

Effect of Different Time of Earthing up on Growth and Yield Performances of Groundnut (*Arachis hypogaea* L.) Varieties

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Abstract: An experiment was conducted to assess the effect of different time of earthing up on growth and yield performances of groundnut (*Arachis hypogaea* L.) varieties at the Faculty of Agriculture, Kilinochchi during the period of February to July 2018. Two factor factorial experiment was conducted in Randomized Complete Block Design (RCBD) with four replicates. Different dates of earthing up such as 23 days after (T_1), 30 days after (T_2) and 37 days after (T_3) planting and five groundnut varieties; Lanka jumbo (V_1), Tissa (V_2), Tikiri (V_3), Indi (V_4), and ANK G1 (V_5) were used as factors. The groundnut varieties were planted at the spacing of 45 cm \times 15 cm and all other agronomic practices were done according to the recommendation of Department of Agriculture. The growth and yield parameters were recorded and shelling percentage was calculated. ANOVA and Duncan's Multiple Range Test (DMRT) were performed to find out the significant differences among the treatment combinations. Growth parameters of groundnut varieties such as plant height, number of leaves and branches were not significantly differed among the varieties with duration of earthing up. The yield parameters such as fresh and dry pods weight per plant, 100 pods and seed weight and mature pods per plant were significantly differed among the duration of earthing up and also among the varieties and the highest records in T_3 treatment in all varieties. There was no interaction effect among earthing up period and varieties. The highest shelling percentage of 84 % was observed in groundnut variety Lanka jumbo under the T_3 . The highest yield was obtained from T_3 treatment in each variety and among the varieties; Lanka jumbo gave the highest yield. It can be concluded that 37 days after earthing up and Lanka jumbo can be selected as suitable treatment combination to obtain the highest yield from groundnut in Kilinochchi District.

Keywords: Earthing up, Groundnut, Shelling percentage, Yield.

Introduction

Groundnut (*Arachis hypogaea* L.) belongs to the family Fabaceae. It is also called as Peanut, *earhnut*, *monkey nut*, *pinda*, *goober* and *manila nut* (Beghin *et al.*, 2003). It contains 48 - 50 %

oil, 26 - 28 % protein and 11 - 27 % carbohydrates, minerals and vitamins (Mukhtar, 2009). The groundnut can be used for extraction of edible oil, eaten as roasted nut and used to prepare peanut milk, butter, snacks and confectioneries.

The oil of the groundnut is used in the industries to produce soap, cosmetic cream, plasters and oil (Reddy and Kaul, 1986).

Groundnut is grown in nearly 23.95 million ha in worldwide with the total production of 36.45 million Mt and an average yield of 1520 kg/ha (FAOSTAT, 2011). In dry and intermediate zones of Sri Lanka, it can be grown as rain fed crop in highland during *Maha* season and irrigated crop in paddy lands during *Yala* season. In Sri Lanka, it is grown mainly in Moneragala, Kurunegala, Ampara, Badulla, Puttalam and Ratnapura districts. It was cultivated in an extent of 11609 ha with a total production of 21953 tons and an average yield of 1890 kg/ha in Sri Lanka (Department of Agriculture, 2012a). In Northern Province of Sri Lanka, groundnut is cultivated in 3914 hectares of lands and its production was 6305 tons (Vavuniya 807 hectares, Mullaitivu 2648 hectares, Kilinochchi 154 hectares, Mannar 170 hectares and Jaffna 135 hectares) (Department of Agriculture, 2012c).

Earthing up is the raising of the soil around the base of the plant in order to cover the pegs (Mhungu and Chitaka, 2010). The aerial pod formation of groundnut was first reported by Prasad (1985). Swanevelter (1998) reported that earthing up has a positive influence on the groundnut yield. Major constraints in groundnut leading to low yield are low soil fertility and use of improper agronomic practices as a result of lack of knowledge of the appropriate timing of earthing up (Madamba, 1997).

Department of Agriculture released eight varieties such as Red Spanish, Number 45, Tissa, Walawe, Indi, Tikiri, ANK G1 and Lanka jumbo (Department of Agriculture, 2012b).

Several researches have been conducted to study the growth and yield of groundnut by modifying cultural practices worldwide including in Sri Lanka. However, only few of the researches were reported to study the time of earthing on growth and yield performance of groundnut, especially in Kilinochchi. Studying the impact of different time of earthing up on groundnut yield would facilitate the farmers to get additional groundnut production and income. With this view, the experiment was carried out with the main objective of studying impact of different time of earthing up on growth and yield performances of different varieties of groundnut and to evaluate the yield parameters and shelling percentage under different time of earthing up with different varieties.

Materials and Methods

A field experiment was carried out at the Faculty of Agriculture, Ariviyal Nagar, Kilinochchi, which belongs to the agro-ecological region of DL₃, during February to July 2018 to study the effect of different time of earthing up on growth and yield performance of groundnut varieties. Two factor factorial experiment was carried out in Randomized Complete Block Design (RCBD) with four replicates. Different time of earthing up such as 23 days after planting (T_1), 30 days after planting (T_2)

and 37 days after planting (T_3) were used as first factor and five groundnut varieties; Lanka jumbo (V_1), Tissa (V_2), Tikiri (V_3), Indi (V_4), and ANK G1 (V_5) were used as second factor. Certified seeds were collected from District Agriculture Research and Training Centre, Kilinochchi. Unshelled seeds were mixed with captan (fungicide) and kept for 2-3 hours. Planting was done in recommended spacing of 45 cm \times 15 cm with the rate of one seed per hill. In each plot 24 seeds were planted. Gap filling was done by replanting the groundnut plants which were produced in the small cups simultaneously during field planting and same plant population was maintained in the field for each treatment. All other management practices were carried out according to the recommendations of Department of Agriculture.

The earthing up height was maintained as 5 cm from the collar region based on the previous study of Ragulan *et al.* (2016). Groundnut varieties were harvested at different periods when those varieties reached the maturity by vein yellowing and leaves start to shed. Tissa and ANK G1 varieties were harvested at 95 days after planting and Lanka jumbo, Indi and Tikiri Varieties were harvested at the 110 days after planting. After harvesting the pods were separated from the plants and allowed 5 days for sun drying until the pods were dried.

Growth parameters such as plant height (cm), number of leaves and number of branches were measured at weekly interval after planting of seed and yield

parameters such as fresh weight of pods per plant (g), dry weight of pods per plant (g), number of mature pods per plant, number of immature pods per plant, 100 pods weight (g), 100 seed weight (g) were recorded and shelling percentage (%) was calculated by five randomly selected plants from each plot and estimated as ratio between dry kernel weight to dry pod weight. ANOVA was performed by using statistical package SAS (9.1) and mean separation was done by using Duncan's Multiple Range Test at p value of 0.05.

Results and Discussion

Growth Parameters

Plant Height of Groundnut

Plant height is important growth parameter which is influenced by the genetic and the environmental factors. There was no interaction effect on plant height among time of earthing up and varieties. There was no significant difference among the different time of earthing up (Table 1). But there was a significant difference among varieties after the 8th week of planting. The maximum height of 32.4 cm was observed in ANK G1 variety and the minimum height of 24.6 cm was observed in variety Tissa after 10th weeks of planting.

Number of Leaves

Number of leaves is important for photosynthesis. There was no interaction effect between time of earthing up and varieties. Numbers of leaves were non-significant among different time of earthing up. It may be depending on the genetic characters of the plant. Number

Table1: Plant height of the groundnut varieties under different time of earthing up.

Varieties	Treatments	Weeks after planting				
		2 nd	4 th	6 th	8 th	10 th
Lanka jumbo	T ₁	5.8 ^a	10 ^a	17.3 ^a	26.4 ^a	34.1 ^a
	T ₂	5.3 ^a	9.6 ^a	17 ^a	25.9 ^a	32.1 ^a
	T ₃	5.7 ^a	10 ^a	16.5 ^a	25.4 ^a	30.8 ^a
Tissa	T ₁	3.5 ^a	7.9 ^a	13.6 ^a	22.3 ^a	24.4 ^a
	T ₂	3.5 ^a	7.9 ^a	13.8 ^a	23.5 ^a	24.9 ^a
	T ₃	3.4 ^a	8.3 ^a	14.8 ^a	22.3 ^a	23.3 ^a
Tikiri	T ₁	3.7 ^a	8.0 ^a	15.6 ^a	23.1 ^a	28.1 ^a
	T ₂	3.6 ^a	7.9 ^a	15.2 ^a	24.1 ^a	27.4 ^a
	T ₃	3.5 ^a	7.5 ^a	14.7 ^a	23.9 ^a	26.3 ^a
Indi	T ₁	3.1 ^a	8.4 ^a	14.4 ^a	20.2 ^a	25.2 ^a
	T ₂	3.2 ^a	9.1 ^a	13.2 ^a	21.6 ^a	26.9 ^a
	T ₃	3.1 ^a	9.1 ^a	13.2 ^a	20.9 ^a	24.4 ^a
ANK G1	T ₁	6.5 ^a	13.8 ^a	21 ^a	30.9 ^a	28.8 ^a
	T ₂	6.5 ^a	12.5 ^a	20.1 ^a	29.2 ^a	29.7 ^a
	T ₃	6.6 ^a	12.6 ^a	22.7 ^a	30.5 ^a	30.2 ^a

Mean with the same letter indicate not significantly different at $p=0.05$ in each variety within the treatments

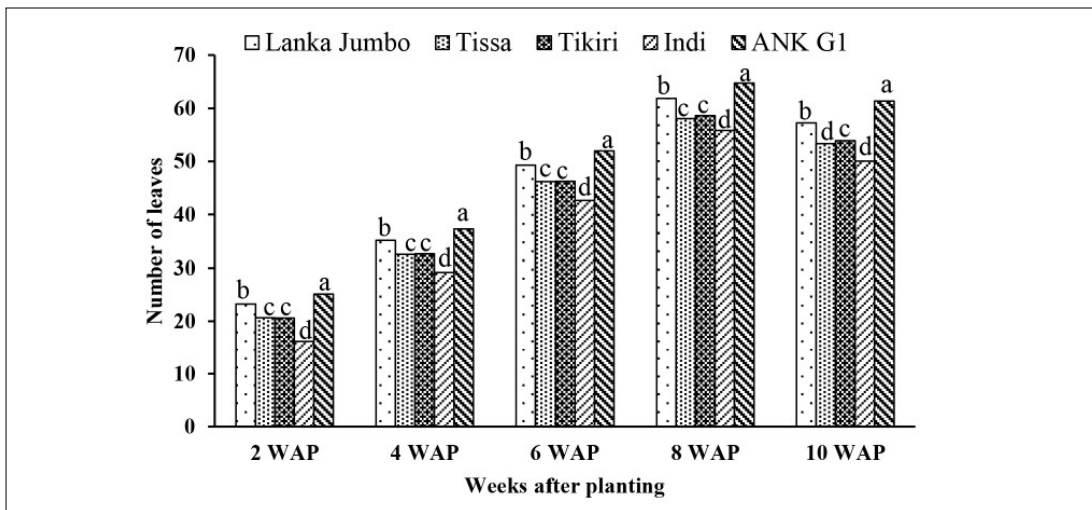


Figure 1: Number of leaves of groundnut varieties at two weeks interval from 2 weeks after planting.

Means with same letters are not significant at $p=0.05$

of leaves was significantly differed among the varieties except Tissa and Tikiri (Figure 1). Maximum numbers of leaves were observed in ANK G1 variety and minimum number of leaves observed in Indi variety

Number of Branches

There was no interaction effect between time of earthing up and varieties. Number of branches was non-significant among the treatments and significantly differed among the varieties. The maximum number of branches was observed in Lanka jumbo variety and minimum was recorded in Indi variety.

Yield Parameters

Fresh Weight of Pods per Plant

There was a significant difference with the time of earthing up and varieties except in Tissa and Indi (Figure 2). There was no interaction effect between varieties and time of earthing up. Lanka jumbo had the highest fresh weight of pods/plant (136.75 g), under the T_3 than other varieties. Earthing up at 37 days after sowing (T_3) increased the pod weight in each variety and average lowest pod weight was produced by earthing up at 23 days after sowing (T_1). Ouedraogo *et al.* (2012) reported similar results by doing earthing up at 7 weeks after sowing in Bambara groundnut.

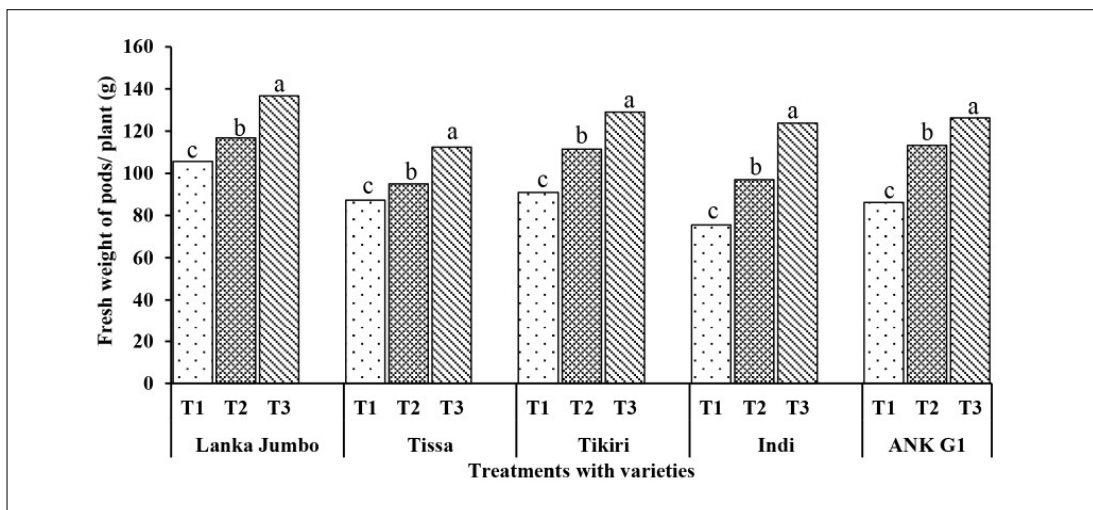


Figure 2: Fresh weight pods / plant with different treatments with varieties. Means with same letters are not significant at $p=0.05$

Dry Pods Weight per Plant (g)

Dry pods weight per plant showed the same trend of fresh pods weight per plant. Among the varieties, the highest (107.62 g) and lowest (73.9 g) pod weight was observed in Lanka jumbo and Tissa varieties, respectively.

Hundred Pod Weight

The highest hundred pod weight was observed in time of earthing up of 37 days after planting (T_3). The highest hundred pod weight was observed in Lanka jumbo (189.6 g) under the T_3 (Figure 3).

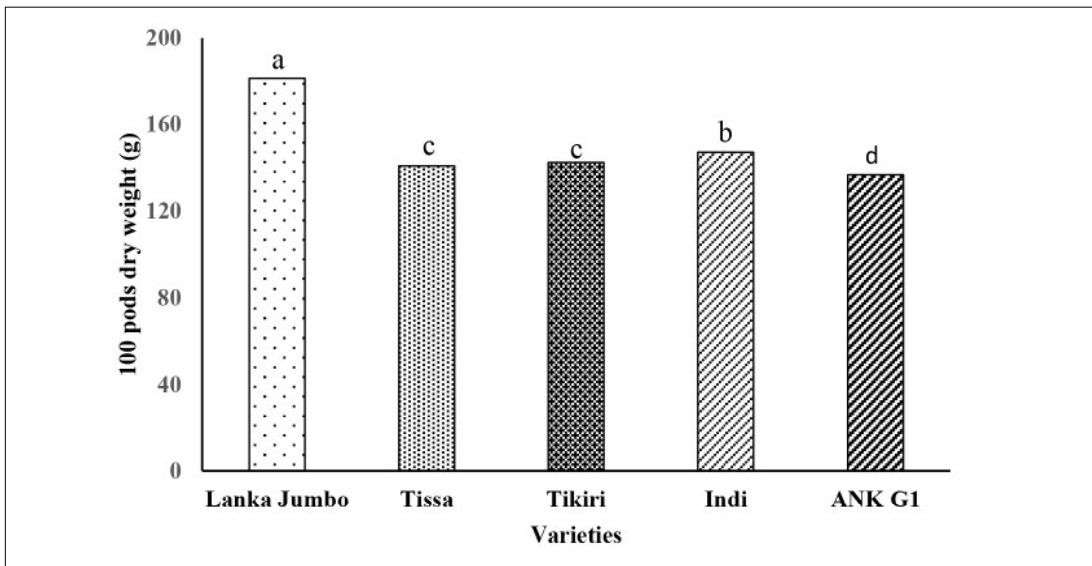


Figure 3: 100 Pods weight in different varieties.
Means with same letters are not significant at $p=0.05$.

Hundred Seed weight

Hundred seed weight also showed the same results as 100 pod weight (Figure 4). The highest 100 seed weight of 91.71 g observed in Lanka Jumbo under the T₃ treatment. The weight of the seed

depends on the genetic characters as well as the timing of the earthing up. The results are in agreement with Prasad and Muralidharudu (1991), Mkandawire and Sibuga (2002) and Ouedraogo *et al.* (2012).

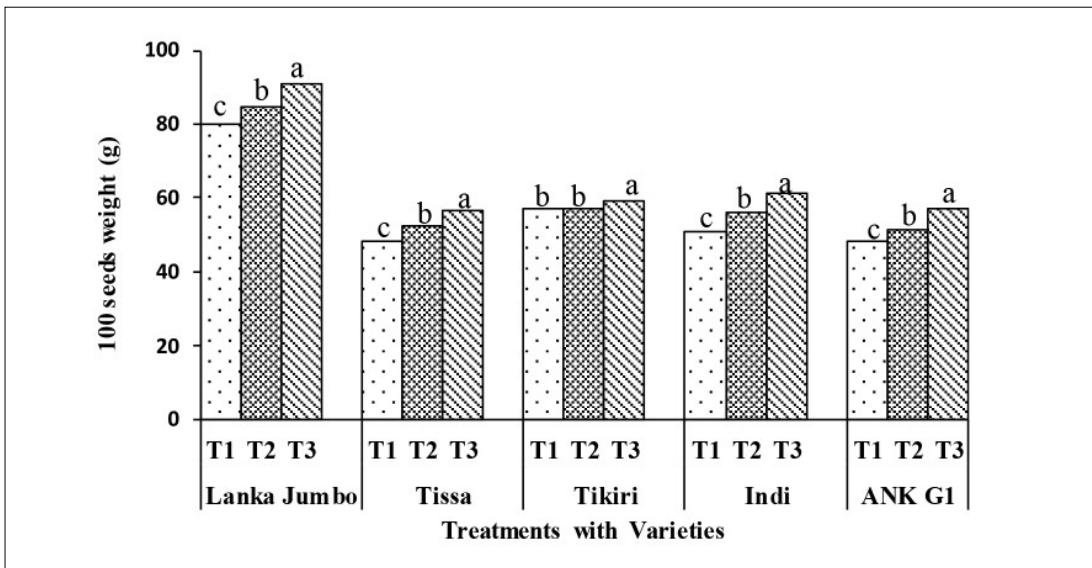


Figure 4: 100 seeds weight in different treatments with varieties.
Means with same letters are not significant at $p=0.05$.

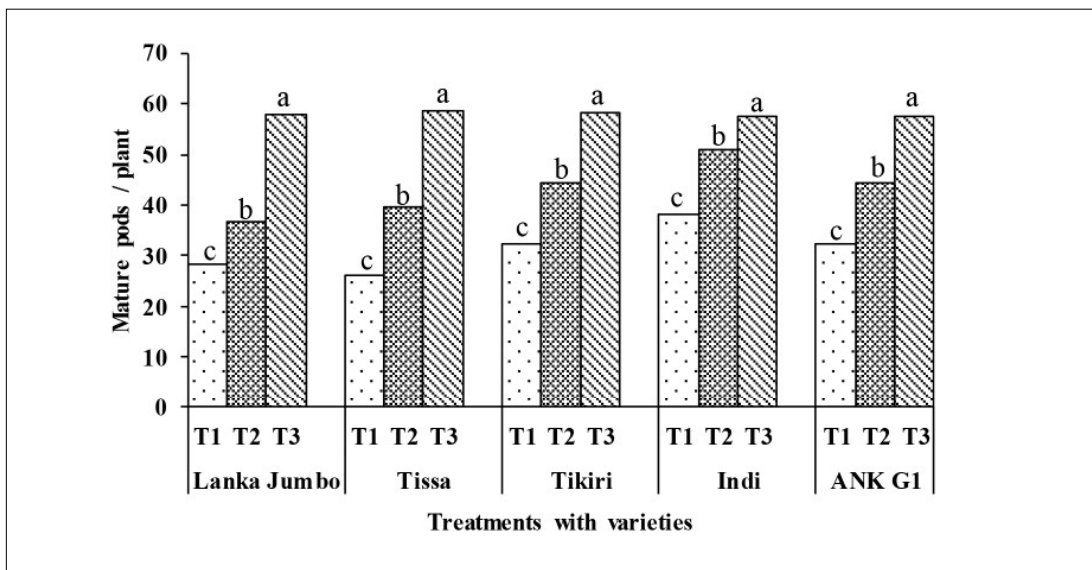


Figure 5: Mature pods per plant in different treatments with varieties. Means with same letters are not significant at $p=0.05$

Mature Pods per Plant

Number of mature pods per plant was significantly differed with time of earthing up and varieties (Figure 5). Matured pod number was significantly highest in T_3 and the lowest in T_1 . The highest mature number of pods of 48 was observed in Indi variety and the lowest number of 40 was observed in Lanka jumbo variety. This variation may also be due to genetic characteristics of these varieties (Naeem *et al.*, 2015).

Shelling Percentage

The highest shelling percentage was observed in time of earthing up of 37 days after sowing in each variety (T_3). The highest and lowest shelling percentages were observed in varieties such as Lanka Jumbo and ANK G1, respectively, in all treatments. This result agreed with Balole *et al.* (2003), who stated that the positive effect of mounding on shelling percentage in Bambara groundnut in

10 different landraces. Ouedraogo *et al.* (2012) indicated that the sandy soil structure, temperature and rainfall allowed the expression of the genetic potential of the landraces that had a high rate of pod filling irrespective of the timing of mounding.

Yield

According to the results, the average total groundnut yield (t/ha) was significantly different among the treatments (Figure 6). The highest groundnut yield (6.8 t/ha) was observed in the Lanka Jumbo variety under the time of earthing up of 37 days after planting (T_3) when compared with the other treatments. The lowest yield of 2.9 t/ha was observed in the Tikiri and Indi varieties under the time of earthing up of 23 days after planting (T_1). Yield was significantly higher in the Lanka Jumbo variety than other varieties (Figure 7).

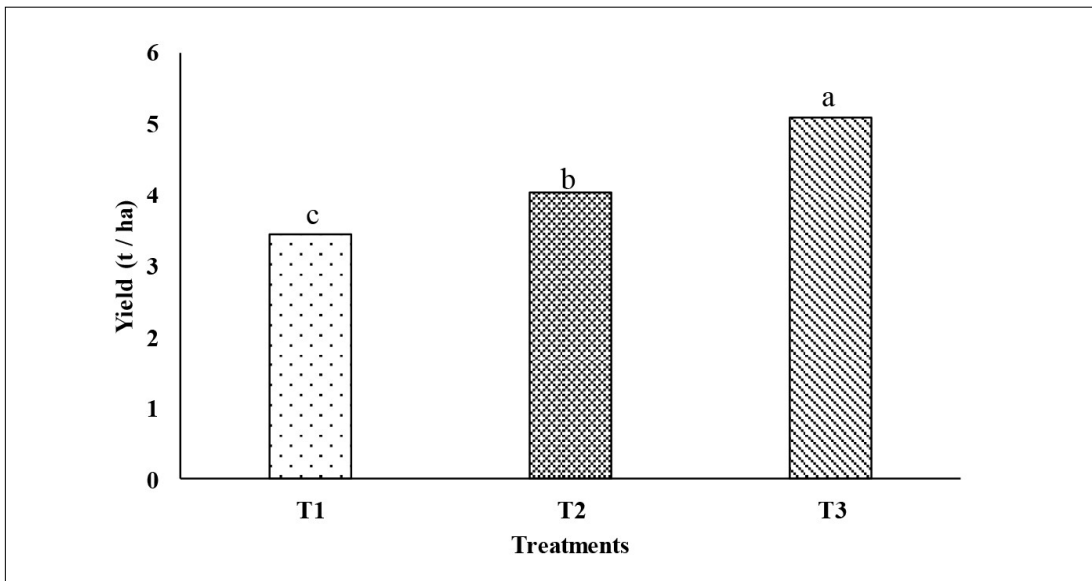


Figure 6: Yield (t/ha) in different treatments.
Means with same letters are not significant at $p=0.05$

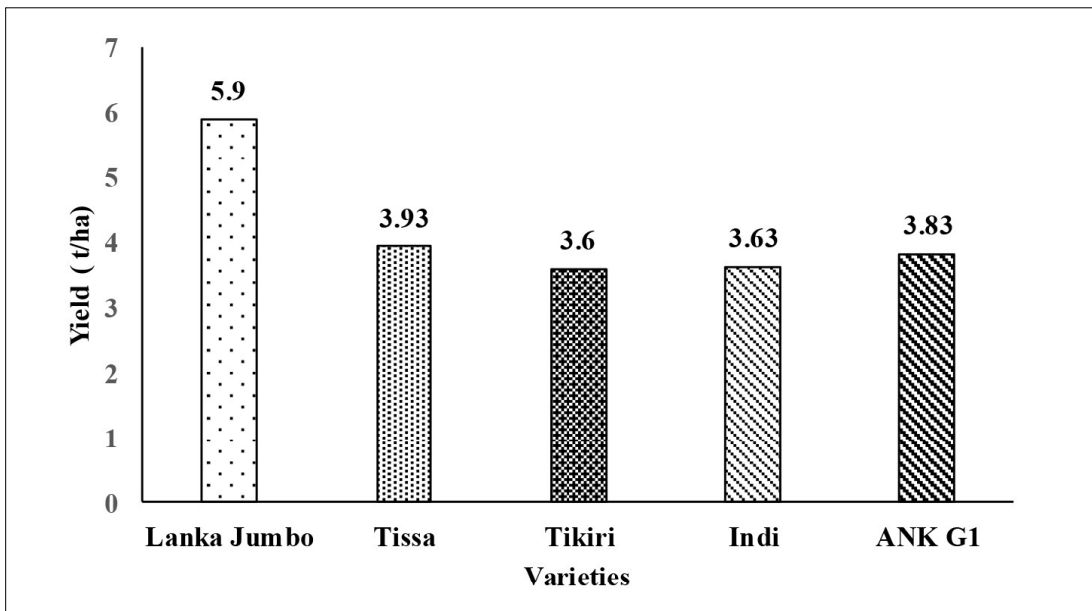


Figure 7: Yield (t/ha) of different varieties.

The potential yield of groundnut is above 4.5 t/ha (Department of Agriculture, 2012 for example, potential yield for ANK G1 variety is 4.5 t/ha). In this study, yield obtained from each variety was higher than the average yield,

but less than the potential yield. This research was carried out in intensive management practices, therefore, there was a possibility to achieve the yield near to potential yield.

Conclusion

Time of earthing up practice did not show significant influence on the growth parameters of each variety of groundnut, but significantly influenced the yield parameters. Among the time of earthing up, 37 days after planting earthing up showed the highest yield than the other times of earthing up. Among the varieties, Lanka jumbo variety gave the highest yield. Therefore, Lanka jumbo variety and 37 days after planting of earthing up combination can be recommended to Kilinochchi farmers to obtain high yield in Groundnut.

Suggestions

This experiment should be repeated during *Maha* season for evaluating the performance of groundnut varieties under different climatic conditions. Research should be carried out to study the height of earthing up on growth and yield performance of different varieties of groundnut.

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