Project on Promotion of Agri-Electronics— Evaluation based on Farmer's Response in Kerala

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AGRI-ELECTRONICS PROJECT
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PROJECT ON PROMOTION OF
AGRI-ELECTRONICS—EVALUATION
BASED ON FARMER'S RESPONSE IN KERALA

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FOREWORD

The Project on Promotion of Agri-Electronics is a unique scheme funded by the Department of Electronics and implemented through the Indian Council of Agricultural Research of the Government of India. A Pilot Centre of the project has been functioning in Kerala Agricultural University, Vellanikkara since June 1987. Three blocks viz. Puzhakkal in Thrissur district, Alathur and Thrithala in Palakkad district formed the operational area of the project. The main thrust of the scheme was to create awareness among the farmers on the use of electronic gadgets and instruments relevant to the agricultural sector. The mobile laboratory under the scheme was providing free services on soil testing, and fertiliser recommendations milk fat and water testing for irrigation quality.

An evaluation study of the project based on farmers response was carried out. The study has clearly revealed that awareness among farmers on the usefulness of electronics in various phases of Agricultural production could be created to a greater extent. The constant demand for testing services provided under the project is a clear indication of the acceptance of the technology. The present study covers the socio economic set up of the farmers, their response to the various uses of Agri-Electronic instruments, Agri-Electronics testing services, etc.

The evaluation has brought out clearly some of the lacunae in the implementation of the project which could serve as guidelines for reorienting the priorities. The absence of inexpensive equipment for a variety of purposes which could be used by farmers is the main impediment in the large scale adoption of electronics in agriculture. The experience gained in the implementation of the project in Kerala will pave the way for refinements in the programme with the ultimate aim of using electronics for the betterment of agriculture and the farming community at large.

Dr. M. Aravindakshan
Director of Research

PREFACE

The emphasis on all development programmes in Agriculture today is to increase production per unit area. For achieving this goal, there has to be a proper blending of technologies evolved through years of experience and adopted by farmers. Electronics offers vast scope in pre and post harvest operations in various phases of Agriculture production which can ultimately increase the net income of the farmers.

The concept of harnessing electronics in the farming sector was initiated by the Department of Electronics, of the Government of India and the Indian Council of Agricultural Research with the starting of pilot centres on Agri-Electronics. The main objective of these centres was to create an awareness among the farmers on the potential use of electronic instruments in the Agricultural sector. The pilot centre located in the Kerala Agricultural University at Vellanikkara initiated a study on the impact of the Agri-Electronics project in the operational area, on the basis of farmers response. This publication incorporating the results of the study, it is hoped will help in planning future strategies for the successful implementation of the programme.

The authors are indebted to Dr. M. Aravindakshan, Director of Research, Dr. C. A. Jose, former Associate Dean, College of Co-operation and Banking, Dr. K. Radhakrishnan, Professor and Head, Department of Agricultural Economics for the suggestions and help rendered at various stages during the study.

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PROJECT ON PROMOTION OF AGRI-ELECTRONICS — AN EVALUATION

1. Introduction

Over the last few decades electronics has made quantum leaps in technological innovations. Though electronics has made great impact in all fields of human activity, its use in the Agricultural sector is only minimal. Presently the major use of electronics in agriculture is confined to research applications.

The concept of making use of electronics in the agriculture sector at the farmers level was initiated by the Department of Electronics of the Government of India and the Indian Council of Agricultural Research, with the starting of pilot centres for the promotion of Agricultural electronics.

The Pilot Centre of the project on promotion of Agri-Electronics (PPAE) started functioning in the Kerala Agricultural University at Vellanikkara from 4-6-1987. The operational area of the project is spread over 24 panchayats in three blocks viz. Thrithala and Alathur in Palakkad district and Puzhakkal in Thrissur district. The project became fully operational in May 1989 with the commissioning of the mobile laboratory. Out of the 48.1 lakhs provided for 5 years an amount of Rs. 29.68 lakhs (about 67% of the budget) was spent during the period 1987-88 to November 1992.

A study on the impact of the project among the farmers of the operational area was carried out with the following objectives.

1. To review the progress made by the project.
2. To examine the extent to which the PPAE could create, awareness, appreciation and establish credibility among farmers towards electronic instruments through demonstration of Agri-Electronic Equipments (AEEs).
3. To evaluate the utility of electronic devices to the farmers.
4. To examine the effectiveness of PPAE in making available the AEEs to the farming community.
5. To examine the measures that PPAE has taken to organise, servicing and training support in Agri-Electronics.

The above aims of the study are in tune with the key objectives of the project viz.,

- ☐ To create awareness, appreciation and establishment of credibility among farmers through demonstration of Agri-Electronic instruments and equipment in comparison with conventional methods.
- ☐ To convince the farmers of utility of electronic devices and instruments in agricultural production, processing and storage.

- To make available to the farming community economical and field usable electronic gadgets and equipment.
- To organise prompt, efficient and well-spread servicing and training support in Agri-Electronics.

Scheme of the report

The report is presented in the succeeding chapters as follows. The second chapter outlines the methodology adopted in the sampling and conduct of survey. The third chapter gives the profile of the sample farmers and the operational area of the project. The results of the field survey are presented in the fourth chapter followed by the conclusion and recommendations of the study. The last chapter outlines the future strategies to be adopted in the implementation of the programme.

2. Methodology

The first objective has been realised through presentation of information on the activities of the project collected from the various project reports. The other objectives have been met mainly through a sample survey of the beneficiaries of the project.

Testing of soil and milk quality are the two major activities that have been undertaken by the PPAE. Hence the sample farmers belong to the beneficiaries of these activities. Systematic random sampling method was used to select the farmers. The farmers who benefited during the period from November 1990 to May 1991 have been considered as the population for the study.

Of the 1326 beneficiary farmers of soil testing in the operational area, a sample of 75 was selected in proportion to the total number of beneficiaries in each block ie. 41 from Alathur, 25 from Puzhakkal and 9 from Thrithala. The majority of the soils tested were from wet lands covering paddy farmers. Since the production and productivity results had to be collected, data collection work was started through the method of personal interview immediately after harvesting, during October-November 1991, with the aid of a well structured and pretested interview schedule.

The number of milk samples tested during the reference period was 1535 (Milk testing was done only in two blocks). Eighteen milk testing sample farmers were selected from the jurisdiction of nine milk societies situated in Puzhakkal and Alathur blocks in such a way that at least two beneficiaries enter in the sample from a society (it has to be noted that milk testing has been done in the premises of Dairy Co-operatives and rarely the farmers were present). Information from them also was collected through personal interview with the aid of another stuctured interview schedule. Thus the total farmer sample was 93.

In addition to the data collected from sample farmers, information was also gathered from personnel working in the Agricultural Department and Co-operative Milk societies.

The data has been analysed using simple statistical tools.

3. Profile of the operational area and sample farmers

3.1. Operational area of the project

The project work has been put into operation in three Blocks namely

Puzhakkal, Alathur and Thrithala. The socio-economic set up and other particulars of the three Blocks are given below. Location maps of the Blocks are given in figures 1 and 2.

a) Puzhakkal Block

Puzhakkal Block is located in Thrissur Taluk of Thrissur District. Block headquarters is at Puranattukara, about 9 km from Thrissur. Basic information about this Block is given below:

Geographical area:		145.96 sq. km
No. of Panchayats	:	7 (Killanur, Tholur, Avanoor, Ayyanthole, Adat, Kaiparambu and Arimpur)
No. of villages	:	23
No. of wards	:	63
Population (1981 census)	:	139003
Literacy (1981 census)	:	77.7%
No. of households	:	23741
Average holdings		
Less than 1 ha	:	20547
1 to 3 ha	:	2419
above 3 ha	:	453
Cultivable area	:	11346 ha
Arable but not cultivated	:	778 ha
Dryland	:	9947 ha
Wetland	:	6068 ha
Total livestock	:	27038
Total poultry	:	809960
Milk production	:	954995 litre
Fertilizer selling points		
Individual	:	10
Co-operative Societies	:	14
No. of Service Co-operative societies	:	9
Milk Societies	:	9

The Block area is comparatively smaller in size. The topography is more or less level with occasional hillocks. On the western side of the Block extensive areas of waterbodies called *Kole* lands (*) exist. These areas are bunded, dewatered and one or two crops of rice are taken. Coconut, banana, pulses, rubber, tapioca, black pepper, arecanut, cashew, vegetables, ginger, sesamum are the other crops grown in this Block.

b) Alathur Block

This block is located in Alathur Taluk in the south central portion of Palakkad District. The block headquarters is situated on the Thrissur—Palakkad National Highway about 22 km from Palakkad and about 38 km from the project head-quarters. Basic information about this Block is given below:

Geographical area	:	396.69 sq. km
No. of Panchayats	:	10

(*) The (*Kole*) regions are paddy growing areas located mainly in Thrissur district. It is a flood plain with some areas below sea level. A single crop of paddy is grown after dewatering the area. The crop has the risk of flood damage and is often a chance. 'Kole' is a vernacular term indicating the bumper yields in case floods do not damage the crop.

Alathur, Erimayur, Kannambra, Kavasseri, Kizhakkenchery, Melarcode, Puthucode, Tarur, Vandazhi and Vadakkenchery)

No. of villages	:	17
No. of wards	:	94
Population (1981 census)	:	228109
Literacy (1981 census)	:	56%
No. of households	:	41749
Arable but not cultivated	:	2657.7 ha
Dryland	:	19593.6 ha
Wetland	:	11823.2 ha
Total livestock	:	49531
Total poultry	:	32498
Fertilizer selling points		
Individual	:	351
Co-operative	:	25
FACT	:	1
No. of Service Co-operative Societies	:	7
Milk Societies	:	17

The entire area is undulating with large and small hills and hillocks. The valleys in between are used for rice cultivation. Rice, coconut, banana, pulses, vegetables, rubber, tapioca and ginger are cultivated in the area. Turmeric, cocoa, arecanut and minor tuber crops are also grown in the Block area.

c) Thrithala Block

Thrithala Block is located in Ottappalam Taluk of Palakkad District. Basic information about this Block is given below:

Geographical area	:	172.15 sq.km.
No. of Panchayats	:	7

(Anakkara, Chalisseri, Kappur, Nagalasseri, Pattithara, Thirumittacode and Thrithala)

No. of villages	:	8
No. of wards	:	62
Population (1981 census)	:	136076
Literacy (1981 census)	:	62.5%
No. of households	:	22681
Average holdings		
Less than 1 ha.	:	14440
1 to 3 ha	:	6568
Above 3 ha	:	1962
Fertilizer selling points	:	13
Individual	:	4
Co-operative	:	9
No. of Co-operative Societies	:	7
Milk Societies	:	3 (but not functioning)

3.2 Sample farmers—A profile

Table 1 presents the characteristics of sample farmers. Of the 93 farmers who constitute the sample, 32 are marginal farmers (34 per cent), 31 are small farmers (33 per cent), 15 are medium farmers (16 per cent), 7 are large farmers (8 per cent) and the remaining 8 belong to agricultural labourers (9 per cent). As has been seen 2/3rd of the sample farmers belong to small and marginal categories.

Nearly 12 per cent of the farmers are illiterates. The percentage of illiterate is higher among agricultural labourers (75 per cent) and marginal farmer(12.5 per cent) groups. The percentage of women as sample farmers is 7.5 and SC/ST 6.5. The average age of the sample farmers is 48 years. The average size of the family is 5.94 and it is high among large farmer group ie. 7.00. The size of land owned by the sample farmers vary from 0.05 ha among Agricultural labourers to 4.74 ha among large farmers. On an average the size of land holding of the sample farmers is 1.41 ha.

Table 1. Sample farmers : A profile

Sl. No.	Farmer classification	No. of sample farmers	Average land size owned (in ha)	Average size of family	% of illiterates	% of sample farmers having subsidiary occupation	Average age of sample farmers	% of SC/ST in the sample	% of women sample farmers
1.	Large farmer	7	4.74	7.00	0.00	57.14	44.29	0.00	0,00
2.	Medium farmer	15	2.81	5,40	0;67	46.67	47.87	0.00	0.00
3.	Small farmer	31	1.29	6.48	0.00	41.94	47.94	3.23	3.23
4.	Marginal farmer	32	0.47	5.44	12.50	40.63	47.56	3.13	9.38
5.	Agrl. Labourer	8	0.05	5.88	75.00	37.5	52.38	50.00	37.50
6.	Total	93	1.41	5.94	11.83	43.01	47.90	6.45	7.53

Almost 43 per cent of the sample farmers have subsidiary occupations and the percentage of farmers with such occupations is high among large farmer groups (57 per cent). It may be noted that the subsidiary occupations are mainly non-agricultural in nature as only 4.3 per cent was involved in allied agricultural activities (see Table 3). Majority of those farmers who are having subsidiary occupations are either in business (11.8 per cent) or in other service sector activities (19.4 per cent). Usually these farmers are giving lesser attention to their agricultural operations in the field.

4. Results

4.1. Field programmes of the Agri-Electronics project— An overview

The first two years of the project since its inception in June 1987 was utilised for purchase of vehicles,equipments, filling up of the various staff positions, setting up of the base and mobile lab and procuring other infrastructural facilities required for the smooth functioning of the Pilot Centre. Field work connected with the selection of the operational area of the project, collection of data for preparation of status report was completed and the same published. The field work connected with the testing facilities to farmers provided under the project was started after the formal commissioning of the mobile laboratory during June 1989.

For the successful implementation of the field programmes a good support and laison with the officials of the Krishi Bhavan*, under the Department of Agriculture,Panchayats, milk societies, group farming committees** etc. were established, schedules for the field programmes for each fortnight were prepared in advance, and field work planned accordingly. The various items of work covered under field programmes are discussed.

i) Demonstration of electronics equipments

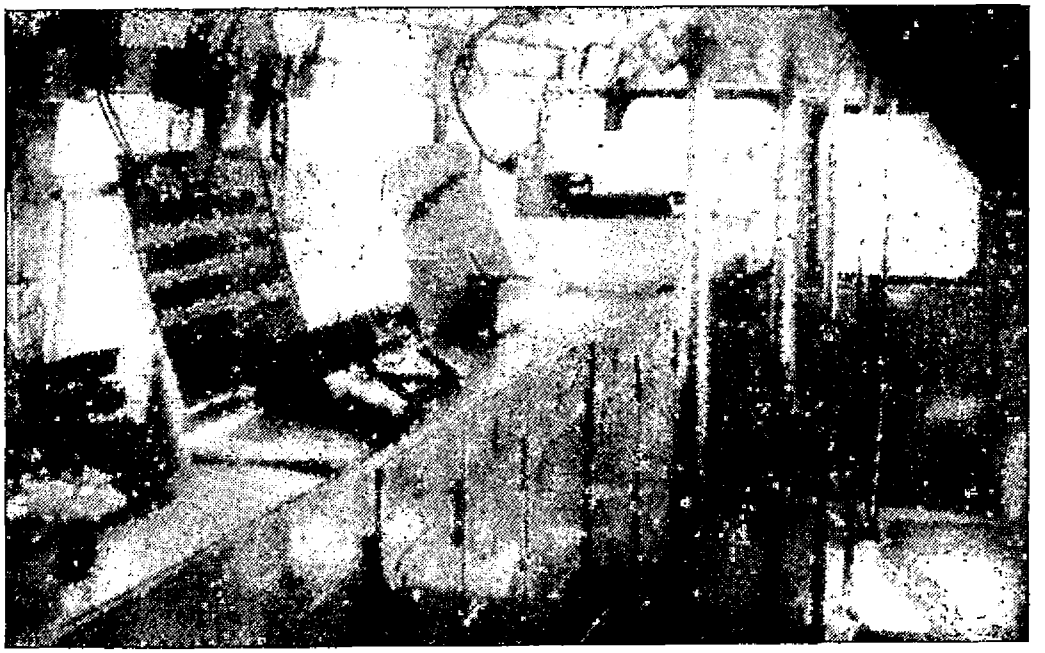
Demonstration classes and group meetings of farmers were held in the various panchayats to highlight the importance of electronics instruments in Agriculture. The project staff also regularly attended the Agroclinics along with the Krishi Bhavan officials. A total of 220 visits were utilised for this purpose.

In the group meetings and classes the farmers were given a detailed account of the purpose and objectives of the project. They were also told about the importance of testing soils, grains and milk using electronics gadgets, highlighting the savings in inputs, increase in production, preventing loss in storage of grains and increase in the cost of milk based on the fat content. The operation of the various instruments were also demonstrated.

As part of the popularisation of electronic instruments, extension

* Panchayat level office of the State Department of Agriculture entrusted with all the Agriculture development activities of the Panchayat

Farmers in a Padasekharam (contiguous paddy fields) take up paddy cultivation on scientific lines by group management to bring down cost of cultivation. A functional and representative advisory body of farmers under the guidance of the Krishi Bhavan looks after the various cultivation operations by group action.



Inner view of mobile lab displaying instruments

officers of the Department of Agrl-culture, Agrl. Development Officers of Banks were given lectures and demonstration on the importance of the project. Three classes were also conducted for the B. Sc. (Agri.) and one class for the P. G. students of the KAU. The students were also allowed to operate the various instruments and analyse samples.

The district level officers (Assistant Director/Deputy Director/Joint Director) of the Department of Agriculture in Thrissur district were given a lecture on the project and its various activities. Demonstration of equipments was also carried out. Twenty five officials attended this programme. The officers expressed their appreciation of the project. They suggested procuring more instruments. The Joint Director suggested purchase of equipments for locating acquifers for open wells. There was also a suggestion to procure grain moisture meters for seed farms. Similar classes were also held in Irinjalakuda and Wadakkancherry subdivision for Junior Agricultural Officers, sixty three officers participated in the programme. There was a suggestion to train these officers also on the use of electronic instruments.

Trainees from the Tribal area (13 Nos.) were explained about the activities of the project.

ii) Soil testing

Soil testing and fertiliser recommendation was an important component of the field programme in which the farmers were most enthusiastic. The mobile laboratory was equipped in such a way to completely analyse

and provide fertiliser recommendation for 30-35 samples per day. To speed up the process of providing fertiliser recommendation, a ready reckoner was prepared by the project staff, based on the KAU Package of Practice Recommendations for all the crops in Kerala. A total of 2939 samples collected from the various panchayats were analysed and fertiliser recommendations given on the spot. In addition to the above, based on the requests from farmers outside the operational area, 65 samples were tested and recommendations given. The crops covered included paddy, coconut, tapioca, pepper, ginger, cashew, arecanut, banana, pineapple, vegetables etc. Based on the analysis of soils covering all the 23 panchayats, carried out during 1990-91, fertility maps were prepared based on the calculated nutrient indices for the three blocks.

iii) Milk testing

Cost of milk production is comparatively high in the State owing to the scarcity of grazing field and high cost of labour and cattle feed. Large scale dairy farms are not available in the operational area. A good number of milk societies are available in two Blocks namely Alathur and Puzhakkal but not in Thrithala where no milk societies are functioning. The mode of fixing the buying price of milk also varies from society to society. Some societies offer flat rate for milk, while a few others fix the price for a whole month based on random milk checks by the conventional Gerber's method of milk fat testing. There are, however, some societies which regularly test milk samples and buy the commodity based on its fat content. These societies are known as APCOS—Anand Pattern Co-operative Societies. They

Farmers being explained on soil sample collection

Digging to collect a soil sample

also use the conventional time-consuming method.

The centre introduced for the first time the electronic milk tester to the milk societies operating in the Puzhakkal and Alathur Blocks.

Cone and quartering of soil samples

One hundred and thirty six visits were conducted with the mobile laboratory for on-the-spot demonstration of the method and testing the milk samples brought by the dairy farmers of the area. A total of 10,489 milk samples were tested in this way.

In addition to the milk tests performed, training was imparted to 72 officials of various milk societies in the actual operation of the electronic milk tester. A lot of interest could be generated in this particular instrument among the milk society officials and farmers by these demonstration and training classes, primarily due to the simplicity and less expertise required in the operation of the instrument. As a result, Puzhakkal Milk Society, Muthuvara has communicated its decision to purchase one electronic milk tester. Several other societies at Arimpur, Eravu, Parambia and Chemmanamkunnu have made enquiries with regard to the purchase of this instrument. There is now a general awareness among the milk society personnel and dairy farmers of the importance of milk fat testing from the buyer's and seller's points of view respectively. A common enquiry from them is whether subsidy could be obtained from the government or its agencies for purchasing this instrument. Considering the interest shown by the societies, the project initiated discussion with the Milma officials and DRDA, Thrissur for providing subsidy for purchase of the EMT. It is understood that the Co-operative Banks also provide loans for the purchase of EMT under the Animal Husbandry Schemes. A detailed proposal has been given for providing subsidy under the operational flood programme.

Farmers watching preparation and sieving soil sample for testing

Testing soil organic carbon using colorimeter and potassium using flame photometer

Filtering. soil extracts

A comparison of the cost of effectiveness per test using conventional Gerber's test and Electronics Milk Tester, was worked out. The electronic milk tester was found to be more accurate, quicker and cheaper as compared to the Gerber method.

Milk fat testing using EMT by a farmer

iv) Water analysis

The water in the operational area is of good quality as far as irrigation is concerned. This is further evident from the data on the analysis of water from the observation wells of the ground water Department. However in some adjacent coastal areas of Puzhakkal Block, salinity is a problem due to sea water ingress. Being a high rainfall area the problem of salinity is intense only during the summer months. This area is confined to the *Kole* regions in Puzhakkal Block. A total of 16 visits were made and 481 water samples were tested.

The break up of the field programmes carried out during the period is given in Table 2.

v) Instrument failure and feed back

Field testing of Agri-Electronic instruments developed by R & D organisations and feed back on their performance is an important activity under the project. The feed back on the performance of instruments being used in the mobile laboratory is also furnished to the Department of Electronics and the firms for carrying out repairs and modifications. The performance of the following instruments were tested and feed back furnished.

1. Field pH meter developed by Central Scientific Instruments, Punjab
2. Elico, Flame photometer
3. Grain moisture meter

The concerned firms have been informed and they have carried out the necessary repairs, modifications etc.

vi) Standardisation of specific ion electrodes

The specific ion electrode available under the project were standardised for NO_3^- and K^+ ions. The work was done in collaboration with

Table 2. Particulars of field programmes carried out

Particulars	1989-90	1990-91	1991-92	Total
1. No. of visits to different blocks	210	216	262	688
2. No. of farmers contacted	1681	1406	2123	5210
3. No. of soil samples analysed	800	1332	807	2939
4. No. of milk samples tested	1513	3705	5271	10489
5. No. of water samples tested	—	31	450	481
6. No. of demonstration classes conducted	79	73	68	220

the Radio Tracer Laboratory, Vellanikkara. A quick method to determine the potassium in the fresh mashed sample of leaf is being standardised. The results obtained with Standard Ion Electrodes and the Flame photometer readings of potassium estimated from the dried leaf powder after acid digestion are found to agree. The study is being continued with more number of samples.

4.2. Impact of the project

4.2.1. Creation of awareness among farmers

One of the main objectives of PPAE is to create awareness among farmers about the use of electronic gadgets in agricultural operations. As is evident from Table 4, this objective of PPAE has been achieved in the sense that about 82 per cent of the sample farmers have knowledge of AEEs and two-thirds of the sample farmers opined that it was through PPAE they came to know of AEEs. Further it is observed that the farmers are convinced of the use of AEEs in agricultural operations as about 80 per cent of the sample farmers have favoured it. However, the intensity of their knowledge of AEEs is quite shallow as it is noted that only 3 per cent of the sample farmers are having acquaintance with more than one AEE. This is rather a weak point as PPAE failed to enlighten the farmers of the various AEEs that are available now for farmers use. The reason behind this as putforth by the PPAE staff is that the farmers remember only the test which has been conducted in their field. Naturally they may be unaware of other tests that have not had been done in their farming operations.

A majority of farmers feel that AEEs are useful in Agricultural operations. As for farmers' perception with regard to the usefulness of AEE's the relevant details are given in Table 5. It is seen that farmers prefer AEEs mainly due to the saving of time in the testing operations which enables them to apply fertilizers in appropriate quantity and at appropriate time leading to enhanced productivity. On an average about 18.70 per cent of the sample farmers are of the opinion that AEEs save time, 15.32 per cent opined that they reduce cost of cultivation and 15.76 per cent states that AEEs enhance productivity.

Table 3. Important subsidiary occupations and percentage of farmers involved

Sl. No.	Subsidiary occupation	% of farmers
1	Dairying	0.00
2	Allied Agri. activities	4.3
3	Wage employment	7·53
4	Business	11.83
5	Others (mainly service sector activities)	19.35
	Total	43.01

Table 4. Level of awareness among farmers about the use of AEEs and the contribution of PPAE for it

Sl. No.	Farmer classification	% of farmers having knowledge of AEE	% of farmers who came to know of AEE through PPAE	% of farmers who are having acquaintance with more than one AEE	% of farmers favoured the use of AEE agricultural operation
1	Large farmer	85.71	71.43	0.00	71.43
2	Medium farmer	86.67	53.33	6.67	86.67
3	Small farmer	80.65	77.42	0.00	83.87
4	Marginal farmer	80.65	65.63	6.25	78.13
5	Agricultural labour	75.00	50.00	0.00	62.5
	Total	81.72	66.67	3.23	79.57

Table 5. Farmers perception regarding the usefulness of Agri-Electronics: Percentage of farmers who gave their opinion by priority

Sl. No.	Useful due to	1 st priority	2nd priority	3rd priority	Weighted average
1	Enable in saving time	27.03	12.16	6.76	18.70
2	Enhances productivity	22.97	10.81	4.05	15.76
3	Reduces cost of cultivation	9.46	27.03	9.46	15.32
4	Increases profits	13.51	4.05	6.76	9.23
5	Electronic gadgets are reliable and accurate	9.46	5.41	6.76	7.66
6	Input applications can be made timely	8.11	6.76	6.76	7.44
7	Saving of inputs	5.41	6.76	10.81	6.76
8	Easy to operate	2.70	5.41	1.35	3.38
9	Instrument failure are less	0.00	0.00	1.35	0.23
10	Cost of such equipments is in the reach of farmers	0.00	0.00	0.00	0.00

Farmers who have some acquaintance with conventional methods of soil testing were asked to give the comparative advantages of AEEs and conventional methods. Majority of the farmers (53 per cent) viewed that conventional methods are not convincing as the testing is not done in their presence (See Table 6), while soil testing through AEEs are convincing because the entire operations are done in farmer's presence. Further, PPAE staff explain and demonstrate AEEs to farmers and also the operations involved. About 70 per cent of the farmers are happy with such an approach of PPAE staff (see Table 7).

4.2.2 Soil testing—Its impact

There were 75 sample farmers from the soil testing activity. In Table 8 the details about them are presented. Wet land which is used for paddy cultivation was got tested by most of the farmers. The average size of wet land tested is 0.52 ha. The agricultural labourers used to lease in land for share cropping as their average size of land tested is 0.18 ha. The average size of garden land tested is 0.17 ha for all groups of farmers.

It can be seen from the table that 68 per cent of the farmers tested the soil for the first time. They had not tested their farm soil prior to PPAE soil testing. Among different farmer groups which tested soil for the first time, it is small and marginal farmers and Agricultural labourers who are more in percentage. This implies that PPAE could involve more and

Table 6. Advantages of AEEs in comparison with conventional methods—Farmers' opinion

Sl. No.	Advantages	Percentage of farmers who favoured AEEs against conventional methods due to
1	Conventional methods are not convincing	52.69
2	The process involved are less and so it's time saving	9.68
3	Easy to learn	2.15
4	Cost-wise it is cheaper	0.00
5	Other reasons	17.20
6	No opinion	18.28

Table 7. PPAE demonstration of Agri-Electronics equipments: Farmers response

1	Percentage of farmers responded positively for the demonstration of Agri-Electronic equipments by PPAE staff	89.89
2	Percentage of farmers who opined that demonstration classes are difficult to understand	10.11

Table 8. Soil testing particulars

Sl. No.	Farmer's classification	No. of sample	Average size of garden land tested (in ha)	Average size of wet land tested (in ha)	% of farmers who tested their soil for the first time	% of farmer better rated PPAE testing (out of those who tested soil earlier)	% of farmers who got test result within one day	% of farmers who got test result after one week	% of farmers who did not get result	% of farmers who found advantage in involving farmers in soil testing	% of farmers who altered cropping pattern after PPAE soil testing
1	2	3	4	5	6	7	8	9	10	11	12
1	Large farmer	6	0.23	1.32	50.00	66.67	83.33	0.00	16.67	100.00	33.33
2	Medium farmer	15	0.32	0.83	53.33	100.00	60.00	20.00	20.00	73.33	6.67
3	Small farmer	25	0.19	0.47	76.00	100.00	76.00	4.00	8.00	80.00	0.00
4	Marginal farmer	25	0.08	0.26	72.00	85.71	68.00	8.00	16.00	76.00	6.67
5	Agrl. Labour	4	0.01	6.19	75.00	100.00	75.00	0.00	26.00	25.00	0.00
	Total	75	0.17	0.52	68.00	91.68	70.67	8.00	14.67	76.00	5.33

more marginal groups in its operations.

PPAE soil testing is also better rated by 92 per cent of those farmers who had experience of testing soil earlier. The major positive attributes of PPAE soil testing (See Table 9) according to them are (a) it is quick and time saving (82 per cent of the farmer had this opinion) (b) PPAE not only tests the soil but also provide fertilizer recommendations (50 per cent) (c) PPAE soil testing is more accurate (27 Per cent) (d) PPAE collect a representative soil sample (27 per cent) (e) PPAE conscientise the farmers about the usefulness of soil testing (14per cent)(f) PPAE involves farmers in soil collection (5 percent) (g) Timely application of fertilizer is possible (5 per cent).

Majority of farmers found PPAE service praiseworthy due to its prompt service. Almost 71 per cent of the farmers opined that they received the test result on the same day of the testing. About 8 per cent of the farmers got the test result after one week. However, there were farmers who did not get test result at all (15per cent). This has happened because these farmers were not present at the site of soil testing and PPAE staff used to handover the test results to concerned group farming conveners. The results might not have reached the respective farmers from these conveners. In some cases it happened with the Krishi Bhavan officials too.

One of the important features of PPAE soil testing is involving farmers in soil testing. It begins from conscientisation and ends with fertilizer applications. In fact, farmers are happy about it as is evident from their response to the question to that effect. As many as 76 per cent of the farmers found advantage in involving farmers in soil testing (see Table 8). The major advantage that has been pointed out by farmers (53 per cent) is that involvement of farmers enable them to get the

Table 9. Percentage of farmers who responded positively and negatively to different aspects of PPAE soil testing

Sl. No.	Aspects of PPAE soil testing	Percentage of positive response	% of negative response
1	PPAE soil testing is quick and time saving	81.82	19.18
2	PPAE not only tests the soil but also provide fertilizer recommendations	50.00	50.00
3	PPAE collect a representative soil sample	27.00	73.00
4	PPAE conscientised the farmers about the usefulness of soil testing	13.64	86.36
5	PPAE involves farmers in soil collection	4 55	95.45
6	Timely application of fertilizer is possible	4.55	95.45

right soil sample (see Table 10) and it enhance the reliability of soil test (23 per cent farmers had this opinion). Another 24 per cent farmers feel that involvement of farmers facilitate the farmer to learn the operations involved in soil testing and also thereby understand the technical details given in the soil test report. This in a way helps the farmers to apply appropriate quantity of fertilizers to their crops.

The percentage of farmers who altered cropping pattern after PPAE soil testing is very small, ie. about 5 per cent (this is not on PPAE suggestion).

4.2.3. Fertilizer applications—Before and after PPAE soil testing

Technological innovations in agricultural operations enhance the possibility of factor substitution in tune with the relative factor prices. In the soil testing efforts, PPAE aims not only at optimising fertilizer quantity that is being applied but also at substituting fertilizers that are relatively cheaper. In order to find out changes, if any, in behaviour of farmers in the matter of fertilizer application an attempt was made to quantify the amount of different types of fertilizers that has been used and cost of it at two time periods ie., before and after PPAE soil testing. The results have been presented in Table 11.

The chemical fertilizers available in the market were categorised into the three nutrient groups: Nitrogen (N), Phosphate (P) and Potash (K). There were also fertilizer mixtures consisting either two or three of these nutrients. In addition to chemical fertilizers there were Organic Manure (OM), Farm Yard Manure (FYM), Lime and Ash.

From the table it can be seen that there was very little change in the behaviour of farmers in the application of various types of chemical fertilizers. The quantum of 'N' fertilizer decreased from 145.11 kg per ha to 138.2 and of 'K' decreased from 104.7 kg/ha to 98.8 kg/ha. While 'P' fertilizer quantity increased from 109.9 kg/ha to 124.7. It is evident from this that either farmers are not that enthusiastic about applying the prescribed fertilizer recommendations or they are very slow in changing the existing pattern. For

Table 10. Major four advantages attributed to involving farmers in PPAE soil testing and the percentage of farmers who noted it.

Sl. No.	Advantages	Percentage of farmers who noted it
1	Enable to get right soil samples	53.33
2	Enhance the reliability of the test result	22.66
3	Learns the operations involved	14.67
4	Understands the technical details given in the soil test report	9.34

Table 11. The quantity of fertilizer that the sample farmers used before and after PPAE soil testing (in kg/ha)

Sl. No.	Fertilizer materials	Farmer Group										All group combined	
		Large farmer		Medium farmer		Small farmer		Marginal farmer		Agrl. labour			
		Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
1	N	183.67	151.97	173.34	168.47	115.13	118.29	112.48	101.39	21.16	14.10	145.11	138.19
2	P	164.67	278.69	99.94	90.40	114.53	91.88	54.71	66.89	112.90	84.69	109.96	124.66
3	K	142.52	123.50	81.98	77.78	115.35	123.08	91.81	73.26	23.98	26.82	104.70	98.80
4	Lime	82.33	503.48	32.33	125.32	94.69	94.69	28.87	65.36	141.13	176.43	62.37	183.13
5	FYM	3040.00	2850.00	4657.00	8414.57	3724.49	3791.15	2564.23	2027.67	296.40	211.70	3624.31	4698.56
6	OM	2849.98	2849.98	109.15	00.00	1490.55	1610.19	690.07	591.27	00.00	1354.97	1167.59	1176.78
7	Ash	00.00	00.00	48.51	48.51	51.28	51.28	12.15	12.15	00.00	00.00	32.60	32.60
8	Complex/ Mixture	6.35	00.00	109.15	97.73	48.46	27.78	99.71	82.99	7.06	00.00	66.96	52.98
9	Others	00.00	6.35	00.00	8.08	00.00	2.12	00.00	00.00	00.00	00.00	00.00	4.47

instance, the farmers apply potassium fertilizer as much as double of the required quantity.

Further, the break up of fertilizer application by farmer categories, gives a different picture. Each group of farmers apply different combinations of fertilizers in their farms. Before PPAE soil testing large farmers used to apply 183.67 kg/per ha, small farmers 115.13 kg per ha and agricultural labourers only 21.16 kg of nitrogen fertilizers per ha. In the case of phosphorus before PPAE soil testing large farmers, small farmers and agricultural labourers applied more than the all groups average. In the matter of potassium it is large farmers and small farmers who applied more than the all groups average. It is seen that agricultural labourers applied only 23.98 kg of potassium before PPAE soil testing.

The situation has not been significantly changed after PPAE service. This is evident from the same table. However, a notable point is that large farmer groups apply higher quantity of all types of chemical fertilizers compared to the all farmer groups average.

Further, when we add all chemical fertilizer materials that the farmer groups use (ie. N+P+K+Mixtures), an interesting point has emerged (see Table 12). It can be seen that except large farmers all other farmer groups decreased in the use of chemical fertilizers after PPAE soil testing. The rate of decrease was high among those farmer groups whose size of holding is less and who use lesser quantity of it per ha. Also when all groups of farmers were combined there was decline in the quantum of chemical fertilizer application by the farmers to the extent of 2.84 per cent. However the most interesting point is that the rate of decline in the quantum of chemical fertilizer was the higher among those groups who use less quantity per hectare. It was seen that poor farmers are unable to bear the cost of chemical fertilizers and they wanted to minimise its use even though they use small quantity.

In the case of 'FYM' it is seen that after PPAE soil testing the quantity has been increased from 3624.31 kg per ha to 4698.56 kg per ha (All groups combined), while the quantum of 'OM' has increased marginally

Table 12. Farmer behaviour in applying chemical fertilizers before and after PPAE soil testing (kg/ha)

Farmer groups	Total quantity of chemical fertilizers		Percentage change
	Before	After	
Large farmer	497.21	554.17	11.46
Medium farmer	464.41	434.39	−6.46
Small farmer	393.47	361.04	−8.24
Marginal farmer	358.72	324.53	−9.53
Agricultural labourer	165.12	125.62	−23.92
All groups combined	426.74	414.64	−2.84

from 1167.59 kg per ha to 1176.58 kg per ha.

In order to understand the farmer behaviour in the use of 'FYM' and 'OM' more clearly both were combined and the same is presented in Table 13. From the table it is observed that there existed wide variations among different groups of farmers in the use of FYM andOM before and after PPAE soil testing. Though when all groups were combined there was an increase (22.61 per cent) in the use of this manure, there are groups of farmers who reduced its use (like large farmers and marginal farmers.) The disturbing point is that those groups who increased the use of FYM and OM are not necessarily those groups who used to apply less than optimum quantity of these fertilizers. Also is the case with those who reduced it. For instance, small farmers who increased the quantum of FYM and OM were on an average were applying about 5214.17 kg per ha of it before PPAE soil testing which is higher than what is required. The medium farmers too who increased per ha application of FYM and OM to 8415 kg after PPAE soil testing (77 per cent increase) and these did not agree with optimality. The case of marginal farmers who reduced the use of FYM and OM to the extent of 20 per cent were only using 1317 kg prior to PPAE soil testing. Even though agricultural labourers have increased the use of FYM & OM it is seen that they used far less (1565 kg per ha) than that what is required. It may be because they cultivate leased-in land.

From the discussions with the farmers it is learned that the use of FYM and OM depends on the availability of these manures in their own farms and the cost bearing ability of the farmers. This is reflected from the data collected as can be seen from Table 13 wherein marginal farmers and agricultural labourers use very small quantities of these manure. This is because either they are unable to afford it or are not self producing it. On the other hand the farmers who have larger farm size are able to manage FYM and OM from their own farm or are able to afford the cost of it.

On the question of change in the pattern of fertilizer application after PPAE soil testing the most notable feature is the nearly two fold increase in the quantum of lime application by all groups of farmers (see Table 14). The increase was the highest among large farmers about (five fold increase) and medium farmers (three fold increase). The enhanced application of lime is in tune with the PPAE recommendation as it has proved the deficiency of lime in the paddy fields. There are farmers who opined that they could not apply adequate lime due to shortage of it. Many of them, did not receive it in time. Another contributory factor for better lime application is the subsidised supply of lime by Agricultural Department of Government of Kerala. It acted as an incentive to the farmers to apply higher quantity of lime. However, it is evident from farmer's reactions that they are now convinced of the use of lime in paddy fields as prior to PPAE soil testing they were quite ignorant of the mode and scientific use of lime application.

Table 13. Farmer behaviour in applying farm yard manure (FYM) and organic manure (OM) before and after PPAE soil testing

Farmer groups	Before	After	Percentage change
	kg/ha		
Large farmer	5889.99	5699.00	−3.23
Medium farmer	4766.16	8414.57	76.55
Small farmer	5215.03	5401.35	3.57
Marginal farmer	3254.30	2618.94	−19.52
Agrl. labourers	296.40	1566.67	428.57
All groups combined	4791.89	5875.34	22.61

Table 14. Farmer behaviour in applying lime before and after PPAE soil testing (kg/ha)

Farmer groups	Before	After	Percentage change
	kg/ha		
Large farmers	82.33	503.48	511.58
Medium farmers	32.33	125.32	287.62
Small farmers	94.69	94.69	0.00
Marginal farmers	28.87	65.36	126.35
Agrl. labourers	141.14	176.43	25.00
All groups combined	62.37	183.13	193.62

To conclude, the general trend in the quantum of fertilizer application that is revealed by the field study is that farmers are rather reluctant to apply the prescribed fertilizer recommendation given by PPAE staff. Optimum use of fertilizers by farmers is a pre-requisite to maximise the utility of PPAE soil testing.

4.2.4. Expenditure of fertilizer before and after PPAE service

We have seen that after the PPAE service farmers reduced the use of chemical fertilizers while they incresed the use of 'FYM' and 'OM' and lime. This being the behaviour of farmers in the matter of quantum of fertilizer application now it is attempted to see whether farmers could save anything from the money which they incurred on fertilizers. In other words it is interesting to know whether inter-factor substitution resulted in cost reduction.

Table 15 shows the results of our survey on the expenditure incurred on different fertilizers by the farmers. On the whole it can be seen that the money spent on the fertilizer increased by 13.2 per cent (chemical fertilizers at constant prices and FYM, OM and Lime at market prices). It is seen that farmers could save only in the cost of chemical fertilizers to the exent of 7.86 per cent per hectare. While in all other fertilizers they had to spend higher amounts in the case of FYM and OM by 18.18 per cent and in Lime by 230 per cent.

The notable point is that the farmers saved only 2.84 per cent on quantity of chemical fertilizers while they saved as much as 7.36 per cent on money spent on such fertilizers. This advantage accured to farmers solely because of the PPAE fertilizer recommendations, which helped them to substitute cost-effective fertilizers (this does not mean that farmers used optimum quantity of chemical fertilizers).

The amount spent on FYM and OM increased. Of course, its unit price did not increase as evident by more than proportionate increase in quantity applied. However, in the case of lime the amount spent had a more than proportionate increase compared to quantity used. Hence it may be concluded that the farmers could not save much money spent on fertilizer mainly due to the enhanced use of FYM and OM and of lime (as per PPAE soil testing) as well as the increased cost of per unit of lime during the reference period.

An examination of farmer behaviour group-wise revealed that only small farmers could save on money spent on fertilizers to the extent of 13 per cent (see Table 16). All other groups had increased expenditure on fertilizers it was as high as 99.74 per cent among agricultural labourers, 37.39 percent among medium farmers, 26.32 percent among large farmers and 3.93 percent among marginal farmers.

Since we have observed that farmers on the whole saved money on chemical fertilizers we further probed into which group of farmers who saved the most. As shown in Table 17 it can be seen that Agricultural labourers (by 28.21 per cent) and medium farmers (by 10.19 per cent) were the groups which effected higher percentage savings than the all groups average. Another important point is that large farmers, in fact, increased the quantum of fertilizers, as we have seen earlier, but they could substitute cheaper ones which enabled them to save on money spent by 2.17 per cent.

4.2.5 Impact of PPAE service on yield of paddy

The ultimate objective of soil testing and related activities is the enhancement of yield of the crop so that their return can be maximised. The use of AEEs is thus meant to increase agricultural production per unit of farm land. The evaluation study, therefore, looked into yield of paddy before and after PPAE soil testing. The results are presented in Table 18. It can be seen that the yield of paddy has not increased during the reference period. In fact, there was a marginal decline to the extent of 1.42 per cent ie. from 4342 kg per hectare is decreased to 4280 kg per hectare. It is observed that this decline is solely because of the decline in yield among large farmer groups. Not only productivity of paddy is very low among them (3220 kg per hectare before) but also it declined by 19.5 per cent (2591 kg per hectare after) during the reference period. The other groups of farmers barring medium farmers experienced increase in yield and the increase was the highest among agricultural labourer groups (by 28.36 per cent). Marginal farmers had an increase by 7.49 per cent and small farmers by 1.73 per cent. The medium farmers could not show any increase in yield.

Table 15. Expenditure incurred on fertilizers prior to and subsequent to soil testing by the sample farmers (Rs. per hectare)

Fertilizer materials	Before	After	Percentage change
Chemical fertilizers	906	840	—7.86
FYM and OM	1060	1252	18.18
Lime	57	188	230.00
Others	17	29.6	71.00
All fertilizers	2040	2309	13.20

Table 16. Money spent on fertilizer prior to and subsequent to soil testing by the sample farmers (in Rs. per hectare)

Farmer groups	Money spent before	Money spent after	Percentage change
Large farmer	1867	2359	26.32
Medium farmer	2213	3041	37.39
Small farmer	2638	2299	—12.83
Marginal farmer	1820	1892	3.93
Agricultural labourer	961	1919	99.74
All groups combined	2040	2309	13.20

Table 17. Money saved on chemical fertilizers by different groups of farmers (Rs. per hectare)

Farmer groups	Before	After	Percentage change
Large farmers	1023	1000	— 2.25
Medium farmers	1020	916	—10.19
Small farmers	810	763	— 5.79
Marginal farmers	778	751	— 3.49
Agrl. labourer	385	276	—28.21
All groups combined	906	840	— 7.36

Large farmers failed to enhance yield mainly as they pointed out, due to unfavourable climate. But this is only partly true as climatic influence must be the same for all the groups. The actual reason is their indifference to paddy cultivation as they usually employ labourers wherein their personal attention is lacking. On the other hand small marginal and the agricultural labourer who work themselves in the field pay more attention to the crops and they could show marked improvements after PPAE soil testing. PPAE service if continued in the future should concentrate on those farmers' groups who take interest in cultivation.

As far as returns are concerned it is seen that, when all groups combined there is a marginal increase by 1.85 per cent after PPAE service. This, inspite of the decline in yield, is due to increase in unit price to the extent of 11 per kg during the reference period. Here too agricultural labourers, marginal farmer and small farmer groups marked relatively higher percentage increase. These groups benefitted both from 'yield effect' and 'price effect'.

To conclude, it is seen that PPAE service is more useful to small farmers, marginal farmers and agricultural labourers as in their case there is an increase in yield rates and also returns from paddy cultivation.

4.2.6 Block-wise effectiveness of PPAE service

Soil testing has been done vigourously by PPAE in the three selected blocks. These blocks are unique in their own way as far as agricultural operations are concerned. How farmers responded to soil testing by PPAE and how effective is the PPAE service in these different blocks? The following section answers this question by presenting the information that was collected from the farmers.

First, we have looked into the farmer behaviour in fertilizer applications. As we have seen earlier sample, farmers as a whole reduced chemical fertilizer application in their fields after PPAE service. However, a block wise breakup revealed that in Puzhakkal block there was no such reduction in chemical fertilizer application. In fact, there, it increased by 2.14 per cent (see Table 19). In Thrithala and Alathur blocks there was reduction to the extent of 10.36 and 4.54 per cent respectively.

It can also be seen that the application of chemical fertilizer per hectare was the highest in Alathur block and the lowest in Thrithala block. In Thrithala block only 225.98 kg of chemical fertilizer was applied, which is far short of what is actually required. In Atathur and Puzhakkal blocks the farmers apply 'K' fertilizer in excess of optimal levels.

As far as 'FYM' and 'OM' are concerned, it is seen that the farmers in Alathur block are applying more of it and the rate of its application increased by 36.32 per cent during the reference period. In Puzhakkal block too there was increase to the extent of 1.63 per cent. In Thrithala block the level of application of FYM and OM is very low and it has increased also.

The quantum of lime application increased in all the blocks. The rate of increase was as high as 301 per cent

Table 18. Yield and returns from paddy cultivation for different sample farmer groups before and after PPAE soil testing

Farmer groups	Yield per hectare in kg		Percentage change	Returns per hectare in Rs.		Percentage change
	Before	After		Before	After	
Large farmer	3221	2591	—19.55	10206	7778	—23.79
Medium farmer	6200	6160	—0.64	17809	18532	4.06
Small farmer	3720	3784	1.73	11322	12122	7.07
Marginal farmer	3399	3653	7.49	9608	10811	12.52
Agricultural labourer	3413	4382	28.36	8596	11705	36.18
All groups combined	4342	4280	—1.42	12804	13041	1.85

Table 19. Nature of fertilizer application before and after PPAE soil testing : Blockwise (kg/hectare)

Blocks	Chemical fertilizer			FYM and OM			Lime		
	Before	After	Percentage change	Before	After	Percentage change	Before	After	Percentage change
Alathur	450.36	429.90	—4.54	4865	6631	36.32	50.09	200.83	301
Puzhakkal	407.18	415.90	2.14	4907	4989	1.63	79.58	152.15	91
Thrithala	252.09	225.98	—10.36	2642	2642	0.00	89.11	200.54	125
Total	426.74	414.64	—2.84	4791	5876	22.61	62.36	183.12	194

in Alathur block, 125 per cent in Thrithala block and 91 per cent in Puzhakkal block.

The nature of the use of various types of chemical fertilizers after PPAE service was introduced in the three blocks is presented in Table 20. It can be seen that in general, farmers have reduced the use of 'N', 'K' and Mixtures (4.77, 5.67 and 20.88 per cent respectively), while they increased the use of 'P' (by 13.36 per cent). However, blockwise, there is marked difference in the mode of fertilizer application. In Puzhakkal block the farmers increased the use of only 'P' fertilizer, the use of all other fertilizers were reduced, while in Alathur, farmers reduced the use of 'P' and mixtures. In Thrithala, farmers increased the use of mixtures and reduced all other fertilizers. So it is seen that the increase in the use of chemical fertilizer in Puzhakkal block is solely due to the increase in the use of 'P' fertilizer.

Blockwise variation in the cost of fertilizer application before and after PPAE service can be seen from Table 21. Only farmers in Puzhakkal block saved some money(1.09percent) on the expenditure made on fertilizer. In Alathur block it inceased by 23.63 per cent and in Thrithala block it increased by 3.85 per cent. Hence it may be concluded that only farmers in Puzhakkal block could save some money on fertilizer expenditure by altering the type of various chemical fertilizers that had been applied in spite of the fact that there was a small increase in fertilizer use.

The 'yield effect' due to PPAE service was also examined block-wise. The results are presented in Table 22. It can be seen that the highest yield was in Alathur block both before and after PPAE service. The lowest was in Thrithala. When the percentage increase over pre-PPAE service is examined, it is seen that the rate of increase was the highest in Thrithala block ie. 27.71 percent. In Alathur it was 0.22 per cent. In Puzhakkal block there is a decrease in yield by 6.72 per cent. Juxtaposing this result with the behaviour in fertilizer application it may be concluded that though farmers in Puzhakkal block saved on expenditure on fertilizers by altering the type of fertilizers, they could not increase yield rate from cultivation, instead it declined substantially. This again pin points to the fact that by maintaining high yield rates and by increasing it, the farmers in Alathur block have heeded to PPAE recommendations. In Thrithala block, though there is increase in yield rates still it is the lowest among all blocks.

The returns per hectare also is high in Alathur block. Except in Puzhakkal block in other two blocks the returns showed good increase— 4.77 per cent in Alathur and 26.92 per cent in Thrithala.

The general conclusion that emerges from the blockwise analysis is that farmers in Alathur block are more progressive in adapting technological innovations suggested by PPAE while farmers in Thrithala are adapting it but very slowly. The effect of PPAE service was least in Puzhakkal block.

4.2.7 Soil testing in Garden lands

Though importance has been given to testing of soil of paddy lands, garden lands has also been tested and

Table 20. Nature of chemical fertilizer application by sample farmers—Blockwise

Blocks	N			P			K			Mixture		
	Before	After	% change	Before	After	% change	Before	After	% change	Before	After	% change
Alathur	60.62	62.62	3.30	50.98	45.99	—9.79	44.01	45.47	3.32	26.72	19.97	—25.26
Puzhakkal	59.49	48.77	—18.02	34.71	60.40	74.01	41.13	35.28	—14.22	29.52	23.93	—18.94
Thrithala	24.23	21.65	—10.65	37.37	27.06	—27.59	29 64	2..65	—26.96	10.82	21.13	95.29
All blocks	58.75	55.95	—4.77	44.52	50.47	13.36	42.39	40.00	—5.64	27.11	21.45	—20.88

Table 21. Nature of expenditure on fertilizers (Blockwise)

Blocks	Before	After	Percentage change
Alathur	787	973	23.63
Puzhakkal	921	911	−1.09
Thirthala	572	594	3.85
Total	826	935	13.20

Table 22. Yield and returns from paddy cultivation before and after PPAE soil testing : Blockwise

Blocks	Yield in kg/hectare			Returns in Rs./hectare		
	Before	After	Change	Before	After	Change
Alathur	4730	4740	0.21	14229	14908	4.77
Puzhakkal	3895	3633	−6.72	11186	10539	−5.78
Thrithala	2593	3312	27.71	6239	7918	26.92
All Blocks combined	4342	4280	−1.42	12804	13041	1.84

recommendations were given. Naturally one is interested to know the impact of soil testing in garden lands. It is quite difficult to quantify the benefits accrued to farmers because of the homestead farming practised especially with perennial crops. For instance, some farmers tested the soil of coconut plantations, some of pepper and some of arecanut. The dose of fertilizer to the plants vary from type to type and age to age and place to place. With all these constraints estimating the impact on garden lands was tried by analysing the farmer behaviour prior to, subsequent to PPAE service. The quantum of fertilizer applications prior to and after the soil testing has been presented in Table 23. Only 27 farmers got their garden land tested. Prior to PPAE service, on an average, the farmers used 61.18 kg of 'N', 127.03 kg of 'P', 99.17kg of 'K' and 67.97 kg of mixtures per acre of garden land. The quantum of lime was 22.18 kg, FYM was 4950 kg and OM was 3371kg. About 427 kg of ash was also used per hectare.

In the situation after availing of PPAE service it is difficult to get a complete picture of fertilizer that has been applied because the farmers apply fertilizers stage by stage.

Table 23. The quantum of fertilizer applied in garden lands—before and after PPAE soil testing (in kg/hectare)

Fertilizer types	Before	After
N	61.18	7.78
P	127.03	53.12
K	99.17	25.07
Mixture	67.97	63.52
Lime	22.18	46.93
FYM	4950	1739
OM	3371	2013
Ash	427	400
Others	151	146

At the time of interview, the farmers had not applied the full quantum of fertilizer, which was recommended for the year.

It is not possible to draw definite conclusions regarding the productivity increase in garden crops. This is due to the timelag in getting results in such crops. However, farmers are of the opinion that their crops have improved after the PPAE service.

4.2.8 Milk testing—Its impact

In order to understand the impact of milk testing by PPAE an attempt was made to measure the direct economic benefit that has been accrued to the dairy farmers in terms of the price advantage per unit of milk sold. Information on the return per unit of milk prior to subsequent to PPAE service was collected from the farmers. (Data on returns from milk supply to co-operatives were collected for two months ie. One month prior to PPAE service and one month subsequent to PPAE service). It has been found that prior to the PPAE milk testing, the average per (litre) price received by the sample farmers was Rs. 4.28, which has increased to Rs. 4.66 after the milk testing. This means that on an average 0.37 paise has been additionally received by the farmers per unit of milk supplied to the co-operatives. In other words, on an average each sample farmer received an incremental income of Rs. 61/- during the month following the PPAE service. This is due to the testing of milk and the resultant price advantage. Hence farmers well received the electronic gadget used for milk testing. It saves time, it gives higher income to farmers. From the

Table 24. Availability of electronics gadgets to farming community

1. Percentage of farmers, who have opined that other than PPAE no other sources exist to get electronic gadgets	12.90
2. Percentage of farmers who satisfied with the working of PPAE staff in getting electronic gadget in their area	68.82
3. Percentage of farmers who suggested farmer groups to take up the supply of Agri-electronic gadgets in their area	45.16
4. Percentage of farmer who suggested Krishibhavans to take up the supply of Agri-Electronic gadgets in their area	51.61
5. Percentage of farmers who do not have any suggestion to improve the mode of availability of Agri-Electronic gadgets in their area	2.67

point of view of management of society also AEE is useful in following ways: (i) It saves time; (ii) It enables them to test more number of samples in a short time; (iii) It enhance the confidence of farmers in milk testing, (iv) It prevents adulteration in milk as, on the spot testing easily identifies the culprit; (v) The equipment is easy to operate; and (vi) Testing cost is considerably reduced. Thus it is clear that the milk testing by PPAE is very effective and useful to the farmers. After understanding this the PPAE project leader has given a proposal to DRDA for providing subsidy/even facility in procuring Electronics milk testers by the milk co-operatives.

4.2.9 Utility from other activities of PPAE

Water quality analysis is one of the other activities taken up by PPAE. However, as the paddy fields in the study region is not seriously affected by any water quality problems the PPAE service in this area was rather limited. The PPAE service in other areas of agricultural production, procurement, storage, and processing was not yet started in the study region.

4.3 Availability of electronic gadgets to farming community

From the study it is revealed that there did not exist any source other than PPAE in making available electronic gadgets to farming community as about 87 percentage of the sample farmers opined so. The remaining 13 per cent was referring to the occasional soil testing activities of Agricultural department (see Table 24). It is understood that PPAE is the only means through which farmers were accustomed with AEEs. About 69 per cent of the farmers are of the opinion that they are satisfied with the working of PPAE staff in creating awareness of electronic gadgets in their area. The other 31 per cent viewed that nothing concrete has been done by PPAE in getting AEEs in their area of agricultural operations.

Table 25. Details organising of servicing and training support in Agri-Electronics

1. Percentage of farmers who got training from PPAE staff in handling Agri-Electronics equipments	12.90
2. Percentage of farmers who rated the usefulness of PPAE training positively	10.75
3. Percentage of farmers who are satisfied with existing servicing facilities of Agri-Electronic gadgets	00.00
4. Percentage of farmers who are satisfied with existing training facilities	3.23
5. Percentage of farmers who stated that PPAE give continuous support to them	82.80
6. Percentage of farmers who could identify any obstacle in the process of organising of serving or training in AEEs	8.60

Table 26. Farmers suggestion to maximise utility of PPAE service and use of Agri-Electronics

Sl. No.	Suggestions	Percentage of farmers suggested
1.	Frequent soil testing	20.00
2.	Classes and demonstrations on soil collection, soil testing and PPAE	17.43
3.	Explanation of fertilizer application	16.00
4.	Needs more conscientisation	10.67
5.	Before conducting classes, demonstrations and tests farmers should be well informed	10.67
6.	PPAE activities should conform seasonal agricultural operations	6.67
7.	Satisfied with PPAE services	5.33
8.	Use television, radio and newspaper in explaining PPAE activities	4.00
9.	Needs help of electronics in pest control	1.33
10.	No suggestions	8.00

It is stated by farmers that either 'Krishibhavans' or 'Farmer groups' (52 and 45 per cent respectively) can take up the supply of AEEs in their area of operation in the future. One important information that has been elicited from farmers is that they know only about the particular AEE which has been used in their farming or other operations. In other words, knowledge of farmers regarding the wide variety of AEEs that are available for the use in agricultural activities in quite shallow.

4.3.1 Organising of servicing and training support in Agri-Electronics

One of the objectives of PPAE is to provide servicing and training support in Agri-Electronics to the farmers. It is seen from the field study that farmers are not happy in this regard as evident from their response to the questions asked. Only about 13 per cent of the farmers stated that (see Table 25) they got training from PPAE in handling Agri-Electronics equipments and only 11 per cent of them rated its usefulness positively. Now the only mode of availability of AEEs is PPAE and the farmers themselves do not own and use AEEs. Likewise, farmers are not pleased with (about 97 per cent of them) existing training facilities. However most of the farmers are not in a position to identify any obstacle in the process of organising of servicing or training in AEEs. Only about 8.6 per cent of them could say something on that. They pointed out that farmers are not

enthusiastic about it and most of them are indifferent to any such innovations.

4.3.2 PPAE service—Farmers suggestions to maximise its utility

The farmers were asked to give their suggestion to maximise the utility of PPAE service in soil testing and other activities. The response of the farmers is presented in Table 26. It can be seen that about 20 per cent of the farmers need soil testing on a continuous basis and about 6.67 per cent observed that it should conform seasonal agricultural operations. It is also stated by 16 per cent of the farmers that they need detailed explanation on the fertilizer recommendations because they are unable to grasp its importance and its mode of application.

Another major area that is to be strengthened by the PPAE is the mode of conscientisation of farmers regarding the use of AEEs. This involves (i) effective classes and demonstrations on soil collection, soil testing and other activities of PPAE (ii) The use of television, radio and newspaper in explaining PPAE activities (iii) advance information to farmers regarding classes, demonstrations and other activities. On the whole about 43 per cent of the farmers stressed upon various aspects of conscientisation as can be seen from Table 26.

In addition to the suggestions to the maximisation of the utility of PPAE service in soil testing farmers also gave some general suggestions regarding the overall improvement of agricultural operations in the study region. They include,

i) improvement of irrigation facilities which enable with farmers to apply the recommended fertilizer doses
ii) supply of fertilizer at subsidised rates and in time
iii) provision of remunerative prices for their products, and
iv) measures to reduce cost of cultivation.

It is learnt from the response of the farmers that many a time the farmers are unable to follow the instructions given by PPAE because of the above stated constraints.

5. Conclusion and recommendations

1. Farmers are having knowledge of AEEs. At least they are aware of the existence of such equipment. The contribution of PPAE in this is substantial.
2. The farmers are fully convinced of the use of AEEs in agricultural operations. The farmers view the usefulness of AEEs from the points of reduction in cost of production and enhancement of productivity through saving of time and scientific application of inputs.
3. The AEEs are more convincing to farmers compared to conventional methods because AEEs are operated in the presence of farmers and they get a participative feeling in the adaptation of new technology.
4. It is seen that a vast majority of the farmers are quite new to the use of AEEs. For instance, about 1/3 of the sample farmers mainly marginal and small farmers stated that they tested their farm soil for

the first time. PPAE in that way did marvellous job in conscientising the different farmer groups especially the marginal ones.

5. PPAE service is better rated in comparison with conventional methods. The time saved in the entire process is the single most important attribute to PPAE service Another important advantage that is stated in favour of PPAE is its participatory approach wherein farmers get a clear idea of the entire process which acts as a promoter of better agricultural practices.

6. Though farmers are very jubilant in accepting the AEEs in their farming operations, it is further revealed that the follow up of it through the scientific application of inputs is not taking place. This has been evident from the steps which the farmers have taken especially in the case of fertilizer application after soil testing.

7. It is seen that the farmers are not strictly following the recommendation given for chemical fertilizer by PPAE staff. The farmers are slow in changing the existing pattern. The same is the case of farm yard manure and organic manure application. The farmers use these manure more than what is needed.

8. A notable trend after PPAE soil testing is the enhanced application of lime in their paddy fields. This is in tune with PPAE recommendation. Farmers have increased the quantum of application almost by two fold after PPAE service.

9. A dis-aggregated analysis of farmer behaviour in fertilizer applications by different farmer groups revealed that each group of farmers apply different combinations of fertilizers in their farms. There is no set pattern. However, large farmers apply higher quantity of all types of fertilizers compared to the all farmer group average.

10. Except large farmers all other farmer groups decreased the use of chemical fertilizers after the PPAE service. The rate of decrease was high among those farmer groups whose size of holding is less. When all groups of farmers were combined there is a decline in the quantum of chemical fertilizer application at the rate of 2.84 per cent.

11. The farmers do not follow any set rule in the application of FYM and OM. In general, the sample farmers apply more than what is required. However, it depends on the availability of these manures and the cost bearing ability of the farmers.

12. The study has revealed that though farmers could save some amount on chemical fertilizers, they could not save on other fertilizers. As a result the overall expenditure on fertilizers was high after the PPAE service.

13. It is noticed that farmers belonging to the weaker sections saved more on the expenditure made on chemical fertilizers.

14. On the vital question of enhancing the yield rates of the crops of farmers, it is seen that PPAE service could not make any notable impact. However, a farmer group-wise analysis revealed that there is substantial improvement in yield rates among small, marginal farmers and agricultural labourers. The large and medium farmers attributed the failure in enhancing productivity to climatic factors.

15. The weaker sections in the farming community in general got the advantage of 'yield effect' which is reflected in the increased returns to them after PPAE service.

16. Block-wise analysis of the impact of PPAE soil testing revealed that farmers in the study blocks are not having a scientific approach to the nature of fertilizer application. As seen earlier the farmers are disinclined to the use of chemical fertilizers and are rather reluctant to apply the prescribed fertilizer recommendations. In two blocks under study the farmers increased the use of FYM and OM (which is actually not needed) after PPAE service.

17. It is seen that farmers in Puzhakkal block saved on the expenditure made on fertilizers after PPAE service by about 1.09 per cent.

18. The 'Yield effect' due to PPAE service was positive in Trithala and Alathur blocks, while it was negative in Puzhakkal blocks. By maintaining high yield rates and by increasing it during the reference period the farmers in Alathur block have heeded better to PPAE recommendations. It may be concluded that the response of farmers to PPAE service in the intensive agricultural operational areas is generally positive and the farmers are comparatively eager to adopt the new technological innovation in their area.

19. The impact of soil testing in garden lands could not be measured quantitatively. However, from farmers response, it is learnt that their crops have improved after PPAE service.

20. One of the areas in which PPAE service is widely appreciated is testing the quality of milk supplied to Dairy co-operatives. Both dairy farmers as well as co-operative management favoured the use of electronic milk testing as they all noticed the advantage of electronic milk tester. For instance, a dairy farmer could get an additional income of Rs. 61/- during the month following PPAE service solely due to price fixation based on PPAE milk testing.

21. The PPAE service is rather limited to soil testing and milk testing in the study region. Due to non-availability of electronic instruments PPAE could not expand its activities to more diversified areas of agricultural operations. Even to a large extent PPAE failed to conscientise the farmers about the use of varied AEEs.

22. There exists no agency to make electronic gadgets available to farming community in the study region. The farmers viewed that

either 'Krishi Bhavan' or 'Farmer groups' equipped with electronic gadgets can serve as service centres in future.

23. It is observed from the field that organising of servicing and training support to farmers in agri. electronics is not satisfactory.

24. The major suggestion from the part of farmers to maximise the utility of AEE service is on the need to have better conscientisation among farmers. It is felt that the effectiveness of PPAE service can be maximised provided the farmers are fully convinced of its use.

25. Above all the farmers especially the small cultivators felt that the use of AEEs in agricultural operations can be expanded only if there exists other supportive measures to make agriculture a viable proposition.

5.1 Future Strategies

The major lacuna in the implementation of the project in the present from was the nonavailability of economical, field usable, rugged, portable type, simple to operate electronic gadgets to cover the various facets of Agricultural production. The project had therefore to limit its activities to soil/milk/water testing and could not expand its activities to diversified areas like water prospecting, water management, post harvest processing, quality control of processed produce etc. In this connection it is suggested that electronics R & D units should team up with SAU's/ICAR institutes for development of AEE's specific for each Agricultural regions/crops.

Of late there has been a proposal from the DOE to commercialise AEE's and Agri-Electronic services to farmers. The development of Agri-Electronics Service Centres (AESC) at the village level has been mooted where unemployed youth would man these centres levying charges for the services rendered to farmers. These centres are to be gradually become self supporting, which in turn could generate jobs for the unemployed youth and also bring about a large scale demand for AEE's.

The impact study carried out by the Pilot Centre at Vellanikkara in the operational area of the project has clearly brought out the need to spread out the uses of AEE's to more diversified areas of Agriculture. As mentioned earlier the absence of adequate AEE's to cover the various facets of Agricultural production is the major constraint in crystallising the concept of AESC's at the village level. In Kerala the per capita land holding is very small. In the present study the small and marginal farmers formed 34 and 31% respectively and the average land holding is 0.88 ha only. Paddy being the major crop, the farmers themselves do not have the paying capacity to procure these instruments or will there be a demand for paid services especially in respect of the testing services now being undertaken under the project. In the case of soil testing, Kerala has 29 laboratories in the Government/ Private sector where the services are totally free.

Kerala has 70% of the crops coming under the plantation sector. Cultivation of high value horticulture

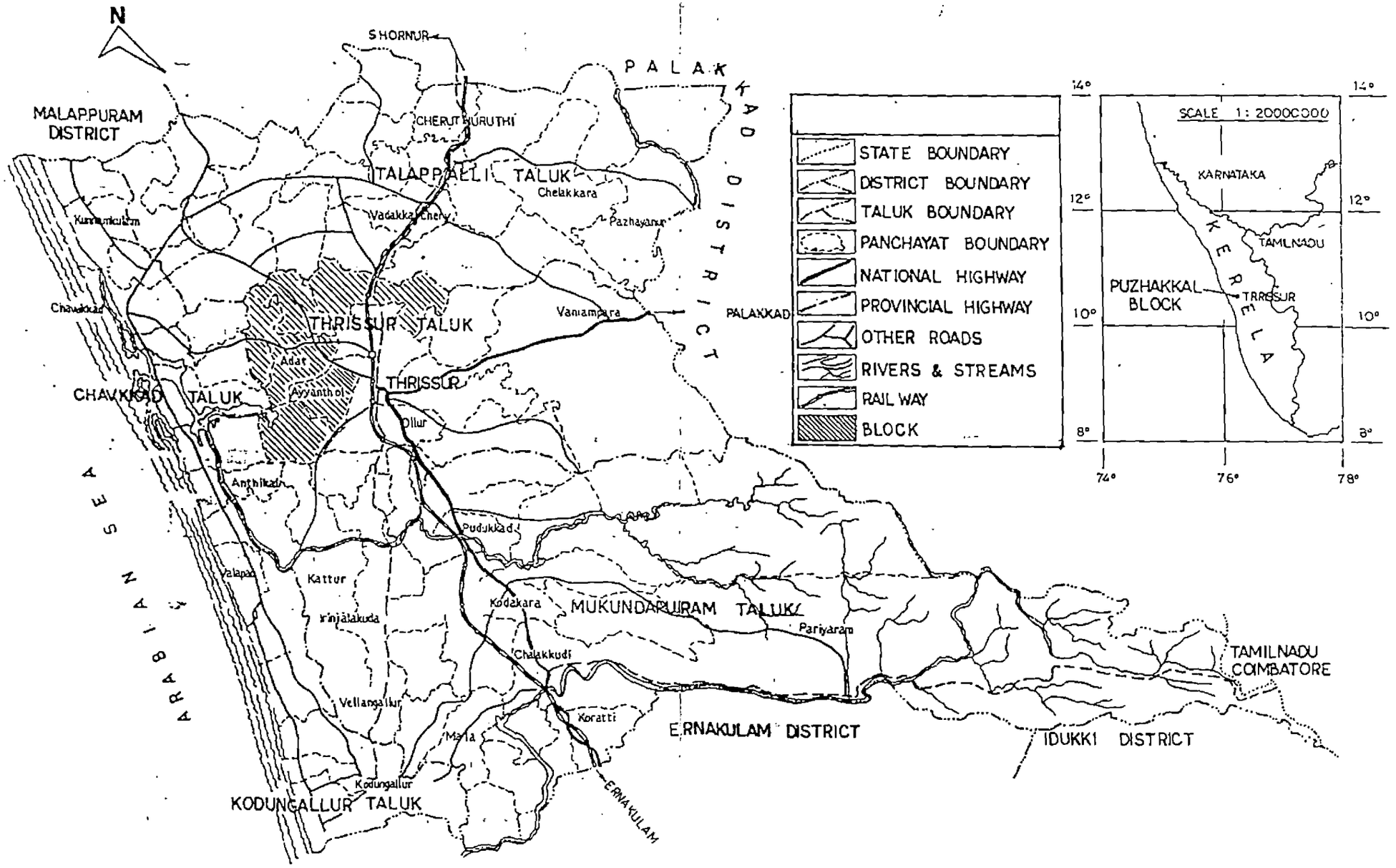
crops like flowers/vegetables are also being expanded on a commercial basis, with the formation on the Horticultural Products Development Corporation (HPDC). Labour costs are very high in the State. It may be highly beneficial to apply electronically controlled techniques in the form of low cost sensors for field use in detecting moisture deficits, controlled application of water and nutrients based on needs, instruments to detect pests especially borers of tree crops, green house controlled cultivation and testing quality parameters of fruit crops etc. Instruments currently in use in other countries may be procured for reverse engineering and suitable modifications made to suit our needs. The greater paying capacity of these crops and the farmers will certainly bring about widespread utilisation of services/equipments.

Thus if we are able to develop at least a few gadgets for each Agricultural region/crop which could be procured by individuals or groups of farmers it would be a significant achievement. These instruments will have to be extensively field tested, before being recommended to farmers. The Kerala case study brings out the revealing point on the bleak future of the proposed RAESC's in the Agriculture scenario of the state at present. Nevertheless a beginning has been made to conscientise the farmers on the usefulness of the technology. Gearing up R/D efforts to develop new instruments to cover the entire gamut of agricultural production is of prime importance. This has to be followed by extensive field testing and popularisation. For any village/panchayat level implementation, the first and the foremost will be the training and orientation of the officials. The Kerala experience calls for the need to reorient the priorities for achieving the goals of Rural Agri-Electronic Service Centres at the village level to meet the farmers needs.

LOCATION MAP OF PUZHAKKAL BLOCK

THRISSUR DISTRICT

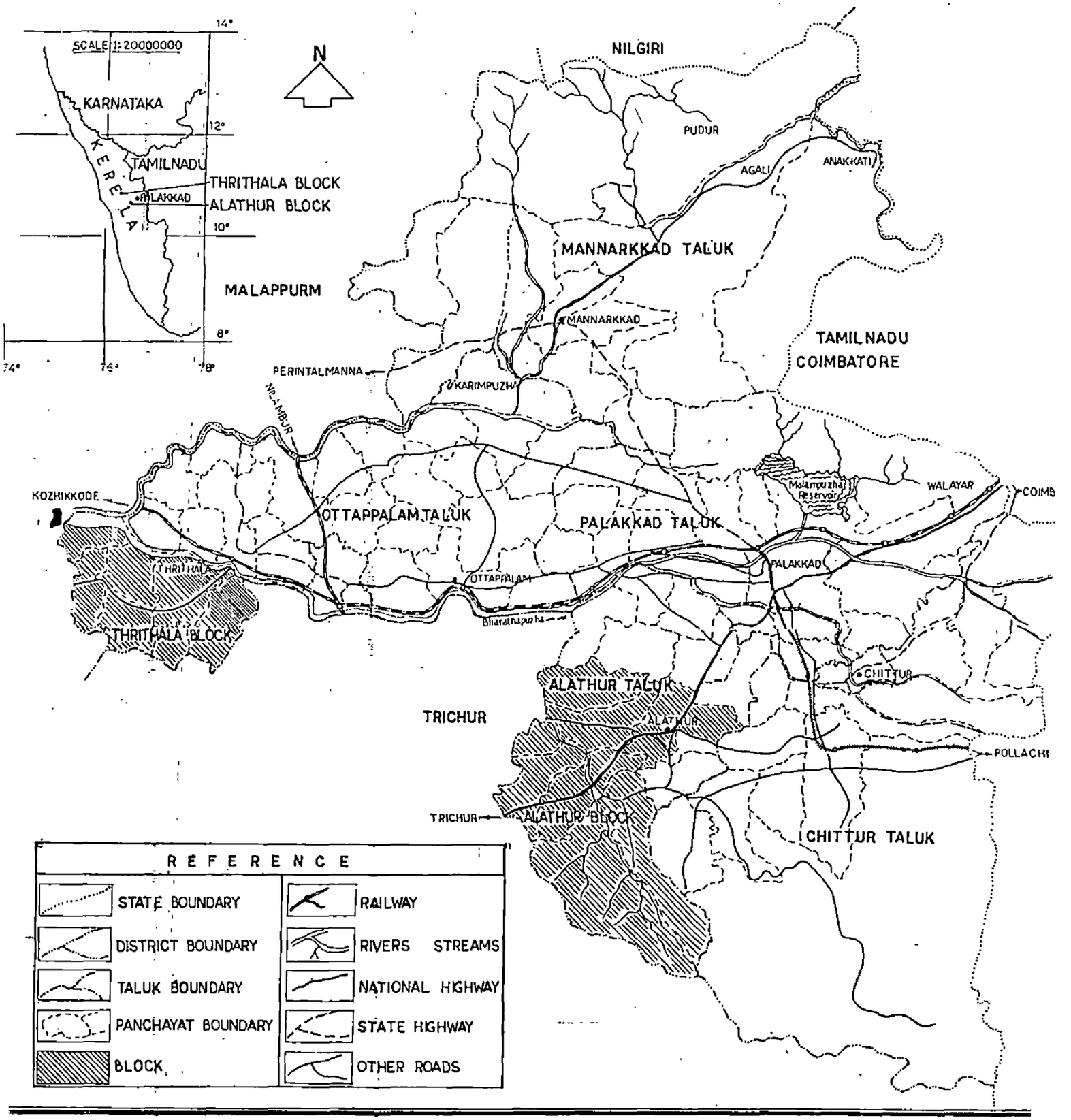
SCALE 1 500000



LOCATION MAP OF ALATHUR & THRITHALA BLOCKS

PALAKKAD DISTRICT

SCALE- 1:500000



APPENDIX

KERALA AGRICULTURAL UNIVERSITY

Project on promotion of Agri-Electronics

Sponsored by Department of Electronics and ICAR, Govt of India

Concurrent Evaluation

(HOUSEHOLD SCHEDULE)

I. IDENTIFICATION

1.1 Block Code : ☐

1.2 Village name :

1.3 Name of the Farmer : .

1.4 Sex : ☐

1.5 Age : ☐

1.6 Size of the Family of the Farmer :

1.7 Farmer classification : ☐

1.8 Social classification : ☐

1.9 Educational level : ☐

1.10 Subsidiary occupations : ☐

II. CREATION OF AWARENESS AMONG FARMERS:

2.1 Do you know that the Government of India promotes the use of electronics in Agriculture? (Yes=1, No=2) ☐

2.2 If answer is 'Yes' to the above question state how did you come to know (See code list) ☐

2.3 Which are the electronic equipments of which you are having acquaintance (See code list) ☐

2.4 State how you got acquaintance with such equipments (See code list) ☐

2.5 Do you think that the agri-electronic gadgets are useful in the agricultural operations?

(Yes=1, No =2, Can't say =3) ☐

State Reasons for your answers :

(See code list)

i. First Reason ☐

ii. Second Reason ☐

iii. Third Reason ☐

2.6 What are the advantages you attribute to agri-electronic instruments in comparison with conventional methods (See code list) ☐

2.7 Is the demonstration of Agri-electronic instruments by PPAE staff informative (Yes = 1, No = 2) ☐

2.8 If the answer to the above question is 'No' give reasons (See code list) ☐

III. UTILITY OF ELECTRONIC DEVICES TO THE FARMERS:

3.1 State which agricultural operation (s) was/were performed with the help of Agrl. electronic equipment (See code list of Q. No. 2.3) ☐

3.2 In the case of soil testing which type of soil got tested and the size of land

	Land	
	Garden	Wet
Area (Acre)		

3.3 Prior to PPAE soil testing, did you ever get the soil tested (Yes = 1, No = 2) ☐

3.4 If 'Yes' to the above question state whether PPAE testing is better rated (Yes = 1, No = 2) ☐

3.5 Give reasons for the above answer (See code list)

1st Reason ☐

2nd Reason ☐

3rd Reason ☐

4th Reason ☐

3.6 How many days did the farmer wait to get the soil test report? (If he did not receive it, note it) ☐

3.7 Do you find any advantage in involving farmer in the matter of soil testing (Yes = 1, No = 2) ☐

3.8 If 'Yes' to the above answer state the advantages (See code list) ☐

3.9 How much had he to spend on fertilizer prior to and subsequent to soil testing

Fertilizer types	Before		After	
	Qty. (kg)	Price (Rs.)	Qty. (kg)	Price (Rs.)
i. N				
ii. P				
iii. K				
iv. Lime				
v. Organic				
vi. Others (specify)				

3.10 Have you altered the cropping pattern after PPAE soil testing (Yes = 1, No = 2) ☐

3.11 If 'Yes' for the above question state the shifts

From To

3.12 Did the PPAE soil testing facilitate in increasing yield rates? Give the details:

Crops	Before			After		
	Area	Qty. (kg)	Price (Rs.)	Area	Qty. (kg)	Price (Rs.)
Paddy						
Others (Specify)						

3.13 What are the benefits you got through

Test/ Analysis	Before			After		
	Unit	Gross return	Net return	Unit	Gross return	Net return
a) Milk testing						
b) Grain testing						
c) Water quality analysis						
d) Others						

3.14 Are you having suggestions to maximise the utility available from the PPAE services and/or from the use of Agri-electronic gadgets.

i.
ii.
iii.
iv.
v.

IV. ELECTRONIC GADGETS—ITS AVAILABILITY TO FARMING COMMUNITY

4.1 What is the current mode of availability of electronic gadgets in your area of agrl. operation (See code list) ☐

4.2 What are the equipments made available by PPAE staff (See code list) ☐

4.3 Are you satisfied with the working of PPAE staff in getting electronic gadgets in their area of agri. operation
(Yes = 1, No = 2) ☐

4.4 If 'No' to the above question state the reasons (See code list) ☐

4.5 Give your suggestions in improving the mode of availability of electronic gadgets in your area of operation ☐

i.
ii.
iii.

V. ORGANISING OF SERVICING AND TRAINING SUPPORT IN AGRI. ELECTRONICS

5.1 Were you given any training by PPAE staff in the handling of Agri. Electronic equipments?
(Yes = 1, No = 2, Not required = 3) ☐

5.2 If yes, was it useful (Yes = 1, No = 2) ☐

5.3 Do you think that the existing facilities in respect of the following are adequate ☐

a) Servicing/other care
(Yes = 1, No = 2) ☐

b) Training (Yes = 1, No = 2) ☐

5.4 Are you given continued support by PPAE or by Govt. agencies on an ongoing basis
(Yes = 1, No = 2, Not required = 3) ☐

5.5 If there is any obstacle in the process of organising of servicing or training in Agri-electronics
(Yes = 1, No = 2) ☐

5.6 If yes, what are they? (See code list) ☐

VI. 6.1 GENERAL COMMENTS

Date: Signature of the Investigator
Place: Name

CODE LIST

Items Nos,		*Code*
1.1	Block Code	
	Alathur	1
	Thrithala	2
	Puzhakkal	3
1.4	Sex	
	Male	1
	Female	2
1.7	Farm classification	
	Large farmer	1
	Medium farmer	2
	Small farmer	3
	Marginal farmer	4
	Agricultural labourer	5
1.8	Social classification	
	SC	1
	ST	2
	Others	3
1.9	Educational level	
	Illiterate	1
	Primary level	2
	Secondary level	3
	High School level	4
	Degree	5
	Technical	6
1.10	Subsidiary occupations	
	Dairying	1
	Business	2
	Employed	3
	Others (Specify)	4

		Yes
2.2	I) Through extension personel	1
	II) Through other farmers	2
	III) Through fertilizer dealers	3
	IV) Through PPAE Scientists of KAU	4
	V) Other means (specify)	5

		Yes	*No.*	*Can't say*
2.3	I) Soil testing	1		
	II) Milk testing	2		
	III) Grain testing	3		

			Yes	No.	Can't say
	IV)	Water quality analysis kit	4		
	V)	Shock preventer	5		
	VI)	Other equipments (specify)	6		
2.4	I)	Demonstration by PPAE staff	1		
	II)	News paper	2		
	III)	T. V.	3		
	IV)	Radio	4		
	V)	Cinema	5		
	VI)	Others (Specify)	6		
2.5	Reasons for not/cannot say usefulness				
	I)	Enhances productivity	1	12	23
	II)	Reduces cost of cultivation	2	13	
	III)	Enables in saving time	3	14	
	IV)	Increases profits	4	15	
	V)	Saving of inputs	5	16	
	VI)	Input applications can be made timely	6	17	
	VII)	Electronic gadgets are reliable and accurate	7	18	
	VIII)	Easy to operate	8	19	
	IX)	Instrument failures are less	9	20	
	X)	Cost of such equipments is in the reach of farmers	10	21	
	XI)	Others (specify)	11	22	
2.6	I)	Easy to learn	1		
	II)	The process involved are less and so it is time saving	2		
	III)	Conventional methods are not convincing	3		
	IV)	Costwise it is cheaper	4		
	V)	Others (specify)	5		
2.8	I)	The demonstration classes were very technical and difficult to understand	1		
	II)	Audio-visual aids were not used in the lecture classes	2		
	III)	All the farmers who were present at the farmers group could not get equal treatment	3		
	IV)	Others (specify)	4		

			Yes	*No.*
3.5	I)	PPAE soil testing is quick and time saving	1	8
	II)	PPAE soil testing is more accurate	2	9
	III)	PPAE not only tests the soil but also provide fertilizer recommendations	3	10
	IV)	PPAE collect a representative soil sample	4	11
	V)	PPAE conscientised the farmers about the usefulness of soil testing	5	12
	VI)	PPAE involves farmers in soil collection	6	13
	VII)	Others (specify)	7	14
3.8	I)	Learns the operations involved	1	
	II)	Enable to get right soil sample	2	
	III)	Enhances the reliability of the test result	3	
	IV)	Understands the technical details given in the soil test report	4	
	V)	Other (specify)	5	
4.1	I)	Not exist	1	
	II)	PPAE only	2	
	III)	Agrl. Department	3	
	IV)	Others (specify)	4	
4.2	I)	pH meter	1	
	II)	Colorimeter	2	
	III)	Flame photometer	3	
	IV)	Conductivity meter	4	
	V)	Electronic milk tester	5	
	VI)	Grain moisture meter	6	
	VII)	Water quality analysis kit	7	
	VIII)	Shock preventer	8	
	IX)	Others (specify)	9	

			Code
4.4	I)	Nothing concrete has been done by PPAE	1
	II)	Slow in doing things	2
	III)	Others (specify)	3
5.6	I)	Time consuming procedure	1
	II)	Indifferent attitude of other farmers	2
	III)	Financial assistances inadequate	3
	IV)	Influential farmers get better treatment	4
	V)	The electronic gadgets are not in tune with farmers requirements	5
	VI)	Lack of enthusiasm as the part of farmers	6
	VII)	Lack of co-ordination among concerned agencies	7
	VIII)	Others (specify)	8