Common Agricultural Practices and Post-Harvest Losses in Trincomalee, Sri Lanka

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Abstract

In Sri Lanka, the post-harvest losses of harvested crop yield has become a national issue in terms of food security and nutrition. Different types of losses occurred during the storage of various crops are frequently reported throughout the country. Despite the awareness on increased post-harvest losses in warm environmental conditions and geographical-area-based crop losses, recent information on such post-harvest losses of crops grown in different regions of Sri Lanka is not available. Therefore, this study assessed the crop cultivation practices, main crops grown and their post-harvest losses in two different areas adopt traditional farming (Mahadiwulwewa) and urbanised agriculture (Nilaweli) in Trincomalee district of Sri Lanka. Data were collected from farmer families using a questionnaire. The main crop cultivated in both Mahadiwulwewa than Nilaveli is paddy. However, farmers in Nilaveli extend their cultivation to field crops, vegetables and fruits tobacco. In both Mahadiulwewa and Nilaveli, the majority of farmers engaged in farming between 50-59 years of age. Paddy occupied 73% of the total cultivated area in Nilaveli and 100% in Mahadiwulwewa. The average yield and use of machineries differed with the crop. Storage duration of paddy was 3-6 months. For storage of paddy, mostly farmers use jute sack and gunny bags. Post-harvest losses occurred during storage and insect infestation is also discussed. The information on numerous agricultural practices in the selected areas would help to improve the existing practices and minimise the losses targeting better agricultural productivity in Trincomalee district in the future.

Keywords: farming practices, paddy, other crops, storage losses, insects

1. Introduction

The post-harvest losses of crop yield across the world is estimated to be about 1.3 billion ton or one-third of the total food production, and is a great challenge to the global food security (Kumar and Kalita, 2017). Such losses can be occurred at any stage from harvesting of crop yield until consumption (Hill, 1992; Hagstrum and Subramanyam, 2006). The influence of various factors on postharvest losses has been reported throughout the world (African Post Harvest Losses Information System, 2011; Khare, 2015). Furthermore, the losses can be minimised through the utilisation of improved technology (Baributsa, 2012; Baoua et al., 2012). Post-harvest losses of agricultural commodities vary with the geographical location (Mvumi and Stathers, 2014; Kumar and Kalita, 2017; Wijayaratne et al., 2018). In Sri Lanka, the last island wide survey on postharvest losses has been done two decades ago (Palipane, 2001) necessitating the requirement to have updated knowledge. In another old study, the losses of paddy in storage systems used in Sri Lanka has been evaluated (Donahaye et al., 1991). While there has been no comprehensive survey done representing entire Sri Lanka on these losses in the recent past, individual records from different geographical regions still provide important data on the crop post-harvest losses. As such, post-harvest losses of paddy, maize and greengram in Anuradhapura district were made available recently (Kumari et

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al., 2020). The post-harvest deterioration is high at higher temperatures (Hagstrum and Subramanyam, 2006). However, there has been a scarcity of such information recorded from the warmer areas of Sri Lanka including the North and Eastern parts of the country. Therefore it is worth surveying the nature of crop losses following harvest in the other warmer parts of the country.

The dry zone of the Sri Lanka bears 11 agro-ecological sub-regions with different climatic characteristics. The agro-ecological sub-regions (DL1c, DL1d, DL1e) belong to eastern part of the dry zone have unique rainfall pattern. The agricultural practices in these areas are highly adaptive to this unique rainfall pattern (Bio diversity clearing house mechanism, 2016-2017). Trincomalee located in the north-east area of Sri Lanka belongs to the DL agro-ecological zone. Trincomalee district bears population of 426,000 dispersed in land area of 2,529 km^2 possessing their main occupation as crop farming. Due to the limited water supply mostly coincides with the rainfall pattern, the crops are cultivated on seasonal basis in Trincomalee (Basic population information on Trincomalee district, 2007).

Rice is the staple food of Sri Lankans (Waisundara, 2020). Furthermore, the contribution from upland crops to the national production is also important in terms of nutrition of the people. For instance, the annual production of manioc, red onion, big onion and green chillies are 184,260, 35,480, 16,920 and 50,720 MT, respectively (Census and Statistics, 2019). While certain information on the production of these crops is available (Census and Statistics, 2019), details on their post-harvest losses are minimum. Possessing these information would be of great importance for taking appropriate remedial measures to minimise the said losses. Therefore, this study was conducted in selected areas in Trincomalee district to determine the nature of crop farming and post-harvest losses of the crops grown in those areas.

2. Materials and Methods

Nilaveli and Mahadiwulwewa, two areas in Trincomalee district having different farming approaches were selected for this survey. While Nilaweli is modernised Mahadiwulwewa still follows traditional farming. From each location, 35 farmer families were selected and their information was collected using a questionnaire. The information collected included age of the farmers engaged in crop cultivation, types of crops cultivated and their amount, land use for crop cultivation, involvement in selected agricultural practices, storage of harvested yield and their losses.

2.1 Statistical analyses

Data collected from Nilaveli and Mahadiwulwewa in respective of age distribution of farmers, percentage farmers cultivated crops, average land extent of cultivated crops in Nilaveli, use of machines for post-harvest practices Nilaveli and storage losses of different agricultural commodities were analysed as percentage with respective to the stored quantity.

3. Results and Discussion

The majority of farmers engaged in farming was between 50-59 years of age in both Mahadiulwewa and Nilaveli areas (Figure 1). Among those older than 59 years engaged in crop cultivation, more people were from Mahadiwulwewa than Nilaveli. It is also recorded that in Mahadiwulwewa, people engaged in cultivation even in older ages. This would have been a consequence of continuation of traditional farming in which they were engaged for generations in Mahadivulwewa whereas urbanisation in Nilaveli would have altered involvement in farming among younger people. However, the exact reason needs to be investigated in a future study. In general, the majority of famers in the dry zone belongs to the age group 41-50 years (Sangakkara and Frossard, 2014). In comparison, the majority of farmers as found in the current study belongs to 50-59 year age group in both Nilaveli and Mahadiwlwewa.

In terms of the crops grown, the rural-based Mahadiwulwewa had mainly paddy cultivation. In contrast, Nilaveli had a variety of crops grown. These include onion (*Allium cepa*), egg plant (*Solanum melongena*), cassava (*Manihot esculenta*), long bean (*Vigna unguiculata*), papaya (*Carica papaya*), chilli (*Capsicum annuum*), winged bean (*Psophocarpus tetragonolobus*), tobacco (*Nicotiana tabacum*) (Figure 2). Urbanisation in Nilaveli compared to Mahadiwulwewa may have opened avenues for the commercialisation of crop cultivation beyond traditional paddy cultivation.

On the whole, paddy farming leads the crop cultivation and occupy 73% of the total cultivated area in Nilaveli. Mahadiwulwewa has more emphasis on paddy among the economically valuable crops than other crops. The study reveals a wide variation of the rice yield between Nilaveli and Mahadiwulwewa. The average yield of paddy was 1500 kg/Ac for Mahadiulwewa and lower than Nilaveli which had 1,718 kg/Ac. The reasons for the variation in paddy yield between Nilaveli and Mahadiulwewa seem to be due to the differences in the use of organic and inorganic fertilizer and agro-chemicals, availability and management of irrigation facilities, soil properties, and knowledge of farmers on agronomic practices. The productivity of other crops grown in Nilaveli varied as 4,821 kg/Ac for onion, 3,250 kg/Ac for egg plant, 300 kg/Ac for papaya and 1,500 kg/Ac for chilli.

Despite the mechanisation of agriculture, still manual harvesting is practiced for majority of crops. The mechanical harvesting is used only for paddy (Figure 4). In paddy cultivation the farmers in Mahadiulwewa used machines for harvesting and threshing. They mostly used combine harvesters and combine threshers. Mahadiulwewa have lager number of paddy farmers than the Nilaveli. Therefore it would be a reason for using more mechanical force for harvesting and threshing of paddy compared to Nilaveli. But in drying of paddy, the machines were not used. Instead, sun drying is practiced in both Nilaveli and Mahadiulwewa. Also farmers in Nilaveli and Mahadiulwewa were not awareness on the recently-developed paddy dryers and new drying techniques (Shyamali et al., 2009; Bandara et al., 2014; Dissanayake et al., 2016). Furthermore, machineries were not used during harvesting or post-harvest operations of other crops in Nilaveli and Mahadiwulwewa.

In both Nilaveli and Mahadiwulwewa, paddy is stored for 3-6 months for consumption and to prepare seed paddy for the next cropping season. In general, paddy is stored in jute sacks or gunny bags in both areas. Jute sacks have nearly 30-50 kg whereas gunny bags have 45-60 kg. The preferred practice is these bags are stacked on wooden pallets inside small rooms near houses. Normally they use 8-12 layers of bags for one stack. In contrast to the above practice of bag-storage of paddy, some farmers in Nilaveli use traditional storage structures such as Atuwa, Bissa, Passa Kuruniya to store paddy. For this, mostly farmers use locally-available materials such as clay, wooden poles, palmyra leaves and bamboo to construct the storage structures. These structures are designed to protect grain or other harvested commodities from insects, mites, fungi, rodents and birds. These records agree with previous finding (Adhikarinayake, 2005). The Sri Lankan farmers who store cereals don't have adequate awareness on small-scale storage structures that accompany minimal post-harvest losses (Adhikarinayake, 2005; Adhikarinayake et al., 2006).

There were important findings on the storage practices adopted for other crops as well. Onion bulbs were left for 3-4 days in the field following harvesting to allow drying of leaves. Following this, the onion bulbs were prepared as bunches by using dried leaves. One onion bunch nearly consisted of 50-75 onions bulbs. The bunches were hung as piles inside a small room which is situated near house. Farmers store these bunches for 3-6 months. In tobacco, 10-15 leaves were piled on each other and these piles were hung on a cable inside the small hut having natural ventilation for 2-3 weeks. Well-dried leaves were stored inside the storage.

The post-harvest losses for paddy were higher in Nilaveli (2% of the harvested yield) than Mahadiwulwewa (1.5%) (Figure 5). Of this, 70% losses occur due to insects. *Rhyzopertha dominica* (F.) (Coleoptera: Bostrychiade), *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae), *Sitotroga cerealella* (Olivier) (Lepidoptera: Gelichiiade) are most common storage pests in both Nilaveli and Mahadiulwewa. Other than that, damage of rodents is a major problem in Mahadiulwewa during paddy storage. Onion showed 3% losses during storage due to fungal attack. Tobacco had 2% damage from Cigarette beetle *Lasioderma serricorne* (F.) (Coleoptera: Anobiidae).

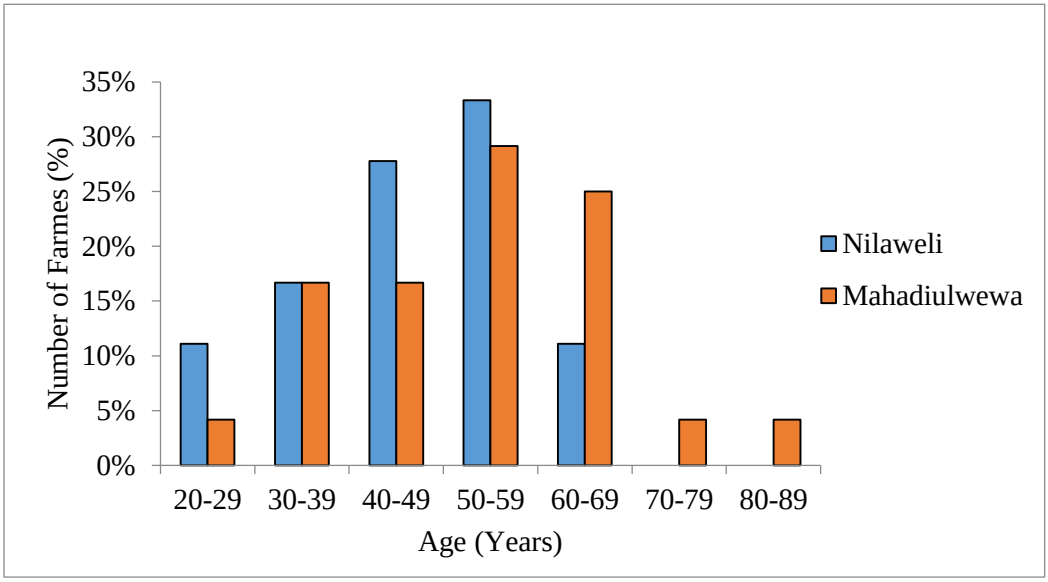

Figure 1. Age distribution of farmers in Nilaveli and Mahadiwulwawa areas.

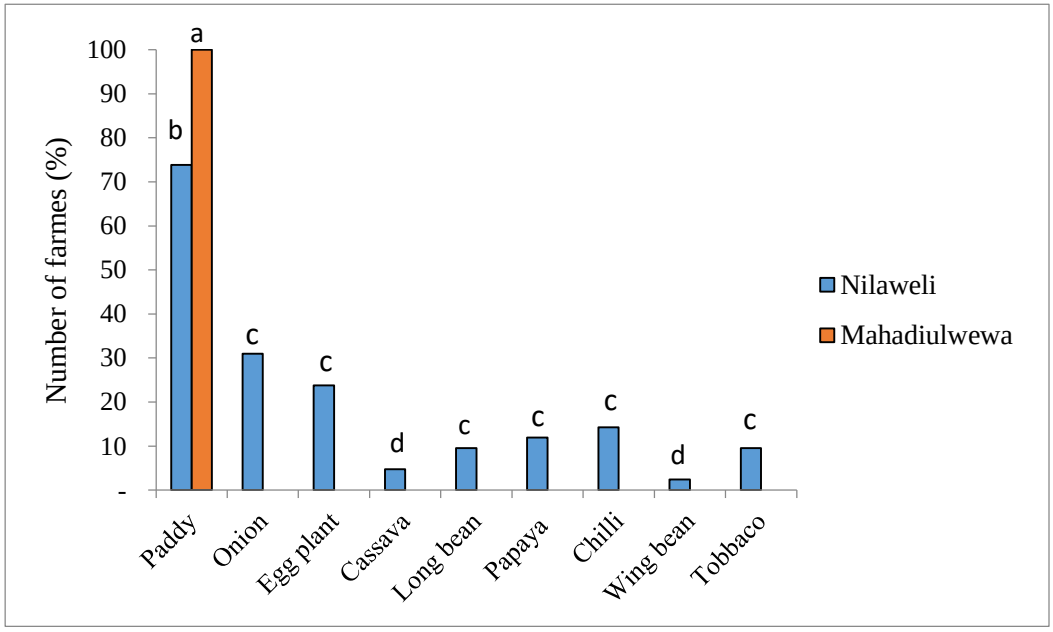

Figure 2. Percentage farmers cultivate crops in Nilaveli and Mahadiulwewa.

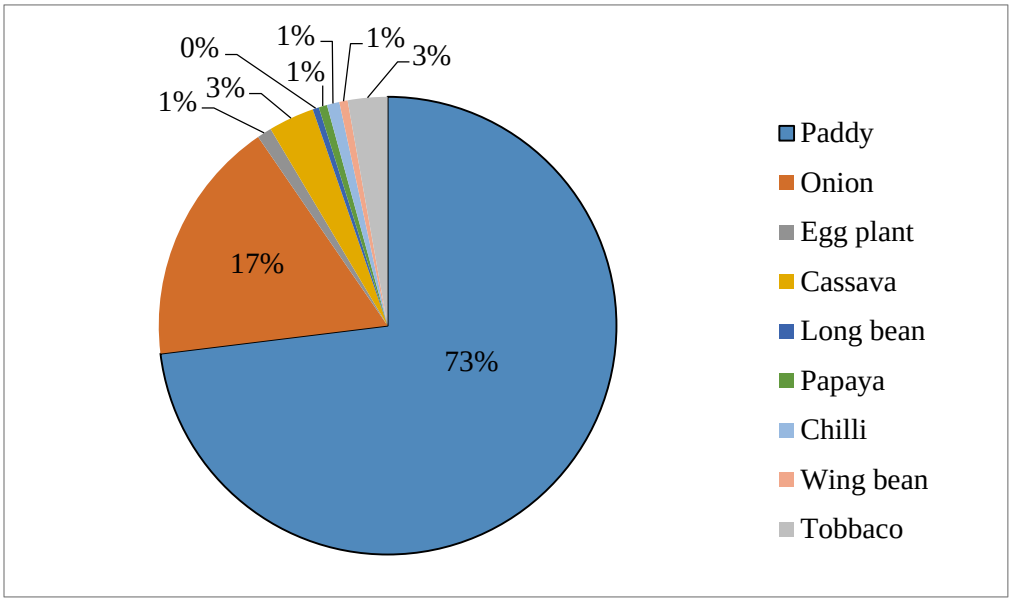

Figure 3. Land extent of cultivated crops in Nilaveli.

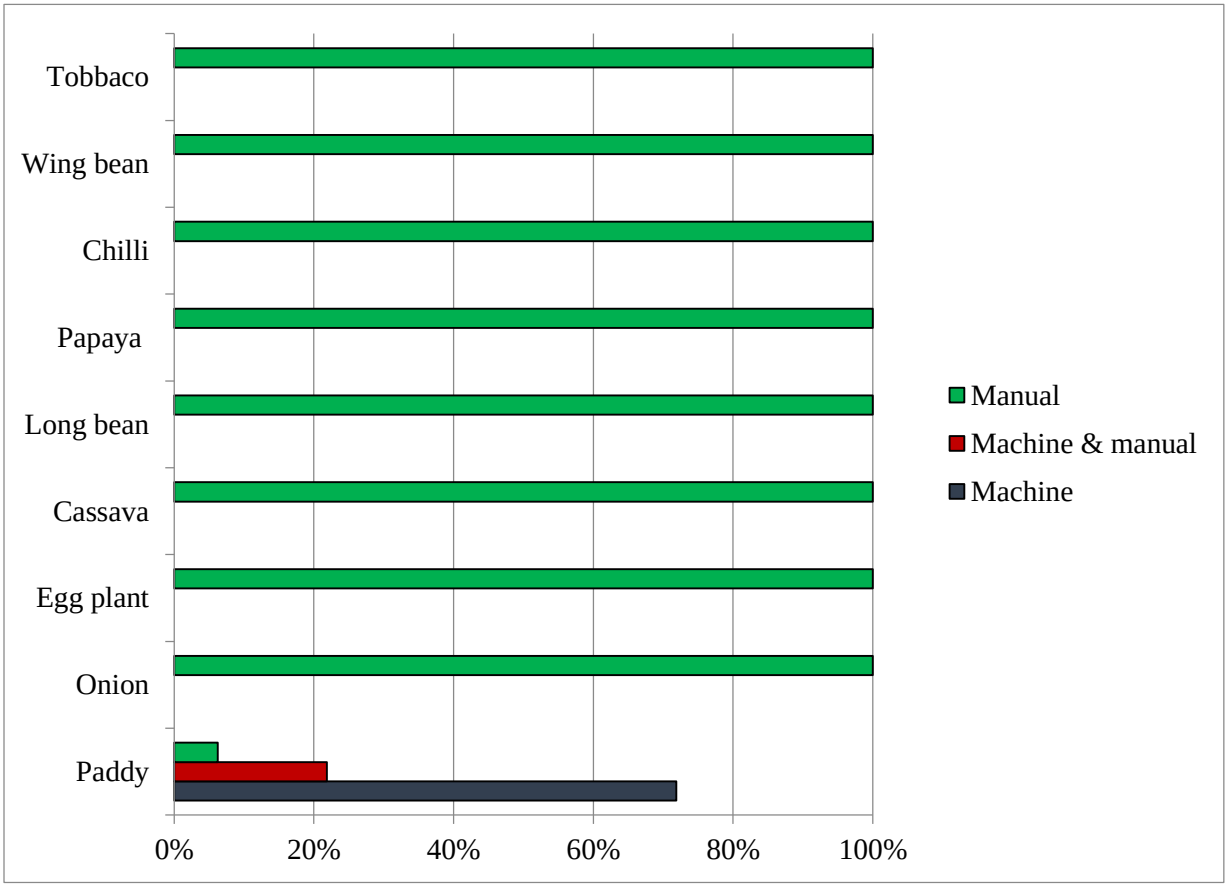

Figure 4. Use of the machines for post-harvest practices Nilaveli.

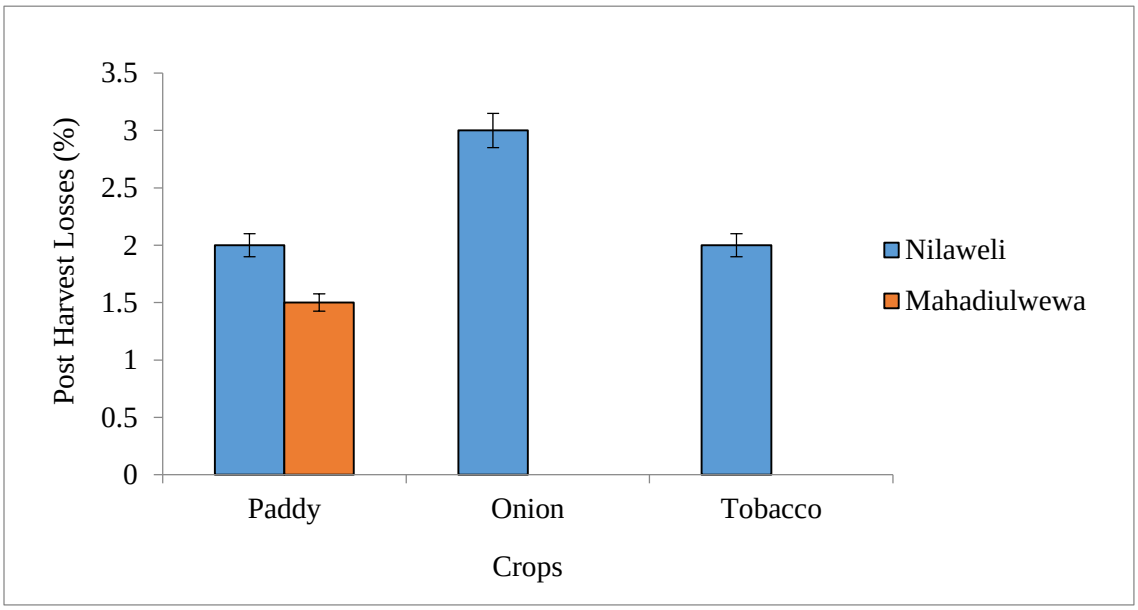

Figure 5. Storage losses of different agricultural commodities.

In the small holding sector out of total extent of agricultural land, paddy contributes to 33.5%. In Trincomalee, land area cultivated with paddy is 71% of agricultural land (Department of Census and Statistics, 2013/2014). In Nilaveli there are 73% for paddy cultivation and 27% for other crops. Also Mahadiwulwewa has 100% paddy cultivation (Figure 3). Thus there is significant variation in the land use pattern based on the geographical area.

There are several economically-valuable crops in Nilaveli area but paddy is the only economically valuable crop in Mahadiwulwewa area. Red onion is a major crop among the farm families in Nilaveli area. On account of all the crop grown in these two areas, the highest annual yield is obtained from onion cultivation. The production of cereals is seasonal. Therefore, the surplus production aside the consumption is stored to meet the consumer demand during off-seasons (Proctor 1994; Dowell and Dowell, 2017).

4. Conclusion

Paddy is the major economically-valuable crop in Mahadiwulwewa. In Nilaveli, Farmers cultivate several upland crops other than paddy. The farmers in Mahadiwulwewa engage in cultivation at their older years. The farmers in both areas use jute sack and gunny bag to store paddy and they use different structures to store onion and tobacco. Stored-product insects, rodents are the main sources for yield losses during storage.

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