ANALYSIS OF THE MANAGEMENT FOR SUSTAINABLE AGRICULTURE BY THE FARMERS OF KERALA

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THESIS

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DECLARATION

I hereby declare that this thesis entitled **"Analysis of the Management for Sustainable Agriculture by the Farmers of Kerala** is a bonafide record of research work done by me during the course of research and that this thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Vellanikkara,
28.7.95

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CERTIFICATE

Certified that this thesis entitled **"Analysis of the Management for Sustainable Agriculture by the Farmers of Kerala** is a record of research work done independently by **Smt. Jayasree Krishnankutty**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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Chapter 1

INTRODUCTION

Science has been described as the unending quest for truth. The truth, however unpleasant it may be, must be the leading light for the real scientist. During the many milleniums of evolution, science has advanced at breath taking rates and scientific progress has become almost synonymous with human development.

In the former days, man used to look up to nature for everything he needed. Nature was worshipped like God and natural phenomena were looked upon with awe. For generations, our ancestors lived in perfect harmony with nature, never damaging it beyond the irreparable limit.

But scientific developments brought about changes at large. As science progressed, so did man's needs. Science equipped man with a power so great that he began to think of conquering nature and controlling it. Simple, nature-oriented way of living gave way to more complicated ways leading today's super-fast, consumer life.

Changes were many fold. The general faster rate in the tempo of life reflected in all sectors. People wanted quick, if not instant remedies for their problems. Words like

result-oriented. hi-tech and fast-acting became the trend of the times. These concepts took their place in agriculture too, which originally started as just an extension of nature.

After the second world war, scientific advancements revolutionised agriculture in the rich countries of the world. Laboratory-born varieties replaced traditionally cultivated varieties evolved from centuries of careful selection. Use of chemicals as fertilizers and for plant protection became imperative. As the times progressed, it became possible even to instill the desired trait into a crop by artificial means. It is now possible through biotechnology to create hybrid crop seeds which incorporate pollen inhibiting genes which promise a 20 per cent increase in yield. This effectively ensures that any sort of natural pollination cannot take place making farmers everywhere completely dependent on the seed companies (Mathen, 1993).

Due to this high-external-input agriculture,production and productivity double or triple-folded in the developed countries. Food grain production became surplus there. However, the developing countries were a far cry from this picture. They lagged pathetically behind in the case of agricultural production.

But India was an exception. In India, the 'green revolution' brought about high yielding varieties and allied use

of synthetic inputs in agriculture which boosted up yields more than ever. During this time the main aim was increased production and productivity. However, only the cream of the cultivator class benefited from these developments in agriculture, while the average Indian rural farmer, who could not afford the additional expenses attached with the high yielding varieties was forced to let go of his land or ended up in heavy debts. The social and economic stratification became more marked still, with the rich getting richer and the poor getting poorer. This resulted in more and more land exploitation by the destitute which caused severe desertification and numerous associated ill effects.

Another problem lurking in the background was the loss of genetic diversity. India is one of the countries that has the maximum genetic diversity in the world. Over 50,000 varieties of rice and other cereal crops, more than 20 varieties of cattle, over 10,000 varieties of trees and countless varieties of pulses, oil seeds, vegetables, herbs, insects, animals, birds, micro-organisms and other life forms form the basis of our genetic wealth. By appalling rates of deforestation and continued nurturing of a few varieties by way of monoculture, there has been such a heavy erosion in the genetic diversity of our country that it came as a rude shock when the realisation finally began to seep in.

Other than retaining the rich diversity of nature, this wide variety of species has some roles of inestimable value. It is this wide genetic base that gives the specific variety, the ability to cope with adverse environmental conditions. The wild relations of the cultivated varieties may be having resistance to major pests and diseases which has been proved time and again by researchers. For example, an IRRI reporter states: "Of the estimated 120,000 varieties of rice world-wide, the International Rice Research Institute (IRRI), Philippines, has collected and screened, around 83,000 varieties. Of those screened, one variety Oryza nivara, a wild rice from India, is the only known source of genes, which has resistance to Grassy Stunt Virus (GSV) disease". In other words, if this variety Oryza nivara becomes extinct the whole rice crop in the world would be subject to the onslaught of the virus. Traditional, multipurpose varieties are so much forgotten with the advent of the new scientific trends in agriculture that the young generation has not even heard of them. An example narrated to the researcher by the local farmers is that of the Scented rice cultivar 'Jeerakasala' or 'Gandhahasala' which was regularly cultivated in some parts of Thrissur District upto the early part of the 1960s. Now the new generation cultivators have not even heard of it. At the same time, they purchase the North Indian cultivated scented rice 'Basmati' at exhorbitant prices - so much for productivity-oriented agriculture.

In addition to the general problems faced by Indian farmers, Kerala faces other problems as well. it stands apart from other Indian states in many aspects. The density of population of the State is one of the highest in the country. It has the highest literacy rate in India and also has the highest wage rate. Still, shortage of labour becomes more acute day by day in the State. Due to the increasing pressure on land and a number of other reasons, land value escalated at unbelievable rates. Subsequently more and more agricultural lands are being sold which are converted for non-agricultural purposes.

All these, do not present a rosy picture. On one side, problems like growing number of mouths to be fed every year, acute poverty and unemployment weigh down. On the other, wider spectrum problems like soil degradation, desertification, decreasing rainfall and environmental hazards abound. What is a viable solution out of this maze?

Here comes the relevance of sustainable agriculture. Sustainability is a concept that experts in every field agree upon as the skeleton around which the future agriculture is to be built. But what is sustainable agriculture? The term is attributed to Lady Eve Balfour, who first used it in the late 1970s (Rodale, 1988).

Sustainable agriculture is an umbrella term that embraces but is not restricted to nor is defined by such terms as organic, regenerative, biodynamic, ecological, alternative or low input agriculture. Just because a farm is organic or alternative, it does not however mean that it is sustainable (Reganold et al., 1990). A sustainable farm must bring out sufficient produce in an economically viable manner, by using organic and inorganic inputs in judicious combination so as not to have any long term detrimental effects on the ecosystem.

Against this background, the present study on sustainable agriculture was taken up. The concept of sustainable agriculture has been expressed in a variety of ways by eminent scientists and noteworthy organisations. Hence, a study of this kind may help to make a detailed analysis of the concept so as to derive a generalisation of the concept and to clarify on the dimensions of sustainable agriculture.

Government is the major agency that motivates and directs developments in agriculture in the State. Hence it was thought desirable to examine how far the element of sustainability is incorporated in the various development programmes of the State Government. Another important aspect was to examine the scope and spread of the concept at the farmer level, for ultimately, they are the real trend setters.

With the above in view, the present study is taken up with the following specific objectives.

a. To analyse the concept of sustainable agriculture as perceived by scientists, extension personnel and farmers,

b. To examine the dimensions of sustainable agriculture.

c. To examine the nature and extent of inclusion of the identified dimensions of sustainable agriculture in the development programmes of the State Departments of Agriculture, Animal Husbandry and Fisheries.

d. To analyse the extent of knowledge, attitude and adoption of the components of sustainable agriculture by the farmers of Kerala.

e. To analyse the different environmental, situational, economic and personal factors which contribute to the knowledge, attitude and adoption of practices for a sustainable agriculture by the farmers.

f. To identify to constraints in the adoption of technologies for sustainable agriculture by the farmers

Limitations of the study

The present study forms part of the Doctorate degree programme and hence has the inherent limitations of an individual investigation done with limited financial resources in a fixed time frame. The student researcher was thus forced

to confine the coverage of the study to a feasible level in the case of sample size, location etc. However, every effort was taken to make the investigation as scientific and systematic as possible.

Sustainable agriculture is a vast topic. A relatively small scale study of the present sort cannot reach upto all of its branches and bifurcations. However, this is the first study of its kind in Kerala undertaken by Extension research.

In spite of these limitations, the best effort was put up to produce a concise study that touches some of the most important areas of the subject. It is expected that the study will project the strengths and weaknesses in the future of sustainable agriculture in the State.

Presentation of the study

The thesis is divided into six chapters. The present chapter which is the first one has already covered the specific need for the study, specific objectives and also the limitations of the study. The second chapter presents the review of related literature to the study. The location of the study, sampling procedure, variable selection and operationalisation, methods of data collection and statistical techniques employed are narrated in the third chapter. The fourth chapter presents the results

what about fifth chapter?

and goes into detailed discussion on the results. The sixth and the last chapter summarises the results and gives the implications of the study. The references, appendices and abstract of the thesis are given at the end.

Theoretical Orientation

Chapter 2

THEORETICAL ORIENTATION

Any kind of research work calls for an exploration into the available literature on the subject related to the research theme. In this chapter, an attempt is made to review the existing literature that were related to the various objectives of the research work, which had helped the researcher to provide a basis for the empirical investigation. The review of literature is presented under the following heads.

1. Concept of sustainable agriculture

2. Dimensions/elements of sustainable agriculture

3. Sustainable agricultural techniques/practices

4. Identification of sustainable agricultural techniques in the development programme of the State through content analysis

5. Relationship of personal and socio-economic variables of farmers with the dependent variables

6. Constraints in adoption of sustainable agricultural practices experienced by farmers

7. Conceptual framework of the study

1. Concept of sustainable agriculture

The concept of sustainable agriculture is understood and explained differently by the experts in different fields. Eventhough there is wide variation in the definitions proposed by eminent scientists and notable organisations, certain aspects like maintaining productivity, preserving the natural resource base and meeting the demands of the future prop up almost uniformly in all the definitions. The important definitions are reviewed as under.

According to Hornick and Parr (1987), a sustainable system is one where the benefits from the soil conservation practices are equal to or greater than the negative effects of the soil degradative processes.

Conway and Barbier (1988) defined agricultural sustainability as the ability to maintain productivity whether of a field or farm or nation in the face of stress or shock.

Granastein (1988) had summarised the historical development of the concept of sustainable agriculture. According to him, earlier, this concept was conceived as "organic farming", a term which was originally coined by Rodale in the 1940s. Other terms such as "natural", "ecological", "biological", "alternative", "low-input", and "regenerative"

have been used in contrast to "high-input", "maximum production" and "intensive" agriculture.

The Technical Advisory Committee of the consultative group on International Agricultural Research (TAC/CGIAR, 1988) stated that sustainable agriculture is the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environments and conserving natural resources.

American Society of Agronomy (1989) opined that sustainable agriculture is one that over the long term (i) enhances environmental quality and the resource base on which agriculture depends, (ii) provides for basic human food and fibre needs, (iii) is economically viable and (iv) enhances the quality of life for farmers and the society as a whole.

FAO (1989) observed that sustainable agriculture should involve the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources.

Lynam and Herdt (1989) defined a sustainable system as one with non-negative trend in measured output.

According to Research Branch of Agriculture, Canada (1989), 'sustainable agricultural systems are those that are economically viable, and meet country's needs for safe and

nutritious food, while conserving or enhancing natural resources and the quality of the environment for future generations'.

Rutten (1989) proposed as a guide to research that the definition of sustainability should include - (a) the development of technology and practices that maintain and/or enhance the quality of land and water resources and (b) the improvement in plants and animals and the advances in production practices that will facilitate the substitution of biological technology for chemical technology.

USAID (1989) suggested a definition for sustainable agriculture as a management system for renewable natural resources including soil, wildlife, forests, crops, fish, livestock, plant genetic resources and ecosystems to provide food, income and livelihood for current and future generations and that maintains or improves the economic productivity and ecosystem services of these resources.

Abrol and Katyal (1990) opined that in simplistic terms, sustainable agriculture implies endurance of productivity level through certain agricultural practices over a period of time.

Hart and Sands (1990) generalised that sustainable land use systems are those that are both economically viable in the short-run, yet not environmentally degrading in the long run.

The essence of sustainability is the maintenance of natural resource productivity.

Reganold et al. (1990) remarked that to be sustainable, a farm must produce adequate food of high quality, be environmentally safe, protect the resource base and be profitable.

Jodha (1991) after reviewing the work of a number of internationally known authors defined sustainability in relation to specific situations as the ability of a system to maintain a certain well defined level of performance (output) over time, and if required, to enhance the same, including through linkages with other systems, without damaging essential ecological integrity of the system. Because of the time factor involved and the system's responsiveness to changing requirements, sustainability is a dynamic phenomenon. This distinguishes sustainability from mere subsistence and makes it compatible with development.

John and George (1991) pointed out that a sustainable agricultural system must be economically and ecologically viable, both in the short and long term perspectives, be dynamic and adaptable to changing needs and give priority attention to the renewable natural resource base.

Venkataramani (1991) defined sustainable agriculture as that form of farming which produces sufficient food to meet the needs of the present generation without eroding the ecological assets and the productivity of the life-supporting system of future generations.

Altieri (1992) opined that the goal of sustainable agriculture is to maintain agricultural productivity with minimal environmental impact, assuming adequate returns while providing for the social needs of the entire population.

2. Dimensions/elements of sustainable agriculture

Dover and Talbot (1987) indicated that the growing need for a productive and sustainable agriculture calls for a new view of agricultural development that builds upon the risk-reducing, resource conserving aspects of traditional farming and draws on the advances of modern biology and technology. With the continuing population increase and rising food demand, industrial agriculture should not disappear, but that an ecological approach can begin to redress the environmental deterioration that both industrial agriculture and misplaced traditional agriculture have brought about.

Khosla (1987) characterised sustainable development designed with factors like resource conserving, equitable,

economically efficient, waste reducing, socially compatible, enjoyment generating, self reliant and need fulfilling.

Brklacich (1989) identified the elements of a sustainable production system as food sufficiency dimension, resource-stewardship dimension and producer-community dimension.

Swaminathan (1989) opined that prevention of soil erosion, conservation and management of water resources, conservation of biological diversity using in situ, ex-situ, in-vitro and in-vivo methods and promoting the spread and development of economically viable and ecologically sound farm techniques are the main components of a sustainable agricultural system.

Lal and Miller (1990) pointed out that some of the manipulable components for attaining sustainability are (a) improved cultivars and cropping systems, (b) conserving tillage and crop residue management, (c) application of fertilisers and organic amendments and (d) water management.

~~Virmani and~~ Eswaran (1990) identified the dimensions for sustainability of farming systems as technological feasibility, economic viability, political desirability, administrative manageability, social acceptibility and environmental soundness.

Jodha (1991) enumerated the two key elements of sustainability as (i) the intergenerational equity that is,

future generations should have equal or more prospects than the present ones, and (ii) primacy of the bio-physical resource base of the system in conditioning such equity - that is, potential degradation of the resource base in course of human efforts to maintain/raise system's performance is a key limitation to sustainability.

Hailu and Runge-Metzger (1992) opined that the sustainability of food production systems involves both environmental and socio-economic dimensions. A system will prove sustainable only if it can

- maintain or enhance environmental quality and remain robust against external stress or major disturbances.

- satisfy society's future demands for food and fibre.

- assure the economic and social well-being of producer.

3. Sustainable agricultural techniques/practices

This is a current area of research in which much individual and institutional attention have been focussed of late. The motto of 'going back to nature' is reflected in the efforts to bring back some of the traditional agricultural practices and revive or make necessary modifications to the age-old conservational techniques which have been largely replaced by artificial methods by the new generation

cultivators. Moreover, what is sustainable for one area may not be so for other areas. Thus a fresh approach for looking into sustainable agricultural practices suitable for each locality is very much necessary.

Dover and Talbot (1987) opined that no single agricultural method has a corner on sustainability. Any farming system whether chemical-intensive or natural can be in some aspects resource-conserving and in other aspects wasteful, environmentally unsound or polluting. Simply substituting non-chemical alternatives may not necessarily make agriculture more sustainable.

Taylor (1987) stressed on the necessity of diversifying the alley cropping technology by including nutritional and economic species. He opined that the basic planting and pruning design of the technology has proven effective for erosion control and soil amelioration.

Wilken (1987) observed that in many indigenous farming systems, field edges and borders, road sides and canal banks are routinely grazed by livestock. Where space is even scarcer, these surfaces may be planted with special crops, herbs or medicines or with deep-rooted shrubs and trees that yield valuable products and act as soil stabilisers and windbreaks. Distinctive field edges and aquatic environments also shelter wild plants and animals that can be harvested.

Greenfield (1988) reported on vetiver-based moisture conservation systems as cheap, replicable and sustainable. Vetiver-hedges, once established completely stop sheet erosion, slow run-off, spread it out and filter out the silt while letting the water seep through the entire length of the hedge. Vetiver grass grows through the silt, forming a natural terrace over the years.

Van Diest (1988) reported that when phosphate is the primary limiting factor in integrated crop-livestock systems, applying rock phosphate to legumes can raise the quantity and quality of fodder leading to better animal health and higher productivity. The phosphates in the forage derived from applied rock phosphate can be recovered in the manure of stall-kept animals. After bio-gas production, the residue can be used to improve the fertility of arable land.

Schrimpf and Dziekan (1989) reported on the effectiveness of some botanical pesticides like castor oil, papaya leaf mixture etc. They also found out that cow dung ash could be used for storing maize free of weevils.

Salam and Sreekumar (1990) recommended coconut based mixed farming system to sustain productivity under the homestead farming system prevalent in Kerala. They presented the intercropping system of a small farmer with coconut-arecanut-

banana-vegetables-fodder grass as the main crop components and cows and chicken as the livestock components and proved it to be sustainable.

Young (1990) stated that sustainable land use requires a combination of production with conservation. Agroforestry can contribute to this through control of erosion, maintenance and improvement of soil fertility, checking forest clearance and range land degradation and watershed management.

Baldwin (1991) referred to vermi composting as the process of using earth worms and micro-organisms to convert organic waste such as manure or household refuse to valuable compost. Earthworms help the farmers by decomposing organic matter, generating nutrient rich casts and opening channels in the soil thus improving soil fertility and structure.

Mollison (1992) viewed permaculture as a sustainable way of adapting to the rich resource-base. Permaculture is partly about agriculture, partly about gardening, transport, architecture, finance, social-design, non-waste production, waste-recycling etc. It is a design-system for people and also for the rehabilitation of native species and damaged landscapes - of which agriculture is the main agent of damage.

Save and Sanghavi (1992) had portrayed about Mr. Save's way of natural farming. Here step by step, his farm was

completely brought under organic farming with complete deletion of chemicals. He used earth worms for tillage, tried and succeeded in trying out better and more beneficial spacing for coconuts etc. According to them for more than 30 years his farm has run profitably.

4. Identification of sustainable agricultural techniques in the development programmes of the state through content analysis

Berelson (1954) stated that content analysis is a method of studying and analysing communication in a systematic, objective and quantitative manner to measure variables.

Good and Scates (1959) quoted that content analysis is the quantitative analysis of documentary materials. It is concerned with certain characteristics that can be identified and counted.

Kerlinger (1973) considered content analysis as an indirect way of observing people's behaviour where the investigator takes note of the communications that people have produced and asks questions of the communication.

Singh (1974) conducted content analysis of Farm Telecast Programmes of Delhi TV. He studied the programmes, did a trend

analysis of agricultural TV and identified the content emphasis, their evaluative nature and motivational nature.

Kayal (1975) used content analysis to study the trends of coverage regarding agricultural topic in a Bengali farm magazine, 'Krishi Pragathi' from 1965 to 1974. The trends in coverage of different areas of agriculture were analysed.

Gajapathy (1975) while analysing the agricultural news content of two Tamil dailies found that during the period of July 1973 to June 1974 the daily Dinamani published 23 articles on agriculture while Melaimurasu published 28 articles.

Sandhu and Shukla (1981) after their content analysis of Trianjan programme of AIR Jullundar opined that the Trianjan programme should provide more coverage to important aspects of rural home life, informational and informa-cultural types of messages should be enhanced and that involvement of experts should be increased.

Siddaramaiah and Raghavendra (1983) did content analysis of the Indian Journal of Extension Education from 1965 to 1981 and found out that the three major areas of Extension research which have been covered to a greater extent were adoption and diffusion, extension methods and communication. The areas which were least represented in terms of articles were social change,

special groups, training of farmers, leadership and group dynamics, rural institutions and youth development.

Prakash et al. (1990) did content analysis of Agricultural pages of three leading Malayalam dailies viz., Malayala Manorama, Methrubhoomi and Kerala Kaumudhi from April 1986 to March 1987 and reported that in the 'Karshikarangam' pages of all three dailies, articles on crop production were the maximum. The crop coverage varied according to the readership pattern of each newspaper. The authors suggested inclusion of details of supply and services, market rates of produces and timely publications of relevant cultivation practices of major crops.

5. Relationship of personal and socio-economic variables of the farmers with the dependent variables

The reviews for each of the dependent variables are given separately.

The reviews pertaining to knowledge of agricultural practices in relation to the selected characteristics of farmers are summarised. Due to the lack of specific studies on knowledge of sustainable agricultural techniques in relation to selected characteristics of farmers, related studies are reviewed.

A. Knowledge about sustainable agriculture

	Independent variable	Author(s)	Year	Nature of Relationship established
1.	Education	Kamarudeen	1981	Positively significant
		Parshad	1981	"
		Nataraju and Chemagowda	1986	No influence
		Baadgaonkar	1987	Positively significant
		Sanjeev	1987	"
		Kher and Halyal	1988	"
		Sulaiman	1989	"
		Sheela	1989	"
		Prabhu and Chandrakandan	1990	"
		Nagpal and Yadav	1991	"
2.	Farming experience	Gopal	1974	Positively significant
		Gadhandapani	1985	Negative relationship
		Sanjeev	1987	Positively significant
		Chenniappan	1987	Negative relationship
		Reddy and Reddy	1988	Non-significant
		Prahbu and Chandrakandan	1990	"
3.	Farm size	Supe and Salode	1975	No relationship
		Vijayaraghavan	1977	Positive relationship

		Chandrakandan	1980	Positive relationship
		Sarkar and Reddy	1980	"
		Kamarudeen	1981	"
		Haraprasad	1982	Negative relationship
		Khanal	1986	"
		Reddy and Reddy	1988	"
		Sulaiman	1989	Non-significant
		Nagpal and Yadav	1991	Positive relationship
4.	Annual income	Sushama	1979	Non-significant
		Kamarudeen	1981	Negative relationship
		Ahmed	1981	Non-significant
		Patil	1985	Positive relationship
		Godhandapani	1985	Non-significant
		Baadgaonkar	1987	Positive relationship
		Chenniappen	1987	Negative relationship
		Sulaiman	1989	Non-significant
5.	Exposure to information sources			
a.	Interpersonal:	Prabhu and Chandrakandan	1990	Positive relationship

b.	Mass media	Menon and Prema	1978	Positive relationship
		Prasad	1978	"
		Manivannan	1980	"
		Chandrakandan	1982	"
		Godhandapani	1985	"
		Senthil	1986	"
		Syamala	1989	"
		Prabhu and Chandrakandan	1990	"
		Sulaiman	1991	"
6.	Economic motivation	Sohal and Tyagi	1978	Positive relationship
		Somasundaram and Singh	1978	"
		Janakiramaju	1978	"
		Vijayaraghavan and Somasundaran	1979	"
		Jayakrishnan	1984	"
		Singh and Ray	1985	"
		Sulaiman	1989	"
		Juliana et al.	1991	"
7.	Innovation proneness	Pachori and Tripathi	1983	Positive relationship
		Philip	1984	Non-significant
		Khanal	1986	Positive relationship

		Kher & Halyal	1988	Non-significant
		Syamala	1989	Positive relationship
		Juliana et al.	1991	Positive relationship
8.	Risk orientation	Misra and Sinha	1981	Non-significant
		Prabhu and Chandrakandan	1990	Positive relationship
		Juliana et al.	1991	Positive relationship
9.	Extension orientation			
		Vijayaraghavan & Somasundaram	1979	Positive relationship
		Baadgaonkar	1987	Non-significant
		Sanjeev	1987	"
		Syamala	1989	"
a.	Extension contact	Kamarudeen	1981	Positive relationship
		Chandrasekharan	1982	Non-significant
		Senthil	1983	Positive relationship
		Godhandapani	1985	"
		Reddy & Reddy	1988	"
		Juliana et al.	1991	"
b.	Extension participation	Sulaiman	1989	Positive relationship

B. Attitude towards sustainable agriculture

The reviews pertaining to attitude of farmers towards sustainable agricultural practices in relation to their selected characteristics are summarised as under.

As in the case of knowledge about sustainable agricultural practices, here also specific studies on attitude of farmers towards sustainable agricultural practices could not be traced. Hence related studies are reviewed.

1.	Education	Kamarudeen	1981	Positive relationship
		Surendran	1982	Non-significant
		Vijayakumar	1982	Positive relationship
		Cherian	1984	"
		Sanjeev	1987	Non-significant
		Anilkumar	1988	Positive relationship
		Kunchu	1989	Non-significant
		Latha	1990	Positive relationship
2.	Farming experience	Rahiman and Menon	1980	Positive relationship
		Naik	1981	"
		Mani & Knight	1981	"
		Cherian	1984	"

		Sanjeev	1987	Non-significant
		Kunchu	1989	Positive relationship
3.	Farm size	Reddy and Reddy	1977	Non-significant
		Prakash	1980	"
		Sarkar	1980	Positive relationship
		Vijayakumar	1983	"
		Cherian	1984	Non-significant
		Khanal	1986	Non-significant
		Kunchu	1989	Positive relationship
		Latha	1990	Non-significant
		Nagpal and Yadav	1991	Positive relationship
4.	Annual income	Sushama	1979	Positive relationship
		Vijayakumar	1983	"
		Viju	1985	"
		Kunchu	1989	"
		Latha	1990	"
5.	Mass media exposure	Rao	1979	Positive relationship
		Prakash	1980	Non-significant

		Kamarudeen	1981	Positive relationship
		Vijaya	1982	Non-significant
		Cherian	1984	Positive relationship
		Singh and Kunsroo	1985	"
		Syamala	1989	"
6.	Economic motivation	Das & Sarkar	1979	Positive relationship
		Mani & Knight	1981	Non-significant
		Pathak	1981	"
		Kunchu	1989	"
		Nagpal & Yadav	1991	"
7.	Innovation proneness	Philip	1984	Non-significant
		Khanal	1986	Positive relationship
		Syamala	1989	"
		Latha	1990	"
8.	Risk orientation	Kunchu	1989	Non-significant
9.	Extension contact	Reddy and Reddy	1977	Non-significant
		Kamarudeen	1981	Positive relationship
		Pathak	1981	Non-significant

Singh and Kunsroo	1981	Non-significant
Syamala	1989	Positive relationship

Studies depicting the relationship of perception about availability of sustainable agricultural techniques, perception about price of inputs and perception about price of outputs with the dependent variable (attitude towards sustainable agriculture) were not available and hence not reviewed.

However, Latha (1990) found positively significant relationship between perception about efficiency of biogas technology among users and their attitude towards biogas technology.

C. Extent of Adoption of sustainable agricultural practices

The review pertaining to extent of adoption with selected independent variables are summarised as under.

In the absence of specific studies depicting the relationship of extent of adoption of sustainable agricultural practices with selected characteristics of farmers, studies on the extent of adoption of improved agricultural practices are presented.

	Variables	Author(s)	Year	Nature of Relationship established
1.	Education	Pillai	1978	Positive relationship
		Ayyathurai	1980	"
		Ramakrishna	1980	"
		Viju	1985	"
		Prasannan	1987	"
		Balan	1987	"
		Aziz	1988	Non-significant
		Ahmed	1988	Positive relationship
		Himantharaju	1988	"
		Mann	1989	"
		Bonny	1991	"
		Rajendran	1992	"
2.	Farming experience	Renganathan	1981	Negative relationship
		Balasubramanian & Kaul	1982	Non-significant
		Ramaswamy	1983	"
		Jayakrishnan	1984	Positive relationship
		Moorthy	1984	"
		Godhandapani	1985	Negative relationship
		Palani	1987	Non-significant

		Ramaswamy	1987	Positive relationship
		Krishnamoorthy	1988	Negative relationship
		Bonny	1991	Positive relationship
3.	Farm size	Ravi	1979	Non-significant
		Ravichandran	1980	"
		Sinha & Sinha	1980	"
		Vijaya	1982	"
		Sanoria and Sharma	1983	Positive relationship
		Kulkarni and Patel	1984	"
		Gangully	1985	Positive relationship
		Swaminathan	1986	"
		Prasannan	1987	"
		Reddy	1987	"
		Aziz	1988	"
		Satheesh	1990	"
		Rajendran	1992	Non-significant
4.	Annual income	Pillai	1978	Positive relationship
		Manivannan	1980	"
		Ramakrishnan	1980	"
		Viju	1985	"
		Aziz	1988	"

	Naik	1988	Non-significant
	Anithakumari	1989	"
	Rajendran	1992	"
	Geethakutty	1993	"
5. Exposure to information sources	Prasad	1978	Positive relationship
	Prakash	1980	"
	Kamarudeen	1981	"
	Balan	1987	"
	Vijayan	1989	"
	Geethakutty	1993	"
a. Mass media	Tripathy	1977	Negative relationship
	Sohi and Kherde	1980	Positive relationship
	Manivannan	1980	"
	Jayakrishnan	1984	"
	Balasubramanian	1985	"
	Godhandapani	1985	"
	Jayapalan	1985	"
	Wilson and Chaturvedi	1985	"
b. Interpersonal sources	Choudhary	1970	Positive relationship
	Menon	1970	"
	Tripathy	1977	Negative relationship
	Singh	1981	Positive relationship
	Ray and Singh	1985	"

6. Perception

There were three variables in this study related with perception. These were perception about availability of sustainable agricultural practices, perception about price of inputs and perception about price of agricultural produce. Since specific studies dealing directly with these variables were not available, related studies on the extent of adoption are listed out.

Ariffin (1975) concluded that the farmer is more inclined to adopt a recommended agricultural practice if he perceives that the practice is relevant to his situation.

Chandrakandan et al. (1975) observed that farmers were more likely to adopt the farm practice 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) observed that farmers who perceived the recommended practices to be less costly, more profitable and tend to have more immediacy of returns were found to be growing HYV.

Thiruthuvadas (1981) reported that the attributes of multicrop thresher were perceived better by users than non-users.

Muthukrishnan (1981) found that majority of users of biogas plants had better perception towards the attributes of biogas plants.

Sulaiman (1989) observed that the perception of the attributes of practices had a bearing on adoption.

Rajendran (1992) reported significant relationship between feasibility perception of the enterprise by farmers and its utilization in the case of coconut and cattle enterprises.

7.	Risk orientation	Ayyathurai	1981	Negative relationship
		Ramaswamy	1983	Positive relationship
		Viju	1985	"
		Bhaskaran and Thampi	1986	Non-significant
		Dudhani et al.	1987	"
		Balan	1987	"
		Rameshbabu	1987	Positive relationship
		Krishnamoorthy	1988	"
		Aziz	1988	Non-significant

		Ajaykumar	1989	"
		Rajendran	1992	Positive relationship
8.	Economic motivation	Sohal & Tyagi	1978	Positive relationship
		Sakthivel	1979	Non-significant
		Manivarnan	1980	Positive relationship
		Joshi	1985	Positive relationship
		Viju	1985	"
		Palvannan	1985	Non-significant
		Prakashkumar	1986	Positive relationship
		Balan	1987	"
		Aziz	1988	Non-significant
		Krishnamoorthy	1988	Positive relationship
		Vijayan	1989	Positive relationship
		Satheesh	1990	Non-significant
		Bonny	1991	Positive relationship
		Rajendran	1992	
		Geethakutty	1993	
9.	Innovation proneness	Ravi	1979	Positive relationship
		Balasubramanian	1977	"

	Ravichandran	1980	Non-significant
	Geethakutty	1982	Positive relationship
	Haque & Ray	1983	"
	Hementharaju	1984	Non-significant
	Balan	1987	"
	Krishnamoorthy	1988	Positive relationship
	Ajaykumar	1989	"
	Vijaykumar	1989	"
	Rajendran	1992	Non-significant
	Geethakutty	1993	"
10. Extension orientation	Karim & Mahboobh	1974	Positive relationship
	Duraisamy	1975	Positive relationship
	Somasundaram	1976	"
	Kamarudeen	1981	"
	Balan	1987	Non-significant
	Sudha	1987	Positive relationship
	Jayaramaiah	1987	"
	Palvarnan	1988	"
	Syamala	1989	"
	Vijayan	1989	"

6. Constraints in adoption of sustainable agricultural practices

Eventhough sustainable agricultural practices are highly recommendable, there are many constraints in the way of their adoption by the farmers. Certain factors like lack of knowledge and apprehension about its unfamiliarity, prevent the farmers from adopting them, while in some cases the farmers simply do not want to adopt sustainable agricultural techniques due to economic reasons. An attempt is made here to present the opinions expressed by different researchers in this context.

Thiam (1987) concluded that small farmers were generally not inclined to adopt composting mainly due to the reasons given.

* Compostible matter is not easily available.
* Digging pits to bury compost is hard work.
* Stirring and turning over compost is repugnant to farmers for whom compost and dung are the same thing.

Lal (1989) reported that the experiments indicate that the current knowledge of biophysical processes in alley cropping and other agroforestry systems is much less than that in agriculture and forestry based systems. In addition to understanding the bio-physical processes, one must assess economic feasibility of the system in the context of non-farm situations. Human ecology and sociology play an important role

in acceptance and spread of technologies. We need to study the specific socio-political and institutional constraints.

Eswaran and Virmani (1990) pointed out that in developing countries, farmers are not able to sustain the productivity of their land due to one or all of the following reasons.

1. Low-economic status of the farmer
2. Technology: availability, transfer and acceptance
3. External intervention and support
4. Intransigencies of the climate
5. Soil/land constraints

Hegde (1990) delineated the constraints involved in integrating trees into farm systems as: (1) trees also have actual or perceived negative effects like they compete for space, scarce nutrients, water and light and they hinder mechanisation, (2) the planting may involve considerable risks because of possible damage by animals, (3) markets for tree products may not exist or prices may be unattractive, (4) trees are often governed by regulations which may prevent potential tree planters from gaining the fruits of their work.

Parr et al. (1990) identified overgrazing resulting from use of the same land for raising crops and animals and

lack of proper equipment and adequate power as the limiting factors for the adoption of conservation tillage in the developing countries.

Reganold et al. (1990) broadly outlined the factors that inhibit farmers from adopting sustainable farming methods as

1. Governmental policies
2. Lack of information on sustainable agricultural practices to the farmer
3. High short term costs
4. Lack of awareness about the adverse effects of agro-chemicals

Rao (1991) indicated that a common reason why farmers do not plant useful trees on bunds or in fields was because the young trees were grazed by stray cattle. He suggested a simple way to prevent this by swabbing the slurry made of equal amounts of cattle/goat droppings and water on the leaves of young trees.

Duhaylunsod (1992) identified the problems for sustainable development as: (1) anthropocentric philosophy without holistic perspective of development, (2) ill-oriented/ ill-planned/ill-managed programmes, (3) imposition of alien ideas/skills and technologies, (4) overpopulation, (5) poverty and (6) state control over resources.

In the opinion of Hall (1992), when government talk about sustainability, they are talking mainly about environmental practices in terms of resource conservation. But when farmers talk about sustainability, they are talking about sustaining their standard of living and looking forward to a better standard in the next generation. They are not looking to preserve the fertility of their land 'per se', because in order to get the necessary food security or cash crops they may, in fact sacrifice the quality of their land. However, agricultural development workers overlook this.

Remonde et al. (1992) reported the main constraint in shifting to organic contour farming by the Philippine farmers as the labour-intensity in establishing and maintaining the system. Also, farmers with a family cannot afford to have a dip in their income as is the case in the transition period from chemical farming to organic farming.

The conceptual framework of the study is given as Fig.2

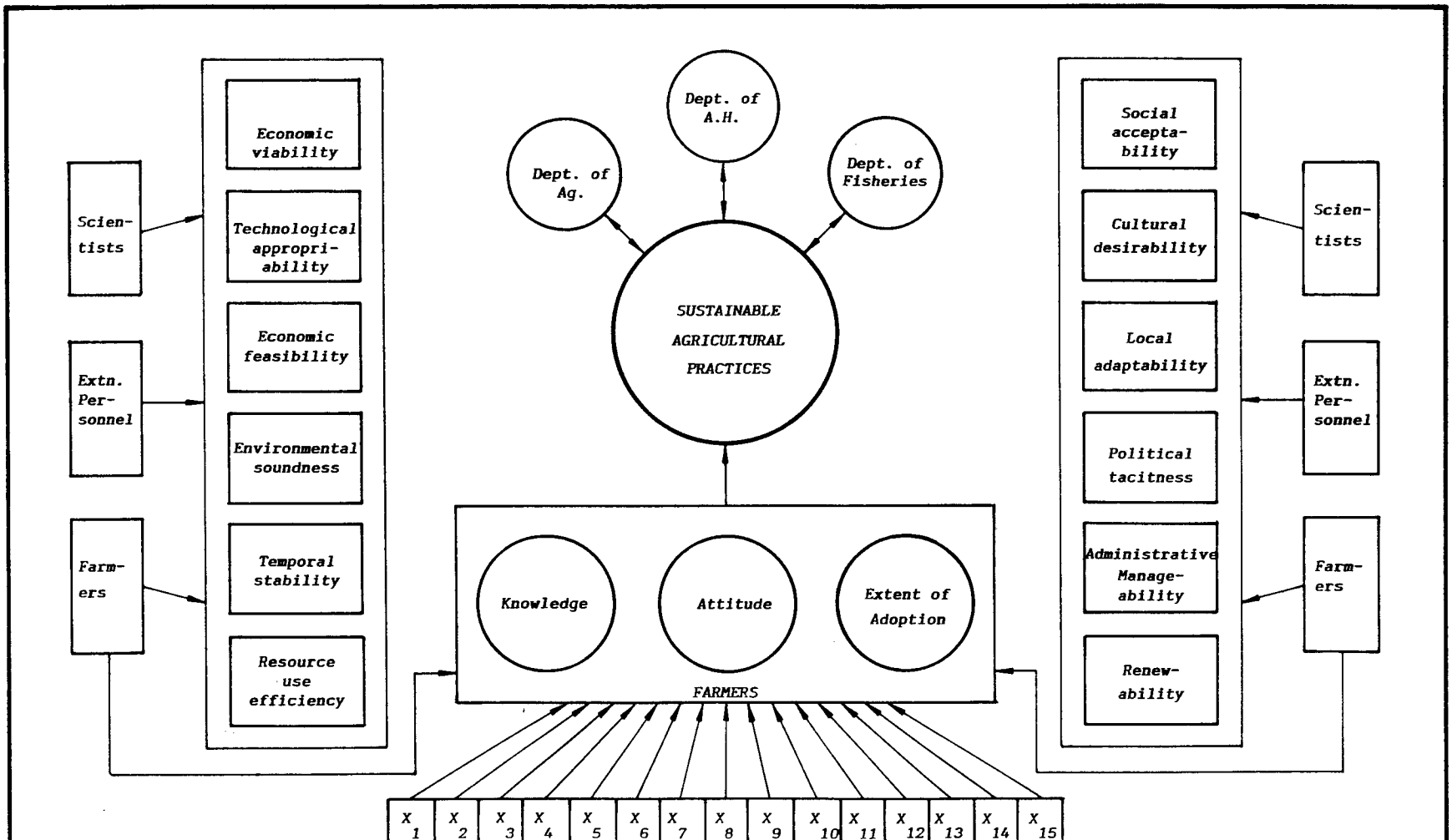


FIG.2 CONCEPTUAL FRAMEWORK OF THE STUDY

Methodology

Chapter 3

METHODOLOGY

This chapter discusses the methods employed in the present study to arrive at the results. The study was conducted in three phases. The first phase covered the first two objectives viz., perception about the concept of sustainable agriculture and identification of dimensions of sustainable agriculture. The second phase consisted of pursuing the third objective i.e., identifying the extent of inclusion of the elements of sustainable agriculture in the various developmental programmes of the State Departments of Agriculture, Animal Husbandry and Fisheries. In the third phase, the last three objectives were covered i.e., extent of knowledge, attitude and adoption of sustainable agricultural practices, relationship of personal and socio-economic characteristics of farmers with the dependent variables and the constraints in the adoption of sustainable agricultural technologies.

The chapter is presented under the following sub-heads.

1. Perception about the concept and dimensions of sustainable agriculture

2. Extent of inclusion of sustainable agricultural technologies in the developmental programmes of the Department of Agriculture, Animal Husbandry and Fisheries

3. Extent of knowledge, attitude and adoption of sustainable agricultural techniques and their relationship with personal, socio-economic and socio-psychological characteristics of farmers and

4. Constraints in the adoption of sustainable agricultural technologies

1. Perception about the concept and dimensions of sustainable agriculture

For this part of the study, in the first stage, 20 scientists of KAU were contacted and were asked to give a standard definition of sustainable agriculture and also to indicate the possible dimensions of sustainable agriculture. Based on this and also an exhaustive review of literature, five definitions (Appendix I) and 12 dimensions of sustainable farming were identified. These were then subjected to perception analysis.

a. Selection of sample

It was decided that perception about sustainable agriculture may be obtained from three categories of judges

viz., agricultural scientists, extension personnel and farmers. For this purpose, a list of all the available scientists in the disciplines of Agronomy, Soil Science, Horticulture and Agricultural Extension from Kerala Agricultural University and Tamil Nadu Agricultural University was prepared. Twenty five scientists were randomly selected from this list. Similarly, a list of extension personnel in the cadre of Assistant Director and Deputy Directors from the State Department of Agriculture was prepared from which 25 officers were randomly selected to form another category of judges. The third category of 25 farmers was selected at random from a list of progressive farmers obtained from the three sub-divisional agricultural offices in Thrissur district. While preparing the list, it was ensured that progressive and educated farmers only were included.

b. Operationalisation of concepts

The 12 identified dimensions of sustainable agriculture were operationalised as detail below for the purpose of this study.

1. Technological appropriateness: refers to how far a technology suits the social and infrastructural situations of the farmer.

2. Economic feasibility: refers to whether the farmer can afford to adopt the technology within his realm of financial status and position.

3. Economic viability: refers to whether the technology can result in bringing positive net returns to the farmer.

4. Environmental soundness: refers to the extent to which the technology results in enriching the environment or at least in not harming the environment even to a small extent.

5. Temporal stability: refers to whether the positive aspects of the technology remain stable in the long run.

6. Resource use efficiency: refers to how efficiently the technology can utilise the inputs and convert them into useful and productive outputs.

7. Local adaptability: refers to the extent to which the technology is adaptable to the existing local conditions of the farmers.

8. Social acceptability: refers to the extent to which the technology is acceptable by the different sections of the society.

9. Political tacitness: refers to whether the technology can be used unhampered in the existing intricacies and implications of the political system.

10. Administrative manageability: refers to whether the technology can be practically implemented under the existing bureaucratic structure.

11. Cultural desirability: refers to the extent to which the technology fits with the cultural patterns and values of the society.

12. Renewability: refers to the extent to which the technology can be used and re-used without much additional efforts and inputs.

c. Response collection

The responses of the three categories of judges were obtained using mailed questionnaire. For measuring the perception about the concept of sustainable agriculture, the five selected definitions were administered. The respondents were requested to either choose one of these definitions that reflected his idea of sustainable agriculture the best or give a definition in his/her own words. From the definition selected/given by the respondents, a generalisation was tried to be arrived at.

To identify the dimensions, the respondents were asked to assign ranks to the 12 selected dimensions according to their perceived importance and also to assign weightages to the different dimensions such that the total weightage added to 100. There was no restriction imposed on the weightage to be assigned except the condition that the total of all the weightages for the dimensions should not exceed 100.

2. Extent of inclusion of sustainable agricultural technologies in the developmental programmes of the Department of Agriculture, Animal Husbandry and Fisheries

This was examined by employing the method of content analysis. Good and Scates (1941) have defined content analysis as 'the quantitative analysis of documentary material. It is concerned with certain characteristics that can be identified and counted.

The research question here was to examine whether there is adequate inclusion and emphasis on the elements of sustainable agriculture with reference to various development programmes of the State Departments. To obtain the information, the relevant records of the three departments viz. Agriculture, Animal Husbandry and Fisheries (mainly their annual plans for the year 1992-93) were thoroughly examined. In the case of Department of Agriculture and Animal Husbandry,

the programmes were categorised based on the crop and animal concerned respectively. In the case of fisheries, categorisation was not necessary since there were only a limited number of programmes. For analysis, activities or specific practices relevant to sustainable agriculture were identified in these schemes wherever present. If in any scheme, there is at least one component/practice that is related to sustainable agriculture per se, that scheme was included. Thus, it was possible to obtain the number of schemes under each department which have some element of sustainablity.

3. Extent of knowledge, attitude and adoption of sustainable agricultural techniques and their relationship with personal, socio-economic and socio-phychological characteristics of farmers

a. Location

The data for this purpose were collected from farmers of lowland, midland and upland farming systems in the State. One district, namely Thrissur district was purposively selected covering the three farming systems. From the selected district, one Agricultural Sub-division viz. Thrissur sub-division was selected randomly.

Three blocks were randomly selected from this sub-division. The three selected blocks were Cherpu,

Ollukkara and Koorkanchery. Three panchayaths, one each belonging to low-elevation lands, medium-elevation lands and high-elevation lands were selected purposively from these blocks.

Low-elevation lands: These lands are usually characterised by low elevation ranging from MSL to 7.5 m and high rainfall. The soils are sandy and coastal alluvium in the coastal area lowlands and saline hydromorphic soils in the Pokkali areas. In the kole areas, there is salt water inundation and the land is below MSL in certain areas. Major cropping systems of this agro-ecological situation in Thrissur district are rice-rice-fallow, water fallow-rice-vegetable, rice, vegetable, and rice-banana. In the raised garden lands predominantly homesteads, the major cropping system is coconut and arecanut homesteads with intercrops like banana, arecanut, vegetables, fruit trees like mango and cashew.

Medium-elevation lands: The elevation ranges from 7.5 m to 75 m above MSL. The soils are predominantly lateritic sandy loams. The major cropping systems are rice-rice-rice, rice-rice-fallow, rice-rice-vegetables, rice-vegetables/pulses, rice-rice-green manure etc. The first crop is raised as rainfed, second and third crops with supplementary irrigation. Flooding is experienced during south-west monsoon and drought during the months of January-May. The light textured lateritic soils of this region help drainage. The homesteads are mainly

rainfed. Supplementary irrigation is provided in limited areas using water lifting devices. Crops experiencedrought from January to May.

High-elevation lands: This region is characterised by undulating topography with terraces, slopes and hill tops. The soils are mainly lateritic loams. Major cropping systems are rice-rice-rice, rice-rice-fallow, rice-rice-vegetables/pulses, rice-banana, rice-tapioca/yam. These are coconut/arecanut based homesteads where crops are raised as poly-crop mixtures. First crop rice is mainly rainfed and second and third crops supplemented with irrigation. Pulses and sesamum are raised with residual moisture. Drought is experienced during January-May months.

For the purpose of this study, three panchayats viz. Cherpu, Koorkanchery and Paralam that came under low-elevation lands were purposively selected. In the case of medium elevation lands. Vilvattom, Madakkathara and Nenmanikkara panchayath were purposively selected from the selected blocks. Pananchery, Thrikkur and Puthur were the panchayaths selected under high-elevation lands (Fig.2).

b. Selection of sample

From each of these panchayaths, three wards were selected randomly. The ward-wise list of farmers were obtained

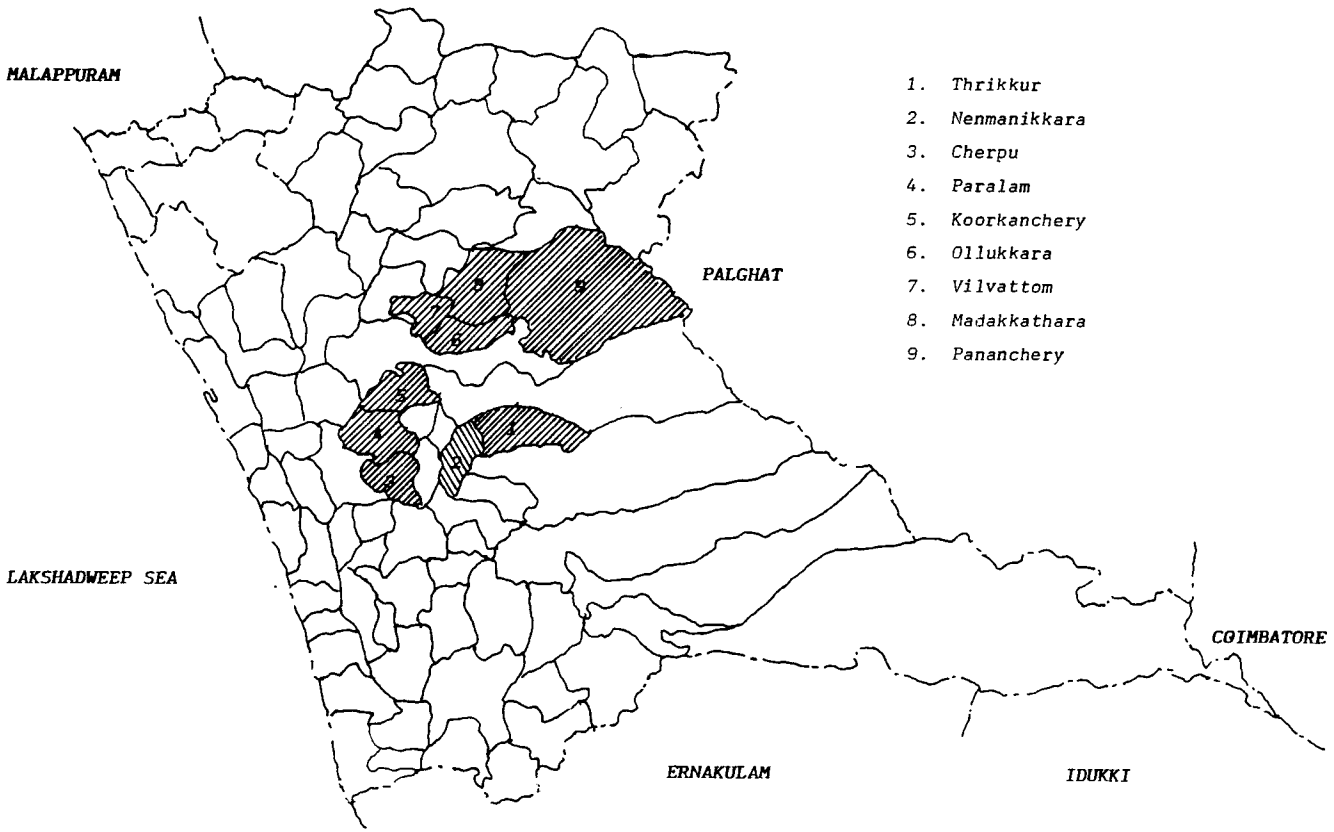


FIG.1 MAP SHOWING THE LOCATION OF THE STUDY

from the respective Krishi Bhavans and from each ward, 10 farmers were selected randomly. Thus 30 farmers were selected from each panchayath and the 270 farmers from the selected nine panchayaths formed the final sample of respondents.

c. Operationalisation of concept and measurement of variables

Based on the specific objectives, review of past studies and consultation with experts in the field of Agricultural Extension, the relevant independent variables were selected. A pilot study was also conducted before the finalisation of variables to be included in the study.

Measurement of variables

The dependent variables for the study were knowledge about sustainable agriculture, attitude towards sustainable agriculture and extent of adoption of sustainable agricultural practices.

The extent of knowledge, attitude and adoption of sustainable agricultural techniques by the farmers were analysed using their mean and standard deviation.

The independent variables selected were:

1. Education
2. Farming experience

3. Farm size
4. Income from agriculture
5. Irrigation pattern
6. Exposure to information sources
7. Perception about availability of sustainable agricultural techniques
8. Perception about price of inputs
9. Perception about price of agricultural produce
10. Risk orientation
11. Economic motivation
12. Innovation proneness
13. Extension orientation

Measurement of variables

A. Independent variables

1. Education

Education is operationalised as the number of years of formal education attained by an individual respondent. The scoring procedure developed by Trivedi (1963) was used. The different categories and the weights given were:

Educational level	Weight
Illiterate	0
Can read only	1
Can read and write	2
Primary education	3
Middle school education	4
High school education	5
Collegiate education	6

2. Farming experience

Chambers' dictionary (1976) explained experience 'as practical acquaintance with any matter derived from the changes and trials of life'.

Farming experience was measured in terms of the number of years since the farmer respondent was actually involved in the farming activities.

3. Farm size

This refers to the actual area of land (both wet and garden) possessed by the farmer respondent, which was measured in cents.

4. **Income from agriculture**

This was measured in terms of the gross annual income from agriculture, obtained by the respondent which was expressed in rupees.

5. **Irrigation pattern**

Irrigation pattern was measured in terms of the extent of irrigated area, and whether irrigation was done during the whole of the dry months or not.

The irrigation pattern of the farmers was measured on a three-point continum as

Full --------- Partial -------- Unirrigated

2 1 0

When the farm was irrigated completely all through the dry months, the irrigation pattern was considered 'full' and a score of 2 was given. If only a part of the farm is irrigated or if the whole farm or part of it only is irrigated for a portion of the dry months the irrigation pattern is considered as 'partial' and a score of 1 was given in such cases. In cases where there were absolutely no irrigation, 0 score was given.

6. Exposure to information sources

This reflects the contact of an individual with various sources of information i.e. his mere exposure to the various sources and not the influence or internalisation of the messages from those sources.

Cherian (1984) developed a scale for the measurement of this variable, which was used in this study.

Two types of information sources were considered viz., mass media and interpersonal sources. The mass media or impersonal sources considered were:

1. TV
2. Radio
3. Newspaper
4. Periodicals/magazines
5. Booklets, pamphlets, leaflets etc.

The interpersonal sources were divided into two, i.e., formal personal sources and informal personal sources.

Formal personal sources were:

1. Agricultural Assistant
2. Agricultural Officer
3. Village Extension Officer

4. Block Development Officer
5. Private Firm Representative

Informal personal sources were:

1. Family members
2. Friends/relatives
3. Neighbours/fellow farmers

The frequency of exposure was measured on a three-point continuum as regular - occasional - never; which were given scores of 2, 1 and 0 respectively. The cumulative score of the individual respondents under each scale was considered as his score for both mass media and interpersonal sources.

The exposure to mass media and exposure to interpersonal sources were considered separately for the purpose of interpretation.

7. Perception about availability of sustainable agricultural techniques

Perception helps individuals cope with the world by assigning meanings to it which can stand the test of subsequent experience (Toch and Maclean, 1970).

Sartain et al. (1973) defined perception as the interpretation of sensory inputs. It involves finding meaningful interpretations of our experiences.

Perception about availability of sustainable agricultural techniques is operationalised as to how far a farmer views, analyses and interprets by himself about the availability of sustainable agricultural techniques in his locality.

In this study, perception about availability of sustainable agricultural practices was measured using a scale developed for the purpose. The scale is considered arbitrary since the 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.

Eight sustainable agricultural practices were included in the scale after detailed discussion with agricultural scientists of Kerala Agricultural University and Officers of the State Department of Agriculture. They are:

1. Vermiculture
2. Green manure
3. Biofertilisers
4. Pesticides of plant origin
5. Biological control
6. Residue management
7. Organic recycling
8. Use of sewage water

The responses of the farmers which rated the availability of each sustainable agricultural technique as high were given a score of 3. A score of 2 was assigned to those responses that rated the perception about availability of sustainable agricultural techniques as medium, while a score of 1 was given to those responses wherein the perception was rated as low. The cumulative score of a respondent on the eight practices was considered as his score on perception about availability of sustainable agricultural techniques.

8. Perception about price of inputs

Perception about price of inputs refers to how a farmer views, analyses and interprets by himself about the reasonability or otherwise of the price of agricultural inputs.

Perception about price of agricultural inputs was measured using an arbitrary scale developed for the purpose. This included seven main agricultural inputs which were:

1. Labour
2. Seeds
3. Fertilisers
4. Weedicides
5. Plant protection chemicals
6. Agricultural implements/farm machinery
7. Irrigation equipments

The responses of the farmers regarding the perception about price of inputs were collected on a 3-point continuum as

High	Medium	Low
3	2	1

A high perception about the price of each agricultural input was given a score of 3. The responses in which the farmers perceived the price of input as medium was given a score of 2 and where it was considered low, a score of 1 was assigned. The cumulative score on all the inputs was considered as the score of a respondent on perception about price of inputs.

9. Perception about price of agricultural produce

Perception about price of farm produce refers to how far a farmer views, analyses and interprets by himself about the prevailing price of agricultural produce which he received on sale of his produce.

This was measured using a scale developed for the study. The major crops grown and their by-products, if any in the case of each farmer respondent were listed out. The perception of the farmer about the price he gets for each crop's main-produce and by-product were noted down on a 3 point continuum as follows:

High ---------- Medium ---------- Low

3 2 1

A high perception about the price was given a score of 3, those responses in which the price of the produce under question was rated as fair were given score of 2, and wherein the respondent perceived the price as 'low' was given a score of 1.

The cumulative score of a respondent on all the main produces and by-products was taken. This was divided by the total number of crops raised by him to arrive at his individual score on perception about price of agricultural produce.

10. Risk orientation

Risk orientation for the purpose of this study was defined as the mentality of the farmer towards risk and uncertainty in farming i.e., whether he would boldly meet risk on the face or shun away from it.

In this study, the scale developed by Supe (1969) with slight modification was used to measure the risk orientation of the respondents. The scale consisted of six statements of which two were negative. The responses were collected on a 5-point continuum as shown below.

Points in the continuum	Score
Strongly agree	7
Agree	5
Undecided	4
Disagree	3
Strongly disagree	1

The scoring pattern given above was reversed in the case of negative statements. The total score thus obtained by an individual was taken as his score for risk orientation.

11. Economic motivation

The scale developed by Supe (1969) was used in this study which consisted of 6 items against a 5-point continuum from 'strongly agree' to 'strongly disagree'. There were five positive items and one negative item. The scoring adopted was as follows:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Positive item score	7	5	4	3	1
Negative item score	1	3	4	5	7

The total score of the respondent for all the item was taken as his score for economic motivation.

12. Innovation proneness

Innovation proneness of a farmer is operationalised as that mental disposition which makes him positively oriented towards new ideas and changes and provides him the urge to try new methods and practices in his field.

This variable was quantified using the scale developed by Feaster (1968) as modified by Prasad (1983). Eight statements were used for the present study, with three response categories as 'yes', 'undecided' and 'no'. For the first four statements, a score of 2 was assigned to 'yes' response, a score of 1 to 'undecided' and 0 for 'no' response. The scoring procedure was reversed in the case of the last four statements. The summation of the scores obtained by a farmer for all the eight statements indicated his score on innovation proneness.

13. Extension orientation

Extension orientation is operationalised for the study as the degree of involvement a farmer has with the various Extension activities.

Extension orientation index developed by Bhaskaran (1979) was followed in the present study, which consisted of two major items (a) Extension contact (b) Extension participation.

a. Extension contact

The extent of extension contact was computed by assigning scores in relation to the frequency of contacting Agricultural Scientists/Extension Officers/Agricultural Assistants by the farmers.

Frequency	Score
Two or more times a week	3
Once in a week	2
Once to thrice a month	1
Never	0

b. Extension participation

The activities identified by Sudha (1987) as listed below were included to measure the extension participation of respondents, with slight modification.

1. Seminar
2. Farmers' meetings
3. Demonstrations
4. Exhibitions
5. Film shows
6. Trainings

The participation of the respondent in the above activities during the previous year of data collection in relation to the frequency of conduction of the activity was used to arrive at the extension participation score.

Frequency	Score
Never	0
Attending activities whenever conducted	1
Attending all activities whenever conducted	2

The scores obtained for both extension contact and extension participation by each respondent was calculated. These added together formed the extension orientation score of the individual respondent.

B. Dependent variables

1. Knowledge about sustainable agriculture

This variable refers to the degree of internalisation of the facts about sustainable agriculture by the respondent which get reflected in his cognitive behaviour.

It was measured using knowledge test developed for the study. The procedure of developing the test is briefly discussed.

Collection of items

A knowledge test consists of questions called items. An item pool of questions was prepared after referring various literature on sustainable agriculture and consulting the subject matter specialists. Thus initially, 55 items on different aspects of sustainable agriculture were collected. From this list, an initial selection of items was done according to the following criteria.

1. An item should promote thinking

2. It should differentiate well informed farmers from the poorly informed ones.

3. It should have some difficulty value.

Based on these, 40 items were selected from the list for inclusion in the knowledge test (Appendix II). Items were converted into relevant question forms which were objective type necessitating the respondents to answer only either yes/no or true/false.

Item analysis

The 40 questions were administered to a randomly selected sample of 33 farmers in Wadakanchery Subdivision which is a non-sample area for the main study. 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 can discriminate the well informed respondents from the poorly informed ones.

The scores obtained by the 33 respondents were arranged in descending order of total scores. The scores thus arranged were then divided into three equal groups, named G1, G2 and G3 with 11 respondents in each group. For item analysis, the middle group namely G2 was eliminated retaining only the high and low groups.

The frequency and percentage of correct responses for all the items were tabulated for these two groups and the difficulty and discrimination indices were calculated.

Calculation of item difficulty index (P)

The index of item difficulty worked out in this study is expressed as percentage of the respondents answering an item correctly. The formula used for the calculation was

$$Pi = \frac{ni}{Ni} \times 100$$

where,

Pi = difficulty index expressed in percentage of the i^{th} item

ni = number of farmers giving correct answer to the i^{th} item

Ni = total number of farmers to whom the i^{th} item was administered.

Calculation of discrimination index

To calculate the discrimination index, the $E^{1/3}$ method was used. The formula is

$$E^{1/3} = \frac{S_1 - S_3}{N/3}$$

where S_1 and S_3 are the frequencies of correct answers in the groups G_1 and G_3 respectively; and N is the total number of farmers in the sample.

The item difficulty indices and discrimination indices for all the 40 items are furnished in Appendix III.

The items having Pi values ranging from 20 to 50 and discriminations index above 0.40 were finally selected for inclusion in the interview schedule as done by Geethakutty (1982). Thus, finally 10 statement were selected for the knowledge test.

Scoring procedure

The respondents were asked to answer the items which were in the form of correct/incorrect, yes/no and true/false. A score of '1' was given to the correct answer and '0' for wrong answer. The cumulative score on all 10 statements was

considered as the respondents' individual score on knowledge about sustainable agriculture techniques.

Content validity of the test

In the initial stage itself, utmost care was taken to make the universe of content as comprehensive as possible. These statements were further screened with the help of experts so as to ensure that the statements readily reflected the respondents' actual knowledge on sustainable agricultural practices. Hence it was assumed that the test was considered to possess ~~have~~ content validity.

The farmers were grouped into three categories based on mean and standard deviation of the scores on knowledge.

2. Attitude of farmers towards sustainable agriculture

Attitude is operationalised as the mental disposition of the respondent about various aspects of sustainable agriculture; whether favourable or unfavourable.

Thurstone (1946) defined attitude as the degree of positive or negative affect associated with a psychological object. In this study, attitude of farmers towards sustainable agriculture was measured using an attitude scale constructed for the purpose. From among the various techniques available for attitude scale construction, the method of equal appearing interval by Thurstone and Chave (1929) was used in this study.

Preparation of universe of content

Sixty statements about sustainable agriculture which reflected the attitude of farmers towards sustainable agriculture were first collected after review of literature, discussion with agricultural scientists and officers of the State Department of Agriculture. These were then edited using the informal criteria as suggested by Wang (1932), Thurstone and Chave (1929), Likert (1932), Bird (1940) and Edwards and Kilpatrick (1948). Out of the 60 statements collected initially, 40 statements were retained after editing (Appendix IV).

The method of equal appearing interval has been widely used for obtaining scale values for a large number of statements. As per the method, all the 40 statements selected after editing were presented to 30 judges, who were Agricultural extension specialists in KAU and TNAU. The judges were asked to rate each statement on a five-point continuum ranging from most favourable through neutral to least favourable. The judges were requested to ensure that they do not express their attitude towards the stimulus, but their estimation of the degree of favourableness or unfavourableness expressed by each statement. The responses by the 30 judges were considered for calculation of the scale and Q values of the attitude statements.

Calculation of scale and Q values

The scale and Q values of the statements were calculated (Appendix V) using the formula given by Thurstone and Chave (1929) as given below:

$$S = l + \frac{0.50 - \Sigma pb}{P_w} i \text{ , where}$$

S = the median or scale value of the statement

l = the lower limit of the interval in which the median falls

Σpb = the sum of the proportions below the interval in which the median falls

P_w = the proportion within the interval in which the median falls

i = the width of the interval and is assumed to be equal to 1.0

Final selection of attitude statements to be included in the scale

The attitude statements to be finally included in the scale were selected using the following criteria.

1. The statement should have smaller Q values as far as possible. A low Q value indicates that there is good agreement among the judges while a high Q value indicates lack of agreement. The statements with the lowest Q values are the least ambiguous.

2. The statements selected should represent the universe of content with respect to sustainable agriculture.

3. The scale values should have equal appearing intervals i.e. distributed uniformly among the continuum.

4. There should be equal number of statements reflecting both favourable and unfavourable attitudes.

Based on these criteria, six statements, three favourable and three unfavourable were selected to constitute the final scale.

Validity of the scale

The validity of a scale refers to the efficiency with which it measures what it is intended to measure. The scale developed was tested for the following two types of validity.

a. Content validity

This is the kind of validity by assumption (Guilford, 1956). In other words, this reflect, how well the contents of

the scale represent the subject matter under study. This was ascertained during the collection and selection of statements for the study. Care was taken to include all possible statements which represent the universe of content.

b. Construct validity

When validity of the measuring instrument cannot be directly measured and certain other measuring instruments are needed to find out the validity of an instrument, the approach is known as construct validity.

This was tested by calculating the correlation coefficient between perception about availability of sustainable agricultural techniques and attitude. The correlation coefficient between the two scores was found to be highly significant ($r = 0.841$) when it was calculated for a sample of 25 respondents from Wadakanchery Panchayat which was not an area of the main study. Hence it was found that the scale had construct validity.

Reliability of the scale

A scale can be said to be reliable only when it consistently produces the same results when applied to the sample at any time. The reliability of the attitude scale constructed for the present study was tested by split-half method. For this, the scale was divided into two equal halves

based on odd-even numbers and administered on 25 respondents. Two sets of scores were thus obtained for the same group of respondents and they were correlated. The correlation coefficient obtained was highly significant (r = 0.807). This indicated that the internal consistency of the attitude scale was quite high.

Administration of the attitude scale

The responses to the statements were obtained on a 5-point continuum. The response categories and their corresponding scores for favourable statements were as follows:

Strongly agree	- 9
Agree	- 7
Undecided	- 5
Disagree	- 3
Strongly disagree	- 1

The scoring procedure was reversed for unfavourable statements. The cumulative score of each respondent for all the six statements was considered as his attitude score.

The farmers were grouped into three categories based on the mean and standard deviation of the scores on attitude.

3. Extent of adoption of sustainable agricultural practices

It is operationalised as the degree to which a farmer accepts, endorses and continues to implement the practices of sustainable agriculture in the field.

In this study extent of adoption was measured using a single scale developed for the study. This scale consisted of 19 sustainable agricultural practices relevant under the local condition of the farmers. The selection of the practices was done after

a. Discussion with Agricultural Extension experts and subject matter specialists in the State Department of Agriculture.

b. Discussion with progressive farmers to ascertain the prevalence and applicability of the practices in the present local conditions.

The farmers were asked to indicate as to whether the different selected practices were in continuous application is their farms or occasionally practised or never. The responses of 'continuous use' were given score of 2, responses of 'occasional use' score of 1 and 'never' responses were given 0 score.

The sum total of scores obtained by an individual on all items was considered as his score on extent of adoption.

4. Constraints in adoption of sustainable agricultural techniques

Based on discussion with experts, review of relevant literature and pilot study, constraints experienced by farmers in adoption of sustainable agricultural techniques were collected. A list containing the possible constraints was presented to the respondents. They were also asked to add any other constraints which they felt as important. The response to each constraint was obtained on a dichotomous response pattern as 'most important' and 'least important'. The frequency of responses under each category was worked out. The frequency percentage of each constraint perceived as important by the respondents was arrived at as follows.

$$\text{Percentage of constraint} = \frac{\text{Frequency obtained for a constraint}}{\text{Total no. of respondents}} \times 100$$

5. Data collection

The data were collected using a well constructed, structured interview schedule. It was personally administered to the respondents by the researcher and the responses recorded. Data collection was done during months April to July 1993.

6. Statistical procedures employed

The following statistical procedures were employed in the study.

1. Simple correlation analysis

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

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

where x = independent variable

y = dependent variable

n = number of observations

2. 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

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

where y = dependent variable

a = intercept

$x_1 \ldots x_n$ = independent variables

$b_1 \ldots b_n$ = 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.

3. Step down regression analysis

This was done to pin point those variables with the maximum contribution towards predicting the dependent variables, by eliminating the variables of less importance. The step-wise regression analysis selects the best sub-set of variables as suggested by Draper and Smith (1966).

4. Path analysis

Path analysis explains the cause and effect relationship between dependent and independent variables. The analysis was done using the method as given by Singh and Choudhary (1979), which gives the path coefficients of independent variables. Path coefficient can be defined as the ratio of the standard elimination of the effect due to a given

cause to the total standard deviation of the effect, i.e., 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 $\frac{X_1}{Y}$.

A conceptual framework of the study is given as Fig.2.

Results and Discussion

Chapter IV

RESULTS AND DISCUSSION

The findings of the present study and the discussion there on are presented in this chapter under the following sub-heads.

1. Concept of sustainable agriculture

2. Dimensions of sustainable agriculture

3. Extent of inclusion of elements of sustainable agriculture in the developmental programmes of the Department of Agriculture, Animal Husbandry and Fisheries.

4. Analysis of knowledge, attitude and extent of adoption of farmers regarding sustainable agriculture.

5. Relationship between the dependent and independent variables.

6. Constraints expressed by farmers in adopting sustainable agricultural technologies.

1. Concept of sustainable agriculture

The result of the analysis about the concept of sustainable agriculture is presented. The distributions of the

three categories of judges in which their choice of the definitions of sustainable agriculture are expressed are given in the Tables 1 to 3.

Table 1. Distribution of scientists based on their choice of definition of sustainable agriculture

(n=25)

Sl.No.	Definition by	Frequency	Percentage
1	American Society of Agronomy	7	28.00
2	FAO	2	8.00
3	Reganold et al.	-	0.00
4	USAID	15	60.00
5	Venkataramani	-	0.00
6	Own definition	1	4.00

Table 1 presents the distribution of scientists based on their choice of the definitions of sustainable agriculture.

Majority of the scientists (60%) chose the definition by USAID (1990), followed by 28 per cent, who chose the definition given by American Society of Agronomy (1989), followed by the definition by FAO (1989) which was chosen by 8 per cent. No one had selected the definition by Reganold (1990) and Venkataramani (1991). Only one scientist preferred to furnish a definition of his own.

Table 2. Distribution of extension personnel in relation to their choice of definition of sustainable agriculture

(n=25)

Sl.No.	Definition by	Frequency	Percentage
1	American Society of Agronomy	5	20.00
2	FAO	9	36.00
3	Reganold et al.	-	0.00
4	USAID	5	20.00
5	Venkataramani	1	4.00
6	Own definition	5	20.00

Table 2 presents the distribution of extension personnel in relation to their choice of the definition of sustainable agriculture.

Among the Agricultural Officers of the State Department of Agriculture, 36 per cent chose the FAO definition, while 20 per cent each chose the definitions given by American Society of Agronomy and USAID. Twenty per cent of the Officers furnished their own definitions. Only one officer chose the definition by Venkataramani, while the definition by Reganold was not chosen by any one.

Table 3. Distribution of farmers according to their choice of definition of sustainable agriculture

(n = 25)

Sl.No.	Definition by	Frequency	Percentage
1	American Society of Agronomy	7	28.00
2	FAO	7	28.00
3	Reganold et al.	-	0.00
4	USAID	6	24.00
5	Venkataramani	3	12.00
6	Own definition	2	8.00

The distribution of farmers based on their choice of the definition about sustainable agriculture is presented in Table 3.

The choice of the farmers was more or less scatteringly distributed. 28 per cent of the farmers chose the definition by American Society of Agronomy, while another 28 per cent chose the FAO definition. This was followed by the USAID definition which was supported by 24 per cent of farmers. Next in line was the definition by Venkataramani which was chosen by 12 per cent. The definition by Reganold was selected by none. Only two farmers chose to give their own definition of sustainable agriculture.

Table 4. Distribution of judges according to their choice of definition of sustainable agriculture (pooled sample)

(n=75)

Sl.No.	Definition by	Frequency	Percentage
1	American Society of Agronomy	19	25.33
2	FAO	18	24.00
3	Reganold et al.	0	0.00
4	USAID	26	34.67
5	Venkataramani	4	5.33
6	Own definition	8	10.67

The distribution of all the categories of judges (pooled) according to their choice of the definition about sustainable agriculture is presented in Table 4.

In the case of the pooled sample, majority of the judges (34.67%) chose the definition by USAID. The definition by American Society of Agronomy was the second widely chosen one (25.33%). This was followed by the FAO definition (24%). Only 5.33 per cent of the judges chose the definition given by Venkataramani while no one selected the definition by Reganold. It was seen that 10.6 per cent of the judges preferred to express the concept of sustainable agriculture in their own words.

It was among the scientists that a large majority (60%) chose the definition by USAID. Majority of the Officers (36%) chose the FAO definition while among the farmers there was no such clear majority. 28 per cent each of farmers chose the FAO definition and the definition by American Society of Agronomy.

The common features in the five given definitions were:

A sustainable farming system

- should be environmentally sound
- should protect the resource-base
- should meet the human needs

10.67 per cent (8 out of 75) of the judges gave their own definitions. The salient features from these definitions other than the common features in the given definitions were:

A sustainable farming system:

- should not upset the mutual interaction among components of the ecosystem.

- should be adaptable, acceptable and viable under the local conditions.

- should integrate ecological and socio-economic principles in the management of agriculture for intergenerational equity.

- should be one to which improvement of any part will not be at the cost of others.

An agricultural system cannot be called sustainable simply because it is economically viable and environmentally safe. It should meet the demand for food and fibre and should rely on easily available inputs. A sustainable agriculture need not necessarily avoid all chemical or synthetic inputs totally. The chemicals can be used in judicious combinations with natural inputs as supplements, considering the scarcity of natural inputs for large scale enterprises. So sustainability is a relative term whose meaning can vary according to the locality, specific situation and economics of the whole operation.

In the light of all these, it can be summed up that a farming system can be called sustainable when it meets the product demand for which it is intended, can maintain the productivity without depleting the natural resource-base, is not harmful to the environment, is economically viable, suited to the local conditions in all aspects and can be expanded without any deleterious effects in case of increased future demand.

2. Dimensions of sustainable agriculture

An analysis of the weightages assigned by the three categories of judges to the selected dimensions of sustainable agriculture is presented in Table 5. The mean weightages assigned to the dimensions by the three categories of judges is presented in Fig.3.

Of all the 12 selected dimensions, the highest weightage was assigned to resource use efficiency by scientists and farmers, while in the view of extension personnel, environmental soundness deserved the highest weightage. Political tacitness was given the lowest weightage by all three categories of judges alike. Economic viability, economic feasibility and technological appropriateness were considered important almost equally by all the judges. There was variation in the weightages assigned to resource use efficiency by the different categories of judges. While the scientists and farmers gave mean weightages of 15 and 14.12 respectively, the extension personnel gave it a weightage of only 11.04. While the farmers assigned a mean weightage of 12.32 to local adaptability, scientists assigned it a mean weightage of only 8.76. This in turn points to the need for understanding of the priorities of the farmers in the case ofsustainable agriculture by scientists. Here it is the role of the extension personnel to convey the feed back from the farmers to the scientists.

Table 5. Mean weightages assigned to the dimensions by the three categories of judges

Sl. No.	Dimensions	Mean weightage assigned by			Overall Mean	Rank
		Scientists	Extension personnel	Farmers		
		n=25	n=25	n=25		
1.	Technological appropriateness	12.28	11.68	12.28	12.27	IV
2.	Economic feasibility	11.16	13.04	8.56	10.92	V
3.	Economic viability	12.68	12.72	12.96	12.79	II
4.	Environmental soundness	10.88	14.40	12.24	12.51	III
5.	Temporal stability	5.32	5.64	3.68	4.88	IX
6.	Resource use efficiency	15.00	11.04	14.12	13.39	I
7.	Local adaptability	8.76	10.36	12.32	10.55	VI
8.	Social acceptability	5.52	5.72	7.24	6.16	VII
9.	Political tacitness	3.00	2.86	3.26	3.06	XII
10.	Administrative manageability	3.68	4.84	4.44	4.32	X
11.	Cultural desirability	3.88	3.56	3.48	3.64	XI
12.	Renewability	7.24	5.88	5.36	6.16	VIII

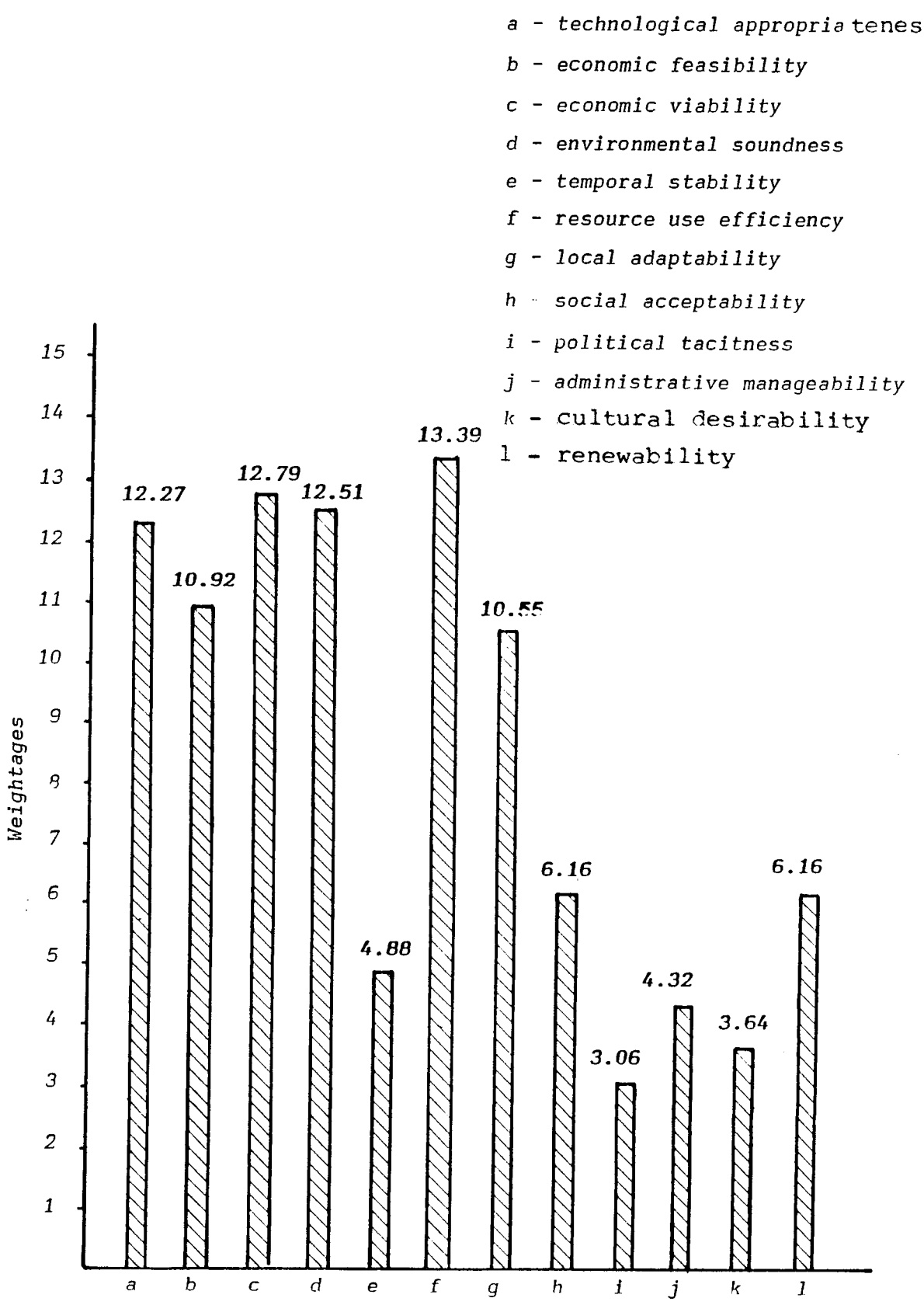


FIG.3 MEAN WEIGHTAGES ASSIGNED TO THE DIMENSIONS BY THE THREE CATEGORIES OF JUDGES

The dimensions renewability, social acceptability, temporal stability, administrative manageability, cultural desirability and political tacitness were given low weightages by all three categories of judges alike. There is such a clear-cut demarcation in the weightages assigned that there is no ambiguity as to which dimensions are felt important by these judges and which are not. The mean weightages of the top six dimensions are in the range of 10.55-13.39 whereas that of the lower six dimensions are in the range of 3.06-6.16.

An analysis of the ranks assigned by the three categories of judges to the selected dimensions of sustainable agriculture is presented in Table 6. Distribution of scientists who assigned ranks from 1 to 6 to the presented dimensions is given as Fig.4. Figure 5 shows the distribution of extension personnel who assigned ranks of 1 to 6 for the presented dimensions and Fig.6 shows the distribution of farmers who assigned ranks of 1 to 6 to the presented dimensions.

More than 90 per cent of all three categories of judges ranked environmental soundness and resource use efficiency among the top six dimensions. Above 80 per cent of all judges gave economic viability one of the top six ranks. Technological appropriateness, economic feasibility and local adaptability were considered among the top six dimensions by more than 60 per cent of all three categories of judges. There were 16 per cent of the scientists who assigned one of the lower six ranks to

Table 6. Analysis of the ranks assigned by the three categories of judges

Sl. No.	Dimensions	No. of scientists who assigned ranks (n=25)				No. of extension personnel who assigned ranks (n=25)				No. of farmers who assigned ranks (n=25)			
		From 1-6		From 7-12		From 1-6		From 7-12		From 1-6		From 7-12	
		F	%	F	%	F	%	F	%	F	%	F	%
1.	Technological appropriateness	21	84.00	4	16.00	23	92.00	2	8.00	17	68.00	8	32.00
2.	Economic feasibility	22	88.00	3	12.00	17	68.00	8	32.00	19	76.00	6	24.00
3.	Economic viability	21	84.00	4	16.00	23	92.00	2	8.00	19	76.00	6	24.00
4.	Environmental soundness	21	84.00	4	16.00	23	92.00	2	8.00	25	100.00	0	0.00
5.	Temporal stability	7	28.00	18	72.00	3	12.00	22	88.00	7	28.00	18	72.00
6.	Resource use efficiency	22	88.00	3	12.00	20	80.00	5	20.00	21	84.00	4	16.00
7.	Local adaptability	15	60.00	10	40.00	20	80.00	5	20.00	23	92.00	2	8.00
8.	Social acceptability	5	20.00	20	80.00	12	48.00	13	52.00	9	36.00	16	64.00
9.	Political tacitness	1	4.00	24	96.00	2	8.00	23	92.00	1	4.00	24	96.00
10.	Administrative manageability	2	8.00	23	92.00	8	32.00	17	68.00	3	12.00	22	88.00
11.	Cultural desirability	2	8.00	23	92.00	3	12.00	22	88.00	1	4.00	24	96.00
12.	Renewability	11	44.00	14	56.00	6	24.00	19	76.00	5	20.00	20	80.00

a - technological appropriateness
b - economic feasibility
c - economic viability
d - environmental soundness
e - temporal stability
f - resource use efficiency
g - local adaptability
h - social acceptability
i - political tacitness
j - administrative manageability
k - cultural desirability
l - renewability

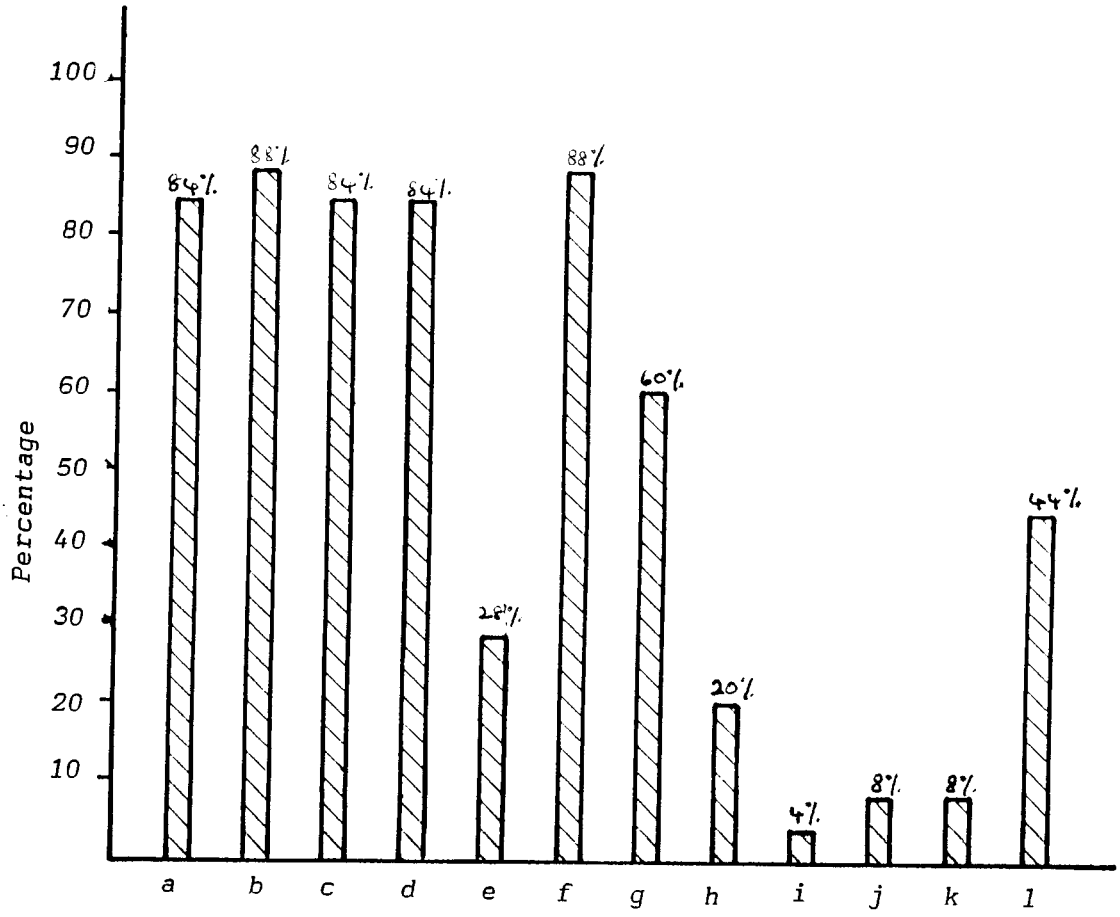


FIG.4 *DISTRIBUTION OF SCIENTISTS WHO ASSIGNED RANKS FROM 1 TO 6 TO THE PRESENTED DIMENSIONS*

a - technological appropriateness
b - economic feasibility
c - economic viability
d - environmental soudness
e - temporal stability
f - resource use efficiency
g - local adaptability
h - social acceptability
i - political tacitness
j - administrative manageability
k - cultural desirability
l - renewability

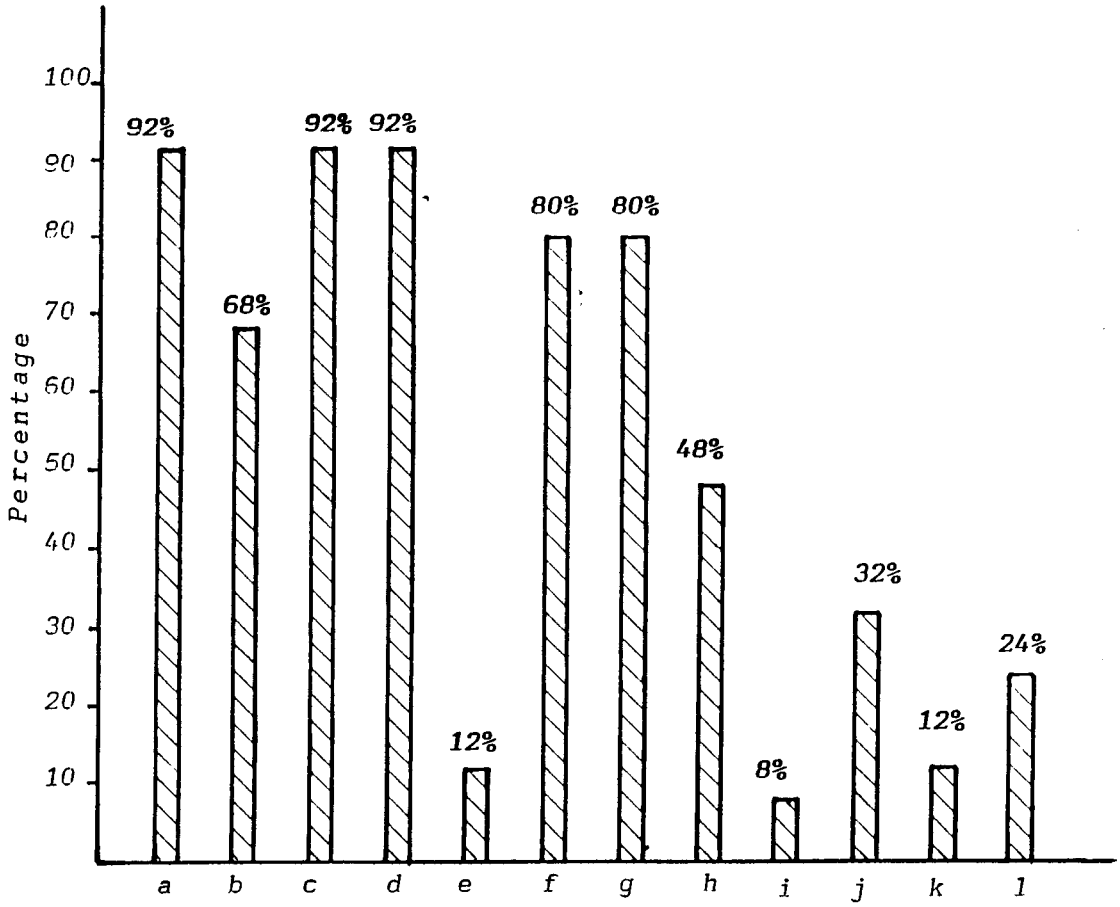


FIG.5 DISTRIBUTION OF THE EXTENSION PERSONNEL WHO ASSIGNED RANKS OF 1 TO 6 FOR THE PRESENTED DIMENSIONS

a - technological appropriateness
b - economic feasibility
c - economic viability
d - environmental soundness
e - temporal stability
f - resource use efficiency
g - local adaptability
h - social acceptability
i - political tacitness
j - administrative manageability
k - cultural desirability
l - renewability

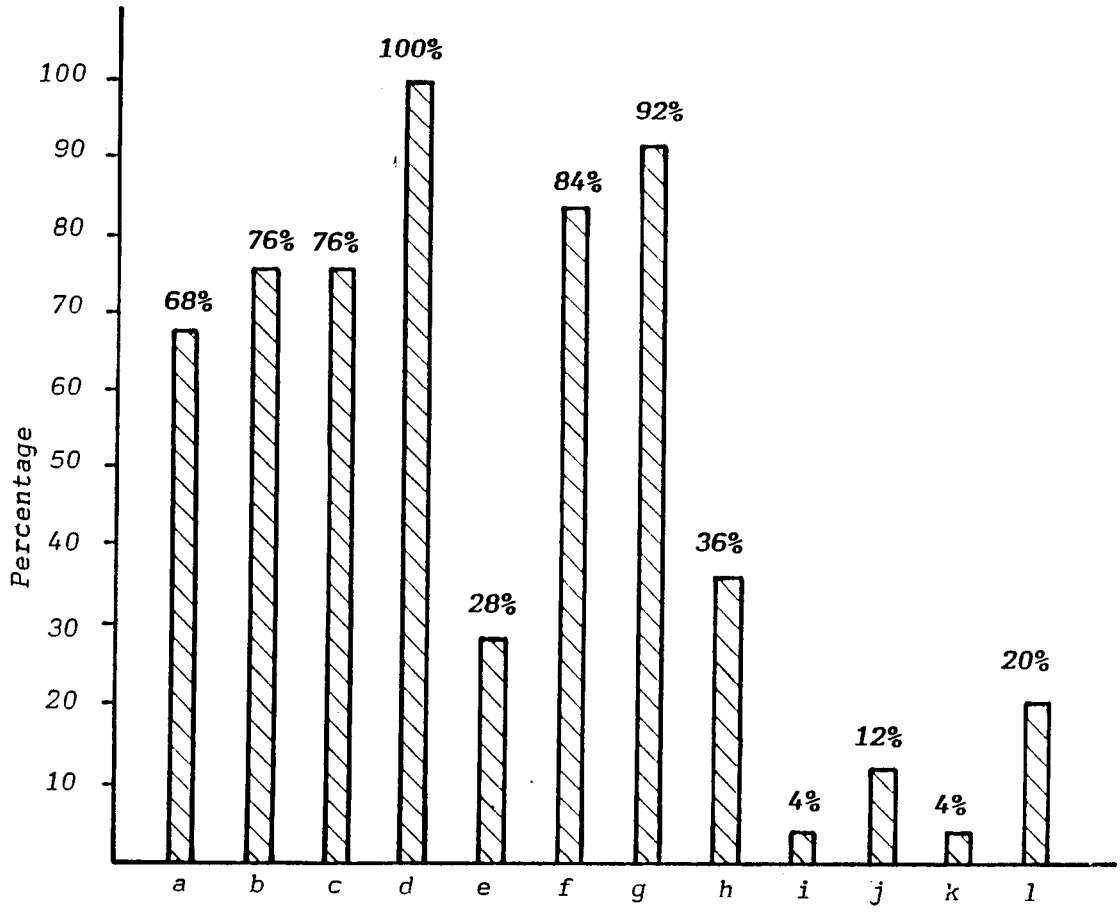


FIG.6 DISTRIBUTION OF FARMERS WHO ASSIGNED RANKS OF 1-6 TO THE PRESENTED DIMENSIONS

environmental soundness whereas not a single farmer placed it in the lower group which tells upon the sound environmental consciousness our farmers have. Similarly local adaptability was placed in the higher group by only 60 per cent of the scientists whereas 80 per cent of the extension personnel and 92 per cent of the farmers considered it among the top six. This points towards the need for the scientists to have a better understanding about the suitability of a technology to the local conditions that makes it acceptable to the farmers. Eighty four per cent of the scientists and 92 per cent of the extension personnel ranked technological appropriateness as quite high whereas only 68 per cent of the farmers assigned it one of the top six ranks. This might be because of the willingness of the progressive farmers to try any new technology once they are convinced about its advantages.

The results point to a clear choice by all the three categories of judges alike. Both rank-wise and weightage-wise, six dimensions emerged as most important. They were resource use efficiency, environmental soundness, economic viability, technological appropriateness, economic feasibility and local adaptability. Hence they are suggested to be the important dimensions of sustainable agriculture as indicated by this study.

3. Extent of inclusion of the elements of sustainable agriculture in the developmental programmes of the Department of Agriculture, Animal Husbandry & Fisheries

Table 7. Analysis of the Departmental schemes in relation to components of sustainable agriculture

Sl. No.	Department	Number of schemes	No. of schemes having dimensions of sustainable nature	Percentage
1	Agriculture	68	16	23.53
2	Animal husbandry	5	1	20.00
3	Fisheries	50	4	8.00
	Total	123	21	17.07

The number of developmental schemes under each Department for the year 1992-93 and the percentage of schemes having dimensions or components of sustainable nature are presented in Table 7.

It can be seen from the Table that in the Department of Agriculture, only 23.53 per cent of the total number of schemes had programmes with components of sustainability at least one. In the case of the Department of Animal Husbandry, this percentage was 20 and in the Department of Fisheries it was 8.00.

The analysis of the schemes for sustainability oriented programmes and the identified dimensions of sustainable agriculture involved in them are presented in Table 8.

Looking at the table, it could be seen that eventhough the dimensions of sustainable farming are envisaged in some of the schemes, single-minded stress on sustainability does not exist even in the activities under those schemes. Many faceted objectives of the schemes more or less cancel the prospects for sustainability rather than complement it. To cite an example, the comprehensive Coconut Development Programme being implemented by the Department of Agriculture at present can be considered. This scheme has many items under it like encouraging the use of green manures, intercropping and coconut-based agro-industries. But in practice at the field level, financial assistance for a number of wells and pumpsets for betterment of irrigation facilities of the coconut gardens form the major physical achievement under the scheme. Eventhough improved irrigation facilities are necessary, it would have been better still if more of the various items under the schemes were pursued. The stress on sustainability envisaged in the scheme originally is thus not carried to the field level due to such limitations in implementation. Hence it is highly necessary that in future, such schemes have to be

Table 8. Analysis of the schemes for sustainability oriental activities and the identified dimensions of sustainable agriculture involved in them

Name of scheme	Activities or specific practices relevant to sustainable agriculture	Identified dimensions that are relevant					
		Resources use efficiency	Economic viability	Environmental soundness	Technological appropriateness	Economic feasibility	Local adaptability
1	2	3	4	5	6	7	8
A. AGRICULTURE							
I. Rice							
1. Group farming	1. Mechanisation by means of using machines like tractor, tiller etc. for land preparation and the like with a view to reducing cost of production.	✓					
	2. Use of high yielding varieties of rice instead of local varieties.		✓				
	3. Soil test based fertiliser application				✓		
	4. Liming to reduce soil acidity				✓		
	5. Production of green manure crops	✓					
	6. Betterment of basic facilities in the Padasekharam for irrigation and drainage.	✓				✓	✓
	7. Raising cowpea or other vegetables after the rice crop	✓					
2. Registered seed growers' program	Production and distribution of high yielding paddy seeds through registered seed growers		✓				
3. Mini kit distribution of rice	Distributing seeds of new high yielding varieties at a nominal cost and making farmers cultivate them and then choose the ones particularly suited to their fields.						✓
4. Distribution of green manure seeds	Distribution of green manure seeds at a nominal cost to make sure of the availability of green manures so as to maintain soil fertility.			✓			

Contd.

1	2	3	4	5	6	7	8
5. Control of agriculturally important pests and diseases	1. Should use the insecticide or fungicide as recommended by the Kerala Agricultural University for the involved pest or disease.				✓		
	2. If a chemical is used in any padasekharam under this scheme the pest/disease attack in that padasekharam should have reached such a level as to bring economic loss to the farmer.	✓	✓				
II Coconut							
1. Integrated coconut Development Programme including Group Management	1. Financial assistance to Kera Samrakshana Samithis for purchase of plant protection equipments both chemical and mechanical.					✓	
	2. Financial assistance for purchase of green manure seeds.					✓	
	3. Subsidy for purchase of zinc phosphide.	✓				✓	
	4. Subsidy for purchase of pumpsets	✓				✓	
	5. Distribution of coconut seedlings produced at Department farms through the samithis at subsidised prices.					✓	
	6. Removal of and compensation for root-disease affected coconut palms to the north of Karuvannur river.			✓			
	7. Subsidy for addition of alluvial soil to palms in sandy areas.	✓					
	8. Subsidy for application of recommended doze of Magnesium sulphate in disease affected areas.	✓				✓	
	9. Subsidy for spread of scientific fertiliser application.				✓	✓	
	10. Financial assistance for installation of drip, irrigation units in coconut orchards.				✓	✓	

Contd.

1	2	3	4	5	6	7	8
2. Integrated programme of the coconut Development Board for enhancing productivity of small scale coconut orchard	1. Assistance for removal of diseased and unproductive palms and for distribution of high yielding seedlings instead of them	✓				✓	
	2. Assistance for irrigation	✓				✓	
	3. Assistance for encouraging intercropping	✓			✓	✓	
	4. Assistance for scientific fertiliser application				✓	✓	
III Other Agricultural Production Schemes							
1. National Biogas Development Scheme	1. Subsidy for construction of biogas plants and training to stone-masons in construction work	✓	✓		✓		
2. Agricultural Engineering services	1. Identification and popularisation of improved agricultural equipment				✓		
	2. Design improved equipments and organise their production and distribution				✓		
3. Agro service centres: Subsidy for tractor, power tiller and other equipment	1. Subsidy for tractor, power tiller and other agricultural equipment	✓					
4. Irrigation by means of springler drip method	1. Subsidy to small and marginal farmers and SC/ST farmers for adopting sprinkler-drip methods of irrigation	✓				✓	
5. Coconut Rehabilitation program	1. Replacing diseased and unproduction palms with healthy seedlings.	✓		✓			
	2. Ensuring irrigation facilities	✓					
	3. Production and distributive of improved coconut seedlings	✓	✓				
	4. Production of natural enemies of coconut pests for biological control.			✓	✓		
6. Popularisation of bio-fertilisers	1. Free distribution of starter-culture of blue-green algae and other bio-fertilisers developed by the Microbiological lab, Pattambi.			✓	✓	✓	

Contd.

1	2	3	4	5	6	7	8
7. National watershed development programme	1. scientific management of natural resources like land, water, flora, human energy etc. to ensure a production bio-mass.	✓					
	2. Increase agricultural productivity, sustain it, find permanent solutions to the increasing demands of man and animals (livestock) for food, cattle feed, and drinking water and make them available.	✓					
8. Development of public property	1. Develop public property by means of agriculture, aqua-culture, tree-planting, fodder grass cultivation etc.	✓					
	2. Protect water-channels	✓		✓			
B. ANIMAL HUSBANDRY							
Scheme for the establishment of Poultry Breeding Unit in potential panchayats as a prelude to the popularisation of back yard poultry rearing	Make available adequate number of Pullets after vaccination to the farmers for backyard poultry rearing.	✓					
C. FISHERIES							
1. Extension	Promotion of aqua culture on a large scale in fresh and brackish water areas by disseminating scientific farm management practices among prospective farmers.	✓					
2. Fish Farmers' Development Agency	Popularise aqua culture in the fresh water areas through motivating the farmers, providing incentives by way of subsidy, seed, training, bank finance and extension support.	✓				✓	
3. Social fishery	The perennial rivers, brackish water lakes, paddy fields etc. experience heavy depletion of fish stock. The objective of the scheme is to make good the loss by way of systematic and judicious stocking of quality fish/prawn seeds in these water bodies which in course of time augment natural fish production			✓			
4. Integrated Fish Farming	To encourage private sector to start fish farming integrated with poultry/duck/pig rearing etc. for which technical guidance and financial assistance will be provided to the farmers.	✓				✓	

devised which clearly and uniformly spell out the dimensions of sustainable agriculture and allied activities in the state.

The extent of inclusion of sustainability oriented dimensions in the various schemes are less than 25 per cent in the case of the three Departments studied. This leaves a lot more to be desired while visualising schemes for these three Departments in future. The problems of increasing pressure on land, decreasing soil fertility and overall disenchantment with agriculture by even the progressive farmers, call for an integrated effort to implement sustainability-oriented schemes. If the stress on sustainability continues to be poor in the Schemes implemented by the Government, there is no way the primary sector can meet the demands of the future since Government is the major force that leads and motivates the primary sector entrepreneur under the present conditions.

4. Analysis of knowledge, attitude and extent of adoption of farmers regarding sustainable agriculture

4.1 Knowledge about sustainable agriculture

Table 9 presents the distribution of farmers according to their knowledge about sustainable agriculture and it is diagrammatically represented in Fig.7.

Table 9. Distribution of respondents according to their knowledge about sustainable agriculture

n = 270

Category	Frequency	Percentage
High	22	8.15
Medium	231	85.55
Low	17	6.30

Knowledge about sustainable agriculture indicates how much a farmer is familiar with the concept, its specific practices and its problems and prospects. Proper knowledge about any technology helps a person to be in a positive state of mind about it.

In the case of the respondents selected for the study, about 85 per cent of them belonged to the medium category in the distribution based on knowledge about sustainable agriculture. This may be due to the close association of sustainable agricultural practices with the traditional nature-oriented cultivation practices. What is recognised as the principles for sustainability and advocated under sustainable agricultural practices today were mostly known to the traditional agricultural system. Most of our farmers are still traditional minded even when they practise the new scientific agriculture. This knowledge of the yester years

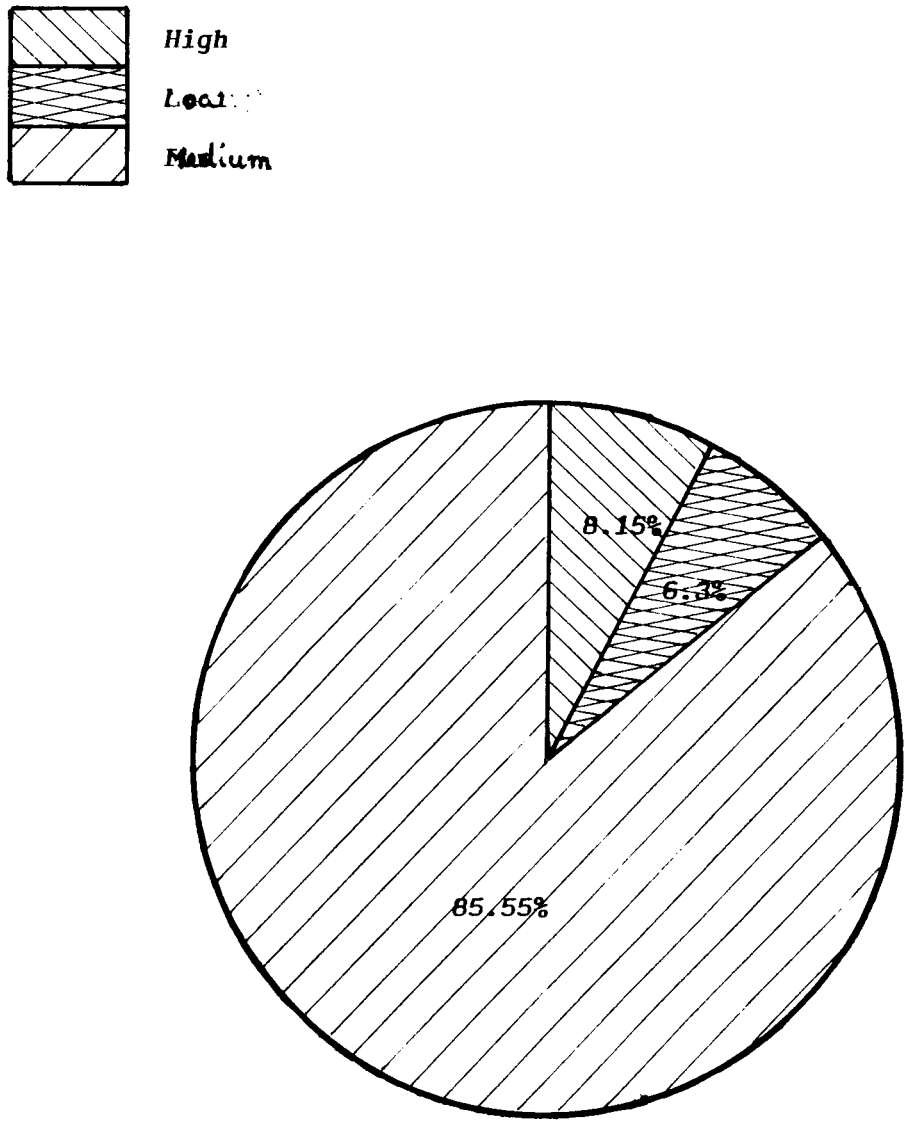


FIG.7 DISTRIBUTION OF RESPONDENTS ACCORDING TO THEIR KNOWLEDGE ABOUT SUSTAINABLE AGRICULTURE

still remain alive in their minds. And hence the possibility of obtaining such a result.

4.2 Attitude towards sustainable agricultural techniques

The distribution of farmers based on their attitude towards sustainable agriculture is presented in Table 10 and diagrammatically represented in Fig.8.

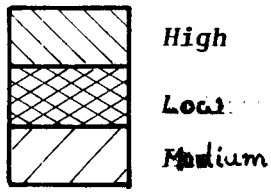
Table 10. Distribution of farmers according to their attitude towards sustainable agriculture

n = 270

Category	Frequency	Percentage
High	38	14.07
Medium	205	75.93
Low	27	10.00

More than 75 per cent of the respondents belonged to the medium category in the case of attitude towards sustainable agriculture. About 14 per cent of the respondents belonged to the high category where as there were only 10 per cent of the respondents in the low category.

Eventhough the scientific trends in agriculture help bring increased yields in shorter time span, a number of factors like excessive dependence on external inputs, complexity, cost,



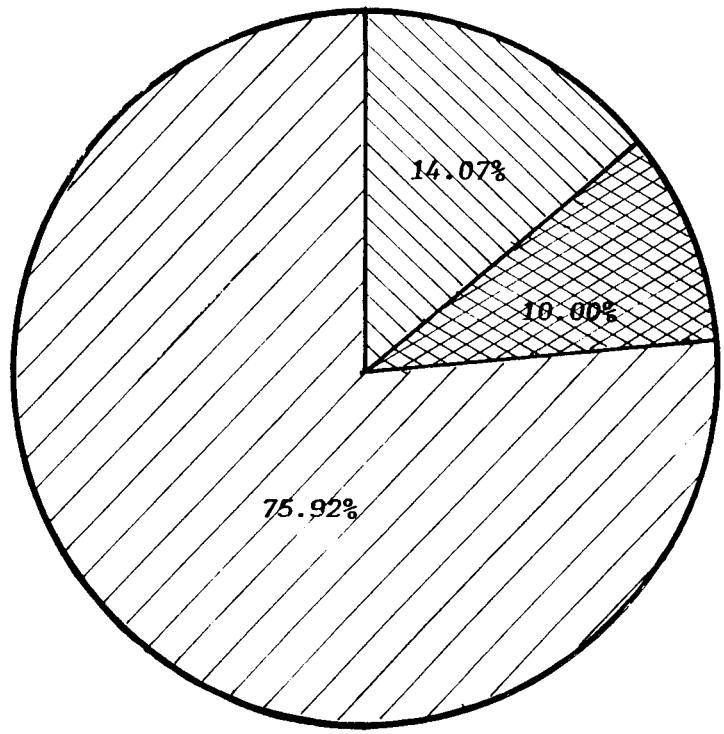


FIG.8 DISTRIBUTION OF FARMERS ACCORDING TO THEIR ATTITUDE TOWARDS SUSTAINABLE AGRICULTURE

higher incidence of pests and diseases etc. urge the farmers to retrieve their steps back into traditional agriculture. As time progresses, there is a new respect for the forebearers' mode of cultivation by the cultivators of today. This perhaps explains the present results.

4.3 Extent of adoption of sustainable agricultural practices

Table 11 presents the distribution of farmers based on that extent of adaptable of sustainable agricultural practices and diagrammatically represented in Fig.9.

Table 11. Distribution of respondents based on their extent of adoption of sustainable agricultural practices

n = 270

Category	Frequency	Percentage
High	36	13.33
Medium	188	69.63
Low	46	17.04

About 70 per cent of the farmers came under the medium group in the case of extent of adoption of sustainable agricultural practices. The fact that many of the sustainable agricultural practices originate from traditionally prevalent ideas might be the explanation for this. As a result, eventhough not precisely conscious of the sustainability

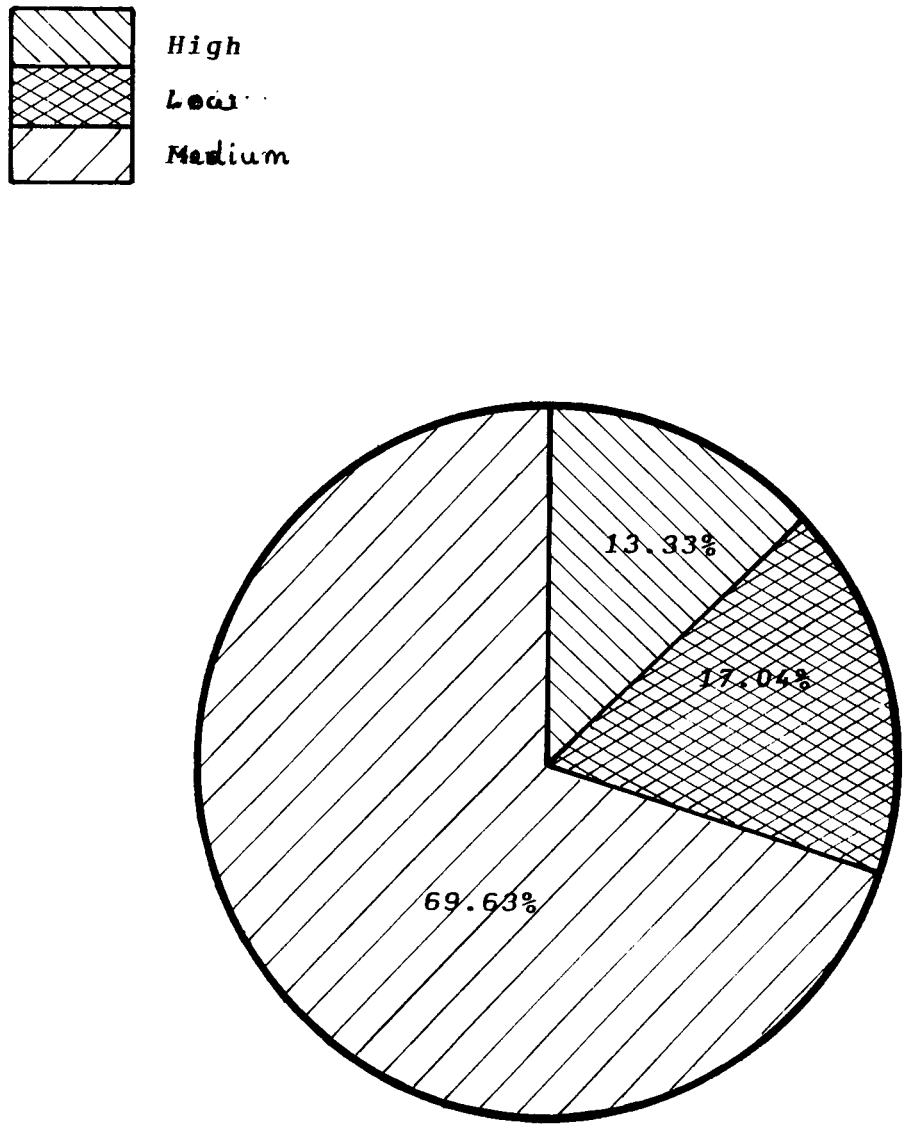


FIG.9 DISTRIBUTION OF FARMERS BASED ON THEIR EXTENT OF ADOPTION OF SUSTAINABLE AGRICULTURAL TECHNIQUES

dimensions, some of the listed practices were at least sometimes adopted by the farmers though not on continued basis.

All these point towards a bright future for sustainable agriculture in the State. With some education on specific sustainable agricultural practices and a little brushing up of the forgotten traditional knowledge, sustainable agriculture may get enrooted in our soils in a very near future.

5. Relationship between the dependent and the independent variables

5.1 Knowledge about sustainable agriculture

5.1.1 Correlation analysis

The results of the correlation analysis between knowledge about sustainable agriculture and the selected independent variables are presented in Table12.

The Table indicates that out of the 15 independent variables selected for the study, only nine variables were found to be significantly related with the knowledge about sustainable agriculture.

Education, income from agriculture, exposure to mass media, exposure to interpersonal sources of information, perception about availability of sustainable agricultural techniques, perception about price of agricultural produce,

Table 12. Correlation analysis of knowledge about sustainable agriculture with the independent variables

Sl. No.	Independent variables	Correlation coefficient (r)
1.	Education	0.297**
2.	Farming experience	-0.063
3.	Farm size	0.178
4.	Income from agriculture	0.242*
5.	Irrigation pattern	-0.089
6.	Exposure to mass media	0.226*
7.	Exposure to interpersonal sources	0.783**
8.	Perception about availability of sustainable agricultural technique	0.226*
9.	Perception about price of inputs	-0.698**
10.	Perception about price of agricultural produce	0.745**
11.	Risk orientation	0.222*
12.	Economic motivation	-0.072
13.	Innovation proneness	-0.039
14.	Extension contact	0.266**
15.	Extension participation	0.045

* Significant at 5 per cent level

** Significant at 1 per cent level

risk orientation and extension contact were positively and significantly related with knowledge about sustainable agriculture, while perception about price of inputs was negatively and significantly related.

5.1.2 Multiple regression analysis

The results of the multiple regression analysis between knowledge of farmers about sustainable agriculture and the selected independent variables are presented in Table 13.

A high R^2 value of 0.742 with significant F value (48.60) indicated that more than 74 per cent of the variation in knowledge about sustainable agriculture of farmers could be explained by the 15 variables taken together.

The table revealed that out of the 15 variables selected, only 6 variables were significantly related with knowledge about sustainable agriculture. They were education, income from agriculture, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques, perception about price of inputs and extension contact, with regression coefficient values of 0.261, 0.162, 0.973, -0.118, 0.241 and -0.134 respectively.

Table 13. Multiple regression analysis of knowledge about sustainable agriculture with the independent variables

(n = 270)

Sl. No.	Independent variables	Regression coefficient (b)	Standard error of 'b'	't' value
1.	Education	0.26130	0.058875	4.438**
2.	Farming experience	0.084486	0.044039	1.918
3.	Farm size	-0.04415	0.059809	-0.738
4.	Income from agriculture	0.16183	0.059333	2.728**
5.	Irrigation pattern	0.027354	0.034349	0.796
6.	Exposure to mass media	-0.082948	0.058527	-1.417
7.	Exposure to interpersonal sources	0.97318	0.16927	5.749**
8.	Perception about availability of sustainable agricultural technique	-0.11791	0.045504	-2.591**
9.	Perception about price of inputs	0.20437	0.054821	-3.819
10.	Perception about price of agricultural produce	0.24148	0.17199	-1.404
11.	Risk orientation	-0.0026037	0.050227	-0.052
12.	Economic motivation	0.070221	0.052842	1.329
13.	Innovation proneness	-0.014179	0.033379	-0.425
14.	Extension contact	-0.13441	0.056628	-2.374*
15.	Extension participation	-0.027105	0.047379	-0.572

R^2 = 0.742 F = 48.60

* Significant at 5 per cent level

** Significant at 1 per cent level

5.1.3 Step-down regression analysis

Step-down regression analysis was employed to select the best set of variables for predicting the dependent variable. The results of the step-down regression analysis between knowledge of farmers about sustainable agriculture and the selected independent variables are presented in Table 14.

It could be seen that in the final step with eight variables included, more than 73 per cent of the variation in the knowledge about sustainable agriculture could be explained. The predictive power increases with the elimination of each variable, till the final step, when the percentage variation is maximum. Thus 73.59 per cent of the total variation could be explained by these eight variables together, i.e., education, farming experience, annual income, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques, perception about price of inputs, economic motivation and extension contact.

5.1.4 Path analysis

Path Analysis was employed to find out the direct and indirect effects of the selected independent variables on knowledge of farmers about sustainable agriculture. The results are presented in Table 15.

Table 14. Results of the step-down regression analysis onknowledge about sustainable agriculture

Step No.	Variables entering regression of analysis	F value	R^2	Percentage variation explained
I	All the variables included	48.60	0.7416	74.16
II	Variables excluding x_{11}	52.57	0.7416	74.16
III	Variables excluding x_{11} and x_{13}	56.46	0.7414	74.14
IV	Variables excluding x_{11}, x_{13} and x_{15}	61.29	0.7411	74.11
V	Variables excluding x_{11}, x_{13}, X_{15} and x_3	66.95	0.7406	74.06
VI	Variables excluding x_{11} x_{13}, X_{15}, x_3 and x_5	73.65	0.7398	73.98
VII	Variables excluding x_{11} x_{13}, X_{15}, x_3, x_5 and x_{10}	81.52	0.7383	73.83
VIII	Remaining variables included i.e. x_1 x_2, X_4, x_7, x_8, x_9, x_{12} and x_{14}	90.93	0.7359	73.59

x_1 Education
x_2 Farming experience
x_3 Farm size
x_4 Income from agriculture
x_5 Irrigation pattern
x_6 Exposure to mass media
x_7 Exposure to interpersonal sources
x_8 Perception about availability of sustainable agricultural technique
x_9 Perception about price of inputs
x_{10} Perception about price of agricultural produce
x_{11} Risk orientation
x_{12} Economic motivation
x_{13} Innovation proneness
x_{14} Extension contact
x_{15} Extension participation

Table 15. Direct and indirect effects of the independent variables on knowledge about sustainable agriculture

Sl. No.	Variables	Direct effect	Substantial indirect effect routed through		
			I	II	III
1.	Education	0.2613	0.1194 (x_7)	0.0599 (x_9)	0.0564 (x_6)
2.	Farming experience	0.0845	-0.1626 (x_1)	0.0252 (x_6)	0.0170 (x_4)
3.	Farm size	-0.0442	0.1375 (x_7)	0.1321 (x_4)	-0.0529 (x_{14})
4.	Income from agriculture	0.1618	0.1381 (x_7)	0.0478 (x_9)	-0.0360 (x_3)
5.	Irrigation pattern	0.0274	-0.0332 (x_1)	-0.0239 (x_4)	-0.0223 (x_9)
6.	Exposure to mass media	-0.0829	0.1775 (x_1)	0.1645 (x_7)	0.0872 (x_9)
7.	Exposure to interpersonal sources	0.9732	-0.2337 (x_{10})	0.1513 (x_9)	-0.0645 (x_{14})
8.	Perception about availability of sustainable agricultural technique	-0.1179	0.4212 (x_7)	-0.1115 (x_{10})	0.9872 (x_9)
9.	Perception about price of inputs	-0.2094	-0.7034 (x_7)	0.1770 (x_{10})	-0.0748 (x_1)
10.	Perception about price of agricultural produce	-0.2415	0.9416 (x_7)	0.1534 (x_9)	-0.0544 (x_8)
11.	Risk orientation	-0.0026	0.1204 (x_1)	0.0630 (x_7)	0.0471 (x_{12})
12.	Economic motivation	0.0702	-0.3027 (x_7)	0.0935 (x_{10})	0.0890 (x_1)
13.	Innovation proneness	-0.0142	-0.0361 (x_7)	0.0264 (x_1)	0.0150 (x_{12})
14.	Extension contact	-0.1344	0.4672 (x_7)	-0.0896 (x_{10})	0.0699 (x_9)
15.	Extension participation	-0.0271	0.1670 (x_7)	-0.0880 (x_{14})	0.0522 (x_1)

Residual = 0.2584

Exposure to interpersonal sources, education, perception about price of inputs and perception about price of produce exerted the maximum direct effect on knowledge about sustainable agriculture (0.9732, 0.2613, -0.2014, -0.2415 respectively).

Out of the 45 indirect effects, 12 were routed through the variable x_7 i.e., exposure to inter-personal sources 8 through x_1 i.e., education and 8 through x_9, i.e., perception about price of inputs. Thus in the case of both direct and indirect effects these variables were important. The direct and indirect effects of the selected independent variables on knowledge about sustainable agriculture is presented in Fig.10.

Scanning all four types of analyses, it becomes clear that six variables were common to all with regard to their importance. They were education, income from agriculture, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques, perception about price of inputs and extension contact.

The discussion on the salient findings of the study is presented.

1. **Education**

Education emerged as positively significant in relation to knowledge in all the analyses. The farmers who

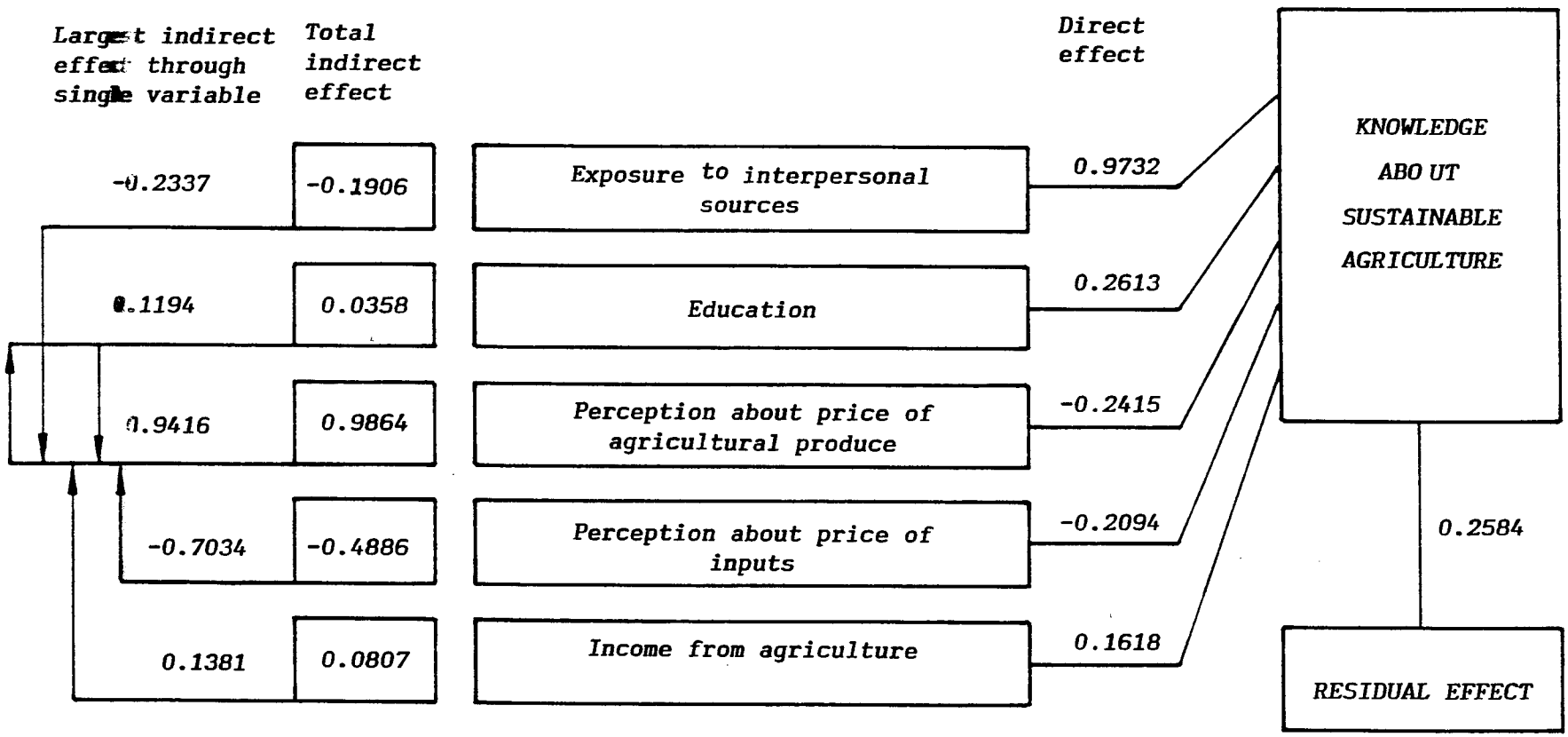


FIG.10 PATH DIAGRAM SHOWING THE DIRECT AND INDIRECT EFFECTS OF SELECTED PERSONAL, SOCIO-ECONOMIC AND SOCIO-PSYCHOLOGICAL CHARACTERISTICS OF THE FARMERS ON THEIR KNOWLEDGE ABOUT SUSTAINABLE AGRICULTURE

possess formal education are assumed to have more knowledge about many innovative areas in farming including sustainable agriculture. Moreover, it is also possible that being educated, they made an effort to utilise various opportunities available to them to gain more knowledge.

The formal education received by the farmers serves to induce them to search for new vistas of knowledge and in this process it is quite possible that they might have got interested in sustainable farming practices.

This finding is supported by Baadgaonkar (1987) Sheela (1989) and Sulaiman (1989).

2. **Income from agriculture**

Income from agriculture was found positively significant in relation to knowledge in all the analyses. The agricultural income in a way reflects the status of the farmer and also his interest and involvement in farming. Farmers with high agricultural income will characteristically keep themselves informed on the current trend and issues in farming and in this process, it is possible that such farmers might have acquired more knowledge.

The findings of Patil (1985) and Baadgaonkar (1987) confirm with the present results.

3. Exposure to interpersonal sources

Exposure to interpersonal sources of information emerged as an important variable in relation to knowledge about sustainable agriculture in all the analyses. The results of this study indicate that the interpersonal sources i.e., both formal and informal have a very good contribution towards increase in knowledge about sustainable agriculture.

Prabhu and Chandrakandan (1990) obtained similar results regarding knowledge in relation to interpersonal sources.

4. Perception about availability of sustainable agricultural techniques

This variable had significant influence on knowledge about sustainable agriculture in all the four types of analyses. Though it had positive relation with knowledge in the correlation analysis, multiple regression analysis, step-wise regression analysis and path analysis however revealed negative relationship. This could be explained by the fact that in correlation analysis, one to one relationship only is attempted in which case, it is likely that a farmer with sufficient knowledge about sustainable agriculture may have a relatively better perception about availability of sustainable agricultural techniques. However, when all the other factors like price of

inputs are considered as in the case of other analyses where multiple factors are considered, it would have resulted in inverse relationship.

5. Perception about price of inputs

Perception about price of inputs emerged as important in all four types of analyses. It had significant association which was negative, with knowledge, as revealed from the Tables. Those farmers who perceived the price of inputs as very high are usually the less progressive farmers who often are complacent with a given situation which may explain the influence of this variable on knowledge about sustainable agriculture.

5.2 Attitude towards sustainable agriculture

5.2.1 Correlation analysis

The results of the correlation analysis between the independent variables and attitude of the farmers towards sustainable agriculture are presented in Table 16.

Out of the 15 selected independent variables, three were found to have significant relationship with attitude of farmers towards sustainable agriculture. They were exposure to interpersonal sources, perception about availability of

Table 16. Correlation analysis of attitude towards sustainable agriculture with the independent variables

(n = 270)

Sl. No.	Independent variables	Correlation coefficient
1.	Education	-0.010
2.	Farming experience	0.007
3.	Farm size	0.016
4.	Income from agriculture	-0.003
5.	Irrigation pattern	-0.013
6.	Exposure to mass media	-0.138
7.	Exposure to interpersonal sources	-0.197*
8.	Perception about availability of sustainable agricultural technique	-0.383**
9.	Perception about price of inputs	0.169
10.	Perception about price of agricultural produce	-0.233*
11.	Risk orientation	-0.081
12.	Economic motivation	0.032
13.	Innovation proneness	-0.046
14.	Extension contact	-0.176
15.	Extension participation	-0.160

* Significant at 5 per cent level

** Significant at 1 per cent level

sustainable agricultural techniques and perception about price of agricultural produce.

5.2.2 Multiple regression analysis

The results of the multiple regression analysis of the selected independent variables with attitude are presented in Table 17.

The same variables which emerged significant in the correlation analysis were found significant in the multiple regression analysis also. The F value was significant (4.32) with an R^2 value of 0.205 which indicated that all the selected variables together could explain only 20 per cent of the variability in the dependent variable. In other words, it could be explained that nearly 80 per cent of the variation is due to other variables, which are not included in the study.

5.2.3 Step-down regression analysis

The result of the step-down regression analysis is presented in Table 18.

One of the variable viz. perception about availability of sustainable agricultural techniques alone could contribute to 14.65 per cent (as indicated by the R^2 value of 0.1465 of the variation in the dependent variable-attitude of farmers towards

Table 17. Multiple regression analysis of attitude towards sustainable agriculture with the independent variables

Sl. No.	Independent variables	Regression coefficient (b)	Standard error of 'b'	't' value
1.	Education	0.1698	0.10326	1.644
2.	Farming experience	0.056103	0.077242	0.726
3.	Farm size	0.12691	0.10490	1.210
4.	Income from agriculture	0.014424	0.10407	0.139
5.	Irrigation pattern	0.078975	0.060246	1.311
6.	Exposure to mass media	-0.057331	0.10265	-0.558
7.	Exposure to interpersonal sources	0.67496	0.29689	2.273*
8.	Perception about availability of sustainable agricultural technique	-0.31745	0.079812	-3.977**
9.	Perception about price of inputs	-0.069262	0.096152	-0.720
10.	Perception about price of agricultural produce	-0.80691	0.30165	-2.675**
11.	Risk orientation	-0.1030	0.088095	-1.169
12.	Economic motivation	-0.08745	0.092682	-0.944
13.	Innovation proneness	0.0007303	0.058545	0.012
14.	Extension contact	-0.084209	0.099322	-0.848
15.	Extension participation	-0.074259	0.08310	-0.894

R^2 = 0.205 F = 4.32

* Significant at 5 per cent level

** Significant at 1 per cent level

Table 18. Results of the step-down regression analysis on attitude of farmers towards sustainable agriculture

Step No.	Variables entering regression	F value	R^2	Percentage variation explained
I	All the variables included	4.37	0.2051	20.51
II	Variables excluding x_{13}	4.70	0.2051	20.51
III	Variables excluding x_{13} and x_{14}	5.08	0.2050	20.50
IV	Variables excluding x_{13}, x_4 and x_6	5.49	0.2041	20.41
V	Variables excluding x_{13}, x_4, X_6 and x_9	5.97	0.2029	20.29
VI	Variables excluding x_{13}, x_4, X_6, x_9 and x_2	6.51	0.2009	20.09
VII	Variables excluding x_{13}, x_4, X_6, x_9, x_2 and x_{14}	7.16	0.1986	19.86
VIII	Variables excluding x_{13}, x_4, X_6, x_9, x_2, x_{14} and x_{12}	7.95	0.1958	19.58
IX	Variables excluding x_{13}, x_4, X_6, x_9, x_2, x_{14}, x_{12} and x_5	8.91	0.1923	19.23
X	Variables excluding x_{13}, x_4, X_6, x_9, x_2, x_{14}, x_{12}, x_5 and x_1	9.93	0.1847	18.47
XI	Variables excluding x_{13}, x_4, X_6, x_9, x_2, x_{14}, x_{12}, x_5, x_1 and x_{15}	11.24	0.1756	17.56

Contd.

Table 18 (Contd.)

XII	Variables excluding x_{13}, x_4, X_6, x_9, x_2, x_{14}, x_{12}, x_5, x_1, x_{15} and x_7	13.33	0.1675	16.75
XIII	Variables excluding x_{13}, x_4, X_6, x_9, x_2, x_{14}, x_{12}, x_5, x_1, x_{15}, x_7 and x_{10}	17.34	0.1336	13.36
XIV	Variables excluding x_{13}, x_4, X_6, x_9, x_2, x_{14}, x_{12}, x_5, x_1, x_{15}, x_7, x_{10} and x_{11}	25.13	0.1584	15.84
XV	Remaining variable included	46.00	0.1465	14.35

x_1 Education
x_2 Farming experience
x_3 Farm size
x_4 Income from agriculture
x_5 Irrigation pattern
x_6 Exposure to mass media
x_7 Exposure to interpersonal sources
x_8 Perception about availability of sustainable agricultural technique
x_9 Perception about price of inputs
x_{10} Perception about price of agricultural produce
x_{11} Risk orientation
x_{12} Economic motivation
x_{13} Innovation proneness
x_{14} Extension contact
x_{15} Extension participation

sustainable agriculture. All the variables together contributed to only 20 per cent of the variation.

5.2.4 Path analysis

The results of path analysis of the independent variables with attitude towards sustainable agriculture by farmers are presented in Table 19.

Three variables showed the maximum direct effect on attitude of farmers towards sustainable agriculture. They were perception about price of agricultural produce (-0.8069); exposure to interpersonal sources (0.6750) and perception about the availability of sustainable agricultural techniques (-0.3174). The direct and indirect effects of the selected independent variables on attitude of farmers towards sustainable agriculture is presented in Figure 11.

Correlation analysis, multiple regression analysis, and path analysis brought out the same results indicating the salience of the three variables viz. exposure to interpersonal sources, perception about availability of sustainable agricultural techniques and perception about price of agricultural produce with respect to attitude of farmers towards sustainable agriculture.

Table 19. Direct and indirect effects of the independent variables on attitude towards sustainable agriculture

Sl. No.	Variables	Direct effect	Substantial indirect effect routed through		
			I	II	III
1.	Education	0.1698	0.0828 (x_7)	-0.0606 (x_{10})	-0.0550 (x_8)
2.	Farming experience	0.0561	-0.1057 (x_1)	0.0214 (x_{11})	-0.0180 (x_{12})
3.	Farm size	0.1269	0.0954 (x_7)	-0.0746 (x_8)	-0.0654 (x_{10})
4.	Income from agriculture	0.0144	0.1036 (x_3)	0.0958 (x_7)	-0.0839 (x_{10})
5.	Irrigation pattern	0.0790	0.0478 (x_8)	-0.0215 (x_1)	0.0199 (x_{11})
6.	Exposure to mass media	-0.0573	-0.1375 (x_8)	0.1154 (x_1)	0.1141 (x_7)
7.	Exposure to interpersonal sources	0.6750	-0.7808 (x_{10})	-0.1374 (x_8)	0.0501 (x_9)
8.	Perception about availability of sustainable agricultural techniques	-0.3174	-0.3724 (x_{10})	0.2921 (x_7)	-0.0406 (x_{14})
9.	Perception about price of inputs	-0.0693	0.5913 (x_{10})	-0.4879 (x_7)	0.1322 (x_8)
10.	Perception about price of agricultural produce	-0.8069	-0.6531 (x_7)	-0.1465 (x_8)	0.0508 (x_9)
11.	Risk orientation	-0.1030	0.0782 (x_1)	-0.0586 (x_{12})	0.0437 (x_7)
12.	Economic motivation	-0.0875	0.3125 (x_{10})	-0.2100 (x_7)	-0.0690 (x_{11})
13.	Innovation proneness	0.0007	0.0471 (x_{10})	-0.0264 (x_8)	-0.0250 (x_7)
14.	Extension contact	-0.0842	0.3240 (x_7)	-0.2993 (x_{10})	-0.1531 (x_{10})
15.	Extension participation	-0.0743	-0.1187 (x_8)	0.1158 (x_7)	-0.0632 (x_{10})

Residual = 0.7949

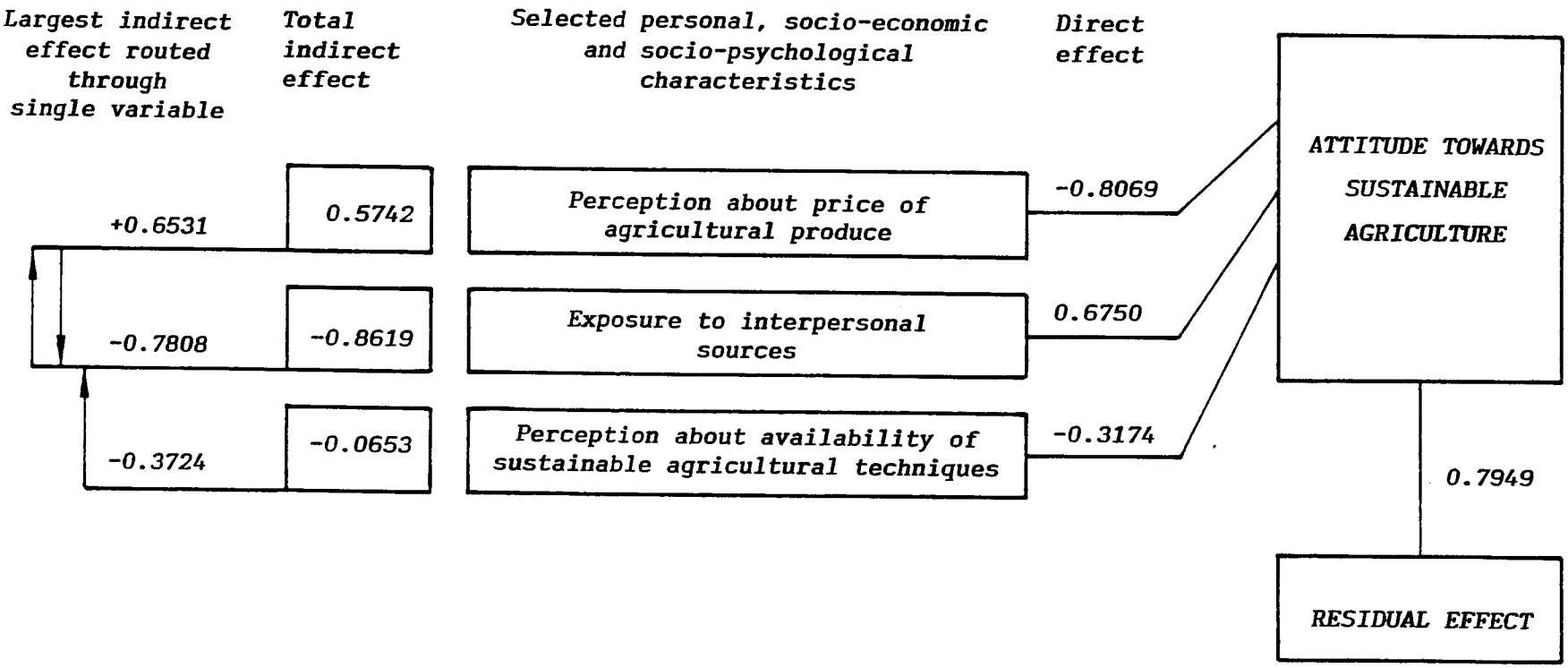


FIG. 11 PATH DIAGRAM SHOWING THE DIRECT AND INDIRECT EFFECTS OF THE SELECTED PERSONAL SOCIO-ECONOMIC AND SOCIO-PSYCHOLOGICAL CHARACTERISTICS OF THE FARMERS ON ATTITUDE TOWARDS SUSTAINABLE AGRICULTURE

The discussion on the results is presented:

1. Exposure to interpersonal sources

The results reinforce the importance of both formal as well as informal interpersonal sources in the formation of specific attitudes by the farmers towards new issues. Even with the higher level of literacy and the higher exposure to different kinds of mass media prevalent in Kerala, it is the interpersonal sources that may still influence the attitude of the farmers. This is in agreement with the attitude theory as established by eminent scholars like Merton, Lazarsfeld and Daniel Learner according to which it is the interpersonal influence that is more effective than the mass media with respect to specific decisions. It is an accepted theory that attitude change is rarely accomplished by the mass media (Cassata and Asante, 1979). The result that was obtained thus could probably be substantiated based on these facts.

2. Perception about availability of sustainable agricultural techniques

Perception about availability of sustainable agricultural techniques had significant but negative relationship with attitude of the farmers about sustainable agriculture. The farmers who perceived the availability of sustainable agricultural techniques as low were quite right in

their judgement in the sense that eventhough the listed practices are very promising, they are not yet widely popular in the State of Kerala. The farmers definitely could assess by themselves where sustainable agriculture stands in our state and also must have developed positive attitude towards sustainable agriculture considering its importance. In reverse, the farmers who rated the availability as high certainly might not have looked into the field reality with respect to sustainable agriculture in the State. Had they considered this aspect too,they would not have rated it as high. The result obtained in thus quite understandable.

3. Perception about price of agricultural produce

Perception about price of agricultural produce had significant negative relationship with attitude towards sustainable agriculture. Farmers who perceived the price for agricultural produces as high could probably be more or less satisfied with their present environment. Perhaps a lack of dissonance with the existing situation may explain their indifferent attitude towards innovations which in the present case is nothing other than sustainable agriculture.

5.3 Extent of adoption of sustainable agricultural practices

5.3.1 Correlation analysis

The results of the correlation analysis of the selected

independent variables with extent of adoption of sustainable agricultural practices are presented in Table 20.

Out of the 15 selected independent variables, nine had significant correlation with the extent of adoption of sustainable agricultural practices by the farmers. They were farm size, income from agriculture, exposure to mass media, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques, perception about price of inputs, perception about price of agricultural produce, extension contact and extension participation. Out of these, perception about price of inputs had negative correlation with extent of adoption.

5.3.2 Multiple regression analysis

The results of the multiple regression analysis of the selected independent variables with extent of adoption are presented in Table 21.

The results of multiple regression analysis revealed that all the 15 selected independent variables together could predict 55 per cent of the total variation in the dependent variable viz., extent of adoption as indicated by the R^2 value of 0.550. Only five variables were significant in predicting the variation in the dependent variable. They were farming experience, income from agriculture, exposure to interpersonal

Table 20. Correlation analysis of extent of adoption sustainable agricultural practices with the independent variables

(n = 270)

Sl. No.	Independent variables	Correlation coefficient
1.	Education	0.106
2.	Farming experience	0.127
3.	Farm size	0.362**
4.	Income from agriculture	0.364**
5.	Irrigation pattern	0.095
6.	Exposure to mass media	0.362**
7.	Exposure to interpersonal sources	0.526**
8.	Perception about availability of sustainable agricultural technique	0.573**
9.	Perception about price of inputs	-0.407**
10.	Perception about price of agricultural produce	0.484**
11.	Risk orientation	0.069
12.	Economic motivation	-0.070
13.	Innovation proneness	0.029
14.	Extension contact	0.564**
15.	Extension participation	0.360**

** Significant at 1 per cent level

Table 21. Multiple regression analysis of extent of adoption ofsustainable agricultural practices with the independent variables

Sl. No.	Independent variables	Regression coefficient (b)	Standard error of 'b'	't' value
1.	Education	0.13337	0.07769	0.172
2.	Farming experience	0.15096	0.058113	2.598**
3.	Farm size	-0.04474	0.078923	-0.567
4.	Income from agriculture	0.21018	0.078295	2.685**
5.	Irrigation pattern	0.055772	0.045327	1.230
6.	Exposure to mass media	0.10601	0.077231	1.373
7.	Exposure to interpersonal sources	0.59316	0.22336	2.656**
8.	Perception about availability of sustainable agricultural technique	0.31579	0.060047	5.219**
9.	Perception about price of inputs	0.083325	0.07234	1.152
10.	Perception about price of agricultural produce	-0.24173	0.22695	-1.065
11.	Risk orientation	-0.091044	0.066278	-1.374
12.	Economic motivation	0.09861	0.06973	1.414
13.	Innovation proneness	0.011281	0.044046	0.256
14.	Extension contact	0.19015	0.074725	2.545**
15.	Extension participation	-0.02904	0.062521	-0.464

R^2 = 0.550 F = 20.70

** Significant at 1 per cent level

sources, perception about availability of sustainable agricultural techniques and extension contact.

5.3.3 Step-down regression analysis

The result of the step-down regression analysis of the independent variables with extent of adoption is presented in Table 22.

The best set of variables that contributed to the highest variation in explaining the extent of adoption consisted of farming experience, income from agriculture, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques and extension contact. These five variables together could predict 52 per cent of the variation as against 55 per cent when all the 15 variables were taken together. The R^2 value for this set was 0.5308 and the F value was 59.72.

5.3.4 Path analysis

The results of the path analysis showing the direct and indirect effects of the independent variables on extent of adoption are presented in Table 23.

The variables that had the maximum direct effect on extent of adoption were exposure to interpersonal sources (0.5932), perception about availability of sustainable

Table 22. Results of the step-down regression analysis on the extent of adoption of sustainable agricultural practices

Step No.	Variables entering regression	F value variation explained	R^2	Percentage
I	All the variables included	20.70	0.5500	55.00
II	Variables excluding x_1	22.26	0.5500	55.00
III	Variables excluding x_1 and x_{13}	24.06	0.5499	54.99
IV	Variables excluding x_1, x_{13} and x_{15}	26.12	0.5495	54.95
V	Variables excluding x_1, x_{13}, x_{15} and x_3	28.55	0.5490	54.90
VI	Variables excluding x_1, x_{13}, x_{15}, x_3 and x_{10}	31.31	0.5473	54.73
VII	Variables excluding x_1, x_{13}, x_{15}, x_3, x_{10} and x_5	34.61	0.5450	54.50
VIII	Variables excluding x_1, x_{13}, x_{15}, x_3, x_{10}, x_5 and x_{11}	38.46	0.5410	54.10
IX	Variables excluding x_1, x_{13}, x_{15}, x_3, x_{10}, x_5, x_{11} and x_{12}	43.70	0.5386	53.86
X	Variables excluding x_1, x_{13}, x_{15}, x_3, x_{10}, x_5, x_{11}, x_{12} and x_9	50.30	0.5344	53.44
XV	Remaining variables i.e., x_2, x_4, x_6, x_7, x_8, and x_{14} included	59.72	0.5308	53.08

x_1 Education

x_2 Farming experience

x_3 Farm size

x_4 Income from agriculture

x_5 Irrigation pattern

x_6 Exposure to mass media

x_7 Exposure to interpersonal sources

x_8 Perception about availability of sustainable agricultural technique

x_9 Perception about price of inputs

x_{10} Perception about price of agricultural produce

x_{11} Risk orientation

x_{12} Economic motivation

x_{13} Innovation proneness

x_{14} Extension contact

x_{15} Extension participation

Table 23. Direct and indirect effects of the independent variables on extent of adoption of sustainable agricultural practices

Sl. No.	Variables	Direct effect	Substantial indirect effect routed through		
			I	II	III
1.	Education	0.0133	-0.0939 (x_2)	0.0728 (x_7)	0.0720 (x_6)
2.	Farming experience	0.1510	-0.0322 (x_6)	0.0221 (x_4)	0.0216 (x_{11})
3.	Farm size	-0.0447	0.1715 (x_4)	0.0838 (x_{14})	0.0749 (x_{14})
4.	Income from agriculture	0.2102	0.0842 (x_7)	0.0589 (x_8)	0.0500 (x_{14})
5.	Irrigation pattern	0.0558	0.0475 (x_8)	-0.0311 (x_4)	0.0176 (x_{11})
6.	Exposure to mass media	0.1060	0.1368 (x_8)	0.1003 (x_7)	0.0794 (x_4)
7.	Exposure to interpersonal sources	0.5932	-0.2339 (x_{10})	0.1367 (x_8)	0.0915 (x_{14})
8.	Perception about availability of sustainable agricultural technique	0.3158	0.2567 (x_7)	-0.1116 (x_{10})	0.0917 (x_{14})
9.	Perception about price of inputs	0.0883	-0.4228 (x_7)	0.1772 (x_{10})	-0.1315 (x_2)
10.	Perception about price of agricultural produce	-0.2417	0.5739 (x_7)	0.1458 (x_8)	0.0705 (x_{14})
11.	Risk orientation	-0.0910	0.0661 (x_{12})	0.0486 (x_4)	0.0397 (x_6)
12.	Economic motivation	0.0986	-0.1845 (x_7)	0.0936 (x_{10})	-0.0610 (x_{11})
13.	Innovation proneness	0.0113	0.0263 (x_8)	0.0220 (x_1)	0.0212 (x_2)
14.	Extension contact	0.1902	0.2848 (x_7)	0.1523 (x_8)	-0.0897 (x_{10})
15.	Extension participation	-0.0390	0.1245 (x_{14})	0.1181 (x_8)	0.1018 (x_7)

Residual = 0.4500

agricultural techniques (0.3158), perception about price of agricultural produce (-0.2417) and income from agriculture (0.2102). Extension contact (0.1902) and farming experience (0.1510) also had direct effects that were substantial.

The direct and indirect effects of the selected independent variables on extent of adoption of sustainable agricultural practices by farmers is presented in Figure 12.

The discussion on the salient results are presented:

1. Farming experience

Farming experience had significant positive influence on extent of adoption of sustainable agricultural practices by the farmers. Care and understanding of nature and consciousness about the deleterious effects of different practices of intensive agriculture experienced during the previous years might have built up a strong faith in sustainability oriented practices among the well-experienced farmers. This result holds good especially on the face of the fact that many of our traditional agricultural practices are sustainability oriented. It is also an accepted fact that the old generation farmers do adopt more sustainable practices which were hither to referred to as traditional agriculture as against the young farmers.

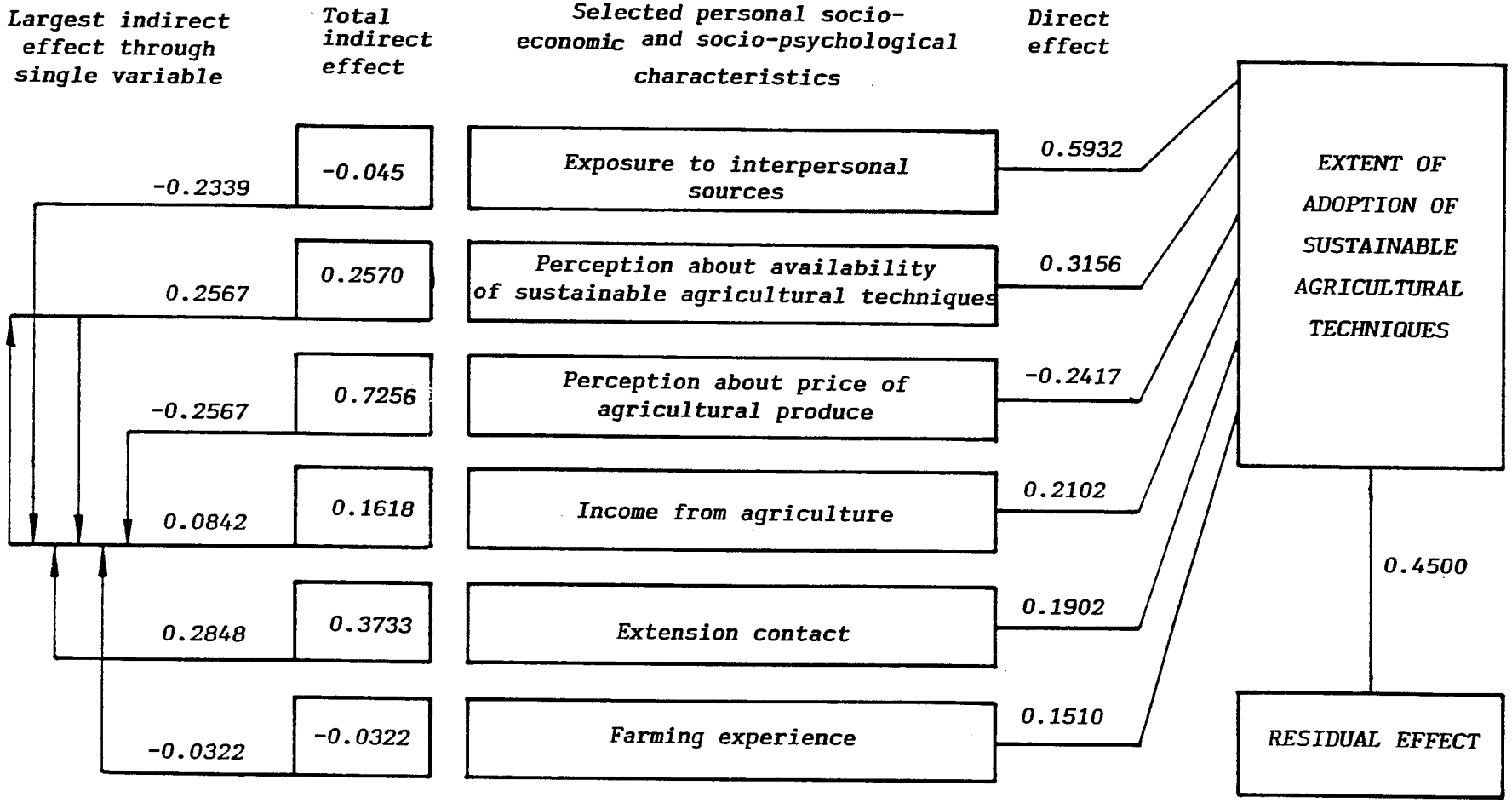


FIG. 12 PATH DIAGRAM SHOWING THE DIRECT AND INDIRECT EFFECTS OF THE SELECTED PERSONAL, SOIO-ECONOMIC AND SOCIO-PSYCHOLOGICAL CHARACTERISTICS OF THE FARMERS ON EXTENT OF ADOPTION OF SUSTAINABLE AGRICULTURE

The positive relationship between farming experience and extent of adoption is supported by many researchers like Ramaswamy (1987), Krishnamoorthy (1983), Bonny (1991).

2. Income from agriculture

Income from agriculture was found positively significant with extent of adoption of sustainable agriculture.

For the marginal and subsistence farmers, a reduction in the profit margin may be too much to bear even for a short while, as is to be expected while turning to sustainable agriculture. But the high income group of farmers need not necessarily experience such fear which probably could be the reason for the positive relationship of income from agriculture with extent of adoption of sustainable agricultural practices.

The positive relationship between annual income and extent of adoption of improved agricultural technologies is reported by many researchers like Anithakumari (1989), Rajendran (1992) and Geethakutty (1993).

3. Exposure to interpersonal sources

Exposure to interpersonal sources had significant positive relationship with extent of adoption of sustainable agricultural practices. Time and again, many studies in the past have revealed that adoption is affected more by

interpersonal influence than by the influence of mass media. The interpersonal sources facilitate cross communication and leads to more follow up. For a farmer to adopt a new technology, various aspects like clearing of his doubts, getting reassurance, encouragement and support are very vital. The interpersonal sources of communication could facilitate these much more than the mass media. In the present context, the findings by Singh (1981), Ray and Singh (1985) also confirm with the present results.

4. Perception about availability of sustainable agricultural practices

Perception about availability of sustainable agricultural techniques had positive influence on extent of adoption of sustainable agricultural practices by the farmers.

The practices presented to the farmers to evaluate their perception included activities of general nature like residue management and recycling of farm output and wastes. So, in all probability, those who rated the availability of sustainable agricultural techniques as high naturally also might have adopted them which in turn resulted in higher extent of adoption.

Sulaiman (1989) and Rajendran (1992) have reported positive relationship between perception and extent of adoption.

5. Extension contact

Extension contact showed significant positive influence on extent of adoption of sustainable agricultural practices.

Extension education is an important and vital component in the agricultural production process. It keeps the farmer well informed on the current and practical trends in agriculture. Contact with various extension agents can motivate the farmer, may keep his interest from waning and may help him to experience the early stages of adoption of a new technology. A farmer with good extension contact may be able to avail the assistance provided by the government in time and will generally nurture a healthy optimism in agriculture and various concepts related to it. This perhaps explains the present results.

Similar findings were reported by Thankaraju (1979), Sudha (1987), Syamala (1988) and Vijayan (1989).

An emperical diagram showing the results of the study is presented as Fig.13.

6. Constraints experienced by the farmers in adoption of sustainable agricultural practices

The major constraints experienced by farmers in

adoption of sustainable agricultural technologies are presented in Table 24. These constraints are ranked based on the severity with which they are felt by the farmers as reported by them.

A great majority of the respondents (95.55%) expressed anxiety about a fall in the profit margin if they resorted to sustainable agricultural practices. There is a widespread fear among farmers that the so-called sustainable agricultural practices will lead to a reduction in returns compared to the high external input agriculture. Such a drop can be borne by the well-off and relatively larger farmer but not by the average subsistence farmer of Kerala State. The apprehension of the farmers about resorting to sustainability oriented practice thus is quite understandable.

93.70 per cent of the respondents viewed the high cost of labour as a constraint in the way of adoption of sustainable agricultural practices. This problem is perhaps the most severe in Kerala with the highest literacy rate in India also paying the highest wage rate to labourers Agricultural work in which a great majority of Kerala's labour-class population used to engage a decade ago, actually suffer a lot from the lack of labourers today. The small number of labourers who still work in the fields demand exhorbitant wages. Thus the problem of high cost of labour as well as shortage of labour go hand in hand as far as Kerala is concerned. This definitely poses a

Table 24. Constraints experienced by the farmers in adoptionof sustainable agricultural practices

(n = 270)

Sl. No.	Constraints	Frequency	%*
1.	Fear of reduction in profit margin	258	95.55
2.	Lack of information about sustainable agricultural practices	251	92.96
3.	High cost of organic inputs	250	92.60
4.	Acute shortage in the availability of organic inputs like organic manure	250	92.60
5.	High cost of labour	253	93.70
6.	Shortage in labour availability	248	91.85
7.	Many of the sustainable agricultural technologies are not easily available at present	213	78.89
8.	Resorting to non-chemical means of pest control is too tedious in relatively large farms	117	43.33
9.	Inadequate transport facilities	92	34.07
10.	Scarcity of water for proper irrigation	68	25.18
11.	Dubiousness about the effectiveness of many of the sustainable agricultural technologies	44	16.29

* Percentage do not add upto 100 because of multiple responses

constraint in the adoption of sustainable agriculture which is labour-demanding in general.

Lack of sufficient information about sustainable agricultural practices was another widely expressed constraint (92.96%). Many new sustainability oriented practices like vermiculture, bio-control, biofertilisers etc. have not reached the common farmer yet. Even the reasonably informed farmers are not well aware of such innovations in the agriculture sector. This calls for large scale and specific extension efforts to take the concepts of sustainable agriculture to the common farmer, convince him of the benefits and persuade him to adopt specific sustainable agricultural practices.

High cost of organic inputs coupled with shortage in the availability of organic inputs like farmyard manure, green manure were also important constraints as expressed by the farmers. This is perhaps a bigger problem than it sounds to be, which is rooted in the deforestation and population explosion problems which the country in general is facing. In Kerala especially, conversion of agricultural lands for residential purpose is a common phenomenon. The decreasing cattle population of the state make farm yard manure a more or less scarce commodity. All these pose problem in the adoption of sustainable agricultural techniques by the farmers.

Many farmers voiced the opinion that the said sustainable agricultural technologies are not easily available yet (78.89%). Practices like vermiculture, biofertilisers, etc. are proven to be effective and practicable but the necessary materials are not easily available to the common farmer. A wider network of such services can easily help to overcome this constraint.

Some of the farmers expressed the view that resorting to non-chemical means of pest control is too tedious in relatively large farms (43.33%). Inadequate transport facilities and scarcity of water for proper irrigation were some of the other constraints expressed by farmers (34.07% and 25.18% respectively).

Some farmers were dubious about the effectiveness of many of the sustainable agricultural technologies because of which they do not consider adopting them. Since such farmers were only 16.29 per cent of the total respondents, it can be well assumed that the necessity for a more sustainable agriculture is felt by almost all the farmers of our State.

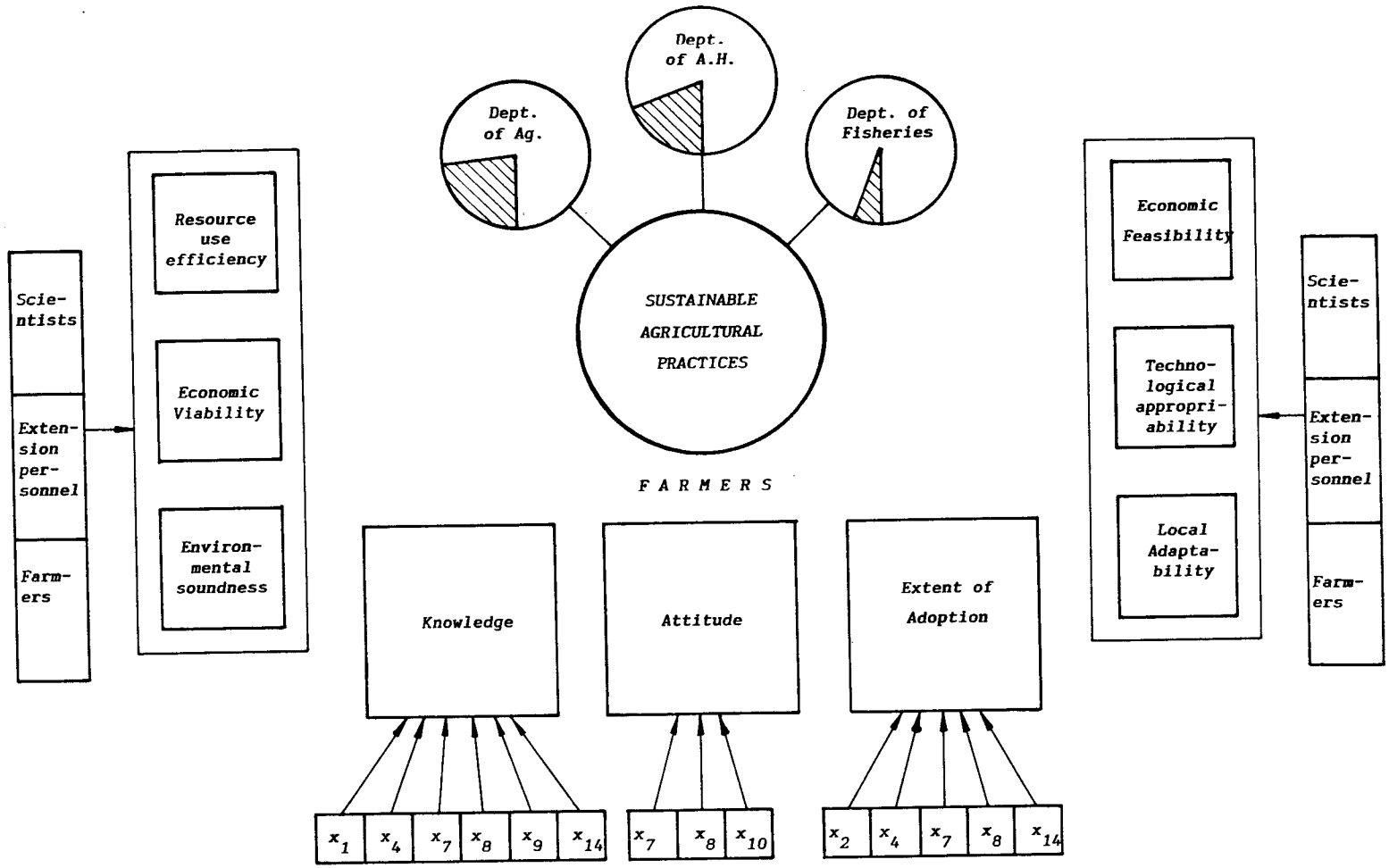


Fig.13 *EMPIRICAL DIAGRAM SHOWING THE RESULTS*

Summary

Chapter V

SUMMARY

Sustainable agriculture is the topic of current interest. In an era where the very thriving of agriculture is put under great pressure, the urgency of resorting to a more sustainable agriculture is felt by all. Now that we have clearly started paying the price for our indiscriminate and thoughtless exploitation of the natural resource base, probing into the practical aspects of sustainability assumes all the more importance. In India, Kerala is a state that is generously endowed with a rich resource base and where agriculture has started playing the position of the second fiddle already. The problems and prospects for a more sustainable agriculture have so far not been explored in this State. Hence the present study was taken up as an in-depth analysis into this field.

The following were the specific objectives of the study.

a. to analyse the concept of sustainable agriculture as perceived by scientists, extension personnel and farmers.

b. to examine the dimensions of sustainable agriculture.

c. to examine the nature and extent of inclusion of the identified dimensions of sustainable agriculture in the development programmes of the State Departments of Agriculture, Animal Husbandry and Fisheries.

d. to analyse the extent of knowledge, attitude and adoption of the components of sustainable agriculture by the farmers of Kerala.

e. to analyse the different environmental, situational economic and personal factors which contribute to the knowledge, attitude and adoption of practices for a sustainable agriculture by the farmers.

f. to identify the constraints in the adoption of technologies for sustainable agriculture by the farmers.

To cover the first two objectives, a sample consisting of 25 scientists were randomly selected from the disciplines of Agronomy, Soil Science, Horticulture and Agricultural Extension from K.A.U. and T.N.A.U. and 25 extension personnel in the cadre of Asst. Director and Deputy Director were randomly selected from the State Department of the Agriculture, 25 progressive farmers were selected at random from the Thrissur Subdivision, from the list of progressive farmers obtained from the Agricultural Officers of the Sub-Division. To study the third objective, content analysis of the programmes implemented by the

Departments of Agriculture, Animal Husbandry and Fisheries for the year 1992-93 was done. For the next three objectives a sample of 270 farmers was obtained randomly from the 9 panchayaths of the Thrissur subdivision representing high-elevation lands, medium elevation lands and low elevation lands.

The dependent variables for the study were knowledge about sustainable agriculture, attitude towards sustainable agriculture and extent of adoption of sustainable agricultural practices. Knowledge about sustainable agriculture was measured using a knowledge test developed for the study and attitude towards sustainable agriculture, using a scale, also developed for the study. Extent of adoption of sustainable agricultural practices was measured using another scale developed for the purpose.

The personal, socio-economic and socio-psychological characteristics of farmers viz., education, farming experience, farm size, income from agriculture, irrigation pattern, exposure to mass media, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques, perception about price of inputs, perception about price of agricultural produce, risk orientation, economic motivation, innovation proneness, extension contact and extension participation were selected as the independent variables for the study, based on pilot study and judges' rating. These variables

were measured using available measuring instruments wherever possible and with thetests developed for the purpose in some cases.

The data were collected from the different groups of respondents using mailed questionnaires and structured interview schedules during the months of February to May 1993. The statistical tools used were mean, percentage, correlation analysis, multiple regression analysis, stepwise regression analysis and path analysis.

The salient findings of the study are presented below:

1. In the analysis about the concept of sustainable agriculture, majority of the scientists chose the definition given by USAID.

2. Among the Agricultural Officers of the State Department of Agriculture, the highest percentage chose the definition given by FAO.

3. There was no clear majority in the choice of the definitions by the farmers. The definition given by American Society of Agronomy and the one given by FAO were endorsed by the same number of farmers.

4. In the case of the pooled sample comprising of all three categories of judges, the majority had selected the definition given by USAID.

5. In the light of the common features in the presented definitions and the salient features emerged from the suggested definitions, it was deduced that a farming system can be called sustainable when it meets the product demand for which it is intended, can maintain the productivity without depleting the natural resource base, is not harmful to the environment, is economically viable, suited to the local conditions in all aspects and can be expanded without any deleterious effects in the case of increased future demand.

6. In the analysis to pinpoint the important dimensions of sustainable agriculture, six dimensions adorned the top positions. They were resource use efficiency, environmental soundness, economic viability, technological appropriateness, economic feasibility and local adaptability.

7. Content analysis of the schemes of the three State Departments viz. Agriculture, Animal Husbandry and Fisheries revealed that the extent of inclusion of the components of sustainable agriculture is less than 25 per cent in all three Departments.

8. Majority of the respondents were in the medium category with respect to knowledge, attitude and extend of adoption of sustainable agricultural practices.

9. The independent variables education, income from agriculture, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques and extension contact contributed positively and significantly to the variation in knowledge about sustainable agriculture whereas perception about the price of inputs had significant negative association with this dependent variable.

10. While exposure to interpersonal sources had significant positive relationship, perception about availability of sustainable agricultural techniques and perception about price of agricultural produce had negatively significant relationships with attitude of farmers towards sustainable agriculture.

11. Farming experience, income from agriculture, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques and extension contact were positively and significantly related to the extent of adoption of sustainable agricultural practices.

12. Fear of reduction in profit margin, high cost of labour, lack of information about sustainable agricultural practices, acute shortage in the availability of organic inputs, high cost of organic inputs, shortages in labour availability and lack of easy availability of many of the

sustainable agricultural technologies were the major constraints in adoption of sustainable agricultural practices as expressed by farmers.

13. Tediousness in resorting to non-chemical means of pest control in large farms, inadequate transport facilities, scarcity of water for proper irrigation, and dubiousness about the effectiveness of many of the sustainable agricultural technologies were the other constraints expressed by farmers.

Implications

1. Eventhough there is varied opinion among the three categories of judges regarding the concept of sustainable agriculture, there was consensus regarding a resource-use-efficient, environmentally safe, economically viable, production-wise sound, locally suitable and natural resource-base protecting system which would ultimately be sustainable. A fact that is noticeable in these judgements is that the former goal of maximising production and productivity is being given a new orientation with more wider perspective by today's experts in the field of agriculture in which the concern for nature also is included.

2. The schemes of the Developmental Departments of the state desperately need more inclusion of the sustainability component in them, a fact which should be considered while devising schemes in the future.

3. By better education, extension contact and more exposure to interpersonal sources of communication, knowledge of the farmers about sustainable agricultural practices might be improved.

4. Progressive and well-experienced farmers are more prone to better adoption of sustainable agricultural practices. The extent of adoption can be improved by extension contact and exposure to other interpersonal sources of communication.

5. By better education on sustainable agricultural techniques, popularising varied kinds of organic inputs, making available specific sustainable agricultural techniques and encouraging selective mechanisation, many of the constraints that stand in the way of adoption of sustainable agricultural technologies by farmers can be removed.

Suggestions for future research

1. Traditional but no-more widely-practised sustainability oriented practices may be identified, examined and then madepopular among the main-stream cultivators through intensive extension officials.

2. The problems and prospects of sustainable agriculture may be analysed area-wise, crop-wise and farmer-category wise so as to identify specific practices for each situation.

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ANALYSIS OF THE MANAGEMENT FOR SUSTAINABLE AGRICULTURE BY THE FARMERS OF KERALA

By

JAYASREE KRISHNANKUTTY

ABSTRACT OF A THESIS

Submitted in partial fulfilment of the
requirement for the degree

Doctor of Philosophy in Agriculture

(Agricultural Extension)

Faculty of Agriculture

KERALA AGRICULTURAL UNIVERSITY

Department of Agricultural Extension

COLLEGE OF HORTICULTURE

VELLANIKKARA - THRISSUR

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ABSTRACT

The study was conducted with the main objectives of analysing the concept and dimensions of sustainable agriculture and the extent of knowledge, attitude and adoption of sustainable agricultural practices by the farmers of Kerala and also the factors affecting them.

The study was undertaken in Thrissur District of Kerala State covering 270 farmers selected using multi-stage random sampling procedure. Besides farmers, 25 agricultural scientists, 25 agricultural extension personnel and 25 progressive farmers were also selected to analyse the perception about the concept and dimensions of sustainable agriculture.

The dependent variables selected for the study were knowledge about sustainable agriculture, attitude towards sustainable agriculture and extent of adoption of sustainable agricultural practices. Fifteen independent variables were selected in relation to the objectives and based on review of literature and pilot study. Correlation analysis multiple regression analysis, step down regression analysis, and path analysis were employed for data analysis and interpretation.

It was deducted from the study that a farming system can be called sustainable when it meets the product demand for which it is intended, can maintain the productivity without depleting

the natural resource base, is not harmful to the environment, is economically viable, suited to the local conditions in all aspects and can be expanded without any deleterious effects in case of increased future demand. Six dimensions were identified as important for sustainable agriculture and they were resource use efficiency, environmental soundness, economic viability, technological appropriateness, economic feasibility and local adaptability.

Content analysis of the various schemes implemented by the three development departments of the State revealed that the extent of inclusion of the components of sustainable agriculture in the development programmes is only less than 25 per cent.

Majority of the respondents were in the medium category with respect to knowledge, attitude and extent of adoption of sustainable agricultural practices. Education, income from agriculture, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques, perception about price of inputs and extension contact were found significant in predicting the variation in knowledge of farmers about sustainable agriculture.

Exposure to interpersonal sources, perception about availability of sustainable agricultural techniques and perception about price of agricultural produce had significant contribution towards the variation in attitude of farmers

towards sustainable agriculture. Farming experience, income from agriculture, exposure to interpersonal sources, perception about availability of sustainable agricultural techniques and extension contact were found to have significant contribution towards the extent of adoption of sustainable agricultural practices by the farmers.

Apprehension about fall in profit margin, high cost of labour, lack of information about sustainable agricultural practices, acute shortage in the availability of organic inputs, shortage in labour availability and lack of easy availability of many of the sustainable agricultural practices were the major constraints in adoption of sustainable agricultural practices as expressed by farmers.

Appendices

APPENDIX - I

KERALA AGRICULTURAL UNIVERSITY

Department of Agrl. Extension
College of Horticulture
Vellanikkara, Thrissur

Date: 9.6.1992

Dr. R.M. Prasad
Associate Professor

Dear .....

Mrs. Jayasree Krishnankutty is doing her Ph.D. programme in Agrl. Extension under my guidance. She has undertaken a research project on Sustainable agriculture for her thesis work. In this connection, she wants your help and co-operation in identifying the dimensions of sustainable agriculture.

I sincerely request you to kindly go through the enclosures and spare some time from your busy schedule for her.

With regards,

Yours sincerely,

R.M. Prasad

Encl:

To

Overleaf are given sample definitions of sustainable agriculture.

You may please go through these definitions and given an improved definition for the concept of sustainable agriculture suited to the farming conditions of Kerala.

In case you feel that any one of the above definitions is quite okay, you may choose one such definition and elaborate and improve the presentation of that definition you have chosen.

Sustainable Agriculture is

1. A sustainable agriculture is one that over the long term (i) enhances environmental quality and the resource base on which agriculture depends, (ii) provides for basic human food and fibre needs, (iii) is economically viable and (iv) enhances the quality of life for farmers and society as a whole.

American Society of Agronomy (1989)

2. Sustainable agriculture should involve the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources.

FAO (1989)

3. To be sustainable, a farm must produce adequate food of high quality, be environmentally safe, protect the resource base and be profitable.

Reganold et al. (1990)

4. Sustainable agriculture is a management system for renewable natural resources including soil, wildlife, forests, crops, fish, livestock, plant genetic resources and ecosystems to provide food, income and livelihood for current and future generations and that maintains or improves the economic productivity and ecosystems services of these resources.

USAID (1990)

5. Sustainable agriculture is that form by farming which produces sufficient food to meet the needs of the present generation without ending the ecological assets and the productivity of the life supporting system of future generations.

Venkataramani (1991)

2. Below are given a set of dimension of sustainable agriculture identified through an exhaustive review of literature on the subject. You are requested to rank the dimension in order of importance you attach to them and assign weights for each dimension, such that the total will be 100. For example, you can assign 25 to one dimension, 15 to second dimension, 10 to third, and so on and the end the total should add upto 100.

You are free to add new dimension/s which you feel appropriate.

Sl.No.	Dimension	Rank	Weightage
1.	Technological appropriateness		
2.	Economic feasibility		
3.	Economic viability		
4.	Environmental soundness		
5.	Temporal stability		
6.	Resource use efficiency		
7.	Local adaptability		
8.	Social acceptability		
9.	Political tacitness/will		
10.	Administrative manageability		
11.	Cultural desirability		
12.	Renewability		

പറയുന്ന കാര്യങ്ങളോട് താങ്കളുടെ അഭിപ്രായം പ്രകടിപ്പിക്കുക.

1. സ്ഥിരമായ കൃഷിരീതികൾ അവലംബിക്കുന്നത് വഴി കൃഷിക്കാർക്ക് നഷ്ടമേ സംഭവിക്കൂ.
അതെ/അല്ല.

2. പച്ചിലവളച്ചെടികൾ ഏതൊരു കൃഷിരീതിയുടേയും ഒഴിച്ചുകൂടാനാവാത്ത ഭാഗമായിരിക്കണം. ശരി/തെറ്റ്

3. കളനാശിനികൾ ഉപയോഗിക്കുന്നത് ആരോഗ്യകരമല്ല. ശരി/തെറ്റ്

4. മൈക്രോകിടരോഗ നിയന്ത്രണം വാസ്തവത്തിൽ കൃഷിസ്ഥലങ്ങളിൽ പ്രായോഗികമല്ല.
ശരി/തെറ്റ്

5. മണ്ണിരകൾ ഉപയോഗിച്ച് കൃഷിചെയ്യാൻ ധനികരായ കൃഷിക്കാർക്കേ കഴിയൂ.
അതെ/അല്ല.

6. സ്ഥായിയായ കൃഷിക്കുവേണ്ടിയുള്ള മുറവിളി കേരളത്തിൽ സംബന്ധിച്ചിടത്തോളം അത്ര തിരക്കു പിടിക്കേണ്ട ഒന്നല്ല. ശരി/തെറ്റ്

7. ഉയർന്ന അളവ് രാസവളം കൊണ്ട് പച്ചിലവളത്തിന്റെ ഉപയോഗം ഇല്ലാതാക്കാവുന്നതാണ്. ശരി/തെറ്റ്

8. ജൈവവളം ഇടുന്നത് ചിലവിനനുസരിച്ച് ലാഭകരമല്ല. ശരി/തെറ്റ്

9. കൃഷി സ്ഥലത്ത് ഉൽപാദിപ്പിച്ച് ഉപയോഗിക്കാവുന്ന നാടൻ കീടനാശിനികൾ കൃത്രിമ കീടനാശിനികളുടെ അത്ര ഫലപ്രദമല്ല. ശരി/തെറ്റ്

10. ജൈവവളം മണ്ണിന്റെ സ്ഥിതി മെച്ചപ്പെടുത്തുന്നു. ഉവ്വ്/ഇല്ല.

11. സ്ഥായിയായ കൃഷിരീതി ധനിക-കൃഷിക്കാർക്കുമാത്രം യോജിച്ച ഒരു ആശയമാണ്. അതെ/അല്ല.

12. ജൈവവളം എത്ര അളവിലായാലും ഒരു വിപരീത ഫലവും ചെയ്യില്ല. ശരി/തെറ്റ്

13. നമ്മുടെ നെൽകൃഷിയെ സംബന്ധിച്ചിടത്തോളം വിള-പരിക്രമണം പ്രാവർത്തികമാക്കാൻ ബുദ്ധിമുട്ടുള്ളതാണ്. അതെ/അല്ല.

14. കൃഷിഭൂമിയിൽ നിന്നും ലഭിക്കുന്ന വസ്തുക്കൾ കൂടുതലായി ഉപയോഗിച്ചു കൃഷി ചെയ്യുന്നതാണ് ഏറ്റവും അഭികാമ്യം. അതെ/അല്ല.

15. തെങ്ങിൻതോപ്പിൽ ഇടവിളകൾ കൃഷി ചെയ്യുന്നതാണ് കൂടുതൽ ലാഭകരം
അതെ/അല്ല.

16. രണ്ടാം വിള നെൽകൃഷിക്കുശേഷം മണ്ണിൽ അവശേഷിച്ചിട്ടുള്ള ജലാംശം ഉപയോഗിക്കാൻ നല്ലൊരു മാർഗ്ഗമാണ് പച്ചക്കറിയുല്പാദനം. അതെ/അല്ല.

17. കപ്പ തുടർച്ചയായി ഒരേ വിളയായി കൃഷിചെയ്യുന്നത് നല്ലതല്ല. ശരി/തെറ്റ്.

18. കൃഷി സ്ഥലത്തുള്ള ജലാശയങ്ങളിൽ മത്സ്യകൃഷി ചെയ്യുന്നത് വരുമാനം കൂട്ടാൻ ഒരു നല്ല മാർഗ്ഗമാണ്. അതെ/അല്ല.

19. ചെളിനജലം കൃഷിക്കായി പ്രയോഗിക്കുന്നത് ആരോഗ്യത്തിന് ഹാനികരമാണ്. അതെ/അല്ല.

20. ജലസേചനം ചെയ്യുന്ന കൃഷി സ്ഥലങ്ങളിൽ മണ്ണിന് പുതയിടൽ ആവശ്യമില്ല.
ശരി/തെറ്റ്.

21. ഗിരികോണ പൊലെയുള്ള വൃക്ഷങ്ങൾ കാറിനെ തടഞ്ഞു നിർത്തുകയും പച്ചിലവളത്തിന്റെ ആവശ്യം നിറവേറ്റുകയും ചെയ്യുന്നു. ശരി/തെറ്റ്.

22. വിളകൾക്ക് ചേർക്കാനായി ഉദ്ദേശിച്ചിട്ടുള്ള കംപോസ്റ്റിൽ പ്ലാസ്റ്റിക്ക്, ലോഹ കഷണങ്ങൾ എന്നിവ പാടില്ല. ശരി/തെറ്റ്.

23. വിളകളുടെ അവശിഷ്ടങ്ങൾ കൃഷിസ്ഥലത്തു വെച്ചുതന്നെ കരിച്ചുകളയുന്നതാണ് ഏറ്റവും നല്ല മാർഗ്ഗം. ശരി/തെറ്റ്.

24. ട്രാക്ടർകൊണ്ട് നിലമുഴുന്നതിനുപകരമായി കൈകൊണ്ട് നിലമുഴുന്നതിന്റെ അത്ര ഫലം ചെയ്യാൻ ഒരിക്കലും കഴിയില്ല. ശരി/തെറ്റ്.

25. നിലം എത്രയധികം ഉഴുന്നുവോ അത്രയും നല്ലത്. ശരി/തെറ്റ്.

26. കൃഷിയിടങ്ങളിൽ മണ്ണിരകളുടെ ഉപയോഗം വൃത്തിഹീനവും അപ്രായോഗികവുമായ ഒരു കൃഷിരീതിയാണ്. ശരി/തെറ്റ്.

27. എല്ലാ കൃഷിയിടങ്ങളിലും ഒരു കംപോസ്റ്റ് കുഴി ഉണ്ടായിരിക്കണം. ശരി/തെറ്റ്.

28. കളകൾ ചെത്തിക്കളയുമ്പോൾ മേൽമണ്ണുകൂടി അല്പം നഷ്ടപ്പെടുന്നതുകൊണ്ട് ഇപ്രകാരം നിത്യം ചെയ്യുന്ന കളകൾ മണ്ണിൽ കുഴിച്ചു മൂടുന്നതാണ് നല്ലത്.
ശരി/തെറ്റ്

29. അമ്ലത്വം ഫോസ്ഫറി ചെറുകിട കൃഷിസ്ഥലങ്ങൾക്ക് യോജിച്ച ഒരു കാര്യമല്ല.
ശരി/തെറ്റ്.

30. ഗ്രൂപ്പറിയാൻ രക്തം പരിശോധിക്കുന്നതുപോലെ, അമ്ല ഗുണമാണോ ക്ഷാര ഗുണമാണോ എന്നറിയാൻ മണ്ണും ഒരിക്കൽ മാത്രം പരിശോധിച്ചാൽ മതിയാകും.
ശരി/തെറ്റ്.

31. മണ്ണു പരിശോധനയെ അടിസ്ഥാനപ്പെടുത്തിയിട്ടുള്ള രാസവളം ചേർക്കൽ നമ്മുടെ മണ്ണിനാവശ്യമാണ്. അതെ/അല്ല.

32. കീടനാശിനികൾ ഏതുസമയത്തു തളിക്കുന്നതും വിളക്ക് ദോഷം ചെയ്യുകയില്ല.
ശരി/തെറ്റ്.

33. രാസ-കീടനാശിനികൾ അധികം ഉപയോഗിക്കുന്നത് കീടങ്ങളുടെ പ്രതിരോധ ശക്തി വളർത്തുന്നതിന് വഴി തെളിക്കും. ശരി/തെറ്റ്.

34. പ്രകാശ-കെണികൾ ( ) ചില കീടങ്ങൾക്കെതിരെ ഫലപ്രദമായി ഉപയോഗിക്കാം ശരി/തെറ്റ്.

35. ചരിവുള്ള സ്ഥലങ്ങളിൽ തടുകളായി കൃഷി ചെയ്യുന്നത് മണ്ണൊലിപ്പ് തടയും. ഉവ്വ്/ഇല്ല.

36. മണ്ണിന്റെ ആവശ്യാനുസരണം ചേർക്കാൻ കൂടുവളങ്ങളേക്കാൾ നല്ലത് നേർവളങ്ങളാണ് അതെ/അല്ല.

37. ബയോഗ്യാസ് പ്ലാന്റുകളിൽ നിന്ന് ഗ്യാസ് ഉല്പാദനത്തിനുശേഷം അവശേഷിക്കുന്ന കുഴമ്പ് വളരെ നല്ലൊരു വളമാണ്, ശരി/തെറ്റ്.

38. നല്ലവണ്ണം ഉണങ്ങാത്ത ചാണകം വിളകൾക്കിടുന്നത് കീടങ്ങൾ പെരുപെരുകാനിടയാക്കും.
ഉവ്വ്/ഇല്ല.

39. ഒരേ
തുടർച്ചയായി/വിളവെടുക്കുന്ന സ്ഥലങ്ങളിൽ മണ്ണിൽ സൂക്ഷ്മ മൂലകങ്ങൾ ഇടക്ക് ചേർക്കേണ്ടതാണ്. ശരി/തെറ്റ്.

40. അധികം കിളയ്ക്കാതെ ആവശ്യത്തിനനുസരിച്ചുമാത്രം കിളയ്ക്കുന്നതാണ് മണ്ണിന്റെ ഘടനയ്ക്കു നല്ലത്. ശരി/തെറ്റ്.

APPENDIX-III

Item difficulty and discrimination indices of the items presented to the respondents for development of the knowledge test

Item No.	Difficulty index (P)	Descrimi-nation index (E 1/3)	Item No.	Difficulty index (P)	Descrimi-nation index (E 1/3)
*1	33.33	0.45	21	66.67	0.00
2	66.67	0.00	22	66.67	0.00
3	12.12	0.18	23	-	-
4	12.12	0.36	*24	24.24	0.54
5	24.24	0.18	25	9.09	0.27
*6	24.24	0.73	*26	39.39	0.82
*7	39.39	0.64	27	66.67	0.00
8	21.21	0.45	28	39.39	0.64
9	15.15	0.27	29	24.24	0.36
10	57.57	0.27	*30	48.48	0.54
11	45.45	0.27	31	57.57	0.27
*12	21.21	0.64	32	60.60	0.00
*13	24.24	0.54	33	51.51	0.09
*14	36.36	0.54	34	54.54	0.18
15	57.57	0.27	35	60.60	0.18
16	60.60	0.18	36	54.54	0.18
17	60.60	0.18	37	57.57	0.27
18	60.60	0.00	38	48.48	0.00
*19	36.36	0.54	39	63.63	0.09
20	42.42	0.00	40	60.60	0.00

APPENDIX-IV

Dr. R.M. Prasad
Associate Professor
(Agrl. Extension)

College of Horticulture
Vellanikkara

Date: 11.1.1993

Dear Sir/Madam,

This is in connection with a research study undertaken by Mrs. Jayasree Krishnankutty, Ph.D. Scholar in the Department of Agrl. Extension, College of Horticulture, Vellanikkara. She intends to develop a scale on the "attitude of farmers towards sustainable agriculture". In this regard, some statements expressing the attitude of farmers towards sustainable agriculture are given (Appendix-I).

You are requested to kindly go through these statements and indicate your judgement about these statements as to its degree of agreement by giving (/) mark in the appropriate column. Please bear in mind that the statements indicate the expression of the farmers and not of yours as a judge.

A set of factors which are likely to be related with knowledge and adoption of sustainable agriculture practices are listed (Appendix-II). You may please indicate the degree of relevance of these items to the knowledge and adoption of sustainable agriculture practices by our farmers. You are free to add any number of factors.

You may please spare some time from your busy schedule for this and kindly give your response.

With regards,

Yours sincerely,

(R.M. Prasad)

APPENDIX-IV

ATTITUDE STATEMENTS

Sl. No.	Item	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1.	Sustainable agriculture is just another paper-tiger					
2.	I do not intend to change my farming practices as long as I get reasonable profit					
3.	It is high time we gave more care to our ecosystem					
4.	Sustainable agriculture may be beneficial, but I cannot afford to think of it					
5.	I am not interested in any bookish ideas like sustainability					
6.	I use chemical pesticides since it is the only method to control pests and diseases					
7.	I don't think crop rotation is advantageous in our paddy fields					
8.	A farmer who struggles to meet both ends cannot think of sustainable agriculture					

Sl. No.	Item	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
9.	I see no adverse effect in resorting to chemical fertilizer alone					
10.	Raising fish in domestic ponds is a practice not suited for farmers					
11.	I don't like to use bio-gas for cooking food in my family					
12.	I am not interested in irrigating my crops with dirty, sewage water					
13.	Poor farmers like me cannot being forth any innovations in our farming techniques					
14.	I will do any modifications that are possible in my farming practices in order to help our ecology					
15.	Agroforestry does not suit an homesteads					
16.	Increased use of synthetic inputs is certainly going to ruin our agriculture					
17.	I carefully evaluate a pesticide for safety before administering it on my crop					

Sl. No.	Item	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
18.	I don't think that I can't do anything for solving the problem of decreasing soil fertility					
19.	I feel vermiculture has to be popularised immediately					
20.	Whatever I do on my land is not going to affect the ecological parameters					
21.	Experience has taught me to grow only local varieties					
22.	Sustainable farming practices are what we need immediately to save our agriculture					
23.	I think biological control can't help in saving our crops from pests and diseases					
24.	Sustainable agriculture takes into account only conservation and not production					
25.	I do not go for excess use of anything whether fertilizer or pesticide					
26.	I am ready to consider the sustainability aspect in my decision-making if it will not reduce my farm-income					

Sl. No.	Item	Stro- ngly agree	Agree	Unde- cided	Dis- agree	Stro- ngly disagree
27.	Sustainable agriculture is not the small and marginal farmers' cup of tea					
28.	Surface run-off can be ignored since it will not affect the standing crop					
29.	We have to go back to nature to a considerable extent to increase our lands productivity					
30.	I think intercropping will exhaust the soil of its productive capacity					
31.	Our rich resource-base should be preserved for the future generations					
32.	You should not tax the land to produce beyond its capacity by growing more crops					
33.	My first preference goes to increasing quantity of produce than quality					
34.	More indigenous inputs is unthinkable to me since they are difficult to get					
35.	The natural resource base can be improved only through sustainable agriculture					

Sl. No.	Item	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
36.	Let us first see to the needs of mankind and after that only comes the ecosystem					
37.	I don't think a change in my farming techniques is necessary to solve any long-term problems					
38.	It is subsistence that matters, not sustainability					
39.	Without using more of chemical fertilisers we cannot grow any crop these days					
40.	Soil testing for fertiliser application is just a waste of time					

APPENDIX-V

Scale and Q values of the statements presented to the judges for finalising the attitude statements

Statement No.	Scale value	Q value	Statement No.	Scale value	Q value
*1	3.96	1.16	21	3.74	1.84
2	2.14	2.14	22	1.96	2.04
3	1.71	1.15	23	3.95	0.84
4	3.73	1.59	24	3.95	0.07
5	3.85	1.23	25	1.73	1.19
6	3.68	2.34	*26	1.67	0.99
7	4.07	1.13	27	3.57	1.82
8	3.63	2.20	28	4.17	0.92
9	4.50	1.33	29	1.78	1.13
10	4.18	0.89	*30	3.73	1.89
11	4.12	1.13	31	1.73	0.99
12	3.76	2.52	*32	2.03	0.87
13	3.82	1.90	33	3.29	2.11
*14	1.89	1.22	*34	2.91	1.82
15	3.78	1.98	35	1.97	0.56
16	1.72	0.96	36	3.82	2.55
17	3.58	2.17	37	3.64	1.94
18	3.74	1.43	38	3.50	2.53
19	2.08	0.96	39	3.56	2.97
20	3.84	1.99	40	3.75	3.04

APPENDIX-VI

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF HORTICULTURE
VELLANIKKARA

DEPARTMENT OF AGRICULTURAL EXTENSION

SCHEDULE FOR DATA COLLECTION

Analysis of the Management for Sustainable Agriculture by the Farmers of Kerala

Serial No.

Date :

PART - I

1. Name of the farmer
2. Education
    1. Illiterate
    2. Can read only
    3. Can read and write
    4. Primary education
    5. Middle school education
    6. High school education
    7. Collegiate education
3. Farming experience

    No. of years (specify)

4. Farm size

Type of land	Area in acres		
	Owned	Leased in	Leased out
Garden land			
Wetland			

5. Annual income (in Rs.)

1. From Agricultural sources
2. From other sources, if any (specify)
3. Total

6. Cropping pattern

Crop	Area (in cents)
1. Seasonal crops (specify)	
1.	
2.	
3.	
2. Perennial crop (specify)	
1.	
2.	
3.	

7. Soil characteristics

1. Type of soil (Garden land) : Laterite/red/river alluvium/clay/clay loam/sandy loam/any other (specify)
2. Reaction : Acidic/Alkaline/Neutral
3. Nature of the terrain : Plain/sloppy/both

8. Irrigation

a. Main source of irrigation : Well/pond/river/canal/tanks/ : any other (specify)

Source of irrigation	Area irrigated (in cents)	Crops irrigated
1. Well		
2. Ponds/tanks		
3. River		
4. Irrigation canals		
5. Others if any (specify)		

9. Exposure to information sources

Sources	Frequency		
	Regular	Occasional	Never
A. Impersonal sources			
1. T.V.			
2. Radio			
3. Newspaper			
4. Periodicals/Magazines			
5. Booklets, Pamphlets, leaflets etc.			
6. Others, if any (specify)			
B. Formal personal sources			
1. Agrl. Assistant			
2. Agrl. Officer			
3. Village Extension Officer			
4. Block Development Officer			
5. Private firm representatives			
6. Others if any (specify)			

C. Information personal sources

1. Family members
2. Friends/relatives
3. Neighbours/fellow farmers
4. Others (specify)

10. Perception about availability of sustainable agriculture practices

Practices	High	Medium	Low
1. Vermiculture			
2. Green manures			
3. Bio-fertilizers			
4. Pesticides of plant origin			
5. Biological control			
6. Residue management			
7. Organic recycling			
8. Use of sewage water			

11. Perception about price of inputs

Name of input	High	Optimum	Raw
1. Labour			
2. Quality seeds			
3. Fertilisers			
4. Weedicides			
5. P.P. Chemicals			
6. Agrl. implements/ Farm machinery			
7. Irrigation equipments			
8. Others (specify)			

12. Perception about price of farm produce

How do you rate the price of farm produce you get?

Crop	Main produce			By-product		
	High	Fair	Low	High	Fair	Low
1.						
2.						
3.						

13. Risk Orientation

Statements	Response category				
	SA	A	UD	DA	SDA
1. A farmer should grow large number of crops to avoid greater risks involved in growing one or two crops					
2. A farmer should take more of chance in making a big profit than to be content with a smaller but less risky profit					
3. A farmer who is willing to take greater risk than the average farmer usually does better financially					
4. It is good for a farmer to take risk when he knows his chance of success is fairly high					
5. It is better for a farmer not to try new farming method unless most others in the locality have used it with success					
6. Trying an entirely new method in farming by a farmer involves risk, but is worth it					

14. Economic motivation

Statements	Response category				
	SA	A	UD	DA	SDA
1. A farmer should work towards larger yields and economic profits					
2. The most successful farmer is the one who makes the most profit					
3. The farmer should try any new farming idea which may earn him more money					
4. A farmer should grow cash crops to increase monetary profits in comparison to growing of food crops for home consumption					
5. It is difficult for the farmers' children to make good start unless he provides them with economic assistance					
6. A farmer must earn his living but the most important thing in life cannot be defined in economic terms					

15. Innovativeness

Here are 8 statements. You may please go through each statement and indicate your response

Statement	Response
1. Do you want to learn new ways to farm?	Yes/Undecided/No
2. If the agrl. extension worker gives a talk on improved cultivation aspects, would you attend?	Yes/Undecided/No

Statement	Response
3. If the Govt. would help you to establish a farm elsewhere would you move?	Yes/Undecided/No
4. Do you want a change in your way of life?	Yes/Undecided/No
5. A farmer should try to farm the way his parents did	Yes/Undecided/No
6. Do you want your sons to be farmers?	Yes/Undecided/No
7. It is better to enjoy today and let tomorrow take care of itself	Yes/Undecided/No
8. A man's fortune is in the hands of God	Yes/Undecided/No

16. Development orientation

Do you agree with the following statements?

Statements	Agree	Disagree
1. Maintaining healthy relations and harmony in different communities is more essential than the achievements of socio-economic progress		
2. The programme of social and economic upliftment should be abandoned if they adversely affect the sweetness of personal human relations		
3. Whatever be their importance, the plans and policies which hurt the sentiments of the people should be dropped		
4. Views and consent of the people must be sought before the implementation of any policy or programme		
5. The programmes of economic development which cause hardships to the people should be dropped		

Statements	Agree	Disagree
6. Even if development programmes are delayed, efforts must be made to take people into confidence before they are implemented		
7. The programme inviting people's displeasure should not be implemented		

17. Extension orientation

a. Extension contact personnel

	Frequency of contact			
	Twice in a week	Once in a week	Once to thrice a month	Never
1. Agrl. Scientists				
2. Agrl. Officers				
3. Development Officers				
4. Agrl. Assistants				
5. Others (specify)				

b. Extension participation activities

	Frequency		
	Whenever conducted	sometimes	Never
1. Seminar			
2. Farmers meetings			
3. Demonstrations			
4. Exhibitions			
5. Film shows			
6. Trainings			
7. Others (specify)			

PART II

1. Knowledge about sustainable agriculture

Statement

1. Adoption of sustainable farming system results in loss to farmers. Yes/No

2. The call for sustainable agriculture is not that urgent under Kerala conditions True/False

3. Green leaf manure can be replaced with higher dose of chemical fertilizer Right/Wrong

4. Organic manure has no adverse effect whatsoever.

5. Crop rotation is too tedious than cost worthy with regard to our rice cultivation Yes/No

6. It is advantageous to use on farm produced inputs. Yes/No

7. Sewage water re-cycling is unhealthy. Correct/Incorrect

8. Tractor-ploughing cannot match the benefits of cattle-ploughing True/False

9. Vermiculture is unhygienic and impractical. Yes/No

10. Like blood tested for group, soil need be tested only once to find out its reaction. True/False

2. Attitude towards sustainable agriculture

Statements	Response				
	SA	A	UD	DA	SDA
1. Sustainable agriculture is just another paper-tiger					
2. I will do any modifications that are possible in any farming practices in order to help our ecology					
3. It is high time we gave more care to our ecosystem					
4. I think intercropping will exhaust the soil of its productive capacity					
5. I do not intend to change my farming practices as long as I get reasonable profit					
6. More indigenous inputs is unthinkable to me since they are difficult to get					

3. Extent of adoption

A list of sustainable agriculture practices that are feasible for adoption by our farmers is given below. Please indicate how far you have used/continued to use these practices by giving '/' mark against the practice.

Practice	Continued use	Used once and dis-continued	Never practice
1. Conservation tillage			
2. Green manures			
3. Biological fertilisers			

Practice	Continued use	Used once and dis-continued	Never practice
4. Pesticides plant origin			
5. Residue management			
6. Bio-gas			
7. Vermiculture			
8. Recycling of farm outputs/wastes			
9. Sewage-water irrigation			
10. Mechanical pest control methods			
11. Cover-crops			
12. Legume-based intercropping			
13. Crop-rotation			
14. Compost production and usage			
15. Contour burding			
16. Insect traps			
17. Soil-test based fertiliser application			
18. Shade-tolerant crops			
19. Need based application of P.P. chemicals above threshold level			

PART III

1. Mention the constraints if any, that you feel stand in the way adoption of sustainable agriculture practice.