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# **Chapter 01**

# **Introduction**

The Asian rice (*Oryza sativa*) can be classified as the foremost cereal crop in Sri Lanka. The rice cultivation is distributed in most parts of Asian countries which is more than ninety per cent of the lands total cultivated lands extent as the staple food. Rice act as the principal contributor of Sri Lankan rural economy. Sri Lanka is a developing country with estimated total land devoted for cultivation is about 792,000 ha (Central Bank of Sri Lanka, 2017). The national average rice yield of Sri Lanka in kilogram per net hectare is 4,349 in Maha and 3092 in Yala season (Department of census and statistics, 2016). And also the annual per capita consumption of the rice is 105kg (Lanka, 2008). According to the annual report of the Central Bank of Sri Lanka in 2017 about 748,000mt rice imported to our country. The demand for the rice is increasing rapidly due to the increment in the population and the per capita rice consumption. The production and the productivity of the rice should be increased rather than increasing the cultivated land extent through better field practices to meet the increasing demand of rice(Dushani and Sandika, 2009)

The cultivation of rice is practised in all the parts of the country as a wetland crop except at the high altitudes, which act as the principal contributor on the rural economy (Henegedara, G.M., 2002). Mainly two cultivation seasons known as Maha and Yala which are equivalent with two monsoons are practised in Sri Lanka. In generally transplanting and the direct seeding of rice are the two main methods of rice cultivation practised in Sri Lanka considering the variations in different ecological regions at where rice is cultivated. The sowing of seeds directly in the field is practised in direct seeding method and the seedlings are raised in seedbeds and then planted in the field in the transplanting method.

In Sri Lanka DSR is practiced by more than 95% of total land extent devoted for rice cultivation as it is considered as an alternative option to lack of sufficient labour force and high cost for labors at the peak transplanting period which cause delayed transplanting and reduced yield in transplanting method (Weerakoon et al., 2011; Santhi et' al., 1998). The problems associated with DSR are, no proper spacing, management practices are difficult and most disastrous problem is the invasion of weeds and weedy rice (Gunawardana et al., 2013; Marambe, 2009). As a solution for this farmer tends to use agrochemicals to control weeds which is not an environmentally friendly practice.

Transplanting is commonly practised in most parts of the Asian countries (Mabbayad and Bordo, 1971). Transplanting of the seedlings on the puddled soil can be done manually as rows or randomly and through machine transplanting. Transplanting of rice gives a significantly higher yield than the direct seeding as it produces more number of productive tillers which bares panicles with an increased number of spikelet’s than the direct seeded rice plants (Fan et al., 2003). Although the labour intensity and labour costs are high in transplanting compared to the direct seeding of rice, highest yield and income is reported from it(Manjappa and Kataraki, 2004; Rani and Jayakiran, 2010).

As the most feasible solutions to increase the yield from rice cultivation proper nursery management practices which gives vigorous seedlings and transplanting of them at the correct time can be used. Mainly in Sri Lanka transplanting is done using dapog nurseries, parachute nurseries, wet bed and dry bed nurseries.

Mechanical transplanting of rice is the best solution for the problems with transplanting method including high labor intensity and delayed transplanting of seedlings. Mechanical Transplanting is the method of transplanting the seedlings which are raised on trays or mats uniformly with optimum plant density and less transplanting shock compared to other transplanting methods, using self-propelled mechanical transplanter. The self-propelled walk behind type transplanter is considered as a popular transplanter among the farmers in Asian countries which gives significantly increased the rice yield. A plastic tray is introduced to as nursery trays in modified dapog nurseries which is compatible with the dimensions of the feeding platform in the transplanter, to increase the convenience of handling seedlings, rather than using mat type nurseries which needed to be cut into parts according to the size of the feeding platform. Although the Ministry of Agriculture and the Department of Agriculture implemented programmes to promote the Mechanical Transplanting in Sri Lanka, very low adaptability of farmers to this method due to the constraints with nursery establishment, lack of technical knowledge and socio-economic reasons. So, it is a timely requirement to do studies on efficient utilization of the mechanical transplanter and introduced them to the farmers to increase the rice production. As introduced recently there is no recommended seeding rate to be used in the nursery trays used for Mechanical transplanting, it is understudied. Generally, use seeding rate between 60g - 150g per tray (ALIZADEH et al., 2011; Columbia and Division, 2013).

Seeding rate can be defined as the amount of the seeds from an individual plant species required to achieve optimum seedling density in the nursery with an increment in the vigor of seedlings (Louisiana, 2009). The seedling vigor is the ability of the plant to emerge from the substrate rapidly and cover the ground surface rapidly (Deseo, 2012). Planting of vigorous seedlings is important factor on the early plant growth of the plants after the establishment which increases the number of productive tillers and the rice yield per unit area by decreasing the mortality rate of seedlings due to the transplanting stress (Panda et al., 1991; Tekrony and Egli, 1991).

Following proper nursery management practices is very important factor which affects on the seedling vigor and early plant growth of rice after field establishment in all the transplanting methods. Studies on the optimum seed rate for the nursery trays of Mechanicaly transplanted rice on seedling vigor and the early plant growth of rice have not been yet investigated properly in Sri Lanka. The main intention of this study is to identify the optimum seeding rate for the nursery trays use for mechanical transplanting and compare the seedling vigor and early plant growth with direct seedling, wet bed nurseries used for random transplanting and with parachute method of transplanting.

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## **1.1 Objectives**

### **1.1.1 General**

To identify the optimum seeding rate in nursery trays for Machine transplanting and comparison of seedling vigor and early plant growth with other nursery methods

### **1.1.2 Specific**

To find out the effect of seeding rate on different growth parameters of the seedlings in modified dapog nursery trays.

To identify the effect of different nursery methods on the vigor of the seedlings and early plant growth.

# **Chapter 02**

# **Literature Review**

## **2.1 Rice plant**

## **2.2** **Rice cultivation in Sri Lanka**

Agriculture can be named as the backbone of Sri Lankan economy on which one third of the rural population depends on (Dushani and Sandika, 2009). Among the agricultural crops rice, is the main contributor for the rural economy which occupies more than 72% contribution on livelihood of them (Henegedara GM, 2002).

Rice is the principle con- tributor of the rural economy as the majority (72%) of rural households is engaged in production of rice as their main and supplementary source of live- hood (Henegedara 2002). Rice is the main crop cul- tivated by the majority of farmers in rural areas and it is the staple food of the 18.6 million inhabitants of Sri Lanka. Further, it is the livelihood of more than 1.8 million farmers. Rice contributes 1.8 % of country’s GDP (Central Bank 2008). Rice is culti- vated in almost all parts of the country, except at very high altitudes, as a wetland crop (Henegedara 2002). The annual per capita consumption of rice was

around 92 kg in 1998 and it was dependent on the paddy production in the country and the price of imported wheat flour.

Rice plant

The Rice (*Oryza sativa* L.) is among the world wide cultivated cereal crops in the world which is next to the wheat

## **2.4 Constrains with Rice Cultivation in Sri Lanka**

## **2.4 Direct seeding of Rice**

## **2.5 Transplanting of Rice**

### **2.51Wet bed for Random transplanting**

### **2.52 Parachute method**

### **2.53 Mechanical transplanting**

#### **2.531 Transplanters**

#### **2.532 Problems with Mechanical Transplanting in Sri Lanka**

**2.6 Seeding rate**

## **2.7 Seedling Vigor**

## **2.8 Growth parameters of seedlings**

## **2.9 Early Growth parameters of rice plants**

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