RESEARCH AND EXTENSION GAPS IN COMMERCIAL VEGETABLE FARMING IN EASTERN PALAKKAD

By

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THESIS

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DECLARATION

I hereby declare that the thesis entitled **"Research and extension gaps in commercial vegetable farming in eastern Palakkad"** is a bonafide record of research work done by me during the course of research and the 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.

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CERTIFICATE

Certified that the thesis entitled **"Research and extension gaps in commercial vegetable farming in eastern Palakkad"** is a record of research work done independently by Sri. Kamalakkannan, K under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, associateship or fellowship to him.

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MOTHER'S LOVE

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Kamalakkannan, K

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LIST OF ABBREVIATIONS

KAU	-	Kerala Agricultural University
POP	-	Package of Practices
PP	-	Plant Protection
PRA	-	Participatory Rural Appraisal
VFPCK	-	Vegetables and Fruits Promotion Council of Keralam

INTRODUCTION

I. INTRODUCTION

Vegetables are rich sources of vitamins and minerals and they constitute major components of human diet. India produces around 12 per cent of the world's vegetables (Gowda, 1999). Indian vegetable exports have achieved a growth rate of 23 per cent in the last decade whereas its share in the world is only one per cent (Bose and Rajan, 1999; Pandey, 1998).

Our vegetable requirement in 2020 would be 135 million tonnes. According to the Diet Advisory Committee of the Indian Council of Medical Research, an adult requires 284 g of vegetables per day. But the present national production of 87.5 million tonnes of vegetables does not meet the requirement (Singh, 2001).

The cultivation of vegetables gives a much higher rate of income per unit area than field crops. Vegetable crops can be fitted into many viable crop rotations and cropping patterns like intercropping, multiple cropping and companion cropping. Their cultivation is labour intensive and hence helps in generating employment throughout the year.

Kerala is endowed with diverse climatic conditions. The humid tropical climate in plains, hot dry climate in the Chittoor tract adjoining TamilNadu, relatively cool and sub-tropical to temperate climate in Idukki, Wayanad and parts of Palakkad district offer great scope for cultivation of a variety of vegetables in this small State (Devdas, 1999;Gopalakrishnan, 1999).

In spite of congenial climatic conditions, the present situation regarding vegetable cultivation in the State is not satisfactory when compared to other states. The contribution from Kerala is meagre in both area and production.

In Kerala there is approximately of 78000 ha under vegetable cultivation with a production of 8 lakh tonnes including drumstick and tuber crops. The 13 lakh

tonnes of vegetables consumed in Kerala had a share of 7 lakh tonnes from other states. Out of the total domestic requirement of vegetables in Kerala, about 60 per cent is brought from neighbouring states and an amount of Rs.850 crores is spent annually for this (Gopalakrishnan, 1996).

The important vegetable crops in Kerala include bitter gourd (*Momordica charantia*), cowpea (*Vigna unguiculata* var. *sesquipedalis*), snake gourd (*Trichosanthes anguina*), oriental pickling melon (*Cucumis melo* var *conomon*), ash gourd (*Benincasa hespida*), amaranth (*Amaranthus sp.*), bhindi (*Abelmoschus esculentus*) and pumpkin (*Cucurbita moschata*) (Gopalakrishnan, 1997).

The high production cost of vegetables in Kerala made the farmers highly sensitive to even slight fluctuations of price levels of produce. Increased pest and disease incidence, unorganized marketing system, lack of soil or location specific technologies, insufficient capital support and the like became as a felt problems of vegetable growers and it is a threat to commercial vegetable farming.

A detailed investigation of the specific problems/constraints experienced by the vegetable growers followed by identification of available technological interventions thereby exploring the research and extension gaps in commercial vegetable farming is the need of the hour to promote and encourage commercial vegetable cultivation in the state so as to bridge the growing disparities in production and consumption. Hence, a study was attempted on these lines.

Objectives of the study:

1. To analyze the status and identify the problems/constraints in commercial vegetable farming.

2. To explore the availability of appropriate technologies with the research system and gaps thereon to tackle the identified problems/constraints.

3. To study the gaps in knowledge and adoption levels of the identified technologies.

4. To study the profile of the commercial vegetable growers of eastern Palakkad.

5. To suggest suitable strategies for commercial vegetable farming in eastern Palakkad.

Scope and importance of the study

Exploration of problems/constraints in commercial vegetable farming will be useful in identifying new problem areas in vegetable farming. Listing the technological options available with the research system so as to identify the gaps in technology support will enable the research system to streamline the generation and propagation of suitable technologies with an inbuilt scope for replication in similar micro-farming situations.

The investigation on both research and extension gaps in commercial vegetable farming will be useful for the research system as well as extension system to focus on appropriate strategies to make up for the deficiency areas.

Limitations of the study

This study was undertaken as a part of the post-graduate research programme and it had the invariable inherent limitations such as time and money. Because of these limitations it was not possible for the researcher to explore the area in depth and in more comprehensive manner. Therefore, the generalizations made in the study based on the research findings may only have limited application to other areas.

In spite of these limitations, sincere and devoted efforts have been made to make this study as objective and systematic as possible.

Presentation of the thesis

The thesis is presented in five chapters including the present one, introduction. The second chapter covers the review of the relevant studies in the context of the objectives set forth for the study. The materials and methods have been presented in the third chapter. The fourth chapter brings out the results of the present investigation supported with the discussion of the salient findings. Fifth chapter gives a summary of the study followed by the references, appendices and abstract of the thesis.

REVIEW OF LITERATURE

II. REVIEW OF LITERATURE

Any scientific endeavour becomes more clear, valid and concrete, when it is supported by pertinent studies conducted earlier in that regard. Review of all such efforts, either theoretical or empirical would help to outline the new problem areas and develop a conceptual framework for the study. Keeping this in mind, a comprehensive review of the previous research studies related to the topic has been done in accordance with the objectives of the present study.

The contents of this chapter are presented under the following heads.

2.1. Problems/constraints in commercial vegetable farming.
2.2. Research gaps in commercial vegetable farming.
2.3. Extension gaps in commercial vegetable farming.
2.4. Socio-economic profile of the vegetable growers.
2.5. Conceptual framework of the study.

2.1. PROBLEMS/CONSTRAINTS IN COMMERCIAL VEGETABLE FARMING

Studies directly related to problems / constraints in commercial vegetable farming were few and intermittent and therefore some related studies in other areas also have been referred to in this section.

Bacterial wilt caused by *Ralstonia solanecearum* is the most serious problem in brinjal cultivation. This is more so because of the warm humid climate and acidic soils in Kerala, which limit the cultivation of high yielding varieties /hybrids (Gopimony and George, 1979; Jyothi, 1992; James, 2001).

Norman (1982) identified the major problems in vegetable farming as the high attack of pests and diseases and high input cost. Farmers also stated that they experienced serious problems in transporting their produce.

Chitnis and Bhilegaonkar (1987) reported service and supply constraints as the major limitations causing technological gap in the process of adoption of dryland technology. The farmers needed adequate and timely supply of production inputs, timely advice and training.

Prakash (1989) identified high wage rate, small sized holding, incidence of pests and diseases and non-availability of inputs in time as the major constraints in rice cultivation.

Govind (1992) observed that lack of assured irrigation was the most serious constraints among both the IPM and non-IPM rice farmers. Inadequacy of inputs and package deals with subsidy were found to be the second and third important constraints experienced by a large percentage of rice farmers.

Ramachandran (1992) reported that the major constraints felt by participant rice farmers were lack of input supply in time, lack of timely guidance and supervision, lack of information regarding the package of practices recommendations of the varieties and poor quality of seeds.

Heddybai (1994) found that fluctuations in the market price, long distance of market, inadequate supply of inputs, inadequate credit facilities, delayed payment and inadequate transport facilities as the major problems perceived by garden land farmers.

Puzari (1994) reported (i) non availability of seeds of recommended varieties in time, (ii) lack of awareness of newly evolved varieties, (iii) lack of conviction of the utility and importance of the scientific nursery bed preparation to produce quality vegetable seedlings, (iv) non availability of pesticides, plant protection equipment and lack of awareness of pesticides and their proper use, (v) lack of awareness of recommended dose of fertilizers, (vi) lack of irrigation facilities and (vii) non

availability of storage and market facilities as major constraints in vegetable production.

Rahman and Kashem (1995) reported that non-availability and high cost of fertilizers were most important problems encountered in growing and marketing of oil seeds.

Bonny and Prasad (1996) inferred that majority of the commercial vegetable growers had rated inadequate market facility as one of the most important constraints experienced by them in marketing of vegetables.

Jabbar (1996) revealed that the most important constraint in using vegetable production technologies were uneconomic holding size, inadequacy of capital and increased cost of plant protection chemicals.

Being an indeterminate and fast growing crop with succulent plant parts, bitter gourd is severely affected by a number of pests and diseases particularly mosaic, downey mildew, jassids and fruit fly (KAU, 1996).

In okra, yellow vein mosaic is the most destructive viral disease transmitted by white fly. The reported yield reduction due to this disease infection is up to 95.7 per cent affecting the marketability of the fruits (Pun and Duraisamy, 1996).

According to Sathiyaseelan (1996), 77 per cent of the onion growers perceived that the cultivation of onion was a difficult venture while 23 per cent of them expressed that marketing was a problem.

Alagirisamy (1997) reported that fluctuations in market price, inadequate supply of inputs, non availability of labour during peak season, inadequate credit facilities, major incidence of pests and diseases, high cost of inputs, inadequate

information about latest technologies and inadequate transport facilities were the major constraints faced by vegetable growers.

The important constraints perceived by the vegetable farmers were increased cost of plant protection chemicals, difficulty in preparation/application, difficulty in selection of alternate chemicals, inadequacy of capital, non-availability of labour and lack of knowledge about technology (Manoj, 1998).

Solanaceous vegetables are affected by a number of diseases like leaf spot, mosaic, leaf curl, fruit rot, bacterial wilt, etc. Among these the bacterial wilt is the most destructive disease in tropics and sub-tropics, causing yield losses up to 100 per cent (James, 2001).

Jayapalan and Sushama (2001a) reported that among the production constraints, incidence of pest and diseases were ranked first followed by labour scarcity. Among the economic constraints cost of material input was ranked first followed by labour cost with regard to bitter gourd cultivation.

Based on frequent field visits and thorough interaction with farmers of traditional vegetable growing tracts in Kerala, the problems of major vegetable crops were identified and prioritized as follows: (KAU, 2002b)

Bitter gourd: Mosaic, downy mildew, jassids, fruit fly and mites.
Cowpea: Mosaic, blackening of vines, basal swelling and wilting and thrips.
Snake gourd: Downy mildew and fruit fly.
Cucumber/melon: Mosaic, downy mildew and fruit fly.
Ash gourd: Mosaic and fruit fly.
Amaranth: Leaf blight.
Brinjal: Bacterial wilt, fruit and shoot borer and jassids.
Chilli: Mites, thrips and bacterial wilt.

Bhindi: Yellow vein mosaic disease.

Kumar (2002) revealed that cent per cent of cotton growers perceived the incidence of pests and lack of adequate irrigation water as the major constraints. Other constraints were spurious pesticides (60%), high cost of inputs (51.45%) and high labour charges (38.5%).

Non-availability of inputs, transportation, finance and lack of market information were expressed as most important constraints in cowpea cultivation (Ogunsumi *et al.*, 2002).

Based on the above findings it was considered worthwhile to include elaborate investigation on problem identification and prioritisation in the present study. It is therefore hoped that the results of this study would be of immense use as it explores the felt needs of the farmers.

2.2. RESEARCH GAPS IN COMMERCIAL VEGETABLE FARMING

Jaiswal and Arya (1979) stated that sometimes the researcher ignores the field problems and requirements. This was due to the lack of communication between the clients and researchers. They were supposed to be aware of the field problems through the feedback given by the client system directly or through guidance. However, the feed back on field problems to scientists has been extremely meagre. As a result, the improved technologies were not oriented to field conditions and they are mostly publication oriented.

Panikkar (1981) discussed the relevance and importance of breeding new varieties to suit local conditions and constraints.

India has one of the largest formal agricultural research and extension systems. They are complex, both in terms of institutional arrangement and

organisational management. Their strategies of technology generation and dissemination have been top down and centrist (Biggs, 1989).

According to Witcombe *et al.* (1996), farmers' preference differed depending upon agro ecological requirements and such regional preferences were to be highlighted as breeders resorted to go for varietal traits.

G.V.K.Rao committee identified six technical, administrative and operational problem areas in Indian agricultural research, which threaten the very concept of evolving improved technology. They are (i) Inadequate focus on local problems in research programmes. (ii) Excessive focus on uniformity of experiments and straightjacket approach in research. (iii) Inadequate financial resources and delay in release of funds. (iv) Sub-optimal utilisation of resources. (v) Lack of effective monitoring and (vi) Weak links in extension (John et al., 1997).

A study conducted by Song and Manikand (1999) revealed that there was a wide gap between breeders' limited supply of varieties and the diversity of farmers' needs.

Chandra (2000) and Kumar *et al.* (2002) reported that India has one of the largest and most complex public systems for generation, testing and transfer of technologies.

Devdas (2001) found that the time lag between evolving a new technology and its final reach in actual farm level is very long in the traditional system of institutional research whereas farmers' participatory research can speed up the transfer of technology since the trials are conducted in the real farming situations by farmers themselves in their own farms. Applied research in horticultural crops can be shifted to farmers participatory research and the fundamental and basic research can be strengthened in the institutions.

The literature available are however not sufficient to draw any meaningful inference on research gap. The present study attempts to elaborate the concept.

2.3. EXTENSION GAPS IN COMMERCIAL VEGETABLE FARMING

2.3.1. **Knowledge level of the identified technologies in commercial vegetable farming**

Mayani and Sheth (1978) reported that farmers' knowledge on plant protection was poor while it was fair on agronomic and manurial practices in vegetables.

Majority (67%) of commercial vegetable growers had medium level of knowledge on improved vegetable cultivation practices (Bonny, 1991).

Juliana *et al.* (1991) reported that most of the marginal and small farmers possessed only medium level of knowledge about integrated pest management practices. More than half of the big farmers possessed high level of knowledge. In contrast to this, only 2.5 per cent of marginal farmers and one-fourth of small farmers had high level of knowledge.

Leemarose (1991) concluded that 45 per cent of the chilli growers had medium level of knowledge followed by high level (30%) and low levels (25%) of knowledge on chilli cultivation practices.

Majority of the agricultural labourers (61%) belonged to the low category in knowledge on IVPT (Improved Vegetable Production Technology) (Jabbar, 1996).

Alagirisamy (1997) inferred that 61.67 per cent of the vegetable growers possessed medium level followed by high level (21.67%) and low level (16.67%) of knowledge on cauliflower cultivation.

Venkattakumar (1997) reported that majority of the commercial coconut growers (76.35%) had medium to high level of knowledge about the recommended coconut cultivation practices whereas 23.65 per cent of the respondents had low level of knowledge about the recommended coconut cultivation practices.

Manoj (1998) found that 52 per cent of the commercial vegetable farmers had medium level of knowledge about improved plant protection practices in vegetable farming.

Santhasheela (1999) reported that in the case of potato and beans growers 36.67 per cent had low level of knowledge about the plant protection measures followed by 30 and 33.33 per cent having medium and high levels of knowledge respectively.

Venkatesan (2000) revealed that more than one-third of the respondents (35.5%) had medium level of knowledge whereas another one-third (33.33%) of them had high level of knowledge and about the same proportion (31.67%) of them had low level of knowledge on recommended tomato cultivation practices.

Jayapalan and Sushama (2001b) reported that only 57.5 per cent of the farmers belonged to high knowledge category in respect of the knowledge on commercial cultivation of bitter gourd. The study also revealed that all the respondents were aware of recommended practices regarding seed selection, spacing, land preparation, fertilizer application, intercultural operations and plant protection measures. About 77.5 per cent of the farmers were having knowledge about the exact seed rate of bitter gourd, 65 per cent of the farmers had knowledge about the exact waiting periods.

Hence, it appears only logical to predict similar results with respect to knowledge level of the farmers on recommended cultivation practices.

2.3.2. Adoptioin level of the identified technologies in commercial vegetable farming

Ravichandran (1980) reported that majority (63.34%) of the sugarcane growers had medium level of adoption of package of practices. He also pointed out to the wide variation in the extent of adoption of package of practices.

Rahiman *et al.* (1986) reported that seed rates used by vegetable growers were quite high compared to the package of practices recommendations. They also identified that in contrast to the specific POP recommendations for protecting vegetable crops from pest and disease, they applied chemicals of their own choice.

Saxena *et al.* (1990) reported that 17.6 per cent of wheat farmers adopted the recommended practices in full, while 49.6 per cent adopted partially and 32.8 per cent followed recommendations to the minimal level in their fields.

A large majority (82%) of vegetable growers had medium level of adoption of improved practices in vegetable cultivation. Among the practices selected, plant protection measures recorded the highest level of adoption closely followed by fertilizer application (Bonny, 1991).

Radhakrishnan (1991) indicated that regarding the adoption of onion production technology two-third of the onion growers were found under low level of adoption (69.93%), followed by medium (26.64%) and high (3.33%) levels. He also reported that nearly three-fourth of the grape growers (73.33%) were found under medium level of adoption followed by low (16.67%) and high (10%) levels.

Swamidasan (1994) observed that 44.29 per cent of the betel vine growers were low level adopters followed by high level (32.14%) and medium (23.57%) level adoption with respect to betelvine cultivation practices.

Majority of the agricultural labourers (59%) belonged to the medium category in extent of utilisation of IVPT (Improved Vegetable Production Technologies), only 19 per cent were low adopters (Jabbar, 1996). The study also revealed that amaranth production technologies received the highest utilisation score (6.15) while bitter gourd received the lowest (5.35). In amaranth cultivation, utilisation index was highest for the foliar fertilization (1.85) while it was plant protection measures (1.67) in bhindi, improved varieties (1.59) in pumpkin. Split application of fertilizers received the high utilisation index in brinjal and bitter gourd cultivation.

Alagirisamy (1997) found that majority (58.33%) of the vegetable growers were found to possess medium level of adoption of improved vegetable cultivation practices, while 23.33 per cent of them possessed low level of adoption. Higher adoption category constituted relatively low percentage (18.34%) among the vegetable growers.

Venkattakumar (1997) reported that majority of the commercial coconut growers (67.26%) had low to medium level of adoption whereas 32.74 per cent of the respondents had high level of adoption on recommended coconut cultivation practices.

The mean adoption score for cowpea cultivation was 30.88 and majority of the farmers had adoption score ranging from 20 to 30.In the case of adoption of different practices, correct seed rate was adopted by 80 per cent of the farmers, whereas the adoption of *Rhizobium* culture treatment and time of application was the minimum *i.e.* 1.3 per cent only. Farmers adopting high yielding variety seeds, chemical fertilizers and plant protection measures were 52, 42.67 and 33.67 per cent respectively (Kalavathy and Anithakumary, 1998).

Above 54 per cent of the commercial vegetable farmers had medium level of adoption of improved plant protection practices and only 6 per cent were high adopters (Manoj, 1998).

Waman *et al.* (1998) observed that majority of the onion growers (50.67%) were having medium level of adoption followed by low level of adoption (38%). Only 11.33 per cent of the onion growers had a relatively high level of adoption with respect to recommendations on onion production technologies.

Santhasheela (1999) reported that 46.68 per cent brinjal growers had low level of adoption followed by 26.67 per cent each, who had medium and high levels of adoption of various plant protection measures.

Venkatesan (2000) inferred that majority of the tomato growers (70.83%) had low to medium level of adoption whereas more than one-fourth (29.17%) of them had high level of adoption.

The above findings indicate the possibility of similar results in this study also. Hence, it was decided to verify the same in the present context.

2.4. SOCIO-ECONOMIC PROFILE OF THE VEGETABLE GROWERS

Subhashini (1990) reported that 81.67 per cent of the farm women belonged to middle age group followed by 17.50 per cent in old age group. Less than one per cent belonged to young women in hill vegetable farming.

Manoharan (1991) reported that the banana growers were found to have more social participation either as members or office bearers in various organisations.

The socio-economic variables selected by Mansingh (1993) were educational status, family status, farm status, social participation status and communication status.

Pochiah *et al.* (1993) stated that most of the vegetable growers (43.3%) had primary school level followed by high school (20.80%), illiterates (15%), middle school (13.40%) and collegiate (7.5%) levels of education.

He also stated that majority (55.80%) of the vegetable growers had medium level of farming experience followed by low (24.2%) and high levels (20%) of farming experience.

Heddybai (1994) found that 53.33 per cent of the garden land farmers had medium level of social participation, followed by high level (29.34%) and low levels (17.33%).

Sathiyaseelan (1996) found that majority (68.57%) of the commercial onion growers were marginal farmers.

Alagirisamy (1997) indicated that majority of the vegetable growers (52.5%) were educated up to middle school followed by 29.16 per cent, who had secondary school education. A less percentage (18.34%) had primary school education. No one was an illiterate.

He also observed that most (91.66%) of the vegetable growers were found to possess more than 10 years of farming experience followed by 8.34 per cent of vegetable growers with 5 to 10 years of experience in vegetable cultivation.

Further the study revealed that more than half of the vegetable growers (55.84%) had medium level of information seeking behaviour followed by 34.16 and 10 per cent with high and low levels of information seeking behaviour respectively.

Venkattakumar (1997) revealed that an equal proportion of the commercial coconut growers (40.71%) had low and medium levels of social participation whereas nearly one-fifth had high level of social participation (18.58%).

A study conducted by Santhasheela (1999) revealed the following results.

One-fifth (20%) of the tomato growers possessed low level of land holdings followed by 50 and 30 per cent who possessed medium and high levels of land holdings respectively.

About 40 per cent of the tomato growers had low level of education followed by 26.67 and 33.33 per cent who had medium and high school level of education respectively.

Around 23 per cent of the brinjal growers belonged to young age group followed by 43.33 and 33.67 per cent belonged to middle and old age group respectively.

Thirty per cent of potato growers had low level of information seeking behaviour followed by 43.33 and 26.67 per cent who had medium and high levels of information seeking behaviour respectively.

About 26.7 per cent of the brinjal growers had low level of farming experience followed by 50 and 23.3 per cent who had medium and high levels of farming experience respectively.

Majority (46.66%) of the brinjal growers had medium level of contact with extension agency while 26.67 per cent of each had low and high levels of contact.

Regarding potato and beans grower, majority (46.66%) of them had medium level of social participation followed by 36.67 and 16.6 per cent who had low and high levels of social participation respectively.

Age, education, main occupation, experience in bitter gourd cultivation, area under bitter gourd cultivation, social participation, extension orientation and

economic motivation were the selected characteristics of the respondents and were measured using appropriate tools to categorise the farmers (Jayapalan and Sushama 2001b).

Socio-economic profile analysis of the tomato growers revealed that 54 per cent of the respondents were old followed by middle age (30%) and young (16%) respectively. About 44 per cent of the respondents were of primary education category and only four per cent were illiterate. Majority (58 %) of the respondents were in the medium organisational participation followed by 43 per cent of the respondents in the low category. Very less (8%) were in high organisational participation. With regard to extension participation majority (70%) of were in the low category followed by 30 per cent in high category. The study also concluded that 60 per cent of the respondents were in the medium extension contact category followed by 28 per cent in low extension contact category (Jahagirdar and Sundarasamy, 2002).

The preceded discussions provide ample evidence to include the socio-economic characteristics of the farmers in profile analysis. A similar trend of distribution of the respondents may be predicted in the present study also.

2.5. CONCEPTUAL FRAMEWORK OF THE STUDY

The conceptual framework aims to provide a theoretical roadmap to the present study. The details may be presented on the following steps (Fig. 1).

Step1: Identification of problems/constraints in commercial vegetable farming

The problems/constraints experienced by the vegetable growers would be identified by using PRA techniques, field investigation and 'farmers-extensionists-

scientists' interaction sessions. Further they would be prioritised based on their importance using farmers' responses in personal interviews.

Step2: Exploration of research gaps in commercial vegetable farming

Availability of technological interventions with the research system of KAU to tackle the identified problems/constraints in vegetable cultivation would be explored with extensive review of relevant literatures and Package of Practices (POP) released by KAU followed by threadbare discussions and deliberations by a multidisciplinary research team comprising of experts from all the departments connected with vegetable research. The deficiency areas would bring to light the research gaps related to specific problems in commercial vegetable farming.

Step 3: Identification of extension gaps in commercial vegetable farming.

The identified technological interventions would then be presented to the farmers to study their knowledge and adoption level. The extension gaps if any is proposed to be identified this way.

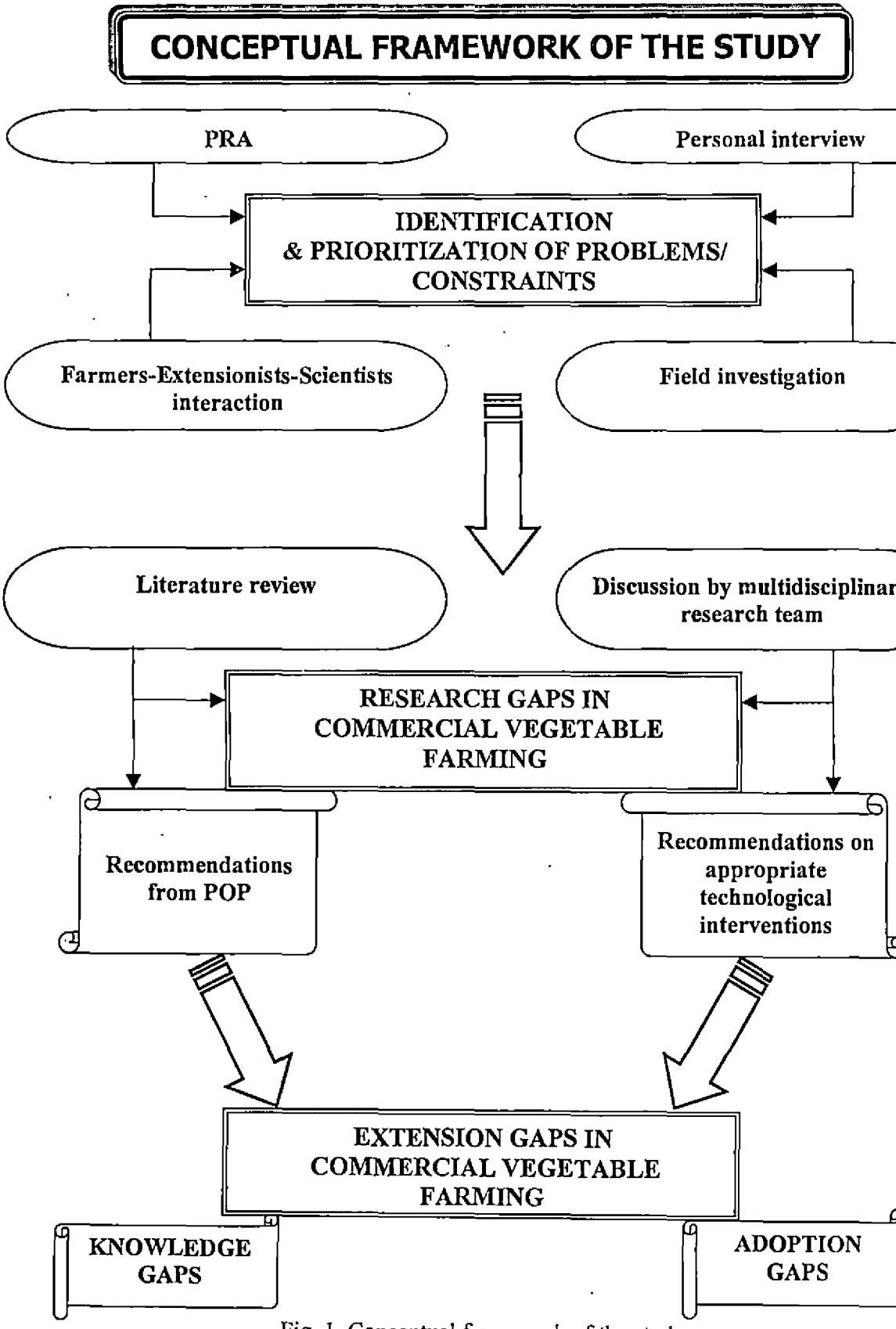

Fig. 1. Conceptual framework of the study

MATERIALS AND METHODS

III. MATERIALS AND METHODS

The present investigation was undertaken with the main objective of identifying and prioritising the problems/constraints in commercial vegetable farming followed by exploring the research and extension gaps associated with it.

Appropriate research methods and techniques were adopted according to the requirements of the objectives set fourth in this study. A general description of the methods and procedures followed in conducting the research is furnished in this chapter under the following subheadings.

3.1. Research design
3.2. Locale of study area
3.3. Selection of sample
3.4. Identification and prioritisation of problems/constraints in commercial vegetable farming
3.5. Exploring the availability of technological interventions to tackle the identified problems/constraints in commercial vegetable farming
3.6. Knowledge and adoption level of the identified technologies in commercial vegetable farming
3.7. Socio-economic profile of the vegetable growers
3.8. Procedures employed in data collection
3.9. Statistical tools employed in the study

3.1. RESEARCH DESIGN

The present study was conducted by adopting an 'ex-post-facto' research design. 'Ex-post-facto' research design is a systematic enquiry in which the scientist does not have direct control over the independent variables because their manifestations have already occurred or because they are inherently not manipulatable (Kerlinger, 1983).

In this study, since there was no scope for manipulation of any dimensions under study, 'ex-post-facto' research design was resorted to.

3.2. LOCALE OF STUDY AREA

The present study was carried out in Nemmara block of Palakkad district in Kerala. (Fig.2) The eastern parts of Palakkad district bordering TamilNadu are the major vegetable growing tracts of the district. Palakkad district is unique in its crop diversity and agro-climatic characteristics.

Harithasangams were formed by the state government of Kerala to organise the vegetable farmers and promote vegetable production in the state. Nemmara block in Palakkad district was purposively selected as the study area because of the presence of maximum number of *harithasangams*.

3.3. SELECTION OF SAMPLE

3.3.1. Selection of panchayats

Judgement sampling was the technique adopted for selecting the panchayats for the study. In Nemmara block, Nemmara and Ayilur panchayats were selected because of the presence of maximum number of *harithasangams* and predominance of area under vegetable cultivation.

3.3.2. Selection of vegetable crops

Bitter gourd, snake gourd, chilli, amaranth, yard long bean, brinjal, bhindi and coccinea were the major vegetables selected for the study owing to the largest area under these vegetables and discussions with extension workers and progressive farmers in the study area.

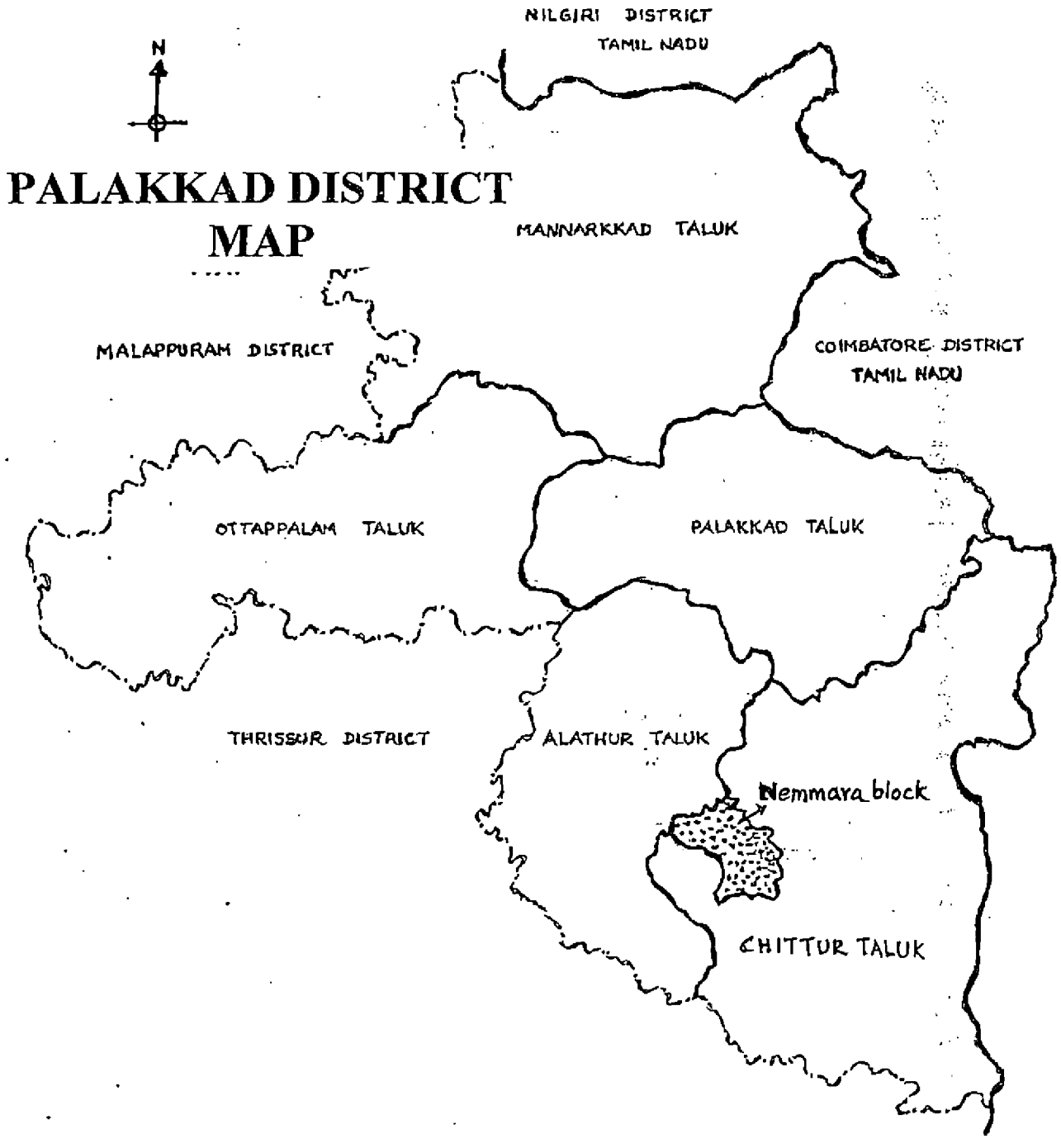

Fig. 2. Locale of study area

3.3.3. Selection of farmers from *Harithasangams*

A complete list of *harithasangams* functioning in both the selected panchayats was prepared by using the secondary data collected from *Krishibhavan.*

Table 1. Number of farmers selected from each panchayat

Sl.No.	Name of the Panchayats	Number of *harithasangams*	Number of farmers
1	Nemmara	13	55
2	Ayilur	7	25

There are about 13 *harithasangams* functioning in Nemmara and seven in Ayilur panchayats. Again, it was decided to select 55 farmers from Nemmara and 25 farmers from Ayilur panchayats proportionate to the number of *harithasangams* functioning in each panchayat (Table 1).

An exhaustive list of members of all the 20 selected *harithasangams* was prepared, in which farmers cultivating at least three of the identified vegetables were selected purposively. The mean and standard deviation of the area under commercial vegetable farming were worked out to categorise the farmers into three major categories (Table 2).

Table 2. Categorization of the vegetable growers

Sl.No.	Categorization of the respondents	
1	Low group	< Mean - 1Sd
2	Medium group	Mean ± 1Sd
3	High group	> Mean +1 Sd

Finally 80 farmers belonging to different categories were selected from each *harithasangam* proportionate to the size of the group (Table 3) by using simple random sampling.

Table 3. Number of farmers selected from each *harithasangam*

Sl.No.	Name of the *Harithasangams*	Number of farmers
Nemmara Panchayat:		
1	Kannode *harithasangam*	4
2	Pothundy *harithasangam*	3
3	Aasadeepam mahila *harithasangam*	4
4	Chemmanthode *harithasangam*	3
5	Arimpoorapathy *harithasangam*	8
6	Edakkampadam *harithasangam*	5
7	Elanthakulambu mahima mahila *harithasangam*	4
8	Kacheripadam *harithasangam*	3
9	Koottakadaru *harithasangam*	6
10	Aiswarya-Kothasserry *harithasangam*	3
11	Elanthakulambu *harithasangam*	3
12	Mullakkal *harithasangam*	3
13	Vithanassery *harithasangam*	6
Ayilur Panchayat:		
14	Thengumpadam *harithasangam*	3
15	Aiswarya *harithasangam*	6
16	Priya *harithasangam*	1
17	Mankurusi *harithasangam*	3
18	Udaya *harithasangam*	6
19	Kurumboor-Paliya mangalam *harithasangam*	3
20	Pulikkalchira-puthichi *harithasangam*	3

3.3.3. Selection of multidisciplinary research team

A multidisciplinary research team was constituted to identify the technological interventions available with the research system of Kerala Agricultural University (KAU) to tackle the identified problems/constraints in commercial vegetable farming as perceived and pronounced by the farmers. The multidisciplinary research team comprising of 21 experts from concerned departments were selected purposively by considering their professional expertise and vast field experience in view of the problems/constraints identified in commercial vegetable farming.

3.4. IDENTIFICATION AND PRIORITISATION OF THE PROBLEMS / CONSTRAINTS IN COMMERCIAL VEGETABLE FARMING

3.4.1. Identification of problems/constraints

A pilot study was conducted to study the major vegetables grown and the problems/constraints faced in their cultivation. After discussion with concerned scientists, it was decided to use Participatory Rural Appraisal (PRA) as the technique to elicit the required information. PRA's were arranged at convenient places in both the panchayats, where the respondents were invited in groups and they were assisted by an expert team consisting of scientists, extension workers and peoples' representatives to elicit the specific problems/constraints faced in commercial cultivation of selected vegetables *viz.*, bitter gourd, snake gourd, chilli, amaranth, yard long bean, brinjal, bhindi and coccinea.

3.4.1.1. Participatory techniques in identification of problems/constraints

Participatory approaches in scientific investigations and the technique of Participatory Rural Appraisal (PRA) or Participatory Learning and Action (PLA) were originally propounded and propagated by Robert Chambers (1991). He also opined that data collection in large questionnaire survey could be costly, time consuming and most of the data collected lay idle without being used by anybody.

The research findings of Action Aid Nepal (1992), Huddad *et al.* (1993), Rajarathnam *et al.* (1993) and Malik and Richar (1994) suggested that PRA could be applied to a larger scale of enquiry and could be scaled up for larger areas under consideration.

Ahamed *et al.* (1996) reported that PRA approach was extremely flexible, meaningful and joyous to the participants and researchers provided the latter believed

that the people were storehouses of knowledge and had clean perception of their needs.

3.4.1.2. PRA tools used

1. Timeline: The farmers were requested to recall the trends and changes that have occurred in commercial vegetable farming in the study area. The important milestones were arranged chronologically to form the timeline.

2. Crop calendar: The month wise information regarding major seasons, the important agronomic operations and the time of major inter-cultural operations in important crops were collected to express the cropping pattern of the study area.

3. Crop preference matrix: The preference for specific vegetables of the respondents with respect to selected crop characteristics such as market demand and preference, profit, cost of cultivation, pest and disease problems, soil and climatic suitability were included to form the crop preference matrix.

4. Problem-Cause diagram: Problem-cause diagrams were prepared by illustrating the major socio-economic and biophysical problems/constraints in commercial vegetable farming.

'Farmers-Extensionists-Scientists' interface: Interaction sessions were arranged with farmers, extensionists and scientists to validate the collected information. The identified problems/constraints were then verified for the causes by extensive review of literature, discussion with the multidisciplinary research team and field investigations.

3.4.2. Prioritisation of problems/constraints

An exhaustive list of identified problems/constraints was prepared under two heads *viz.*, 'general' and 'specific' to each vegetable. The structured and finalised list

was included in the interview schedule in which the respondents were asked to give a score out of 10 by considering the importance of problems/constraints in each vegetable. The average score for each item was then worked out and they were ranked based on the importance of problems/constraints as perceived by the vegetable growers.

3.5. EXPLORING THE AVAILABILITY OF TECHNOLOGICAL INTERVENTIONS TO TACKLE THE IDENTIFIED PROBLEMS/CONSTRAINTS IN COMMERCIAL VEGETABLE FARMING

The identified problems/constraints in the cultivation of all the selected vegetables were discussed by the multidisciplinary research team of KAU consisting of scientists from olericulture, agricultural entomology, plant pathology, soil science and agricultural chemistry, agricultural economics and agricultural extension with an extensive review of Package of Practices-Crops released by KAU. The recommendations available in POP to tackle each problem/constraint were explored in depth and all possible technological interventions identified by the KAU multidisciplinary research team.

The research gap in each vegetable was computed as follows and expressed in percentage.

$$\text{Research gap index} = \frac{\text{Number of problems not addressed directly in POP}}{\text{Total number of problems identified}} \times 100$$

3.6. KNOWLEDGE AND ADOPTION LEVELS OF THE IDENTIFIED TECHNOLOGIES IN COMMERCIAL VEGETABLE FARMING

3.6.1. Knowledge level of the identified technologies in commercial vegetable farming

Different researchers had defined and measured knowledge level by developing and standardising the items, which reflect the knowledge level of the respondents.

Bloom *et al.* (1955) defined knowledge test as those behaviours and tests situations, which emphasised remembering either by recognition or recall of ideas, materials or phenomena.

English and English (1961) defined knowledge as a body of information possessed by an individual, which is in accordance with established fact.

In this study, knowledge denotes the farmers' know-how of recommended improved vegetable cultivation practices in the cultivation of selected vegetables (Bitter gourd, snake gourd, chilli, amaranth, yard long bean, brinjal, bhindi and coccinea).

Noll (1957) defined a standardised knowledge test as one that has been carefully constructed by experts, according to the acceptable objectives or purposes and procedures for administering, scoring and interpreting scores, which are specified in detail so that the results should be comparable.

Nair (1969) measured knowledge level of farmers on recommended package of practices of rice using teacher made knowledge test with multiple-choice questions. The same method was followed by Kamarudeen (1981), Aziz (1988) and Shyamala (1988).

Jaiswal and Dave (1972) computed the knowledge score as mentioned below:

$$\text{Knowledge index} = \frac{\text{Number of correct answers}}{\text{Total number of scores}} \times 100$$

Singh and Singh (1974) developed a knowledge test based on the response of farmers regarding wheat cultivation. The formula used to calculate the individual knowledge score was

$$\text{Knowledge index} = \frac{X_1}{N} \times 100$$

Where, X_1 - Number of correct answers

N -Total number of questions

In the present study, a teacher made knowledge test was developed by using the following steps:

3.6.1.1. Selection of items

A list of technological interventions to tackle the identified problems/constraints was prepared from the Package of Practices Recommendations of KAU (2002a). Again, a universe of items was prepared based on the identified technologies. These questions were edited and sorted after discussing with scientists of related departments. Finally a list containing 15 items with questions of different modes viz. Yes/No, True/False and fill in the blanks was compiled as sub-items (Appendix IV).

3.6.1.2. Item analysis

Structured list of selected items was subjected to judges rating. The members of the multidisciplinary research team and concerned scientists from various departments were requested to rate each item considering the difficulty level of answering the questions in view of the vegetable farmers of Palakkad district. A

difficulty level continuum ranging from 'most difficult' to 'least difficult' with a weightage of 5 to 1 was adopted for judges rating after discussing with the experts.

3.6.1.3. Standardising the knowledge test

The mean score for each item was computed and one sub item from each of the 15 items was selected in view of including all the technologies by considering the central tendency within each item. Thus 15 sub items representing all the technological interventions recommended in the POP to tackle the identified problems/constraints formed the final items for the knowledge test.

3.6.1.4. Computing knowledge index

The questions selected to measure the knowledge level of the identified technologies were explained to the respondents and responses were collected. The knowledge scores of each respondent were calculated after assigning a score of 1 and 0 to the correct and incorrect answers respectively.

The following formula was used to compute the knowledge index:

$$\text{Knowledge index} = \frac{\text{Obtained score}}{\text{Total number of questions}} \times 100$$

3.6.1.5. Categorisation of the respondents based on the knowledge level

Mean and standard deviation of the individual knowledge scores obtained by 80 respondents were computed and they were categorised into three major categories as mentioned below.

Table 4. Categorisation procedure for knowledge level

Sl.No.	Categorization of the respondents	
1	Low group	< Mean - 1Sd
2	Medium group	Mean ± 1Sd
3	High group	> Mean +1 Sd

3.6.2. Adoption level of the identified technologies in commercial vegetable farming

Many researchers have standardised various methods to quantify adoption behaviour of farmers. The approach followed in this study was based on the conclusions derived from an extensive review of the past studies.

Rogers (1962) defined adoption process as the mental process through which an individual passes from first hearing about an innovation to its final adoption.

Chandrakandan and Subramanian (1975) concluded that farmers were more likely to adopt the farm practices when they perceive the practice to be more compatible, more efficient and feasible, more communicable, simple to adopt, less costly, highly divisible and more profitable.

Usharani (1998) calculated the adoption index of the farmers using the following formula.

$$\text{Adoption index} = \frac{\text{Adoption score obtained by the respondent}}{\text{Possible maximum score}} \times 100$$

In this study the extent of adoption meant the level of use of improved vegetable cultivation practices as recommended by the research system of KAU.

3.6.2.1. Selection of items

An extensive review of Package of Practices KAU (2002a) was made to explore the availability of the technological interventions to tackle the identified problems / constraints. Finally it was decided to use 16 appropriate recommendations from POP as items to study the adoption level of the technologies identified in commercial vegetable farming.

3.6.2.2. Fixing weightage score

The respondents were explained with the identified technologies and were asked to give their responses on a three-point-continuum measuring 'adoption', 'partial adoption' and 'non –adoption' with a weightage of 1, 0.5 and 0 respectively.

3.6.2.3. Computing adoption index

The adoption score of the respondents were calculated by summing up the scores of the items that were applicable to them.

The adoption index was computed by using the formula:

$$\text{Adoption index} = \frac{\text{Obtained score}}{\text{Number of applicable practices}} \times 100$$

3.6.1.5. Categorisation of the respondents based on the adoption level

Mean and standard deviation of the individual adoption scores obtained by 80 respondents were computed and they were categorised into three major categories as mentioned below.

Table 5. Categorisation procedure for adoption level

Sl.No.	Categorization of the respondent	
1	Low group	< Mean - 1Sd
2	Medium group	Mean ± 1Sd
3	High group	> Mean +1 Sd

3.7. SOCIO-ECONOMIC PROFILE OF THE VEGETABLE GROWERS

3.7.1. Selection of dimensions of the farmers' profile

Based on extensive review of available literature an exhaustive list of farmers' profile dimensions were prepared and given for relevancy rating. The extension scientists as judges were asked to rate the relevancy of each dimension on a three-point-continuum measuring 'more relevant', 'relevant' and 'not relevant' with a weightage of 2,1 and 0 respectively (Appendix III).

The total score obtained by each item was calculated and the relevancy coefficient was worked out by using the formula,

$$\text{Relevancy coefficient} = \frac{\text{Obtained score}}{\text{Potential score}} \times 100$$

Some of the highly relevant dimensions as rated by judges were selected for the final list. Further, it was decided to skip some of the psychological dimensions after discussing with the scientists from related fields considering practical limitations in the study. Thus a list of nine farmer characteristics was selected to study the socio-economic profile of the respondents.

3.7.2. Operationalisation and measurement of the farmers' profile dimensions

The selected nine farmer characteristics as the dimensions of socio-economic profile of the vegetable growers were operationalized and measured as follows,

3.7.2.1. Age

Age was operationalised as the number of completed years of age of the respondents. This was directly measured by asking the number of years he/she has completed at the time of investigation.

3.7.2.2. Number of vegetables grown

This was calculated by asking the respondent to list the vegetables that were grown on commercial basis in their farm.

3.7.2.3. Experience in vegetable farming

It was operationalized as the number of years a farmer had been involved in vegetable cultivation on a commercial basis, and was measured in number of completed years.

3.7.2.4. Farm size

Farm size referred to the number of acres of land owned by the respondent.

3.7.2.5. Educational status

The educational status was operationally defined as the extent of literacy attained by the respondent.

It was measured by adopting the scoring system followed in the socio-economic scale of Trivedi (1963) with slight modification.

The scoring procedure adopted was as follows,

Table 6. Scoring procedure to measure educational status

Category	Score
Illiterate	0
Functionally literate	1
Primary school	2
UP school	3
High school	4
Predegree/equivalent	5
College and above	6

3.7.2.6. Irrigation potential

Irrigation potential was operationalised as the presence of source of irrigation water and favourable condition for availability for irrigating the vegetable crops raised by the farmer.

The scale adopted by Bonny (1991) was used in the study for measuring this variable.

Table 7. Scoring procedure to measure irrigation potential

Water availability	Score
Throughout the year	2
Only during season	1
Unassured and irregular	0

3.7.2.7. Availability of farm inputs

Availability of farm inputs was operationally defined as those farm resources, which were obtained for use in various farming activities of vegetable cultivation.

Based on adequacy and periodicity of availability of farm inputs, scoring procedure followed is mentioned Table 8.

Sum of the scores obtained under adequacy and periodicity was taken as a cumulative score of availability of farm inputs.

Table 8. Scoring procedure to measure availability of farm inputs

Sl.No.	Availability of farm inputs	Scoring		
1	Adequacy	Adequate	Moderate	Inadequate
		3	2	1
2	Periodicity	Always	Seasonal	Occasional
		3	2	1

3.7.2.8. Social participation

Social participation was operationally defined as the degree of involvement of respondents in formal and informal social organisations as member or as office bearer, which also included their degree of participation.

The scoring procedure adopted by Kamarudeen (1981) was followed in this study as mentioned below.

Table 9. Scoring procedure to measure social participation

1. Membership in organisation

No membership	0
Member	1
Office bearer	2

2. Frequancy of attending meetings

Never	0
Occasionally	1
Regularly	2

The total score for social participation was obtained by summing up the scores over the two different categories of responses.

3.7.2.10. Information source utilisation

Information source utilisation was operationally defined in terms of the frequency of obtaining information from different sources listed in the scale.

Kalavathy and Anithakumary (1998) reported that the most frequently used source of farm information was fertilizers or pesticides dealers and other farmers.

The procedure followed by Nair (1969) was adopted in the present study to develop an information source utilisation index. Items of personal-cosmopolite, personal-clocalite, impersonal-cosmopolite and official sources were put to the respondents and were asked to indicate how often they got information from these information sources regarding vegetable farming.

The scoring pattern was as follows.

Table 10. Scoring procedure to measure information source utilisation

Frequency of utilisation	Score
Never	0
At times needed	1
Whenever needed	2

The scores were summed up to form an information source utilisation index.

3.8. PROCEDURE EMPLOYED FOR DATA COLLECTION

The information required in the present investigation was collected in four main steps as described below.

Step1: Pilot survey- A pilot survey was conducted to study the nature of vegetable farming, structure and functioning of *harithasangams* in the study area. Secondary data were collected from the *krishibhavans* of Nemmara and Ayilur panchayats regarding important vegetables grown, farmers' list of 20 selected *harithasangams* with number of vegetables grown and area under commercial vegetable farming.

Step2: PRA- Participatory Rural Appraisal was the technique adopted to gather information regarding the specific problems/constraints faced by vegetable growers.

Step3: Multidisciplinary research team- Review of relevant literature and POP followed by discussion by the multidisciplinary research team was made to elucidate the technological interventions available with the research system of Kerala Agricultural University (KAU) to tackle the identified problems/constraints.

Step4: Structured interview schedule- A structured interview schedule (Appendix-I and II) was prepared systematically to collect the data required for the study, which was first prepared in English and then translated into Malayalam.

3.9. STATISTICAL TOOLS EMPLOYED IN THE STUDY

3.9.1. Percentage analysis

Percentage analysis was employed wherever necessary to statistically represent the number of respondents falling under each category.

3.9.2. Mean and standard deviation

Mean and standard deviation were used to categorise the respondents with respect to the selected dimensions in socio-economic profile analysis, knowledge and adoption levels.

3.9.3. Prioritisation

Prioritisation using the mean scores was used to rank the identified problems/constraints.

RESULTS AND DISCUSSION

IV. RESULTS AND DISCUSSION

An attempt was made in this study to elucidate the information regarding research and extension gaps in commercial vegetable farming. This chapter highlights the salient findings of the present investigation entitled "Research and extension gaps in commercial vegetable farming in eastern Palakkad". The results are presented and discussed under the following headings in the light of the objectives set forth for the study.

4.1. Status of commercial vegetable farming in the study area
4.2. Problems / constraints in commercial vegetable farming
4.3. Research gaps in commercial vegetable framing
4.4. Extension gaps in commercial vegetable farming
4.5. Profile analysis of the vegetable growers
4.6. Strategies for commercial vegetable farming

4.1. STATUS OF COMMERCIAL VEGETABLE FARMING IN THE STUDY AREA

A clear knowledge about the present status of agriculture is quite essential for any field oriented agricultural research. It helps the researcher to have better perception and understanding of agri-business in the study area. As the present investigation focused on vegetable cultivation and the research - extension gaps associated with it, the information regarding the present status of vegetable farming was elicited using appropriate data gathering techniques such as PRA, farmers-extensionists-scientists interactions, field investigation and personal interview with the farmers. The details in this regard are presented and discussed in this section.

Important vegetables grown in the study area were bitter gourd, snake gourd, chilli, amaranth, yard long bean, bhindi, brinjal and coccinea. The trends and changes

that have occurred in the commercial vegetable farming were gathered and summarized. It is presented and discussed as a timeline below.

4.1.1. Timeline of commercial vegetable farming in the study area

1965: Bhindi, brinjal, chilli, oriental pickling melon, pumpkin, ash gourd, were the most important vegetables cultivated in Nemmara. Farmers were using their own seed materials in vegetable farming. With supplementary irrigation they started cultivating bitter gourd, snake gourd, amaranth on a large scale.

1970-75:Farmers started vegetable farming on commercial basis. Farming with inorganic fertilizers and chemical pesticides.

1980: Started extensive cultivation of vegetables using pumpsets. Marketed the produce to outside vegetable markets, especially southern districts of Kerala. During this period vegetable farming was a secondary occupation for most of the farmers.

1990: VFPCK was established for the benefit of vegetable growers. Farmers started using high yielding varieties and hybrids in commercial vegetable farming.

1995: Soil testing, direct application of chemicals, plastic wired panthals were the improved techniques adopted during this period.

Intensive agriculture with organic fertilizers and pesticides. Farmers started realising the importance of IPM and biological control measures in plant protection.

Vegetable farming became a major agri-business leading to good profit and better livelihood with monetary and technical support from VFPCK and *Krishibhavan.*

Farmers started marketing their produce in distant markets especially to the southern districts on daily basis.

Farmers became aware of plant growth regulators / plant hormones and started using them in commercial vegetable farming.

1999-2000:Farmers started raising seedlings in polythene bags at the end of first season for planting in the already prepared *panthals* in relay manner.

Harithasangams were formed with the financial and technical support from *Krishibhavan* to organise and promote vegetable cultivation.

VFPCK started local vegetable markets as direct procurement centres.

4.1.2. Crop calendar of Nemmara block

Thorough knowledge about the cropping pattern of the study area is a necessity for better understanding of the location specific problems so as to recommend the suitable technological interventions for the same. The month wise crop specific details of Nemmara block were collected and it is illustrated as a crop calendar in Table 11.

A perusal of the table reveals the information regarding major seasons, important agronomic practices and time of intercultural operations of the major crops of the study area *viz*., Rice, vegetables, coconut, banana, ginger, turmeric, tapioca, arecanut and black pepper.

4.1.3. Vegetable farming in the study area

About 80 representative vegetable growers were selected using appropriate sampling techniques. The respondents were asked to identify and list the major

Table 11. Crop calendar of Nemmara block

Crops	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Rice	I st Crop (110-120 days)					II nd Crop (140-160 days)						
	Apr.20-May7-8 Seed bed preparation and sowing					Sep.20-Oct.25 Nursery preparation						
		Basal fertilizer application and weeding		July25-Aug.10 Fertilizer application and PP (BPH and Leaf roller)			Oct 20-30 Planting, basal fertilizer application and weeding		PP (Rice bug and Leaf roller)			
			Top dressing and transplanting		Aug.25-Sep.20 Harvesting			Second dose of fertilizer application, PP (Rice bug and stem borer)		Jan.20-Feb.10 Harvesting		
Vegetables	Apr.15-20 to May25 Sowing (Bitter gourd, snake gourd, pumpkin, ash gourd, chilli, coccinea, cowpea, bhindi and amaranth		Sowing Bhindi, amaranth and brinjal									

Table 11. cont.

Crops	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Vegetables		May15-June 1 *Panthal* construction, manuring and weeding		PP and manuring								
	Apr.20-30 Transplanting of chilli			Harvesting starts								
					Harvesting ends							
					Snake gourd and coccinea		Snake gourd and cowpea					
							Irrigation, manuring, PP and weeding					
											Chilli nursery Mar.15-20 to Apr.30	
	Apr.20-30 Chilli transplanting											

Table 11. cont.

Crops	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March
Coconut	Irrigation		Basin preparation			Crown cleaning						
		Planting			Manuring		Second dose fertilizer		Irrigation			
								Mulching and irrigation				
Banana	Banana growing stage											
					Harvesting							
							Oct.15 onwards – Irrigated banana					
Ginger and Turmeric	Apr.15-May1-10 Planting			Manuring and PP					Dec.25-Jan30 Harvesting			
Tapioca	Apr.15- May10 Land preparation and planting											
			Fertilizer application, weeding and earthing up			Weeding			Dec.20-Jan30 Harvesting			

Table 11. cont.

Crops	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March
Arecanut	Apr.25-May5 Lime application							Nov1-Dec25 Inter-cultural operations				
			June1-15 Planting						Dec. to May Irrigation			
										Jan 1-15 Mulching		
Black pepper		May15-June10 Planting of standards										
			June1-July30 Organic manuring and chemical fertilizer applications									
			June20-July15 Planting of rooted cuttings and PP						Harvesting			
		COC and Bordeaux mixture application										

vegetables grown in the study area according to the most important characteristics in vegetable farming as perceived by them.

One of the objectives of the study was identification and prioritisation of problems/constraints in vegetable cultivation. During initial discussions with the vegetable growers, they were asked to list and rank the most important problems in commercial vegetable farming which could lead them to discontinuance of vegetable farming.

Table 12. Ranking of major reasons for the discontinuance of vegetable farming

Sl.No.	Reasons	Rank obtained
1	Pest and disease problems	1
2	Problems in marketing of vegetables	2
3	Problem related to seed and planting materials	3

A perusal of Table 12 reveals that damage due to pests and diseases were the most severe problems felt by the vegetable growers followed by difficulties in marketing of vegetables. The problems related to seeds and planting materials was cited as third most important problem as the reasons for the discontinuance of commercial vegetable farming in the study area.

The detailed findings in this regard are presented in the following sections (Section 4.2) with elaborate discussions.

Table 13 shows overall ranking of vegetables in the study area based on the severity of problems as perceived by the vegetable growers. A glance at the table indicate the following:

Snake gourd was ranked first with respect to the severity of problems experienced by the farmers in its cultivation on a commercial basis followed by bitter gourd and coccinea. Again it could be inferred from Table 13 that the severity of

problems in the cultivation of bhindi was relatively low followed by yard long bean and amaranth.

Table 13. Overall ranking of vegetables with respect to the severity of problems as perceived by the farmers

Sl.No.	Name of the vegetables	Rank obtained
1	Snake gourd	1
2	Bitter gourd	2
3	Coccinea	3
4	Chilli	4
5	Brinjal	5
6	Pumpkin	6
7	Ash gourd	7
8	Oriental pickling melon	8
9	Amaranth	9
10	Yard long bean	10
11	Bhindi	11

The vegetables grown on commercial basis in the study area are bitter gourd, snake gourd, chilli, amaranth, yard long bean, brinjal, bhindi, coccinea, ash gourd, pumpkin and oriental pickling melon. The table illustrates three most ranked vegetables under 10 major characteristics as perceived by the vegetable growers.

It could be seen from Table 14 that bitter gourd was ranked first with respect to market demand and profit followed by yard long bean and bhindi in vegetable cultivation. Thus, it could be concluded that cultivation of vegetables having high market demand gave high profit in commercial vegetable farming. Farmers perceived bhindi as a vegetable having low cost of production followed by yard long bean and amaranth.

Again it is evident from the table that amaranth was less prone to pest and diseases followed by yard long bean and bhindi. As a similar trend of results was observed in the case of climatic suitability also, it could be attributed as a reason for

this. Farmers ranked snake gourd as the high yielding vegetable among the vegetables grown in the study area followed by bitter gourd and bhindi. Oriental pickling melon was perceived as a vegetable requiring less maintenance and irrigation followed by ash gourd/pumpkin and amaranth was ranked as third with respect to the requirement of maintenance. Farmers perceived amaranth as highly suited to the soils of the study area and snake gourd and oriental pickling melon were ranked as second and third with respect to soil suitability. It could be seen from Table 14 that bhindi required less labour followed by yard long bean and amaranth in commercial vegetable farming.

Table 14. Ranking of major vegetables according to the identified characteristics

Sl. No.	Characteristics	Ranking		
		1	2	3
1	Market demand	Bitter gourd	Yard long bean	Bhindi
2	Profit	Bitter gourd	Yard long bean	Bhindi
3	Low cost of cultivation	Bhindi	Yard long bean	Amaranth
4	Low pest and disease problems	Amaranth	Yard long bean	Bhindi
5	Suitability to climatic condition	Amaranth	Yard long bean	Snake gourd
6	High yield	Snake gourd	Bitter gourd	Bhindi
7	Requiring less maintenance	Oriental pickling melon	Ash gourd /Pumpkin	Amaranth
8	Less irrigation requirement	Oriental pickling melon	Ash gourd	Pumpkin
9	Suitability to soil	Amaranth	Snake gourd	Oriental pickling melon
10	Low labour requirement	Bhindi	Yard long bean	Amaranth

4.2. PROBLEMS / CONSTRAINTS IN COMMERCIAL VEGETABLE FARMING

An attempt was made to identify and rank the problems / constraints as perceived by the farmers in commercial vegetable cultivation. The major problems / constraints experienced by the vegetable growers are presented in Table 15. They were ranked based on the severity with which they were felt by the farmers.

Each problem / constraint as ranked by the farmers are mentioned in Table 15 and they are presented and discussed in this section.

Table 15. Ranking of problems / constraints in commercial vegetable farming based on their severity as perceived by the farmers

Sl.No.	Problems / Constraints	Average score out of 10	Rank
1	High cost of PP chemicals	8.113	1
2	No local market facility	7.825	2
3	Difficulties in timely soil testing	7.288	3
4	Non-availability of good quality neem oil	7.125	4
5	Capital inadequacy while establishing the farm	6.963	5
6	Purchasing the PP chemicals based on the advice of the pesticide sellers	6.925	6
7	Non-availability of soil/location specific technologies	6.788	7
8	Low local demand and low market price	6.750	8
9	Difficulties in getting timely good quality seeds	6.575	9
10	Problems in marketing the produce at distant markets	6.450	10
11	Insufficient quality control of farm inputs *viz.*, PP chemicals, seeds, fertilizers and manures	6.188	11
12	Inability in identifying and diagnosing insect pests and diseases	6.038	12
13	Lack of awareness about locally suitable varieties	5.725	13
14	Damage and loss while transporting the produce	5.238	14

It could be seen from Table 15 that high cost of plant protection (PP) chemicals was ranked as the first and most important problem / constraint in

commercial vegetable farming with a maximum score of 8.113 out of 10. No local market facility, difficulties in timely soil testing, non-availability of good quality neem oil and capital inadequacy while establishing the farm were the other problems / constraints perceived as second, third, fourth and fifth by the vegetable growers in commercial vegetable farming.

4.2.1. High cost of PP chemicals

It could be inferred from the table that high cost of PP chemicals was the most important problem / constraint in commercial vegetable framing. Further, it was observed as a result of PRA (Table 15) that pest and disease problems were the top most reason for the discontinuance of vegetable farming. Farmers expressed sudden out break of new pests and diseases as a major threat for vegetable farming in the study area. It is imperative for the researchers to increase the pace of need-based researches for developing low cost, problem specific plant protection technologies.

Similar results were reported by Norman (1982), Prakash (1989), Rahman and Kashem (1995), Jabbar (1996), Alagirisamy (1997), Manoj (1998), Jayapalan and Sushama (2001), Kumar (2002) and Paul (2002).

4.2.2. No local market facility

No local market facility for marketing the vegetables was the second most important problem / constraint perceived by vegetable growers. Non-existence of proper marketing channels for vegetables in the study area might have contributed for perceiving this problem as second most important problems / constraints. Till recently there was no proper public/private direct procurement of vegetables through any regulated markets in Nemmara, which would have excluded the intermediaries and commission agents in marketing. The severity of this particular problem was solved to an extent by the establishment of local markets of VFPCK. Farmers opined that

establishment of similar markets throughout the block would solve this problem enabling smooth flow of produce in the marketing channel and ensuring remunerative prices.

Puzari (1994), Bonny and Prasad (1996), Murugesan (1996), Karthikeyan (2001) and Ogunsumi *et al.* (2002) also reported 'no local market facility' as an important problem / constraint in commercial farming.

4.2.3. Difficulties in timely soil testing

Soil testing is one of the major components in hi-tech agriculture, quite so in commercial agriculture. Though, Nemmara is a major vegetable belt in Palakkad, difficulties in timely soil testing was voiced as one of the main problem / constraint in commercial vegetable farming in the study area. Farmers gave a score of 7.3 out of 10 to rank it as the third most important problem / constraint.

Lack of mobile soil testing labs in the study area and inadequate soil testing services might have aggravated this problem. Extensionists and secretaries of the *harithasangams* in turn opined that unwillingness and lethargy of farmers contributed more to this problem. Some of the framers in the study area have yet to realize the importance of soil testing in scientific farming. So Agricultural Department needs to mobilize the farmers with awareness and training programmes on soil testing and its importance.

4.2.4. Non availability of good quality neem oil

Next in the list of problems / constraints in commercial vegetable farming was the non-availability of good quality neem oil. Chemicals having less residual toxicity are always preferred in vegetable farming, as vegetables constitute an important component of balanced human diet. Since the farmers in the study area are more

innovative they had realized the importance of plant-based pesticides in plant protection, especially neem oil in vegetable cultivation. They prefer to use neem oil for plant protection rather than chemical pesticides. In spite of the farmers being progressive and preferring to use neem oil in the present scenario of organic framing, non-availability of good quality neem oil was a hindrance to their innovative farming practices.

4.2.5. Capital inadequacy while establishing the farm

Adequate capital is a necessity in any commercial farming activity, and more so in labour and capital-intensive vegetable cultivation. As the average farm holding size of the respondents in the study area is small (Table 27) they are facing severe capital inadequacy while establishing the farm.

This finding was in line with the results interpreted by Heddybai (1994), Jabbar (1996), Murugesan (1996), Alagirisamy (1997), Manoj (1998) and Ogunsumi *et al.* (2002).

4.2.6. Purchasing the PP chemicals based on the advice of the pesticide sellers

Purchasing the PP chemicals based on the advice of the pesticide sellers is the standard practice among the farmers of the study area. Farmers opined that sudden outbreak of pests and diseases and the necessity to control them immediately forced them to buy any chemical from the near-by agro-chemical traders. Though the credibility of the recommendations given by the private sources is most often questionable, the easy accessibility of the private pesticide dealers when compared to the *Krishibhavan* makes them to opt for the former. But farmers have expressed their difficulty in accessing genuine and timely technical guidance specific to the problem. This highlights the necessity of timely problem specific technical support and training programmes during the critical periods of vegetable cultivation.

Ramachandran (1992) also reported similar results as the major problem / constraint in commercial farming.

4.2.7. Non-availability of soil / location specific technologies

Even though the non-availability of soil / location specific technologies have been perceived as only the seventh important problem / constraint by the vegetable growers, this may be considered as the root cause that aggravates the other mentioned problems to a great extent. This necessitates need based problem and location specific research. It has been discussed in detail under section 4.3.

4.2.8. Low local demand and low market price

The perishable nature and low keeping quality of the vegetables warrant immediate local disposal of the produce even at low price. Lack of adequate processing industries in the adjacent areas combined with inadequate storage facilities force the farmers to go for immediate sale. Since vegetable price fluctuates during different months based on market demand, the sustainability of income from vegetable cultivation is always suspected.

The present result is a re-emphasis of the results obtained by Heddybai (1994), Murugesan (1996), Alagirisamy (1997) and Nagesh (2002).

4.2.9. Difficulty in getting good quality seeds in time

Since seeds are the most crucial inputs in crop production, the quality of seeds is the deciding factor for production and quality of produce. Farmers perceived difficulty in getting timely good quality seeds as another problem / constraint in vegetable farming especially in the critical periods of requirement. Sparse availability of vegetable seed growers, limited availability of government and private agencies to supply good quality seeds might be the probable reasons for this constraint. Farmers

demanded necessary steps by the Agricultural University as well as by the Department of Agriculture to ensure proper availability of good quality seeds.

This result draws support from the findings of Chitnis and Bhilegaonkar (1987), Govind (1992), Ramachandran (1992), Heddybai (1994) and Puzari (1994).

4.2.10. Problems in marketing the produce at distant markets

As farmers perceived the lack of local market as the second most important constraint, the vegetable growers in the study area are highly dependent on the distant markets like Palakkad, Ernakulam and other southern districts of Kerala. Additional transportation and storage cost involved in this marginalizes the profit that they would have otherwise realized in the absence of commission agents and intermediaries by marketing their produce directly in the local market.

Problems in marketing the farm produce to distant markets was the major problem / constraint reported by Heddybai (1994).

4.2.11. In-sufficient quality control of farm inputs

Quality of the crucial inputs *viz.*, seeds, fertilizers and manures and PP chemicals are the cornerstones in deciding the performance of any agri-business. Farmers of the study area expressed inadequate quality control of farm inputs as another important problem in vegetable farming. Adulteration in chemical fertilizers with sand and soil particles, ineffective PP chemicals, non-availability of good quality neem oil (Subsection 4.2.1) and broad -spectrum pesticides and poor germination percentage of the seeds are the major complaints that intensified this problem.

Puzari (1994) found similar results in his research on identification of problems / constraints in vegetable production.

4.2.12. Inability in identifying and diagnosing insect pests and diseases

Though inability in identifying and diagnosing insect pests and diseases was expressed as a problem / constraint, intensity of this problem among the respondents expressed to be less as it has been given the twelfth rank by the vegetable growers. It could be supported with the results of Table 25 and Fig. 13 that majority of the respondents had medium level of knowledge about vegetable cultivation practices and they are sufficiently well experienced in (Table 26 and Fig. 15) vegetable cultivation.

Similar trend of results were obtained by Puzari (1994) and Alagirisamy (1997) in their investigation on commercial vegetable farming.

4.2.13. Lack of awareness about the locally suitable varieties

Crop production is highly dependent on soil and climatic characteristics, this necessitates locally suitable varieties in scientific farming to ensure remunerative agri-business. This problem was much illustrated in section 3.4 explaining the availability of technological interventions to tackle the identified problems / constraints. It could be inferred from the farmer perceived problems that though they had good knowledge about the recommended technologies in vegetable cultivation their awareness about the varietal suitability to the location is poor.

The present finding was in line with the reports of Ramachandran (1992), Puzari (1994), Alagirisamy (1997) and Manoj (1998)

4.2.14. Damage and loss while transporting the produce

Damage and loss while transporting the vegetables is an extension of problems 4.2.2 and 4.2.8. Inadequate local market facility and low local demand are the major reasons why farmers are forced to take their produce to distant markets. As

a consequence of this the farmers encountered several difficulties and loss while transporting their produce. The perishable nature of the vegetables intensified this particular problem among the vegetable growers.

The succeeding section deals with crop specific problems/constraints encountered by the farmers in commercial vegetable farming.

4.2.15.Problems/ constraints in commercial bitter gourd cultivation

Bitter gourd, an important vegetable crop in the study area is a remunerative vegetable having extensive market demand.

Table 16. Problems/constraints in bitter gourd cultivation

Sl.no	Problems / constraints	Average score	Rank
1	Yellowing and stunting (mosaic)	7.722	1
2	Green Jassids (severe during summer, less in rainy season)	7.076	2
3	Fruit fly	6.684	3
4	Fruit rotting (tip of the fruits) during rainy season	6.418	4
5	Uneven fruit size (Fruit curling during summer)	6.266	5
6	Green fruit borer (1 inch length, half inside and half out side while feeding)	6.089	6
7	Leaf spot (*Cercospora,Alternaria*)	5.595	7
8	Leaf eating caterpillar (Green colour, 2cm long)	5.481	8
9	Gall fly	5.354	9
10	Yellow hairy grub, *Epilachna* beetle	4.861	10
11	Collar rot	4.772	11
12	Yellowing of fruit surface during April-May	4.772	11

Table 16 indicates the severity of major problems/constraints as perceived by the bitter gourd farmers. It is evident from the table that yellowing and stunted plant growths caused by mosaic were the most destructive diseases in bitter gourd closely followed by green jassids. Fruit fly was perceived as the next

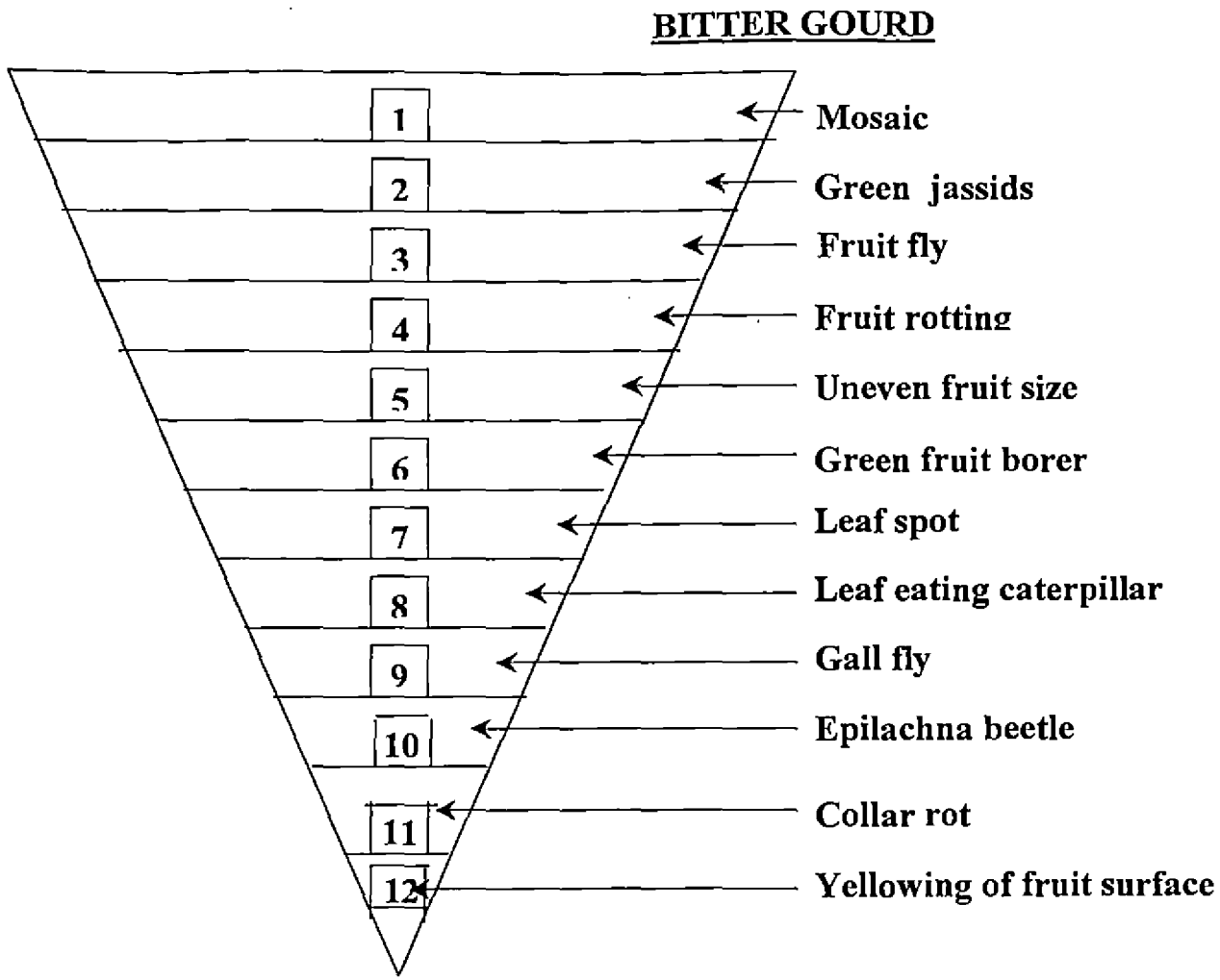

Fig. 3. Hierarchy of problems / constraints – Bitter gourd

important problem in commercial cultivation of bitter gourd. The average scores based on the severity of problems/constraints along with their ranks were furnished in Table 16.

As a whole, mosaic was reported as the most severe disease in bitter gourd cultivation. With respect to insect pest, green jassid was ranked first.

Ravikrishnan (1989) studied the nutrient management aspects of bitter gourd in relation to pest and disease incidence. Jyothi (1994) had reported *Amrasca biguttula* infecting bitter gourd. Nandakumar (1999) had elaborated the pest complex of bitter gourd with special reference to pest monitoring and management.

Purushothaman (1994) had investigated the mosaic disease and dynamics of the mosaic virus vector in spreading this most destructive disease. Jalaya (1989) and Padmanaban (1998) had done researches on fruit fly incidence in bitter gourd.

4.2.16.Problems/ constraints in commercial snake gourd cultivation

Table 17. Problems/constraints in snake gourd cultivation

Sl.no	Problems / constraints	Average score	Rank
1	Fruit fly	5.789	1
2	Leaf spot	5.113	2
3	General yellowing, upward leaf drying and falling of leaves (More during winter)	4.944	3
4	Leaf eating caterpillar (Green colour) occurs regularly	4.930	4
5	Yellowing and spots on leaves	4.831	5
6	White larvae – Stem cracking	4.775	6
7	Stem borer (Drying of plants) at fruiting stage	4.690	7
8	Bulging of stem (bottom region) – Vine borer	4.451	8
9	Red pumpkin beetle	4.099	9

SNAKE GOURD

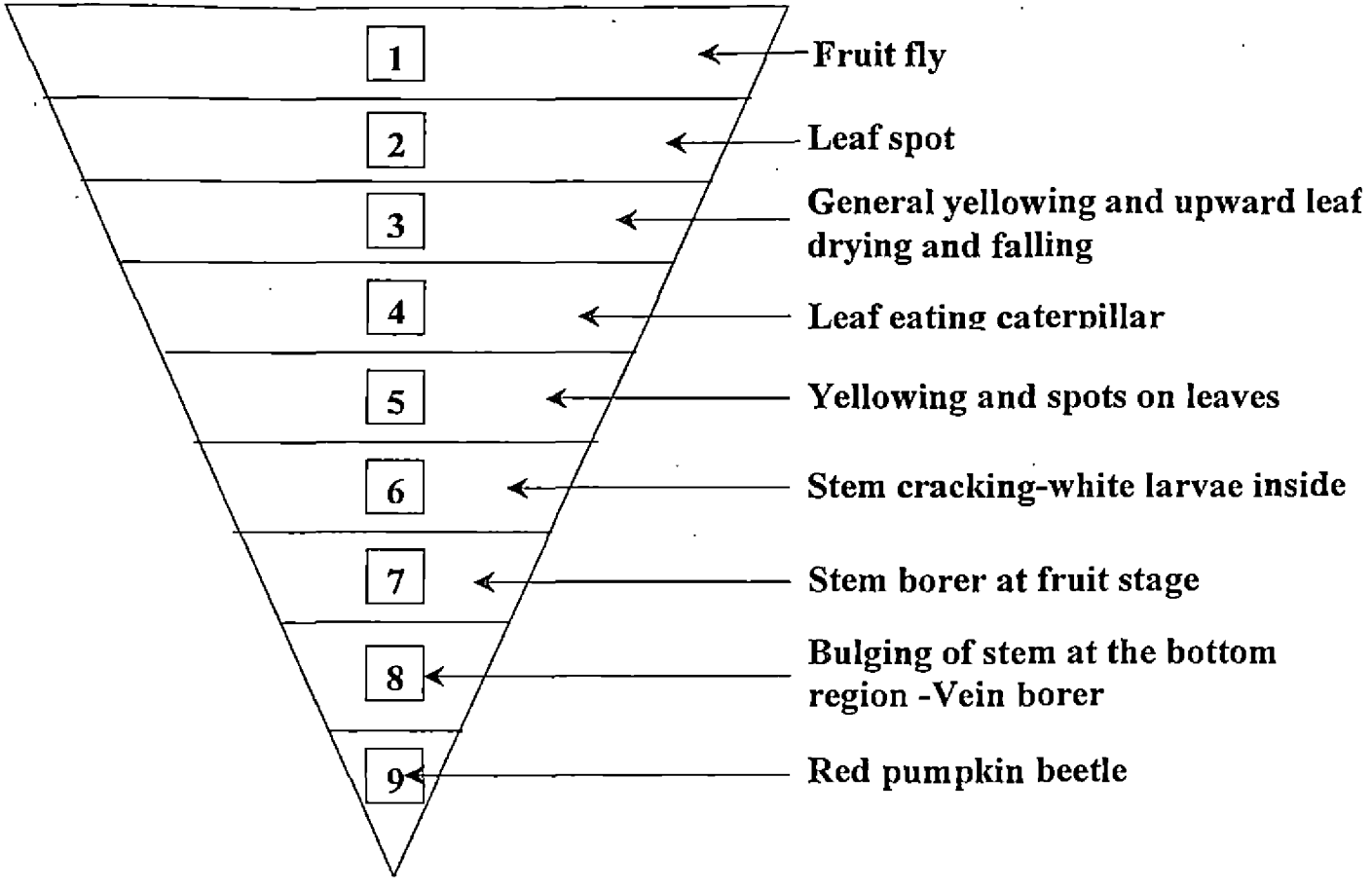

Fig. 4 . Hierarchy of problems / constraints – Snake gourd

Table 17 and Fig. 3 show the ranking of problems/constraints in commercial cultivation of snake gourd with respect to their severity as perceived by the farmers. Among the nine reported problems in snake gourd, fruit fly and leaf spot were ranked as most destructive pests causing severe damage to the crop. White larvae coupled with stem cracking were reported as third most important problem/constraint. Other reported problems/constraints in the order of importance with respect to the amount of damage and yield reduction caused to snake gourd were shown in Table 17.

Mathew (1980) had explained the microbial diseases and the pathogens affecting snake gourd semilooper and the project on control of fruit fly in snake gourd had emphasized the severity of this pest. As only limited researches are available in this regard, it could be suggested that more emphasis need be given to farmers felt problems in snake gourd research.

4.2.17.Problems/ constraints in commercial chilli (White Kanthari) cultivation

It could be inferred from Table 18 that wilting was the most serious disease causing severe crop damage in chilli followed by mosaic. Leaf crinkling and subsequent leaf fall due to mites or other sucking pests and top drying together were ranked as third most important problems in cultivation of chili. Table 18 illustrates the average scores for severity and the ranks for other felt problems of chilli growers.

Table 18 Problems/constraints in chilli cultivation

Sl.no	Problems / constraints	Average score	Rank
1	Wilting	7.341	1
2	Mosaic disease	6.415	2
3	Top drying and stunted growth	5.537	3
4	Leaf fall due to mites attack	5.537	3
5	Premature fruit drop	4.610	4
6	Fruit borer	4.463	5

CHILLI

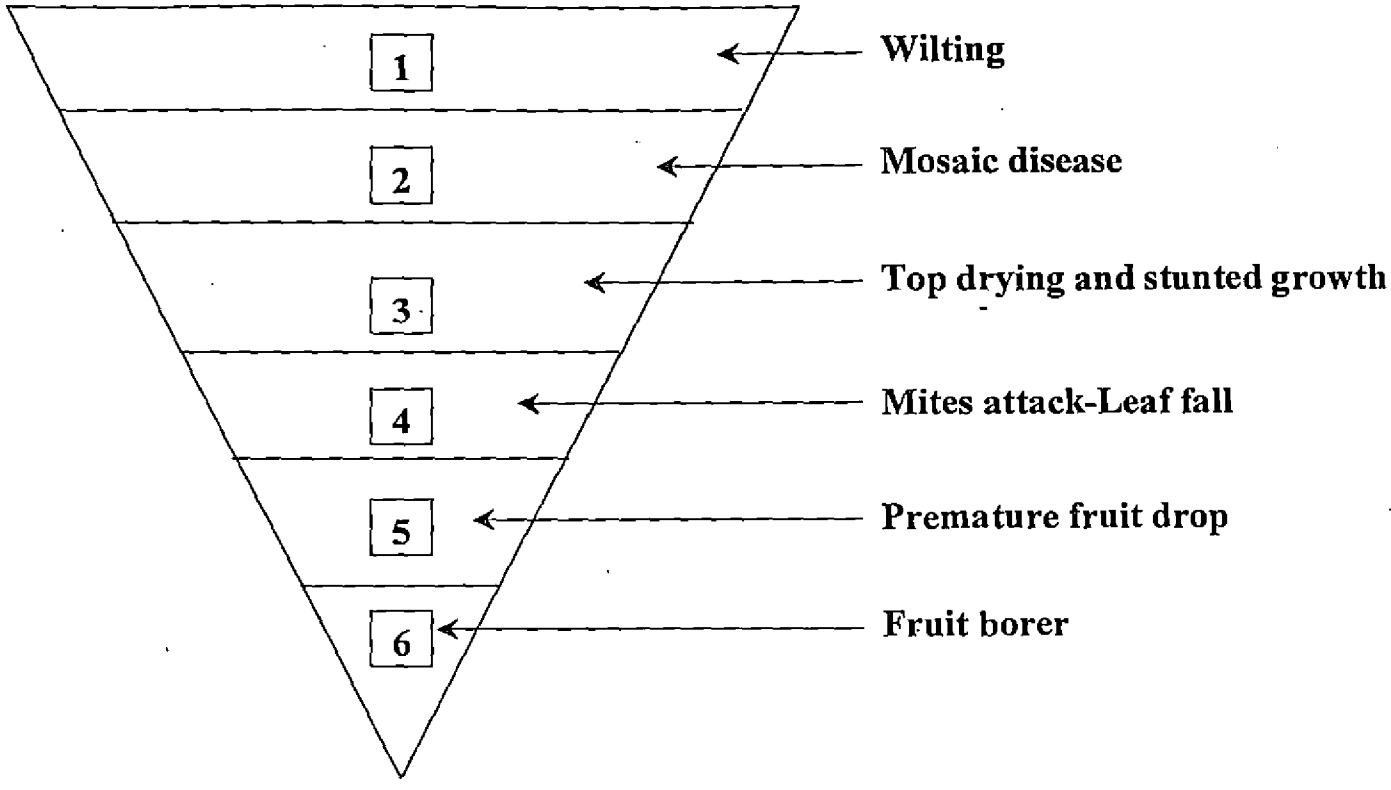

Fig. 5 . Hierarchy of problems / constraints - Chilli

Markose (1996), Seena (1996), Paul (1998) and Fatima (1999) had carried out researches on bacterial wilt, the most destructive disease of chilli and they confirmed the severity of this disease.

Manjari, Ujwala and Anugraha are the bacterial wilt resistant varieties released from KAU (Gopalakrishnan and Indira, 2002).

Usha (1998) had reported about the regulation of flower and fruit setting. Rajendran (2000) had carried out research upon effect of growth regulators on flower and fruit drop in chilli.

Santhoshkumar (1999) studied the sucking pests of chilli with special reference to its ecofriendly management. Sudharma (1996) also had reported sucking pests in chilli.

Fatima (1999) inferred upon mosaic resistant genotypes of chilli. She had also reported the severity of the problem referring to qualitative and quantitative losses due to the disease.

4.2.18.Problems/ constraints in commercial amaranth cultivation

Table 19. Problems/constraints in amaranth cultivation

Sl.no	Problems / constraints	Average score	Rank
1	Leaf spot	6.621	1
2	Bolting during summer	6.207	2
3	Leaf eating caterpillar	5.241	3
4	Yellowing during high soil moisture	4.586	4

The data presented in Table 19 explains the problems in cultivation of amaranth, the most important leafy vegetable in the study area. Among the four identified problems/constraints leaf spot was reported as the most destructive disease

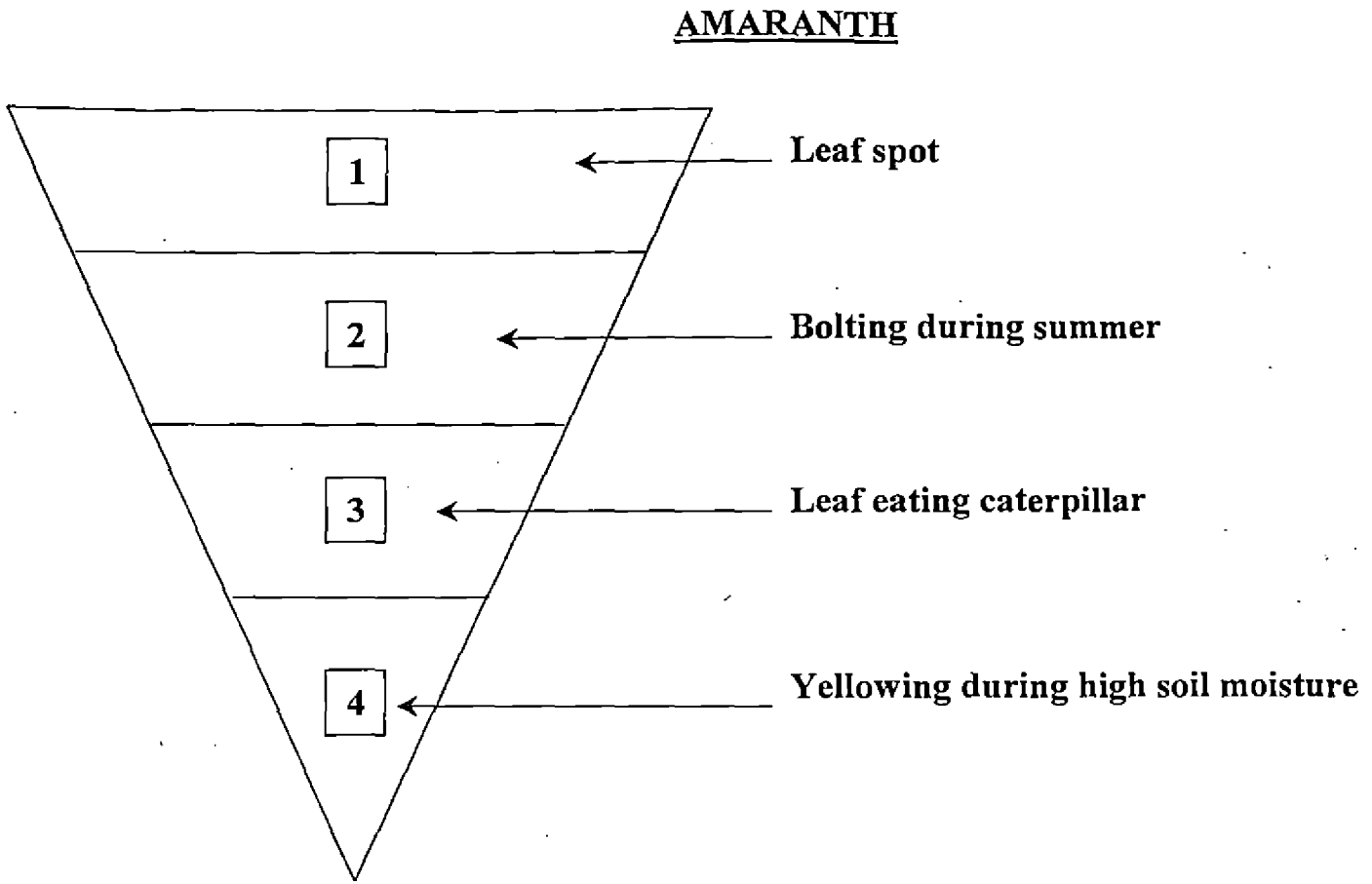

Fig. 6 . Hierarchy of problems / constraints – Amaranth

causing qualitative and quantitative loss to the produce. Bolting during summer was perceived as second important problem in amaranth cultivation followed by leaf eating caterpillar and yellowing during high soil moisture.

Kamala *et al.* (1996), Gokulapalan *et al.* (1999) and Krishnakumary (2000) observed and reported a ravaging leaf spot in amaranth in Kerala. Incidence of leaf spot is very severe during rainy season causing considerable economic loss owing to reduction in marketability of the produce. Even total loss in yield was observed when plants were infected in the seedling stage. The effective way to manage the disease is use of resistant varieties. In Kerala all the cultivars including the most commonly cultivated red varieties Kannara local and Arun are susceptible to the disease where as the green leaved variety Co1 is found resistant to this disease.

Bolting during summer was expressed as one of the most important problems in amaranth cultivation. Devdas (1982) had done research on nonbolting type of amaranth suitable all around the year.

4.2.19.Problems/ constraints in commercial yard long bean cultivation

Table 20. Problems/constraints in yard long bean cultivation

Sl.no	Problems / constraints	Average score	Rank
1	Aphids attack	6.614	1
2	Fruit shortening (No seeds at the tip of the pod)	6.158	2
3	Flower drop during rainy season	5.737	3
4	Stunting – mosaic	5.544	4
5	Leaf miner	5.351	5
6	Fruit borer	5.316	6
7	White flies	5.193	7
8	Wilting	4.860	8
9	Black arm disease	4.649	9

YARD LONG BEAN (COWPEA)

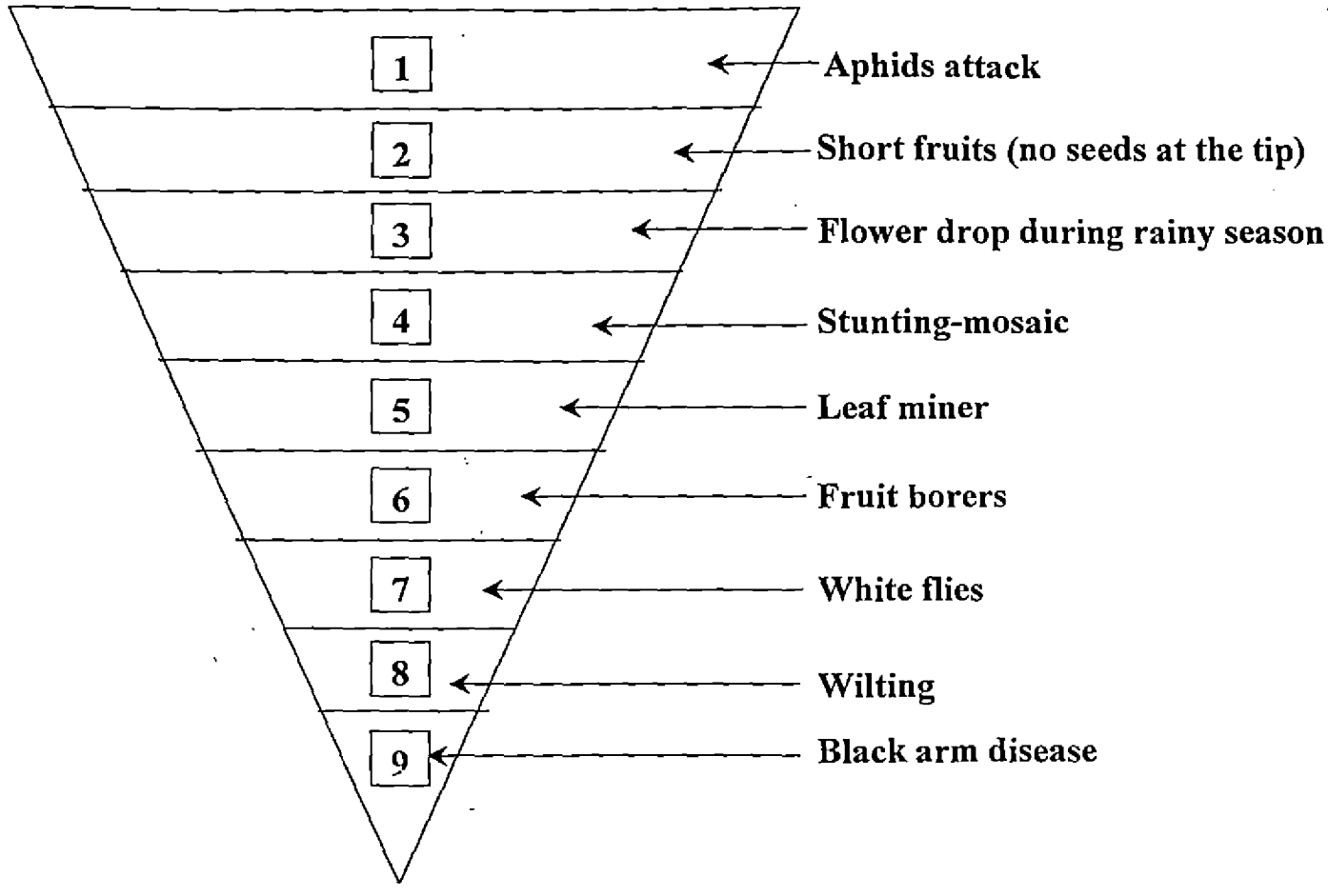

Fig. 7. Hierarchy of problems / constraints – Yard long bean

Aphids attack was expressed as the top most problem/constraint experienced by the yard long bean growers (Table 20). The physiological disorder causing fruit shortening-no seeds at the tip of the pods was the next important problem encountered in yard long bean cultivation. Flower drop during rainy season was ranked third based on the severity of problem as perceived by the farmers. Though mosaic has been ranked as fourth, the damage caused by this disease is more when compared to other diseases. Leaf miner, fruit fly and white flies were the other insect pests reported in the order of severity of problems/constraints. Further wilting and black arm disease followed the list.

Mathew *et al.* (1971) reported that the pea aphids are the serious pests of yard long bean in Kerala during dry period. According to Singh and Allen (1980) it is a major pest in Asia causing an estimated yield loss of 20-40 per cent. Gupta and Singh (1981) and Sulochana (1984) stated that it is a wide spread pest of yard long bean in India and it caused significant damage by feeding on stems, terminal shoots, petioles of seedlings, pods and flowers. Koshy *et al.* (1987) reported a yield loss of 13.44 to 33.59 per cent by aphids in yard long bean.

Panicker (2000) and Vidya (2000) had reported pod borer incidence in vegetable cowpea. Kumari (1993) and Sreelekha (1991) had worked on the epidemiology and control of mosaic virus.

4.2.20.Problems/ constraints in commercial brinjal cultivation

Table 21. Problems/constraints in brinjal cultivation

Sl.no	Problems / constraints	Average score	Rank
1	Shoot and fruit borer	6.906	1
2	Leaf eating caterpillar	5.563	2
3	Damping off	5.406	3
4	Leaf folder	5.000	4

BRINJAL

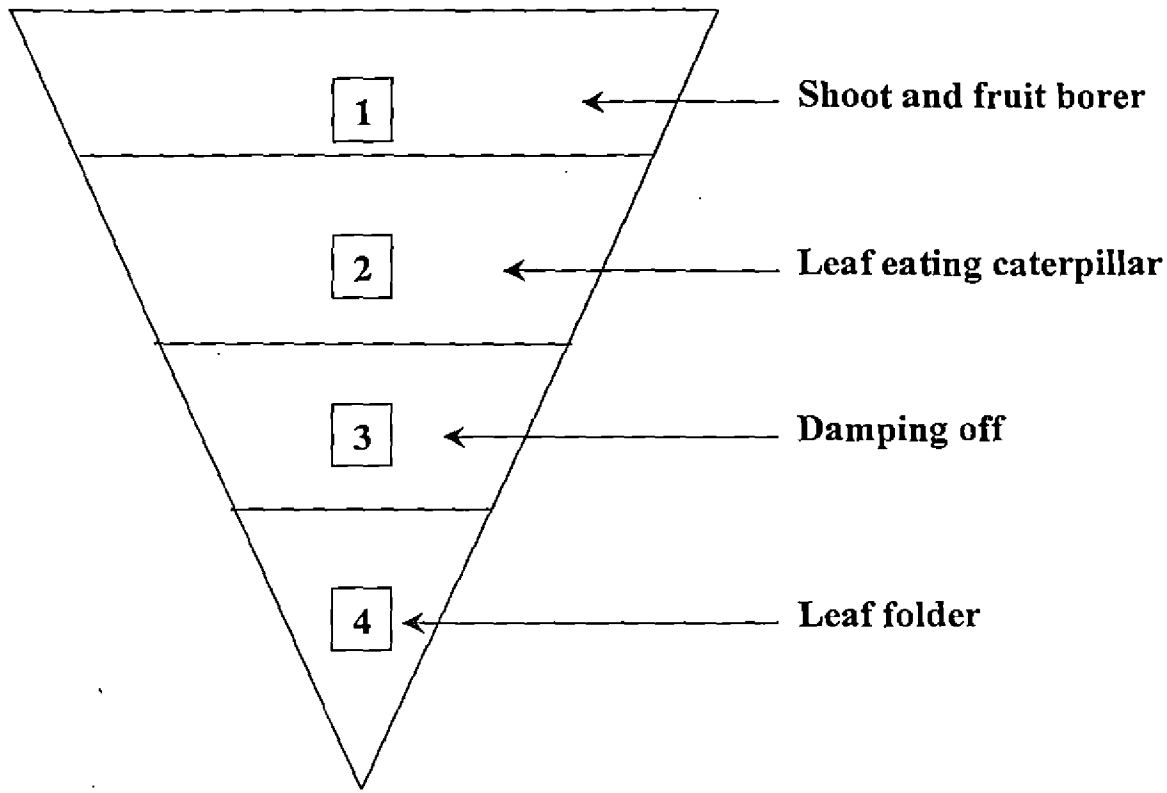

Fig. 8 . Hierarchy of problems / constraints - Brinjal

The damage due to shoot and fruit borer was rated highest with a score of 6.906 out of 10 closely followed by leaf eating caterpillar. Damping off was perceived as most important disease in brinjal. Farmers perceived it as third most important problem/constraint with respect to the severity of the problem experienced followed by leaf folder.

Shoot and fruit borer, the most important problem in the cultivation of brinjal had been studied by Sudarma (1981) and Nair (1983). They had reported uopn control of the pest and the terminal residues in fruits.

4.2.21.Problems/ constraints in commercial bhindi cultivation

Table 22. Problems/constraints in bhindi cultivation

Sl.no	Problems / constraints	Average score	Rank
1.	Yellow-vein mosaic	7.837	1
2.	Shoot and fruit borer	5.419	2
3.	Leaf folder	4.907	3
4.	Flower shedding	4.628	4
5.	Leaf eating caterpillar	4.233	5

Yellow vein mosaic was perceived as most destructive disease in bhindi followed by leaf folder. Flower shedding was expressed as next most severe problem in commercial cultivation of bhindi. Leaf eating caterpillar was perceived as least important problem with a score of 4.233 out of 10.

Ravisankar (2002) had worked on development of yellow vein mosaic virus resistant hybrids in bhindi. Virus disease caused heavy loss in economically important plant parts, the extent of loss due to this may be quantitative and qualitative. The cheapest, simplest, ecofriendly and effective method to control virus disease is to grow resistant varieties. The other problems discussed under brinjal are applicable to bhindi also.

BHINDI (OKRA)

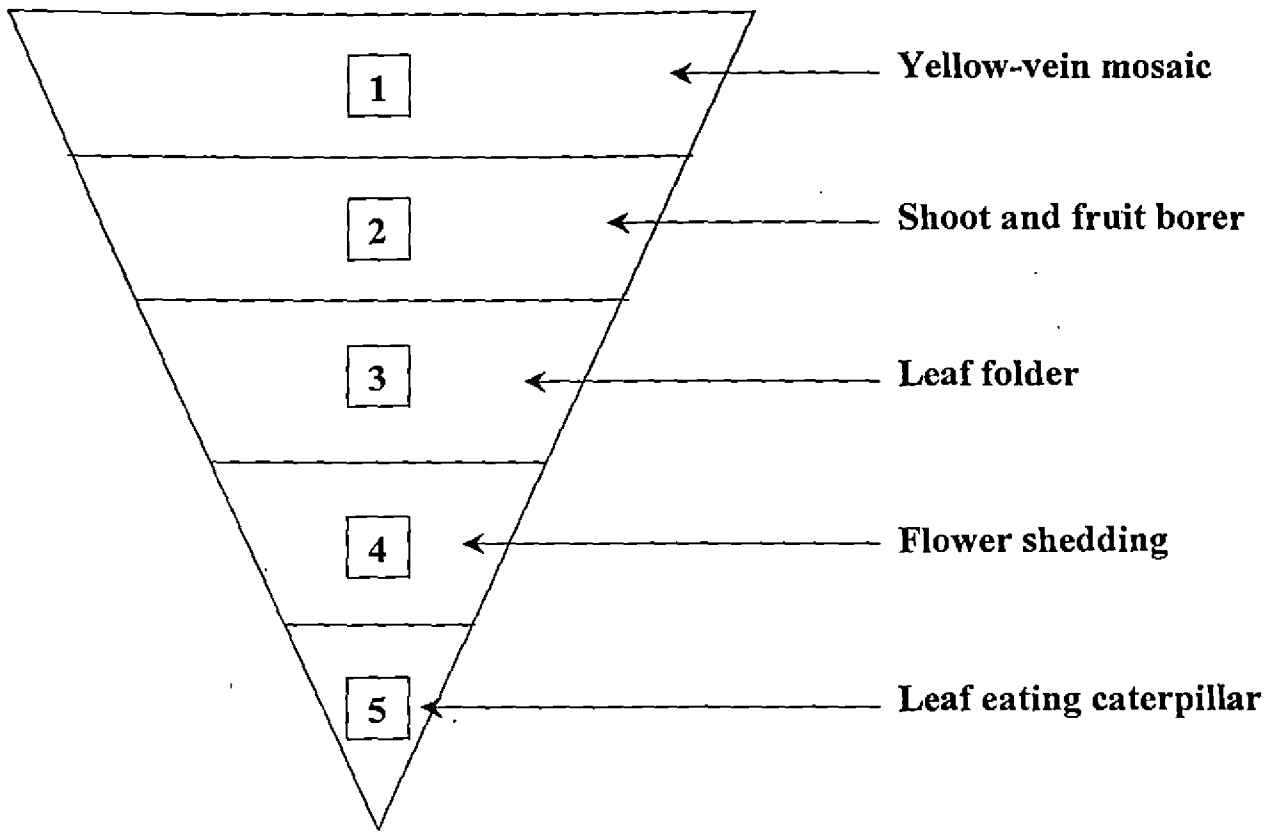

Fig. 9 . Hierarchy of problems / constraints – Bhindi

4.2.22.Problems/ constraints in commercial coccinea cultivation

Table 23. Problems/constraints in coccinea cultivation

Sl.no	Problems / constraints	Average score	Rank
1	Stunting – Mosaic	6.529	1
2	Flower and fruit drop during rainy season	5.980	2
3	Long light green fruited plants are highly susceptible to mosaic	5.137	3
4	Fruit fly	4.706	4
5	Leaf eating caterpillar (Green colour)	4.627	5
6	White fly	4.078	6
7	Problem in maintenance of *panthals*	3.804	7

Similar to bitter gourd, mosaic was ranked first among problems experienced in commercial coccinea farming. Flower and fruit drop during rainy season was the second important problem/constraint experienced by the farmers closely followed by the problem reporting susceptible nature of long and light green-fruited plant types to mosaic. Other insect pests perceived as more severe in coccinea cultivation are fruit fly, leaf eating caterpillar and white fly. Though farmers had expressed problems in maintaining *panthals*, it was ranked last.

Though crop specific researches on coccinea were limited, the researches on other cucurbitaceous vegetables can also be generalized to coccinea.

Consequent on the introduction of high yielding varieties/cultivars/types, several species of minor pests have attained the status of major pests due to the change in the agro-ecosystem. The foregoing findings and discussion highlights the crop specific problems/constraints and the farmers' perception about their severity followed by appropriate research works on each problem. Thus it could be concluded that though past researches gave generalized recommendations for scientific farming,

COCCINEA

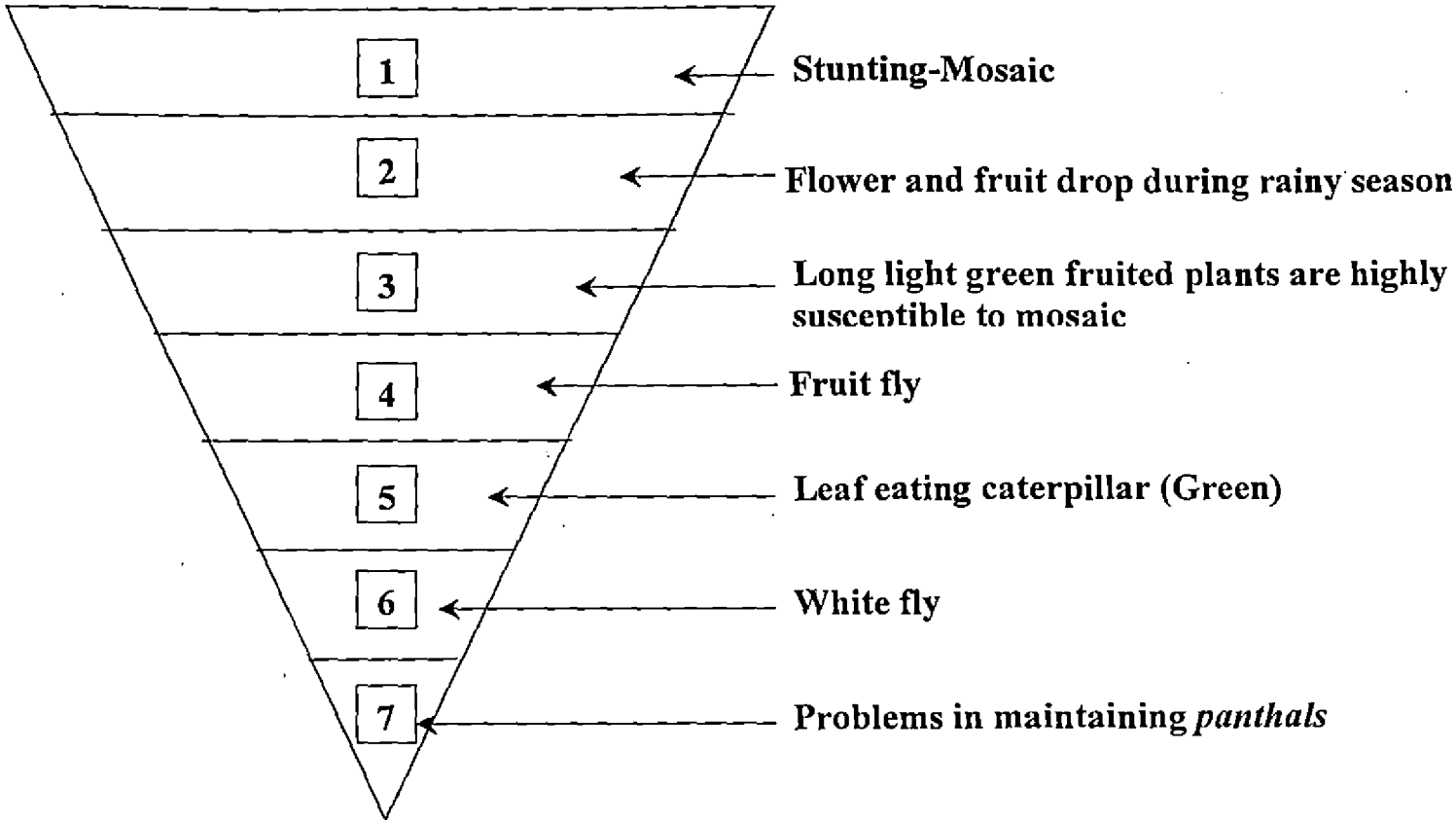

Fig. 10 . Hierarchy of problems / constraints - Coccinea

problem specific and location suitable researches are the need of the hour to satisfy the felt needs of the farmers.

4.3. RESEARCH GAPS IN COMMERCIAL VEGETABLE FARMING

This study attempted to explore the availability of appropriate technological interventions with the KAU research system to tackle the identified problems/constraints in commercial vegetable farming. The problems/ constraints as perceived and pronounced by the vegetable farmers were brought to the notice of the research system and they were discussed by a multidisciplinary research team comprising of subject matter specialists from various disciplines involved in vegetable research.

The discussions and deliberations by the multidisciplinary research team revealed that solutions to most of the felt problems/constraints of the vegetable growers were not addressed directly in the package of practices recommendations of the university.

Table 24 and Fig. 11 indicates the data regarding the number of problems/constraints identified in each vegetable and the availability of technological interventions with the research system of KAU. Further, it also shows the research gaps in each vegetable, which was computed with respect to the number of identified problems/constraints not addressed in POP.

It could be inferred from Table 24 and Fig. 12 that research gap in yard long bean was very wide (77.78%). Though POP considers it as a minor vegetable, farmers of Nemmara block are cultivating yard long bean extensively on commercial basis. Farmers expressed that they had sufficient demand for yard long bean and it fetched remunerative price in the market. They also consider it as an important

commercial vegetable crop having good profit. Thus yard long bean should be given more importance in vegetable research.

Bitter gourd, the most important vegetable having extensive area under cultivation, indicated lack of specific recommendations to tackle three-fourths of the identified problems/constraints that resulted in 75 per cent research gap followed by coccinea with 71.43 per cent research gap. It is evident from Table 24 that other major vegetables included in the study *viz.* snake gourd, chilli, amaranth and bhindi had a research gap of 66.66, 50, 25 and 20 per cent respectively. Further, it could be seen from the table that there was no gap with respect to research in brinjal.

Table 24. Research gaps in commercial vegetable farming

Sl. No.	Vegetables	No. of Problems/ constraint identified	No. of Rec. available in POP	No. of Rec. from the MDRT	Research gaps (%)
1	Bitter gourd	12	3	9	75.00
2	Snake gourd	9	3	6	66.66
3	Chilli	6	3	3	50.00
4	Amaranth	4	3	1	25.00
5	Yard long bean	9	2	7	77.78
6	Brinjal	4	4	0	0.00
7	Bhindi	5	4	1	20.00
8	Coccinea	7	2	5	71.43

No.=Number, Rec.=Recommendations, POP=Package of practices recommendations
MDRT=Multidisciplinary research team

As a whole, cucurbitaceous vegetables had higher research gaps when compared to solanaceous vegetables. It could be concluded from the results presented in Table 23 that researches were more extensive in solanaceous vegetables and more attention needed be given to yard long bean and cucurbitaceous vegetables.

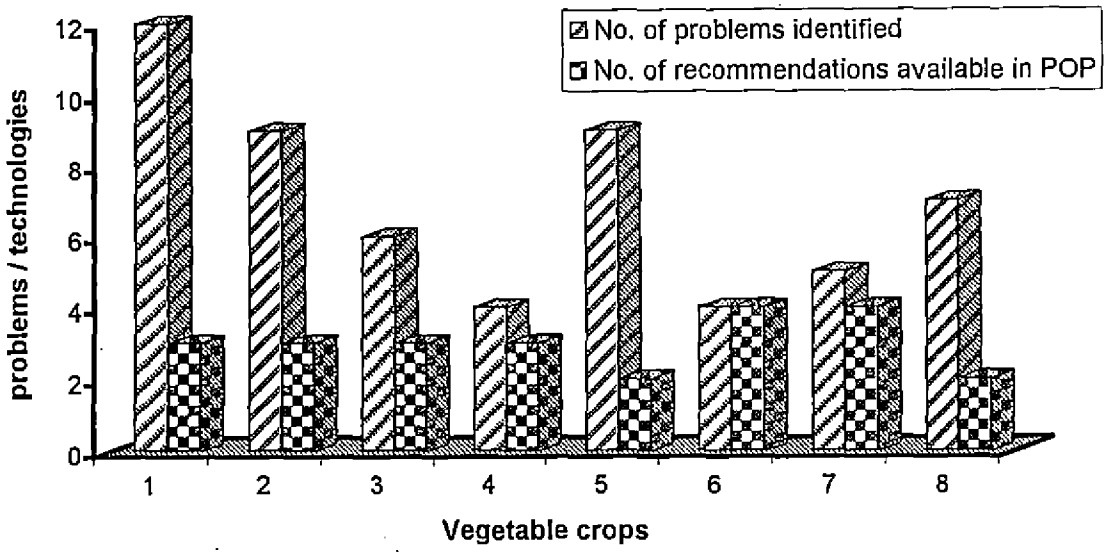

Fig. 11. Availabilty of technological interventions with KAU research system

1 = Bitter gourd	3 = Chilli	5 =Yard long bean	7 = Bhindi
2 = Snake gourd	4 =Amaranth	6 = Brinjal	8 = Coccinea

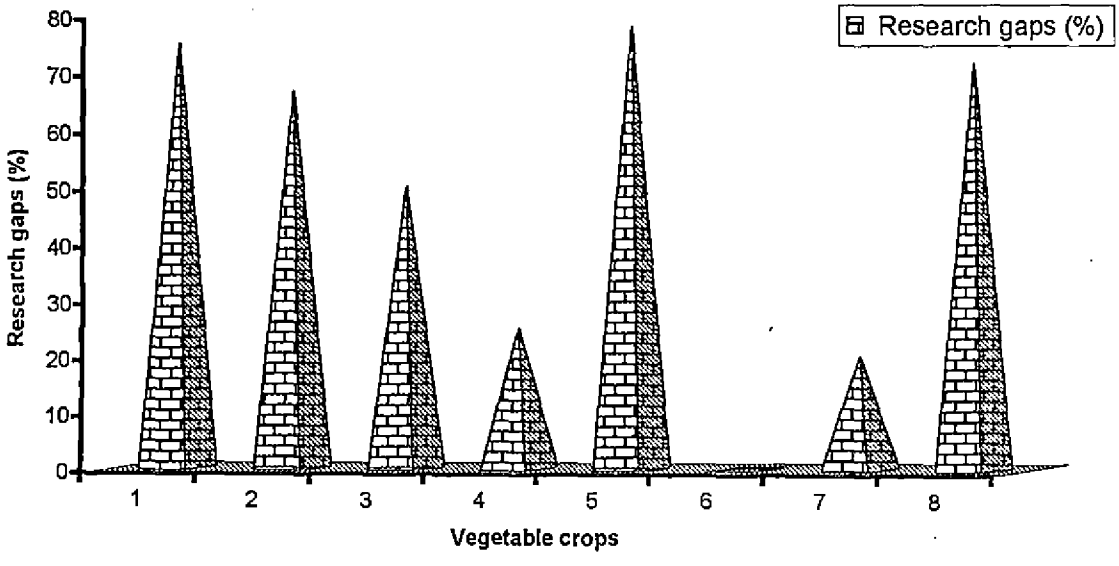

Fig. 12. Research gaps in commercial vegetable farming

The recommendations of the multidisciplinary research team on technological interventions available with the KAU research system to tackle each of the identified problems/constraints in commercial farming of the major vegetables of the study area are presented and discussed below:

Note: *(Recommendations from POP are given in italics)*

4.3.1. Bitter gourd

4.3.1.1. Yellowing and stunting (mosaic)

No control measure is available, only management is possible. No resistant variety available. Varieties released from KAU are susceptible. In endemic areas continuous cultivation should be avoided. Prophylactic sprays of *Kiriath* (*Andrographis paniculata*), Imidachloprid spray, Neem+Garlic spray are recommended to control the vector.

Nutritional deficiency may mimic the symptom. Cupping and curling may be due to calcium and magnesium deficiency. This can be confirmed only through field investigation and verification of the history of fertilizer application.

Control the vectors by spraying Dimethoate 0.05%. Uprooting and destruction of affected plants and collateral hosts should be done. Harvesting can be done only after 10 days (at least) of insecticide application. The fruits should be washed thoroughly in water before cooking.

4.3.1.2. Green Jassids (severe during summer, less in rainy season)

Severe during Feb-March, continues up to the onset of monsoon. Increased temperature leads to high pest incidence. Spray Acephat or Imidachloprid. In general,

toxicity will persis up to a week. Crop specific toxicological studies and residue analysis should be made.

4.3.1.3. Fruit fly

Apply Carbaryl 10% DP in pit before sowing of seeds to destroy the pupae. In homestead gardens the fruits may be covered with polythene cloth or paper bags to ensure mechanical protection. In large gardens, apply Carbaryl 0.2% or Malathion 0.2% suspension containing sugar or jaggery at 10 g/l at fortnightly intervals at flowering and fruit initiation. Spray as coarse droplets on the ventral surface of leaves. Remove and destroy affected and decayed fruits.

It can also be effectively controlled by the use of banana fruit traps coupled with the removal and destruction of infested fruits. It is more efficient than two sprayings with insecticides. The trap is prepared by applying Carbofuran granules at the cut ends of ripe banana fruits (variety Palayankodan). Traps are to be set at a distance of 2 m after a border row and they may be replenished after 7 to 9 days. Start bait trapping just before flowering.

4.3.1.4. Fruit rotting (tip of the fruits) during rainy season

Tip rotting can be due to fungal attack. No tolerant varieties available, adjusting the time of sowing can prevent it. Severity may be enhanced by rain. Severe rain leads to leaching of calcium from soil and weakening of plant cells ultimately enhances the disease incidence. Apply Lime @25-50gm/pit at fruit setting stage. Further field investigations are needed to verify the cause of the problem.

4.3.1.5. Uneven fruit size (Fruit curling during summer)

The symptoms may be due to mosaic, green jassids, nutrient deficiency or any other stress. Further field investigations are needed to verify the cause.

4.3.1.6. Green fruit borer (1 inch length, half inside and half out side while feeding)

Application of Acephate+Bt mixture can control the fruit borer.

4.3.1.7. Leaf spot (Cercospora, Alternaria)

No crop specific recommendation available in POP. However, any contact fungicide *viz.* Mancozeb / Bavistin can be applied to control the disease. In severe cases, *Alternaria* leaf spot may lead to leaf blight.

4.3.1.8. Leaf eating caterpillar (Green colour, 2cm long)

NSKE 5%, Ekalux can be used to control the pest.

4.3.1.9. Gall fly

Incidence is more towards the tip of vine. Cutting, removing and burning the infected vine tips is the possible mechanical control. By limiting the irrigation and nitrogenous fertilizers the fast growing nature of the plant can be reduced but it has the limitation of yield reduction. Further investigations are needed.

4.3.1.10. Yellow hairy grub, Epilachna beetle

Remove and destroy egg masses, grubs and adults occurring on leaves. Spray Carbaryl 0.2%. Sevin should be avoided at flowering stage, as it is harmful to pollinators.

4.3.1.11. Collar rot

Drenching the soil with Mancozeb / Bavistin can check the spread of the disease.

4.3.1.12. Yellowing of fruit surface during April-May

The symptom may be due to the attack of sucking pests or sun scorching.

4.3.2. Snake gourd

4.3.2.1. Fruit fly

The problem has already been discussed under Bitter gourd.

4.3.2.2. Leaf spot

Leaf spot in snake gourd may be due to *Cercospora* or downy mildew. Apply any contact fungicide *viz.* Acomine.

4.3.2.3. General yellowing, upward leaf drying and falling of leaves (More during winter)

The symptom may be due to root damage or soil borne fungal pathogens. Further field investigations and verifications are needed.

4.3.2.4. Leaf eating caterpillar (Green colour) occurs regularly

The snake gourd semilooper can be controlled by mechanical removal and destruction of infected leaves with caterpillar. Apply any contact insecticide.

4.3.2.5. Yellowing and spots on leaves (Downey mildew)

It is severe during rainy season. This can be checked by spraying Mancozeb 0.2% (Waiting period of Mancozeb is three days).

4.3.2.6. White larvae – Stem cracking

If the incidence of larvae is secondary infection any contact insecticide can be applied to control the larva. The problem should be further verified with field investigations and research trials to verify the primary cause.

4.3.2.7. Stem borer (Drying of plants) at fruiting stage

Initially it was a minor pest, now it has become a major problem. The percentage of incidence should be noted. Apply Chlorpyriphos 2.5ml/lit as localized application before wilting of plants.

4.3.2.8. Bulging of stem (bottom region) – Vine borer

No specific recommendation available in POP. Using any systemic insecticide vine borer can be controlled.

4.3.2.9. Red pumpkin beetle

Adult beetle eats the leaves, makes holes on foliage and causes damage on roots and leaves. Incorporate Carbaryl 10% DP in pits before sowing the seeds to destroy grubs and pupae.

4.3.3. Chilli

4.3.3.1. Wilting

Wilting may be due to *Fusarium* or bacterial wilt. *Uproot and destroy the plants affected by bacterial wilt. Cultivate resistant varieties like Manjari, Ujwala and Anugraha in bacterial wilt prone areas.* Resistant variety, Ujwala is green-fruited type. No location specific white-fruited resistant variety released from KAU.

Disease is severe in acidic soil. Application of lime in the pit can reduce the severity of the disease. Crop rotation, removal of the alternate weed hosts *(Solanaceous sp.)*, deep summer ploughing and burning of pits are recommended as the control measures for the disease.

4.3.3.2. Mosaic disease

Uproot and destroy the plants affected by mosaic. Green fruited resistant variety (Ujwala) is available. However, no location specific white-fruited varieties released from KAU.

4.3.3.3. Top drying and stunted growth

No specific recommendations available in POP to control *Colletotrichum* dieback. Mancozeb can control the disease effectively.

4.3.3.4. Crinkling and subsequent leaf fall due to the attack of mites/other sucking pests

No specific recommendation available in POP. Dimethoate / Sulphur can be used in chilli. *Dimethoate at 0.05% is effective for controlling mites, aphids and other sucking insects.*

4.3.3.5. Premature fruit drop

It is a serious problem in white Kanthari. Planofix spray @ 2.5 ml/10 lit can control premature drop of the fruits.

4.3.3.6. Fruit borer

It is not a common pest in chilli. Spray Acephate+Bt mixture. Further field investigation should be made to identify the species.

4.3.4. Amaranth

4.3.4.1. Leaf spot

It is a severe problem during rainy season. Avoid splashing during irrigation. Mixed cropping with green leaved resistant variety Co1 can reduce the disease incidence.

4.3.4.2. Bolting during summer

It may be due to water scarcity / Nitrogen scarcity / varietal characters. Improve tilth and aeration of the soil. *Kannara Local is a season bound variety, which comes to flowering in November-December.*

4.3.4.3. Leaf eating caterpillar (Leaf webber)

As far as possible, avoid use of insecticides. In severe cases of leaf webber attack, spray Malathion 0.1% or dust Malathion 10% DP.

4.3.4.4. Yellowing during high soil moisture

During rainy season, planting shall be done on raised beds. Planting in raised beds can prevent yellowing during high soil moisture.

4.3.5. Yard long bean

4.3.5.1. Aphids attack

The fungus ***Fusarium pallidoroseum*** *can be used for controlling black pea aphid. Bran based fungus can be applied at the rate of 3 kg per 400 m^2 immediately after infestation is observed. Only one application is necessary. Spray Malathion (0.05%) or Quinalphos (0.03%) for controlling pea aphids.*

4.3.5.2. Fruit shortening (No seeds at the tip of the pod)

It may be due to Boron deficiency. Apply Borax@10gm/plant in pits. Needs further investigation to verify the primary cause.

4.3.5.3. Flower drop during rainy season

No specific recommendation is available in POP. Apply NAA 15ppm.

4.3.5.4. Stunting – mosaic

Kairali is a semi-trailing variety resistant to mosaic. However, mosaic resistant yard long bean varieties are not available.

4.3.5.5. American serpentine Leaf miner

Apply Neem + Garlic at fortnightly interval before flowering. Further research is ongoing.

4.3.5.6. Fruit borer

Spray Carbaryl 0.2% or Fenthion 0.05% to protect the crop from pod borers. Repeat the application, if infestation persists. Apply the insecticides after harvesting mature pods and pick the pods only 10 days after the application of insecticides.

Any synthetic pyrethroide can be used to control fruit borer. 4% Neem leaf extract can also be applied to control the fruit borer. Further studies are needed to verify the species.

4.3.5.7. White fly

Acephate or any systemic insecticide can be used. Yellow trap is recommended for the monitoring and controlling of white flies.

4.3.5.8. Wilting

Wilting can be due to *Fusarium* attack. It can be controlled by drenching the soil with 1% Bordeaux mixture / Bavistin. Apply lime to neutralize the soil.

4.3.5.9. Black arm disease

Treat the seeds with Carbendazim. Spray stem and leaves with Fytolan during rainy season or high humidity conditions.

4.3.6. Brinjal

4.3.6.1. Shoot and fruit borer

Follow mechanical removal and destruction of affected portions for control of fruit and shoot borer. Spray Carbaryl 0.15% at an interval of 15-20 days to control fruit and shoot borer under large-scale cultivation

4.3.6.2. Leaf eating caterpillar (Epilachna grub)

The control of *Epilachna* grub and adult has already been discussed under bitter gourd.

4.3.6.3. Damping off

For avoiding damping off of the seedlings in the nursery, sow the seeds as thin as possible in the raised beds prepared in the open area during summer months.

4.3.6.4. Leaf folder

Removing and destroying the affected leaves with larva is the effective mechanical control. *Application of granules of Carbofuran at the rate of 0.5 kg ai/ha or Phorate at the rate of 1 kg ai/ha at seeding followed by need-based application of foliar insecticides has been recommended. The application of granules is recommended only at the time of seeding. In general, insecticides of plant origin may be used, as far as possible.*

4.3.7. Bhindi

4.3.7.1. Yellow-vein mosaic

*This is a common disease in okra, which shows vein clearing and vein chlorosis of leaves. The yellow network of veins is very conspicuous and veins and veinlets are thickened. Fruits become small and yellowish green in colour. White fly (**Bemisia tabaci**) and leaf hopper (**Amrasca biguttula biguttula**) are vectors of this virus. Hence, their control is very important. Use of resistant varieties like Arka Anamika, Arka Abhay and Susthira, and destruction of host weeds (**Croton sparsiflora** and **Ageratum sp.**) are also effective.*

4.3.7.2. Shoot and Fruit borer

The problem has already been discussed under brinjal

4.3.7.3. Leaf folder

The problem has already been discussed under brinjal

4.3.7.4. Flower shedding

Severe during summer. Apply Borax@10-15g/plant.

4.3.7.5. Leaf eating caterpillar

The problem has already been discussed under brinjal. The cause should be further verified with field investigations.

4.3.8. Coccinea

4.3.8.1. Stunting – Mosaic

No control measure is available; other management techniques have already been discussed under bitter gourd

4.3.8.2. Flower and fruit drop during rainy season

It is a natural phenomenon, as it is off-season for coccinea. Proper shade management and limiting the nitrogenous fertilizer application may give better results. When crops are retained for more than two years prune the vines during on set of monsoon.

4.3.8.3. Long light green-fruited plants are highly susceptible to mosaic

Mosaic resistant long fruited cultivars are not available, but small-fruited cultivars are somewhat tolerant to mosaic.

4.3.8.4. Fruit fly

The problem has already been discussed under bitter gourd.

4.3.8.5. Leaf eating caterpillar (Green colour)

The problem has already been discussed under bitter gourd.

4.3.8.6. White fly

Control measures for white fly have already been discussed under yard long bean.

4.3.8.7. Problem in maintenance of 'panthals'

There is no specific recommendation to tackle this problem. Proper management can solve this problem.

The findings and recommendations in the above section bring to light the non-availability of specific recommendations to solve many of the identified problems/ constraints in commercial vegetable farming. Ironically the scientists had possible technological interventions to tackle many of the problems, however it had not found a place in POP recommendations due to procedural delays and system limitations.

4.4. EXTENSION GAPS IN COMMERCIAL VEGETABLE FARMING

One of the prime objectives of the present study was to assess the knowledge and adoption levels of the KAU recommendations on improved vegetable cultivation practices among the commercial vegetable growers, thereby interpreting the extension gaps in the technology dissemination process.

4.4.1 Knowledge level of the recommended technologies in commercial vegetable cultivation

The distribution of the respondents with respect to the knowledge score obtained is presented in Table 25 and Fig.13.

The commercial vegetable growers were categorized in to three major categories *viz.*, low, medium and high knowledge groups based on the mean and standard deviation of the knowledge scores obtained by them.

The farmer with low level of knowledge had a knowledge score below 48.009 (Mean - 1Sd) medium group had knowledge score between 48.009 (Mean - 1Sd) and 69.991 (Mean + 1Sd) and those in the high group with knowledge scores above 69.991 (Mean + 1Sd) were found to be having high level of knowledge about the recommended vegetable cultivation practices.

Table 25. Distribution of the respondents with respect to the knowledge level of the recommended technologies

n = 80

Sl.No.	Categories of the respondents		
	Group	**Criteria**	**Percentage**
1	Low group	< Mean - 1Sd	21.25
2	Medium group	Mean ± 1Sd	61.25
3	High group	> Mean +1 Sd	17.50

Mean: 59.000 SD: 10.991

Table 25 clearly indicates that more than half (61.25 %) of the vegetable growers had medium level of knowledge followed by 21.25 and 17.5 per cent with low and high knowledge on improved cultivation practices recommended by Kerala Agricultural University.

The data presented in Table 25 representing the profile analysis of the commercial vegetable growers reveals that majority of the respondents had medium level of farming experience. As the respondent farmers engaged in vegetable cultivation period in many years on commercial basis they can be assumed to have acquired clear knowledge about the recommended technologies. The other results of the farmers' profile analysis that could be attributed as reasons for the higher knowledge level are higher rate of literacy coupled with high level of information source utilization.

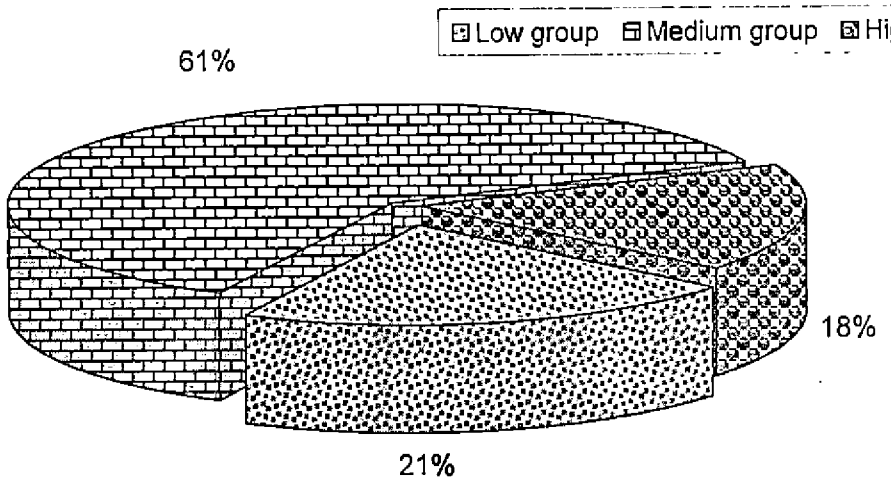

Fig. 13. Distribution of the respondentds according to the knowledge level of the identified technologies in commercial vegetable farming

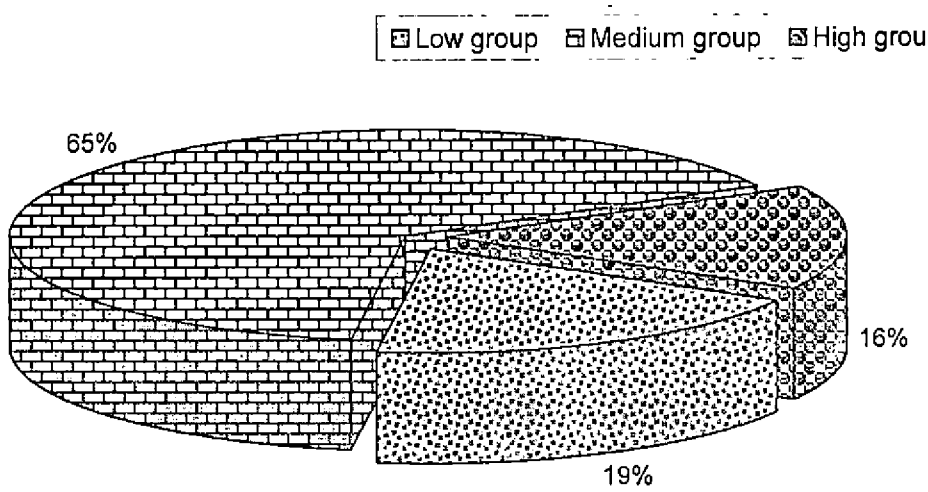

Fig. 14. Distribution of the respondentds according to the adoption level of the identified technologies in commercial vegetable farming

The present study was in agreement with the findings of Bonny (1991), Leemarose (1991), Walke *et al.*, (1995). Alagirisamy (1997), Manoj (1998), Venkatesan (2000), Jayapalan and Sushama (2001b) and Sheela and Seetharaman (2002), who also reported that the majority of the farmers had medium level of knowledge on recommended cultivation practices.

4.4.2. Adoption level of the recommended technologies on commercial vegetable cultivation

The commercial vegetable growers were categorized into three major categories using mean and standard deviation. A farmer with an adoption score below 45.16 (Mean - 1Sd) was categorized under low group. While one with an adoption score between 45.16 Mean - 1Sd) and 81.54 (Mean + 1Sd) was categorized under medium group and those having adoption scores above 81.54 (Mean + 1Sd) was categorized under high group with respect to the adoption levels of the recommended technologies.

The distribution of the respondents with respect to the obtained adoption scores is presented in Table 25 and Fig.14.

Table 26. Distribution of the respondents with respect to the adoption level of the recommended technologies

n = 80

Sl.No.	Categories of the respondents		
	Group	Criteria	Percentage
1	Low group	< Mean - 1Sd	18.75
2	Medium group	Mean ± 1Sd	65.00
3	High group	> Mean +1 Sd	16.25

Mean: 63.35 SD: 18.186

A perusal of Table 26 and Fig. 14 reveal that majority of the commercial vegetable growers (65%) had medium level of adoption of recommended technologies regarding vegetable cultivation followed by 16.25 and 18.75 per cent of them belonging to low and high adoption categories respectively.

As seen earlier in this chapter, a majority of the respondents had medium level of knowledge with respect to the recommended technologies (Table 25) this could be cited as the reason for the higher adoption levels because knowledge of any innovation has a direct positive influence on its adoption.

All the vegetable crops choosen for the study required use of scientific production techniques from sowing to harvest. The commercial market oriented vegetable farming necessitated the farmers to adopt improved vegetable practices for better yield. Any lapse in the adoption of appropriate technologies would result in a drastic reduction in the yield and also the quality of the produce.

The credibility of the standardized technologies of Kerala Agricultural University and farmers' conviction about the relative advantage of the practices coupled with their knowledge on scientific vegetable cultivation appears to have greatly influenced this result. Constant motivation of the extensionists of *Krishi bhavan* and other service agencies like VFPCK by monetary support and technical guidance coupled with impact of mass media and peer group encouragement could be attributed as the reasons for the better adoption of recommended technologies in scientific farming.

The present result derives support from the findings reported by Chenniappan (1987), Aziz (1988), Bonny (1991), Nagabhushnam (1994), Venkattakumar (1997), Alagirisamy (1997), Kalavathy and Anithakumary (1998), Manoj (1998), Waman *et al.* (1998) and Venkatesan (2002).

4.5. PROFILE OF THE COMMERCIAL VEGETABLE GROWERS

The socio-economic profile of the respondents was studied with reference to the selected characteristics of the vegetable growers. The results related to these aspects are presented and discussed below.

Table 27 illustrates the distribution of the respondents according to the selected profile dimensions. A perusal of Table 27 and Fig. 15 reveal the following results.

Table 27. Distribution of respondents with respect to selected socio-economic characteristics

n = 80

Sl.No.	Characters	Mean	SD	Categories of the respondents (%)		
				Low group	Medium group	High group
1	Age	44.350	12.348	12.50	75.00	12.50
2	Number of vegetables grown	5.100	1.539	15.00	66.25	18.75
3	Experience	13.812	10.541	10.00	68.75	21.25
4	Farm size	1.756	1.294	10.00	87.50	2.50
5	Education	3.225	1.102	25.00	70.00	5.00
6	Irrigation potential	2.137	0.568	10.00	66.25	23.75
7	Input availability	15.200	1.679	18.75	63.75	17.50
8	Social participation	8.175	2.293	7.50	70.00	22.50
9	Information source utilization	7.087	1.569	13.75	71.25	15.00

4.5.1. Age

Three-fourth (75 %) of the commercial vegetable growers belonged to middle age group followed by the remaining population distributed equally among the low age group (12.5 %) and high age group (12.5 %).

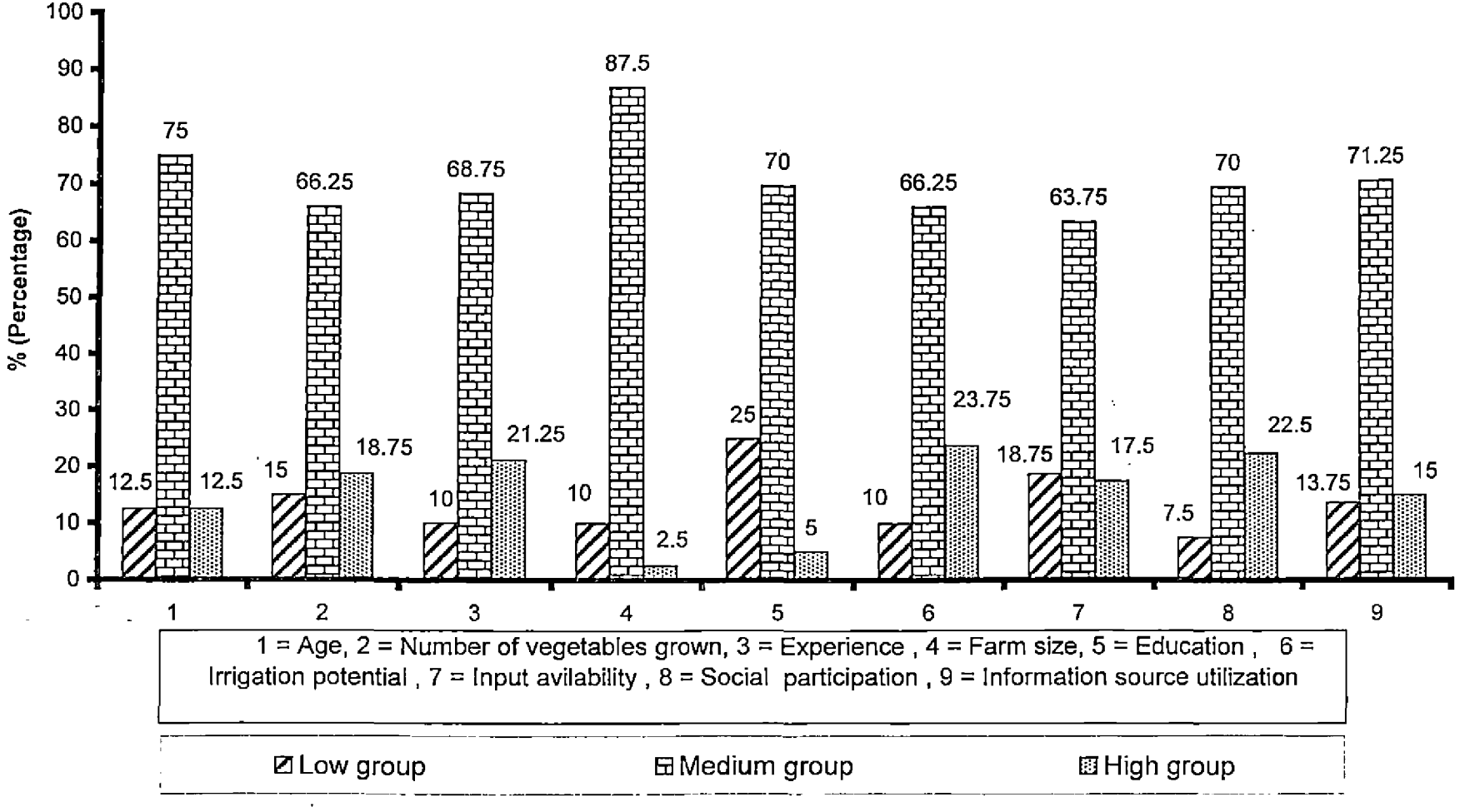

Fig. 15. Profile analysis of the vegetable growers

As a whole, it looks as though middle-aged farmers are engaged more in commercial vegetable farming. However, it is encouraging to note that the aged and young people also contribute for 25 per cent.

This result derives support from the findings of Subhashini (1990), Swamidasan (1994) and Santhasheela (1999).

4.5.2. Number of vegetables grown

More than fifty (66.25 %) per cent of the respondents were found in the middle category with respect to the number of vegetables grown followed by 18.75 and 15 per cent belonging to high and low categories respectively.

It could be inferred from the above result that the vegetable growers in the study area are adopting a changing cropping pattern and proper allocation of farm area under each vegetable based on the demand and other conducive situations.

4.5.3. Farming experience

Majority (68.75 %) of the commercial vegetable growers had medium level of farming experience, followed by 21. 25 and 10 per cent of them with high and low levels of farming experience respectively.

As the same trend was observed in the distribution of respondents according to age also the present result indicates active participation of the respondents in vegetable farming since an early age.

The result of the present investigation is in line with the findings of Subhashini (1990), Swamidasan (1994), Marimuthu (1998) and Santhasheela (1999).

4.5.4. Farm size

Large majority (87.50%) of the respondents were found under the category of medium farm holding size followed by 10 per cent under small sized farms and only 2.5 per cent of them had large farms.

The above findings indicated that a majority of the commercial vegetable growers had small to medium level of farm size and it could be interpreted that the per capita availability of land in the study area is considerably small.

This result was a re-emphasis of the results obtained by Swamidasan (1994), Sathiyaseelan (1996), and Santhasheela (1999).

4.5.5. Educational status

Out of the total sample population higher percentage (70%) of the vegetable growers had medium level of education followed by 5 and 25 per cent of them had high and low levels of education respectively.

It could be concluded that majority of the commercial vegetable growers had low to medium level of education.

The present finding was in agreement with the results obtained by Pochiah *et al.* (1993), Venkattakumar (1997), Santhasheela (1999), Alagirisamy (1997) and Namboothiripad (2000).

4.5.6. Irrigation potential

Two-third of the vegetable growers (66.25%) had medium level of irrigation potential, while 23.75 and 10 per cent of them possessed high and low potential for irrigation in vegetable farming respectively.

Farmers opined that delay in sowing of second crop necessitated the supplementary irrigation in vegetable cultivation. Irrigation during the crucial periods of flowering and fruiting is a must in vegetable farming.

4.5.7. Input availability

The data furnished in the table reveal that more than half (63.75%) of the respondents perceived medium availability of farm inputs followed by 17.50 and 18.75 per cent perceived high and low input availability respectively.

Most of farmers expressed unavailability of good quality farm inputs *viz.* Neem oil, fertilizers and manures coupled with inadequacy of seeds and planting materials during peak seasons as the most important problems / constraints in commercial vegetable farming (Table 15). The above facts can be attributed as a reason for the present finding as more than 80 per cent of farmers expressed low and medium level of availability of farm inputs.

4.5.8. Social participation

It could be inferred from Table 27 that a majority (70%) of vegetable farmers belonged to medium social participation category followed by 22.5 and 7.5 per cent under high and low social participation respectively.

Vegetables being highly perishable commodities the farmers need up to date information on market demand and price levels. Farmers either take their produce directly to the markets or sell through the VFPCK local market. In both the cases, farmers meet and interact with number of people. Moreover the selected respondents are the members of the *harithasangams* having active participation. Thus, majority of the commercial vegetable growers had medium levels of social participation.

Similar results were also reported by Heddybai (1994), Venkattakumar (1997) and Santhasheela (1999).

4.5.9. Information source utilization

In case of information source utilization 71.25 per cent of the respondents had medium information source utilization followed by 15 and 13.75 per cent with high and low information source utilization regarding vegetable cultivation respectively.

Farmers had frequent contact with peer group and *Krishibhavan* officials when compared with mass media and personal-cosmopolite sources.

The above finding was in line with the reports of Venkattakumar (1997), Santhasheela (1999) and Namboothiripad (2000).

4.6. SUITABLE STRATEGIES FOR COMMERCIAL VEGETABLE FARMING

The present study was mainly centred around commercial vegetable farming with special focus on identification of problems/constraints and research-extension gaps. The appropriate strategies for commercial vegetable farming are suggested and presented under the following four heads.

4.6.1. Production strategies

The farmers may skip the seasons, which are more prone to pests and diseases and they may cultivate resistant varieties wherever possible.

The farmers may adopt change in cropping pattern with suitable crop rotations and mixed croppings.

The farmers may purchase the required vegetable seeds well in advance from the university.

The growers may cultivate vegetables that are less risky in production especially with respect to pest and disease attack.

The growers may grow vegetables having comparatively low production cost. The vegetable growers may grow those vegetables that are less perishable and can be preserved using local resources.

The growers may cultivate vegetables, the seeds of which are available in the local markets and they may produce their own seeds under better management for the succeeding season.

The growers may follow Integrated Pest Management (IPM) practices for better scientific vegetable farming. The growers may adopt prophylactic spray with organic pesticides to control regularly occurring pests.

4.6.2. Marketing strategies

The farmers may follow an appropriate sales pattern for vegetables, highly perishable vegetables may be sold immediately in the local market and vegetables having long shelf life may be sent to the outside markets.

The VFPCK may establish more local markets and procurement centres in the extensive vegetable growing areas.

The *harithasangams* may establish group based marketing facilities especially for local sale, storage and transportation of the vegetables to distant markets.

4.6.3. Extension strategies

The extensionists of the *Krishibhavans* may document and report the field level problems in Zonal Research and Extension Advisory Committee Meeting.

The extensionists may prioritize the vegetables and also the technologies associated with them.

The extensionists may organize farmers' group and support them with timely interventions to make them self-sustaining.

The State Department of Agriculture may open advisory centres at grama panchayat level for providing technical and infrastructural support to the vegetable growers during critical periods of production.

4.6.4. Research strategies

The researchers may get more exposure to the field problems and they need to take research programmes that are vital to solve the field level problems of the farmers.

Attention may be given for developing technologies on preferred vegetables.

The researchers and extensionists may work in tandem to develop suitable technologies for commercial vegetable farming.

Farmers' participatory action research may be encouraged for solving location specific felt problems of the farmers.

Researchers may provide ad-hoc recommendations during the critical periods of crop production in commercial vegetable farming.

Research policy makers may think of a separate package of practices recommendations exclusively for vegetables.

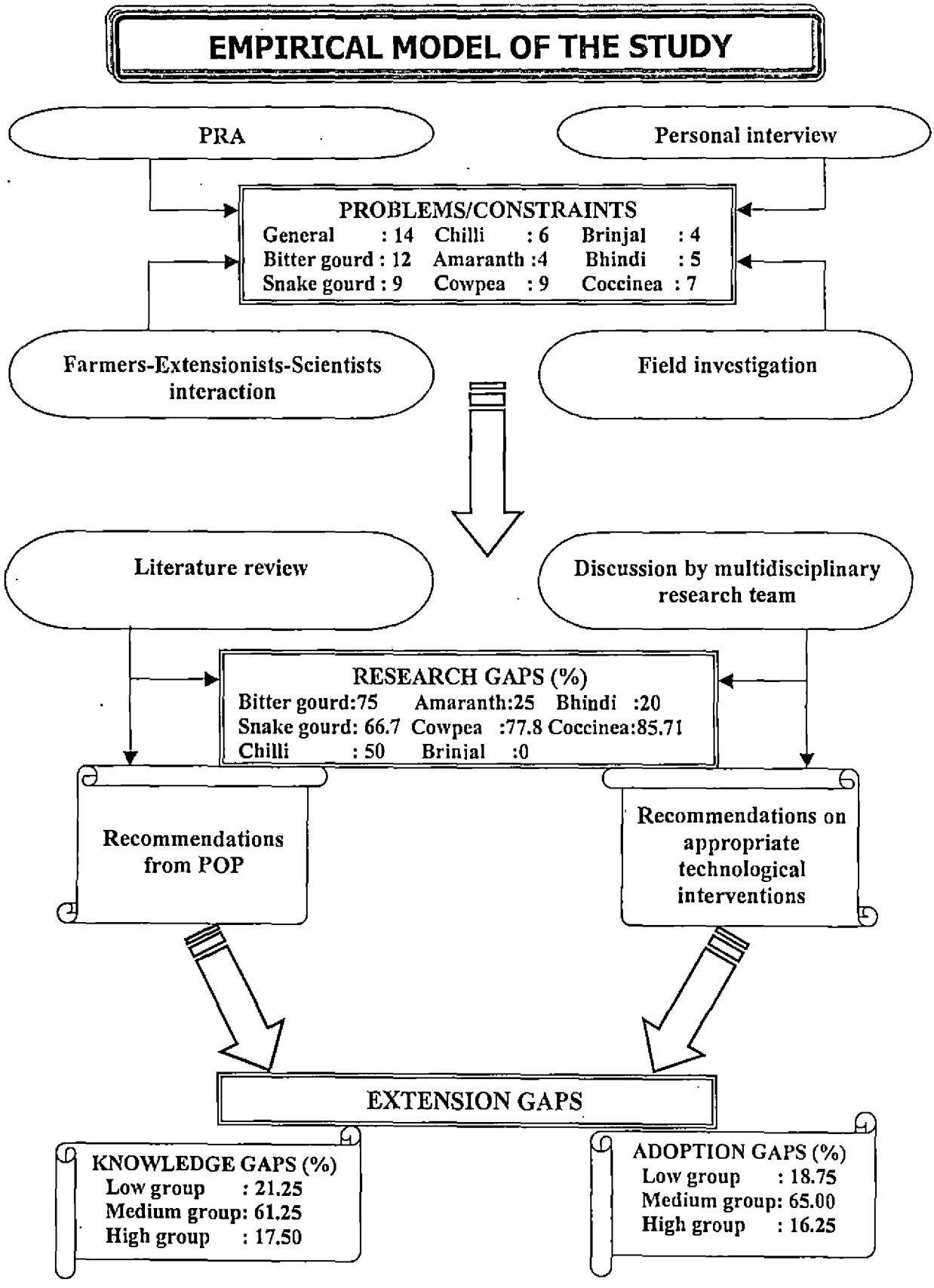

Fig. 16. Empirical model of the study

SUMMARY

V. SUMMARY

India is the second largest producer of vegetables next to China whereas the total area under vegetable in the country is hardly 2 to 2.5 per cent. The present per capita availability of vegetables is 135 g, which accounts for 48 g/unit of the dietary needs, but the needed vegetable consumption/day/person is 284 g thereby throwing up a wide gap between the current availability and actual requirement of vegetables.

Vegetables are more profitable crops having sustained consumer demand. Though Kerala is blessed with favorable soil and agro-climatic conditions, it remains a consumer state. The state heavily depends on neighbouring states to meet her requirements as it is evidenced by the report that vegetables worth Rs.850 crores are imported annually from out side the state.

Against this backdrop the present study was conceived with the following specific objectives.

1. To analyze the status and identify the problems/constraints in commercial vegetable farming.

2. To explore the availability of appropriate technologies with the research system and gaps thereon to tackle the identified problems/constraints.

3. To study the gaps in knowledge and adoption levels of the identified technologies.

4. To study the profile of the commercial vegetable growers.

5. To suggest suitable strategies for commercial vegetable farming.

The present study was carried out in Nemmara block of Palakkad district in Kerala. Nemmara and Ayilur panchayats under Nemmara block were selected for the

study considering the predominance of area under vegetables and functioning of maximum number of *harithasangams.* There are about 13 and seven *harithasangams* functioning in Nemmara and Ayilur panchayats respectively. Totally 80 respondents, 55 from Nemmara and 25 from Ayilur were selected randomly proportionate to the size of the group, to constitute the sample for the study.

A pilot survey was carried out to study the status of commercial vegetable farming in the study area. Timeline, vegetable preference ranking, crop growing calendar and problem-cause diagram were the major PRA tools used in the investigation. The problems/constraints associated with the cultivation of vegetables were explored using PRA, farmers-extensionists-scientists interaction, field investigation and personal interview techniques. The gathered information was authenticated and validated with triangulations involving progressive farmers, extensionists and researchers.

An exhaustive list of identified problems/constraints was prepared under two heads *viz.* general and specific to each vegetable and included in the interview schedule to prioritize these problems based on their severity as perceived by the farmers.

The identified problems/constraints in the cultivation of all the selected vegetables were discussed by a multidisciplinary research team of KAU with an extensive review of Package of Practices Recommendations-Crops' 2002 released by KAU. The recommendations available in POP to tackle each problem/constraint were explored in depth and all possible technological interventions available were identified and listed out by the KAU multidisciplinary research team.

A teacher made knowledge test was developed using appropriate methods and included in the interview schedule to measure the knowledge level of the farmers about the identified KAU recommended practices.

Based on extensive review of available literature an exhaustive list of farmers' profile dimensions were prepared for profile analysis of the vegetable growers.

The standardized interview schedule comprising of the items regarding farmers' profile, problems identification and prioritization, knowledge and adoption tests were used for collecting the final information from the respondents. The gathered information was analyzed using appropriate statistical techniques.

The salient findings of the present investigation are presented below.

1. Damage due to pests and diseases were the most severe problem felt by the vegetable growers followed by difficulties in marketing the vegetables. The problems related to seeds and planting materials was ranked as third most important problem and these were cited as probable reasons for the discontinuance of commercial vegetable farming in the study area.

2. Snake gourd was ranked first with respect to the severity of problems experienced by the farmers in its cultivation on a commercial basis followed by bitter gourd and coccinea. The severity of problems in the cultivation of bhindi was relatively low followed by yard long bean and amaranth.
3. Bitter gourd was ranked first with respect to market demand. Farmers perceived bhindi as a vegetable having low cost of production. Amaranth was reported to be less prone to pest and diseases followed by yard long bean and bhindi. With respect to yield, snake gourd was ranked first among the major vegetables grown in the study area. Cucumber was found to be the vegetable requiring less maintenance and irrigation followed by ash gourd/pumpkin and amaranth. The results showed that amaranth is the vegetable most suited to the soils of the study area. With respect to labour requirement, bhindi was rated first as requiring comparatively less labour followed by yard long bean and amaranth in commercial vegetable farming.

4. The ten important problems/constraints experienced by vegetable growers in the order of importance as perceived and pronounced by the farmers were: high cost of PP chemicals, no local market facility, difficulties in timely soil testing, non-availability of good quality neem oil, capital inadequacy while establishing the farm, purchasing the PP chemicals based on the advice of the pesticide sellers, non-availability of soil/location specific technologies, low local demand and low market price, difficulties in getting timely good quality seeds and difficulties in marketing the produce to distant markets.
5. Farmers had reported maximum number of problems in bitter gourd followed by snake gourd and coccinea. Amaranth and brinjal were reported to have less number of problems in their cultivation.
6. It was found that yard long bean had high research gap when compared to other major vegetables. Bitter gourd had shown a wider research gap of 75 per cent closely followed by coccinea (71. 43 %). Brinjal had shown no research gap with respect to number of specific recommendations available in POP to tackle the identified problems/constraints in commercial vegetable farming.
7. More than half (61.25 %) of the vegetable growers had medium level of knowledge followed by 21.25 and 17.5 per cent with low and high knowledge on improved cultivation practices recommended by Kerala Agricultural University.
8. Majority of the commercial vegetable growers (65 %) had medium level of adoption of recommended technologies regarding vegetable cultivation followed by 16.25 and 18.75 per cent of them belonging to low and high adoption categories respectively.
9. The profile analysis of the vegetable growers revealed that majority of the respondents belonged to medium group with respect to age (75%), number of vegetables grown (66.25%), experience in vegetable farming (68.75%), farm holding size (87.5%), education (70%), irrigation potential (66.25%), availability of farm inputs (63.25%), social participation (70%) and information source utilization (71.25%).

Implications of the study

The present study explored the specific problems/constraints in commercial vegetable farming and the research-extension gaps associated with that. The findings of this study will be of immense use to the vegetable growers in focusing attention on deficiency areas in terms of technology and methods. The problems/constraints in commercial vegetable farming in the study area having been identified with clinical precision applying scientific participatory techniques and validated using triangulations with farmers, extensionists and scientists and prioritized using sound statistical tools this vital knowledge will enable the farmers to come to terms with the ground realities and approach the issues more scientifically. As evidenced from the study the research system is precariously slow in responding to field problems though individual scientists are much ahead armed with scientific solutions to most of the issues raised. This demands a significant improvement in reaction time to emerging problems on the part of the research systems.

The extension systems on its part also has to update and keep abreast with the farmers' problems and streamline the introduction and propagation of suitable technologies to tackle them effectively with an inbuilt scope for replication in similar microfarming situations in the state. Both the research and extension systems appear to suffer from major system defects in terms of vitality and dynamism. The study throws much light into hitherto unexplored areas and provides ample food for thought to researchers in orienting research strategies to rise up to new challenges.

In this rare convergence of the farmers, extension and research systems to systematically explore the core issues affecting commercial vegetable farming, it is genuinely hoped that creative solutions will emerge adding life and greenery to the fields and cheer and brightness to farmers' faces.

REFERENCES

REFERENCES

Action Aid Nepal. 1992. *Utilization Survey Report Part I.* Monitoring and Evaluation Unit, Action Aid Nepal, Sindhupal Chowk, Nepal, p.123

Ahamed, P., Rajendran, P., Ramesan, K.K. and Potti, N.N. 1996. Farmers' criteria for selecting rice varieties give new insight to rice breeders. National Symposium on Technological Advancement in Rice Production, June 17-19, 1996. Directorate of Extension, Trichur. *Abstract*: 187

Alagirisamy, A. 1997. Knowledge and adoption behaviour of vegetable growers. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.178

Aziz, A. E. 1988. Adoption of drought management practices by farmers-A critical analysis. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.124

Biggs, S. D. 1989. *Resource Poor Farmers Participation in Research-A Synthesis of Experience from Nine National Agricultural Research Systems: OFCOR Comparative Study Paper No.3.* ISNAR, The Hagar, p.58

*Bloom, B.S., Engelhardt, M., Hill, W. and Krathwhol, D.R. 1955. *Taxonomy of Educational Objectives-The Cognition Domain.* Longman Greens and Company, New York, p.97

Bonny, B.P. 1991. Adoption of improved agricultural practices by commercial vegetable growers of Ollukkara block in Thrissur district. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p. 127

Bonny, B.P. and Prasad, R.M. 1996. Constraints in commercial production of vegetables. *J. trop. Agric.* 34:159-160

Bose, S.S.C. and Rajan, S. 1999. Export competitiveness of tropical crops. *Proceedings of National Seminar - HortIndia'99*, January 8-9, 1999. Kerala Horticultural Development Programme, Thiruvananthapuram, pp. 48-51

Chambers, R. 1991. Shortcut and participatory methods for projects. *Putting People First: Sociological Variables in Rural Development* (ed. Cernea, M.M.). Oxford University Press, London, pp.31-76

Chandra, S. 2000. Strengthening research-extension linkages for empowering farming community. *Indian Fmg* 49: 62-67

Chandrakandan, K. and Subramanian, S. 1975. Differential perception of farm practices attributed by adopters and non-adopters. *Madras Agric.J.* 62: 862-863

Chenniappan, V.K. 1987. The study of knowledge and extent of adoption of improved practices for irrigated cotton. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.109

Chitnis, D. H. and Bhilegaonkar, M.G. 1987. Constraints causing technological gap in dry farming system. *J.Maharastra agric. Univ.* 12: 84-88

Devdas, V. S. 1999. Streamlining vegetable seed production in Kerala. *KSHS Souvenier*. (ed. KSHS.). pp. 56-58

Devdas, V.S. 2001. Farmer participatory research in horticultural crops. *S. Indian Hort.* 49 : 351-353

Devdas, V.S. 1982. Screening for non-bolting type(s) of amaranths suited for year round planting. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.82

*English, H.B. and English, A.G. 1961. *A Comparative Dictionary of Psychological Terms*. Longmans Green and Co., New York, p.210

Fatima, A.G. 1999. Screening of chilli (*Capsicum annum* L.) genotypes for resistance to wilt and mosaic. M.Sc. (Hort.) thesis, Kerala Agricultural University, Trichur, p.63

Gokulapalan, C., Regunath, V.A. and Nair, S.R. 1999. Managing leaf blight on amaranth. *Indian Hort.* 44:33

Gopalakrishnan, T.R. 1996. *Horticulture Vikasanam-Keralathakal.* Mathrubhumi Printing and Publishing Co. Ltd., Kozhikode, p.235

Gopalakrishnan, T.R. 1997. *Keralathile Pachakkari Krishi: Janapatham.* Department of Public Relations, Government of India, Thiruvananthapuram, p .87

Gopalakrishnan, T.R. 1999. Commercial vegetable cultivation In Kerala. *Proceedings of National Seminar - HortIndia'99*, January 8-9, 1999. Kerala Horticultural Development Programme, Thiruvananthapuram, pp. 125-129

Gopalakrishnan, T.R. and Indira, P. 2002. *Vegetable Varieties Released from KAU - Technical Bulletin No: 31.* Directorate of Extension, Kerala Agricultural University, Trichur, p.105

Gopimony, R. and George, M.K. 1979. Screening brinjal varieties for wilt resistant. *Agric. Res. J. Kerala* 17:7-10

Govind, S. 1992. Integrated pest and disease management in rice: Achievements and opportunities. Ph.D thesis, TamilNadu Agricultural University, Coimbatore, p.117

Gowda, B.A. 1999. Organised marketing of horticultural produce-Experience of hopcorns: Participatory for horticultural development. *Proceedings of National Seminar - HortIndia'99*, January 8-9, 1999. Kerala Horticultural Development Programme, Thiruvananthapuram, pp.56-58

Gupta, P.K. and Singh, J. 1981. Important insect pests of cowpea- *Vigna unguiculata* (L.) in agroecosystem of eastern U.P. *Indian J.Zool.* 21: 71-95

Heddybai, L. 1994. Marketing behaviour of garden land farmers. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.87

Huddad, L., Chung, K. and Devi, V.P. 1992. *Report on Alternate Methods to Locate the Food and Nutritional Insecurity.* Andhra Pradesh Agricultural University, Hyderabad, p.142

Jabbar, P.K.A. 1996. Feasibility and utilization of improved vegetable production technology in family farming by agricultural labourers in Thrissur district. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p. 153

Jahagirdar, A.K. and Sundaraswamy, B. 2002. Adoption of recommended practices of tomato cultivation. *Agric.Ext.Rev.* 14: 12-16

Jaiswal, N. K. and Dave, A. K. 1972. *Measurement of Progressiveness in Farming-Studies in Extension.* National Institute of Rural Development, Hyderabad, p.115

Jaiswal, N.K. and Arya, 1979. *Transfer of Technology in India: National Workshop on Management of Farm Technologies.* National Institute of Rural Development, Hyderabad, p.56

Jalaya, P. N. 1989. Integrated control of fruit fly (Tephritidae-Diptera) on bitter gourd. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.116

James, D. 2001. Molecular characterization of *Ralstonia solanacearum* (Smith) Yabuuchi *et al.* causing bacterial wilt in solanaceous vegetables. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p. 113

Jayapalan, M. and Sushama, N.P.K. 2001a. Constraints in the cultivation of bitter gourd (*Momordica charantia* L.). *J. trop. Agric.* 39:91

Jayapalan, M. and Sushama, N.P.K. 2001b. Knowledge of farmers about bitter gourd cultivation. *J. trop. Agric.* 39:89-90

Juliana, C.S., Annamalai, R. and Somasundaram, S. 1991. Adoption of integrated pest management practices. *Indian J. Ext. Edn.* 27: 23-27

Jyothi, A.R. 1992. Characterization of bacterial wilt of chillies caused by *Pseudomonas solanacearum* E.F. Smith. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.125

Jyothi, P. B. 1994. Relative susceptibility of population of *Amrasca biguttula biguttula* (Ishida) infecting bitter gourd (*Momordica charantia*) collected from different locations to insecticides. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.60

Kalavathy, S. and Anithakumary, P. 1998. Extent of adoption in cowpea cultivation. *J. trop. Agric.*36: 97-99

Kamala, N., Gokulapalan, C. and Nair, M. C. 1996. A few foliar blight of amaranth caused by *Rhizoctonia solani. Indian Phytopath.* 29:407

Kamarudeen, M. 1981. A study on the impact of national demonstration programme on paddy cultivation in Trichur district. Kerala Agricultural University, Trichur, p.109

Karthikeyan, N. 2001. Economic analysis of cool season vegetables in Devikulam block of Idukki district. M.Sc. (Ag.) thesis, Ph. D thesis, Kerala Agricultural University, Trichur, p.123

KAU. 1996. *Package of Practices Recommendation: Crops*. Eleventh edition, Directorate of Extension, Kerala Agricultural University, Trichur, p.267

KAU. 2002a. *Package of Practices Recommendation: Crops*. Twelfth edition, Directorate of Extension, Kerala Agricultural University, Trichur, p.278

KAU. 2002b. *Three Decades of Vegetable Research in KAU*. Kerala Agricultural University, Trichur, p.144

Kerlinger, F. N. 1983. *Foundations of Behavioural Research*. Surjeet Publication, New Delhi, p. 741

Koshy, G., Nandakumar, C. and Premila, K.S. 1987. Need based use of insecticides for the control of pests of cowpea in rice fallows of Kerala. *J. trop. Agric.* 7:25-27

Krishnakumary, K. 2000. Genotypic and seasonal influence of leaf spot disease in amaranth. Ph. D thesis, Kerala Agricultural University, Trichur, p.199

Kumar, G.D.S. 2002. Constraints analysis of cotton farmers in Warangal district of Andhra Pradesh. *Madras agric. J.* 89: 327-328

Kumar, K.N.R., Sreelakshmi, K. and Reddy, M.N. 2000. Strengthening the public extension and research system. *Agric. Ext. Rev.* 22: 19-23

Kumary, J.S.S. 1993. Screening of cowpea (*Vigna unguiculata* L Walp.) types for resistance to cowpea aphid borne mosaic. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.91

Leemarose, S.C. 1991. Training needs of chilli growers. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.94

Malik, H. and Rachard, E. 1994. *Large Scale Wealth Ranking in West Pakistan.* Action Aid Pakistan. Multan, Pakistan, p.67

John, K.C., Rajan, C.S., Sharma, D.K. and Singh, C. 1997. *Farmers' Participation in Agricultural Research and Extension Systems.* National Institute of Agricultural Extension Management, Hyderabad, p.271

Manoharan, M. 1991. *Constraint Analysis in Adoption of Package of Practices for Banana in Southern Districts.* Agriculture College and Research Institute, TamilNadu Agricultural University, Killikulam, p.98

Manoj, M. 1998. Gaps in the adoption of improved agricultural practices by commercial vegetable growers of Thrissur district. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p. 132

Mansingh, J. P. 1993. Construction and standardization of socio-economic status scale. Ph.D thesis, TamilNadu Agricultural University, Coimbatore, p.110

Marimuthu, P. 1998. Marketing behaviour of tomato growers. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.133

Markose, B. L. 1996. Genetic and biochemical bases of resistance to bacterial wilt in chilli. Ph.D thesis, Kerala Agricultural University, Trichur, p.120

Mathew, M. P. 1980. Survey of the microbial diseases of important vegetable pests of Kerala and detailed studies on the pathogens affecting snake gourd semilooper (*Anadevidia peponis* Fab., Noctuidae, Lepidoptera). M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.127

Mathew, P.K., Thomas, M. J. and Nair, M.R.G.K. 1971. Population fluctuation of the pea aphids in relation to climate and predators. *J. trop. Agric.9*:23-26

Mayani, V.V. and Sheth, D. M. 1987. Training of small farmers. *Kurukshetra* 25: 21-22

Nagabhusnam, K. and Guruprasad, T.R. 1994. Knowledge and adoption of coconut cultivation practices. *J. Ext. Edn.* 5: 918-920

Nagesh, S.S. 2001. Economic analysis of production and marketing of vegetables in Thiruvananthapuram district. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p. 112

Nair, G.T. 1969. A multivariate study on adoption of high yielding paddy varieties by the farmers of Kerala state. Ph.D thesis, Indian Agricultural Research Institute, New Delhi, p.106

Nair, M. G. 1983. Host resistance in brinjal varieties to the fruit and shoot borer. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.105

Namboothiripad, P. 2000. A study of commercial vegetable cultivation in Oddanchathiram area and its socio-economic impact on the growers. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.197

Nandakumar, C. 1999. Monitoring and management of pest complex of bitter gourd (*Momordica charantia*). Ph.D thesis, Kerala Agricultural University, Trichur, p.210

Noll, V.H. 1957. *Introduction to Educational Measurement.* Haughton Miffin Company, Boston, p.158

Norman, S.J.T. 1982. Production and marketing of vegetables in Malappuram district. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.134

Ongunsumi, L.O., Ladele, A. and Agustus, E. O. 2002. Assessment of cowpea production technologies in southwest Nigeria. *J. Ext.System* 18: 111-115

Padmanaban, V. 1966. Host resistance in bitter gourd to the infestation by fruit fly (*Dacus cucurbitae* coq). M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.96

Pandey, U.B. 1998. Export of vegetables. *Proceedings of National Symposium on Emerging Scenario in Vegetable Research and Development.* December 12-14, 1998 (ed. Kaloo, G). Indian Society of Vegetable Research, Varanasi, pp. 131-138

Panicker, P.R. 2000. Evaluation of vegetable cowpea for legume pod borer *(Maruca vitrala)* resistance and yield. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.126

Panikkar, P.G.K. 1981. *High Yielding Varieties of Rice: A Study of Selected Areas in Kerala. Working Paper No.140.* Centre for Development Studies, Thiruvananthapuram, p.49

Paul, B. 2002. Adaptation behaviour of vegetable growers in crisis situations. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.85

Paul, T.S. 1998. Biochemical and biological bases of resistance in solanaceous vegetables against bacterial wilt incited by *Ralstonia solanacearum* (Smith) Yabuuchi *et al.* Ph.D thesis, Kerala Agricultural University, Trichur, p.134

Pochiah, M.T.V., Rao, S. and Sundaresan, M. 1993. The entrepreneurial characters of vegetable growers. *J.Ext.Edn.* 4: 737-742

Prakash, R. 1989. Sequential analysis of constraints in increasing production of rice and coconut in Kerala. Ph.D thesis, Kerala Agricultural University, Trichur, p.142

Pun, K.B. and Duraisamy, S. 1996. Effect of age of okra plants on sustainability to okra yellow mosaic virus. *Indian J. Virol.* 15: 57-58

Purushothaman, S. M. 1994. Investigation on mosaic disease of bitter gourd. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.138

Puzari, R. 1994. Vegetable production constraints in Assam. *Agric.Ext. Rev.*6: 26-27

Radhakrishnan, T. 1991. Source utilization and adoption behaviour of onion growers. Ph.D thesis, TamilNadu Agricultural University, Coimbatore, p.106

Rahiman, O.A., Ragunath, P. and Prasad, R.M. 1986. Prospects and problems of commercial vegetable growing in rural areas. *Rural Dev.Rev.*5: 492-498

Rahman, M.H. and Kashem, M.A. 1995. Farmers' perception about the growing and marketing problems of oil crops in Bangladesh- A farm level study. *Economic affairs* 40: 106-111

Rajarathnam, J., Ganesan, C., Helen, T. and Abel, N.B. 1993. *Validating Wealth Ranking of PRA and Formal Survey in Identifying the Rural Poor.* Christian Medical College, Vellore, TamilNadu, p.84

Rajendran, S. 2000. Effect of growth regulator on flower and fruit drop in chilli. M.Sc. (Hort.) thesis, Kerala Agricultural University, Trichur, p.115

Ramachandran, C. 1992. Impact of rice minikit trials on the adoption behaviour of farmers. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.119

Ravichandran, P. 1980. A study on attitude and extent of adoption and problems encountered by registered sugarcane grower. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.119

Ravikrishnan, M.K. 1989. Nutrient management of bitter gourd in relation to pest and disease incidence. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.98

Ravisankar, R.V. 2002. Development of yellow vein mosaic virus (YVMV) resistant hybrids in okra [(*Abelmoschus esculentus* L.) Moench]. M.Sc. (Hort.) thesis, Kerala Agricultural University, Trichur, p.69

Rogers, E. M. 1962. *Diffusion of Innovations*. The Free Press, New York, p.246

Sadhama, K. 1981. Chemical control of brinjal shoot and fruit borer in relation to pollination and terminal residues on fruits. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.115

Santhasheela, M. 1999. Plant protection behaviour of vegetable growers in plains and hills. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.131

Santhoshkumar, T. 1999. Ecofriendly management of important sucking pests of chilli (*Capsicum annum*). M.Sc. (Hort.) thesis, Kerala Agricultural University, Trichur, p.96

Sathiyaseelan, R. 1996. A study on commercial onion growers in Pondichery region. Ph.D thesis, TamilNadu Agricultural University, Coimbatore, p.127

Saxena, K.K., Jain, N.C. and Pandya, S.C. 1990. Transfer of rainfed wheat technology and its adopters by the farmers in Malabar region. *Indian J. Ext. Edn.* 26: 70-73

Seena, P. G. 1996. Incorporation of bacterial wilt resistance in green chillies. M.Sc. (Hort.) thesis, Kerala Agricultural University, Trichur, p.86

Sheela, S. M. and Seetharaman, R.N. 2002. Knowledge level of plant protection practices of potato and beans growers in hilly areas. *J. Ext. Edn.* 13: 68-72

Shyamala, K.S. 1988. An analysis of the effectiveness of national demonstration conducted by KAU. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.134

Singh, K. 2001. Inaugural address by the author. *Proceeding of XLX group meeting AICRP on vegetables*, January 15-18, 2001 (ed. Project coordinators cell). Indian Institute of Vegetable Research, Varanasi, pp. 2

Singh, K.M.P. and Singh, R. P. 1974. Impact of national demonstration in the adoption of high yielding varieties of wheat. *Indian J. Ext. Edn.* 10: 65-67

Singh, S.R. and Allen, D.J. 1980. Pests, diseases resistance and protection in cowpea. *Adv. legume Sci.* 8: 124-125

Song, V. and Manikand, G. 1999. Seed selection and biodiversity maintenance by women farmers. *LEISA Newsl.* 12:18-20

Sreelekha, L. 1991. Properties, host range and control of cowpea mosaic virus. M.Sc. (Hort.) thesis, Kerala Agricultural University, Trichur, p.127

Subhashini, R. 1990. Role of farm women in hill vegetable farming. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.118

Sudarma, K. 1996. Distribution and bioecology of phytophagous mites of vegetables, medicinal plants and ornamentals in Trivandrum district. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.107

Sulochana, K.A. 1984. Screening for resistance to *Aphis cracivora* in vegetable cowpea (*Vigna unguiculata* var. *sesquipedalis* and var. *cylindrica*) and evaluation of early types. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.65

Swamidasan, S. 1994. Knowledge, adoption and marketing behaviour of betelvine growers. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.141

Trivedi, G. 1963. Measurement analysis of socio-economic status in rural families. Ph.D thesis, Indian Agricultural Research Institute, New Delhi, p.113

Usha, P. 1988. Regulation of flowering and fruit set in clustered chilli through use of stimulants, anti-transpirants and regulators. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.83

Usharani, S. 1998. Status and potential for sunflower production in northern districts of TamilNadu. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.136

Venkatesan, S. 2000. Awareness, knowledge and adoption level of recommended tomato cultivation practices. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.127

Venkattakumar, R. 1997. Socio-economic analysis of commercial coconut growers. M.Sc. (Ag.) thesis, TamilNadu Agricultural University, Coimbatore, p.104

Vidya, C. 2000. Legume pod borer resistance and genetic divergence in domestic germplasm of yard long bean. M.Sc. (Ag.) thesis, Kerala Agricultural University, Trichur, p.121

Walke, P. K., Wangikar, S.D. and Raut, A.C. 2002. Knowledge and adoption of recommended practices of banana crop. *Maharastra J. Ext. Edn.* 14:201-204

Waman, G. K., Patil, P.S. and Patil, P.G. 1998. Adoption of onion production technologies and its correlates. *J.Maharastra Agric. Univ.* 23: 154-156

Witcombe, J.R., Joshi, A. and Joshi, K.D. 1996. Farmer participatory crop improvement-I: Varietal selection and breeding methods and their impact on biodiversity. *Exp.Agric.* 32:445-460

* Originals not seen

APPENDICES

APPENDIX – I
Interview schedule - English

KERALA AGRICULTURAL UNIVERSITY
College of Horticulture
Vellanikkara - 680 656, Trichur, Kerala

I) PROFILE OF THE VEGETABLE GROWERS:

1.Name and Address:

2.Age:

3.Major vegetables grown on commercial basis:

.....

4.Farming experience in vegetable cultivation: ..... Years

5.Area

5.1. Total:.....cents

5.2.Vegetable area:..... cents

6.Educational status:.....

7.Irrigation potential: (Put ✓ Mark)

Throughout the year	Only during season	Unassured and irregular water availability

8.Availability of farm inputs: (Put ✓ Mark)

Sl.No.	Items	Adequacy			Periodicity		
		Adequate	Moderate	Inadequate	Always	Seasonal	Occasional
1.	Seeds and planting materials						
2.	Manures and fertilizers						
3.	PP chemicals						
4.	Others (Please specify)						

9.Social participation: (Put ✓ Mark)

Sl.No.	Organization	Member	Office bearer	Frequency of meeting attended		
				Regularly	Occasionally	Never
1.	Panchayat					
2.	Cooperative society					
3.	*Padasekaram*					
4.	*Harithasangam*					
5.	KHDP					
6.	Others (Please specify)					

10.Information source utilisation: (Put ✓ Mark)
How often do you use the following information sources?

Sl.No.	Sources	Whenever needed	At times needed	Never
1.	Mass media sources (TV, Radio, News paper, Farm publication)			
2.	Kerala Agricultural University (Scientists)			
3.	*Krishibhavan* (Agricultural officers and Agricultural assistants)			
4.	KHDP			
5.	Friends and relatives			
6.	Others (Please specify)			

II) IDENTIFICATIION AND PRIORITIZATION OF PROBLEMS / CONSTRAINTS IN COMMERCIAL VEGETABLE FARMING: (Give a score out of 10 by considering the severity of each problem)

PROBLEMS / CONSTRAINTS COMMON TO ALL VEGETABLES:

Sl.No	PROBLEMS / CONSTRAINTS	SCORE
1.	No local market facility	
2.	Low local demand and low market price	
3.	Difficulties in getting timely good quality seeds	
4.	Capital inadequacy while establishing the farm	
5.	Inability in identifying and diagnosing insect pests and diseases	
6.	Difficulties in marketing the produce to distant markets	
7.	Damage and loss while transporting the produce	
8.	Insufficient quality control of farm inputs viz. PP chemicals, manures and fertilizers, seeds, etc.	
9.	Difficulties in timely soil testing	
10.	Non-availability of soil/location specific technologies	
11.	Lack of awareness about locally suitable varieties	
12.	Non-availability of good quality neem oil	
13.	Purchasing the PP chemicals based on the advise of the pesticide sellers	
14.	High cost of PP chemicals	

BITTERGOURD:

Sl.No	PROBLEMS / CONSTRAINTS	SCORE
1.	Yellowing and stunting (mosaic)	
2.	Green Jassids (severe during summer, less in rainy season)	
3.	Fruit rotting (tip of the fruits) during rainy season	
4.	Green fruit borer (1 inch length, half inside and half out side while feeding)	
5.	Leaf eating caterpillar (Green colour, 2cm long)	
6.	Yellow hairy grub, *Epilachna* beetle	
7.	Fruit fly	
8.	Gall fly	
9.	Leaf spot (*Cercospora,Alternaria*)	
10	Collar rot	
11.	Uneven fruit size (Fruit curling during summer)	
12.	Yellowing of fruit surface during April-May	

SNAKEGOURD:

Sl.No	PROBLEMS / CONSTRAINTS	SCORE
1.	Leaf eating caterpillar (Green colour) occurs regularly	
2.	Stem borer (Drying of plants) at fruiting stage	
3.	Fruit fly	
4.	Leaf spot	
5.	White larvae – Stem cracking	
6.	Red pumpkin beetle	
7.	Yellowing and spots on leaves	
8.	General yellowing, Upward leaf drying and falling of leaves (More during winter)	
9.	Bulging of stem (bottom region) – Vine borer	

CHILLIES:

Sl.No	PROBLEMS / CONSTRAINTS	SCORE
1.	Wilting	
2.	Top drying and stunted growth	
3.	Mosaic disease	
4.	Leaf fall due to mites attack	
5.	Fruit borer	
6.	Premature fruit drop	

AMARANTHUS:

Sl.No	PROBLEMS / CONSTRAINTS	SCORE
1.	Leaf eating caterpillar	
2.	Yellowing during high soil moisture	
3.	Bolting during summer	
4.	Leaf spot	

COWPEA:

Sl.No	PROBLEMS / CONSTRAINTS	SCORE
1.	Aphids attack	
2.	Fruit shortening (No seeds at the tip of the pod)	
3.	Black arm disease	

4.	Fruit borer	
5.	White flies	
6.	Stunting – Mosaic	
7.	Leaf miner	
8.	Wilting	
9.	Flower drop during rainy season	

BRINJAL:

Sl.No	PROBLEMS / CONSTRAINTS	SCORE
1.	Shoot and Fruit borer	
2.	Leaf folder	
3.	*Epilachna* grub	
4.	Damping off	

BHINDI:

Sl.No	PROBLEMS / CONSTRAINTS	SCORE
1.	Yellow-vein mosaic	
2.	Shoot and Fruit borer	
3.	Leaf folder	
4.	Flower shedding	
5.	Leaf eating caterpillar	

COCCINEA:

Sl.No	PROBLEMS / CONSTRAINTS	SCORE
1.	Stunting – Mosaic	
2.	Leaf eating caterpillar (Green colour)	
3.	Fruit fly	
4.	Problem in maintaining *panthals*	
5.	White fly	
6.	Flower and fruit drop during rainy season	
7.	Long light green fruited plants are highly susceptible to mosaic	

III) KNOWLEDGE LEVEL OF THE IDENTIFIED TECHNOLOGIES IN COMMERCIAL VEGETABLE FARMING

SL.NO.	ITEMS	RESPONSE
1.	.....is the home made material used as a carrier with pesticides to control fruit flies in bittergourd, snakegourd and coccinea.	
2.	Can carbaryl control epilachna effectively? (Yes/No)	
3.	.....is the important symptom of mosaic disease?	
4.	When carbaryl is applied to control red pumpkin beetle in snakegourd?	
5.	Spraying mancozeb@0.2% controls downy mildew effectively in snakegourd (T/F)	
6.	Manjari,Ujwala and Anugraha are the bacterial wilt resistant varieties of chillies (T/F)	
7.	Dimethoate is an effective miticide (T/F)	
8.	Planting in the raised beds can prevent yellowing during high soil moisture in amaranth (T/F)	
9.	Malathion @0.1% can control the severe leaf webber damage in amaranth (T/F)	
10.	Bran based *Fusarium pallidoroseum* is effective against black pea aphids of cowpea (T/F)	
11.	.....is the pesticide used to control pod borer in cowpea?	
12.	Thin sowing will increase the damping off incidence in brinjal (T/F)	
13.	Which is the pesticide used to control fruit and shoot borer in brinjal and bhindi?	
14.	Soil application of carbofuran/phorate followed by the foliar spray of neem based pesticide can control the insect pests in bhindi and brinjal (T/F)	
15.	Mosaic affected plants can be cured (T/F)	

III) ADOPTION LEVEL OF THE IDENTIFIED TECHNOLOGIES IN COMMERCIAL VEGETABLE FARMING

SL. NO.	TECHNOLOGIES	ADOPTION LEVEL			DEVIATION IF ANY
		Adoption	Partial adoption	Non adoption	
1	To control fruit flies in bittergourd, snakegourd and coccinea remove and destroy affected and decayed fruits. Apply carbaryl 10% DP in pits before sowing to destroy pupae. Apply carbaryl 0.2% or malathion 0.2% suspension containing sugar or jaggery @ 10g/l at fortnightly interval at flowering and fruiting stage. Keep banana fruit traps prepared by using carbofuran granules, replace it after 7-9 days.				
2	To control *Epilachna* beetles in bittergourd and snakegourd remove and destroy egg masses, grubs and adults. Spray carbaryl 0.2%.				
3	To control mosaic disease in bittergourd, snakegourd and chillies uproot and destroy the affected plants and collateral hosts. Control the vector by spraying 0.05% dimethoate or phospomidan.				
4	To control red pumpkin beetle in snakegourd incorporate carbaryl 10% DP in pits before sowing to destroy the grubs and pupae.				
5	To control downy mildew in snakegourd uproot and destroy the affected plant parts. Spray mancozeb 0.2% (waiting period is 3 days)				
6	To control bacterial wilt in chillies cultivate resistant varieties viz. Manjari, Ujwala and Anugraha.				
7	To control mites in chillies apply dimethoate 0.05%.				

8.	To avoid yellowing in amaranth during high soil moisture planting should be done on raised beds.				
9.	As far as possible, avoid pesticides in amaranth. During severe incidence of leaf webber spray malathion 0.1% or dust malathion 10% DP				
10.	To control black pea aphid in cowpea apply bran based *Fusarium pallidoroseum* 3kg /400m^2(or) spray malathion 0.05% or quinalphos 0.03%.				
11.	To control pod borer in cowpea apply carbaryl 0.2% or fenthion 0.05%. pick the pods only 10 days after application.				
12.	To control damping off in brinjal sow the seeds as thin as possible on raised beds in open area during summer.				
13.	To control shoot and fruit borer in brinjal and bhindi remove all drooping shoots and damaged fruits. Spray carbaryl 0.15% with an interval of 15-20 days.				
14.	To control insect pests in bhindi and brinjal apply carbofuran granules 0.5kg ai/ha or phorate 1kg ai/ha at seeding followed by neem spray.				
15.	To control yellow vein mosaic in bhindi destroy host weeds *(Croton sparsiflora* and *Ageratum sp.)*. Cultivate resistant varieties viz. Arka Anamika, Arka Abhay and Susthira.				

കേരള കാർഷിക സർവ്വകലാശാല

ഹോർട്ടികൾച്ചർ കോളേജ്

വെള്ളാനിക്കര – തൃശൂർ

I. പച്ചക്കറി കർഷകന്റെ വിശദ വിവരങ്ങൾ :

1. പേരും മേൽവിലാസവും :–

2. വയസ് :

3. വാണിജ്യാടിസ്ഥാനത്തിൽ മുഖ്യമായി കൃഷി ചെയ്യുന്ന പച്ചക്കറി വിളകൾ :

.....

4. പച്ചക്കറി കൃഷിയിലുള്ള അനുഭവം ..... വർഷത്തിൽ

5. വിസ്തൃതി :

ആകെ വിസ്തൃതി: ..... സെന്റ്. പച്ചക്കറി വിളകൾ: ..... സെന്റ്

6. വിദ്യാഭ്യാസ നിലവാരം :.....

7. ജലസേചനത്തിന്റെ ലഭ്യത (✓ മാർക്കിടുക)

വർഷം മുഴുവനും	പ്രത്യേക സീസണിൽ മാത്രം	ഉറപ്പില്ലാത്ത, അസ്ഥിരമായ ജലലഭ്യത

8. കൃഷിക്കാവശ്യമായിട്ടുള്ള ഘടകങ്ങളുടെ ലഭ്യത (✓ മാർക്കിടുക)

ക്രമ നമ്പർ	തരങ്ങൾ	ലഭ്യത			കാലപരിധി (സമയ പരിധി)		
		ആവശ്യത്തിന്	മിതമായി	തികയാത്തത്	എല്ലായ് പ്പോഴും	സീസണിൽ മാത്രം	വല്ലപ്പോഴും
1	വിത്തും, നടീൽ വസ്തുക്കളും						
2	ജൈവ വളങ്ങളും, രാസവളങ്ങളും						
3.	സസ്യ സംരക്ഷണ മരുന്നുകൾ						
4.	മറ്റുത്പന്നങ്ങൾ						

9. സാമൂഹ്യ പങ്കാളിത്തം (✓ മാർക്കിടുക) :

ക്രമ നമ്പർ	സംഘടന	അംഗം	ഔദ്യോഗിക ഭാരവാഹി	യോഗങ്ങളിൽ പങ്കെടുക്കുന്ന വിവരം		
				സ്ഥിരമായി	ഇടക്കിടക്ക്	ഒരിക്കലുമില്ല
1.	പഞ്ചായത്ത്					
2.	സഹകരണ സൊസൈറ്റി					
3.	പാടശേഖരം					
4.	ഹരിതസംഘം					
5.	കെ.എച്ച്.ഡി.പി.					
6.	മറ്റു സംഘടനകൾ					

10. വിവരങ്ങളുടെ ശരിയായ വിനിയോഗം (✓ മാർക്കിടുക) :

കൃഷിയാവശ്യത്തിനുവേണ്ടി താഴെ പറയുന്ന വിവര സ്രോതസുകളെ നിങ്ങൾ എത്രത്തോളം ഉപയോഗിക്കുന്നുണ്ട്?

ക്രമ നമ്പർ	സ്രോതസ്സുകൾ	ആവശ്യം വരുമ്പോൾ	ചിലപ്പോൾ	ഒരിക്കലുമില്ല
1.	ടിവി/റേഡിയോ/പത്രമാസികകൾ			
2.	കേരള കാർഷിക സർവ്വകലാശാല			
3.	കൃഷിദവൻ			
4.	കെ.എച്ച്. ഡി.പി.			
5.	സുഹൃത്തുക്കളും, ബന്ധുക്കളും			
6.	മറ്റുള്ളവർ			

II. വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറി കൃഷിയുടെ പ്രശ്നങ്ങൾ:

(പ്രശ്നങ്ങളുടെ പ്രാധാന്യമനുസരിച്ച് ഓരോ പ്രശ്നത്തിനും പത്തിൽ മാർക്കിടുക).

ക്രമ നമ്പർ	പ്രശ്നങ്ങൾ	മാർക്ക്
1	പ്രാദേശിക വിപണിയുടെ അഭാവം	
2.	പ്രാദേശികമായ ആവശ്യകതയില്ലായ്മയും, വിപണിയിലെ വിലകുറവും	
3.	ഗുണമേന്മയേറിയ വിത്തിന്റെ യഥാസമയത്തുള്ള ലഭ്യതയില്ലായ്മ	
4.	തോട്ടമുണ്ടാക്കുന്നയവസരത്തിൽ മുതൽ മുടക്കിനുള്ള ലഭ്യത കുറവ്	
5.	കീടരോഗങ്ങളെ തിരിച്ചറിയാനും, നിയന്ത്രിക്കാനുമുള്ളയറിവിന്റെ അഭാവം	
6.	ഉത്പന്നങ്ങൾ ദൂര വിപണിയിലെത്തിക്കുന്നതിലുള്ള ബുദ്ധിമുട്ട്	
7.	ഉത്പന്നങ്ങൾ കയറ്റിയയക്കുമ്പോഴനുഭവപ്പെടുന്ന നാശ നഷ്ടങ്ങൾ	
8.	സസ്യ സംരക്ഷണ വസ്തുക്കൾ, രാസ ജൈവ വളങ്ങൾ, വിത്തുകൾ, എന്നിവയുടെ ഗുണ നിയന്ത്രണത്തിലുള്ള അപര്യാപ്തത	
9.	യഥാസമയത്ത് മണ്ണുപരിശോധന ചെയ്യാനാവാത്ത അവസ്ഥ	
10.	മണ്ണിനും, ഓരോ പ്രദേശത്തിനും യോജിച്ച വിധത്തിലുള്ള സാങ്കേതിക വിദ്യയുടെ കുറവ്	
11.	പ്രദേശത്തിനനുയോജ്യമായ ഇനങ്ങളെക്കുറിച്ചുള്ള കർഷകരുടെ അറിവില്ലായ്മ	
12.	ഗുണമേന്മയടങ്ങിയ വേപ്പണ്ണയുടെ ലഭ്യത കുറവ്	
13.	കീടനാശിനി വിൽപനക്കാരുടെ ഉപദേശത്തിനനുസരിച്ച് സസ്യകീടരോഗ മരുന്നുകൾ വാങ്ങുന്ന സ്വഭാവം	
14.	സസ്യ സംരക്ഷണ മരുന്നുകളുടെ വർദ്ധിച്ച വില	
പാവൽ :		
1.	മഞ്ഞളിക്കൽ, മുരടിപ്പ് (മൊസേക്കു രോഗം/നരപ്പ്)	
2.	പച്ചത്തുള്ളൻ - വേനലിൽ രൂക്ഷം	
3.	കായ്ചീയൽ - കായയുടെ ചുണ്ട് (മൂട്) ചീയൽ - മഴക്കാലത്ത് രൂക്ഷം	
4.	തുളച്ചു കയറുന്ന പച്ചപ്പുഴു - ഒരിഞ്ച് നീളം വരുന്ന പുഴു, പകുതി കായയുടെ ഉള്ളിലും, പകുതി പുറത്തുമായിരുന്നു കായ് തിന്നുന്നു.	
5.	ഇലതീനിപ്പുഴു, പച്ചനിറം, ഒന്നു സെന്റീ മീറ്റർ നീളം	
6.	എപ്പിലാക്നാവണ്ടും, മഞ്ഞരോമമുള്ള കുട്ടി വണ്ടും	
7.	കായീച്ച	
8.	തണ്ട് വണ്ണം ഉണ്ടാക്കുന്ന ഗ്വാളീച്ച	
9.	ഇലപ്പുള്ളി രോഗം - ഇലയുടെ അരിക് വഴി കരിച്ചിൽ തുടങ്ങി, താഴെനിന്നും മുകളിലേക്ക് കയറി, മൊത്തത്തിൽ കരിഞ്ഞുണങ്ങുന്നു.	
10.	ചെടിയുടെ കട അഴുകൽ	
11.	വേനലിൽ വളഞ്ഞ കായ്കൾ കാണുന്നു. ഒരേ വലിപ്പത്തിലുള്ള കായ്കൾ കിട്ടാറില്ല.	
12.	ഏപ്രിൽ, മെയ് മാസങ്ങളിൽ കായ്കളുടെ മുകളിലായി മഞ്ഞളിപ്പ്	

പടവലം :

1.	പച്ചനിറത്തിലുള്ള ഇലതീനിപ്പുഴു	
2.	തണ്ടുതുരപ്പൻ - കായ് വരുന്നയവസരത്തിൽ തണ്ടുണങ്ങാൻ തുടങ്ങുന്നു.	
3.	കായീച്ച	
4.	ഇലപ്പുള്ളിരോഗം	
5.	തണ്ട് വിണ്ടു കീറുന്നു. അകത്ത് വെളുത്ത പുഴുവിനെ കാണാം.	
6.	സാമി കളറുള്ള വണ്ട്	
7.	മഞ്ഞളിപ്പും, ഇലപ്പുള്ളി രോഗവും	
8.	മഞ്ഞളിപ്പ്, ഇലകരിഞ്ഞ് മൊരിഞ്ഞ് പോവുക.	
9.	തണ്ട് വണ്ണം വെയ്ക്കൽ - അടി ഭാഗത്ത്	

മുളക് :

1.	വാട്ടരോഗം	
2.	തലപ്പുണങ്ങി കുറ്റിയാകുന്നു	
3.	മൊസേക്ക്	
4.	മണ്ഡരിബാധ നിമിത്തം വരുന്ന ഇലകൊഴിയൽ	
5.	കായ് തുരപ്പൻ	
6.	ഇളയ കായ്കൾ കൊഴിച്ചിൽ (അകാലിക കായ്കൊഴിയൽ)	

ചീര :

1.	ഇല തീനിപ്പുഴു	
2.	ഇല മഞ്ഞളിപ്പ്, മണ്ണിൽ നല്ല തണുപ്പ് (നനവ്) ഉള്ളപ്പോൾ	
3.	വേനലിൽ നേരത്തെയുള്ള പുഷ്പിക്കൽ	
4.	ഇലപ്പുള്ളി രോഗം	

പയർ :

1.	മുഞ്ഞ (എഫിഡ്)	
2.	പയറിന്റെ നീളം കുറഞ്ഞ് കായ്യുടെ അറ്റത്ത് പയർ മണിയില്ലാത്തത്	
3.	തണ്ടിൽ മന്തുരോഗം	
4.	കായ് തുരപ്പൻ	
5.	വെള്ളീച്ചകൾ (കൂട്ടമായിട്ട് കാണുന്നു)	
6.	മുരടിപ്പ്, നരപ്പ് (മൊസേക്ക് രോഗം)	
7.	ചിത്രകീടം	
8.	വാട്ട രോഗം	
9.	മഴക്കാലത്ത് പൂക്കൊഴിച്ചിൽ	

വഴുതിന :

1.	തണ്ടും, കായും തുരക്കുന്ന പുഴു	
2.	ഇലമടക്കി (ചുരുട്ടി)പ്പുഴു	
3.	എപ്പിലാക്നാവണ്ട്	
4.	കട ചീയൽ	

വെണ്ട :

1.	ഞെരമ്പ് മഞ്ഞളിപ്പ് രോഗം (മൊസേക്ക്)	
2.	തണ്ടും കായും തുരക്കുന്ന പുഴുക്കൾ	
3.	ഇല മടക്കി	
4.	പുക്കൊഴിച്ചിൽ	
5.	ഇലതീനി പുഴുക്കൾ	

കോവൽ :

1.	മുരടിപ്പ് (മൊസേക്ക്) - നരപ്പ് രോഗം	
2.	പച്ച ഇലതീനിപ്പുഴു	
3.	കായീച്ച	
4.	പന്തലിന് വരുന്ന രോഗബാധ	
5.	വെള്ളീച്ച (കൂട്ടമായി കാണുന്നു)	
6.	മഴക്കാലത്തുള്ള പൂവും, കായും കൊഴിച്ചിൽ	
7.	നീളമേറിയതും, ഇളം പച്ചനിറത്തിലുള്ളതുമായ കായ്കൾക്ക് മൊസേക്കുരോഗം കൂടുതലാണ്	

III. വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറി കൃഷിയിലെ സാങ്കേതിക വിദ്യയുടെ വിജ്ഞാന തലങ്ങൾ:

ക്രമ നമ്പർ	ഇനങ്ങൾ	
1.	പാവൽ, പടവലം, കോവൽ എന്നീ വിളകളിലെ കായീച്ചശല്യം നിയന്ത്രിക്കാനായി കീടനാശിനി യോടൊപ്പം ചേർത്തുപയോഗിക്കുന്നതിനുള്ള വീട്ടിൽ വെച്ചുതന്നെ തയ്യാറാക്കുന്ന വസ്തുവാണ്	
2.	കാർബാറിലിന് എഫിലാക്നാ വണ്ടിനെ ശരിയ്ക്കു നിയന്ത്രിക്കാനാവുമോ? (ഉവ്വ്/ഇല്ല)	
3.	മൊസേക്കു രോഗത്തിന്റെ പ്രധാന ലക്ഷണം .... ആണ്	
4.	പടവലത്തിലെ ചെമ്മന മത്തൻ വണ്ടിനെ നിയന്ത്രിക്കാനായിട്ടെപ്പോഴാണ് കാർബാറിൽ പ്രയോഗിക്കുന്നത്?	
5.	പടവലത്തിലെ അടിപൂപ്പ് രോഗം നന്നായി നിയന്ത്രിക്കാനായി മാൻകോസെബ് ദശാംശം രണ്ട് ശതമാനം വീര്യത്തിൽ തളിച്ചാൽ മതി (ശരി/തെറ്റ്)	
6.	മഞ്ജരി, ഉജ്വല, അനുഗ്രഹ എന്നിവ ബാക്ടീരിയാവാട്ട പ്രതിരോധ ശക്തിയുള്ള മുളകിനങ്ങളാണ് (ശരി/തെറ്റ്)	
7.	ഡൈമെത്തേറ്റ് മികച്ചൊരു മണ്ഡരി നാശിനിയാണ്. (ശരി/തെറ്റ്)	
8.	ചീര കൃഷിയിടത്തിലെ മണ്ണിലെ കൂടിയ നനവു നിമിത്തം വരുന്ന മഞ്ഞളിപ്പ് രോഗം തടയാനായി ഉയർന്ന തവാരണയിൽ ചീര തൈനട്ടാൽ മതി (ശരി/തെറ്റ്)	
9.	ചീരയിലെ രൂക്ഷമായ ഇലമടക്കി കീടശല്യം നിയന്ത്രിക്കാൻ ദശാംശം ഒരു ശതമാനം വീര്യം വരുന്ന മാലത്തിയോൺ തളിക്കുന്നതു നല്ലതാണ് (ശരി/തെറ്റ്)	
10.	പയറിലെ കറുത്ത മുഞ്ഞ ശല്യത്തിനെ നിയന്ത്രിക്കാൻ തവിടിൽ ചേർത്തിയ *ഫ്യൂസേറിയം പാലിഡോറോസിയം* കുമിൾ മിശ്രിതം ഫലപ്രദമാണ് (ശരി/തെറ്റ്)	
11.	പയറിലെ കായ് തുരപ്പനെ നിയന്ത്രിക്കാനായിട്ടുപയോഗിച്ചു വരുന്ന കീടനാശിനിയാണ്	
12.	ഇടതിങ്ങാതെ വിത്തിടുന്നത് വഴുതിനയിലെ കടചീയൽ രോഗം വർദ്ധിപ്പിക്കും (ശരി/തെറ്റ്)	
13.	വഴുതിന, വെണ്ടയ്ക്ക എന്നീ വിളകളിലെ കായും, തണ്ടും തുരക്കുന്ന കീടത്തെ നിയന്ത്രി ക്കാനേറ്റവും നല്ല കീടനാശിനിയേത്?.....	
14.	വെണ്ടയ്ക്ക, വഴുതിന എന്നീ വിളകളിലെ കീടങ്ങളെ നിയന്ത്രിക്കാനായി മണ്ണിൽ കാർബോഫുറാൻ, അല്ലെങ്കിൽ ഫോറേറ്റ് ചേർത്തിളക്കിയശേഷം, വേപ്പടിസ്ഥാനമാക്കിയുള്ള കീടനാശിനി തളിച്ചാൽ മതി (ശരി/തെറ്റ്)	
15.	മൊസേക്ക് രോഗബാധ വന്ന ചെടികളെ രക്ഷപ്പെടുത്താം (ശരി/തെറ്റ്)	

IV. വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറി കൃഷിയിലെ സാങ്കേതിക വിജ്ഞാനങ്ങളുടെ ഉപയോഗതലങ്ങൾ:

(✓ മാർക്കിടുക)

നമ്പർ ക്രമ	സാങ്കേതിക വിജ്ഞാനങ്ങൾ	ഉപയോഗ തലങ്ങൾ			വ്യതിയാനങ്ങൾ വല്ലതുമുണ്ടെങ്കിൽ
		ഉപയോഗിക്കുന്നുണ്ട്	ഭാഗികമായ ഉപയോഗം	ഉപയോഗിക്കുന്നില്ല	
1	പാവലിലെ കായീച്ച ശല്യം നിയന്ത്രിക്കുവാനായി കാർബാറിൽ 10 ശതമാനം തൂവുന്ന പൊടിരൂപത്തിലുള്ള മിശ്രിതം വിത്ത് കുത്തിയിടുന്നതിന് മുമ്പായി കുഴിയിൽ ചേർത്തിളക്കുന്നത് നല്ലതാണ്. രണ്ടാഴ്ചയിടവിട്ട് പാവൽ പൂവിടുന്ന അവസരത്തിലും ദശാംശം രണ്ട് ശതമാനം വീര്യമുള്ള കാർബറിൽ അല്ലെങ്കിൽ ദശാംശം രണ്ട് ശതമാനം വീര്യമുള്ള മാലത്തിയോൺ, പത്ത് ഗ്രാം ശർക്കരയോ, പഞ്ചസാരയോ, ഒരു ലിറ്റർ വെള്ളത്തിൽ കലക്കി ഇലയുടെ അടിയിൽ വലിയ കണികകളായി തളിക്കുന്നത് നല്ലതാണ്.				
	പാളയൻ കോടൻ പഴത്തിൽ ഫുറഡാൻ തരികൾ മുക്കി തോട്ടത്തിൽ കെണിയായി വെക്കാം. ഈ കെണി പാവൽ തോട്ടത്തിൽ ഏഴു മുതൽ ഒമ്പതു ദിവസത്തിന് ശേഷം, മാറ്റി പുതിയ കെണി വെക്കേണ്ടതാണ്. തുടക്കത്തിലേ കായീച്ച ശല്യം മനസ്സിലാക്കി കീടബാധയേറ്റ പാവയ്ക്ക പറിച്ച് തീയിട്ട് നശിപ്പിക്കണം. ഇതേ മാർഗ്ഗം തന്നെ ഉപയോഗിച്ച് പടവലത്തിലും, കോവലിലും കായീച്ച ശല്യം നിയന്ത്രിക്കാം.				
2.	പാവലിലും, പടവത്തിലുമുള്ള എഫിലാക്സ വണ്ടുകളുടെ ശല്യം നിയന്ത്രിക്കാൻ മുട്ടക്കൂട്ടം, ചെറിയ കുഞ്ഞുങ്ങൾ, പ്രായമെത്തിയ വണ്ടുകൾ, ഇവയെ നീക്കിയിട്ട് നശിപ്പിക്കുന്നത് നല്ലതാണ്. ഇതിനുപുറമെ, ദശാംശം രണ്ടു ശതമാനം കാർബാറിൽ തളിച്ചും ഇവയെ നശിപ്പിക്കാം.				
3.	പാവൽ, പടവലം, പച്ചമുളക് എന്നിവയിൽ വരുന്ന നരപ്പ് രോഗത്തിനെ നിയന്ത്രിക്കാനായി, രോഗ വാഹകരായ കീടത്തിനെ നശിപ്പിക്കണം. ഇതിനായി ദശാംശം പൂജ്യം അഞ്ചു ശതമാനം ഡൈമെത്തോയിറ്റോ, അല്ലെങ്കിൽ ഫോസ്ഫാമിഡോണോ തളിച്ചു കൊടുക്കണം. നരപ്പ് രോഗം ബാധിച്ചു നിൽക്കുന്ന ചെടികളെ പിഴുതു നീക്കി നശിപ്പിക്കണം. രോഗം പരത്താൻ സഹായിക്കുന്ന കള സസ്യങ്ങളെയും നശിപ്പിക്കണം.				

ക്രമ നമ്പർ	സാങ്കേതിക വിജ്ഞാനങ്ങൾ	ഉപയോഗ തലങ്ങൾ			വ്യതിയാനങ്ങൾ വല്ലതുമുണ്ടെങ്കിൽ
		ഉപയോഗിക്കുന്നുണ്ട്	ഭാഗികമായ ഉപയോഗം	ഉപയോഗിക്കുന്നില്ല	
4.	പടവലത്തിലെ ചെമന്ന മത്തൻ വണ്ടിനെ നിയന്ത്രിക്കാനായി കാർബാറിൽ പത്തു ശതമാനം പൊടി, ചെടിച്ചുവട്ടിലെ തടത്തിൽ ചേർത്താൽ മതി. ഇതു വിത്തിടുന്നതിനുമുമ്പു തന്നെ ചെയ്താൽ, വണ്ടിന്റെ ആദ്യഘട്ടവും, പുഷ്പയും നശിക്കും.				
5.	വർഷക്കാലത്ത് പടവലത്തിലെ മഞ്ഞനിറം ബാധിച്ച ഇല പൊട്ട് രോഗം (അടിപൂപ്പ് രോഗം) നിയന്ത്രിക്കാൻ ദശാംശം 2 ശതമാനം വീര്യം വരുന്ന മാങ്കോ സെബ് തളിക്കുന്നത് നല്ലതാണ്. മരുന്നു തളിച്ചു മൂന്നു ദിവസം കഴിഞ്ഞാലിത് വിപണിയിലെത്തിക്കാം.				
6.	പച്ചമുളകിൽ വരുന്ന ബാക്ടീരിയാവട്ടം കണ്ടാൽ ഉടൻ തന്നെ അത്തരം ചെടികൾ പിഴുതുനീക്കി നശിപ്പിക്കണം. രോഗപ്രതിരോധശേഷിയുള്ള പച്ചമുളകിനങ്ങളായ മഞ്ജരി, ഉജ്വല, അനുഗ്രഹ എന്നിവ കൃഷിയിറക്കണം.				
7.	മുളകിലെ മണ്ഡരി ശല്യത്തിനെതിരെ ഡൈമെത്തേയിറ്റ് ദശാംശം പൂജ്യം അഞ്ചു ശതമാനം വീര്യത്തിൽ തളിച്ചാൽ മതി.				
8.	കുടിയ നനവുള്ളയവസരത്തിൽ ചീര, മഞ്ഞളിക്കാതിരിക്കാനായി നല്ല ഉയർത്തിയ തവാരണയിൽ ചീര തൈ നട്ടാൽ മതി.				
9.	ചീരയിലെ ഇല മടക്കി കീടശല്യം വളരെ രൂക്ഷമായാൽ ദശാംശം ഒരു ശതമാനം വീര്യം വരുന്ന മാലത്തിയോൺ തളിച്ചോ, പത്തു ശതമാനം മാലത്തിയോൺ പൊടിതുവിയോ നിയന്ത്രിക്കാം. കഴിയുന്നതും, ചീരയിൽ രോഗ കീടനാശിനികൾ തളിക്കാതിരിക്കുന്നതാണുചിതം.				
10.	അച്ചിങ്ങാപ്പയറിലെ കറുത്ത പയർ മുഞ്ഞ ശല്യത്തിനെ നിയന്ത്രിക്കാൻ ജൈവിക നിയന്ത്രണ കുമിളായ *ഫ്യൂസേറിയം പല്ലിഡോറോസിയം*, അരി തവിടിലടങ്ങിയ മിശ്രിതം, നാനൂറ് ചതുരശ്ര മീറ്ററിന് മൂന്ന് കിലോയെന്ന കണക്കിൽ കീടബാധ കണ്ടയുടനെ പ്രയോഗിക്കണം. ഇതല്ലെങ്കിൽ ദശാംശം പൂജ്യം അഞ്ചു ശതമാനം മാലത്തിയോണോ, ദശാംശം പൂജ്യം മൂന്നു ശതമാനം ക്യൂനാൽഫോസോ തളിക്കണം.				

ക്രമ നമ്പർ	സാങ്കേതിക വിജ്ഞാനങ്ങൾ	ഉപയോഗ തലങ്ങൾ			വ്യതിയാനങ്ങൾ വല്ലതുമുണ്ടെങ്കിൽ
		ഉപയോഗിക്കുന്നുണ്ട്	ഭാഗികമായ ഉപയോഗം	ഉപയോഗിക്കുന്നില്ല	
11.	അച്ചിങ്ങാപ്പയറിലെ കായ് തുരപ്പനെ നിയന്ത്രിക്കാനായി ദശാംശം 2 ശതമാനം കാർബാറിലോ ദശാംശം പൂജ്യം അഞ്ചുശതമാനം ഫെൻത്തയോൺ എന്ന കീടനാശിനിയോ തളിച്ചാൽ മതി. മരുന്നടിച്ച ശേഷം 10 ദിവസം കഴിഞ്ഞു മാത്രമേ പയർ പറിച്ചെടുക്കാവൂ.				
12.	വഴുതിനയിലെ തൈ അഥവാ ചെടിയഴുകൽ രോഗത്തിനെ നിയന്ത്രിക്കാൻ വേനലിൽ തവാരണ തയ്യാറാക്കുന്നത് നല്ല സൂര്യപ്രകാശം കിട്ടുന്ന ഭാഗത്തായിരിക്കണം. വിത്തു പാകുന്നത് തിങ്ങിയായിരിക്കരുത്. നല്ല ഉയർന്ന തവാരണയാണുണ്ടാക്കേണ്ടത്.				
13.	വഴുതിന, വെണ്ടയ്ക്ക എന്നിവയിലെ കായും, തണ്ടും തുരക്കുന്ന കീടത്തിനെ നിയന്ത്രിക്കാൻ, കീടബാധ വന്നയെല്ലാ കായ്കളും, വാടി നിൽക്കുന്ന ചെടി, തണ്ടു സഹിതം നീക്കി നശിപ്പിക്കണം. ദശാംശം 15 ശതമാനം വീര്യം വരുന്ന കാർബാറിൽ എന്ന കീടനാശിനി 15 മുതൽ 20 ദിവസത്തെ ഇടവേളയിൽ തളിച്ചു കൊടുത്താലും ഇവയെ നിയന്ത്രിക്കാം.				
14.	വഴുതിന, വെണ്ടയ്ക്ക എന്നിവയിലെ മറ്റു കീടങ്ങളെ നശിപ്പിക്കാൻ കാർബോഫുറാൻ തരി രൂപത്തിലുള്ളത് ദശാംശം 5 കിലോ മരുന്ന് ഒരു ഹെക്ടറിനെന്ന തോതിൽ ചേർത്താൽ മതി. അല്ലെങ്കിൽ ഫോറേറ്റ് എന്ന തരി രൂപ മരുന്ന് 1 കിലോ ഒരു ഹെക്ടറിന് എന്ന തോതിൽ വിത്തിടുമ്പോൾ ചേർക്കണം. ഇതിനുശേഷം വേപ്പെണ്ണയടങ്ങിയ ലായനി തളിക്കുന്നതും നല്ലതാണ്.				
15.	വെണ്ടയിലെ മാരക രോഗമായ ഞെരമ്പു മഞ്ഞളിപ്പ് രോഗം (നരപ്പ്) തടയാൻ, കൃഷിയിടത്തിലെ കളച്ചെടികളെ നശിപ്പിക്കണം. രോഗപ്രതിരോധശേഷിയുള്ള വെണ്ടയിനങ്ങളായ അർക്ക അനാമിക, അർക്കാ അഭയ്, സുസ്ഥിര എന്നിവ കൃഷിയിറക്കാനും ശ്രദ്ധിക്കണം.				

APPENDIX – III
Farmer's profile analysis

KERALA AGRICULTURAL UNIVERSITY
College of Horticulture
Vellanikkara - 680 656, Trichur, Kerala

Dr. Joy Mathew
Associate professor

Department of Agricultural Extension
Date: 06-03-2003

Sir/madam,

Sri. Kamalakkannan, K, one of the postgraduate students of this department is undertaking a research study entitled "Research and extension gaps in commercial vegetable farming in eastern Palakkad" as part of his research work. After extensive review of the available literature and discussion with extension scientists variables supposed to have close association with the study have been identified.

Considering your vast experience and professional expertise you have been selected as a judge to rate the relevancy of the variables.

I request you to kindly spare some of your valuable time for examining the questionnaire critically and return the list duly filled at the earliest.

Thanking you.

Yours sincerely,

OBJECTIVES OF THE STUDY:

- To analyse the status and identify the problems/constraints in commercial vegetable farming in eastern Palakkad.
- It aims to explore the availability of appropriate technologies with the research system and gaps thereon to tackle the identified problems/constraints.
- To study the gaps in knowledge and adoption levels of the identified technologies and selected characteristics with respect to the vegetable growers.
- This study also envisages suggesting suitable strategies for commercial vegetable farming.

Sl.No.	Independent variables	Relevancy rating		
		Relevant	Less Relevant	Not relevant
1.	Age			
2.	Education			
3.	Annual income			
4.	Experience in vegetable farming			
5.	Farm size			
6.	Area under vegetable			
7.	Cropping intensity			
8.	Number of vegetables grown			
9.	Irrigation potential			
10.	Availability of farm inputs			
11.	Knowledge on vegetable farming			
12.	Land tenure status			
13.	Personal guidance on scientific farming			
14.	Innovativeness			
15.	Social participation			
16.	Extension contact			
17.	Scientific orientation			
18.	Credit orientation			
19.	Economic motivation			
20.	Risk orientation			
21.	Information source utilisation			
22.	Market orientation			
23.	Others, If any: Please specify			

Thank you

Name & Designation

APPENDIX – IV
Knowledge test

KERALA AGRICULTURAL UNIVERSITY
College of Horticulture
Vellanikkara - 680 656, Trichur, Kerala

Department of Agricultural Extension Date: June 9, 2003

Sir/madam,

Sri. Kamalakkannan, K, one of the postgraduate students of this department is undertaking a research study entitled "Research and extension gaps in commercial vegetable farming in eastern Palakkad" .As part of his research work he wants to construct a teacher made knowledge test to know the knowledge level of vegetable farmers from the *Harithasaghams* of Nemmara and Ayilur panchayats in Palakkad district. After reviewing the Package of Practices-Crops of KAU and discussions with scientists from various faculties the enclosed have been identified.

Considering your vast experience and professional expertise you have been selected as a judge to rate the difficulty level of the questions constructed in relevance with the identified technologies.

I request you to kindly spare some of your valuable time for examining the questionnaire critically and return the list duly filled at the earliest.

Thanking you.

Yours sincerely,

(Please give a score ranging from most difficult (5) to least difficult (1) for the statements A,B,..)

Sl.No.	ITEMS	SCORE				
		1	2	3	4	5
1	Fruit fly (Bitter gourd, Snake gourd, Coccinea) A. Baiting with banana fruits using carbofuran controls the fruit fly effectively (T/F) B. Give the name of pesticide, which is commonly used to control fruit flies? C. .....is the home made material used as an attractant with pesticides to control fruit fly D. Removal and destruction of affected fruits is the most effective control of fruit flies (T/F) E. .....pesticide is not recommended at flowering stage as it is harmful to honey bees?					
2	*Epilachna* beetle:(Bitter gourd, Snake gourd) A. Name the commonly used pesticide to control *Epilachna* beetle? B. Removal and destruction of egg masses, grubs and adults can control the *Epilachna* beetle effectively (T/F) C. Can carbaryl control *Epilachna* effectively? D. Carbaryl is applied at.....concentration to control epilachna beetle?					
3	Mosaic (Bitter gourd, Snake gourd and Chillies) A. Control of insect vectors can reduce the mosaic spread (T/F) B. Uprooting and destruction of affected plants reduces the disease spread (T/F) C. .....is the important symptom of mosaic disease?					
4	Red pumpkin beetle:(Snake gourd) A. Where carbaryl is applied to control red pumpkin beetle? B. When carbaryl is applied to control red pumpkin beetle? C. Incorporating the pesticide in pits at sowing controls the red pumpkin beetle (T/F) D. .....is the pesticide incorporated in soil to control red pumpkin beetle?					
5	Downy mildew:(Snake gourd) A. Waiting period for the mancozeb spray is..... B. Spraying mancozeb@0.2% controls downy mildew effectively (T/F) C. .....is the fungicide used to control downy mildew? D. What is the important symptom of downy mildew?					
6	Bacterial wilt: (Chillies) A. Cultivating the resistant varieties can reduce the wilt occurrence (T/F) B. Bacterial wilt resistant varieties are not available (T/F) C. Name one of the bacterial wilt resistant varieties in chillies? D. Manjari,Ujwala and Anugraha are the bacterial wilt resistant varieties (T/F)					

7	Mites: (Chillies) A. .....is the chemical used to control mites in chillies? B. Dimethoate is an effective miticide (T/F) C. ..... is the major symptom caused by mites attack?					
8	Yellowing during high soil moisture :(Amaranth) A. Planting in the raised beds can prevent yellowing during high soil moisture (T/F) B. Good drainage can prevent yellowing during high soil moisture (T/F) C.Plants are raised in .....type of beds to avoid yellowing during high soil moisture					
9	Leaf webber:(Amaranth) A. Pesticides should be used only during severe incidence of leaf webber (T/F) B. ..... pesticide shall be used to control leaf webber during severe incidence C. Malathion @0.1% can control the severe leaf webber damage (T/F) D. Pesticides shall be used immediately after the occurrence of leaf webber (T/F) E. As far as possible pesticide spray should be avoided in amaranth (T/F)					
10	Black pea aphids:(cowpea) A. .....is the pesticide commonly used to control aphids in cowpea? B. Malathion/quinalphos is applied to control pea aphids (T/F) C. Bran based *Fusarium pallidoroseum* is effective against pea aphids (T/F) D. How many times the fungus (*Fusarium pallidoroseum)* is applied to control aphids in cowpea?					
11	Pod borer: (cowpea) A. The pods are ti be picked. .....days after the application of carbaryl/fenthion? B. .....is the pesticide used to control pod borer? C. Pod shall be picked only 10 days after the application of carbaryl/fenthion?					
12	Damping off :(Brinjal) A. Thin sowing will increase the damping off incidence (T/F) B. Sow the seeds as thin as possible to avoid damping off incidence (T/F) C. Sow the seeds in raised bed to reduces the damping off incidence (T/F) D. .....is the planting technique used to control damping off?					

13	Fruit and shoot borer: (Brinjal and Bhindi) A. Which is the pesticide used to control fruit and shoot borer? B. Removal of the affected plant parts and fruits can reduce the fruit and shoot borer incidence (T/F) C. Carbaryl is applied in a interval of.....days to control fruit and shoot borer?					
14	Insect pests:(Brinjal and Bhindi) A. .....is the pesticide applied in the soil to control the insect pests in bhindi and brinjal B. Soil application of chemical pesticides followed by the foliar spray of neem based pesticide can control the insect pests in bhindi and brinjal (T/F) C. Soil application of carbofuran/Phorate followed by the foliar spray of neem based pesticide can control the insect pests in bhindi and brinjal (T/F)					
15	Yellow vein mosaic:(Bhindi) A. Arka Anamika, Arka Abhay and Susthira are yellow vein mosaic resistant varieties (T/F) B. .....are the yellow vein mosaic resistant varieties in bhindi? C. Yellow vein mosaic resistant bhindi varieties are not available (T/F) D. Removal and destruction of affected plants is not a effective control (T/F) D. Mosaic affected plants can be cured (T/F) E. The major symptom of yellow vein mosaic is.....?					

Thank you

Name and Designation

Signature

RESEARCH AND EXTENSION GAPS IN COMMERCIAL VEGETABLE FARMING IN EASTERN PALAKKAD

By

KAMALAKKANNAN, K.

ABSTRACT OF THE THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture
Kerala Agricultural University

2003

Department of Agricultural Extension

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR-680 656

KERALA, INDIA

ABSTRACT

The present study entitled "Research and extension gaps in commercial vegetable farming in eastern Palakkad" was conducted with the prime objective of identifying and prioritizing the problems/constraints in commercial vegetable farming followed by exploration of the availability of technological interventions with the research system to tackle them and further to study the research - extension gaps associated with it.

Eighty randomly selected vegetable growers representing 20 *harithasangams* of Nemmara block were the respondents for the study. The status of commercial vegetable farming in the study area and problems/constraints experienced in commercial cultivation and marketing of the important vegetables were elicited using PRA, farmers-extensionists-scientists interaction, field investigations and personal interviews. The lists of identified problems were discussed by a multidisciplinary research team to explore the availability of technological interventions with KAU research system and the gaps thereon in vegetable research. Bitter gourd showed a wider research gap while bhindi was reported to have no research gap with respect to the number of specific problems left unaddressed in the POP recommendations of the university.

The identified problems/constraints in commercial vegetable farming were ranked based on their severity as perceived by the farmers. The appropriate technological interventions recommended by the multidisciplinary research team based on extensive review of POP were listed and included in the interview schedule to study the knowledge and adoption levels of these recommended vegetable production technologies. It was found that majority of the commercial vegetable growers had medium level of knowledge and adoption with respect to the recommended package of practices of KAU on vegetable cultivation.

A socio-economic profile analysis of the vegetable growers was also carried out for the purpose of knowing the distribution of respondents with respect to the selected characteristics as dimensions of the profile study.