EVALUATIVE PERCEPTION OF APPROPRIATENESS OF THE RECOMMENDED FERTILISER MANAGEMENT PRACTICES

BY

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THESIS

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DECLARATION

I hereby declare that this thesis entitled "EVALUATIVE PERCEPTION OF APPROPRIATENESS OF THE RECOMMENDED FERTILISER MANAGEMENT PRACTICES" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship or other similar title of any other University or Society.

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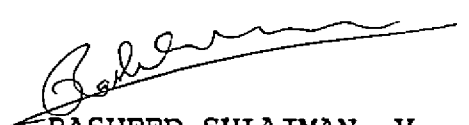

RASHEED SULAIMAN, V.

CERTIFICATE

Certified that this thesis entitled "EVALUATIVE PERCEPTION OF APPROPRIATENESS OF THE RECOMMENDED FERTILISER MANAGEMENT PRACTICES" is a record of research work done independently by Sri.Rasheed Sulaiman, V. under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associate-ship to him.

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CHAPTER-I

INTRODUCTION

Fertilisers do play an important role in increasing agricultural production. Among the various agricultural inputs, fertiliser next only to water, contributes the maximum to increasing agricultural production. In the long history of agricultural development in the world, advent of fertiliser use has been the main accelerating force for the rapid increase in agricultural productivity and thereby production.

The Consultative Group on International Agricultural Research sponsored a world wide review of the plant nutrition situation in developing countries which concluded that food production in developing countries would be more heavily dependent on improved plant nutrition through added fertiliser inputs over the next 20 years (Sanches and Nicholaides, 1982). While incremental gains in yields can still be made in developed countries by improved fertilisers and improved fertiliser management practices, much greater gains can be made in developing countries, if fertilisers are used to the same extent as in developed countries.

The technological explosion in Indian agriculture during the last decade has brought the country on the

threshold of a major break through in agriculture. Needless to say that fertiliser is one of the most indispensable inputs which is responsible for increased food grain production in our country. However it is observed that inspite of the available potential technologies, farmers have not adopted them to the expected level. In India, the present level of fertiliser consumption is only 52 kg of NPK/ha and is used only in 45% of the cultivated area. There are a number of countries in the world where the level of fertiliser consumption is more than 300 kg/ha. It is in this context that extensive efforts are being made by the Government, Fertiliser Industries, Agricultural Universities, Research Institutes etc. to propagate and promote fertiliser use in the country.

There is wide variation in fertiliser consumption in the different states of the country. The per hectare consumption of NPK varies from 159 kg/ha in Punjab, 96 kg/ha in Tamil Nadu, 75 kg/ha in Uttar Pradesh, 53 kg/ha in Kerala to 16 kg/ha in Orissa and 5 kg/ha in Assam against the all India average of 50 kg/ha during 1986-87. Not only this, the interdistrict variations are also very prominent. The extent of interdistrict variations can be visualised from the fact that the fertiliser consumption in the single district of Faridkot in the Punjab State (0.18 mt) is

comparable or even higher than the total fertiliser consumption in some of the states like Orissa (0.11 mt) Kerala (0.13 mt), Himachal Pradesh (0.02 mt), Assam (0.014 mt) and Jammu and Kashmir (0.027 mt) in 1984-85 (Anonymous, 1988).

Fertiliser, being an expensive input, forms a sizeable percentage of the farmer's total cultivation cost. Therefore, it is of critical importance to use every unit of this input efficiently. Planning for high fertiliser use efficiency is important from the point of view of getting the best out of the quantity applied, so that the income and margin of profits can be enhanced. Efficient use of manures and fertilisers depends on using correct quantities of these materials in relation to crops and soil needs and on applying in the best way at the correct time.

To attain this objective, various fertiliser management practices have been evolved to enhance fertiliser use efficiency. But to what extent, these practices are adopted by the farmers and also how they perceive the appropriateness of these practices for them still remain unknown due to lack of empirical evidences. The present study is an attempt in this direction.

Need for the study

The future of agriculture in India is dependent on replenishing the plant nutrient to the impoverished soil by adopting the integrated, well balanced, adequate and timely application of fertilisers which would result in enhancing the fertiliser use and efficiency in various agro-climatic zones of the country. Farmers are the ultimate decision makers about the use of fertilisers on their farms. Due to the concerted efforts of extension functionaries and input agencies most of the farmers in Kerala are using fertilisers in recent years. There has been a steady increase in the use of fertilisers by the farmers in Kerala during the last two decades. As against 6264 tonnes of N, 8461 tonnes of P_2O_5 and 2248 tonnes of K_2O used by the farmers during 1961-62, the corresponding figures for 1987-88 were 70730, 49350 and 62410 tonnes of N, P_2O_5 and K_2O respectively (Government of Kerala, 1989).

But what is essential now is the adoption of fertiliser management practices which have been evolved to make the farmers use fertiliser more efficiently and economically. Various fertiliser management practices have been evolved, which are being recommended for adoption by the farmers. Studies by Srinivasamurthy (1985), Singh and Ray (1985) and Murthy and Rao (1986) showed that majority

of the farmers lack proper knowledge about fertiliser management practices. Bidari (1982), Shivasankara (1986) and Bahadur et al. (1988) had observed that majority of the farmers have not gone upto the recommended dose of fertilisers. There are not many studies reported on the appropriateness of the different fertiliser management practices. The present study is formulated on this premise and it is hoped that the results of this study may help the researchers to reconsider the different recommended fertiliser management practices to make them more appropriate to the farmers' situation, if needed.

Objectives of the study

The study has been designed with the following specific objectives.

1. To study the level of knowledge about fertiliser management practices of the farmers and field extension personnel.
2. To find out the extent of adoption of the various recommended fertiliser management practices by the farmers.
3. To identify the determinants in the adoption of recommended fertiliser management practices by the farmers.

4. To evaluate the recommended fertiliser management practices for their appropriateness to farmers on various attributes of the practices as perceived by them and field extension personnel.
5. To find out the constraints, if any, faced by the farmers in the adoption of fertiliser management practices.

Limitations of the study

Since the present study was undertaken as a part of the post graduate research programme, the study had the inherent limitation in terms of coverage. Being a post-graduate research work, the study could be confined only to two panchayats in the selected two districts. Moreover, the study was confined to only one crop, namely, rice. However care has been taken to make the study as systematic and objective as possible. Although the study may have some limitations in making generalisations to other areas, it is expected that findings of this study would certainly provide definite clues for the successful implementation of fertiliser promotion activities and in orienting different fertiliser management practices appropriate to the farmers' situation.

Presentation of the study

The thesis is divided into five chapters. The first chapter already covered the need, objectives and limitations of the study. The second chapter deals with the theoretical orientation covering the review of literature pertaining to the study and the third deals with methodology comprising description of study area, selection of respondents, empirical measurement of variables, tools for data collection and statistical techniques used. The fourth chapter deals with results of the study and discussion of the results obtained. The final chapter gives the summary and conclusions of the study. The references and appendices are given at the end.

Theoretical Orientation

CHAPTER-II

THEORETICAL ORIENTATION

The main objective of this chapter is to give an orientation to the concepts pertaining to the study and to link different research findings that exist in the area of study with the research problem. For the same, a probe into the past research studies has been attempted with a view of locating the problem on a theoretical perspective.

In accordance with the objectives of the present study, the literature that appeared relevant is furnished under the following heads.

1. Level of knowledge about fertiliser management practices
2. Extent of adoption of fertiliser management practices
3. Relation between knowledge and adoption of improved practices
4. Relation of knowledge and adoption with selected characteristics of farmers
5. Perception of appropriateness of the recommended fertiliser management practices
6. Constraints experienced by the farmers in the adoption of recommended fertiliser management practices

1. Levels of knowledge about fertiliser management practices

A. Farmers

Various studies indicated that there was great variation in the level of knowledge of farmers about fertiliser management practices.

A study conducted by Chaukidar and George (1972) reported that only 60 per cent of the farmers had comple knowledge regarding fertilisers. Govindappa (1974) in his study on fertiliser use by the farmers in Bangalore found that only eight per cent of large farmers and two per cent of small farmers knew the role of all the three elements (NPK) in plant growth. However, the role of nitrogen was better known compared to the other two nutrients.

Nanjaiyan et al. (1975) reported that the practice of application of correct dose of fertilisers in sugarcane was known to 74.17 per cent of the respondents. He also reported that eventhough the details of foliar spray with urea were known to nearly 70 per cent of the respondents, 84.34 per cent of them were found to be non-adopters because of cumbersomeness and more technicality.

Bhilegaonkar (1976) concluded that a little over half of the farmer respondents had medium level of knowledge

with reference to fertiliser use. The study also revealed that 21.05, 22.22 and 18.41 per cent of big, medium and small farmers respectively belonged to high knowledge level whereas 22.36, 25.00 and 28.94 per cent of big, medium and small farmers respectively were in low knowledge level category.

Sunderraj (1978) observed that majority of small farmers had only some knowledge about fertiliser in tomato whereas 42 per cent of big farmers had good knowledge. Srinivasamurthy (1985) concluded that fertiliser awareness is universal among the elite farmers but there is a lack of proper understanding about the profitability of fertiliser use at the recommended levels. Singh and Ray (1985) reported that knowledge about soil fertility and fertiliser management contributed positively and significantly to the level of fertiliser use of the marginal, small and pooled sample of farmers. Murthy and Rao (1986) reported that none of the vegetable growing small farmers in Karnataka had knowledge of plant nutrients present in many fertilisers. Only 11.1 per cent had knowledge of percentage of nitrogen in urea.

B. Extension personnel

There are not many studies reported on the level of knowledge of extension personnel about improved farm practices.

Parshad (1981) observed that 12.5 per cent of the village level workers had very poor knowledge of cultivation of high yielding varieties, more than one fourth of them (26.39 per cent) were having poor knowledge, and only 22.92 per cent were in the high knowledge level category.

2. Extent of adoption of fertiliser management practices

Sohal and Shukla (1967) reported that although not very large, some percentage of farmers (6.60 per cent in the case of Nitrogen and 18.05 per cent in the case of phosphorus) were found to use quantity of fertilisers in excess of the recommended dose.

Gopalakrishna (1972) reported that only 44.60 per cent of the farmers applied recommended quantity of fertilisers in potato. Jati and Tripathy (1972) in their study on adoption of fertiliser in Sambalpur Package District (Orissa) revealed that, out of the total number of growers under maize, wheat and paddy, 86.00 per cent, 85.00 per cent and 73.80 per cent of growers respectively utilised

fertilisers. A good majority of the respondents (73.30 per cent) had adopted while the remaining 26.70 per cent had not applied fertilisers. Nanjaiyan et al. (1975) observed that nearly two-thirds of the sugarcane growers were non-adopters of fertilisers. Sundaraswamy and Duraiswamy (1975) pointed out that 40 per cent of the ragi farmers applied recommended dose of fertilisers while 51 per cent applied the fertilisers at different levels.

Vijayaraghavan (1977) identified wide variation in the extent of adoption of high yielding variety paddy for all practices including fertiliser management among marginal farmers. He also reported wide variation in the extent of adoption of all practices except seed rate by small farmers.

Narayanappa (1978) observed that only 1.80 per cent of farmers applied recommended quantity of fertilisers in peas. Janakiramraju (1978) revealed that adoption of fertilisers for cholam crop was more in general in irrigated areas than in non-irrigated areas. In the case of top dressing of Nitrogen, there was almost total non-adoption in non-irrigated areas, whereas more than two-thirds of the farmers in irrigated areas adopted the same. Singh (1979) observed that only 1.70 per cent of farmers applied recommended quantity of fertilisers in chilly. Sunderraj

(1979) reported that majority of the farmers (90 per cent) did not adopt fertiliser practices in tomato.

Sen (1981) reported that the extent of adoption of fertilisers varied considerably from state to state. At one end of the spectrum, showing the least adoption was Assam with barely 5 per cent of farms using fertilisers and at the other end was Punjab, where more than 95 per cent of the cultivators used fertilisers. The adoption rates were higher than the all India average in seven states including Kerala.

Singh (1981) found that the farmers in general applied lower than the recommended doses of nitrogen, phosphate and potash. In terms of percentage of recommended dose, all the three categories of farmers - marginal, small and medium applied significantly more amount of nitrogen in comparison to both phosphate and potash and significantly more amount of phosphate than potash.

Bidari (1982), Shivasankara (1986), Somashekarappa and Manimegalan (1987) and Bahadur (1988) observed that majority of farmers had not gone up to the recommended dose of fertilisers.

Krishnamoorthi (1984) reported that, exactly half of the big, one-fifth of the medium and only one-eighth of the

small dryland farmers applied chemical fertiliser for the dryland crops. Majority of the small and medium farmers were found to be non-adopters.

Randhawa (1985) found that nitrogenous fertiliser was applied to the rice crop by all the farmers, while phosphate fertilisers was not used by all, and potassic fertiliser was used only by a small proportion. The majority of the farmers (59.60 per cent) did not apply zinc for rice crop. Sharma (1985) reported that average dose of fertilisers used were far below the recommended levels in Rajasthan.

Rajagopalan (1986) reported that majority (67.3 per cent) of the paddy growers in Thanjavur District of Tamil Nadu adopted split dose of nitrogen application. Srinivasamurthy and Nagaraj (1986) indicated that though fertiliser use was generally accepted for irrigated crops in Karnataka, the recommended levels were not adopted. However the levels of fertiliser for paddy and sugarcane were found to be nearer to the recommended level.

Jayaramaiah (1987) observed that majority of the farmers had used less than the recommended doses of nitrogen, phosphorus and potash for all the three crops considered viz, jowar, groundnut and potato. Majority of the farmers had

used medium levels of NPK for paddy and ragi crops, indicating the non-adoption of recommended levels of fertilisers. Parshad (1987) reported that farmers in general were using lesser quantity of nitrogen and inappropriate quantity of zinc sulphate.

Siddaramaiah and Veerabhadraiah (1987) reported that the percentage of farmers applying the recommended dose (full adoption) of fertilisers was only 40 per cent in hybrid jowar, 35 per cent in ragi, 30-43 per cent in paddy and 15 per cent in hybrid maize. Although the percentage of non-adopters seemed to be very less in respect of these creps, partial adoption was quite high in case of hybrid maize (81 per cent) and paddy (55-68 per cent).

Reddy (1988) observed that majority of farmers applied fertiliser but the dose was less than 25-50 per cent of the recommended quantity. However, application of fertilisers has been taking place in drylands also.

The above studies indicated that there was variation in the extent of adoption of fertiliser management practices by the farmers.

3. Relation between knowledge and adoption of improved practices

Nimje (1975) found that the personal and situational characteristics of farmers were related to their knowledge level and knowledge level was related to the adoption behaviour of farmers.

Janakiramraju (1978) reported that knowledge of farmers was positively and significantly associated with their extent of adoption of fertilisers in both irrigated and non-irrigated areas.

Singh and Ray (1985) observed that knowledge about soil fertility and fertiliser management contributed positively and significantly to the level of fertiliser use of the farmers.

Jayaramaiah (1987) reported that knowledge of fertiliser and its utility was significantly associated with adoption of NPK in groundnut, potato and jowar.

The above findings indicated that the level of knowledge of farmers about fertiliser management practices and their adoption were closely related. In the present study, it was hypothesised that there would be a positive relation between knowledge about fertiliser management practices of farmers and adoption.

4. Relation of knowledge and adoption with selected characteristics of farmers

Since direct studies in the area of adoption of fertiliser management practices are less, related studies were also reviewed.

Age

Singh and Prasad (1974), Vijayaraghavan and Somasundaram (1979), Ahmed (1981) and Sushama et al. (1981) had reported non-significant relationship between age and knowledge. However, Manivannan (1980) found negative and significant relationship between age and knowledge level of sunflower growers. Chandrakandan (1982) also observed a similar result. Senthil (1983) also reported that age had negative and significant association with the knowledge level of hybrid cotton seed growers.

The study by Godhandapani (1985) also revealed negative and significant association between age and knowledge of farmers about nutrient recommendation for groundnu

Manivannan (1980) reported that age of the farmer was negatively and significantly correlated with extent of adoption of practices. Similar results were also obtained by Vijayakumar (1983), Philip (1984), Balasubramaniam and

Kaul (1985), Wilson and Chaturvedi (1985), Godhandapani (1985) and Nanjaiyan (1985).

Somasekharappa and Manimegalan (1987) found no association between fertiliser use and age of farmers.

Based on the above reviews, it is hypothesised that there would be negative relationship between age and knowledge as well as age and adoption of fertiliser management practices.

Education

Supe and Salode (1975) reported that formal education was significantly related to level of knowledge of farmers. Similar results were reported by Pandey and Ray (1977), Kaleel (1978), Somasundaram and Singh (1978) and Balachandran (1983). However Surendran (1982) observed no significant association between education level of the farmers and their knowledge level.

Many researchers have established a positive relationship between education and adoption of improved agricultural practices by the farmers (Hussain, 1971; Perumal and Duraiswamy, 1972; Ramamurthy, 1973). Similar results were also obtained by Prasad (1978); Janakiramraju (1978) and Sinha and Sinha (1980).

However, Nair (1969), Bhaskaran (1978) and Ravi (1979) observed that education had no significant relationship with adoption.

Tantray (1987) also reported that education had little influence in the adoption of fertilisers.

In the present study, a positive relationship between education and knowledge as well as education and adoption were hypothesised.

Farm size

Singh and Prasad (1974), Vijayaraghavan and Somasundaram (1979) and Sohal and Tyagi (1978) reported that size of land holding was positively related with the knowledge level of farmers.

Ambalagan (1974) reported that farm size had significant association with the adoption of schedule of fertilisers by the farmers. Similar results were also obtained by Srinivasan (1974) and Janakiramraju (1978).

But Supe and Salode (1975), Ravi (1979) and Sinha and Sinha (1980) did not find any association between farm size and adoption.

Karim and Mahboob (1974) reported that effective farm size and adoption of fertilisers in paddy were positively correlated. Krishnamoorthi (1984) also obtained a similar result in the case of application of chemical fertilisers to dryland crops.

Sen (1981) observed that the adoption rates varied from one size group of farms to another. Among all the fertiliser users, 46.00 per cent were marginal, 19.00 per cent were small, 18.00 per cent semi medium, 13.00 per cent medium and only 4.00 per cent were large farmers.

Tantray (1987) also observed that the rate of acceptance of fertilisers, weedicides and soil testing showed an increasing tendency as the land holding increased.

Based on the above reviews, it was postulated that there would be a positive relation between farm size and knowledge as well as farm size and adoption.

Area under rice

No study indicating the relationship of this variable with knowledge of farmers could be reviewed.

NCAER (1978) in a study on fertiliser found that 34.88 per cent of all fertiliser used was on paddy, 25.6 per cent on wheat and 8.03 per cent on sugarcane.

Singh and Sirohi (1988) reported that crop wise pattern of demand for fertiliser for individual states indicates that in the major paddy growing states of Eastern and Southern regions, paddy crop alone accounted for the bulk of the fertiliser demand for nitrogenous fertiliser.

In the present study, a positive relation between areas under rice and knowledge as well as area under rice and adoption were hypothesised.

Percentage area under high yielding varieties

No related literature could be traced establishing the relationship between percentage of area under high yielding varieties and the level of knowledge of farmers about fertiliser management practices.

Pant and Baghel (1987) reported that no farmer had ever used HYV seed and only a very negligible number had used fertiliser in the tribal areas of Madhya Pradesh. Pandey (1988) observed that area under high yielding varieties significantly influenced fertiliser use. Sinha and Thakur (1988) also reported a similar finding.

In the present study it was hypothesised that there would be positive relationship between percentage area

under HYV and knowledge as well as percentage area under HYV and adoption.

Annual income

Vijayaraghavan and Somasundaran (1979) revealed that socio-economic status of the farmers was significantly and positively related with knowledge of high yielding varieties of crops of the marginal farmers.

Acharya and Bhowmik (1978) had noted that the degree of knowledge of farmers about agricultural innovations had a positive and significant relationship with their income.

Ramamurthy (1973) concluded that the gross income was positively associated with the adoption of NPK fertiliser.

Subramanyan and Menon (1975), Pillai (1978) and Singh et al. (1985) observed that adoption of improved farm practices was positively and significantly correlated with the total annual income.

Tantray (1987) found that the percentage of adopters increased in all innovations with the increase in income.

In the present study, a positive relation between annual income and knowledge as well as annual income and adoption were expected.

Economic performance index

There was no study available relating economic performance index with the level of knowledge of farmers.

Sreekumar (1985) reported that economic performance was positively and significantly correlated with adoption behaviour of borrowers of bank credit.

But Syamala (1988) reported positive but non-significant relationship between economic performance index with the level of adoption of demonstrated practices.

In the present study, it was hypothesised that there would be positive relationship between economic performance and knowledge and economic performance and adoption.

Attitude towards fertiliser use

Rogers and Havens (1961) reported that farmers' knowledge of fertiliser acted as intervening variable between their attitude and use of fertiliser. Somasundaram and Singh (1978) observed that attitude had positive and significant association with knowledge of adopter small farmers.

Janakiramraju (1978) reported that attitude towards fertilisers had significant relation with the extent of

adoption of fertilisers by the farmers in irrigated area. Singh and Ray (1985) reported that attitude towards fertiliser use contributed positively and significantly to the level of fertiliser use of farmers. Balan (1987) reported that attitude of farmers towards fertiliser use was significantly correlated with adoption of soil test recommendations.

In the present study, it was hypothesised that there would be positive relationship between attitude towards fertiliser use with knowledge and adoption.

Economic motivation

Vijayaraghavan and Somasundaram (1979) had observed that there was significant relation between farmers' knowledge and their economic motivation. Somasundaram and Singh (1978) reported significant association between economic motivation and knowledge of adopters of high yielding variety of paddy. Sohal and Tyagi (1978) also had indicated a similar trend.

Nair (1969) revealed that economic motivation was positively and significantly related with adoption of high yielding varieties of paddy by the farmers. Similar results were obtained by Singh and Singh (1970) and Rajendran (1978). Sohal and Tyagi (1978) and Haque and

Ray (1983) also had reported that economic motivation was significantly related with adoption of improved practices.

Singh and Ray (1985) reported that economic motivation contributed positively and significantly to the level of fertiliser use of the farmers.

Jayaramaiah (1987) observed that economic motivation was significantly associated with levels of NPK use in groundnut, potato and jowar.

In the present study, it was hypothesised that there would be a positive relation between economic motivation and knowledge as well as economic motivation and adoption.

Scientific orientation

Vijayaraghavan (1977) found that scientific orientation had significant relationship with knowledge of small farmers about high yielding varieties of paddy while it was found to have non-significant association with knowledge of marginal farmers.

Somasundaram and Singh (1978) observed that scientific orientation had positive and significant association with knowledge of adopter small farmers while it had no significant relationship with knowledge of non-adopter small farmers.

Knowledge of sunflower growers had positive and significant correlation with their scientific orientation as reported by Manivannan (1980). Similar pattern of relationship was reported by Kamarudeen (1981), Senthil (1983) and Krishnamoorthi (1984).

Veerasamy and Bahadur (1979) found that those small farmers who had greater orientation toward science were better adopters of improved rice technology. Manivannan (1980) reported positive and significant correlation of scientific orientation with extent of adoption of sunflower growers. Aristotle (1981) and Kamarudeen (1981) also observed similar association between the two variables.

Positive and significant association was observed between scientific attitude of farmers with their adoption of improved technology for tobacco cultivation by Wilson and Chaturvedi (1985). A similar trend was reported among certified rice seed growers by Jayapalan (1985) and among small farmers by Nanjaiyan (1985).

Ramegowda and Siddaramaiah (1987) reported that scientific orientation was positively and significantly related with innovativeness of farmers in adopting MR-301 paddy variety. However Philip's (1984) study showed non

significant association between extent of adoption of recommended practices and scientific orientation of farmers.

Based on the above reviews, it was hypothesised that there would be a positive relation between scientific orientation and knowledge as well as scientific orientation and adoption.

Personal guidance on better farming

Geethakutty (1982) had reported that personal guidance had positive and significant relation with understanding of principles behind the recommended practices and also with the knowledge of procedure of the recommended practices.

Desai (1981) had clearly brought out a positive relationship between extension guidance and adoption of improved practices.

Singh (1981) had also reported that personal guidance on better farming was found to play a crucial role in determining the level of fertiliser use by the farmers and found significant association between personal guidance and adoption.

Singh and Ray (1985) reported that personal guidance on better farming contributed positively and significantly to the level of fertiliser use of the small and medium farmers.

Balan (1987) also reported a positive relationship between personal guidance and level of fertiliser use.

Jayaramaiah (1987) observed that personal guidance contributed significantly in explaining differences in the level of use of NPK in ragi and paddy.

In the present study, a positive association between personal guidance and knowledge as well as personal guidance and adoption were expected.

Mass media utilisation

Sohal and Tyagi (1978) found positive and significant correlation between mass media exposure and knowledge of farmers about dairy innovations. Haraprasad (1980), Manivannan (1980), Chandrakandan (1982), Senthil (1983) and Godhandapani (1985) had also reported similar results.

Ramamurthy (1973) reported that among the sources of information that had influenced the farmers for the adoption of complex fertilisers, radio occupied the foremost place followed by Gramsevaks, neighbours and friends.

Manivannan (1980) reported that mass media exposure had positive and significant correlation with extent of adoption of sunflower growers. This was supported by the studies of Balasubramanian (1980), Sohi and Kherde (1980), Sanoria and Sharma (1983) who had also observed similar results.

Jayakrishnan (1984) reported that mass media participation was positively and significantly associated with extent of adoption of low cost technology among paddy growers. Balasubramanian (1985), Godhandapani (1985), Jayapalan (1985) and Wilson and Chaturvedi (1985) also observed positive and significant correlation of farmers extent of adoption with their mass media participation.

A contrasting result was observed in the study of Nanjaiyan (1985) wherein, mass media exposure was found to have no significant association with the extent of adoption by small farmers.

In the present study, a positive relation between mass media utilisation and knowledge as well as mass media utilisation and adoption were hypothesised.

Interpersonal source utilisation

Dwarakinath (1973) reported that there was positive and significant association between information seeking behaviour of farmers and their knowledge.

Somasundaram and Singh (1978) reported that the use of personal cosmopolite channels, use of impersonal cosmopolite channels and frequency and use of impersonal cosmopolite channels of adopter small farmers were significantly related with their knowledge.

Singh and Ray (1985) reported that personal cosmopolite sources of information contributed positively and significantly to the level of fertiliser use of the small farmers.

In the present study, a positive relation between interpersonal source utilisation and knowledge as well as mass media utilisation and adoption were hypothesised.

Social participation

Singh et al., (1970) had revealed that social participation had a positive association with knowledge. Acharya and Bhowmik (1978) and Kanthraj (1980) had also reported that social participation had significant association with knowledge of agricultural practices.

Social participation was reported by many researchers to have positive and significant association with the adoption of farm practices (Chandrakandan, 1973; Ramamurthy, 1973; Ambalagan, 1974; Bhilegaonkar, 1976; Palaniswamy, 1978; Mishra and Sinha, 1980; Kamarudeen, 1981; Pillai,

1983). However, researchers like Sundaraswamy (1971), Rao (1972), Viswanathan (1972) and Sakthivel (1979) reported non-significant association between social participation and adoption.

Karim and Mahboob (1974) reported a positive and significant relationship between organisational participation and adoption of fertilisers among transplanted aman rice growers in Bangladesh.

Somasekharappa and Manimegalan (1987) found no association between organisational participation and fertiliser use.

In the present study, a positive relation between social participation and knowledge as well as social participation and adoption were expected.

Extension participation

Somasundaram and Singh (1978) found that contact with extension agency was positively and significantly associated with knowledge of adopter small farmers. Vijayaraghavan and Somasundaram (1979) had observed that extension orientation had positive and significant correlation with knowledge level among marginal farmers.

Similar results were reported by Manivannan (1980) in the case of sunflower growers and by Kamarudeen (1981) among National Demonstration Farmers.

Senthil (1983) and Godhandapani (1985) also had observed positive and significant relationship between farmers contact with extension agency and their knowledge about the improved agricultural practices.

The findings reported by Singh and Singh (1970), Karim and Mahboob (1974), Sinha et al. (1974), Vijayaraghavan (1977), Palaniswamy (1978) and Bhaskaran (1979) indicated that farmers contact with extension agency had positive and significant influence on their adoption behaviour. Manivannan (1980) found positive and significant association between degree of contact with extension agency and extent of adoption of sunflower growers. Kamarudeen (1981) also reported that farmers contact with extension agencies showed positive and significant association with their extent of adoption of demonstrated practices.

Jayaramaiah (1987) observed a significant relationship between participation in extension activity and adoption of NPK in groundnut, potato and jowar.

Ramegowda and Siddaramaiah (1987) reported that extension participation was positively and significantly related with innovativeness of farmers in adopting MR-301 paddy variety.

However, Somasekharappa and Manimegalan (1987) found no association between extension contact and fertiliser use of farmers.

In the present study a positive relation between extension participation and knowledge, as well as extension participation and adoption were hypothesised.

Credit utilisation

No study was available relating credit utilisation with knowledge of farmers about fertiliser management practices.

Krishnamoorthi (1984) reported that lack of credit facility influenced the dryland farmers not to apply the chemical fertiliser to the dryland crops. Singh and Ray (1985) observed that fertiliser use was in general dependant on the farmers borrowing of credit. Jayaramaiah (1987) observed a significant relation between credit borrowing and NPK use in groundnut, potato and jowar.

FAI (1988) concluded that fertiliser being the costliest purchased input, credit plays a dominant role in increasing fertiliser use. Timely and adequate availability of credit should be ensured to increase fertiliser consumption and agricultural production. Pandey (1988) observed that amount of credit plays an important role in growth of fertiliser consumption.

It was hypothesised in this study that there would be positive relationship between credit utilisation and knowledge as well as credit utilisation and adoption.

5. Perception of appropriateness of the recommended fertiliser management practices

A. Farmers

Ramamurthy (1973) observed that the characteristics of complex fertilisers that had motivated the respondents to adopt were that concentrated fertiliser contained all the three nutrients, required no physical mixing, easy and economical to apply and easy to work out the dosage.

Subramanyan and Viswanathan (1973) reported that the three attributes namely compatibility, communicability and relative advantage largely contributes towards the adoption of NPK fertilisers.

Chandrakandan et al. (1975) concluded that farmers were more likely to adopt the farm practices when they perceive the practices to be more compatible, more efficient and feasible, more communicable, simple to adopt, less costly, highly divisible and more profitable. Arulraj and Knight (1978) found that farmers who perceived the recommended practices to be less costly, more profitable and to have more immediacy of return were found to be growing high yielding varieties.

Rajagopalan (1986) reported 'observability' to be the reason for adoption of Di-ammonium phosphate in paddy nursery.

Ramegowda and Siddaramaiah (1987) observed that profitability, compatibility, triability and observability were positively and significantly related with innovativeness of farmers, while initial cost and complexity had negative and significant relationship with innovativeness.

B. Extension personnel

Ravishankar (1978) and Niranjanakumar (1979) had reported that majority of extension workers were favourably predisposed to most of the characteristics of innovations. It was also pointed out that, they had unfavourable perception of certain characteristics of innovations.

Perception about the attributes of an innovation and their appropriateness as judged by them is crucial in deciding the adoption behaviour. It was, therefore decided to study the perception of appropriateness of the recommended fertiliser management practices.

6. Constraints experienced by the farmers in the adoption of recommended fertiliser management practices

Narayanappa (1978) reported the constraints in fertiliser use in peas as: lack of knowledge (66.2 per cent), misapprehension that fertiliser use may result in greater disease incidence (20.50 per cent), lack of finance (10.20 per cent) and scarcity of water.

Sethy (1978) reported the constraints in fertiliser use as: high cost of fertilisers, inadequate credit, non-availability of credit in time, complex credit obtaining procedure, non-availability of fertiliser in villages and non-availability of desired fertiliser.

Waghmare and Pundit (1982) reported lack of knowledge, lack of technical guidance and high cost of chemical fertilisers as major constraints in application of technology of chemical fertilisers. Tripathi et al. (1982) observed that the most important constraint in fertiliser

application as perceived by the farmers was 'high dose of fertiliser spoils the soil' (95 per cent) followed by 'heavy fertiliser dose induces diseases and pests' (78.50 per cent).

Padmaraj (1983) observed non-availability of credit as the chief problem in getting fertiliser requirements from the private agency and untimely supply as the chief problem in getting fertiliser from the departmental agency.

Jayakrishnan (1984) revealed that the reasons for non-adoption of fertilisers by the paddy farmers based on soil test were: tedious nature of work (52.38 per cent), delay in getting the result (46.03 per cent) and lack of experience (41.28 per cent).

Sharma (1985) found that fragmented holdings, lack and uncertainity of irrigation, lack of awareness of the farmers about balanced fertiliser use, lack of soil testing facilities, poor contact between farmers and extension agencies, lack of credit and relatively high cost of fertilisers especially for small farmers were some of the constraints in promoting fertiliser use.

Srinivasamurthy (1985) observed that the specific constraints in fertiliser use were: no way to cover the risk of investment on fertiliser if crop fails for any

reason, crop loan not available at reasonable rate, the amount of crop loan inadequate, lack of proper understanding about the net income due to fertiliser use, fertiliser sale point not being nearby and uncertainty of canal water supply during crucial periods.

Jayaramaiah (1987) reported that the constraints perceived by farmers of Dharwad District in the adoption of recommended doses of NPK, in the order of priority were: high prices of fertilisers, inadequate supply of fertilisers, lack of desired type of fertilisers, non-availability of credit, lack of soil testing facilities and adulteration in fertilisers.

Singh and Singh (1987) observed lack of credit (75 per cent), poor technical knowledge (64.5 per cent), non-availability of suitable crop varieties (59 per cent), poor irrigation facilities (51 per cent) as the major constraints in the adoption of pyrite based user reclamation technology. Siddaramaiah and Veerabhadraiah (1987) observed that lack of knowledge about fertilisers on the part of farmers and lack of financial resources to buy fertilisers were the two main reasons for non-adoption of fertilisers.

Agro Economic Research Centre (1988) observed that 16 per cent of the sample farmers had to travel more than

five kilometre to procure their fertiliser and in many cases, this posed a problem.

Patnaik (1988) reported high depth of standing water in the field and flow of surface rain water from field to field as the major constraints in the application of nitrogenous fertilisers.

The above studies indicate that there are many problems which a farmer may encounter in adopting fertiliser management practices. Hence it was decided to identify the constraints which the farmers perceived as important in adopting fertiliser management practices.

The conceptual framework developed for the study is presented in Fig. 1.

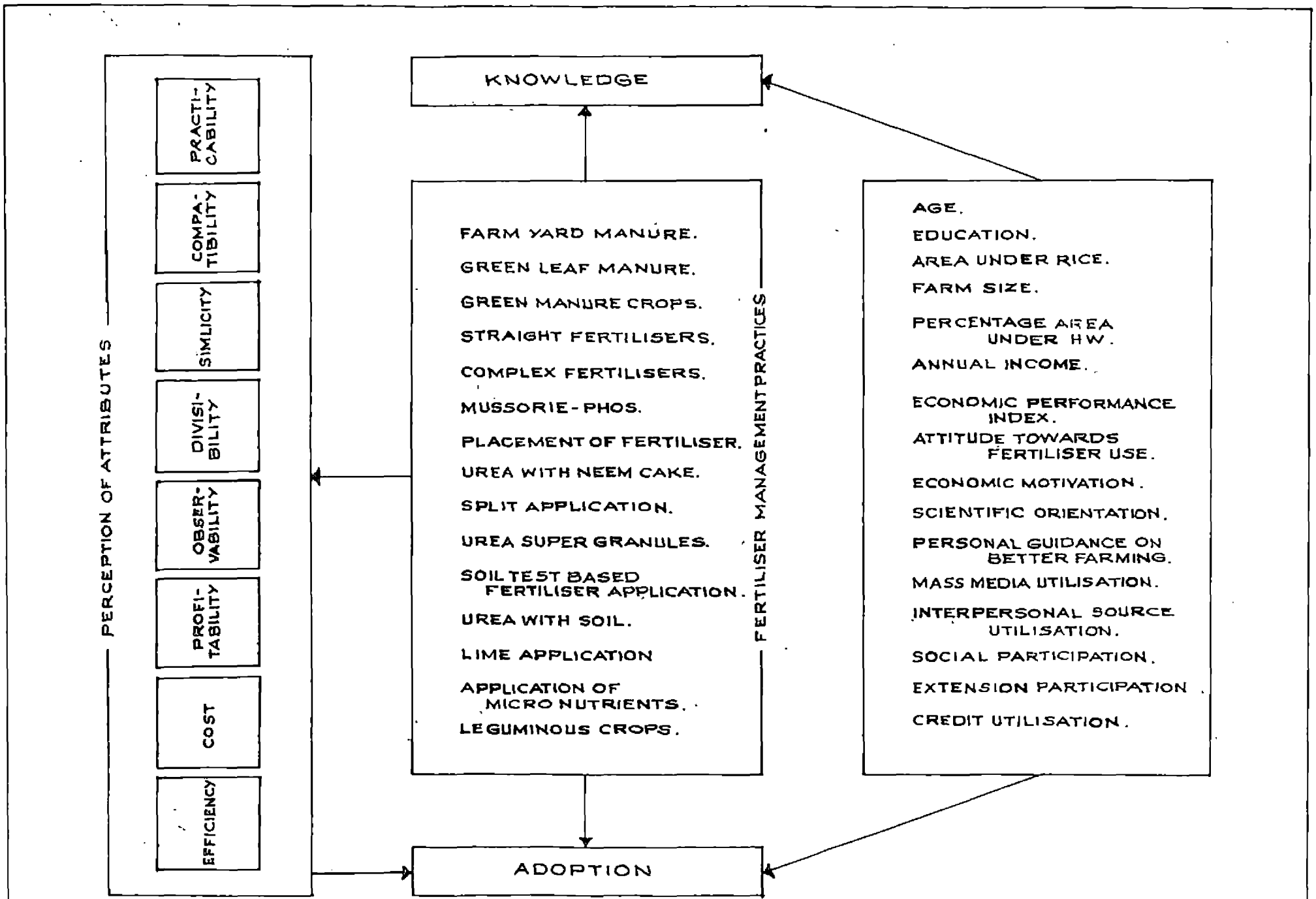


FIG.1. CONCEPTUAL FRAMEWORK DEVELOPED FOR THE STUDY.

Methodology

CHAPTER-III

METHODOLOGY

The chapter deals with the methods employed in the study which are presented under the following heads

1. Location of the study
2. Selection of the sample
3. Selection of variables for the study
4. Operationalisation and measurement of variables included in the study
5. Procedure of data collection
6. Statistical tools used in the study

1. Location of the study

A. Selection of Districts

The study was conducted in Palghat and Cannanore Districts of Kerala State. These districts were purposively selected for the study for the following reasons.

It was decided that two districts be selected in such a way that one district shall have high cropped area under rice and also high rate of fertiliser consumption, while the other district shall also have high cropped area under rice, but low rate of fertiliser consumption. Based on 1985-86 statistics, of all the districts of

Kerala State, Palghat District had high gross cropped area under rice and also high fertiliser consumption. Cannanore District also had a comparatively high gross cropped area under rice, but low fertiliser consumption. Hence these two districts were purposively selected.

B. Selection of Agricultural Sub-Divisions

Chittoor Sub Division from Palghat District and Payyannur Sub Division from Cannanore district were purposively selected for the study for the following reasons.

The selected Sub Division in Palghat District should have the highest rate of fertiliser consumption in rice, while the selected Sub Division in Cannanore District should have the lowest rate of fertiliser consumption in rice. Such a selection is defended on the ground that by studying two contrasting areas, it is quite possible to identify trends that eventually occur in other areas also.

Palghat District is divided into four Agricultural Sub Divisions namely Alathur, Chittoor, Mannarkad and Shoranur. Statistics were not available to select a sub-division based on the quantity of fertiliser consumption for rice. Hence discussions were held with the officers of the Department of Agriculture, and from the information

gathered from them, it was concluded that, of the four sub-divisions, Chittoor Sub Division had the highest fertiliser consumption for rice. Hence Chittor Sub Division was selected for the study.

Cannanore District is divided into three Agricultural Sub Divisions namely Tellichery, Cannanore and Payyannur. From the available information gathered from Department Officers it was concluded that, of the three sub-divisions, Payyannur Sub Division had the lowest fertiliser consumption for rice and hence this Sub Division was selected for the study.

C. Selection of Panchayats

The Officers of the respective Agricultural Sub Divisions were briefed about the objectives of the study and the criteria for the selection of the panchayats to be followed were explained to them. An assessment of the fertiliser consumption in rice in the different panchayats under Chittoor Sub Division were made based on the experience of the officers and also their familiarity with the area. After detailed discussion with the officers, it was revealed that, out of the 26 panchayats in Chittoor sub division, Pattanchery Panchayat had the highest fertiliser consumption in rice and hence that panchayat was purposively selected for the study.

In a similar fashion, it was revealed that out of the 27 panchayats in Payyannur Sub Division, Kadannappally-Panapuzha Panchayat had the lowest fertiliser consumption in rice and so that panchayat was purposively selected for the study.

The above procedure was resorted to due to the non-availability of statistical data pertaining to the crop-wise consumption of fertilisers at the respective levels.

A map showing the location of the study is furnished in Fig. 2 and 3.

2. Selection of the sample

The method of sampling adopted for the study is described below.

The list of farmers growing rice in the selected two panchayats was prepared separately and from the list, 100 farmers were selected at random for each panchayat. Thus there were 200 farmers selected for the study.

Besides farmers, all the Agricultural Demonstrators in the selected two Sub divisions were included for the study to form a second category of respondents. Thus 30 Agricultural Demonstrators from Chittoor Sub Division and 24 Agricultural Demonstrators from Payyannur Sub Division were also selected as respondents for the study.

FIG. 2. MAP OF PALGHAT DISTRICT SHOWING THE PANCHAYATS SELECTED FOR THE STUDY.

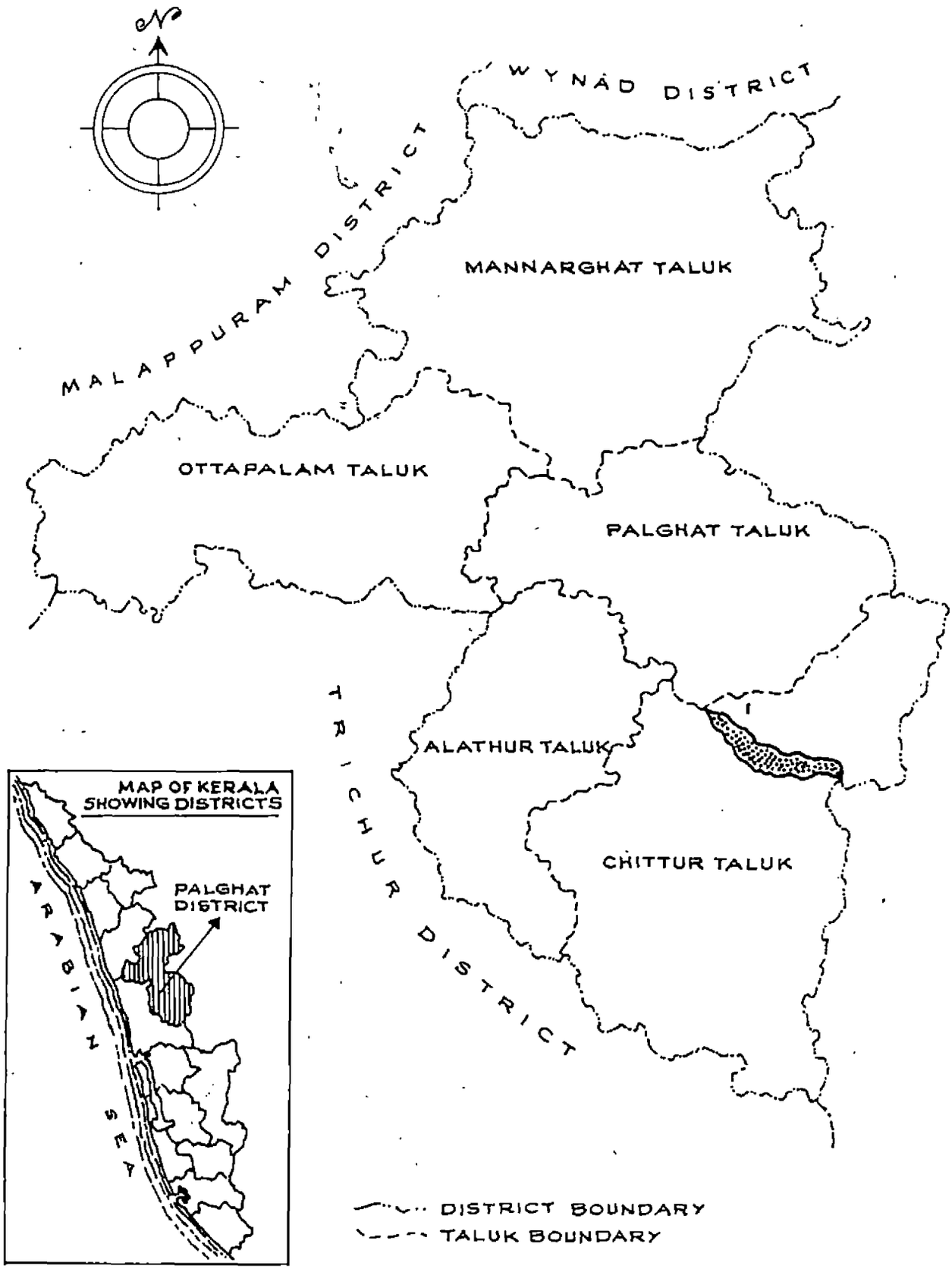
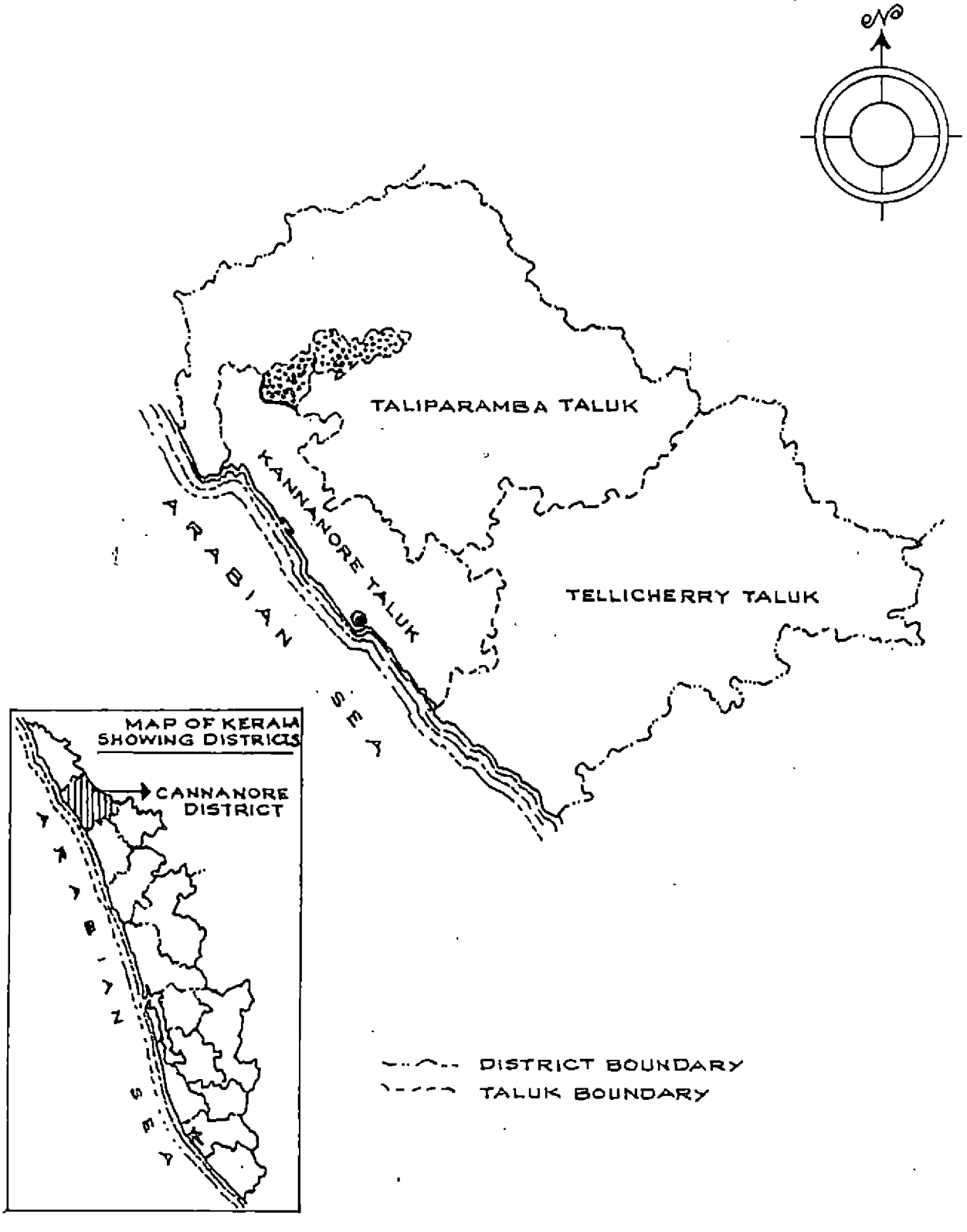


FIG. 3. MAP OF CANNANORE DISTRICT SHOWING THE PANCHAYATS SELECTED FOR THE STUDY.



3. Selection of variables for the study

Based on the objectives of the study, review of relevant literature and discussion with experts both in the Department of Agriculture and in the Kerala Agricultural University, the following variables were selected for the study.

A. Dependent variables

1. Knowledge about recommended fertiliser management practices in rice.
2. Adoption of recommended fertiliser management practices in rice.

B. Independent variables

1. Age
2. Education
3. Farm size
4. Area under rice
5. Percentage area under high yielding rice varieties
6. Annual income
7. Economic performance index
8. Attitude towards fertiliser use
9. Economic motivation
10. Scientific orientation

11. Personal guidance on better farming

12. Mass media utilisation

13. Interpersonal source utilisation

14. Social participation

15. Extension participation

16. Credit utilisation

C. Perception of appropriateness of the recommended fertiliser management practices

D. Constraints experienced by the farmers in the adoption of fertiliser management practices

4. Operationalisation and Measurement of variables indluded in the study

A. Dependent variables

1. Knowledge about recommended fertiliser management practices in rice

Cronbach (1949) defined knowledge test as one in which procedures, apparatus and scoring have been fixed so precisely that the same test can be given at different times and places.

A standardised knowledge test defined by Noll (1957) is one that has been carefully constructed by experts in the light or acceptable objectives or purposes and

procedures for administering, scoring and interpreting scores which are specified in detail so that the results should be comparable and norms and averages for different age and status have been predetermined.

In this study, the extent of knowledge of farmers about the fertiliser management practices in rice was measured using a knowledge test developed for the purpose. The steps followed in developing the knowledge test are described below.

Collection of items

The content of a knowledge test is composed of questions called items. An item pool of questions was prepared by reviewing literature such as the package of practices recommendations of the Kerala Agricultural University (1986) and conducting discussions with the subject matter specialists and the extension personnel of the University. Finally, a thorough scrutiny of the item pool was made with the assistance of the subject matter specialists. The selection of the items was done on the basis of the following criteria.

1. The items should promote thinking.

2. It should differentiate the well informed rice fafmers from the poorly informes ones, and
3. It should have a certain difficulty index.

Thirty two items (questions) which covered all aspects of fertiliser management practices in rice cultivation were selected to carry out item analysis for developing a standardised knowledge test (Appendix I).

Item analysis

The initially prepared thirty two items were checked to fourty eight respondents prior to the preparation of the final schedule. The respondents were randomly selected rice farmers who were altogether different from the sample selected for the main study and at the same time having identifical conditions.

Item analysis yields two kinds of information, item difficulty and item discrimination. The index of item difficulty reveals how difficult an item is whereas the index of discrimination indicates the extent to which an item discriminates the well informed individuals from the poorly informed ones.

Scores of value one and zero were given to correct and incorrect responses respectivelv. There was thus a

possibility of respondents scoring a maximum of thirty two points for all correct answers and zero for all wrong answers.

The scores obtained by the forty eight respondents were arranged in the descending order of total scores, from the highest to the lowest and the respondents were divided into three equal groups arranged in descending order of total scores obtained by them. The three groups were G1, G2 and G3 with sixteen respondents in each group. For item analysis, the middle group namely G2 was eliminated retaining only the terminal ones with high and low scores.

The data pertaining to correct responses for all the items in respect of these two groups G1 and G3 were tabulate and the difficulty and discrimination indices calculated (Appendix II).

An example of the calculation of the difficulty and discrimination indices is presented below.

Table 1. Difficulty and discrimination index of knowledge test items

Item number in the initial test	Frequency of correct answers		Total frequencies	Percentage of respondents giving correct answers (P)	$E^{1/3}$
	S_1	S_3			
9	16	4	20	41.67	0.75
15	15	5	20	41.67	0.63
18	16	2	18	37.5	0.88

P = index of item difficulty

$E^{1/3}$ = index of discrimination

$E^{1/3} = \frac{(S_1) - (S_3)}{N/3}$, where S_1 and S_3 are the frequencies of correct answeres in the group G_1 and G_3 respectively.

N = Total number of respondents in the sample

Substituting the value for item number (9) of the above table, the value arrived at was:

$$E^{1/3} \text{ for item } 9 = \frac{16-4}{48/3} = 0.75$$

Calculation of item difficulty index

The index of item difficulty as worked out in this study refers to the percentage of the respondents answering an item correctly. As Coombs (1950) pointed out, the difficulty of an item varied for different individuals. In the present study, the items with P value ranging from 25 to 75 were considered for final selection for knowledge test.

Calculation of Discrimination index

The second criterion for item selection was the discrimination index indicated by $E^{1/3}$. Mehta (1958) in using $E^{1/3}$ method to find out item discrimination values

emphasised that this method was somewhat analogous to, and therefore, a convenient substitute for the phi coefficient as formulated by Perry and Michael (1951). In the present study, the items with $E^{1/3}$ value above 0.40 were considered for the final selection as definite criteria of selection is not advocated by any researchers. In their studies, Lokhande (1973), Reddy (1976), Sadamate (1978) and Pillai (1983) had put these units as 0.35 to 0.55, 0.17 to 0.79, 0.12 to 0.87 and 0.35 to 0.50 respectively. The selected 13 items for the final format of the knowledge test are given in Appendix II).

Reliability

The split-half method was used to test the reliability of the test. All the 13 items of the knowledge test were divided into two equal halves each having seven odd numbers and six even numbers and administered to thirty respondents. The coefficient of correlation between the two sets of scores was 0.79 which was significant at 1 per cent level of probability. This indicated that the reliability of the test was high.

Content validity

Content validity is a kind of validity by assumption as described by Guilford (1971). Care was taken to include

items covering the entire universe of relevant aspects of knowledge in fertiliser management practices in rice cultivation. Items were collected through various sources such as specialists in Agronomy, Extension and Soil Science and also the subject matter specialists of the Department of Agriculture, so that it was assumed that the test could measure the knowledge of the rice farmers in fertiliser management practices.

Method of scoring

Thirteen items were included in the knowledge test. Each respondent was given one score for correct answer and zero score for incorrect answer. The total knowledge score for each respondent was calculated by summing up the scores given for each item. Thus the maximum knowledge score that could be obtained by a respondent was 13 and the minimum zero.

The knowledge test developed for measuring the knowledge of farmers was used to measure the knowledge of Agricultural Demonstrators in fertiliser management practices. The same test was used so that a comparison of the knowledge scores of both categories of respondents would be possible.

2. Extent of Adoption of the recommended fertiliser management practices

Research workers have developed different methods to measure the adoption behaviour.

Wilkening (1952) used an index for measuring the adoption of improved farm practices. The index of adoption used by him was the percentage of practices adopted to the total number of practices applicable for that farmer.

Marsh and Coleman (1955) used "practice adoption" scores computed as the percentage of applicable practices adopted.

Fliegel (1956) constructed an index of adoption of farm practices using the correlation of several adoption variables. He used factor analysis of each of the 11 factors selected. A score of one was given for adoption and zero for non-adoption.

Chattopadhyay (1963) used adoption quotient for measuring adoption which is a ratio scale that measures a farmers' behaviour on dimensions of applicability, potentiality, extent, time, consistency and differential nature of innovations.

Supe (1969) developed a scale viz. cotton practices adoption scale. He selected ten practices of cotton and for each practice, a score of six was assigned for complete adoption. The practices which were divisible were assigned partial score for partial adoption.

In the present study, the method developed by Supe (1969) and as modified by Kamarudeen (1981) and Syamala (1988) was followed for measuring the level of adoption of recommended fertiliser management practices.

The following fertiliser management practices in rice cultivation as recommended by the Kerala Agricultural University were selected for the study.

Application of farm yard manure
Application of green leaf manure
Growing green manure crops
Application of nitrogenous fertiliser
Application of phosphatic fertiliser
Application of potassic fertiliser
Use of cheaper sources of fertilisers
Placement of fertiliser
Use of urea with neem cake
Application of fertiliser in split doses
Application of urea super granules

Application of fertiliser based on soil test

Mixing urea with soil

Application of lime

Application of micronutrients

Growing leguminous crops

The extent of adoption of each individual practice was calculated by giving the score as follows:

For the practices, application of farm yard manure, application of green leaf manure, application of nitrogenous fertiliser, application of phosphatic fertiliser, application of potassic fertiliser, application of lime and application of fertiliser in split doses the scoring was done as given below:

	Score
Recommended dosage and above	2
Less than the recommended dosage	1
Non adoption of the practice	0

For the practices, growing of green manure crops, use of cheaper sources of fertiliser, placement of fertiliser, use of urea with neem, application of urea super granules, application of fertiliser based on soil test, mixing urea with soil, application of micro nutrients and growing leguminous crops the scoring was done as follows.

	Score
Adoption of the practice	1
Non-adoption of the practice	0

In the case of application of fertiliser (NPK) for high yielding varieties in rice, the scoring pattern followed was altered to give weights to the quantity of fertiliser applied also. So in the case of application of fertiliser (N, P and K) to high yielding varieties, the scoring pattern was as follows.

Recommended dosage and above	4
Les than the recommended dosage	2
Non-adoption of the practice	0

A high score was assigned for fertiliser application above the recommended dosage since the researcher has come across many instances, wherein the application of fertilisers above the recommendation as given in the package of practices is common among the farmers. It was also observed that organic manures were not applied in adequate quantities. Under such situations, application of fertilisers above the recommended dosage becomes necessary because of the following reasons (1) to compensate for the nutrients supplied through organic manures, (2) to compensate for the larger loss of nutrients supplied through fertilisers, because of poor

chemical properties of soil arising from lower organic matter content of soil.

The adoption score of a farmer was calculated by summing up the scores obtained by him for the different individual practices.

B. Independant variable

Age

Age was measured as the number of years the respondent has completed at the time of the investigation since his birth.

Education

In this study education is operationalised as the number of years of formal education attained by the respondent at the time of investigation.

Education was measured by assigning scores for different levels of education as per the scoring system followed in the socio-economic status scale of Trivedi (1963). The categorization of respondents and the corresponding scores assigned are given below:

Category	Score
Illiterate	0
Can read only	1
Can read and write	2
Primary school	3
Middle school	4
High school	5
Collegiate	6

Farm size

Farm size is defined in terms of the area of land owned and cultivated by a farmer, which includes both wet land and garden land.

The total land holding including both wet land and garden land was considered for measuring the farm size. Wet land having cultivation more than once was multiplied by 2 so as to get a standardized estimate.

Area under rice

Area under rice cultivation is defined in terms of the area of wet land owned and cultivated by a farmer. Wet land having cultivation of rice more than once was multiplied by two for calculating the total area under rice.

Percentage area under high yielding rice varieties

Percentage area under high yielding rice varieties (HYV) is defined as the ratio of the area under HYV of rice to the total area under rice multiplied by 100

$$\text{Percentage area under HYV} = \frac{\text{Area under HYV of rice} \times 100}{\text{Total area under rice}}$$

Annual income

In this study, annual income has been operationally defined as the total earnings of the respondent and the members of the family in an year from the farm and also other sources (expressed in rupees).

This variable was measured by asking the respondents to indicate his family's total annual income from the farm and other sources.

Economic performance index

Economic performance index is operationally defined as the ratio of the value of total output to total expenditure incurred on the major crop enterprises. The procedure adopted by Shankaraiah and Crouch (1977) which was slightly modified and used by Rannorey (1979) was used

to quantify this variable. Economic performance index (EPI) of a respondent was measured by working out the ratio of the value of total output to the total expenditure incurred.

Only one component, crop enterprise and out of it only one crop viz. rice was considered in this study for computing the total output and expenditure. The formula used to work out EPI was

$$\frac{\text{Total value of the rice produce}}{\text{The total cost of production of rice}} \times 100$$

The area under cultivation of rice during each season and the per acre yield of rice for that particular season were first recorded. The total production of the crop was then calculated. The value for produce from each season and the cost of production of rice for these seasons were obtained. The ratio of the value of the produce to the cost of production multiplied by 100 gave the EPI for a particular season.

The EPI for the different seasons were summed up and divided by the number of seasons. This value was taken as the Economic performance index for an individual respondent.

Attitude towards fertiliser use

Allport (1935) has defined attitude as a mental and neural state of readiness organised through experience exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related.

In this study, attitude of farmers towards fertiliser use has been operationally defined as the degree of favourable or unfavourable disposition of a respondent as expressed by him to a set of statements with varying intensities or the stimulus.

In this study, the scale developed by Choudhary and Prasad (1977) was used to measure attitude of farmers towards fertiliser use.

The scale consisted of nine statements rated on a four point Likert continuum ranging from strongly agree, agree, disagree and strongly disagree with weights 4, 3, 2 and 1 respectively for positive statements and the weights reversed for negative statements. The scoring was done with the help of the method proposed by Eysenck and Crown (1949). According to this method, the weight of Likert and scale value of Thurstone (Appendix III) were combined

in the form of products for each statement. The total score of a respondent was the sum of such products for all the nine items.

Economic motivation

In farming system, economic motivation may be regarded as one indication of the degree of willingness of a farmer for investment of his available potential resource in adopting farm innovation. It is operationally defined in terms of the extent to which a farmer is oriented towards profit maximisation and the relative value placed by him towards achievement of maximum monetary gains. In this study economic motivation was measured using the scale developed by Moulik (1965). The scale consisted of three sets of statements, each set having three short statements with weights 3, 2 and 1 indicating different intensities of motivation from high to low. The forced choice method was followed to overcome the familiar problems of personal bias and lack of objectivity in self evaluation. The method forced the respondent to choose from a group of three short sentences describing a particular personality characteristic, the one which most accurately described the respondent himself and also the one which least accurately portrayed himself.

After obtaining the most-least choice for each of the three sets of statements, the scoring was done by summing up the ratios of the weight of most-like statements to the weight of least-like statements.

Scientific orientation

According to Supe (1969), scientific orientation is the degree to which a farmer is oriented to the use of scientific methods in decision making in farming. The same operational definition is adopted in the present study for measuring this variable.

The scale developed by Supe (1969) was used in this study to measure the scientific orientation of the farmer. The scale consisted of six statements of which one was negative. The responses were collected on a five point continuum as shown below.

Response	Scores
Strongly agree	7
Agree	5
Undecided	4
Disagree	3
Strongly disagree	1

The scoring pattern was reversed for the negative statement. The total score thus obtained by an individual for all the six statements was taken as his score for scientific orientation.

Personal guidance on better farming

Personal guidance is operationally defined as the advice, help and assistance received by a farmer from different extension personnel for efficient utilisation of the resources and solving farming problems.

The scale developed by Singh (1981) and modified by Balan (1987) was used to measure personal guidance on better farming. The scale consisted of 12 statements rated on a four point continuum ranging from very much, much, not so much, and very little with scores 4, 3, 2 and 1. The summation of the scores for different statements gave the total score on personal guidance for a respondent.

Mass media utilisation

In this study, mass media utilisation is operationally defined as the extent of use of different mass media sources by a farmer with a view to obtain information about improved agricultural practices.

The procedure followed by Nair (1969) was adopted in the present study to develop an index of mass media utilisation. Each respondent was asked to indicate as to how often he got information regarding improved agricultural practices from each of the listed mass media sources. The range of responses and the scoring pattern were as follows:

Frequency	Score
Regularly (Daily, weekly)	4
Often (once in a fortnight)	3
Sometimes (once in a month)	2
Rarely (once in anyear)	1
Never	0

The scores were summed up across each item to form the index of mass media utilisation.

Interpersonal source utilisation

In this study interpersonal source utilisation is operationally defined as the extent of use of different personal sources by a farmer with a view to obtain information about improved agricultural practices.

The procedure developed by Nair (1969) was adopted in the present study to develop an index of interpersonal source utilisation.

Each respondent was asked to indicate as to how often he got information regarding improved agricultural practices from each of the listed personal sources. The range of responses and the scoring pattern were as follows:

Frequency	Score
Regularly (daily, weekly)	4
Often (once in a fortnight)	3
Sometimes (once in a month)	2
Rarely (once in an year)	1
Never	0

The scores were summed up across each item to form the index of interpersonal source utilisation.

Social participation

Sadamate (1978) defined social participation of the respondent as participation in social institutions as a member or as an office bearer.

In this study, social participation is operationally defined as the degree of involvement of the respondent in social organisations as a member or as an office bearer and regularity in attending the meetings.

In the present study, social participation was measured using the scale developed by Kamarudeen (1981). He had used a scale having two dimensions, namely membership in organization and participation in organizational activities.

For membership, scores were given as:

Member - 1

Office bearer - 2

For frequency of participation, the scoring was as follows

Attended all meetings - 2

Attended some meetings - 1

Not attended any of the meetings - 0

The scores obtained by a respondent on the above two dimensions were summed up across each item which gave the social participation score.

Extension participation

Extension participation is operationally defined as the extent of participation by a farmer in various extension programmes/activities conducted in the area.

The following activities were included to evaluate the extension participation of respondents.

1) Campaigns 2) Film shows 3) Seminars
4) Group meetings 5) Exhibitions 6) Demonstrations
7) Farmers' days

The participation of the respondents in the above extension activities during the previous year was used to arrive at extension participation score.

Frequency	Score
Always attending an activity whenever conducted	2
Sometimes attending an activity whenever conducted	1
Never	0

Credit utilisation

This is operationally defined as a measure of the utilisation of credit facilities available to a farmer.

Credit utilisation was measured using a dichotomous response pattern as to whether the farmer had availed any credit or not from any agency. If the farmer had availed credit, a score of 1 was assigned for the same, while a score of zero was assigned if he has not availed any credit.

C. Perception of appropriateness of the recommended fertiliser management practices

The purpose of perception is to help individuals cope with the world by assigning meanings to it which can stand the test of subsequent experiences (Toch and Maclean, 1970).

Perception about the appropriateness of the recommended fertiliser management practices is operationally defined as the meaningful understanding and interpretation made by the respondents about the various attributes of the fertiliser management practices which are recommended for adoption.

In this study, perception of appropriateness of the recommended fertiliser management practices was measured using an arbitrary scale developed for the purpose. The scale is considered as arbitrary since rigorous procedures of standardisation by estimating reliability and validity of the scale were not attempted in the present case. However, an earnest attempt was made to measure the perception as scientifically as possible.

The appropriateness of the fertiliser management practices was measured in terms of certain attributes of

the practices. The attributes of the practices were selected based on review of relevant literature and detailed discussion with experts. The attributes selected were practicability, compatibility, simplicity, divisibility, observability, profit, cost and efficiency. The perceived attributes for each of these practices were rated on a four point continuum with response pattern as follows.

Response	Score
Very much	4
Much	3
Little	2
Least	1

The respondents were asked to indicate against each attribute of the practice, whether it was very much, much, little or least important as considered by them. For each practice, the frequency of response under the various points in the continuum were multiplied with the respective weights and added up to get a cumulative index for that practice for each selected attribute. The cumulative index for each practice on the different selected attributes were worked out. The ratio between the cumulative index and the frequency of response for each was worked out. Based on this ratio, the practices were ranked for each selected attribute.

D. Constraints experienced by the farmers in the adoption of fertiliser management practices

Based on discussion with farmers and also through review of relevant literature, some of the constraints faced by the farmers were collected. A list containing forteen such constraints were included in the final interview schedule.

The procedure used by Syamala (1988) was followed for ranking the constraints. The response to each constraint was obtained on a four point continuum, viz. most important, important, less important and least important, with weights 4, 3, 2 and 1 respectively. For each constraint, the frequency of response under the various points in the continuum were multiplied with the respective weights and added up to get a cumulative index for that particular constraint. The ratio between the cumulative index and the frequency of responses for each constraint was worked out. Based on this ratio, the constraints were ranked.

5. Procedure of Data Collection

The data were collected from the farmers using a well structured interview schedule prepared for the purpose (Appendix III). The draft schedule was prepared, which

was pretested by conducting a pilot study and on its basis suitable modifications were made in the schedule. The Malayalam version of the same was prepared for the use of the researcher during data collection.

A questionnaire for Agricultural Demonstrators was also prepared to assess their knowledge about fertiliser management practices in rice and their perception of appropriateness of the recommended fertiliser management practices (Items 19 and 21 of Appendix-III)

The data collection was done during the months of January-February 1989. The farmer respondents were directly interviewed by the researcher. In the case of Agricultural Demonstrators, the questionnairs in Malayalam were directly administered to them and responses collected. The respondents were contacted at the meetings conducted at the Sub divisional level for collecting information from them.

6. Statistical tools used in the study

1. Students 't' test

Students 't' test was used to test the significance of difference between means to compare the farmers at Palghat and Cannanore with respect to all their selected

characteristics. The following formula was used for equal sample sizes.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

where,

$\bar{x}_1$ = Mean of sample at Palghat

$\bar{x}_2$ = Mean of sample at Cannanore

s_1 = Standard deviation of sample at Palgha

s_2 = Standard deviation of sample at Cannanore

n_1 = Size of sample at Palghat

n_2 = Size of sample at Cannanore

t = Computed value for t

2. Simple correlation analysis

To study the association between each independent variable and the dependent variables, simple correlation analysis was done.

The formula used was,

$$\text{Correlation coefficient, } r = \frac{\Sigma xy - \frac{\Sigma x \Sigma y}{n}}{\sqrt{\Sigma x^2 - \frac{(\Sigma x)^2}{n} \times \Sigma y^2 - \frac{(\Sigma y)^2}{n}}}$$

where x = independent variable

y = dependent variable

n = number of observations

3. Multiple regression analysis

Multiple regression analysis was done to determine the net contribution of the selected independent variables to the dependent variable. This gives the percentage of variation that a set of independent variables jointly explains in the dependent variable.

The regression equation employed in the study was

$$y = a + b_1x_1 + b_2x_2 + \ldots\ldots\ldots\ldots\ldots\ldots + b_nx_n$$

where y = Dependent variable

a = intercept

$x_1 \ldots\ldots\ldots x_n$ = independent variables

$b_1 \ldots\ldots\ldots b_n$ = regression coefficients

The high R^2 values and significant R value suggest the desirability of regression analysis in predicting the dependent variable. The test of significance of regression coefficients (b's) was carried out with the help of 't' values computed.

4. Step-wise regression analysis

This was done to know the relative effect of the independent variables in predicting the dependent variable and for elimination of unimportant variables. The setp-wise

regression analysis selects the best subset of variables as suggested by Draper and Smith (1966).

5. Path analysis

Path analysis explains the cause and effect relationship between dependent and independent variables. The analysis was carried out following the matrix method as given by Singh and Choudhari (1979), which gives the path coefficients of the independent variables. Path coefficient can be defined as the ratio of the standard deviation of the effect due to a given cause to the total standard deviation of the effect, ie. if Y is the effect and X_1 is the cause, the path coefficient for the path from cause X_1 to the effect Y is $\sigma X_1 / \sigma Y$.

The statistical analysis was done using the computer facility available in the Kerala Agricultural University, Vellanikkara.

Results and Discussion

CHAPTER IV

RESULTS AND DISCUSSION

The findings of the present study and the discussions thereon are presented in this chapter under the following broad sub-heads.

I Level of knowledge about fertiliser management practices.

II Extent of adoption of the various recommended fertiliser management practices.

III Determinants in the knowledge and adoption of recommended fertiliser management practices.

IV Perception of appropriateness of the recommended fertiliser management practices.

V Constraints experienced by the farmers in the adoption of recommended fertiliser management practices.

I. Level of knowledge about fertiliser management practices

a. Farmers

The mean scores of the respondents on knowledge about fertiliser management practices is presented in Table 2.

Table 2. Mean scores of the respondents on knowledge about fertiliser management practices

Respondents	Mean knowledge score	't' value
Palghat farmers (n = 100)	7.60	9.79**
Cannanore farmers (n = 100)	4.32	

**Significant at 1 per cent level

From the results, it could be seen that there is significant difference in the knowledge about fertiliser management practices between farmers of Palghat and Cannanore. The farmers of Palghat had a higher mean knowledge score (7.60) than those of Cannanore (4.32) and the difference in the mean scores was statistically significant.

The distribution of farmers on their knowledge about fertiliser management practices is shown in Table 3. The table reveales that while only 13 per cent of the farmers in Palghat belonged to the low knowledge category, as high as 47 per cent of the farmers in Cannanore belonged to this category. About 50 per cent of the farmers in both Palghat and Cannanore belonged to the medium category. However, while 37 per cent of the farmers belonged to the high knowledge category in Palghat, there was no respondent belonging to this category in Cannanore.

One cannot overlook the expressive element in any culture in a truly scientific behaviour analysis. Based on judgement, one can very well state that the farmers of Palghat are exposed to a conducive environment with better resource endowments for agricultural development than that of Cannanore wherein resource endowments for agricultural development are not so prospective. Dutta (1971) had

Table 3. Distribution of farmers based on their knowledge about fertiliser management practices

Category	Knowledge score	Palghat		Cannanore		Pooled sample	
		F	%	F	%	F	%
Low (Below $\bar{X}$ - 1.S.D)	Below 3.08	13	13.00	47	47.00	60	30.00
Medium (Below $\bar{X} \pm$ 1.S.D)	Between 3.08 and 8.84	50	50.00	53	53.00	103	51.50
High (Above $\bar{X}$ + 1.S.D)	Above 8.84	37	37.00	-	-	37	18.50
	Total	100	100.00	100	100.00	200	100.00

$\bar{X}$ = 5.96 S.D. = 2.88

indicated that the force which triggers change in a society has its source always in the material environment.

Scientific farming demands a thorough understanding of the package of practices to be followed in the cultivation of crops for obtaining higher yields. It also calls for an understanding of the management of different dimensions of the technology. Viewed from this perspective, the farmers of Palghat with better resource endowments and higher motivation for change (Table 6) might have strived to acquire more knowledge about scientific agriculture. Thus the observed result is quite understandable.

b. Extension personnel

All the Agricultural Demonstrators selected for the study obtained the same score (13), which was the maximum possible score that could be obtained, which implied that there was no variation in the level of knowledge among Agricultural Demonstrators selected for the study.

Though one can anticipate such a result using the same knowledge test developed for the farmers being administered to the Agricultural Demonstrators, the results could be possibly due to their frequent exposure to trainings under the Training and Visit System.

II. Extent of adoption of the various recommended fertiliser management practices

Table 4 depicts the mean score of the respondents on adoption of fertiliser management practices.

Table 4. Mean scores of the respondents on adoption of fertiliser management practices

Respondents	Mean adoption score	't' value
Palghat farmers (n = 100)	27.27	21.41**
Cannanore farmers (n = 100)	14.31	

**Significant at 1 per cent level

From the results it could be found that farmers of Palghat had a high mean adoption score (27.27) than the farmers of Cannanore (14.31) and the difference was found statistically significant.

The distribution of farmers on their adoption of fertiliser management practices is given in Table 5. The table reveals that 42 per cent of the farmers in Cannanore belonged to the low adoption category, while there was none in Palghat belonging to this category. More than half of the respondents in both Palghat (57%) and Cannanore (58%) belonged to the medium category. 43 per cent of the farmers in Palghat belonged to the high adopter category, while none was found belonging to this category in Cannanore.

Table 5. Distribution of farmers based on the adoption of fertiliser management practices

Category		Adoption score	Palghat		Cannanore		Pooled sample	
			F	%	F	%	F	%
Low	(Below $\bar{X}$ - 1.S.D)	Below 13.02	-	-	42	42.00	42	21.00
Medium	(Between $\bar{X}$ ± 1.S.D)	Between 13.02 and 28.56	57	57.00	58	58.00	115	57.50
High	(Above $\bar{X}$ + 1.S.D)	Above 28.56	43	43.00	-	-	43	21.50
		Total	100	100.00	100	100.00	200	100.00

$\bar{X}$ = 20.79 S.D = 7.77

Knowledge is an important input in adoption. Without a proper understanding of the different aspects of the practices, adoption of the practices in the true sense will not materialise. Rogers and Shoemaker (1971) had observed that besides awareness - knowledge, "how-to" knowledge, which consists of information necessary to use an innovation properly, what quantity of an innovation to secure, how to utilise it correctly and so on is equally important for adoption.

The very fact that there is significant difference in the level of knowledge between farmers of Palghat and Cannanore indicate the possibility of higher adoption in the case of farmers of Palghat, whose level of knowledge is quite high. Janakiramraju (1978), Singh and Ray (1985) and Jayaramaiah (1987) had also reported that knowledge of the farmers about fertiliser practices was significantly related with the extent of adoption of fertilisers.

III. Determinants in the knowledge and adoption of recommended fertiliser management practices by the farmers

Table 6 presents the mean scores for all the independent variables selected for the study.

Table 6. Comparison of mean scores of independent variables selected for the study

No.	Independent variable	Palghat farmers	Cannanore farmers	t value
		Mean score	Mean score	
X_1	Age	44.19	46.9	1.570
X_2	Education	4.12	2.45	6.349**
X_3	Area under rice	8.23	1.64	7.680**
X_4	Farm size	8.57	2.17	7.248**
X_5	Percentage area under HYV	100.00	18.85	33.6**
X_6	Annual income	18095.00	9830.00	13.29**
X_7	Economic performance index	200.00	133.56	13.65**
X_8	Attitude towards fertiliser use	16.68	15.62	3.87**
X_9	Economic motivation	4.35	3.89	1.83
X_{10}	Scientific orientation	29.03	26.29	8.01**
X_{11}	Personal guidance on better farming	13.89	11.55	4.34**
X_{12}	Mass media utilisation	6.45	4.65	4.88**
X_{13}	Interpersonal source utilisation	9.83	6.70	7.43**
X_{14}	Social participation	3.26	2.07	5.13**
X_{15}	Extension participation	3.84	2.20	5.49**
X_{16}	Credit utilisation	0.79	0.28	8.38**

** Significant at 1 per cent level

From the Table 6 it could be seen that the farmers of Palghat had a higher mean score for all the independent variables than that of farmers of Cannanore which when tested evidenced that this difference was statistically significant for all other variables except age and economic motivation.

A. CORRELATION ANALYSIS

1. KNOWLEDGE

a. Palghat

The results of the correlation analysis between knowledge about fertiliser management practices of the farmers and the selected independent variables are presented in Table 7.

The table reveals that out of the 16 independent variables included in the study, only 11 variables were significantly related with the knowledge about fertiliser management practices.

Education, area under rice, farm size, annual income, economic motivation, scientific orientation, personal guidance on better farming, mass media utilisation, social participation and extension participation were positively and significantly related with knowledge about fertiliser

Table 7. Correlation between knowledge about fertiliser management practices and the selected independent variables

Variable No.	Independent variable	Coefficient of correlation (r)	
		Palghat (n=100)	Cannanore (n=100)
X_1	Age	-0.230*	-0.425**
X_2	Education	0.563**	0.650**
X_3	Area under rice	0.353**	0.197*
X_4	Farm size	0.359**	0.024
X_5	Percentage area under HYV	-	0.270**
X_6	Annual income	0.391**	0.360**
X_7	Economic performance index	-0.015	0.013
X_8	Attitude towards fertiliser use	0.107	0.358**
X_9	Economic motivation	0.317**	0.410**
X_{10}	Scientific orientation	0.345**	0.308**
X_{11}	Personal guidance on better farming	0.285**	0.403**
X_{12}	Mass media utilisation	0.533**	0.716**
X_{13}	Interpersonal source utilisation	0.182	0.426**
X_{14}	Social participation	0.323**	0.541**
X_{15}	Extension participation	0.546**	0.611**
X_{16}	Credit utilisation	0.141	0.261**

** Significant at 1 per cent level
* Significant at 5 per cent level

management practices at 1 per cent level of significance, while age was negatively and significantly related at 5 per cent level.

The results of the intercorrelation between the different independent variables are furnished in Table 8. It could be seen from the table that education and economic motivation were significantly related with maximum number of variables followed by extension participation and farm size, while attitude towards fertiliser use and economic performance index were significantly related with least number of variables.

b. Cannanore

The results of the correlation analysis between knowledge about fertiliser management practices of farmers in Cannanore and the selected independent variables are presented in Table 7.

The table reveals that out of the 16 independent variables included in the study, 14 variables were significantly related with the knowledge about fertiliser management practices.

Education, percentage area under HYV, annual income, attitude towards fertiliser use, economic motivation,

Table 8. Relative importance of the independent variables in relation to other independent variables with respect to knowledge

No.	Independent variable	Number of other independent variables with which it is significantly related					
		Palghat			Cannanore		
		At 1 per cent level	At 5 per cent level	Total	At 1 per cent level	At 5 per cent level	Total
1	Age	2	2	4	4	1	5
2	Education	8	3	11	11	0	11
3	Area under rice	5	2	7	9	3	12
4	Farm size	5	3	8	2	3	5
5	Percentage area under HYV	-	-	-	4	4	8
6	Annual income	5	2	7	12	2	14
7	Economic performance index	1	2	3	1	2	3
8	Attitude towards fertiliser use	1	1	2	11	1	12
9	Economic motivation	8	3	11	12	1	13
10	Scientific orientation	0	3	3	10	1	11
11	Personal guidance on better farming	2	3	5	11	2	13
12	Mass media utilisation	3	3	6	12	1	13
13	Interpersonal source utilisation	0	4	4	8	3	11
14	Social participation	4	1	5	12	1	13
15	Extension participation	5	4	9	12	0	12
16	Credit utilisation	3	2	5	6	4	10

scientific orientation, personal guidance on better farming, mass media utilisation, interpersonal source utilisation, social participation, extension participation and credit utilisation were positively and significantly related with knowledge about fertiliser management practices at 1 per cent level of significance, while age was negatively and significantly related. Area under rice was positively and significantly correlated with knowledge at 5 per cent level of significance.

The results of the intercorrelation between the different independent variables are furnished in Table 8.

A perusal of the table reveals that annual income was significantly related with maximum number of variables, followed by economic motivation, mass media utilisation, social participation and personal guidance on better farming. The variables which were significantly related with the least number of variables were economic performance index followed by farm size and age.

2. ADOPTION

a. Palghat

The results of the correlation analysis between adoption of fertiliser management practices by the farmers and the selected independent variables are presented in Table 9.

Table 9. Correlation between adoption of fertiliser management practices and the selected independent variables

Variable No.	Independent variable	Coefficient of correlation (r)	
		Palghat (n=100)	Cannanore (n=100)
X_1	Age	-0.324**	-0.103
X_2	Education	0.454**	0.301**
X_3	Area under rice	0.215*	0.210
X_4	Farm size	0.232*	0.110
X_5	Percentage area under HYV	-	0.616**
X_6	Annual income	0.298**	0.262**
X_7	Economic performance index	-0.071	0.008
X_8	Attitude towards fertiliser use	0.301**	0.396**
X_9	Economic motivation	0.438**	0.345**
X_{10}	Scientific orientation	0.154	0.279**
X_{11}	Personal guidance on better farming	0.135	0.379**
X_{12}	Mass media utilisation	0.165	0.413**
X_{13}	Interpersonal source utilisation	0.069	0.322**
X_{14}	Social participation	0.175	0.442**
X_{15}	Extension participation	0.203*	0.395**
X_{16}	Credit utilisation	0.334**	0.391**
X_{17}	Knowledge about fertiliser practices	0.339**	0.499**

** Significant at 1 per cent level
* Significant at 5 per cent level

The table reveals that out of the 17 independent variables (including knowledge) selected for the study, only 10 variables were significantly correlated with adoption of fertiliser management practices.

Education, annual income, attitude towards fertiliser use, economic motivation, credit utilisation and knowledge about fertiliser management practices were positively and significantly related with adoption of fertiliser management practices while age was negatively and significantly correlated at 1 per cent level of significance. The variables area under rice, farm size and extension participation were positively and significantly correlated at 5 per cent level only.

The results of the intercorrelation between the different independent variables are furnished in Table 10. It could be seen from the table that economic motivation was significantly correlated with maximum number of independent variables, followed by knowledge about fertiliser management practices and education, while attitude towards fertiliser use and economic performance index were significantly related with least number of variables.

b. Cannanore

The results of the correlation analysis between adoption of fertiliser management practices by the farmers

Table 10. Relative importance of the independent variables in relation to other independent variables with reference to adoption

No.	Independent variable	Number of other independent variables with which it is significantly related					
		Palghat			Cannanore		
		At 1 per cent level	At 5 per cent level	Total	At 1 per cent level	At 5 per cent level	Total
1	Age	2	3	5	5	1	6
2	Education	9	2	11	11	0	11
3	Area under rice	6	2	8	10	3	13
4	Farm size	6	2	8	2	3	5
5	Percentage area under HYV	-	-	-	4	5	9
6	Annual income	6	2	8	13	2	15
7	Economic performance index	0	3	3	2	2	4
8	Attitude towards fertiliser use	1	1	2	12	1	13
9	Economic motivation	10	2	12	13	1	14
10	Scientific orientation	1	3	4	10	2	12
11	Personal guidance on better farming	3	2	5	11	3	14
12	Mass media utilisation	4	3	7	12	2	14
13	Interpersonal source utilisation	0	4	4	8	3	11
14	Social participation	5	1	6	12	1	13
15	Extension participation	6	4	10	13	0	13
16	Credit utilisation	3	2	5	7	4	11
17	Knowledge about fertiliser management practices	10	1	11	13	1	14

and the selected independent variables are presented in Table 9.

The table reveals that out of the 17 independent variables included in the study, 14 variables were significantly correlated with adoption of fertiliser management practices.

Education, percentage area under HYV, annual income, attitude towards fertiliser use, economic motivation, scientific orientation, personal guidance on better farming, mass media utilisation, interpersonal source utilisation, social participation, extension participation, credit utilisation and knowledge about fertiliser management practices were positively and significantly related with adoption of fertiliser management practices at 1 per cent level of significance while area under rice was positively and significantly related at 5 per cent level only.

The results of intercorrelation between the different independent variables are furnished in Table 10.

A cursory look at the table indicates that annual income was significantly related with maximum number of independent variables followed by economic motivation, knowledge about fertiliser management practices and extension

participation. The variables which were significantly related with the least number of variables were economic performance index followed by farm size and age.

The results of the correlation analysis revealed that most of the variables selected for the study were found to be significant in relation to knowledge and adoption of farmers in both Palghat and Cannanore. This is an indication of the right type of independent variables selected for the study. Since more number of variables were found to have significant relationship with knowledge and adoption, the significant variables were subjected to multivariate analysis, namely, multiple regression analysis, step wise regression analysis and path analysis for more meaningful interpretation of the results.

B. MULTIVARIATE ANALYSIS

1. Knowledge

For multivariate analysis, only those variables which were significantly correlated with knowledge in the case of both Palghat and Cannanore farmers were selected. The selected variables were age, education, area under rice, annual income, economic motivation, scientific orientation, personal guidance on better farming, mass media utilisation, social participation and extension participation.

i. Palghat

a. Multiple regression analysis

The results of the multiple regression analysis between the knowledge about fertiliser management practices of the farmers and the selected independent variables are presented in Table 11.

A high R^2 value of 0.6033 with significant F value (13.536) indicated that more than 60 per cent of the variation in knowledge could be explained by the 10 independent variables taken together.

The table reveals that out of the 10 variables selected, only four were significantly related with knowledge about fertiliser management practices. They were education, scientific orientation, extension participation and mass media utilisation with values 0.6937, 0.6328, 0.3934 and 0.2622 respectively. The results indicated that a unit increase in education could result in an increase of 0.6937 units in the knowledge of farmers about fertiliser management practices, other things being kept constant. Similarly one can interpret for the other variables viz., scientific orientation, extension participation and mass media utilisation.

As it was observed from Table 8, there is a fairly good amount of intercorrelation between the independent variables selected for the study which could account for multicollinearity. When multicollinearity prevails, one major problem is encountered in assessing the separate effects of the different independent variables. The estimated regression coefficient for one independent variable may vary substantially, depending on which other independent variables are included in the regression equation. One possible remedy is that one can drop some independent variables from the regression equation in order to lessen the degree of multicollinearity in the remaining variables (Neter et al., 1978). Hence step wise regression analysis was employed.

b. Step wise regression analysis

This was employed to select the best regression equation and thereby identify the best set of variables for predicting the dependent variable. The results of the step wise regression between knowledge about fertiliser management practices of the farmers and the selected independent variables are presented in Table 12.

From the table it could be seen that step No.I with only one variable (X_2) included, could explain more than

31 per cent variation in the knowledge about fertiliser management practices. The predictive power increases with the inclusion of each variable in the successive steps, till a particular step, when the percent variation do not increase significantly. That step which gives the highest per cent variation is taken as the last step in which all the variables included become significant. In the present case, Step No.IV gave the highest per cent variation.

It could be found that out of the total variation of 60.33 per cent explained by all the 10 variables together, 58.68 per cent of variation could be explained by four variables, viz., education (X_2), extension participation (X_{15}), scientific orientation (X_{10}) and mass media utilisation (X_{12}). Thus, these four variables became important in predicting the knowledge about fertiliser management practices in Palghat.

c. Path analysis

It is revealed from Table 13, which presents the results of path analysis, that the independent variables, education, extension participation, mass media utilisation and scientific orientation exerted the maximum direct effects on the knowledge about fertiliser management practices in the descending order (0.362, 0.341, 0.223 and

Table 11. Regression analysis of knowledge about fertiliser management practices with the selected independent variables (Palghat)

n = 100

Sl. No.	Variable No.	Independent variable	Regression coefficient 'b'	SE of 'b'	't' value
1	X_1	Age	0.0223	0.023	9.961
2	X_2	Education	0.6937	0.212	3.276**
3	X_3	Area under rice	-0.0047	0.039	-0.120
4	X_6	Annual income	0.00004	0.000041	0.985
5	X_9	Eeconomic motivation	-0.0798	0.124	-0.646
6	X_{10}	Scientific orientation	0.6328	0.204	3.102**
7	X_{11}	Personal guidance on better farming	0.0433	0.058	0.753
8	X_{12}	Mass media utilisation	0.2622	0.096	2.732**
9	X_{14}	Social participation	0.0723	0.137	0.528
10	X_{15}	Extension participation	0.3934	0.104	3.773**

$F = 13.536^{**}$

$R^2 = 0.6033$

** Significant at 1 per cent level

Table 12. Results of the step wise regression analysis of knowledge with selected independent variables (Palghat)

Step No.	Variable/s entering regression		Regression coefficient 'b'	SE of 'b'	't' value	Percentage variation explained
I	X_2	Education	0.5632	0.1599	3.522	31.72
II	X_2	Education	0.4610	0.1416	3.256	49.89
	X_{19}	Extension participation	0.4384	0.0925	4.739	
III	X_2	Education	0.4194	0.1387	3.024	54.17
	X_{15}	Extension participation	0.4258	0.5332	0.7985	
	X_{10}	Scientific orientation	0.2119	0.2037	1.040	
IV	X_2	Education	0.3227	0.1443	2.236	58.68
	X_{15}	Extension participation	0.3517	0.0898	3.916	
	X_{10}	Scientific orientation	0.2309	0.1952	1.183	
	X_{12}	Mass media utilisation	0.2500	0.0913	2.738	

Table 13. Results of the path analysis showing the direct and indirect effects of the independent variables on knowledge (Palghat)

Variable No.	Independent variable	Total effect	Direct effect	Variables through which substantial indirect effects are channelled		
				I	II	III
X_1	Age	-0.230	0.091	-0.234 (X_2)	-0.034 (X_{10})	-0.024 (X_{12})
X_2	Education	0.563	0.362	0.098 (X_{12})	0.073 (X_{15})	-0.058 (X_1)
X_3	Area under rice	0.353	-0.014	0.123 (X_2)	0.095 (X_{15})	0.094 (X_6)
X_6	Annual income	0.391	0.118	0.140 (X_2)	0.067 (X_{15})	0.053 (X_{12})
X_9	Economic motivation	0.317	0.051	0.157 (X_2)	0.063 (X_{15})	0.061 (X_{12})
X_{10}	Scientific orientation	0.345	0.220	0.076 (X_2)	0.033 (X_{15})	0.027 (X_6)
X_{11}	Personal guidance on better farming	0.285	0.055	-0.095 (X_{15})	0.070 (X_2)	0.054 (X_{12})
X_{12}	Mass media utilisation	0.533	0.223	0.159 (X_2)	0.119 (X_{15})	0.028 (X_6)
X_{14}	Social participation	0.323	0.041	0.119 (X_{15})	0.113 (X_2)	0.048 (X_{12})
X_{15}	Extension participation	0.546	0.341	0.084 (X_2) 0.084 (X_{12})	0.025 (X_6	0.023 (X_{10})

Residual effect = 0.397

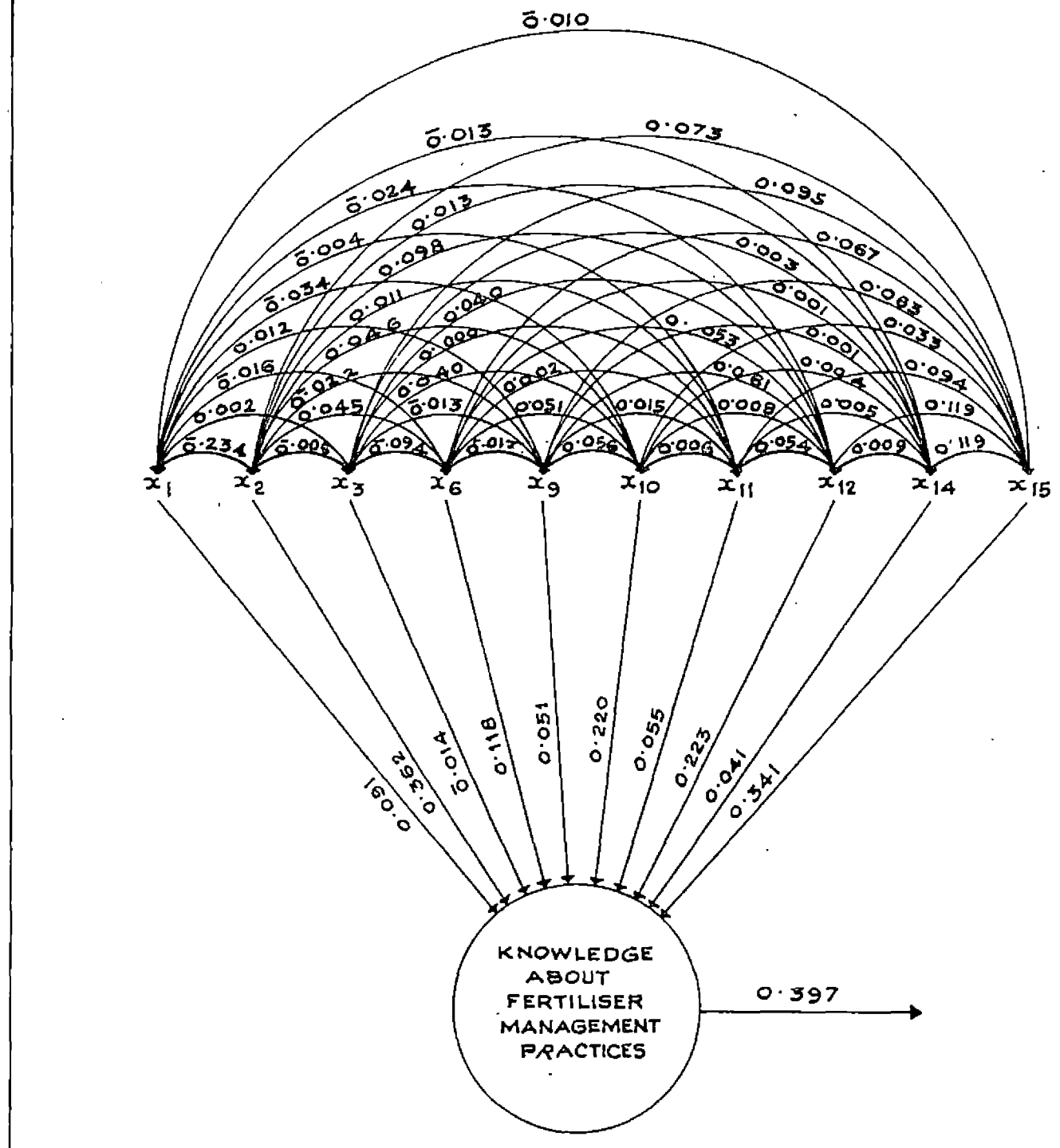


FIG. 4. PATH DIAGRAM SHOWING THE DIRECT AND INDIRECT EFFECTS OF INDEPENDENT VARIABLES ON KNOWLEDGE ABOUT FERTILISER MANAGEMENT PRACTICES (PALGHAT).

0.220 respectively). Annual income, age, personal guidance on better farming and economic motivation also had relatively higher values, while the remaining variables registered comparatively smaller effects on the level of knowledge.

Though the data were subjected to the above three types of analyses with specific purposes, the results of these analyses were uniform. These analyses unequivocally established the importance of these four variables namely, education, extension participation, scientific orientation and mass media utilisation in explaining the level of knowledge of farmers in Palghat.

The variable-wise discussion is presented below.

Education

Education widens the vision and minds of people and orient them to new experiences for betterment of their life and vocation. Higher level of education acts as a facilitator for progressive outlook. The significant relationship of this variable with the knowledge of fertiliser management practices indicated that education had helped the farmers to obtain knowledge about fertiliser management practices which is quite possible. In the present context, education had acted as a motivating force for information seeking and

use. Education might have also enabled them to interact with other different information sources and acquire more information about scientific management practices resulting in higher knowledge. Pandey and Ray (1977), Kaleel (1978), Somasundaram and Singh (1978) and Balachandran (1983) had also reported that formal education and level of knowledge of farmers were related.

Extension participation

Participation in extension activities provides a means for the self disclosure of individuals as suggested by the concept of Johari window, which opines that self disclosure is possible only if people are provided with different areas of information. The farmers who get opportunities to participate in the different extension activities are likely to receive information related to the package of practices to be followed for increased crop production. Fertiliser management practices being considered a vital practice for increased yield, these farmers might have absorbed this important message of the extension agencies and hence the present result.

Scientific orientation

When a farmer is favourably oriented to scientific farming, naturally his knowledge about different aspects of

scientific management practices will be high. The scientific mind of the farmer is likely to lead him to acquire more of information regarding better management practices for higher returns. Viewed in this angle, it is quite clear that, as scientific orientation increases, proportionate increase in knowledge also is likely to occur. Manivannan (1980), Kamarudeen (1981), Senthil (1983) amd Krishnamoorthi (1984) had also reported a positive and significant relation between scientific orientation and knowledge.

Mass media utilisation

Mass media such as the radio, television and news papers now-a-days give due importance to agricultural programmes and bring to the farmers practical knowledge on improved cultivation practices of various crops. Frequent exposure to several such types of programmes may induce a tendency in a farmer to acquire more information with the motive of setting higher performance in farming. A farmer who is exposed to information presented through media of literature, radio, television etc. is actually undergoing social learning which allows for a much more complex kind of response acquisition than simple imitation of role models. The concept of "information threshold" given by Gaikwad (1968) seems to be applicable in the present case, wherein exposure to a large number of information sources may

generate a force in an individual, to acquire more information, even without a deliberate or conscious effort. Chandrakandan (1982), Senthil (1983) and Godhandapani (1985) had also reported a significant relation between mass media utilisation and knowledge of farmers.

ii. Cannanore

a. Multiple regression analysis

The results of the multiple regression analysis between the knowledge about fertiliser management practices of the farmers and the selected independent variable are presented in Table 14.

The high R^2 value (0.6035) with significant F value of 13.545 indicated that more than 60 per cent of the variation in knowledge about fertiliser management practices could be explained by the 10 independent variables taken together.

The results in Table 14 indicate that only two variables, extension participation and mass media utilisation contributed significantly to the knowledge about fertiliser management practices in Cannanore. A unit increase in extension participation and also in mass media utilisation could result in an increase of 0.2711 units and 0.2180 units respectively in knowledge about fertiliser management practices, other things being kept constant.

b. Step wise regression analysis

The results of the step wise regression analysis between knowledge about fertiliser management practices of the farmers and the selected independent variables are presented in Table 15. From the table it could be seen that Step No.III gives the highest per cent variation and all the variables included are significant. It could be found that, the variables mass media utilisation (X_{12}), extension participation (X_{15}) and education (X_2) together explained 58.08 per cent of the total variation, where as all the ten variables combined together could explain only 60.35 per cent of the variation. Thus these three variables could be considered as important in predicting the knowledge about fertiliser management practices in the case of Cannanore farmers.

c. Path analysis

It is revealed from Table 16 which presents the results of path analysis that the independant variables mass media utilisation, extension participation and education exerted maximum direct effects on the knowledge about fertiliser management practices in the descending order (0.339, 0.295 and 0.188 respectively). Annual income, economic motivation and social participation also had relatively higher values

Table 14. Regression analysis of knowledge about fertiliser management practices with the selected independent variables (Cannanore)

n = 100

Sl. No.	Variable No.	Independent variable	Regression coefficient 'b'	SE of 'b'	't' value
1	X_1	Age	-0.0031	0.012	-0.251
2	X_2	Education	0.1652	0.117	1.409
3	X_3	Area under rice	-0.1553	0.145	-1.068
4	X_6	Annual income	0.0001	0.000064	1.553
5	X_9	Economic motivation	-0.1486	0.114	-1.299
6	X_{10}	Scientific orientation	-0.0256	0.044	-1.579
7	X_{11}	Personal guidance on better farming	0.0100	0.040	0.250
8	X_{12}	Mass media utilisation	0.2180	0.085	2.550*
9	X_{14}	Social participation	0.1497	0.100	1.490
10	X_{15}	Extension participation	0.2711	0.087	3.119**

F = 13.545**

R^2 = 0.6035

** Significant at 1 per cent level

* Significant at 5 per cent level

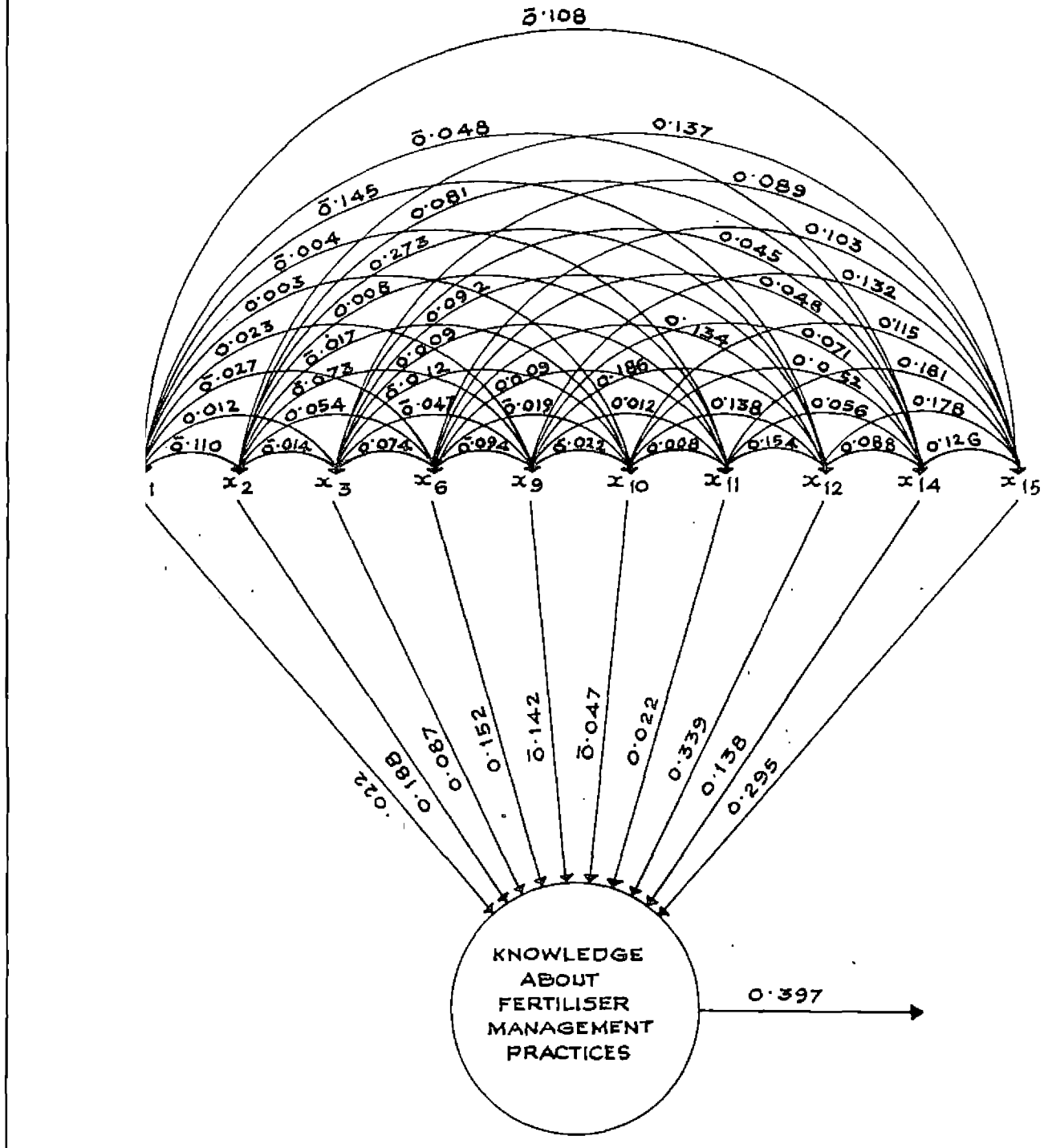
Table 15. Results of the step wise regression analysis of knowledge with selected independent variables (Cannanore)

Step No.	Variable/s entering regression		Regression coefficient 'b'	SE of 'b'	't' value	Percentage variation explained
I	X_{12}	Mass media utilisation	0.7156	0.0454	15.76	51.206
II	X_{12}	Mass media utilisation	0.5456	0.0541	10.085	56.26
	X_{15}	Extension participation	0.2819	0.0775	3.637	
III	X_{12}	Mass media utilisation	0.3575	0.0796	4.491	58.0865
	X_{15}	Extension participation	0.2896	0.0763	3.795	
	X_{2}	Education	0.2279	0.0978	2.330	

Table 16. Results of the path analysis showing the direct and indirect effects of the independent variables on knowledge (Cannanore)

Variable No.	Name of variable	Total effect	Direct effect	Variables through which substantial indirect effects are channelled		
				I	II	III
X_1	Age	-0.425	-0.022	0.145 (X_{12})	0.110 (X_2)	-0.108 (X_{15})
X_2	Education	0.650	0.188	0.273 (X_{12})	0.137 (X_{15})	0.081 (X_{14})
X_3	Area under rice	-0.197	0.087	0.092 (X_{12})	0.089 (X_{15})	0.074 (X_6)
X_6	Annual income	0.360	0.152	0.134 (X_{12})	0.103 (X_{15})	-0.094 (X_9)
X_9	Economic motivation	0.410	-0.142	0.186 (X_{12})	0.132 (X_{15})	0.101 (X_6)
X_{10}	Scientific orientation	0.308	-0.047	0.138 (X_{12})	0.115 (X_{15})	0.068 (X_2)
X_{11}	Personal guidance on better farming	-0.403	0.022	0.161 (X_{15})	0.154 (X_{12})	-0.077 (X_9)
X_{12}	Mass media utilisation	0.716	0.339	0.178 (X_{15})	0.152 (X_2)	0.088 (X_{14})
X_{14}	Social participation	0.541	0.138	0.216 (X_{12})	0.126 (X_{15})	0.110 (X_2)
X_{15}	Extension participation	0.611	0.295	0.204 (X_{12})	0.087 (X_2)	-0.064 (X_9)

Residual effect = 0.397



x_1 - AGE	x_{11} - PERSONAL GUIDANCE ON BETTER FARMING
x_2 - EDUCATION	x_{12} - MASS MEDIA UTILISATION
x_3 - AREA UNDER RICE	x_{14} - SOCIAL PARTICIPATION
x_6 - ANNUAL INCOME	x_{15} - EXTENSION PARTICIPATION
x_9 - ECONOMIC MOTIVATION	

FIG. 5. PATH DIAGRAM SHOWING THE DIRECT AND INDIRECT EFFECTS OF INDEPENDENT VARIABLES ON KNOWLEDGE ABOUT FERTILISER MANAGEMENT PRACTICES (CANNANORE).

while the remaining variables registered comparatively smaller effects on the level of knowledge.

As could be seen, the results of the above three types of analyses were comparable. While extension participation and mass media utilisation emerged significant in multiple regression analysis, step wise regression analysis and path analysis revealed mass media utilisation, extension participation and education as the most important variables. The results of the analysis of Cannanore farmers are comparable with those of Palghat except for scientific orientation.

Scientific orientation as such is a psychological attribute, which has a bearing on the natural environment. As pointed out earlier, it is a fact that the prevailing scenario of Cannanore is not much conducive to develop a favourable orientation of farmers towards scientific farming, unlike their counter parts in Palghat. In this regard, Byrne had remarked that individuals have a learned drive to be logical and to interpret correctly their stimulus world. Presumably, this may reveal why scientific orientation had not emerged as a significant variable in the present case.

The same arguments put forth earlier for explaining the significant relationship of education, extension

participation and mass media utilisation with knowledge of Palghat farmers hold good in the case of farmers of Cannanore also.

iii. Pooled sample

a. Multiple regression analysis

The results of the multiple regression analysis between the knowledge about fertiliser management practices of the sample of farmers of both Palghat and Cannanore and the selected independent variables are presented in Table 17.

It was found that 64.48 per cent of the variation in the knowledge of farmers was due to the 10 variables included as indicated by the coefficient of determination (R^2). This variation was found to be significant (F = 34.313).

The table reveals that out of the 10 variables selected, only three were found significantly contributing to the level of knowledge about fertiliser management practices of farmers. They are education, extension participation and mass media utilisation. The results indicated that a unit increase in education could result in an increase of 0.4475 units in the knowledge of farmers about fertiliser management practices, other things being kept constant. Similarly the results can be interpreted for extension participation and mass media utilisation.

b. Step wise regression analysis

The results of the step wise regression analysis between knowledge about fertiliser management practices of the farmers and the selected independent variables are presented in Table 18. The table elucidates that Setp No.V gives the highest per cent variation wherein all the variables included are significant. It can be found that out of the total variation of 64.48 per cent explained by all the 10 variables together, 63.32 per cent variation was explained by the five variables viz. education (X_2), extension participation (X_{15}), annual income (X_6), mass media utilisation (X_{12}) and area under rice (X_3). These variables, therefore, could be considered as important for predicting the knowledge about fertiliser management practices of farmers in general.

c. Path analysis

It is revealed from Table 19 which presents the results of the path analysis that the independent variables education, extension participation, mass media utilisation and annual income exerted the maximum direct effects on the knowledge about fertiliser management practices in the descending order (0.306, 0.288, 0.172 and 0.135 respectively). Area under rice, economic motivation and social participation

Table 18. Results of the step wise regression analysis of knowledge with selected independent variables (Pooled Sample)

Step No.	Variable/s entering regression		Regression coefficient 'b'	SE of 'b'	't' value	Percentage variation explained
I	X_2	Education	0.6586	0.0782	8.42	43.38
II	X_2	Education	0.4668	0.0755	6.182	58.04
	X_{15}	Extension participation	0.4282	0.0657	6.517	
III	X_2	Education	0.3951	0.0768	5.144	61.456
	X_{15}	Extension participation	0.3890	0.0642	6.059	
	X_6	Annual income	0.2082	0.1343	1.551	
IV	X_2	Education	0.2945	0.0939	3.136	62.7929
	X_{15}	Extension participation	0.3388	0.0677	5.004	
	X_6	Annual income	0.2076	0.1384	1.500	
	X_{12}	Mass media utilisation	0.1749	0.691	2.531	
V	X_2	Education	0.2871	0.0937	3.064	63.318
	X_{15}	Extension participation	0.3194	0.0690	4.628	
	X_6	Annual income	0.1102	0.0689	1.601	
	X_{12}	Mass media utilisation	0.1905	0.0695	2.741	
	X_3	Area under rice	0.1262	0.0316	3.993	

Table 17. Regression analysis of knowledge about fertiliser management practices with the selected independent variables (Pooled Sample)

n = 200

Sl. No.	Variable No.	Independent variables	Regression coefficient 'b'	SE of 'b'	't' value
1	X_1	Age	-0.0109	0.013	0.825
2	X_2	Education	0.4475	0.120	3.722**
3	X_3	Area under rice	0.0455	0.032	1.419
4	X_6	Annual income	0.00003	0.000018	1.695
5	X_9	Economic motivation	-0.1439	0.088	-1.639
6	X_{10}	Scientific orientation	0.0444	0.055	0.803
7	X_{11}	Personal guidance on better farming	0.0347	0.039	0.898
8	X_{12}	Mass media utilisation	0.1794	0.071	2.518*
9	X_{14}	Social participation	0.1096	0.092	1.191
10	X_{15}	Extension participation	0.3661	0.075	4.884**

F_2 = 34.313**
R^2 = 0.6448

** Significant at 1 per cent level
* Significant at 5 per cent level

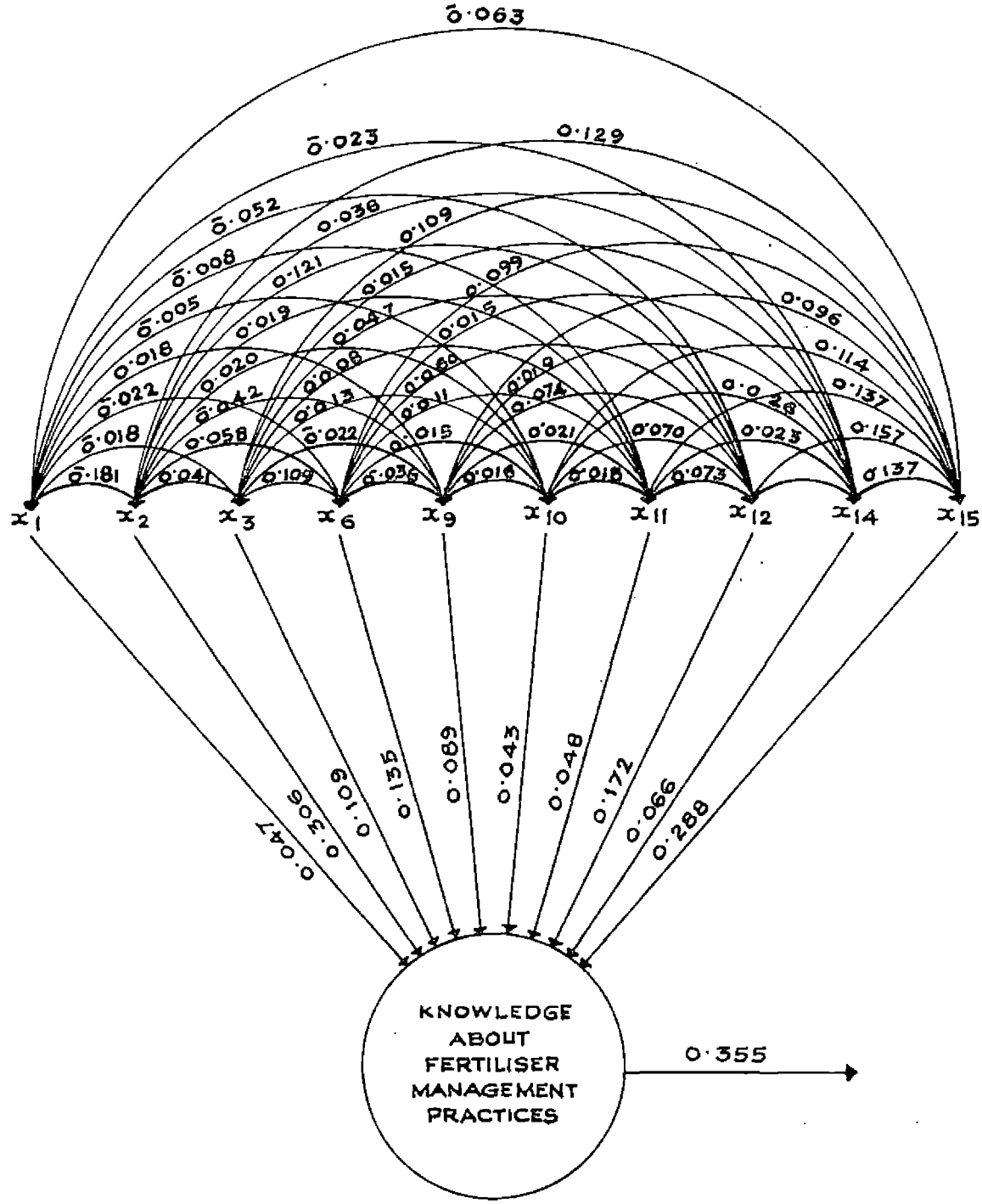
Table 18. Results of the step wise regression analysis of knowledge with selected independent variables (Pooled Sample)

Step No.	Variable/s entering regression		Regression coefficient 'b'	SE of 'b'	't' value	Percentage variation explained
I	X_2	Education	0.6586	0.0782	8.42	43.38
II	X_2	Education	0.4668	0.0755	6.182	58.04
	X_{15}	Extension participation	0.4282	0.0657	6.517	
III	X_2	Education	0.3951	0.0768	5.144	61.456
	X_{15}	Extension participation	0.3890	0.0642	6.059	
	X_6	Annual income	0.2082	0.1343	1.551	
IV	X_2	Education	0.2945	0.0939	3.136	62.7929
	X_{15}	Extension participation	0.3388	0.0677	5.004	
	X_6	Annual income	0.2076	0.1384	1.500	
	X_{12}	Mass media utilisation	0.1749	0.691	2.531	
V	X_2	Education	0.2871	0.0937	3.064	63.318
	X_{15}	Extension participation	0.3194	0.0690	4.628	
	X_6	Annual income	0.1102	0.0689	1.601	
	X_{12}	Mass media utilisation	0.1905	0.0695	2.741	
	X_3	Area under rice	0.1262	0.0316	3.993	

Table 19. Results of the path analysis showing the direct and indirect effects of independent variables on knowledge (Pooled Sample)

Variable No.	Name of variable	Total effect	Direct effect	Variables through which substantial indirect effects are channelled		
				I	II	III
X_1	Age	-0.307	0.047	0.181 (X_2)	-0.063 (X_{15})	-0.052 (X_{12})
X_2	Education	0.659	0.306	0.129 (X_{15})	0.121 (X_{12})	0.058 (X_6)
X_3	Area under rice	0.494	0.109	0.114 (X_2)	0.109 (X_{15})	0.109 (X_6)
X_6	Annual income	0.511	0.135	0.131 (X_2)	0.099 (X_{15})	0.088 (X_3)
X_9	Economic motivation	0.354	0.089	0.146 (X_2)	0.096 (X_{15})	0.074 (X_{12})
X_{10}	Scientific orientation	0.453	0.043	0.140 (X_2)	0.114 (X_{15})	0.070 (X_{12})
X_{11}	Personal guidance on better farming	0.420	0.048	0.118 (X_2)	0.137 (X_{15})	0.073 (X_{12})
X_{12}	Mass media utilisation	0.640	0.172	0.216 (X_2)	0.157 (X_{15})	0.047 (X_6)
X_{14}	Social participation	0.502	0.066	0.166 (X_2)	0.137 (X_{15})	0.087 (X_{12})
X_{15}	Extension participation	0.637	0.288	0.137 (X_2)	0.094 ($X_{\_}$)	0.046 (X_6)

Residual effect = 0.355



x_1 - AGE	x_{11} - PERSONAL GUIDANCE ON BETTER FARMING
x_2 - EDUCATION	
x_3 - AREA UNDER RICE	x_{12} - MASS MEDIA UTILISATION
x_6 - ANNUAL INCOME	x_{14} - SOCIAL PARTICIPATION
x_9 - ECONOMIC MOTIVATION	x_{15} - EXTENSION PARTICIPATION

FIG. 6. PATH DIAGRAM SHOWING THE DIRECT AND INDIRECT EFFECTS OF INDEPENDENT VARIABLES ON KNOWLEDGE ABOUT FERTILISER MANAGEMENT PRACTICES (POOLED SAMPLE).

also had relatively higher values, while the remaining variables registered comparatively smaller effects on the level of knowledge.

The above results clearly showed that eventhough the pooled data were subjected to the above three analyses, the results obtained were more or less uniform. Education, extension participation and mass media utilisation emerged as the most important variables in all the three analyses. Annual income also emerged as a significant variable in step wise regression analysis and path analysis, while area under rice was also significant in step wise regression.

Annual income

Farmers with higher income are likely to have more access to different mass media sources including both the print and electronic media. It is a known fact that now-a-days, a lot of information regarding scientific farming is being disseminated through these sources. Analysed in this way, one could clearly trace the relation between knowledge and annual income. Vijayaraghavan and Somasundaran (1977) had revealed that socioeconomic status and knowledge of farmers were significantly related. Acharya and Bhowmik (1978) had also noted that degree of knowledge of farmers had a positive and significant relationship with their income.

Area under rice

It is possible that farmers with less area under rice may not take pains to acquire knowledge regarding scientific cultivation practices on account of their judgement or feeling that the scientific technologies are not scaleneutral. Though this may not be true always and in all cases, majority of small farmers still hold this notion. Farmers with more area under rice are generally economic-minded and they invariably have the motive to get higher returns from farming, which they knew by themselves could be possible only by adoption of scientific management practices. To make the farmers adopt these scientific management practices, it is inevitable that knowledge about these practices becomes a pre-requisite. The above could be the probable reason for the emergence of area under rice as a significant variable in the step wise regression analysis.

The same arguments put forth earlier for explaining the significant relationship of education, extension participation and mass media utilisation hold good here also.

2. Adoption

For multivariate analysis, only those variables which were significantly related with adoption at both Palghat

anc Cannanore were selected. The selected variables were education, area under rice, annual income, attitude towards fertiliser use, economic motivation, extension participation, credit utilisation and knowledge about fertiliser management practices.

i. Palghat

a. Multiple regression analysis

The results of the multiple regression analysis between the adoption of fertiliser management practices by the farmers and the selected independent variables are presented in Table 20.

The R^2 value of 0.3463 indicated that only 34.63 per cent of the variation in the adoption of fertiliser management practices was explained by the eight independent variables together, which was found significant as indicated by the F value (6.026).

The table reveals that out of the 8 variables selected, only 2 were significantly contributing to adoption of fertiliser management practices. They are education and attitude towards fertiliser use. The results indicated that a unit increase in education of the farmers could result in an increase of 0.8332 units in the adoption of fertiliser

management practices other things being kept constant. Similarly a unit increase in the attitude towards fertiliser use could result in an increase of 0.4603 units in the adoption.

b. Step wise re

The results of the step wise regression analysis between the adoption of fertiliser management practices by the farmers and the selected independent variables are presented in Table 21.

A perusal of the table reveals that Step No.IV gives the highest per cent variation wherein all the variables included are significant. It is seen that out of the total variation of 34.63 per cent explained by all the eight variables together, 33.53 per cent variation was explained by the four variables viz. education (X_2), attitude towards fertiliser use (X_8), economic motivation (X_9) and credit utilisation (X_{16}). These variables, therefore, could be considered as important for predicting the adoption of fertiliser management practices of farmers in Palghat.

c. Path analysis

The results of the path analysis of selected independent variables on the adoption of fertiliser manage-practices by the farmers are furnished in Table 22.

Table 20. Regression analysis of adoption of fertiliser management practices with the selected independent variables (Palghat)

(n = 100)

Sl. No.	Variable No.	Independent variable	Regression coefficient 'b'	SE of 'b'	't' value
1	X_2	Education	0.8332	0.312	2.669**
2	X_3	Area under rice	-0.0376	0.071	-0.531
3	X_6	Annual income	0.00003	0.000033	0.902
4	X_8	Attitude towards fertiliser use	0.4603	0.211	2.183*
5	X_9	Economic motivation	0.3811	0.232	1.643
6	X_{15}	Extension participation	0.0659	.192	0.343
7	X_{16}	Credit utilisation	0.5425	.357	1.520
8	X_{17}	Knowledge about fertiliser management practices	0.0628	0.178	0.352

$F = 6.026^{**}$

$R^2 = 0.3463$

** Significant at 1 per cent level

* Significant at 5 per cent level

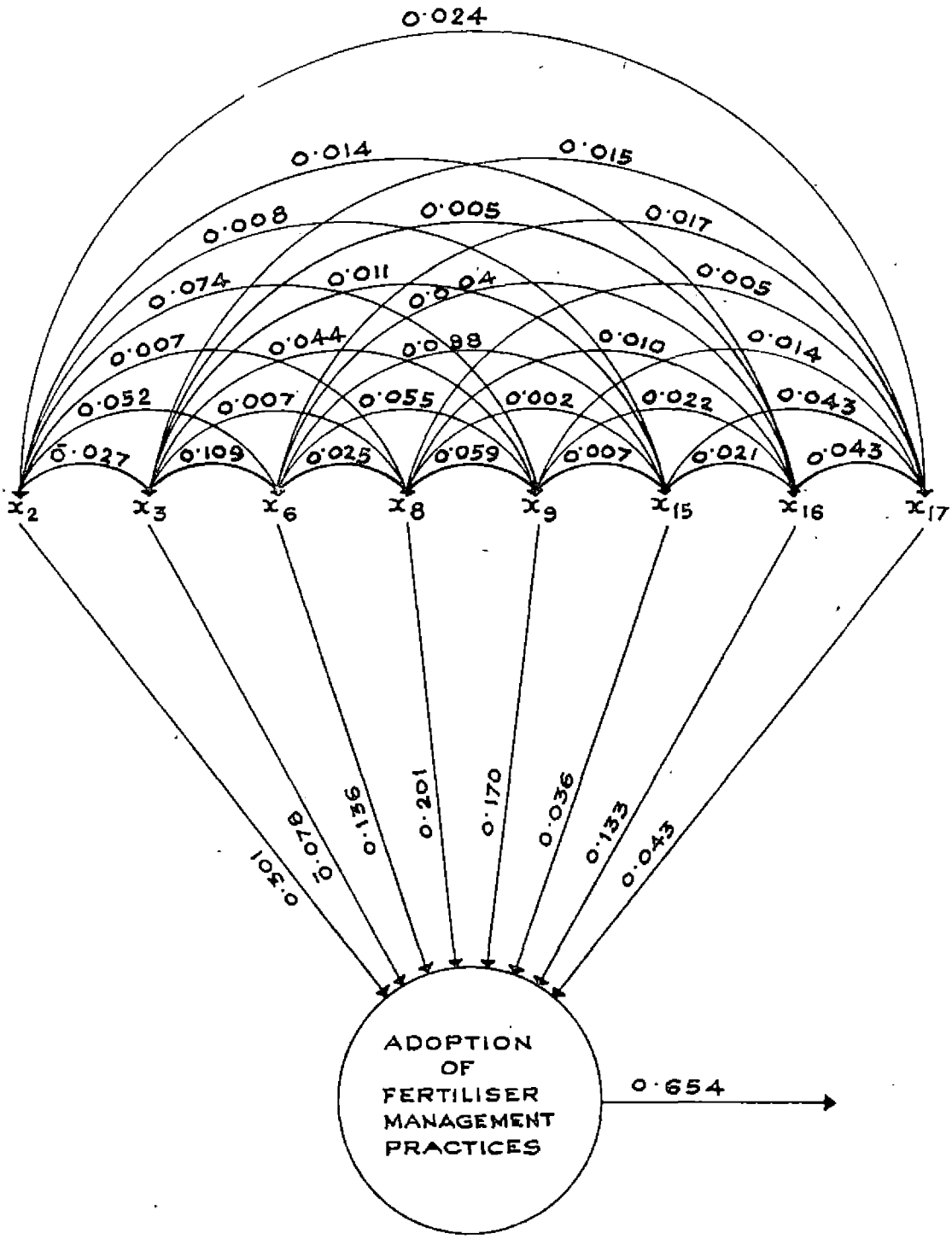
Table 21. Results of the step wise regression analysis of adoption of fertiliser management practices with selected independent variables (Palghat)

Step No.	Variable/s entering regression		Regression coefficient 'b'	SE of 'b'	't' value	Percentag variation explained
I	X_2	Education	0.4540	0.2492	1.82	20.612
II	X_2	Education	0.4444	0.2373	1.87	28.815
	X_8	Attitude towards fertiliser use	0.2866	0.1962	1.46	
III	X_2	Education	0.3565	0.2616	1.36	31.842
	X_8	Attitude towards fertiliser use	0.2180	0.2074	1.05	
	X_9	Economic motivation	0.2076	0.2254	0.92	
IV	X_2	Education	0.3508	0.2598	1.35	33.536
	X_8	Attitude towards fertiliser use	0.2141	0.2060	1.04	
	X_9	Economic motivation	0.1892	0.2253	0.84	
	X_{16}	Credit utilisation	0.1322	0.3467	0.38	

Table 22. Results of the path analysis showing the direct and indirect effects of the independent variables on adoption (Palghat)

Variable No.	Name of variable	Total effect	Direct effect	Variables through which substantial indirect effects are channelled		
				I	II	III
X_2	Education	0.454	0.301	0.074 (X_9)	0.052 (X_6)	0.027 (X_3)
X_3	Area under rice	0.215	-0.078	0.109 (X_6)	0.102 (X_2)	0.044 (X_9)
X_6	Annual income	0.298	0.136	0.116 (X_2)	-0.063 (X_3)	0.055 (X_9)
X_8	Attitude towards fertiliser use	0.301	0.201	0.059 (X_9)	0.017 (X_6)	0.010 (X_2) 0.010
X_9	Economic motivation	0.438	0.170	0.131 (X_2)	0.069 (X_8)	0.044 (X_{16})
X_{15}	Extension participation	0.203	0.036	0.070 (X_2)	0.034 (X_9)	0.029 (X_6)
X_{16}	Credit utilisation	0.217	0.133	0.031 (X_2)	0.029 (X_9)	0.016 (X_8)
X_{17}	Knowledge about fertiliser management practices	0.339	0.043	0.169 (X_2)	0.054 (X_9)	0.053 (X_6)

Residual effect = 0.654



x_2 - EDUCATION	x_9 - ECONOMIC MOTIVATION
x_3 - AREA UNDER RICE	x_{15} - EXTENSION PARTICIPATION
x_6 - ANNUAL INCOME	x_{16} - CREDIT UTILISATION
x_8 - ATTITUDE TOWARDS FERTILISER USE.	x_{17} - KNOWLEDGE ABOUT FERTILISER MANAGEMENT PRACTICES.

FIG.7. PATH DIAGRAM SHOWING THE DIRECT AND INDIRECT EFFECTS OF INDEPENDENT VARIABLES ON ADOPTION OF FERTILISER MANAGEMENT PRACTICES (PALGHAT).

It is revealed from Table 22, that the independent variables, education, attitude towards fertiliser use and economic motivation exerted the maximum direct effects on the adotpion of fertiliser management practices in the descending order (0.301, 0.201 and 0.170 respectively). Annual income and credit utilisation also had relatively higher values, while the remaining variables registered comparatively smaller effects on the adoption of fertiliser management practices.

It could be seen that the same data when subjected to the three types of analyses, namely, multiple regression analysis, step wise regression analysis and path analysis yielded more or less comparable results. Education and attitude towards fertiliser use emerged as important in all the three analysis. Economic motivation emerged as significant in step wise regression and path analysis while credit utilisation also became significant in step wise regression.

The variable wise discussion is presented below.

Education

The significance of education in relation to adoption lies in the essence of the learning process that unlocks the mental apathy of the farmers to admit 'new' ideas and

practices, so that they could perceive these ideas in their proper perspective. Education enables the farmers to perceive the role and importance of plant nutrients in crop production which make them more nutrient conscious. No doubt, such farmers will be more inclined to adopt fertiliser management practices for increased crop production, and hence the observed result.

Attitude towards fertiliser use

The relationship between benefits which an individual associates with an object and the attitude towards the object had been set forth in several versions of attitude behaviour consistency (Fishbein and Raven, 1962; Mc Guire, 1969). If an individual has a favourable attitude towards an object, naturally that may reflect in his response towards the object and hence the obtained result. Janakiramaraju (1978), Singh and Ray (1985) and Balan (1987) had also reported significant relation between attitude towards fertiliser use and level of fertiliser use by farmers.

Economic motivation

Economic motivation may be regarded as one indication of the degree of willingness of a farmer for investment of his available potential resource in adopting farm innovations, for higher returns. Fertiliser being a costly input, its

level of use greatly depends on how the farmers view the application of fertilisers in attaining high profits. Those farmers with the desire to maximise their profit from crop production naturally use fertilisers since they get additional profit by the use of fertilisers. The additional returns which they get could more than compenstate for the cost of fertilisers, which might have economically motivated them to use higher level of fertilisers. Singh and Ray (1985) and Jayaramaiah (1987) had also reported significant relation between economic motivation and level of fertiliser use of the farmers.

Credit utilisation

Farmers can adopt any innovation only if they are endowed with adequate resources. Farmers seek and avail credit when their resources are inadequate to take advantage of profitable investment opportunities. Adoption of scientific management practices usually need more money to be invested by the farmers. Unless there is some financial support in the form of credit, adoption of the practices may not be rendered possible for a good majority of the farmers. Hence the observed relation between credit utilisation and adoption of fertilisers is quite understandable. FAI (1988) and Pandey (1988) had reported that amount of credit plays an important role in increasing fertiliser

use. Padmaraj (1983) and Sharma (1985) had also pointed out non-availability of credit as an important constraint in fertiliser use.

ii. Cannanore

a. Multiple regression analysis

The results of the multiple regression analysis between the adoption of fertiliser management practices of the farmers and the selected independent variables are presented in Table 23.

The R^2 value of 0.3629 explains that 36.29 per cent of the variation in the adoption of fertiliser management practices was explained by the eight independent variables taken together, which was found to be significant as indicated by the F value (6.478).

The results reveale that only two variables knowledge about fertiliser management practices and credit utilisation contribute significantly to the adoption of fertiliser management practices in Cannanore. A unit increase in the knowledge of farmers about fertiliser management practices could result in an increase of 1.0684 units in the adoption of fertiliser management practices, other things being kept constant. Similarly, a unit increase in credit utilisation could result in an increase of 2.4106 units in the adoption of fertiliser management practices of the farmers of Cannanore.

b. Step wise regression analysis

The results of the step wise regression analysis between adoption of fertiliser management practices by the farmers and the selected independent variables are presented in Table 24.

From the table it could be seen that Step No.III gives the highest per cent variation in adoption with the variables knowledge about fertiliser management practices (X_{17}), credit utilisation (X_{16}) and attitude towards fertiliser use (X_8) together explaining 34.98 of the total variation while all the eight variables combined together explained only 36.29 per cent of the variation in adoption. Thus these three variables could be considered as important in predicting the adoption of fertiliser management practices of the farmers of Cannanore.

c. Path analysis

The results of the path analysis of selected independent variables on the adoption of fertiliser management practices are furnished in Table 25.

It is revealed from Table 25 that knowledge about fertiliser management practices, credit utilisation and attitude towards fertiliser use exerted the maximum direct

Table 23. Regression analysis of adoption of fertiliser management practices with the selected independent variables (Cannanore)

Sl. No.	Variable No.	Independent variable	Regression coefficient 'b'	SE of 'b'	't' value
1	X_2	Education	-0.2275	0.258	-0.880
2	X_3	Area under rice	0.2293	0.438	0.524
3	X_6	Annual income	-0.0001	0.000102	-0.976
4	X_8	Attitude towards fertiliser use	0.4166	0.288	1.446
5	X_9	Economic motivation	0.1646	0.415	0.397
6	X_{15}	Extension participation	0.0450	0.260	0.173
7	X_{16}	Credit utilisation	2.4106	0.945	2.552*
8	X_{17}	Knowledge about fertiliser management practices	1.0684	0.311	3.430**

$F = 6.478^{**}$

$R^2 = 0.3629$

** Significant at 1 per cent level

* Significant at 5 per cent level

Table 24. Results of the step wise regression analysis of adoption of fertiliser management practices with selected independent variables (Cannanore)

Step No.	Variable/s entering regression		Regression coefficient 'b'	SE of 'b'	't' value	Percentage variation explained
I	X_{17}	Knowledge about fertiliser management practices	0.4988	0.2177	2.29	24.881
II	X_{17}	Knowledge about fertiliser management practices	0.4257	0.2154	1.97	32.179
	X_{16}	Credit utilisation	0.2799	0.8605	0.33	
III	X_{17}	Knowledge about fertiliser management practices	0.3714	0.2221	1.67	34.989
	X_{16}	Credit utilisation	0.2328	0.8774	0.27	
	X_{8}	Attitude towards fertiliser use	0.1860	0.1965	0.95	

Table 25. Results of the path analysis showing the direct and indirect effects of the independent variables on adoption (Cannanore)

Variable No.	Name of variable	Total effect	Direct effect	Variables through which substantial indirect effects are channelled		
				I	II	III
X_2	Education	0.301	-0.104	0.279 (X_{17})	0.074 (X_8)	0.046 (X_{16})
X_3	Area under rice	0.210	0.052	0.085 (X_{17})	0.075 (X_{16})	-0.059 (X_{16})
X_6	Annual income	0.262	-0.122	0.155 (X_{17})	0.099 (X_8)	0.094 (X_{16})
X_8	Attitude towards fertiliser use	0.396	0.194	0.154 (X_{17})	0.080 (X_{16})	-0.062 (X_6)
X_9	Economic motivation	0.345	0.063	0.176 (X_{17})	0.148 (X_8)	-0.081 (X_6)
X_{15}	Extension participation	0.395	0.020	0.262 (X_{17})	0.084 (X_8)	0.076 (X_{16})
X_{16}	Credit utilisation	0.391	0.243	0.112 (X_{17})	0.064 (X_8)	-0.047 (X_6)
X_{17}	Knowledge about fertiliser management practices	0.499	0.430	-0.069 (X_8)	0.068 (X_2)	0.063 (X_{16})

Residual effect = 0.637

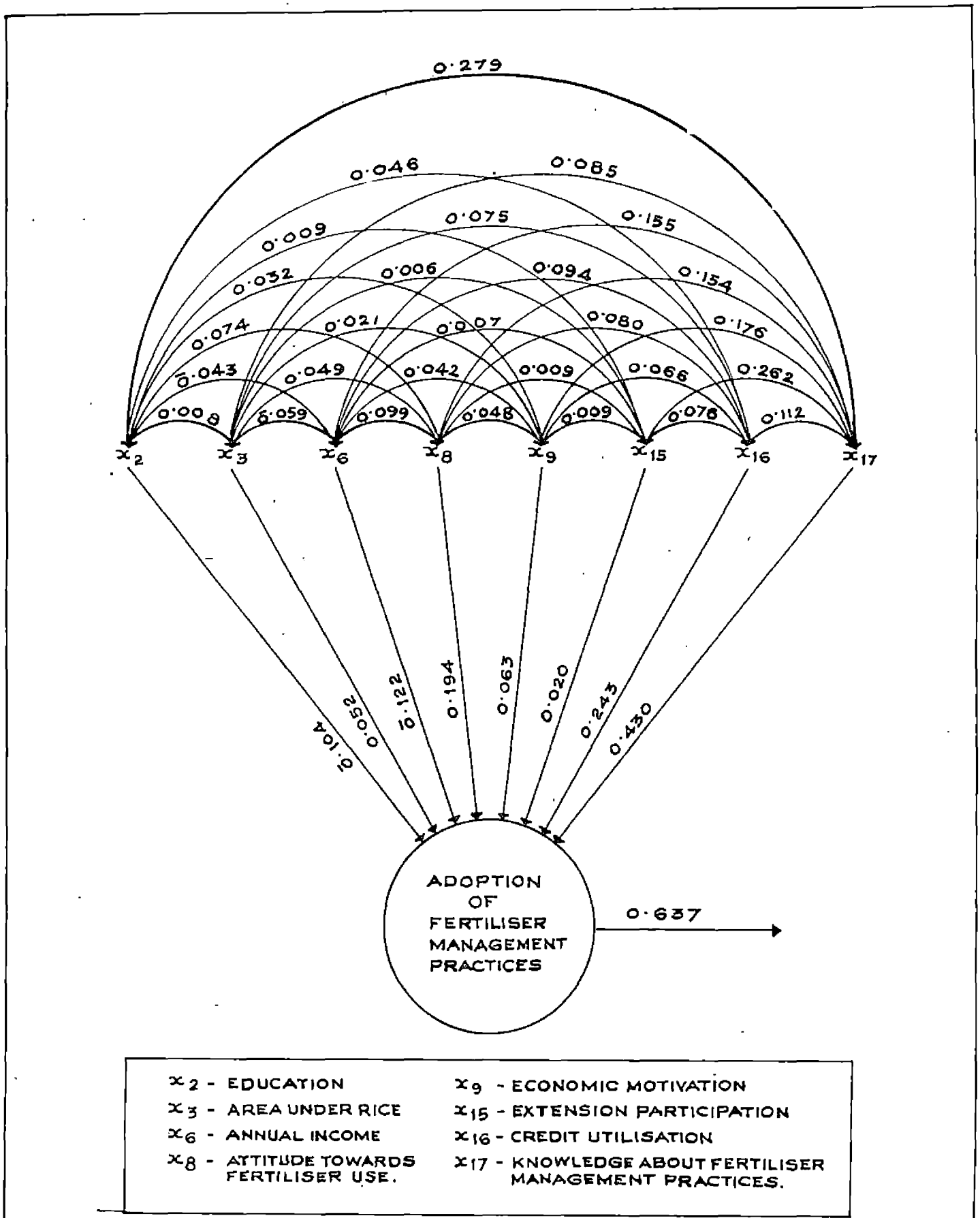


FIG. 8. PATH DIAGRAM SHOWING THE DIRECT AND INDIRECT EFFECTS OF INDEPENDENT VARIABLES ON ADOPTION OF FERTILISER MANAGEMENT PRACTICES (CANNANORE).

effects on the adoption of fertiliser management practices in the descending order (0.430, 0.243 and 0.194 respectively). Annual income and education also had relatively higher values, while the remaining variables registered comparatively smaller effects on the adoption of fertiliser management practices.

The results of multiple regression analysis, step wise regression analysis and path analysis of the data of Cannanore farmers presented above gave similar results. Knowledge about fertiliser management practices and credit utilisation were found significant in all the three types of analysis. Attitude towards fertiliser use emerged as significant in step wise regression analysis and path analysis.

Knowledge

Knowledge is one of the three components of behaviour, which is vital for the adoption of any practice. It exercises not only a direct contribution to adoption, but also indirectly influences the effect of other variables as is evident from the results of the path analysis given in Table 25. The concept of information influence as given by Deutsch and Gerard (1955) which operates when an individual possesses adequate knowledge is largely determined by a tendency to conform with the knowledge level, which could be a possible

reason for a positive relationship between knowledge and adoption. In this context, Narayanappa (1978) and Waghmare and Pandit (1982) had reported lack of knowledge as a major constraint in the adoption of fertiliser management practices, which highlights the importance of knowledge in adoption.

The same arguments putforth earlier for explaining the significant relationship of credit utilisation and attitude towards fertiliser use with adoption hol here also.

iii. Pooled sample

a. Multiple regression analysis

The results of the multiple regression analysis between the adoption of fertiliser management practices of the pooled sample of farmers of both Palghat and Cannanore and the selected independent variables are presented in Table 26.

The high R^2 value (0.6002) with significant F value of 35.85 indicates that 60 per cent of the variation in adoption of fertiliser management practices could be explained by the eight independent variables taken together.

The results reveal that only four variables, area under rice, attitude towards fertiliser use, credit utilisation and knowledge about fertiliser management practices contributes significantly to the adoption of fertiliser management practices. The results indicated that a unit increase in the knowledge about fertiliser management practices could result in an increase of 0.9956 units in the adoption of fertiliser management practices of farmers in general, other things being kept constant. The results can be interpreted in the same way for area under rice, attitude towards fertiliser use and credit utilisation.

b. Step wise regression analysis

The results of the step wise regression analysis between adoption of fertiliser management practices of the pooled sample of farmers of both Palghat and Cannanore and the selected independent variables are presented in Table 27.

The table epitomises that Step No.IV gives the highest per cent variation with all the variables included found significant. It is seen that knowledge about fertiliser management practices (X_{17}), credit utilisation (X_{16}), attitude towards fertiliser use (X_8) and area under rice (X_3) together explained 58.99 per cent of the total variation,

whereas all the eight variables combined together could explain only 60.02 per cent of the variation in adoption. These four variables thus could be considered as important in predicting the adoption of fertiliser management practices of farmers in general.

c. Path analysis

The results of the path analysis of selected independent variables on the adoption of fertiliser management practices are furnished in Table 28.

It is revealed from the table that the knowledge about fertiliser management practices, credit utilisation and attitude towards fertiliser use exerted maximum direct effects on the adoption of fertiliser management practices in the descending order (0.370, 0.338 and 0.206 respectively). Area under rice, education and economic motivation also had relatively higher values while the remaining variables registered comparatively smaller effects on the adoption of fertiliser management practices.

The pooled sample when subjected to the above three types of analyses revealed that knowledge about fertiliser management practices, credit utilisation and attitude towards fertiliser use were the most important variables in determining adoption, since all the three analyses

Table 26. Regression analysis of adoption of fertiliser management practices with the selected independent variables (Pooled Sample) (n = 200)

Sl. No.	Variable No.	Independent variable	Regression coefficient 'b'	SE of 'b'	't' value
1	X_2	Education	0.4185	0.257	1.626
2	X_3	Area under rice	0.2038	0.091	2.227*
3	X_6	Annual income	-0.00003	0.000056	-0.537
4	X_8	Attitude towards fertiliser use	0.7984	0.222	3.602**
5	X_9	Economic motivation	-0.3884	0.269	-1.444
6	X_{15}	Extension participation	-0.1594	0.211	-0.756
7	X_{16}	Credit utilisation	5.2654	0.825	6.379**
8	X_{17}	Knowledge about fertiliser management practices	0.9956	0.201	4.957**

$F = 35.845^{**}$ ** Significant at 1 per cent level

$R^2 = 0.6002$ * Significant at 5 per cent level

Table 27. Results of the step wise regression analysis of adoption of fertiliser management practices with selected independent variables (Pooled Samples)

Step No.	Variable entering regression		Regression coefficient 'b'	SE of 'b'	't' value	Percentage variation explained
I	X_{17}	Knowledge about fertiliser management practices	0.6516	0.1453	4.484	42.457
II	X_{17}	Knowledge about fertiliser management practices	0.4850	0.1416	3.425	55.28
	X_{16}	Credit utilisation	0.3950	0.8182	0.482	
III	X_{17}	Knowledge about fertiliser management practices	0.4489	0.1417	3.167	57.499
	X_{16}	Credit utilisation	0.3623	0.8153	0.444	
	X_{8}	Attitude towards fertiliser use	0.1598	0.1934	0.826	
IV	X_{17}	Knowledge about fertiliser management practices	0.3875	0.1527	2.537	58.994
	X_{16}	Credit utilisation	0.3386	0.8148	0.415	
	X_{8}	Attitude towards fertiliser use	0.1628	0.1905	0.854	
	X_{3}	Area under rice	0.1427	0.0602	2.370	

Table 28. Results of the path analysis showing the direct and indirect effects of the indepentdent variables on adoption (Pooled Sample)

Variable No.	Name of variable	Total effect	Direct effect	Variables through which substantial indirect effects are channelled		
				I	II	III
X_2	Education	0.533	0.106	0.243 (X_{17})	0.132 (X_{16})	0.067 (X_3) 0.067 (X_8)
X_3	Area under rice	0.476	0.181	0.183 (X_{17})	0.116 (X_{16})	0.039 (X_2)
X_6	Annual income	0.462	-0.045	0.189 (X_{17})	0.146 (X_3)	0.118 (X_{16})
X_8	Attitude towards fertiliser use	0.408	0.206	0.115 (X_{17})	0.101 (X_{16})	-0.051 (X_9)
X_9	Economic motivation	0.319	0.089	0.131 (X_{17})	0.117 (X_8)	0.099 (X_{16})
X_{15}	Extension participation	0.453	-0.46	0.236 (X_{17})	0.129 (X_{16})	0.068 (X_3)
X_{16}	Credit utilisation	0.600	0.338	0.156 (X_{17})	0.062 (X_3)	0.062 (X_8)
X_{17}	Knowledge about fertiliser management practices	0.652	0.370	0.143 (X_{16})	0.090 (X_3)	0.070 (X_2)

Residual effect = 0.400

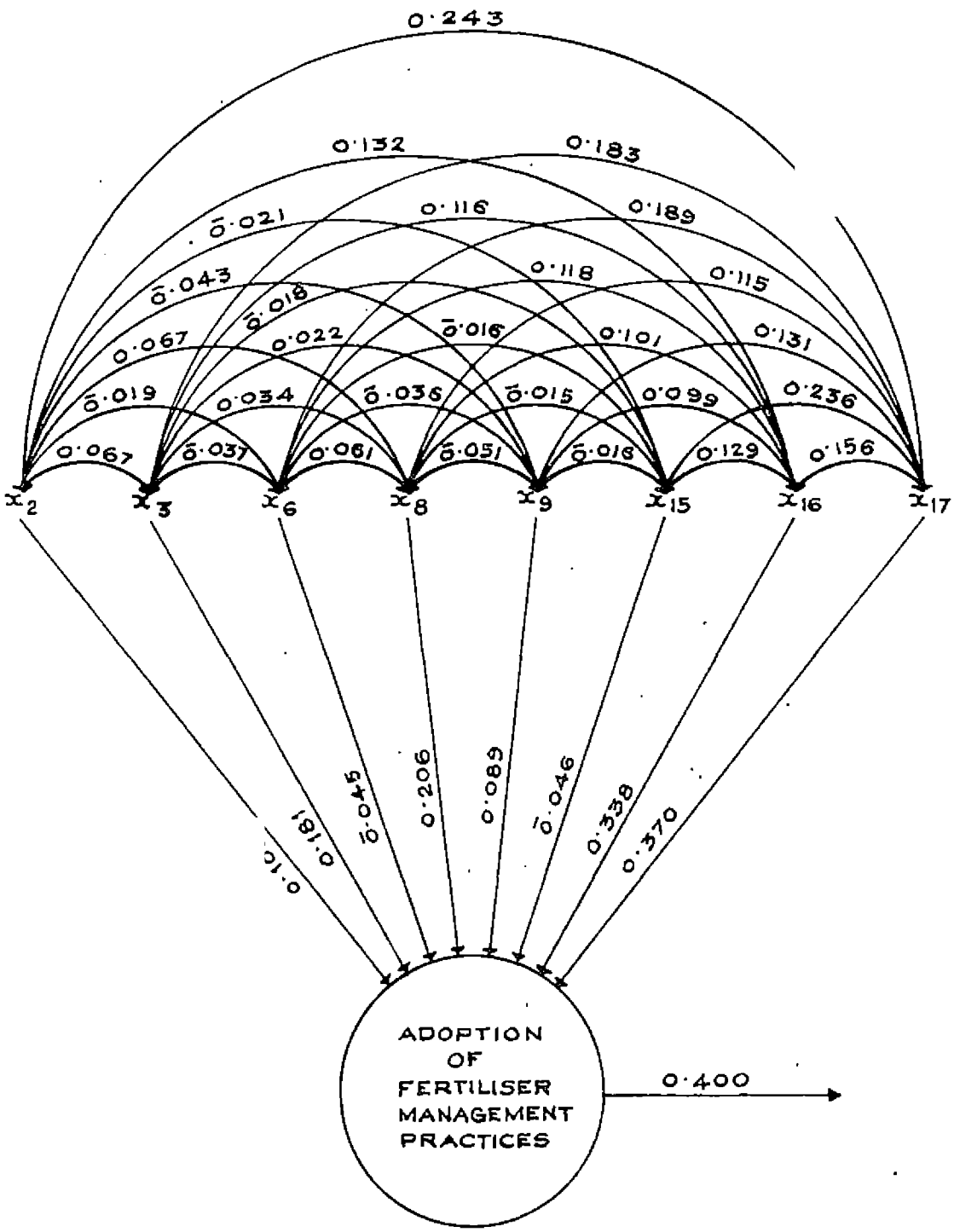


FIG. 9. PATH DIAGRAM SHOWING THE DIRECT AND INDIRECT EFFECT OF INDEPENDENT VARIABLES ON ADOPTION OF FERTILISER MANAGEMEN PRACTICES (POOLED SAMPLE).

yielded the same results. Area under rice was significant both in multiple regression analysis and step wise regression analysis.

Area under rice

Farmers with more area under rice cultivation are likely to have a different orientation than those who cultivate small areas. Such farmers are likely to invest more in farm inputs with an eye on profit maximisation. The resource base of such farmers will also be sound for such investments. On the other hand farmers with less area have the inherent limitation to use more inputs while adopting scientific farming practices. Hence the observed relation is quite logical.

The same arguments put forth earlier for explaining the significant relationship of knowledge of fertiliser management practices, credit utilisation and attitude towards fertiliser use with adoption hold good here also.

IV. Perception of appropriateness of the recommended fertiliser management practices

All the farmers did not respond to some of the practices with which they were either totally unfamiliar or which they did not adopt. Such practices were not taken for

measuring perception index. Accordingly, the practices like application of micro-nutrients and application of urea super granules were not included in the case of Palghat and the practices, viz., placement of fertilisers, application of urea with soil, application of micro-nutrients and application of urea super granules were not included in Cannanore for measuring perception index.

(a) Palghat

The perception index for the different selected attributes for each practice at Palghat are shown in Table 29. Based on the perception indices obtained, the practices were ranked for each attribute. The fertiliser management practices perceived as highest and lowest on selected attributes by the farmers in Palghat are shown in Table 30.

The practice 'application of fertiliser in split doses' was perceived as having the highest practicability and efficiency while placement of fertiliser was perceived as the least practicable.

Application of farm yard manure was perceived as high in terms of compatibility. Application of complex fertilisers and application of lime were perceived as having highest simplicity, while application of lime was perceived as the highest in terms of divisibility.

Table 29. Perception index on different attributes for different fertiliser management practices (Palghat)

Fertiliser management practices	Perception index for							
	Practicability	Compatibility	Simplicity	Divisibility	Observability	Profitability	Cost	Efficiency
Application of farm yard manure (n=100)	30.04	3.49	2.10	2.44	2.76	1.65	3.23	3.23
Application of green leaf manure (n=100)	1.84	2.44	2.04	1.54	1.46	1.29	3.58	1.83
Growing green manure crops (n=100)	2.55	2.32	2.55	1.96	2.67	2.79	2.61	2.82
Use of straight fertilisers (n=100)	2.82	3.04	2.83	2.14	2.90	2.41	3.20	2.86
Use of complex fertilisers (n=100)	3.09	3.07	3.40	2.91	2.75	2.02	3.39	3.29
Use of Mussorie-Phos (n=100)	1.69	1.63	1.76	2.16	1.78	2.21	2.42	2.75
Placement of fertiliser (n=100)	1.19	1.0	1.0	1.06	-	-	-	-
Application of urea with neem cake (n=100)	3.04	2.77	2.87	2.49	1.78	1.20	2.59	1.51
Application of fertiliser in split doses (n=100)	3.47	3.26	3.19	2.15	2.85	2.58	2.99	3.38
Application of fertiliser based on soil test (n=100)	1.63	1.52	1.62	1.29	1.24	1.51	1.07	1.29
Application of urea with soil (n=22)	2.18	1.82	2.55	2.09	1.86	1.32	3.59	1.90
Application of lime (n=60)	3.06	3.06	3.40	5.83	2.50	1.28	3.80	3.20
Growing leguminous crops (n=100)	3.41	3.34	3.16	2.29	3.21	3.29	2.18	3.31

Table 30. Fertiliser management practices perceived as highest and lowest on selected attributes by the farmers (Palghat)

Attributes of the practice	The practice perceived as highest	Perception index	The practice perceived as lowest	Perception index
Practicability	Application of fertiliser in split doses	3.47	Placement of fertiliser	1.19
Compatibility	Application of farm yard manure	3.49	Placement of fertiliser	1.0
Simplicity	Application of complex fertiliser	3.40	Placement of fertiliser	1.0
	Application of lime	3.40		
Divisibility	Application of lime	5.83	Placement of fertiliser	1.06
Observability	Growing leguminous crops	3.21	Application of fertiliser based on soil tests	1.24
Profitability	Growing leguminous crops	3.29	Application of urea with neem cake	1.20
Cost	Application of lime	3.80	Application of fertiliser based on soil test	1.07
Efficiency	Application of fertiliser in split doses	3.38	Application of fertiliser based on soil test	1.29

The practice of placement of fertiliser was perceived as the lowest in terms of compatibility, simplicity and divisibility. The practice of growing leguminous crops was perceived as having highest observability and profitability. Application of urea with neem cake was perceived as the lowest in terms of profitability.

Application of lime was perceived as the highest in terms of cost, while application of fertiliser based on soil test was perceived as a low cost practice. However, soil test based fertiliser application was also perceived as lowest in terms of observability and efficiency.

The perception of the attributes of practices have a bearing on adoption. The practice of split application of fertiliser was perceived to be the most practicable and efficient among the various fertiliser management practices by the farmers of Palghat. It was also found that irrespective of whether small, medium or large, all farmers were following split application of fertilisers. At Palghat, most of the farmers were growing leguminous crops as a third crop and they perceive that practice as highest in terms of observability and profitability. Application of lime though perceived as the most costly, was perceived as high in terms of simplicity and divisibility.

Though nearly one-third of the farmers in Palghat were aware of the practice of placement of fertiliser they were not adopting the same. As the results indicate, it is virtually due to their low perception in terms of practicability, compatibility, simplicity and divisibility. It was observed that none was following the recommendations of soil test results eventhough majority of the farmers had tested their soil. The above observation may be attributed to their perception of this practice as low in terms of observability and efficiency.

(b) Cannanore

The perception index for the different selected attributes for each practice at Cannanore are shown in Table 31. Based on the perception indices obtained, the practices were ranked for each attribute. The fertiliser management practices perceived as highest and lowest on selected attributes by the farmers in Cannanore are shown in Table 32.

The practice, use of complex fertilisers was perceived as highest in terms of practicability and divisibility. Growing leguminous crops was perceived as high in terms of simplicity, observability and profitability. Application of farm yard manure was perceived as high in

Table 31. Perception Index on different attributes for different fertiliser management practices (Cannanore)

Fertiliser management practices	Perception Index for							
	Practicability	Compatibility	Simplicity	Divisibility	Observability	Profitability	Cost	Efficiency
Application of farm yard manure (n=100)	3.29	3.64	2.40	2.54	2.69	1.67	2.86	3.16
Application of green leaf manure (n=100)	1.71	2.55	2.11	1.66	2.01	1.85	3.55	2.35
Growing green manure crops (n=100)	1.49	1.91	1.62	2.05	1.88	0.92	0.66	1.04
Use of straight fertiliser (n=100)	2.49	2.43	3.03	2.05	2.70	2.22	3.55	2.76
Use of complex fertiliser (n=100)	3.37	2.96	2.57	3.08	2.29	2.61	3.57	3.40
Use of Mussorie-Phos (n=38)	2.0	1.79	2.31	2.31	1.63	2.94	2.53	2.66
Application of urea with neem cake (n=27)	2.96	3.03	1.93	1.81	2.03	1.0	3.93	2.59
Application of fertiliser in split doses (n=100)	2.70	2.77	2.72	2.40	2.58	2.14	2.50	2.98
Application of fertiliser based on soil tests (n=9)	2.88	2.66	1.88	0.66	2.33	2.11	1.0	5.55
Application of lime (n=100)	2.40	2.31	3.11	2.21	2.04	2.04	3.37	2.84
Growing leguminous crops (n=100)	3.20	3.01	3.27	1.81	2.78	2.99	2.22	3.14

Table 32. Fertiliser management practices perceived as highest and lowest on selected attributes by the farmers (Cannanore)

Attributes of the practice	The practice perceived as highest	Perception Index	The practice perceived as lowest	Perception Index
Practicability	Use of complex fertiliser	3.37	Growing green manure crops	1.49
Compatibility	Application of farm yard manure	3.64	Use of Mussorie-Phos	1.79
Simplicity	Growing leguminous crops	3.27	Growing green manure crops	1.62
Divisibility	Use of complex fertilisers	3.08	Application of fertiliser based on soil test	0.66
Observability	Growing leguminous crops	2.78	Use of Mussorie-Phos	1.63
Profitability	Growing leguminous crops	2.99	Growing green manure crops	0.92
Cost	Application of urea with neem cake	3.93	Growing green manure crops	0.66
Efficiency	Application of fertiliser based on soil test	5.55	Growing green manure crops	1.04

compatibility and application of urea with neem cake as high in terms of cost, while application of fertiliser based on soil test was perceived as high in terms of efficiency.

The practice of growing green manure crops was perceived as the lowest in terms of practicability, simplicity, profitability, cost and efficiency. Use of Mussorie-Phos was perceived as low in terms of compatibility and observability. Application of fertiliser based on soil test was perceived as low in terms of divisibility.

It could be seen that the practice of growing leguminous crops was perceived as high in terms of simplicity, observability and profitability and many of the farmers were raising leguminous crops during the third crop season which reflects the congruence between perception and behaviour. Application of complex fertiliser was perceived to be the highest in terms of practicability and divisibility. The researcher had very clearly noticed that many of the farmers of Cannanore were using complex fertilisers compared to straight fertilisers even for top dressing, which brings out the salience of perception in adoption of an innovation.

Growing green manure crops, though perceived as a less costly practice, the same was perceived as low in terms of practicability, simplicity, profitability and efficiency.

It was noticed that majority of the farmers were not following the practice which eulogises that low cost alone is not the motive for adopting a practice. Farmers give much importance to other attributes like practicability, efficiency etc.

(c) Agricultural Demonstrators

The perception index for the pooled sample of Agricultural Demonstrators selected for the study is presented in Table 33.

Based on the perception indices obtained, the practices were ranked for each attribute. The fertiliser management practices perceived as highest and lowest on selected attributes by the Agricultural Demonstrators are shown in Table 34.

It could be seen that, the perception of the practice by the Agricultural Demonstrators was comparable to some extent with the perception by the farmers of Palghat than that of Cannanore. However, the perception of farmers of Cannanore greatly differs from the perception by the Agricultural Demonstrators.

The empirical diagram depicting the salient results of the study is given in Fig. 10.

Table 33. Perception Index on different attributes for different fertiliser management practices by the Agricultural Demonstrators (n=54)

Fertiliser management practices	Perception Index for							
	Practicability	Compatibility	Simplicity	Divisibility	Observability	Profitability	Cost	Efficiency
Application of farm yard manure	3.74	3.44	3.04	2.50	3.05	2.0	2.74	3.02
Application of green leaf manure	2.37	3.0	3.06	2.42	2.81	1.89	3.0	2.94
Growing green manure crops	2.79	2.83	2.46	2.02	3.05	3.05	1.59	3.24
Use of straight fertilisers	2.20	2.74	2.20	2.37	2.89	3.22	3.17	2.94
Use of complex fertilisers	3.27	2.76	3.24	2.87	2.96	2.33	3.22	2.80
Use of Mussorie-Phos	2.74	2.67	2.76	2.42	2.59	3.48	2.43	3.09
Placement of fertilisers	1.70	1.85	1.48	1.78	2.24	1.57	3.06	2.57
Application of urea with neem cake	2.63	2.76	2.98	2.31	2.35	1.85	3.13	2.67
Application of fertiliser in split doses	3.18	2.79	3.13	3.02	3.0	2.93	1.72	3.30
Application of fertiliser based on soil test	2.98	2.79	3.05	2.46	2.65	2.96	1.65	2.85
Application of urea with soil	3.14	2.63	2.67	2.42	2.43	2.06	2.48	3.09
Application of lime	3.35	3.12	3.26	3.13	2.80	2.76	3.06	3.28
Application of urea super granules	2.24	1.98	2.04	2.01	2.30	1.98	3.17	3.02
Application of micronutrients	3.07	2.85	2.94	2.78	2.43	1.89	3.31	2.80
Growing leguminous crops	2.89	2.83	2.81	2.22	2.65	2.94	2.41	3.13

Table 34. Fertiliser management practices perceived as highest and lowest on selected attributes by the Agricultural Demonstrators

Attributes of the practice	The practice perceived as highest	Perception Index	The practice perceived as lowest	Perception Index
Practicability	Application of farm yard manure	3.74	Placement of fertiliser	1.70
Compatibility	Application of farm yard manure	3.44	Placement of fertiliser	1.85
Simplicity	Application of lime	3.26	Placement of fertiliser	1.48
Divisibility	Application of lime	3.13	Placement of fertiliser	1.78
Observability	Application of farm yard manure	3.05	Placement of fertiliser	2.24
Profitability	Application of Mussorie-Phos	3.48	Placement of fertiliser	1.57
Cost	Application of complex fertilisers	3.31	Growing green manure crops	1.59
Efficiency	Application of fertiliser in split doses	3.30	Placement of fertiliser	2.57

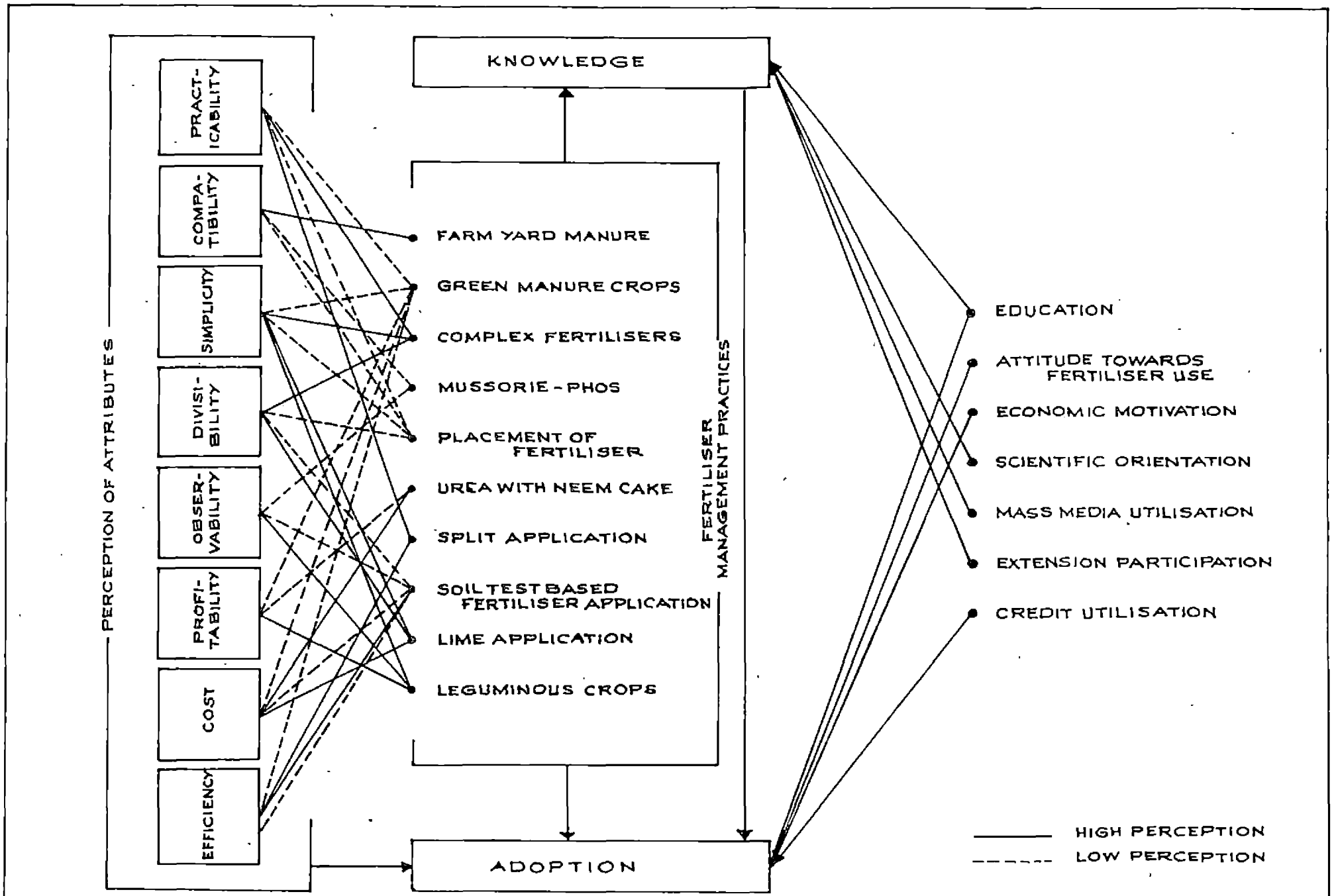


FIG. 10. EMPIRICAL DIAGRAM SHOWING THE RESULTS OF THE STUDY.

V. Constraints experienced by the farmers in the adoption of different fertiliser management practices

The major constraints experienced by the farmers in the adoption of different fertiliser management practices are presented in Table 35. These were ranked based on the response of the farmers considering the importance they attach to each constraint.

'High cost of fertilisers', 'interest rate of crop loan high' and 'uncertainity of irrigation water availability' were ranked as the most important in the order of its importance by the farmers of Palghat followed by 'amount received as crop loan is very much less' and 'crop loan distribution system inadequate'.

'High cost of fertilisers', 'uncertainity of irrigation water availability' and 'interest rate of crop loan high' were ranked as the most important constraints by the farmers of Cannanore in order of its importance. The next in importance was 'amount received as crop loan is very much less' followed by 'the crops become more susceptible to pests and diseases'.

Fertiliser, being an expensive input, forms a reasonably high percentage of the total cultivation cost. As the cost of fertilisers are increasing year by year,

Table 35. Constraints experienced by farmers in the adoption of fertiliser management practices

Sl.No.	Constraints	Palghat		Cannanore	
		Total score	Rank	Total score	Rank
1	No way to cover the cost incurred in fertiliser if the crop fails for one or other reason	118	XI	123	XII
2	Interest rate of crop loan high	384	II	363	III
3	Does not know the different aspects of fertiliser management	120	IX	147	VIII
4	Uncertainity of irrigation water availability	351	III	385	II
5	Amount received as crop loan is very much less	347	IV	262	IV
6	Crop loan distribution system inadequate	223	V	178	VI
7	The fertiliser depots are distantly located	143	VIII	152	VII
8	Availability of fertiliser not enough	185	VI	109	XIV
9	Not fully convinced about the benefits of fertiliser application	109	XIII	135	X
10	Recommended fertilisers not available	118	XI	145	IX
11	Non availability of fertilisers at the correct time	104	XIV	116	XIII
12	The crops become more susceptible to pests and disease	152	VII	185	V
13	High cost of fertilisers	398	I	397	I
14	Crops get burned	119	X	124	XI

often farmers find it difficult to buy and apply required quantity of fertilisers, as the price for their produce is not increasing proportionately. It may probably be the reason for ranking cost of fertiliser as the most important constraint by farmers of both Palghat and Cannanore. Ramesh (1978) had reported that small farmers decreased the level of use of nitrogen for both dryland and irrigated crops as a result of price rise. Sethy (1978), Sharma (1985) and Jayaramaiah (1978) had also reported that high price of fertilisers act as a major constraint in adoption of fertilisers.

The cost of cultivation of rice increases year by year, mainly due to rise in the prices of various inputs. Credit becomes inevitable owing to the above reason. Though adequate credit facilities are available, it is seen that farmers avail credit with some reluctance due to high rate of interest on such loans. This may be the probable reason for 'interest rate of crop loan high' to be ranked as an important constraint felt more by the farmers of Palghat, the majority of whom avail such credit compared to farmers of Cannanore. One could observe this from Table 6, which clearly reveals that fermers of Palghat are having a higher credit utilisation than that of Cannanore.

It is a known fact that fertiliser use efficiency generally depends on the availability of water. If the water is not available especially at times when it is needed, it is quite natural that farmers hesitate to apply fertilisers. At Cannanore, rice is raised mainly as a rainfed crop and hence irrigation water availability has been pointed out as a major constraint, whereas in Palghat there exists more facilities for irrigating the crop, but the availability becomes a problem to those at the tail end of the canals. The above facts signify the rankings made on this constraint by farmers of Palghat and Cannanore.

Summary

SUMMARY

Fertiliser is one of the most indispensable inputs which is responsible for increasing crop production in our country. However, it is observed that our farmers have not adopted fertilisers to the expected level. There exists a wide variation in fertiliser consumption in the different states of the country. It varies from 159 kg/ha in Punjab, 96 kg/ha in Tamil Nadu and 75 kg/ha in Uttar Pradesh, 53 kg/ha in Kerala to 16 kg/ha in Orissa and 5 kg/ha in Assam against the all India average of 50 kg/ha during 1986-87. Not only this, the interdistrict variations are also very prominent. Out of the data available for 329 districts in the country, 48 districts mainly in the states of Punjab, Uttar Pradesh, Tamil Nadu and Andhra Pradesh have the consumption of more than 100 kg/ha, while there are 49 districts whose consumption is less than 10 kg/ha.

Fertiliser being an expensive input, forms a sizeable percentage of the farmer's total cultivation cost. It is therefore of crucial importance to use every unit of this input efficiently. To attain this objective, various fertiliser management practices have been evolved to enhance fertiliser use efficiency. But to what extent these practices are adopted by the farmers and also how they perceive the appropriateness of these practices still remain unknown due

to lack of empirical evidence. No research work in Kerala had been reported on this aspect. In this context, the present study was undertaken with the following specific objectives.

1. To study the level of knowledge about fertiliser management practices of the farmers and field extension personal.
2. To find out the extent of adoption of the various recommended fertiliser management practices by the farmers.
3. To identify the determinants in the knowledge and adoption of recommended fertiliser management practices by the farmers.
4. To evaluate the recommended fertiliser management practices for their appropriateness to farmers on various attributes of the practices as perceived by them and field extension personnel.
5. To find out the constraints, if any, faced by the farmers in the adoption of different fertiliser management practices.

The study was conducted in Palghat and Cannanore districts of Kerala State. Pattanchery Panchayat under Chittoor sub division of Palghat District and Kadannappally-Panapuzha panchayat under Payyannoor Sub Division of Cannanore District were purposively selected for the study. From each selected panchayat, 100 rice farmers were randomly selected

resulting in a total sample of 200 respondents. Fifty four Agricultural Demonstrators from the selected two Agricultural Sub Divisions also formed another category of respondents for the study.

Knowledge about recommended fertiliser management practices and adoption of recommended fertiliser management practices were selected as dependent variables for the study. Sixteen independent variables were selected for the study which were age, education, farm size, area under rice, percentage area under high yielding rice varieties, annual income, economic performance index, attitude towards fertiliser use, economic motivation, scientific orientation, personal guidance on better farming, mass media utilisation, interpersonal source utilisation, social participation, extension participation and credit utilisation. The relationship of these independent variables with the two dependent variables were studied.

The data were collected from the farmers using a structured interview schedule developed for the purpose. A questionnaire was also prepared for collection of relevent data from the Agricultural Demonstrators. The collected data were analysed using percentages, students 't' test, simple correlation, multiple regression analysis, step wise regression analysis and path analysis.

The salient findings of the study are summarised and presented below

1. There was significant difference between the rice farmers of Palghat and Cannanore with respect to their knowledge about and adoption of recommended fertiliser management practices in rice. The farmers of Palghat had a higher level of knowledge and a higher level of adoption than the farmers of Cannanore.

2. There was no difference in the knowledge of fertiliser management practices among the Agricultural Demonstrators of both Palghat and Cannanore districts. All the Agricultural Demonstrators selected for the study were found to have a good knowledge of fertiliser management practices.

3. Correlation analysis revealed that education, area under rice, farm size, annual income, economic motivation scientific orientation, personal guidance on better farming, mass media utilisation, social participation and extension participation had positive and significant relationship with knowledge of fertiliser management practices while age was negatively and significantly related with knowledge of fertiliser management practices of farmers of Palghat.

4. In the case of farmers of Cannanore, correlation analysis revealed that education, area under rice, percentage

area under HYV, annual income, attitude towards fertiliser use, economic motivation, scientific orientation, personal guidance on better farming, mass media utilisation, interpersonal source utilisation, social participation, extension participation and credit utilisation were positively and significantly related with knowledge about fertiliser management practices, while age was negatively and significantly correlated.

5. Step wise regression analysis indicated that education, scientific orientation, extension participation and mass media utilisation were found significant in predicting the knowledge about fertiliser management practices of Palghat farmers.

6. In the case of farmers of Cannanore, step wise regression analysis indicated that mass media utilisation, extension participation and education were found significant in predicting the knowledge of farmers about fertiliser management practices.

7. Correlation analysis indicated that education, annual income, attitude towards fertiliser use, economic motivation, credit utilisation, knowledge about fertiliser management practices, area under rice, farm size and extension participation were positively and significantly related with adoption

of fertiliser management practices in Palghat, while age was negatively and significantly related.

8. Education, percentage area under HYV, annual income, attitude towards fertiliser use, economic motivation, scientific orientation, personal guidance on better farming, mass media utilisation, interpersonal source utilisation, social participation, extension participation, credit utilisation, knowledge about fertiliser management practices and area under rice were found positively and significantly related with adoption of fertiliser management practices at Cannanore.

9. Education, attitude towards fertiliser use, economic motivation and credit utilisation were found to contribute significantly to the adoption of fertiliser management practices in Palghat.

10. Knowledge about fertiliser management practices, credit utilisation and attitude towards fertiliser use were significantly contributing to adoption of fertiliser management practices in Cannanore.

11. The farmers of Palghat perceived application of fertiliser in split doses as the most practicable and efficient and growing leguminous crops as the most observable and profitable. Placement of fertilisers was perceived as low

in terms of practicability, compatibility, simplicity and divisibility, while application of fertiliser based on soil test was perceived as low in terms of observability, cost and efficiency.

12. The practice of growing leguminous crops was perceived as high in terms of simplicity, observability and profitability and use of complex fertilisers was perceived as high in terms of practicability and divisibility by the farmers of Cannanore. The practice of growing green manure crops was perceived as low in practicability, profitability, cost and efficiency while use of Mussorie-Phos was perceived as low in compatability and observability.

13. The Agricultural Demonstrators selected for the study perceived application of farm yard manure as high in terms of practicability, compatibility and observability and application of lime as high in simplicity and divisibility. Placement of fertilisers was perceived as low in practicability, compatibility, simplicity, divisibility, observability and profitability.

14. High cost of fertilisers was considered as the main constraint experienced by the farmers of Palghat and Cannanore in the adoption of fertiliser management practices. High rate of crop loan and uncertainity of irrigation water

availability were the second and third major constraints respectively, in Palghat, whereas uncertainity of irrigation water availability and the higher rate of crop loan were ranked as second and third major constraint, respectively by the farmers of Cannanore.

Implications and recommendations

The following implications and recommendations emerge out of the findings of the present study.

1. Eventhough various fertiliser management practices have been evolved to enhance fertiliser use efficiency, many of these practices are not seen adopted by the farmers. So more extension efforts are needed in the field of fertiliser promotion.

2. The integrated nutrient management practices for irrigated rice and rice based cropping system are of prime importance since in this system, a large dose of fertiliser input has been used. Short duration trainings for farmers on integrated nutrient management practices may be organised for rice and other crops.

3. Perception of attributes of practices have a bearing on adoption. Hence extension efforts may be made to enable the farmers perceive the different attributes of the

practices in a correct perspective with a view to enhance the rate of adoption.

4. Fertiliser use has been limited under non-irrigated conditions. Bringing more area under irrigation will automatically lead to more use of fertilisers. Since irrigation facilities cannot be created beyond certain limits, it is necessary to focus our attention on educating farmers about better soil moisture conservation techniques and efficient use of fertilisers in rainfed farming.

5. Soil test based fertiliser application is not properly perceived by the farmers, which results in uneconomic use of fertilisers. Hence more attention may be given by the extension workers for popularising the practice of soil test based fertiliser application through demonstrations, seminars and other extension methods.

6. The price of fertilisers are increasing every year which makes the farmers difficult to apply fertiliser in required quantities. The Government may take appropriate measures to make available the required type and quantity of fertiliser keeping the price at the level accessible to small and marginal farmers.

Suggestions for further research

The present study was confined to only two selected areas in two districts and that too only on a single crop. A comprehensive study of the adoption of integrated nutrient management practices covering all the districts in the state with larger sample size and covering more crops could be undertaken.

An evaluative research on the different aspects of perception of the different attributes of the integrated nutrient management practices recommended for adoption could be undertaken.

A study may also be undertaken to identify the motivational pattern of farmers and to suggest ways and means to motivate them to adopt different fertiliser management practices.

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* Originals not seen

Appendices

APPENDIX-I

List of items initially selected for the knowledge test

Sl.No.	Item
1	Name an organic manure
2	Which are the important nutrients present in organic manures?
3	Mention any other advantage in applying organic manures other than supplying nutrients.
4	Instead of farm yard manure, application of green leaf manure is enough (True/False)
5	How much farm yard manure has to be applied for an acre
6	In the case of green leaf manure, mention the quantity to be applied per acre
7	When organic manure has to be applied to soil?
8	Name a crop that can be used as a green manure
9	Name a green manure crop which can supply nitrogen
10	Give the advantage in using straight fertilisers
11	What does N, P and K signify in fertiliser recommendation?
12	What is the fertiliser recommendation for rice?
13	How much fertiliser has to be applied as basal dose?
14	Name a nitrogenous fertiliser
15	Which is profitable, urea or ammonium sulphate?
16	How much urea or ammonium sulphate has to be applied per acre?
17	How urea super granules are applied in soil?
18	Name a phosphatic fertiliser
19	Which is profitable, super phosphate or Mussorie-Phos?
20	How much super phosphate or Mussorie-Phos has to be applied per acre?

Contd.

Appendix-I. Continued

Sl.No.	Item
21	Name a potassic fertiliser
22	How much potassic fertiliser has to be applied per acre?
23	When basal dose of fertiliser has to be applied to soil?
24	Name a method by which the efficiency of nitrogenous fertilisers can be improved
25	Fertiliser has to be given in split doses (True/False)
26	What is the advantage of applying fertiliser in split doses?
27	What is the problem with soil acidity?
28	Name a method to reduce acidity in soil.
29	How much lime has to be applied per acre.
30	When lime has to be applied?
31	Which is better for improving soil fertility, growing leguminous crops or keeping the field fallow during the third crop season?
32	Name a micronutrient.

APPENDIX-II

Difficulty indices and discrimination indices of the items of knowledge test

Sl. No. of the item as in Appendix-I	Frequencies of correct answers given by each group of respondent		Total frequencies of correct answers (N = 48)	Difficulty Index (P)	Discrimination Index ($E^{1/3}$)
	G_1	G_2			
1	2	3	4	5	6
1	16	16	32	66.67	0.0
* 2	14	0	14	29.16	0.88
3	14	11	25	52.08	0.19
4	16	16	32	66.67	0.0
5	1	0	1	2.08	0.06
6	1	1	2	4.17	0.0
7	16	16	32	66.67	0.0
8	16	12	28	58.33	0.25
* 9	16	4	20	41.67	0.75
*10	16	2	18	37.50	0.88
11	10	1	11	22.92	0.56
12	3	0	3	6.25	0.19
*13	13	0	13	27.08	0.81
*14	16	4	20	41.67	0.75
*15	15	5	20	41.67	0.63
16	9	0	9	18.75	0.56
17	0	0	0	0.0	0.0
*18	16	2	18	37.50	0.88
*19	15	0	15	31.25	0.94
20	7	0	7	14.58	0.44
*21	16	6	22	45.83	0.63
22	8	0	8	16.67	0.50
23	16	16	32	66.67	0.0

Contd.

Appendix-II. Continued

1	2	3	4	5	6
24	10	0	10	20.83	0.63
25	16	14	30	62.50	0.13
*26	16	8	24	50.0	0.50
*27	16	3	19	39.58	0.81
28	16	12	28	58.33	0.25
29	4	1	5	10.42	0.19
*30	16	7	23	47.92	0.56
*31	16	10	26	54.17	0.38
32	5	0	5	10.42	0.31

* Items selected for the knowledge test

APPENDIX-III

EVALUATIVE PERCEPTION OF APPROPRIATENESS OF THE RECOMMENDED FERTILISER MANAGEMENT PRACTICES

Sl.No.

Date :

INTERVIEW SCHEDULE

Panchayat Sub Division District

1. Name of the farmer :

2. Age :

3. Address :

4. Education : Illiterate/Can read/Can read and write/ Primary school/Middle school/High School/Collegiate

5. Farm size : (Area in (ha)

(a) Wet land

(b) Dry land

(c) Total

6. Cultivated area :

(a) Wet land (ha) Single/Double/Triple Cropped

(b) Dry land (ha) Single/Double/More than two crops or crop combinations

7. Area under High Yielding Rice Variety (Area in ha)

(a) Ist crop

(b) IInd crop

(c) IIIrd crop

8. (a) Whether irrigated or not? : Yes/No

(b) If yes, specify (a) the source of irrigation

(b) area under irrigation (in ha)

9. Income

(a) Income from agriculture :

(b) Income from other sources :

(c) Total income :

10. Economic performance index (Rice)

Sl. No.	Season	Total acerage	Quantity produced per hectare		Total production		Total value	Total cost of production	E.P.I. items 8/9x100
			Rice	Straw	Rice	Straw			
1	2	3	4	5	6	7	8	9	10
1	Ist crop								
2	IInd crop								
3	IIIrd crop								

11. Attitude towards fertiliser use
(Please indicate your response for each of the following statements)

Items	Scale value	Strongly Agree	Agree	Dis agree	Strongly Disagree
1. Use of fertilisers is a very useful practice	(8.80)				
2. The crop yields can easily be increased by the use of fertilisers	(8.50)				
3. Use of fertilisers is one of the important ways to increase farm income	(7.90)				
4. Use of fertilisers results in further improvement in farming practices	(6.70)				
5. Use of fertilisers cannot remove all the problems of a farmer	(3.56)				
6. Most of the farmers should use fertilisers	(8.42)				
7. The continuous use of fertilisers spoils the land	(1.36)				
8. If a farmer wants to have a good crop, better he should fertilise	(7.50)				
9. Use of fertilisers means to invite diseases and pests in the farm	(1.30)				

12. Economic motivation
(Below are given 3 sets of statements. From each set, select two statements, one "most like" and the other "least like")

Items		Most like	Least like
I	(a) All I want from my farm is to make just a reasonable living for the family	(1)	

Items			Most like	Least like
	(b)	In addition to making reasonable amount of profit, the enjoyment in farming life is also important to me	(2)	
	(c)	I would invest in farming to the maximum to gain large profit	(3)	
II	(a)	I do not hesitate to borrow any amount of money inorder to run the farm properly	(3)	
	(b)	Instead of growing new cash crops which cost more money, I follow the routine farming practices	(1)	
	(c)	It is not only monetary profit, but the enjoyment of work done well, which gives me satisfaction for my hard work on farming	(2)	
III	(a)	I hate to borrow money, on principles, even when it is necessary for running the farm	(1)	
	(b)	My main aim is maximising profits by growing cash crops in comparison to growing of crops which are simply consumed by my family	(3)	
	(c)	I avoid excessive borrowing of money for farm investment	(2)	

13. Scientific orientation
(Please indicate the degree of your agreement or disagreement or undecisiveness with each of the following statements

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
1. New methods of farming give better results to a farmer than the old methods					

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
2. The way of farming of our forefathers is still the best way to farm today					
3. Even a farmer with lot of farm experience should use new methods of farming					
4. A good farmer experiments with new ideas in farming					
5. Though it takes time for a farmer to learn new methods in farming, it is worth the efforts					
6. Traditional methods of farming have to be changed in order to raise the living of a farmer					

14. Personal guidance on better farming
(Indicate your response to the following statements in the appropriate column)

Items	Very much	Much	Not so much	Very little
1. The extent to which you discussed your farming problems with the extension personnel in the last two seasons				
2. The extent to which the extension personnel visited your crop in the last two seasons				
3. The assistance you received in testing your farm soil				

Items	Very much	Much	Not so much	Very little
4. The help you received in preparation of your farm plan				
5. The help you received in determining the most suitable cropping pattern for your farm				
6. The advice you have received for proper use of fertiliser to different crops of your farm				
7. The advice you have received for efficient water use in your farm				
8. The advice you have received in using farm machinery in your farm				
9. The assistance you have received in identifying the insect-pests of your crop plants and prescribing control measures for them				
10. The assistance you have received in identifying the diseases of your crop plants and prescribing control measures for them				
11. The advice you have got about proper storage of your farm produce				
12. The advice you have received in getting the additional return in the use of new inputs				

15. Information Sources Used
(Please indicate from which of the following sources you obtain technical information regarding new practices in farming)

Sources	Frequency			
	Most often (once in a week)	Often (once in a fort-night)	Some time (once in a month)	Rarely (once in a year)
I Mass media				
1) Television				
2) Radio				

Sources	Frequency			
	Most often (once in a week)	Often (once in a fort-night)	Some time (once in a month)	Rarely (once in a year)
3) Movies				
4) Newspaper				
5) Farm magazines				
6) Any other (specify)				
II Interpersonal				
1) Agricultural Demonst-rator				
2) Agricultural Officer				
3) University Scientists				
4) Input agencies				
5) Neighbours				
6) Relatives				
7) Any other (Specify)				

16. Social participation
(Please indicate whether you are a member or office bearer in the following organisations and if so, how frequently you attend the meetings)

Sl. No.	Organisation	Nature of participation		Frequency of participation		
		As member	As office bearer	Attend meetings		
				Regularly	Occas-ionally	Never
1	Panchayat					
2	Co-operative Society					
3	Agricultural advisory committee					

Sl. No.	Organisation	Nature of participation		Frequency of participation		
				Attend meetings		
		As member	As Office bearer	Regularly	Occas-ionally	Never
4	Farmers' organisation					
5	Arts and sports club					
6	Recreation club					
7	Any other (specify)					

17. Extension participation
(Please indicate your frequency of participation in the following extension activities)

Sl. No.	Extension activities	Frequency of participation		
		Whenever conducted	Occasionally	Never
1	Campaigns			
2	Film shows			
3	Seminars			
4	Group meetings			
5	Exhibitions			
6	Demonstrations			
7	Any other (specify)			

18. Credit utilisation

(a) Did you avail any credit during the last two seasons? : Yes/No

(b) If yes, give the following details

1. Source of credit :
2. Type of credit :
3. Amount :
4. Rate of interest :

5. Purpose for which the credit was availed :
6. Whether utilised the credit for the same purpose :
7. If not, utilised for what other purpose :
8. Did you repay the loan? : Yes/No
9. If not, the amount outstanding

19. Knowledge about fertiliser management practices

1. Name a green manure crop supplying nitrogen
2. Which are the important nutrients present in organic manures
3. Give the advantage in using straight fertilisers
4. How much fertiliser has to be applied as basal dose?
5. Name a nitrogenous fertiliser
6. Which is profitable, urea or ammonium sulphate
7. Name a phosphatic fertiliser
8. Which is profitable, super phosphate or Mussorie-Phos
9. Name a potassic fertiliser
10. What is the advantage of applying fertiliser in split doses
11. What is the problem with soil acidity?
12. When lime has to be applied
13. Which is better for improving soil fertility, growing leguminous crops or keeping the field fallow during the third crop season

20. Adoption of fertiliser management practices
(Please indicate whether you are adopting the following fertiliser management practices in rice and if so, give details)

Sl. No.	Fertiliser management practices	Source/ Material	Quantity	Area	Remark
1	Farm yard manure				
2	Green leaf manure				
3	Green manure crops				
4	Straight fertilisers				
	(a) Nitrogenous				
	(b) Phosphatic				
	(c) Potassic				
5	Complex fertilisers				
	(a) Nitrogenous				
	(b) Phosphatic				
	(c) Potassic				
6	Mussorie-Phos				
7	Placement of fertiliser				
8	Mixing urea with neem cake				
9	Application of fertiliser in split doses				
10	Urea super granules				
11	Application of fertiliser based on soil test				
12	Mixing urea with soil				
13	Application of lime				
14	Application of micronutrients				
15	Leguminous crops				

21. Perception of attributes of the recommended fertiliser management practices

Fertiliser management practices	Practicability				Compatibility				Simplicity				Divisibility				Observability				Profitability				Cost				Efficiency			
	VH	H	L	VL	VH	H	L	VL	VH	H	L	VL	VH	H	L	VL	VH	H	L	VL	VH	H	L	VL	VH	H	L	VL	VH	H	L	VL
1. Farm yard manure																																
2. Green leaf manure																																
3. Green manure crops																																
4. Straight fertilisers																																
5. Complex fertilisers																																
6. Mussorie-Phos																																
7. Placement of fertiliser																																
8. Urea with neem cake																																
9. Application of fertiliser in split doses																																
10. Urea super granules																																
11. Application of fertiliser based on soil test																																
12. Urea with soil																																
13. Application of lime																																
14. Application of micronutrients																																
15. Leguminous crops																																

VH - Very High; H - High; L - Low; VL - Very Low

22. Some of the constraints experienced by the farmers in the adoption of fertiliser management practices are given below. On the basis of your experience, please indicate your response against each constraint in the appropriate column.

Sl. No.	Constraint	Most Important	Important	Less Important	Least Important
1	No way to cover the cost incurred in fertiliser if the crop fails for one or other reason				
2	Interest rate of crop loan high				
3	Does not know the different aspects of fertiliser management				
4	Uncertainity of irrigation water availability				
5	Amount received as crop loan is very much less				
6	Crop loan distribution system inadequate				
7	The fertiliser depots are distantly located				
8	Availability of fertiliser not enough				
9	Not fully convinced about the benefits of fertiliser application				
10	Recommended fertilisers not available				
11	Non-availability of fertilisers at the correct time				
12	The crops become more susceptible to pests and diseases				
13	High cost of fertilisers				
14	Crops get burned				
15	Any other (specify)				

EVALUATIVE PERCEPTION OF APPROPRIATENESS OF THE RECOMMENDED FERTILISER MANAGEMENT PRACTICES

BY

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ABSTRACT OF THE THESIS

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ABSTRACT

A study was undertaken to investigate into the extent of knowledge, extent of adoption and evaluative perception of appropriateness of the recommended fertiliser management practices among rice farmers (n = 200) and Agricultural Demonstrators (n = 54) in Palghat and Cannanore Districts of Kerala State.

The study revealed that farmers of Palghat and Cannanore differed significantly with respect to their knowledge and adoption of fertiliser management practices with farmers of Palghat having higher level of knowledge and adoption. The analysis of the pooled data showed that only less than one-fifth (18.50%) of the farmer respondents had high knowledge of recommended fertiliser management practices and only a little more than one-fifth (21.50%) had high adoption of fertiliser management practices. All the Agricultural Demonstrators selected for the study were found to have high knowledge of fertiliser management practices.

Education, scientific orientation, extension participation and mass media utilisation were found important in predicting the knowledge of fertiliser management practices, while education, attitude towards fertiliser use, economic motivation, credit utilisation and knowledge about fertiliser management practices were found significant in predicting the adoption.

The practice of growing leguminous crops was perceived as high in terms of observability and profitability by the farmers of both Palghat and Cannanore. Placement of fertilisers was perceived as low in terms of practicability, compatibility, simplicity and divisibility by the farmers of Palghat, while use of complex fertilisers was perceived as high in terms of practicability and divisibility by the farmers of Cannanore. Though application of fertiliser based on soil test was perceived as low in terms of observability, cost and efficiency by the farmers of Palghat, the same was perceived as high in terms of efficiency by the farmers of Cannanore. Growing green manure crops was perceived as low in terms of practicability, cost and efficiency by the farmers of Cannanore.

The Agricultural Demonstrators perceived application of farm yard manure as high in terms of practicability, compatibility and observability and placement of fertiliser as low in practicability, compatibility, simplicity, divisibility, observability and profitability.

'High cost of fertiliser' was perceived as the main constraint experienced by the farmers of Palghat and Cannanore in the adoption of fertiliser management practices, followed by 'interest rate of crop loan high' and 'uncertainity of irrigation water availability'.