

# Executive Summary

## Estimation of Pre-and Post-Harvest Losses in Paddy Crop in Tamil Nadu

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## **Executive Summary**

Agriculture plays an important role in the Indian economy. Its share in the Gross Domestic Product (GDP) has exhibited a declining trend from 55.4 percent in 1950-51 to 14.3 percent in 2010-11. But, still about 38 percent of food items are exported to foreign countries and a sizable work force is depending on agriculture. There has been significant progress in agricultural production during past six decades in India. Foodgrain production increased from 50 MT in 1950-51 to 241 MT in 2010-11. The increased food production is mainly due to the use of High Yielding Varieties (HYV), fertilizers and modern technology. The Green Revolution has played a significant role in increasing agricultural productivity. But the benefits of Green Revolution have not reached the marginal farmers.

The important natural resources, land and water are becoming increasingly scarce due to multiple uses; it has become difficult to extend the intensive cultivation. And the cultivated area is reduced due to the development of other sectors over a period of time. We have to explore alternatives to increase the agricultural production and to meet the growing demand for food grains. Food is essential for future generations. 'Poverty, hunger, water scarcity, land degradation, migration and other health constraints still persist in the agricultural sector' (Ministry of Agriculture 2008-09, 2009-10). Therefore, there is a need for food items to solve the persistent increase in the population growth.

In India, the main objective of Green Revolution was to increase the productivity in agriculture through the adaptation of high yielding varieties (HYV) along with use of chemical fertilizers and pesticides during 1960s. After 1980s, the crop diversification and emergence of allied sectors have been given high priority and new technology has been introduced in the oilseeds. After the implementation of economic reforms there is an increase in the demand for agriculture commodities in both domestic and foreign markets. Food consumption pattern is in slow change from cereals to fruits, vegetable and livestock products. Trade liberalization has led to production of such commodities which have export demand in the international market. These developments have changed multi-commodity production to a specialized system in different parts of the country. In the process, many traditionally cultivated crops have lost their area or out of cultivation. But these developments have resulted in increased pest and diseases and

consequent use of pesticides has also resulted in developing insects and diseases resistance, leading to the crop yield reduction.

## **1. Background of Pre- and Post-Harvest Losses**

The problem of food losses is given most importance in world's poorest countries to improve food security and increase to farmer's income. These losses have deep impact on food security, economic development and environment. Generally, there are two kinds of losses pre-harvest and post-harvest losses.

### **1.1 Pre-Harvest Losses**

The worldwide crop loss due to various types of pests was estimated at 37.4 percent in rice, 28.2 percent in wheat, 31.2 percent in maize and 26.3 percent in soybean (Oerke, 2007). In India, crop loss estimate due to insect pests has been provided by Dhaliwal et al. (2010). According to their study, crop loss was estimated at 25 percent in rice and maize, 5 percent in wheat, 15 percent in pulses and 50 percent in cotton. The crop loss has increased during post-Green Revolution period than pre-Green Revolution period. The severity of pest problems has been changing with the developments in agriculture technology. Many studies have revealed that there is strong relationship between pest infestation and yield loss in various crops in India (Nair, 1975, Dhaliwal and Arora, 1994, Muralidharan, 2003, Rajeswari et al. 2004, Muralidharan and Pasalu, 2006, Muralidharan and Rajeswari).

### **1.2 Post-Harvest Loss**

Several studies have reported post-harvest losses of cereal grains such as paddy, wheat and maize (Bala, 1978, Singaravadivel, 1992, Saxena et al. 2000, Singh et al., 2002 and Basappa, et al., 2007). Bala (1978) reported the estimate of quantitative losses of paddy in Bangladesh at each stage starting from harvesting to retailing. The loss was estimated to be about 8 percent to as high as 22 percent counting all the processes between the harvest and retailing. The important stages of losses are threshing, drying, distribution and storage. The highest loss is reported to have occurred during storage.

Post-harvest losses especially in vegetables and fruits are presently in the range of 20 to 30 percent. It contributes directly to higher costs and reduces availability of these commodities

(Tenth Five Year Plan 2002-07, Government of India). Fruits are highly perishable products and their quality can be affected by post-harvest practices such as handling, transportation, storage and marketing (Naureen et al., 2009). Decrease in post-harvest losses can minimize cost of production, improve trade and distribution, enhance food security especially in developing countries and increase farmers' income. There will be great challenges in paddy crop due to mismatch between supply and demand in future. Increasing paddy production is a major challenge to the economy because of climatic change (plant hopper outbreaks induced by rising temperatures) in Asian regions; In addition, intensive cropping systems are affected because of plant hopper and overuse of fertilizers and pesticides. Paddy supply can also be increased by reducing grain losses at the post-harvest stage. About 5-6 percent of paddy is lost due to poor cutting, handling, threshing, and cleaning. Another 5-21 percent is lost because of inadequate drying, storage, milling, and processing facilities. The total estimated losses are 10-37 percent of paddy grown (Asian Development Bank, 2009).

### **1.3 Objectives of the Study**

The objectives of the present study are:

- To estimate the physical and financial losses caused by pests and diseases in paddy (rice) at farm level in Tamil Nadu.
- To examine the measures of pest and disease management to reduce the pre-harvest crop loss due to pests and diseases at farm level.
- To arrive at pre-and post-harvest losses in paddy (rice) under different agro climatic conditions.
- To identify factors responsible for such losses and suggest ways and means to reduce the extent of losses in different operations in order to increase national productivity.

### **1.4 Data base and Methodology**

The study is based on the farm level data collected from the two major paddy growing districts namely Tiruvarur and Villupuram of Tamil Nadu. The crop production faces various constraints particularly infestation by pests and diseases. Losses caused by them were worked out based on the estimates provided by the farmers. As not only pests and diseases cause crop damage when their population reach beyond a threshold level, there are also other bio-economic

factors like soil fertility, water scarcity, poor seed quality, high input costs and low output prices resulting in considerable financial loss to farmers. So, data on these bio-economic variables were also collected from the farmers. The post-harvest losses during the process of harvesting, collection and threshing, transportation and storage were also quantified based on the estimates provided by the farmers. As storage material used by the farmers was not scientific, it was essential to identify the structure of storage at the farmers' level and enumerate the losses occurring in the process of storage at the farm level.

To collect the primary data, a sample survey was conducted in Tiruvarur and Villupuram districts of Tamil Nadu for the reference period for rabi 2010-11 (November to May) and kharif 2011-12 (June to October) for paddy crop. Tiruvarur district is located in the southern part of Tamil Nadu region while Villupuram district is in the northern part of Tamil Nadu region. From each district, two villages with one nearby the market/mandi centre and one far off from the market centre were selected for canvassing the questionnaire. Random samples of 40 paddy growing farmers are selected from each block. This constituted a total sample of 160 farmers for each crop in the state. To ensure proportionate representation to various farm size categories in the study sample, standard national level definition of operational holdings viz., marginal (< 2.50 acres), small (2.51 to 5.00 acres), medium (5.01 to 10.00 acres) and large (> 10.01 acres) was applied. In addition to the primary data collected from the farmers, concerned district agriculture offices and State Commissioner, Agriculture Office (Chennai) and Tamil Nadu Agricultural University were also consulted to compile the crop loss estimates (if any) for pre- and post-harvest losses. Simple statistical tools were used to interpret the sample survey results.

The random sample procedure adopted at the district, taluk and village level. It can be observed that the majority of the farmers fall in the marginal (33.5 percent) and small farmers (27.5 percent) category. The percentage of farmers in medium category is 17.5 percent. About 160 households have been selected from 8 villages in 4 blocks of Tiruvarur and Villupuram districts at the rate of two villages in a block and two blocks from each district on random basis.

### **1.5 Major Findings**

The major findings mainly resolve around the estimates with respect to area, production and productivity of the paddy crop cultivated in Tamil Nadu, Second chapter deals with trends of cost of cultivation and profitability involved in the cultivation of paddy crop. Third chapter

focuses on socio-economic profile of sample households particularly family size, composition, educational status, caste category, land use pattern, cropping pattern, irrigated area, sources of irrigation, crop productivity, marketed surplus, value of output etc., Fourth chapter deals with the assessment of pre-harvest losses of paddy crop which focused on constraints faced in cultivation of paddy crop, assessment of incidence of pests and disease attacks and crop losses, methods of pests and diseases control adopted by the sample households, source of information for pests and disease control by the sample households, households suggestions on how to reduced that losses. Fifth chapter deals with the assessment of post-harvest losses of paddy crop; it includes production loss during harvest, threshing, winnowing, transportation and handling, storage, capacity utilization of storage by the households and suggestions of sample households to reduce such losses.

## **2. Growth Trends in Area, Production and Yield of Paddy Crop in Tamil Nadu**

Tamil Nadu is one of the major paddy producing states in India. On one side the area under paddy cultivation declines but on the other, production of paddy get increased. The increase in the production of paddy can be attributed largely to the impact of high yielding varieties during that period. Specifically, there were remarkable positive growth in area and production during 1991 to 2001. The area under cultivation of paddy in the State marginally declined over the years whereas there are significant fluctuations in paddy yield and production.

District level analysis shows that the paddy is produced in almost 31 districts of Tamil Nadu except Chennai. Out of that, Thanjavur, Tiruvarur, Villupuram, Nagapattinam, Ramanathapuram, Cuddalore, Vellore, Tirunelveli and Kancheepuram districts are produced predominately with high level. On contrary, Niligiris, Coimbatore and Namakkal districts are producing with minimum level. All most in all the districts of Tamil Nadu, the area and production under paddy generally shared a declining trend due to urbanization, cultivated land has become converted into real estates, industrial development and finally farmers feel that agriculture has become an unprofitable occupation.

The highest yield rate of 5056kg/ha was recorded in Theni district followed by Thoothukudi (4945kg/ha), Dindugal (4737kg/ha) and Kanyakumari (4405kg/ha) during 2009-10. The highest ACGR was recorded of Sivagangai (4.11 percent) followed by Ramanathapuram (3.23 percent), Dindugal (2.36 percent), Kanniyakumari (2.21 percent), Salem (1.97 percent),

and on lowest share of ACGR by Perambalur (0.91 percent), Virudhunagar (0.61 percent) Thoodhukudi (0.23 percent).

The ACGR of area under paddy cultivation were declined to 1.62 percent during 1985-90 to 2000-2010. Even though, in mean time of 1990-2000, there was positive growth rate of 1.55 percent in Tamil Nadu. It is noted that the area extension under paddy crop due to availability of water sources, good rainfall, use of HYV seeds and use of modern technology in farm field. Within 32 districts of Tamil Nadu, only four districts increased the production during 2000-10. Krishnagiri was a leading district in the production of 6.21 percent of ACGR, followed by Thoothukudi (3.59 percent), Thiruvannamalai (2.77 percent) and Thirunelveli (0.49 percent). It is observed that there are wide variations in area, production of paddy among districts.

During the period of 25 years, the earlier period of 1985-90 is the most significant one, because most of the districts in Tamil Nadu in terms of area and production in paddy cultivation exhibited an increasing trend than the later period of 2000-10. The average annual growth rate of paddy production declined almost in majority of the districts in Tamil Nadu, except Krishnagiri, Thoothukudi, Thiruvannamalai and Tirunelveli.

## **2. 1. Changes in Costs and Profitability of Paddy Crop in Tamil Nadu**

In Tamil Nadu, total cost of cultivation under paddy crop increased from Rs. 37575 per ha. in 2007-08 to Rs. 59496 per ha. in 2011-12. Operational cost per ha increased from Rs.25024 in 2007-08 to Rs.44952 in 2011-12. That means an increase of 8.95 percent (Rs.19928) during the five year period. Within operational cost, human labour cost increased to Rs. 24395 in 2011-12 against to Rs. 11754 in 2007-08, which is increased to 10 percent (Rs.12644). This implies that the human labour cost is increased to above 50 percent between 2007 and 2012. The cost of seeds per ha increased to Rs.5268 in 2011-12 from Rs.2066.

The highest share is occupied by human labour of 31.28 percent, followed by machine power cost of 15.14 percent. The cost of fertilizers was 10.03 percent of the operational cost during 2007-08. The proportion of operational cost increased to 75.55 percent during 2011-12, out of which, the cost of human labour was 41 percent over the five year period. On the other hand, cost of machine power, fertilizers, irrigation charges, fixed cost had shown declining trend during 2011-12.

### **3 Socio-economic Conditions of the Study Area**

The socio-economic conditions of different farm size of paddy crop in Tiruvarur and Villupuram districts have been analyzed. The conditions involved family size, number of earning members, various age groups, educational status of the sample households, caste status and annual family income.

#### **3.1 Demographic Profile**

The different farms shows that there are 53 (33.13 percent), 44 (27.5 percent), 28 (17.5 percent) and 35 (22 percent) for marginal, small, medium and large farms, respectively. There significant difference exists among the different sizes of farms. The majority of the sample households are belonged to marginal and small farms. The majority of the farmers are educated upto primary, secondary and higher secondary, graduate level at 12 percent, 47 percent and 26 percent, respectively. On the other hand, 14 percent of the farmers are illiterate. This helps them to easily adapt new technology in agriculture. The majority of the households were belonged to OBCs, out of that 57 percent belonged to marginal farms, 80 percent belonged to small, medium and large farm categories. On contrary, 36 percent and 20 percent of marginal, small farmers belonged to the Scheduled Caste (SC). The small percentage of SC farmers had medium and large holdings.

#### **3.2 Operational Holdings**

The highest operational holdings is 20.32 acres for large farmers and lowest of 1.68 acres for marginal farmers. Marginal farmers have minimum share of 1.33 acres own land as compared to leased-in land of 0.31 acres. On contrary, large farmers have own land of 15.67 acres with more leased-in land of 3.80 acres with leased-out land of 0.26 acre.

#### **3.3 Nature of Tenancy**

The paddy received in terms of crop-sharing for leased-in land is highest of 0.13 acre (42 percent) for marginal farms, 0.21 acre (36 percent) for small farms and 1.09 acres (29 percent) for large farms. The average fixed rent paid for utilization of leased-in land is 2.71 acres (71 percent) where as 1.26 acres (65 percent) for medium farms. This indicates that of most of the farmers, irrespective of their farm size; prefer fixed rent rather than crop-sharing.

### **3.4 Sources of Irrigation**

Generally, Cauvery water is used by Tiruvarur district farmers while in Villupuram district; water is not available from the rivers, therefore, they are mainly using tube well. Majority of the farmers make use of canal and tube well irrigation are 73.81 percent, 71.52 percent and 83.27 percent of marginal, small and of large farms, respectively.

### **3.5 Cropping Pattern**

The Gross Cropped Area (GCA) is expanded by the sample farmers at 37.44 percent, 34.82 percent and 27.77 percent during kharif, rabi and summer seasons, respectively. Among different crops, paddy occupies the single most cropped area during all the seasons in both districts. It is more or less the same for the land by marginal, small, medium and large farmers during kharif season. It implies that the production level declined due to continuous utilization of land in three seasons.

The percentage of GCA is 37.44 percent for all selected crops, out of that paddy occupied by 29.44 percent and rest of the other crops for 8 percent (cotton, pulses and vegetables) during kharif season. Similarly, 34.82 percent for all the selected crops, 26.19 percent for paddy are 8.63 percent during the rabi season. During summer season, paddy accounted for 21.52 percent out of total 27.75 percent GCA for selected crops. It shows that paddy is a predominant major crop in Tiruvarur and Villupuram districts. This also points out the need for adequate supply of water for this crop.

### **3.6 Percentage of Area under HYVs**

The farmers enjoyed high returns due to using the HYV seeds. Both districts sample farmers are used the HYV seeds with cent percent level. Government succeeded in creating awareness among the sample farmers over the years about the advantages of using HYV seeds in crop cultivation. The sample households in both the districts make use of HYV seeds for all the crops.

### **3.7 Crop Productivity**

The yield of paddy per acre is 22.89 quintals, 21.39 quintals and 20.40 quintals during kharif, rabi and summer seasons, respectively. The highest yields per acre produced by medium

farmers are 27.45 quintals and lowest yield by large farmers (23.56 quintals) during kharif season. During rabi season, small farmers are produced highest yield per acre at 22.55 quintals. The marginal farmers are produced the production with bottom level in all the seasons because of their inability to use HYV seeds in a big way.

### **3.8 Value of Output**

Clearly highlights that there are wide variations in the value output per household among different farm sizes. The percentage share of output marketed by medium and large farmers was 86.83 percent and 88.17 percent respectively, whereas for marginal and small farmers, the percentages were at a lower level (81.26 percent and 83.49 percent). The percentage figures for output market also reveals that agriculture in Tiruvarur and Villupuram districts is no longer subsistence farming without marketable surplus. Another point to be noted is that the percentage share of output market increases with the size of the farm.

### **4. Pre-Harvest Losses of Paddy Crop: Estimation**

During estimating pre-harvest losses, which cover the estimate constraints faced by the farmers during cultivation of paddy crop, incidence of pests and diseases attack, magnitude of crop loss due to pests, diseases and weed infestation, methods of pests and diseases control adopted by different size of sample households, cost of chemicals, sources of information received by the sample households for pests and diseases control and household suggestions to reducing such losses.

#### **4.1 Constraints Faced in Cultivating Paddy Crop**

The farmers were faced different constraints like low output price, high costs of inputs, water deficit and others. Low output price was the most important constraint faced by 57.50 percent in Villupuram, and 40 percent in Tiruvarur district. High cost of inputs was the most important constraint faced by 56.3 percent in Villupuram and 35 percent in Tiruvarur. Water deficiency was cited as most important constraint by 32.5 percent in Tiruvarur and 13.8 percent in Villupuram.

#### **4.2 Assessment of Incidence of Pests and Diseases Attack**

The quantitative assessments about the attack of the diseases were identified by 17.5 percent in Tiruvarur and 11.2 percent in Villupuram. The qualitative assessments of the attack were identified by 61.3 percent in Tiruvarur and 70 percent in Villupuram. Most of the pests and diseases more frequently attacked, Tiruvarur farmers owing to continuous use of land for cultivation in a year. This is the main reason for the attack of pests and diseases in the paddy crop in the Tiruvarur district than Villupuram district.

The majority of the respondents were opined that the pests and diseases attacked the crops every season in Tiruvarur. The Rice Stem Borer and Plant Hoppers and Leaf Folder ranked as very important were 69 percent, 42.5 percent, 25 percent, respectively with production loss at 5 percent level. The majority of the respondents (66.30 percent, 55.0 percent, respectively) ranked the diseases like false mute, bacterial leaf blight and sheath blight as important. A majority of them (more than 86 percent) put the production loss at 5.0 percent.

The majority of the sample farmers in Villupuram district were reported major pests and diseases attacked the crops every season. The Rice Stem Borer, Leaf Folder and Plant Hoppers were ranked important pests attacked by 61 percent, 55 percent and 49 percent, respectively, with production loss at 5 percent level. Majority of the sample farmers were ranked the diseases of Bacterial Leaf Blight, Sheath Blight and False Mute as important by 51 percent, 42 percent and 41 percent, respectively, with production loss at 5 percent level.

A comparative study of the incidence of the major pests and diseases in Tiruvarur and Villupuram districts shows that the intensity of the attack by pests seems to be greater in the former district. But both districts seem to suffer from major plant diseases almost in equal measurement of course, with differences in frequency of attack.

The overall loss of output per acre in Tiruvarur district is about 1.92 quintal for all the farms, whereas, heavier loss suffered by large farms (3.42 quintals). Loss occurs due to the attack of pests, plant diseases and weed infestations (actual production) are varied from 14 percent, 12 percent, 14 percent and 16 percent for marginal, small, medium and large farms, respectively. This noted that the variance with the perception of the farmers who felt that the percent of production loss was below 5 percent.

The average loss of output per acre is 2.48 quintal for all the farmers in Villupuram district, while large farmers suffered heavy loss at 2.93 quintal. Loss causes the attack of pests,

diseases and weed infestations are varied from 13 percent, 9 percent, 12 percent and 14 percent for marginal, small, medium and large farmers, respectively. It is noted variance with the perception of the respondents who put the percentage of production loss at 5 percent.

#### **4.3 Methods of Pests and Diseases Control**

The cost per acre was the lowest of Rs.303 for large farmers and highest cost of Rs.345 for medium size farmers and sprayed the chemicals only once per acre in Tiruvarur district. The total cost per acre for insecticides was lowest of Rs.317.04 for marginal farmers and highest cost of Rs. 395 for the large farmers. The average cost incurred to control the insecticide was Rs.346. The highest total cost was Rs.338 for small farmers and the lowest for medium farmers (Rs. 301).

The total cost per acre for weedicides was the lowest of Rs.257 for the medium and the highest of Rs. 373 for large farm in Villupuram district. The cost of insecticides was the lowest of Rs. 422 for the small farm and the highest of Rs.484 for the large farm. The total cost of fungicides was more or less the same for all the farms sizes. It was in the immediate neighborhood of the average cost (Rs. 362 per acre). It reveals that large farmers spent more on weedicide and insecticides.

#### **4.4 Sources of Information for Pests and Diseases Control**

About 66 percent of sample farmers was reported the services provided by the Government extension agent, as the most important in Tiruvarur district and only 19 percent in Villupuram district. But 59 percent is considering the services of private input dealers as most important in Villupuram and 15percent in Tiruvarur district. It implied that the poor utilization of the services of Government agency in Villupuram district is a matter of concern and needs further study in depth. The high percentage in Villupuram district, in a way, may be attributed to the easy availability of agricultural inputs on credit from private dealers.

The fellow farmers were advised about pests control with ranked as most important to 45 percent in Tiruvarur and whereas, ranked important as 67.5 percent in Villupuram. The majority of the households in both the districts were of the opinion that the services provided by TV/Radio/News papers, Agricultural University/KVK were of least important. Agricultural

University may intensify its efforts to propagate the new techniques of production and innovative agricultural practices.

#### **4.5 Household Suggestions to Reduce the Pre-Harvest Losses**

In order to reduce the pre-harvest losses, the household suggestion of paddy crop cultivators in Tiruvarur and Villupuram districts, Government may give advice from beginning of the paddy crop cultivation till the harvesting stage. It should play the role of a caretaker at every stage of paddy production. Government should create awareness among the farmers about the pests, diseases and weeds. The agent should be given advice about how to control pests, diseases and weeds. At present, chemicals used in the control of pests and diseases and weeds are not effective in many cases. Government should give advice to the firms manufacturing chemicals relating to the quality of that product. Government/Private agencies should arrange special camps relating to pre-harvest losses in every village of paddy growing region and the farmers should be given advice as how to control the pre-harvest losses in that season. Government should provide better quality seeds, fertilizers and chemicals in time. Otherwise, the farmers will suffer. Most of the time, the government selling centres are closed without any reasons. With the result that farmers are forced to purchase pesticide etc. from private dealers travelling long distance. Government should open the agro-centre in at least every panchayat village. Otherwise, farmers will be put to unnecessary hardship for reasons of time and distance and they have to incur sizeable transport costs for purchase of agricultural inputs like seeds and chemical fertilizers. Government should give training to the farmers for controlling the pre-harvesting losses caused by pests and diseases and weed infection in the farm field.

#### **5. Post-Harvest Losses: Estimation**

In order to estimate post-harvest losses, the losses occurring during harvest, threshing, winnowing, transportations, handling and storage, assessment quantitative aspects of storage and their pests control measures adopted by the sample households and suggestions of the sample households relating to reduce the post-harvest losses of paddy crop.

### **5.1 Production Loss during Harvest**

The heavier quantity lost per acre during early and late harvest was 92.32 Kg. and 87.63 Kg. in Tiruvarur and 72 Kg, 88.48 Kg, in Villupuram district. It implies that both the seasons affect huge amount of paddy loss, but, heavier loss occur to the Tiruvarur than Villupuram district. But in mid-season, 51 Kg, 68 Kg in Tiruvarur and Villupuram districts respectively. During mid-season, farmers of Tiruvarur district were reducing the loss than Villupuram. The heavier loss per acre was incurring 92 Kg. in Tiruvarur district than Villupuram district (72 Kg.) during the early harvest season. It is also observed that a majority of sample households (60 percent) in Villupuram district harvest the paddy during the mid-season than Tiruvarur district (42 percent).

The heavier losses per quintal were occur 3.87 Kg, 3.68 Kg in Tiruvarur and 2.96 Kg, 3.60 Kg in Villupuram for early and late harvest, respectively. Both the districts were make huge loss, even though, sample farmers of Tiruvarur were occur heavier loss than Villupuram during early and late harvest time. The loss can be reduced to 2.21 Kg., 2.86 Kg., in Tiruvarur and Villupuram districts respectively. It is noted that the loss were reduced during the mid- season.

### **5.2 Production Loss during Threshing and Winnowing**

The average quantity lost per quintal during threshing activities was 2.11 Kg. and 0.83 Kg. in Tiruvarur and Villupuram districts. These machines were making use of 67 percent and 53 percent in that districts. That shows that the make use of it by Tiruvarur than Villupuram district. The average quantity lost per acre during winnowing activities was 0.18 Kg. in Tiruvarur district. About 68 percent ranked the loss as low during the winnowing process. The majority of the sample households in Villupuram sell their produce within a week as they are in dire need of money.

### **5.3 Production Loss during Transportation and Handling**

The average quantity per households transported to marketing place was 125.6 quintals and with the average distance of 2.58 Kms in Tiruvarur and whereas in Villupuram it was 132.03 quintals with distance of 19.06 Kms. The average loss per quintal during transportation incurred was 0.56 Kg. in Tiruvarur whereas in Villupuram was 0.65 Kg. About 55 percent and 67.5 percent reported low level of loss during transportation of paddy in Tiruvarur and Villupuram

districts. The transportation charges per quintal were Rs.9.86 in Tiruvarur but in Villupuram, they account for Rs. 14.64.

When we compare the two districts of Tiruvarur and Villupuram, majority of the sample households used the government procurement centre which was within a distance of 5 Kms in Tiruvarur. But in Villupuram, as only two government procurement centre are there. The farmers had to transport their produce for a long distance with huge transportation costs. Therefore, Government of Tamil Nadu can set up *Government Procurement centres* during the harvesting seasons within a distance of 10 Kms from the farm.

#### **5.4 Production Loss during Storage**

About 41 percent and 32 percent of Tiruvarur sample farmers store their produce in a pucca house, open place, respectively. But in Villupuram, the sample farmers were 87 percent and 13 percent as use the open place and pucca house for a short period. The farmer in the sample households in the district had no proper storage facilities as most of them are marginal farmers. The average amount stored per households was 0.88 quintal in Tiruvarur district, whereas in Villupuram was 0.62 quintal. The average number of days per households the grain preserved was 175 days in Tiruvarur and 10 days in Villupuram due to inadequate storage facilities in the district.

The average quantity lost per quintal during storage was 0.24 Kg., 0.25 Kg., and 0.22 Kg. due to weight loss, rodents and fungus pretentious in Tiruvarur district. The corresponding figures were 0.19 Kg., 0.21 Kg. and 0.06 Kg. in Villupuram district. It noted that highest loss due to fungus of long duration. The storage cost per quintal Rs. 0.79 Kg. in Tiruvarur district, and 0.98 Kg. in Villupuram district. About 50 percent and 56 percent in respective districts ranked the loss to storage as medium level.

#### **5.5 Post-Harvest Losses**

The highest quantity lost per quintal occurred by medium and marginal farmers during harvest was 3.14 Kg. and 3.36 Kg. in Tiruvarur and Villupuram districts. The overall quantity loss per quintal occurred during harvest was 3.10 quintal, 3.16 quintal in both districts. It is observed on the basis of overall loss in Villupuram sample farmers lost more during harvest seasons than Tiruvarur's sample households. The quantity lost per quintal during storage was

2.34 Kg. in Tiruvarur and 0.84 Kg. in Villupuram. Medium size farms incur the highest loss were 3.37 Kg. and 1.08 Kg. The highest storage losses in Tiruvarur may attribute to the long period of storage (average number of days 175), whereas, the corresponding figures is 10 days for sample households in Villupuram.

The average quantity lost per quintal during threshing activities was 2.11 Kg and 0.83 Kg. in Tiruvarur and Villupuram districts. The quantity lost per quintal in transport was larger for Villupuram households (0.65 Kg per quintal) than for Tiruvarur households (0.56 Kg per quintal) because the farmer had to transport their produce for sale over relatively longer distance. The overall post-harvest losses per quintal incur heavier (8.29 Kg.) in Thiruvarur whereas in Viluupuram incur lesser overall loss of 5.47 Kg.

### **5.6 Quantitative Aspects of Storage and their Pests Control Measures**

The cost of permanent storage is higher in Tiruvarur district (Rs.3569 per households than in Villupuram district (Rs. 3125 per household). But the cost of storage in kutchha or cemented house is lower in both districts-Tiruvarur (Rs.1280) and Villupuram (Rs.1250). The sample households incur very low costs towards maintenance of storehouses and pest control during storage.

### **5.7 Households Suggestions to Reduce the Pre-and Post-Harvest Losses**

Government should give consistent advices to the farmers from the beginning stage of paddy crop cultivation to harvesting stage. It should play the role of a caretaker at every stage of paddy production. Government and other private dealers should create awareness among the farmers to control pests, diseases and weeds. Chemicals used by the farmers are not effective in controlling the pests and diseases and weeds. So, government should regulate the chemical manufacturing firms to maintain their quality of the product. Government/Private agencies should arrange special camps to train farmers to reduce pre-and post-harvest losses in every village of paddy growing regions. Government should provide better quality seeds, fertilizers and chemicals to the farmers in time. Government selling centres were closed frequently without any reasons, as a result farmers are forced to purchase from private dealers. Government should open the agro-farm centres at every panchayat village level to reduce hardship of farmers due to time and distance which incur sizeable transport costs. Government should provide jute bags to

the farmers at subsidized prices. Government should construct the godown facilities and drying facilities in every village panchayat union. Good infrastructures facilities should be built in rural areas which can reduce transportation cost and losses. Government should fix the procurement price for paddy well in advance. Government and co-operative societies should provide paddy harvesting machines and other farm equipment at subsidized rates. Government should set up Procurement Centres during every harvest season. Farmer should harvest the crop within time; otherwise, he will incur huge loss. The storage structures should be maintained in good condition and guarded against rat anemone. Government can set up seed purification centres in every village panchayat union for seed purification. Farmers may follow organic farming in the agriculture field for protecting clean environment. Government should purchase the paddy directly from the farmers for the welfare of common man. This will help in containing prices and in controlling inflation.