Evaluation of Yield Variation in Sri Lankan Traditional Rice (*Oryza Sativa.L) Kalu Heenati*

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Abstract: *Evaluation of a rice variety using yield components gives tremendous benefits to develop new varieties for future requirements. Selecting good genotypes of traditional rice varieties, which have a higher yield potential provides much information for breeders. Kaluheenati is one of the traditional rice varieties with several accessions (AN) with considerable morphological and flowering time variation. It is known to possess medicinal and nutritional properties. The objective of this study was to determine the relationship between days to flowering (DF) and yield of Kaluheenati ANs. Twenty six ANs of "Kaluheenati" from Plant Genetic Resources Center (PGRC) were grown at Rice Research and Development Institute, Batalagoda with four replicates during Mahaseason of 2013. Days to flowering (DF), total panicle weight (TPW), hundred grain weight (HGW), grains per panicle (GPP) and filled grain percentage (FGP) were recorded. The flowering time of selected accessions varied from 61to 85 days. The highest means for TPW (24.7±2.85 g), HGW (3.95±0.06 g.), GPP (172.0±4.13 g) and FGP (97±0.46 %) were recorded in the AN 2087, 4090, 5191, and 6713respectively. Seven ANs flowered between 75-79 days. Results revealed that there is a negative correlation between DF and TPW (r = -0.12, P = 0.10) and a significant positive correlation between DF and HGW (r = 0.44, P = 0.05). Based on the results, it can be suggested that relatively late flowering ANs could be utilized in future breeding programmes of Kaluheenati for higher yield.*

Keywords— *Days to flowering, Kalu heenati, yield*

I. INTRODUCTION

Rice (*Oryza satava* .L) is the world's second largest produced cereal after maize and it is the staple food in most of the Asian countries including Sri Lanka (Abeysiriwardana, 2003) Approximately 37 per cent (0.77 million ha) of the cultivated land area of Sri Lanka is under rice. With the increasing population, demand for rice increases in Sri Lanka at a rate of 1.1 per cent per year. Rice production should be increased at a rate of 2.9 per cent per year to meet the demand. (Department of Agriculture , 2014)

There are around 2000 accessions of traditional rice conserved at Plant Genetic Resources Center (PGRC). Sri Lankan traditional rice had been replaced mainly from regular farmer fields due to introduction of new improved varieties of green revolution in 1960s (Abesiriwardena, 2003). They are known to have several medicinal and nutritional properties (Pushpakumari *et al* , 2015) It is used to reduce toxins in body, for easy excretion, for body strength, for hepatitis and to detoxify snake venom (Farmer federation of traditional seeds and agri- resources, 2013). *Kalu heenti* is cited in Sri Lankan folk literature about its higher nutritional properties also. There is a trend of integrating traditional rice into farming systems since recent past as they are known to be suitable for organic agriculture .However, the relatively low yields, long age, lodging and large plant architecture might be the great barriers in re-introduction of most of traditional rice accessions (our unpublished data).

Evaluation of a variety for yield potential provides information for development of new varieties for future requirements. In PGRC, Sri Lanka, most of the varieties contain several accessions under one variety. Selection of good accessions from a particular variety for higher yield may be useful for breeders for rice improvement.

Kalu heenati is a short aged variety. Different accessions of *Kalu heenti* exhibit a variation in DF and morphological characters (Team of NRC 12-129, 2014). During the investigations on diversity of flowering time using some landraces from a rice diversity research set, (Takahashi et al, 2009) had observed that one of accessions of Sri Lankan variety *Kalu heenati* (a representative for Sri Lankan rice) possessed nonfunctional *Hd1* allele. Takahashi et al, 2009 had observed that presence of functional *Hd1* allele is a reason for early flowering in rice. Flowering time genes may associate with yield components as well: Number of panicles and number of spikelets reduced under short days condition with the shortest DF (Endo-Higashi *et al* 2011). Yield was reduced in Sri Lankan traditional rice *Sulai, Kohu ma wee* and

Deveraddari under LD condition when DF increased (Geekiyanage *et al*, 2012).

In the present study, effect of DF variation among 26 accessions(ANs) of *Kalu heenati* was checked on yield components. Identification of such relationship could be useful in future breeding programs and reintroduction programs to popularize *Kalu heenati* among farmers.

II. MATERIALS AND METHODS

Traditional rice seeds **:** Seeds of twenty six ANs of "*Kaluheenati* " were obtained from PGRC, Sri Lanka .(AN 5191, 6232, 2090,7802, 6713, 2100, 5485, 5484, 4253, 4740, 4536, 5385, 3989, 4991, 4091, 4621, 2087, 4086, 4620, 4088, 4087, 2101, 4089, 4090, 2197 and 3851).

Research design and field establishment: Seeds were sown in the upland nursery bed with 15 cm of spacing in between plants. Seedlings of 21 days of age were transplanted with a spacing of 20 cm x 20 cm. One seedling was transplanted per hole and 4 replicates were grown in a Completely Randomized Design (CRD) during Maha season in 2013.

Recommended cultural practices were applied according to Department of Agriculture; Basal dressing of Urea: TSP: MOP (5:35:15) Kg/ac was applied during land preparation. Urea was applied at the rate of 25 kg/ac as a top-dressing at 2 weeks of planting and a second top dressing rate 50 kg/ac was applied at 5 weeks of planting.

Data collection and analysis**:** Days to flowering (DF) , Total Panicle Weight (TPW) Hundred Grain Weight (HGW), Grains per panicle (GPP) , Filling percentage (FP) was recorded in 4 replicates of 26 accessions. Average values were calculated. Means were separated by Duncan multiple range test in SAS 9.1 Software. Pearson correlation coefficient analysis was carried out.

III. RESULTS AND DISCUSSION

A. Variation of DF

DF varied from 61 to 85. The minimum and maximum DF was recorded from AN 5485 and 210 . Seven ANs were flowered during a range of 75-79 days. (Figure 1)

B. Variation of Yield Components

Total panicle weight **:** ANs 2087, 4091, and 5191 had significantly highest means of TPW of 24g ± 2.85, 23g±3.15, and 22g±2.25 respectively. ACCN 2100 produced the significantly lowest TPW of 6.02g ± 2. 46.

Hundred grain weight: AN 4090 gave the significantly highest mean of HGW 3.95±0.06 g, ANs 6713, 4086, 6232, and 4740, are significantly gave the significantly lowest HGW 1.4g ±2.4, 1.4g±3.1, 1.3g±1.2 and 1.2g±3.4 respectively. There was a significant positive correlation between DF and HGW (r = 0.439, P = 0.047). at 5% probability level.

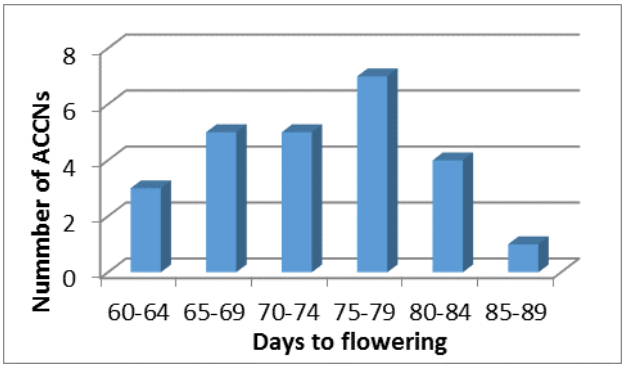

Figure 1. Variation of days to flowering among accessions of *Kalu heenati* used in present study

Grains per panicle**:** AN 5191 produced significantly highest mean GPP 172.0±4.13 which is closer to that of the commonly grown improved rice. Endo-higashi *et al* 2012 have studied about relationships among plant biomass, grain number and flowering time in different genotypes of rice. Manipulation of vegetative growth and yield per plant is an important research target for increased grain yield in rice. There was a strong positive correlation between shoot dry weight and days to flowering time .However ANs of *Kalu Heenati* variety showed positive correlation between DF with GPP. These relationship indicated relatively late flowering ANs had significantly higher GPP values.

Filled grains percentage**:** ANs 6713 and 4740 had the significantly highest means of FGP (96% ±0.06).ANs 2090 had the significantly lowest FGP (4% ±1.5). There was positive correlation between DF and FGP (r = 0.015, P = 0.949).

Most yield related traits are controlled by complex gene network. Flowering time genes affect Vegetative stage and plant architecture are reported to be controlled. Panicle development, grain filling percentage and spikelet number per panicle are affected by key flowering genes of *Hd 1*, *Ehd1* (Endo- Higashi *et al*, 2011)According to Richards, (2000) FGP is determined by genotypes. The variation in FGP among *Kalu heenati* ANs could also indicate genetic variation among basically morphologically similar ANs.

Based on above results, relatively late flowering ANs could be nominated for further studies for future breeding programmes of *Kalu heent*i for higher yield.

IV. CONCLUSIONS

The highest means for TPW (24.7±2.85 g), HGW (3.95±0.06 g.), GPP (172.0± 4.13) and FGP (96±0.46 %) were recorded in the AN 2087, 4090, 5191, and 6713 respectively. The range of TPW , HGW, GPP, FGP from 24.7±2.85 g, 3.95±0.06 g, 172.0±4.13 , 96±0.46 % to 6.07±2.46g, 1.27±3.4g, 31±2.67 and 4%±1.5.The DF Varied from 85 ± 1.27to 61 ± 1.20 days.

There is a significant positive correlation between DF and HGW (r = 0.44, P = 0.05).

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