

**Constraints on Diffusion and Adoption of  
Agro-mechanical Technology in Rice  
Cultivation in Kerala**

**Balachandran Pillai. G**

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**Kerala Research Programme on Local Level Development  
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# Constraints on Diffusion and Adoption of Agro-mechanical Technology in Rice Cultivation in Kerala

Balachandran Pillai. G

## 1. Introduction

Rice is the most important cereal and staple food consumed in Kerala. It is cultivated mainly in fragmented fields of varying sizes both in irrigated and rain-fed conditions under different agro-climatic regimes. The total area under rice cultivation in the State in 1997 was 430.83 thousand ha as compared to 588.34 thousand ha. in 1990. The decline in the cultivated area during this period was 26.8 per cent; rice production recorded a negative growth of 23.6 percent during the same period; but productivity increased by 3.2 percent. Rice cultivation in the State has been steadily shrinking in spite of the best efforts by the Government and various other agencies to boost it. Some of the factors attributed to the decline of rice cultivation are high labour cost, shortage of labour, lack of appropriate farming machines, unfavourable socio-economic conditions of the State, poor crop management by farmers who have alternate sources of income, and very low market price of rice.

Conversion of paddy lands for housing purposes and for cultivation of commercial plantation crops has been a major reason for the decline in cultivated area. The process of conversion of paddy lands for non-agricultural uses is still on. The practice of leaving them fallow is also on the rise.

The youth have been progressively alienating themselves from the hazards and drudgery of farm operations. Rice cultivation can be sustained only by attracting younger generations to the farms by introducing appropriate mechanical practices that would reduce drudgery, improve timeliness of operations and provide attractive wages to farm workers.

Mechanization in rice farming in Kerala is constrained due to the lack of appropriate machinery systems suited for varying field situations of the State even though commercial brands of machines proven elsewhere are available in the market. Rice cultivation requires very high labour input, as much as 1000-1200 man-hours per ha in the State compared to only 800 man-hours per ha in other States in India. Considerable reduction in labour requirement can

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Balachandran Pillai. G is

be achieved through selective mechanization with appropriate machinery systems to make rice production economically viable. At present, tillage operations in rice cultivation are mechanized to a great extent with the help of tractor and power tillers. However, other labour-intensive operations such as transplanting and harvesting are performed manually. Commercial rice-farming machines like mechanical rice transplanter, vertical conveyor reaper and rice combines are yet to be adopted widely in the farms of the State mainly due to their high investment cost and sophisticated technology for operation and maintenance.

Large scale adoption of this kind of machines in rice-farming is possible only through Government support to co-operative groups of farmers to make them economically viable and to enable farmers to meet local requirements. As the farming scenario in Kerala is highly sensitive due to the presence and operation of militant trade unions, it is essential to formulate a package for adopting mechanization after conducting a thorough investigation. The present study is undertaken, in this context, with the following objectives, for sustaining and promoting rice farming in the State.

### **Objectives**

- (i) To assess the status of farm implements and machinery in use in the rice farms of Kerala.
- (ii) To study the perception of farmers and farm laborers on various aspects of rice farm mechanisation.
- (iii) To study the extent of use of improved farm implements and machinery by rice farmers of Kerala.
- (iv) To identify possibilities for the use of improved implements and machinery and the constraints for their adoption as perceived by the rice farmers.
- (v) To study the attitudes of various organizations of farm laborers on mechanization of rice farming.
- (vi) To study the socio-economic conditions of rice farmers.

## 2. Constraints on Mechanisation: An overview of studies

Several studies conducted in India and other south Asian countries have examined questions pertaining to constraints for adoption of mechanization in rice farming. Studies conducted in Sri Lanka by Kathirkamatham (1978), in Japan by Kishida (1978), in Pakistan by Qureshi (1978), in Nepal by Shreshta (1978), in Indonesia by Tarmana (1978) and Hafsah (1983), in Burma by Tin (1978), in Bangladesh by Jabbar, et al (1983), in India by Prasad, et al (1987) and Gupta and Ram (1989) are some of them. A few studies such as the ones by Rijk (1986), Bambridge (1987) and Kothicane et al. (1987), Prasad, et al (1987), and Nikkade and Bhople (1989) have made attempts to classify the constraints into biological, technological, economic, institutional, organisational, and attitudinal. In most studies, the smallness and the fragmentation of holdings and lack of finance with the farmers have been identified as the most serious constraints. Other difficulties identified include non-availability of suitable equipment, lack of facilities for repairs of machines and tools, lack of awareness on the part of farmers of the advantages of mechanization, and lack of organizational and institutional support.

The classification of constraints made by Nikkade and Bhople (1989) on the basis of studies made in India, known as the 'standardized categorization of constraints' is given below:

### (a) Economic constraints

- (i) lack of capital
- (ii) Non-availability of loans to defaulters

### (b) Input constraints

- (i) Non-availability of inputs
- (ii) High cost of inputs
- (iii) Untimely availability of essential inputs

### (c) Information constraints

- (i) Lack of technical knowledge
- (ii) Lack of skill

### (d) Technological constraints

- (i) Complexity of certain improved technologies
- (ii) Susceptibility of improved strains to pests and diseases

### (e) Psychological constraints

- (i) Perception of risk
- (ii) Perception of low profitability
- (iii) Non-perception of necessity for suitable technology
- (iv) Impact of beliefs and traditions

(f) Infrastructural constraints

- (i) Non-availability of draught animals
- (ii) Non-availability of improved implements and machinery

(g) Situational constraints

- (i) Unsuitability of soil for particular crop
- (ii) Inadequate sources of irrigation
- (iii) Use of inputs restricted to items available in the local co-operatives

In Kerala, only a few studies have gone into constraints of mechanization of rice-farming. The conclusions of these studies are not at variance from those of studies conducted elsewhere in Asia. For instance, Menon (1983) grouped the various socio-economic extension and organizational constraints limiting rice production in Kerala into a) economic constraints, b) extension constraints and c) organizational constraints.

According to a report of the Project Planning and Monitoring Cell of the Government of Kerala (1986), the small size of farm holdings constituted a large segment of the arable land in Kerala and the small farmers have little access to appropriate farm equipments, especially power machines. The report has identified the following constraints: economic and socio-cultural limitations, lack of foreign exchange to import equipment, low quality of locally manufactured equipment, shortage of rural artisans to supply tools and implements and unsuitability of imported machines to the resource endowments of the State.

James and Mohammed (1988) identified the following constraints to rice farm mechanisation in Kerala: a) small size of holdings, b) fragmented holdings, c) economic backwardness of farmers, d) lack of sufficient credit facilities, e) lack of promotional subsidies, f) unemployment problem, g) inadequacy of research and field trails, h) lack of location-specific and production-oriented research on farm machinery using electric power, i) lack of appropriate equipment to suit the regional requirements of the State, j) scanty infrastructural facilities for extension activities in the field of farm machinery, k) lack of facilities to train farmers in the use of improved farm equipment and l) absence of village artisans to supply hand-tools and animal-drawn implements.

According to Prakash (1989) the constraints in Kerala on farm mechanisation are the following: a) small farm size, b) fragmentation of holdings, c) non-availability of suitable equipment, d) lack of facilities to train operators, e) insufficiency of private and public hire services, f) lack of freedom given to farmers to select farm equipment of their choice while granting hire-purchase facility and g) inadequacy of repair and service facilities.



### 3. Area of Study, Sampling Design and Method of Analysis

#### Study area

The areas selected for the study were Palakkad, the *Kole* lands of Thrissur and the *Puncha* lands of Kuttanad, the three major rice-growing regions in Kerala.

#### *Kole* land

The *Kole* lands covering an area of 13,632 ha are spread over Thrissur and Malappuram districts, extending from the north bank of the Chalakkudy river in the south to the southern bank of the Bharathapuzha river in the north (Johnkutty and Venugopal). These are low-lying areas located 0.5-1.0 m below the mean sea level; the major portion of these lands remains submerged for about six months in a year. Therefore, only one crop is raised in the *Kole* areas, which is known as *Kole Puncha*. Group-farming is well established in *Kole* lands, a practice followed from very early days under the leadership of the *Kole Padavu* committee.

Acidity, salinity, poor drainage and presence of toxic salts are the characteristics of the *Kole* lands. The cost of cultivation in these lands is, therefore, quite high. Shortage of labourers at peak season constitutes a major problem. The group-farming method of cultivation followed in *Kole* lands facilitates the use of agricultural machinery on a profitable basis for tillage, transplanting, harvesting, and threshing.

#### Palakkad

Palakkad district accounts for about one-fourth of the total area under rice cultivation of the state. There are three crop seasons for rice viz., *virippu*, *mundakan* and *puncha*. Mechanized farming, especially mechanized rice-farming, has made a significant contribution to revolutionising the agricultural scene of the Palakkad region. This region is the forerunner in the use of tractors, power tillers, paddy transplanters and harvesting and threshing machines.

#### Kuttanad

Kuttanad comprises low-lying lands and the backwater system in the districts of Alappuzha and Kottayam. The paddy fields are mostly lands reclaimed from the backwaters. The fields lie at a level of 1.0-2.5m below mean sea level and are subjected to salt-water intrusion. One or two crops of rice are raised, *puncha* being the dominant crop. A second crop is raised depending upon the location of the *padasekharam* and the weather.

The area of each *padasekharam* ranges from a few hectares to above 1000 hectares, owned by several cultivators. The large size of the paddy fields allows mechanisation to a great extent. Tractors and power tillers are commonly used even though traditional manual ploughing also is practised in some areas. Manual and power sprayers are in use for pesticide application.

## **Sampling design**

A multi-stage sampling procedure was followed for the present study.

Representative areas under each of the three regions were selected following a three-stage sampling design based on the net cropped area and production of rice in the year 1995-'96. In the first stage, four agricultural sub-divisions were selected from each of the three regions. These subdivisions had both the highest net cropped area of rice and production. Thus there were 12 agricultural subdivisions for the study. In the second stage, three *Krishibhavans* were selected from each agricultural subdivision in the Palakkad region. In the case of Kuttanad and *Kole* lands, two *Krishibhavans* each under the selected agricultural subdivisions were chosen. The selection of *Krishibhavans* was based on the same criterion of net cropped area and production as has been in the case of the other subdivisions. Thus, there were 28 *Krishibhavans* for the study.

In the third stage, three *Padasekharams* were selected under each *Krishibhavan* in the Palakkad region and two *Padasekharams* each under the *Krishibhavans* in the case of Kuttanad and *Kole* lands, again based on the criterion of the area and production of rice, as was done at the earlier stages. Thus, there were 68 *Padasekharams* for the study.

## **Selection of respondents**

The ultimate sample units for the study were individual farmers, farm labourers and leaders of various organizations of labourers such as Kerala State *Karshaka Thozhilali* Union (KSKTU) and Kerala *Karshaka Thozhilali* Federation (KKTF). The respondents from each *Padasekharam* were selected using random sampling. Three farmers and three farm labourers were selected from each *Padasekharam* under the respective *Krishibhavan* in the three regions. Thus there were 204 farmers and 204 farm labourers. The sampling design for the study is schematically presented in Fig.3.1 and in Table 3.2.

Perceptions of various labour organizations on the issue of rice farm mechanization were recorded by personal interviews with leaders of the two respective organizations KSKTU and KKTF. At least one leader from each organization was interviewed in every agricultural subdivision of all the three regions. Thus there were a minimum of 24 leaders of both the organisations as respondents for the study.

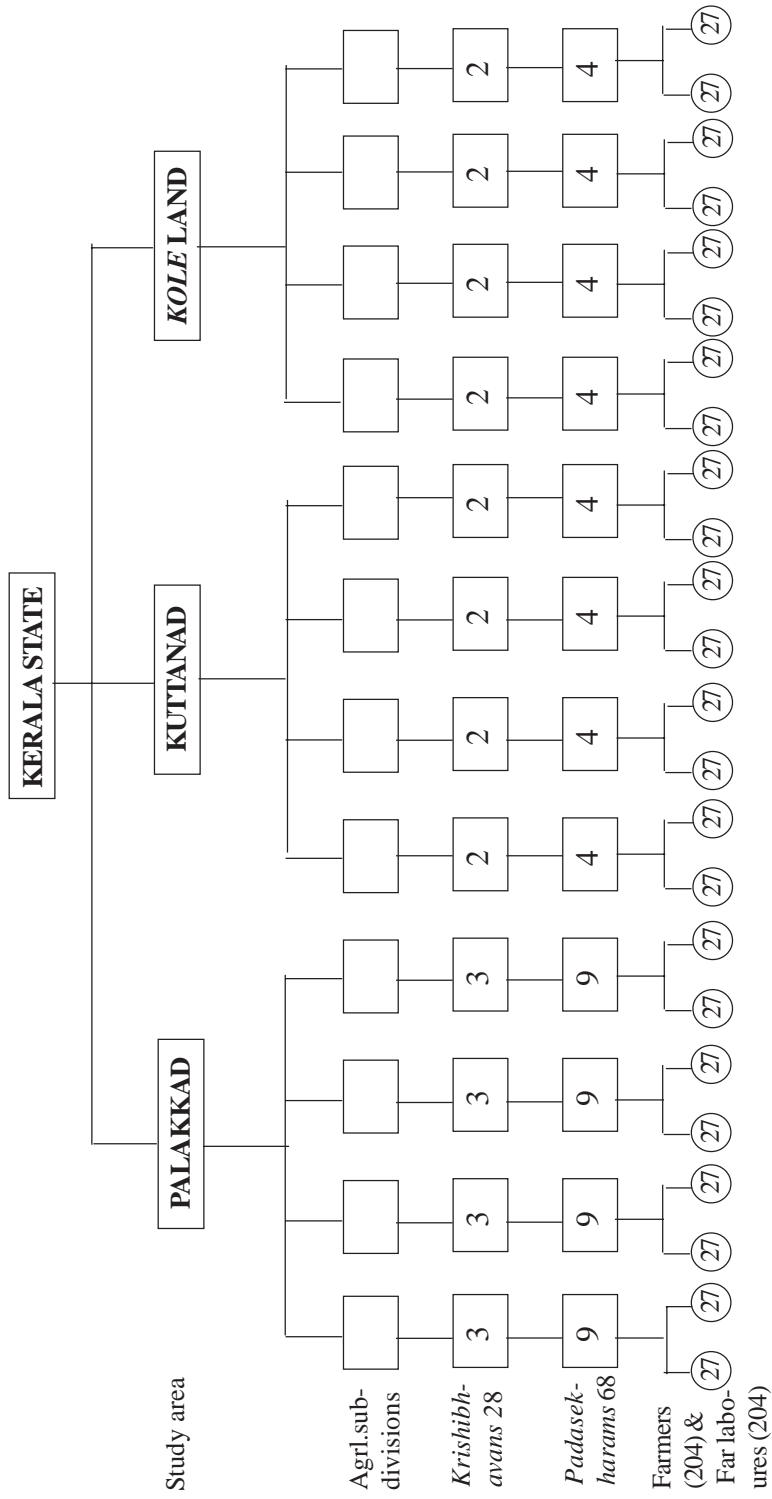
## **Extent of rice farm mechanisation**

The extent of use of improved farm implements / machines constitutes the level of mechanisation. A list of 23 farm implements/machines was prepared in the light of the discussions held with farmers of Kollangode subdivision in Palakkad region, Agricultural Officers, Agricultural Engineers, and Agricultural Extension Officers (Table 3.1). The farmers were interviewed with the list to find out the level of mechanisation. The responses were quantified using a three-point scale.

**Table 3.1 Details of study region and number of respondents**

Sl. No	Study region	Agricultural subdivision	<i>Krishibhavs</i>	No. Far
1.	Palakkad	Pattambi	Vilayoor	9
			Pattambi	9
			Muthuthala	9
		Kuzhalmannam	Kuzhalmannam	9
			Kannadi	9
			Thenkurissi	9
		Chittur	Chittur	9
			Kallepilli	9
			Pattanchery	9
		Kollangode	Puthiyanagaram	9
			Koduvayoor	9
			Kollangode	9
2.	<i>Kole</i> lands	Cherpu	Kurukkenchery	6
			Cherpu	6
		Anthikkad	Anthikkad	6
			Manaloor	6
		Mullassery	Mullassery	6
			Venkidange	6
		Puzhakkal	Arimbur	6
			Adatt	6
Pulikkezhu	Niranam	6		

Figure.3.1 Schematic representation of smapling design



**Table 3.2 List of farm implements and machines**

<b>Sl.No.</b>	<b>Name of farm implements/ machineries</b>
1.	Bose plough/ improved iron plough
2.	Mould board plough
3.	Helical blade puddler
4.	Tractor drawn disc plough
5.	Tractor drawn harrow
6.	Multi-bottom mould board plough (Tractor drawn)
7.	Power tiller with rotavator
8.	Tractor with cultivator
9.	Channel-cum-bund former (animal drawn)
10.	Bund former (power tiller drawn)
11.	Larger modified wooden leveller
12.	Mechanical transplanter
13.	Kerosene/ diesel engine pumpset
14.	Electric-motor pumpset
15.	Paddy weeder
16.	Knapsack sprayer
17.	Power sprayer
18.	Seed-cum-fertiliser drill
19.	Paddy harvester (vertical conveyor reaper)
20.	Motorized mini-thresher
21.	Simple paddy winnowing fan
22.	Motorized engine-driven winnower
23.	Combine harvester

The points ranged from 0 to 2

<b>Response category</b>	<b>Score</b>
Always using	2
Sometimes using	1
Not using	0

### **Difficulties in various farm operations due to the scarcity of labourers**

The difficulties faced by rice farmers in various farm operations due to lack of farm labourers were identified with the help of a questionnaire. Various farm operations mentioned in the questionnaire were:

- (i) Ploughing
- (ii) Irrigation
- (iii) Transplanting
- (iv) Pesticide application
- (v) Weeding
- (vi) Harvesting

- (vii) Threshing
- (viii) Winnowing
- (ix) Drying paddy

The respondent farmers were asked to put scores ranging from 1 to 9 depending on the degree of difficulty in operations due to lack of labourers in such a way that score 1 is assigned for the most difficult operation and score 9 for the least difficult operation.

### **Constraints to rice farm mechanisation as perceived by rice farmers**

A constraints analysis is undertaken to identify the factors responsible for the adoption gaps existing in the case of various farm implements and machines for rice farming. The gaps would be quantified and the difficulty of overcoming the constraints to identified.

### **Identification of constraints**

The major constraints to rice farm mechanisation were identified by a pilot study conducted in the Palakkad region. Discussions were carried out with rice farmers, farm labourers, agricultural officers, agricultural extension officers, and agricultural engineers.

Based on the above study, seventeen major constraints were identified as listed below:

- (i) Small farm size;
- (ii) Lack of co-operation among farmers;
- (iii) Negative attitude towards improved farm implements and machines;
- (iv) High capital cost;
- (v) High cost of operation of machines;
- (vi) Non-availability of suitable farm implements and machines;
- (vii) Non-availability of spare parts;
- (viii) Inadequate repair and service facilities;
- (ix) Complexity of operating and repairing farm implements and machines;
- (x) Low custom hire facilities;
- (xi) Lack of credit facilities;
- (xii) Low profitability of rice cultivation;
- (xiii) Availability of human labour in plenty;
- (xiv) Availability of cheap labour;
- (xv) Opposition from farm labourers;
- (xvi) Lack of skilled labourers for operating improved farm implements and machines; and
- (xvii) Lack of awareness.

### **Measurement of the identified constraints**

It was necessary to measure the incidence and intensity of the identified constraints in the actual field situation to prove their validity and to find out the extent to which they influence

rice farm mechanisation. All the 17 constraints were measured by interviewing the farmers with the help of a structured schedule developed for the study.

### **Description of techniques used for measurement of constraints**

#### ***Small farm size***

The respondents were asked whether the area of rice holdings cultivated by them was sufficient for use of improved farm implements and machines. Their perceptions were measured using the following scale:

<b>Response category</b>	<b>Score</b>
Quite sufficient	1
Somewhat sufficient	2
Not sufficient	3

#### ***Lack of co-operation among farmers***

If farming operations (land preparation with power machines, irrigation with pumpsets, plant protection operations with power sprayers and dusters, harvesting with mechanical reapers, threshing and winnowing with power threshers and winnowers) were done on a co-operative basis, cost of production can be reduced considerably.

This constraint, (lack of co-operation among farmers) was measured in terms of the degree to which the respondent farmer co-operated with other farmers in carrying out various farm operations with improved implements and machines on a joint basis. The scoring for the responses was as follows:

<b>Category</b>	<b>Score</b>
Always co-operative	1
Sometime co-operative	2
Never co-operative	3

#### ***Negative attitude towards improved farm implements and machines***

Farmers' attitude towards any improved farm technology plays a major role in their adoption behaviour. Hence an attempt was made to measure the attitude of farmers towards improved farm implements and machines.

Attitudes were measured by using the following scoring procedure:

<b>Category</b>	<b>Score</b>
Favourable	2
Neutral	1
Unfavourable	0

### ***High capital cost of improved farm implements and machineries***

Cost of various implements and machines for rice farm mechanization as a constraint was measured in terms of the farmer's perception of the capital cost of the implements. The following scoring procedure was used.

<b>Category</b>	<b>Score</b>
Very high	3
High	2
Reasonable	1

### ***High operational cost of improved farm implements and machines***

Farmers are highly conscious of the operational costs and pay-off from technology adoption. High operational cost of implements and machines was measured in terms of farmers' perceptions of the operational cost. The following scoring procedure was used:

<b>Category</b>	<b>Score</b>
Very high	3
High	2
Reasonable	1

### ***Non-availability of suitable implements and machines***

The perceptions of farmers regarding the availability of the implements and machinery in their locality were measured using the following scoring procedure:

<b>Category</b>	<b>Score</b>
Not available	3
Available, but with Difficulty and not in time	2
Easily available	1

### ***Non-availability of spares for implements and machines***

Local non-availability of spare parts for various farm implements and machines is a serious problem especially during peak periods of farm operations. The availability of spares of implements and machines was measured using the following scoring procedure:

<b>Category</b>	<b>Score</b>
Not available	3
Available, but with difficulty and not in time	2
Easily available	1



### ***Inadequate repair and service facilities***

Rice farming, being a strictly season-bound enterprise, the farm machines are put to continuous and intensive work during peak periods of operations. The machines often get damaged. Frequent breakdowns throw farm operations off-balance. Hence, service and repair facilities should be available locally. The farmers' perceptions about the adequacy of service and repair facilities were measured using the following procedure:

<b>Category</b>	<b>Score</b>
Not available	3
Available, but not sufficient and in time	2
Easily available	1

### ***High mechanical complexity***

The intrinsic characteristics of the technology such as simplicity and complexity may influence its adoption, to a great extent. The perceptions of the respondents were measured using the following scoring procedure:

<b>Category</b>	<b>Score</b>
Highly complex	3
Moderately complex	2
Not complex	1

### ***Low custom hire facilities***

In countries in which the majority of rice farmers belong to the small farmer category, they are found to use, due to their economic backwardness, farm machinery by hiring from custom-operators. The cost per unit of machine work may be less with custom-hiring than with a large-scale owner-operation. This aspect of the problem was measured using the following scoring procedure:

<b>Category</b>	<b>Score</b>
Not available	3
Available, but not sufficient and in time	2
Easily available	1

### ***Lack of credit facilities***

Availability and source of credit are important factors determining farmer's investments in high cost equipments. This group of factors was measured using the following scoring procedure:

<b>Category</b>	<b>Score</b>
Not available	3

Available, but with difficulty	2
Easily available	1

### ***Low profitability of rice cultivation***

Profitability is viewed as net returns from cultivation.

A three-point rating scale to quantify the farmer's perception of the level of profitability of rice cultivation as shown below was used for the present study.

<b>Category</b>	<b>Score</b>
Not profitable	3
Neither profitable nor loss-making	2
Profitable	1

### ***Plentiful availability of human labour***

One of the arguments against rice farm mechanisation in overpopulated developing economies is that, it leads to massive labour displacement. But the recent experience of Kerala suggests that in rice tracts seasonal shortage of labour, especially during peak periods of operations, is a serious problem. To examine this proposition in the light of farm mechanisation, the respondent farmers were asked to indicate the availability of labour for doing farm operations in rice cultivation in a three-point scale:

<b>Category</b>	<b>Score</b>
Easily available	3
Available, but not sufficient	2
Not available	1

### ***Cheap labour availability***

Another argument against rice-farm mechanisation in Kerala is that human labour is cheap when compared to the operational costs of machines. But the reality is that Kerala has the highest wage rate in the country. High wages have resulted in reduction of area under food crops, especially rice. In the light of these contradictory arguments, an attempt was made to measure the perceptions of the farmers regarding the cost of human labour in rice cultivation. The scoring procedure was as follows:

<b>Category</b>	<b>Score</b>
Very Cheap	3
Some what cheap	2
Not at all cheap	1

### ***Opposition from farm labourers to the use of improved implements and machines***

It is often argued that in Kerala, where there is highly organised labour force, any move for large-scale mechanisation would be opposed by farm labourers for fear of unemployment. But the farmers often complained that it is very difficult to get enough labour force especially during peak periods of farm operations. Therefore, the perceptions of the farmers regarding this aspect were ascertained. The response categories and the scores assigned were as follows:

<b>Category</b>	<b>Score</b>
Very high opposition	2
Moderate opposition	1
No opposition	0

### ***Lack of skilled labourers for operating improved farm machinery***

For operating improved farm implements and machines such as paddy transplanter, reaper, thresher and combine harvester, necessary technical awareness is needed on the part of the operators. This constrained was measured using the following scoring procedure:

<b>Category</b>	<b>Score</b>
Not available	3
Available, but not in time	2
Easily available	1

### ***Lack of awareness***

Farmers' awareness of improved farm implements and machines plays a major role in the adoption of rice-farm mechanisation technology. The level of awareness was measured by using the following scoring procedure:

<b>Category</b>	<b>Score</b>
Not aware	3
Aware, but not sufficiently	2
Aware	1

### **Perception of farm labourers and their organizations towards rice farm mechanisation**

The number of farm labourers selected from Palakkad region was 108 and from *Kole* lands and Kuttanad regions, 48 each. The following data were collected from farm labourers with the help of a structured schedule developed for this purpose.

- (i) Education;
- (ii) Annual income;
- (iii) Reason for engaging as an agriculture labour;
- (iv) Whether owned paddy lands or not;

- (v) Number of available working days per year;
- (vi) Daily wages of farm labourers;
- (vii) Ranking of drudgery of farm labourers in various farm operations;
- (viii) Awareness of improved farm implements and machinery among the farm labourers;
- (ix) Necessity of rice-farm mechanisation as perceived by farm labourers;
- (x) Attitude towards rice-farm mechanisation;
- (xi) Training obtained for operating improved farm implements and machinery;
- (xii) Perceptions of labourers about loss of working days due to adoption of small-scale mechanisation.

### **Procedure adopted for data collection**

Data were collected from 204 rice farmers and 204 farm labourers of the three regions with the help of separate questionnaires for farmers and farm labourers. The data related to the extent of use of improved farm implements and machinery, drudgery of agricultural labourers in various farm operations and constraints of rice-farm mechanisation. Data were collected from the farmer respondents through personal interviews. Perceptions of farm labourers towards rice-farm mechanisation also were collected in person with the help of pre-tested interview schedules. Leaders of the various organisations of farm labourers were interviewed in person, to identify the attitude of the organisations towards rice-farm mechanisation.

## 4. Impact of Mechanisation in Rice-Farming

In this section, the results of the field investigations are presented under the following sections:

- (i) Extent of use of implements and machines;
- (ii) Difficulties in farm operations due to scarcity of farm labour;
- (iii) Constraints on mechanisation as perceived by rice farmers; and
- (iv) Perceptions of farm workers and their organisations on mechanisation.

### Extent of use of implements and machines

The responses under this aspect were recorded under ‘always using’, ‘sometimes using’ and ‘not using’ with assigned scores of ‘2’, ‘1’, and ‘0’ respectively. The pattern of use of various implements is presented in Table 4.1.

### Palakkad region

In Palakkad region 108 farmer respondents from four agricultural subdivisions were interviewed. The majority of the farmers (82 percent) in this region always used electric motor pumpsets. Wooden levellers ranked second and were used always used by 74 percent of the respondents. It was found that about 49 per cent farmers always used tractors and 37 percent always used borse plough/ improved iron plough for land preparation. For spraying, about 39 percent of farmers always used knapsack sprayers and only 11 percent used sprayers.

The extent of use of labour-saving machines such as paddy reaper, threshers and transplanters was much lower. Harvesters and threshers were always used by 24 and 30 percent respectively while transplanters were always used by only 19 percent of the farmers. As mechanical transplanters were quite new to the farmers of the region and imparting of training and technical know was slow, the level of use of this device remained low, even though it was labour-saving and efficient.

The results tabulated in Table 4.1 show that improved machines such as motorised mini-threshers, vertical conveyor reapers and transplanters were used only ‘some times’, but high percentage of farmers. This may be due to the lack of custom-hiring facilities and non-availability of such machines in time.

Tillage implements such as mould-board plough, helical blade puddler, tractor-drawn disc-plough and tractor-drawn disc harrow were not extensively used in the region. Improved machines combine harvesters too were not popular among the paddy cultivators of this region.

### Kole lands

Responses of 48 farmers from four agricultural subdivisions were recorded from the *Kole* lands region. The most popular agricultural machines in this region were the same as those

Table 4.1. Extent of use of farm implements and machines

Sl. No.	Name of implements/ machinery	Score														
		Palakkad region (no. of respondents 108)					Kole lands (no. of respondents: 48)					Kuttanad region (No. of respondents: 48)				
		Always using (2)	Sometimes using (1)	Not using (0)	Total score	Always using (2)	Sometimes using (1)	Not using (0)	Total score	Always using (2)	Sometimes using (1)	Not using (0)	Total score			
1.	Rose plough/ improved iron plough	80	25	0	105	20	14	0	34	40	20	0	60			
2.	Mould board plough	34	35	0	69	-	-	0	0	-	-	0	0			
3.	Heiral blade puddler	24	20	0	44	-	1	0	1	-	4	0	4			
4.	Tractor drawn disc plough	6	8	0	14	8	1	0	9	-	3	0	3			
5.	Tractor drawn barrow	-	9	0	9	2	-	0	2	-	3	0	3			
6.	Multibottom mould board plough (tractor drawn)	-	-	0	0	-	-	0	0	-	-	0	0			
7.	Power tiller with rotavator	32	32	0	64	24	7	0	31	32	12	0	44			
8.	Tractor with cultivator	106	21	0	127	28	3	0	31	24	13	0	37			
9.	Chained cum hand former (Animal drawn)	-	-	0	0	-	-	0	0	-	-	0	0			
10.	Band former (power tiller drawn)	-	-	0	0	-	-	0	0	-	-	0	0			
11.	Large modified wooden leveler	160	20	0	180	62	10	0	72	66	9	0	75			
12.	Transplanter	40	50	0	90	-	6	0	6	-	5	0	5			
13.	Kerosene/diesel engine pumpset	30	24	0	54	16	15	0	31	22	18	0	40			
14.	Electric motor pumpset	178	8	0	186	84	2	0	86	72	3	0	75			
15.	Paddy weeder	-	-	0	0	-	-	0	0	-	-	0	0			
16.	Knapsack sprayer	84	22	0	106	36	15	0	51	32	17	0	49			
17.	Power sprayer	24	20	0	44	26	7	0	33	24	11	0	35			
18.	Seed cum fertilizer drill	-	-	0	0	-	-	0	0	-	-	0	0			
19.	Paddy harvester (vertical conveyor reaper)	52	49	0	101	36	14	0	50	20	11	0	31			
20.	Motorized miniharvester	64	39	0	103	34	16	0	50	26	21	0	47			
21.	Simple winnowing fan	68	27	0	95	26	11	0	37	22	12	0	34			
22.	Motorized engine driven fan	46	21	0	77	14	1	0	15	12	4	0	16			
23.	Combine harvester	6	5	0	11	50	9	0	59	-	-	0	0			

Figure 4.1. Extent use of various farm implements and machinery in Palakkad region (N= 108)

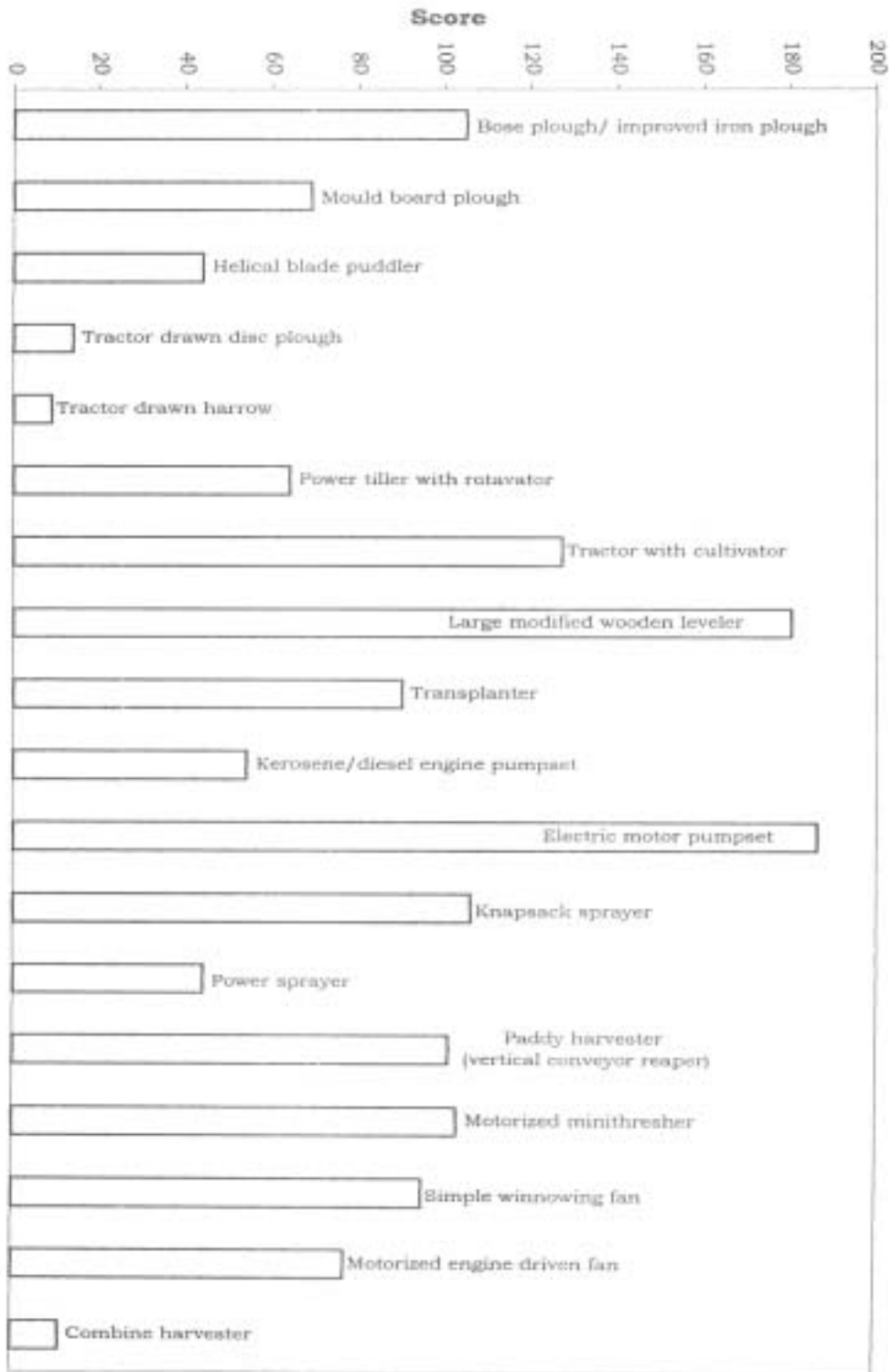
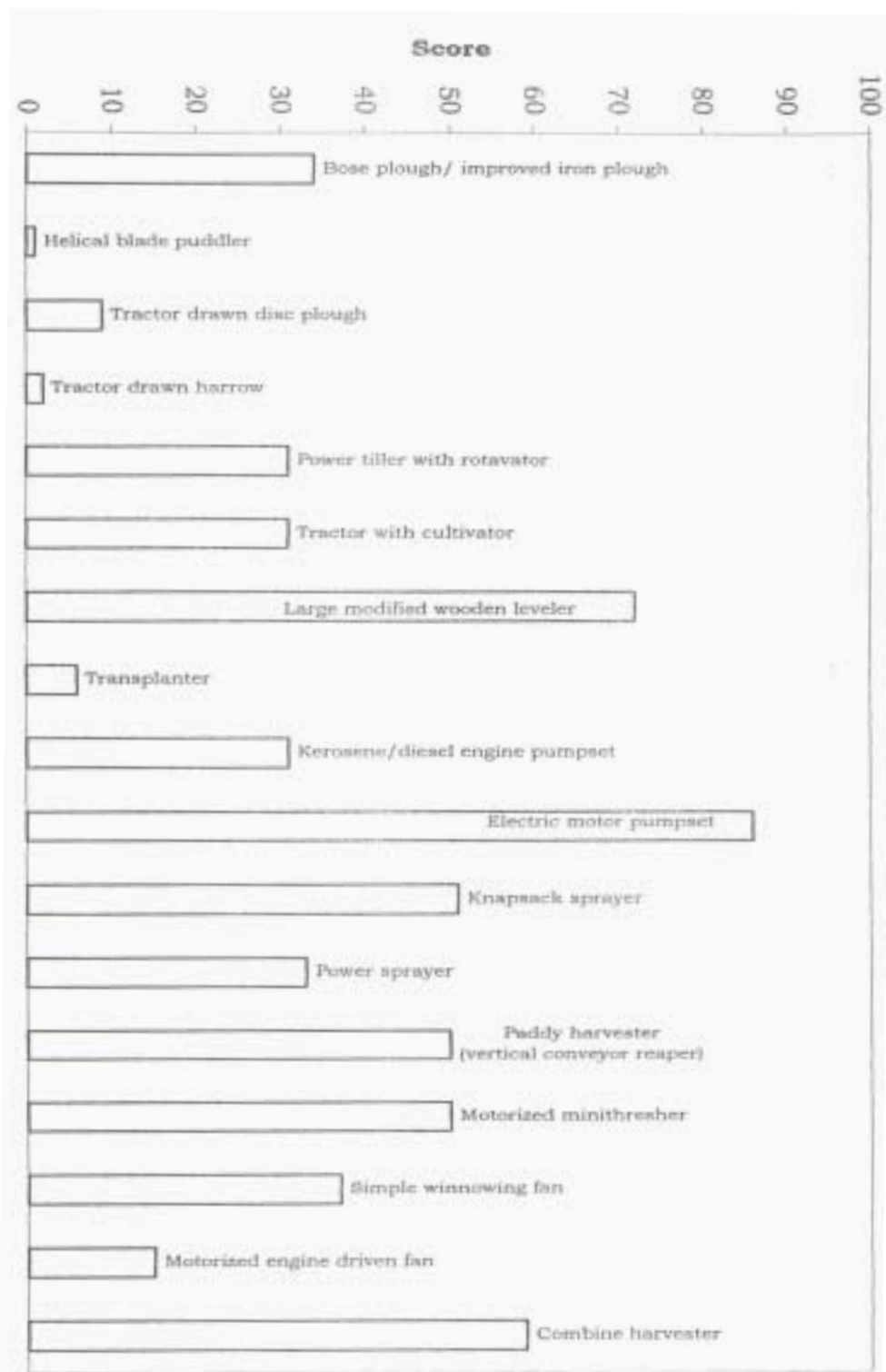


Figure 4.2 Extent of use of various farm implements and machinery in Kole lands (N=48)





of the Palakkad region, namely electric-motor pumpsets and wooden levellers. The majority of farmers (52 percent) always used combine harvesters and 19 percent sometimes used them. The main reasons for the intensive use of complex machines were the well-established farmer's co-operatives, acute shortage of labourers during peak seasons and availability of the machinery on custom-hire basis even from outside the State. The use of vertical conveyor reapers was also higher in this region than in the other two regions.

For spraying, 38 percent (score, 36) farmers in *Kole* lands always used knapsack sprayers and 27 percent always used power sprayers. About 35 percent always used motorized mini threshers. About 33 percent used them only 'sometimes', Winnowing of paddy was done with simple winnowing fan by more than 50 percent of the farmers while 17 percent of them used motorized engine-driven fan for winnowing. Tillage implements such as borse plough/ improved iron plough, power tiller with rotavator and tractor with cultivator were 'always used' for land preparation by 21 percent, 25 percent, and 29 percent of the farmers respectively. Paddy transplanter was not as popular in the *Kole* lands as was the case in the Palakkad region. This might be due to the non-availability of the implement, which is suitable to the field conditions of *Kole* lands and lack of awareness of the farmers about these machines.

### **Kuttanad region**

In Kuttanad region also, the electric-motor pumpset and wooden levellers were the most popular and used by 75 percent and 69 percent of farmers respectively. About 42 percent of the farmers always used borse plough/ improved iron plough as tillage implement. Power tillers with rotavator were always used by 33 percent and tractor with cultivator was always used by 25 percent. Improved implements such as motorised mini-thresher and vertical conveyor reaper were also popular. About 27 percent of the farmers always used motorised mini-thresher while 41 percent used it only 'some times'. The vertical conveyor reaper was always used by 21 percent of the farmers for paddy harvesting. For winnowing 23 percent farmers always used simple winnowing fan and 13 percent motorized engine-driven fan.

### **Difficulties in various farm operations due to the scarcity of farm labourers**

The difficulties faced by rice farmers for various farm operations due to lack of agricultural labourers are tabulated in Table 4.2 to 4.3.

In the Palakkad region 61 percent of the farmers felt that transplanting was the most difficult farm operation because of labour shortage. Harvesting (48 percent) and threshing (52 percent) constituted the second and the third difficult operations (Table 4.2). About 70 percent of the farmers in Palakkad region observed weeding as the fourth difficult operation, again due to shortage of labourers. Irrigation and ploughing were found to occupy the fifth and the sixth positions caused by the same factor, namely shortage of labour during peak seasons.

Tables 4.2 and 4.3 indicate that harvesting was the most difficult operation for 75 percent of the farmers in *Kole* lands and 71 percent of the farmers in the Kuttanad region, caused by shortage of farm labourers. Threshing was found to be the second most difficult operation for 77 percent farmers in *Kole* lands and 50 percent farmers in the Kuttanad region

**Table 4.2. Ranking of difficulty involved in various farm operations due to the scarcity of labourers: Palakkad region**

Sl No	Farm Operations	Percentage of Farmers (					
		Ranking					
		I <sup>st</sup>	II <sup>nd</sup>	III <sup>rd</sup>	IV <sup>th</sup>	V <sup>th</sup>	VI <sup>th</sup>
1.	Ploughing	-	-	-	-	18.5	55.6
2.	Irrigation	-	-	-	-	44.4	29.6
3.	Transplanting	61.1	25.9	13.0	-	-	-
4.	Spraying	-	-	7.4	3.7	22.2	11.1
5.	Weeding	-	-	18.5	70.4	7.4	-
6.	Harvesting	38.9	48.1	9.3	3.7	-	-
7.	Threshing	-	25.9	51.9	22.2	-	-
8.	Winnowing	-	-	-	-	-	-
9.	Paddy Drying	-	-	-	-	7.4	3.7

**Table 4.3 Ranking of difficulty involved in various farm operations due to the scarcity of labourers: Kole lands.**

Sl No	Farm Operations	Percentage of Farmers (					
		Ranking					
		I <sup>st</sup>	II <sup>nd</sup>	III <sup>rd</sup>	IV <sup>th</sup>	V <sup>th</sup>	VI <sup>th</sup>
1.	Ploughing	2.1	-	2.1	2.1	31.3	37.5
2.	Irrigation	-	2.1	4.2	20.8	33.3	25.0
3.	Transplanting	16.7	4.2	33.3	14.6	6.3	4.2
4.	Spraying	-	2.1	8.3	29.2	10.4	10.4
5.	Weeding	2.1	6.3	37.5	20.8	10.4	8.3
6.	Harvesting	75.0	8.3	8.3	8.3	-	-
7.	Threshing	4.2	77.7	6.3	4.2	8.3	-
8.	Winnowing	-	-	-	-	-	-
9.	Paddy Drying	-	-	-	-	-	14.6

**Table 4.4 Ranking of difficulty involved in various farm operations due to the scarcity of labourers: Kuttanad region.**

Sl No	Farm Operations	Percentage of Farmers (					
		Ranking					
		I <sup>st</sup>	II <sup>nd</sup>	III <sup>rd</sup>	IV <sup>th</sup>	V <sup>th</sup>	VI <sup>th</sup>
1.	Ploughing	-	-	-	-	20.8	41.7
2.	Irrigation	-	-	-	10.4	12.5	22.9
3.	Transplanting	20.8	20.8	37.5	20.8	-	-
4.	Spraying	-	-	-	16.7	45.8	29.2
5.	Weeding	-	6.3	22.9	43.8	20.8	6.3
6.	Harvesting	70.8	22.9	6.3	-	-	-
7.	Threshing	8.3	50.0	33.3	8.3	-	-
8.	Winnowing	-	-	-	-	-	-
9.	Paddy Drying	-	-	-	-	-	-

due to this reason. Paddy transplanting was found to be the most difficult operation for 21 percent farmers in the Kuttanad region while it was the third difficult operation for 33 percent farmers in *Kole* lands, arising from this cause. Since transplanting involves drudgery and labour shortage is found more for this than for other operations, farmers have substituted it with direct sowing. Thus, for the farmers of *Kole* lands and the Kuttanad region harvesting and threshing are found to be the most difficult operations due to labour shortage.

The shortage of labourers for the various farm operations such as transplanting, harvesting and threshing might be due to the drudgery involved in these operations. Besides, the younger generations do not enter farming but prefer white collar jobs, preferably outside their villages.

#### **Constraints to mechanization as perceived by rice farmers**

The intensity of constraints to rice farm mechanization as perceived by the rice farmers of Palakkad, *Kole* lands, and Kuttanad region is presented in Table 4.1, 4.2, and 4.3 respectively.

Among the three regions the *Kole* lands recorded the highest average constraint score (of 27 score per respondent) compared to those of the other two regions. In *Kole* lands the three highest average scores were registered by (i) Low custom hire facilities; (ii) Lack of credit facilities and (iii) High capital cost of machinery.

In the Kuttanad region the three highest average scores were recorded under (i) Low custom hire facilities (ii) Lack of credit facilities and (iii) High capital cost of machinery.

Again, in Palakkad region also, the highest average scores were found to be these three factors.

There are inter-regional variations in the intensity of factors. However, the three most important factors constraining the process of mechanization in rice farming is found to be the same in all the three study regions. Small size of holdings, lack of cooperation among farmers, etc were not found to be as important because rice-farming in the study areas is done on a large, sometimes cooperative, basis.

## **Perceptions of farm labourers and labour organisations about rice farm mechanisation**

### ***Farm labourers***

The socio-economic conditions of the farm labourers in Palakkad, *Kole* lands and Kuttanad regions and their responses to questions on rice farm mechanization are presented in Table 4.8.

In all the three regions more than 75 percent of the farm labourers had education up to the primary level. The annual income of the majority of the labourers was found to lie in the range of Rs 5000- Rs 10000. Only less than one-third of them owned paddy lands. All the farm operations such as land preparation, transplanting, weeding, spraying, harvesting, and threshing in the paddy fields owned by them were done manually by them except in *Kole* lands. In *Kole* lands, the labourers were interested in using machinery for ploughing, harvesting and threshing even in their own lands. This is due to the influence of the well-established group-farming concept among the farming community of *Kole* lands as a whole.

The number of available working days per year was found to be lower in *Kole* lands than in the other two regions. In *Kole* lands labourers were engaged for about 100 – 150 days per year while female labourers were engaged only for 50 – 100 days. In *Kole* lands, only one crop season called *puncha* (summer crop) is cultivated in the entire area. In the remaining seasons rice is raised only if the weather is found favourable. Unfavourable weather conditions in *Kole* areas keep both the farmers and the labourers unemployed.

More than 50 percent of the farmers in all the three regions were not properly aware of the improved farm implements and machines. The lack of extension programmes to acquaint them about farm implements and machines and the new techniques in rice farming are the main reasons for the low level of awareness. The majority of the farm labourers in all the three regions were of the view that mechanisation was not essential for rice cultivation. The opposition to introduction of machines for rice cultivation was the highest in the Kuttanad region. About 76 per cent of the farm labourers in Kuttanad region were against mechanization of farming operations. It is the labour unions in the Kuttanad region which waged the maximum number of agitations for the rights of workers and against mechanisation. More than 75 percent of the farm labourers in Kuttanad region thought that even partial mechanization or small scale mechanisation would reduce their work opportunities.

### **Drudgery of farm labourers**

The relative difficulties involved in various farm operations such as ploughing, transplanting, spraying, weeding, harvesting and threshing as perceived by the farm labourers in the three regions are presented in Tables 4.9, 4.10, and 4.11.

**Table.4.5. Intensity of constraints to rice farm mechanization as perceived by the rice farmers of Palakkad region**

Sl. No	Constraints	(N)	
		Pulikkeezh	A
1.	Small farm size	24	
2.	Lack of co-operation among farmers	25	
3.	Negative attitude towards mechanization	6	
4.	High capital cost of improved farm implements/ machinery	29	
5.	High cost of operation	22	
6.	Non-availability of suitable implements	27	
7.	Non-availability of spare parts	20	
8.	Inadequate service and repair facilities	21	
9.	High mechanical complexity of improved machinery	15	
10.	Low custom hire facilities	36	
11.	Lack of credit facilities	32	
12.	Low profitability of rice cultivation	22	
13.	Plentiful availability of human labourers	5	
14.	Cheap labour availability	6	
15.	Opposition from farm labourers	15	
16.	Lack of skilled labourers for operating improved machinery	13	
17.	Lack of awareness	16	
	Total		

**Table 4.6 Intensity of constraints to rice farm mechanisation as perceived by the rice farmers of Kole lands**

Sl. No	Constraints	(N)	
		Pulikkeezh	A
1.	Small farm size	24	
2.	Lack of co-operation among farmers	25	
3.	Negative attitude towards mechanization	6	
4.	High capital cost of improved farm implements/ machinery	29	
5.	High cost of operation	22	
6.	Non-availability of suitable implements	27	
7.	Non-availability of spare parts	20	
8.	Inadequate service and repair facilities	21	
9.	High mechanical complexity of improved machinery	15	
10.	Low custom hire facilities	36	
11.	Lack of credit facilities	32	
12.	Low profitability of rice cultivation	22	
13.	Plentiful availability of human labourers	5	
14.	Cheap labour availability	6	
15.	Opposition from farm labourers	15	
16.	Lack of skilled labourers for operating improved machinery	13	
17.	Lack of awareness	16	
	<b>Total</b>		

**Table 4.7 Intensity of constraints to rice farm mechanisation as perceived by the rice farmers of Kuttanad Region**

Sl. No	Constraints	(N)	
		Pulikkeezh	A
1.	Small farm size	24	
2.	Lack of co-operation among farmers	25	
3.	Negative attitude towards mechanization	6	
4.	High capital cost of improved farm implements/ machinery	29	
5.	High cost of operation	22	
6.	Non-availability of suitable implements	27	
7.	Non-availability of spare parts	20	
8.	Inadequate service and repair facilities	21	
9.	High mechanical complexity of improved machinery	15	
10.	Low custom hire facilities	36	
11.	Lack of credit facilities	32	
12.	Low profitability of rice cultivation	22	
13.	Plethiful availability of human labourers	5	
14.	Cheap labour availability	6	
15.	Opposition from farm labourers	15	
16.	Lack of skilled labourers for operating improved machinery	13	
17.	Lack of awareness	16	
	<b>Total</b>		

**Table 4.8 Socio-economics conditions of farm labours and their responses towards rice farm mechanisation**

Sl. No	Particulars	Category	Percent	
			Palakkad	K
1.	Education	1. Illiterate 2. Primary 3. High school	8.70 85.19 6.11	5.2 86. 7.9
2.	Annual income	1. <5000 2. 5000- 10000 3. 10000-20000	33.33 37.04 29.63	26. 49. 24.
3.	Reasons for engaging as agricultural labourer	1. Traditional 2. Interest 3. Income	- - 100	- - 100
4.	Ownership of paddy land	1. owned 2. Not owned	20 80	36. 63.
5.	No. of available working days per year	1. Male labourer 2. Female labourer	150-200 days 50-150 days	100 days 50 days
6.	Daily wages	1. Male labourer 2. Female labourer	Rs. 110-125 Rs 60-75	Rs Rs
7.	Awareness of improved implements/ machinery	1. Aware 2. Not aware	42 58	48. 52.
8.	Need of mechanization	1. Essential 2. Not essential	49.29 50.71	46. 53.



**Table 4.9 Ranking of drudgery of farm labourers for various farm operations in Palakkad region**

Sl. No	Operations	Percentage of fa			
		Ranking of drud			
		1st	IIInd	IIIrd	IVt
1	Ploughing	-	-	3.7	6.0
2	Transplanting	49.63	36.00	14.37	-
3	Spraying	-	-	3.70	5.6
4	Weeding	15.00	16.00	28.00	36.0
5	Harvesting	32.00	26.50	3.50	-
6	Threshing	3.37	10.00	23.73	48.9

**Table 4.10 Ranking of drudgery of farm labourers for various farm operations in Kole lands**

Sl. No	Operations	Percentage of farm			
		Ranking of dru			
		1st	IIod	IIIrd	IV
1	Ploughing	-	-	-	7.
2	Transplanting	52.5	37.8	9.7	-
3	Spraying	-	-	2.50	13.
4	Weeding	6.5	13.6	41.9	22
5	Harvesting	36.0	38.6	18.4	7.
6	Threshing	5.0	10.0	27.5	49.

**Table 4.11 Ranking of drudgery of farm labourers for various farm operations in Kuttanad region**

Sl. No	Operations	Percentage of farm			
		Ranking of dru			
		1st	IInd	IIIrd	IV
1	Ploughing	-	-	4.95	2
2	Transplanting	54.15	35.40	10.45	
3	Spraying	-	-	-	
4	Weeding	6.0	5.91	37.0	4
5	Harvesting	34.9	53.5	9.6	
6	Threshing	4.95	5.19	38.0	4

Transplanting was found to be the most tedious farm operation for the majority of farm labourers in all the three regions. About one-half of the farm labourers (50 percent in Palakkad and 53 percent in *Kole* lands and 54 percent in Kuttanad region) considered transplanting as the most difficult operation. Transplanting rice seedlings is done usually by women in all the three regions. The fields at the time of transplanting are slushy and workers find it difficult to wade through them. Moreover, transplanting is an activity done by the workers for several hours at a stretch, standing in a stooping position, a most tedious work indeed. In *Kole* lands and in some parts of Kuttanad, farmers used to broadcast the seeds instead of transplanting seedlings due mainly to non-availability of labourers to do transplanting.

Harvesting was reported to be the second most difficult operation in all the three regions. This operation is also done by the worker standing in a stooping position. The only possible way to reduce the tediousness involved in paddy transplanting and harvesting is to introduce improved implements such as paddy transplanter and vertical conveyor reaper. The third position in the ranking of drudgery went to threshing (in Palakkad region) and weeding (in the *Kole* lands and Kuttanad region).

### **Labour organisations**

Labour unions were well established in all the three regions. In the Kuttanad region more than 75 percent of the respondents from the two labour organisations were against the use of even tractors for ploughing unlike in the other two regions. The traditional ploughmen in Kuttanad region enjoy the right to plough the paddy fields for a minimum of one round of ploughing even though the farmers do use tractors for ploughing. The labour unions in Kuttanad region justify this right. Initially Kuttanad was the 'rice bowl' of Kerala and rice cultivation in this region was highly profitable. Large numbers of workers used to be engaged

as agricultural labourers whose sole source of income was the wage income. But now-a-days rice cultivation has become highly expensive and uneconomic due to high wage rates, high prices of fertilisers, insecticides and pesticides and low price of rice. In consequence, the area under rice cultivation is shrinking from year to year and labourers are getting unemployed and underemployed. The farm labourers in other parts of the State have withdrawn from agriculture and sought work in industrial and service sectors. But in the Kuttanad region, since industries are few, labour unions resist introduction of mechanisation in rice cultivation for fear of losing available working days even though they are well aware of the scarcity of labourers experienced during the peak season. The labour unions in this region are highly militant too.

In *Kole* lands, the majority of the labour union leaders favoured mechanization in rice cultivation during the peak season. Rice farming in *Kole* lands is done usually under the leadership of well- established group-farming societies known as *Kole Padavu* Committees. During the peak period of cultivation a big scarcity of farm labourers is experienced; all the farming activities will have to be completed in a few days' time before the weather conditions turn adverse. Delays may cause heavy crop losses. Rice cultivation in *Kole* lands is highly risky due to the vagaries of nature.

The general trend of the labour organisations in the Palakkad region was favourable for introduction of mechanisation. Since Palakkad is the 'rice bowl' of Kerala and there exists acute shortage of farm labourers, the majority of the labour union leaders were aware of the need for farm mechanisation. About 50 percent of the respondents suggested that thorough training should be given to the existing farm labourers about the operation, repairs and maintenance of farm implements and machineries so that the labourers themselves would be able to operate and maintain them. One of their suggestions was the establishment of 'farm machinery service centres' under the leadership of farm labourers with financial support from government or co-operative institutions, so that the farmers in the region could avail the facility. In the process, additional employment would also be generated.

## **5. Summary and Conclusions**

The summary of the preceding discussion and their major findings are listed below.

The extent of use of improved farm machinery such as paddy reaper, threshers and transplanters was found to be small in all the three regions viz; Palakkad, *Kole* lands, and Kuttanad. Electric motor pumpsets and wooden levellers were found to be the equipment in use in all the three regions. The study reveals that only 24 percent of the farmers regularly used paddy harvesters and only 30 percent of them used threshers in the Palakkad region. Transplanters were sparingly used by the farmers in all the three regions.

In *Kole* lands, the majority of farmers (52 percent) regularly used combine harvesters in rice cultivation on custom-hiring basis. For spraying, 38 percent of the farmers used knapsack sprayers and 27 percent of them used power sprayers. Tillage implements such as bose plough/improved iron plough, power tiller with rotavator and tractor with cultivator were also used regularly for land preparation but only by less than 30 percent of the farmers in *Kole* lands. The extent of use of improved farm implements and machines was found to be much smaller in Kuttanad than in Palakkad and *Kole* lands.

### **Difficulties in farm operations**

Transplanting and harvesting were found to be the most difficult farm operations due mainly to the tedious nature of the work and shortage of labour. Threshing was found to be the second most difficult operation for about 78 percent of farmers in *Kole* lands and 50 percent of farmers of the Kuttanad region.

### **Constraints to mechanisation as perceived by rice farmers**

Inadequate custom hire facilities for farm machinery was the major constraint for mechanisation in *Kole* lands. Lack of credit facilities and high capital cost of implements were also serious problems. Constraints such as small farm size, high costs of operation, non-availability of suitable implements and spare parts, inadequate service and repair facilities, complexity of machine technology, low profitability of rice cultivation, lack of skilled labourers for operating machines and lack of awareness of the farmers about the modern technologies were also felt in all the three regions. Opposition from farm labourers was found to be more in Kuttanad than in *Kole* lands and Palakkad.

### **Perception of farm labourers towards rice farm mechanisation**

More than 50 percent farmers in all the three regions were not properly aware of modern farm machines. Inadequacy of extension programmes for them is found to have been the main reason for the low level of awareness on the part of the farm labourers. The majority of farm labourers in all the three regions were of the view that mechanization was not essential for rice cultivation. The highest degree of opposition against mechanization was recorded in

the Kuttanad region. About 76 percent of farm labourers in Kuttanad were against mechanisation. Labour unions in Kuttanad region have been quite active and strong since the 1940s. More than 75 percent of the farm labourers in Kuttanad thought that even partial mechanisation or small-scale mechanisation would reduce their work opportunities. These are found to be the factors underlying the tardy advance in Kerala towards the adoption of modern farm implements and machines in rice-farming.

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