinion of the work of the Rubber Research Institute?

IV General

1. How old are you?

2. How much education have you had?

3. In what organizations do you have membership?

Organization	No. of meetings attended this year	Serve on Committee	Held an Office

4. What are your favourite forms of entertainment?

5. Who do you consider are the three best farmers in the kampong? (List names)

6. Why do you consider them the best farmers?

7. What do you consider are the major problems you have to solve in:

   (*a*) Crop Production

   (*b*) Farming as a whole

   (*c*) In feeling and rearing your family

8. What are the major problems of the kampong?

V Observation Form

1. Home — Size — Large
   Average
   Small

   Construction — Good
   Average
   Poor

   Yard — Pretty
   Average
   Poor

2. Rubber Holding

   General condition — Good
   Average
   Poor

   Tapping — Well Done
   Average
   Poorly Done

   Weeds — Clean
   Average
   Poor

3. Pineaple Holding

   General condition — Good
   Average
   Poor

   Soil — Peat
   Other
   Both

   Plants — Healthy
   Few Diseased
   Many Diseased

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OCT 23 1970
on Adult Education

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Printed by Life Printers, 40, Jalan Raja Bot, K.L.