

EFFECT OF DIFFERENT HEIGHT OF EARTHING UP ON YIELD PERFORMANCE OF GROUNDNUT UNDER IRRIGATED CONDITION IN KILINCHCHI DISTRICT, SRI LANKA.

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ABSTRACT

Research was conducted in Kilinochchi District to study the effect of different heights of earthing up on yield performance of groundnut during February to May 2016. Four different earthing up heights such as 0 cm, 5 cm, 10 cm, and 15 cm of groundnut (Tissa) was tested in RCBD with three replicates. The yield components of groundnut were

recorded and data were analyzed in SAS. The yield components of groundnut among treatments were not significantly different except in shelling percentage and 100 pods weight. Earthing up treatment was not significantly influence on biomass increment *ie* there was no quantity changes observed while practicing earthing up. But quality improvement was observed in ground nut cultivation. The shelling percentage and 100 pods weight was increased due to earthing up treatments. The highest shelling percentage and 100 pods weight were observed at earthing up height of 5cm. Even though cost involved in the earthing up practice, cost incurred for earthing up of 5 cm height was not significant compared to other heights of earthing up. But yield of ground nut was increased at 5cm height of earthing up due to losses were avoided caused by vertebrates like birds and squirrels compared to no earthing up. Therefore, earthing up to the height of 5 cm gave bonus yield to farmers. It can be concluded that in ground nut cultivation, earthing up management practice is not compulsory for the cultivation but it enhanced the yield and gave additional income to farmers.

KEYWORDS: earthing up, groundnut, income, shelling percentage, yield.

INTRODUCTION

Groundnut (*Arachis hypogaea. L.*) belongs to the family Fabaceae. It also called as Peanut, earthnut, monkey nut, pinda, goober and manila nut (Beghin *et al* 2003). Groundnut ranks as 13th important crop in the world. It is an oilseed crop with 40-50% oil content. The remaining portion can be used as meal for food or feed (25-30% protein) (Vijaya *et al* 1997, Waliyar, 2006). The groundnut can be eaten as roasted nut, used to extract edible oil and prepare peanut milk, butter, snacks and confectionaries. The oil is also used in industries to produce soap, cosmetic cream, plasters and oilment. After oil extraction, cake is used as protein supplement in animal feed.

Groundnut is grown on nearly 23.95 million ha in worldwide with the total production of 36.45 million mt and an average yield of 1520 kg ha⁻¹ (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 an extent of 11609 ha with a total production of 21953 t and an average yield of 1890 kg ha⁻¹ in Sri Lanka (DOA 2012). 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) (DOA Northern Province).

Earthing up is the raising of the soil around the plant in order to cover the pegs. Basic idea of earthing up is to encourage the easy penetration of peg in soil and also to provide more contact area to spread. Peg penetration is affected by the soil bulk density as well as it depends upon the peg length. In many cases the pegs are not long enough to penetrate the soil. The aerial pod formation of groundnut was first reported by Prasad (1985). Swanevelder (1998) reported that earthing up has a positive influence on the groundnut yield. Fleissner (2001) considered earthing up as an indispensable practice in the production of groundnut. Some groundnut varieties have aerial pods, which do not set any seed, and thus the yield is considerably reduced. Major constraints 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). Earthing up the pods at proper time may minimize the yield losses in ground nut. The height of the earthing up help influence the peg development in the aerial part, otherwise it will be wasted without developing into a pod or it may be converted

into productive pods with good seed filling by earthing up. Cost of earthing up operation depending on height of mounding. But most farmers say that no need to do earthing up practice to get economic yield due to high cost for earthing up practice.

In Sri Lanka seven recommended varieties are available in ground nut such as Red spanish, number 45, tissa, walawe, indi, tikiri and ANK G1 (www.agricdept.ac.lk). Even though several varieties are available in ground nut, the selection of proper variety is extremely important to get good yield. Tissa variety is mostly preferred by farmers due to its short maturity period (90-100 days) and it can be cultivated in both seasons with few rain fall or irrigation and it gives moderate yield (2500-2700 kg/ha).

Considering the farmers practice, the study was designed to evaluate the effect of different height of earthing up on yield performance of ground nut under irrigated condition in the Kilinochchi District of Sri Lanka. The main and specific objectives of this study were,

Main objective

- Compare the growth and yield performance of groundnut under different height of earthing up management practice.

Specific objectives

- Evaluate the number of pods at different height and shelling percentage under different height of earthing up management practices.
- Analysis the economic benefits of different height of earthing up management practices with yield variation.

MATERIALS AND METHODS

The experimental site was selected in the District Agricultural Training Center at Kilinochchi district of the Northern Province of Sri Lanka belongs to the agro-ecological region of DL3. The groundnut (*Arachis hypogaea. L.*) variety tissa was selected for the experiment due to its suitability for both *Yala* and *Maha* seasons in the drier areas, most prefer variety by farmers, short duration variety (90 –100 days) and have moderate yield of 2500-2700 kg/ha. The experiment was conducted during the period from February to May 2016 in Randomized Complete Block Design (RCBD) with three replicates. In the site, the three blocks (put the block size) were established perpendicular to the fertility gradient. Each block was further divided into four plots, at the size of 2 m x 2 m for different height of earthing up

management practices such as 0 cm, 5 cm, 10 cm and 15 cm and to maintain the 0 cm earthing up as a control.

Table 1: Treatments and their code of the experiment.

Treatments	Treatment Code
Height of 0 cm earthing up (Control treatment)	H ₀
Height of 5 cm earthing up	H ₁
Height of 10 cm earthing up	H ₂
Height of 15 cm earthing up	H ₃

Table 2: Layout of the field.

H ₀	H ₂	H ₃
H ₃	H ₁	H ₀
H ₁	H ₀	H ₂
H ₂	H ₃	H ₁

Seeds were soaked in captan fungicide (2 hours) and put in the recommended spacing of 45 cm x 15 cm with the depth of 2-3 cm. Gap filling was done by replanting the ground nut plants which were produced in the small polythene bags 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 recommendation made by the Department of Agriculture (<http://www.agridept.gov.lk/index.php/en/crop-recommendations/988>). The earthing up of ground nut enhances pegs formation and penetration. The earthing up operation was done at the time of 50 % flowering (35 days after seeding) with different height of 5 cm, 10 cm and 15 cm simultaneously. Groundnut was pulled out from soil at 93 days after seeding when vine began to turn yellow and leaves started to shed in case of branch type of groundnut.

The yield components were measured by selecting six plants randomly per plot in each treatment. The measurements including yield components such as fresh weight of pods per plant, Dry weight of pods per plant, matured number of pods per plant, immature number of pods per plant, 100 pods weight, 100 seeds weight and shelling percentage were measured. The ANOVA was performed using the GLM procedure of the SAS computer software package.

RESULTS AND DISCUSSION

Results of the different heights of earthing up on yield performance of groundnut and economic benefits with yield variation were given below.

1. Number of pods per plant and total number of pods per treatment

The number of pods per plant with different height of earthing up and total number of pods per treatments (6 plants under 3 replicates) for different height of earthing up were not statistically significant at $p < 0.05$ (Figure 1 and Figure 2).

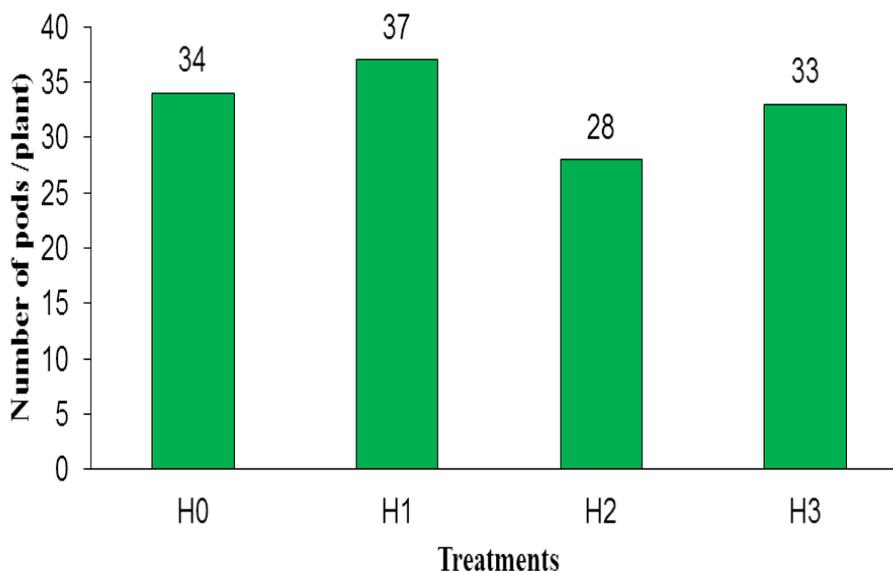


Figure 1: Number of pods per plant at different height of earthing up.

In case of numerical value, 5 cm earthing up treatment gave the highest number of pods per plant than other treatments. Therefore, the result revealed that the 5 cm height was enough for peg penetration into the soil 35 days after planting and formation of healthy pods in groundnut. In addition, the 0 cm earthing up (no earthing up) also performed better than other treatments like 10 and 15 cm height of earthing up. Earthing up is an important yield limiting factor as it influences pod formation of the lower highly productive nodes and promote growth of stem rot caused by fungus (*Sclerotium rolfsii*). It also deteriorates the quality of earlier set mature pods while waiting for the later set pods to mature (http://pmil.caes.uga.edu/documents/UGA203/Publication_UGA203_Deom_FY2015_GroundnutSeedProductionManualforUganda-Okello.pdf).

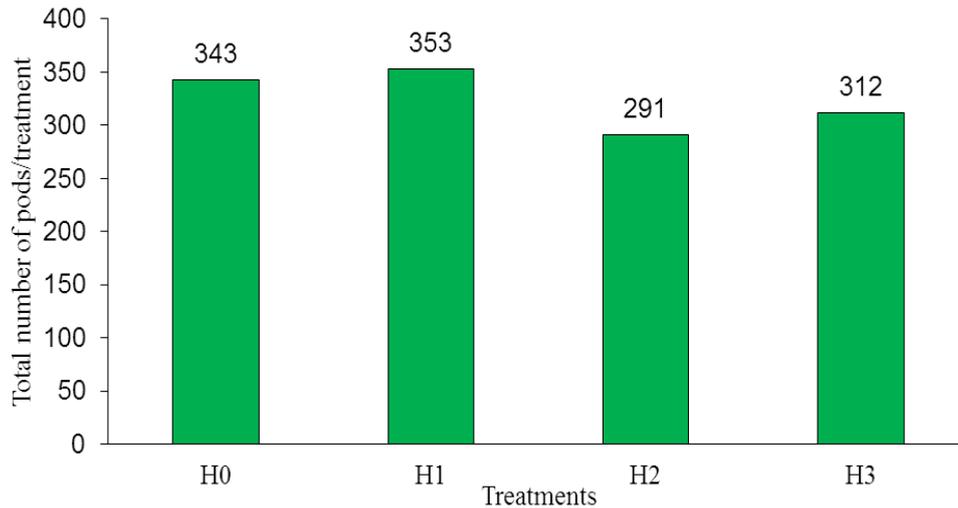


Figure 2: Total number of pods per treatments.

2. Fresh weight of pods per hectare

Fresh weight of pods per hectare was not statistically significant between different heights of earthing up management practice. Earthing up height of 5 cm gave 450 kg/ha more yield compared to no earthing up practice (Figure 3). Other earthing up heights such as 10 cm and 15 cm showed the lowest fresh weight compared to no earthing up treatment.

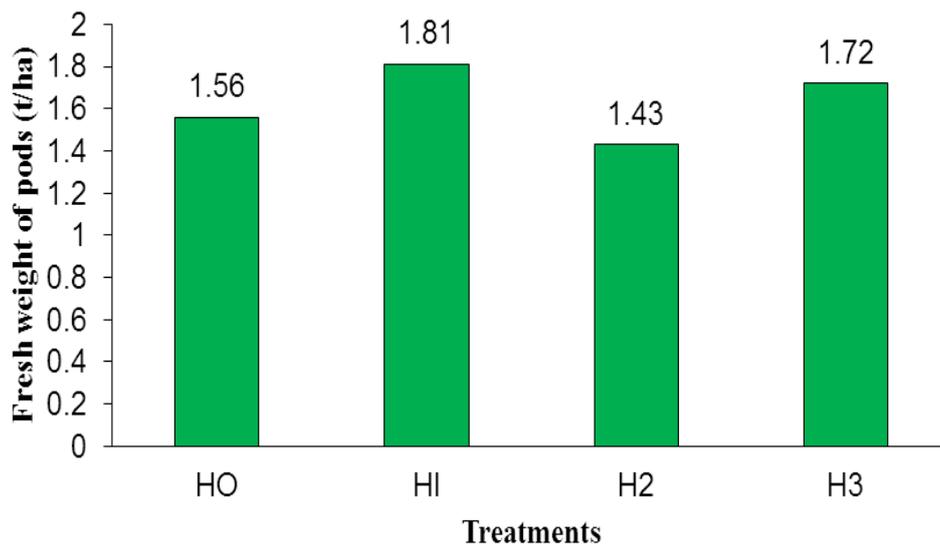


Figure 3: Fresh weight of groundnut under different height of earthing up

3. Number of pods in different height of earthing up

There was a significant difference in pod numbers with different height of earthing up (Table 3). The highest number of pods was observed in 0 cm earthing up (48 %) and lowest number was observed in 15 cm earthing up (6 %).

Table 3: Number of pods at different height of earthing up

Height of Earthing up	Average number of pods	Number of pods in %
0 cm (no control)	14.4 ^a	48
5 cm	8.75 ^b	30
10 cm	4.80 ^c	16
15 cm	1.75 ^d	06

Up to 8-9 cm of height, pegs penetrated to the ground level soil and developed as a effective pods.

4. Shelling percentage

Shelling percentage of ground nut is influenced by earthing up practice. There was a significant difference in shelling percentage of ground nut with different height of earthing up (Figure 4). The highest shelling percentage (78 %) was observed in earthing up height of 5 cm and the lowest percentage (73 %) was observed in earthing up height of 15 cm.

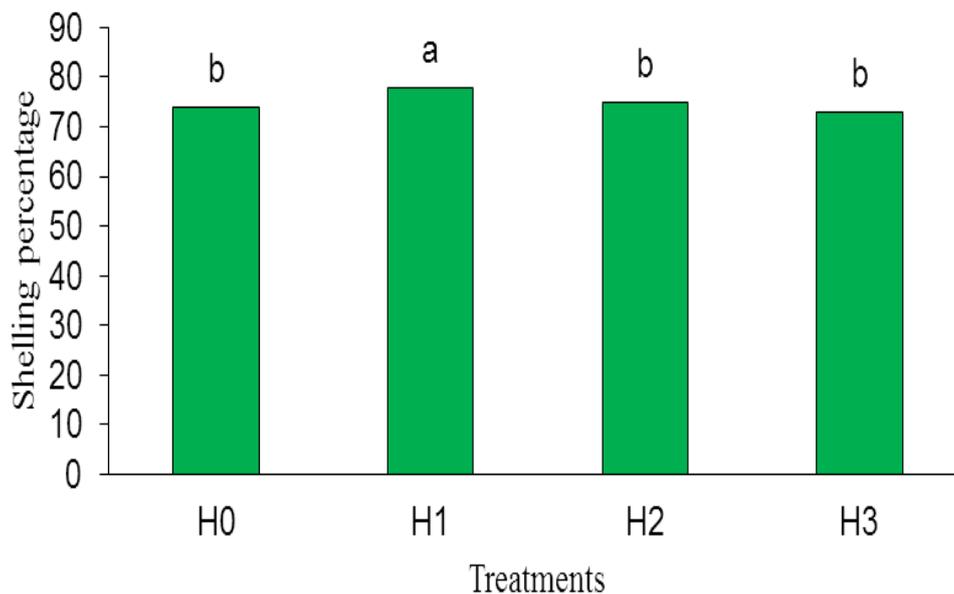


Figure 4: Shelling percentage of groundnut under different earthing up treatments.

5. Dry weight of hundred pods

Dry weight of 100 pods was significantly different among treatments (Figure 5). The highest 100 pod weight (100.15 g) was observed at the earthing up height of 5 cm and the lowest was in earthing up height of 15 cm (87.50g).

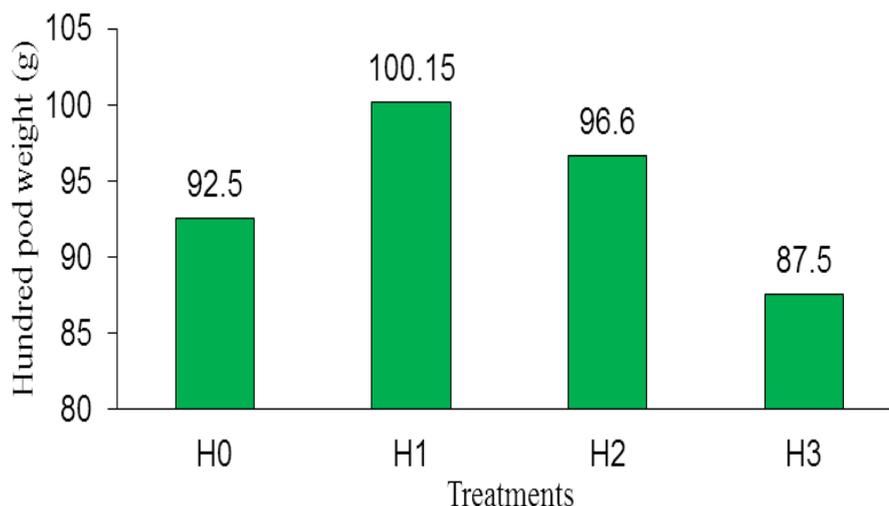


Figure 5: Dry weight of hundred pods with different earthing up treatments.

6. Dry weight of groundnut pods per hectare (Yield)

The dry weight of groundnut pods was also non-significant among treatments. In numerical point of view, earthing up to the height of 5 cm showed higher dry weight (160 kg/ha) than 0 cm earthing up treatments (Figure 6). Other treatments such as 10 and 15 cm heights earthing up showed the lowest dry weight compared to no earthing up treatment.

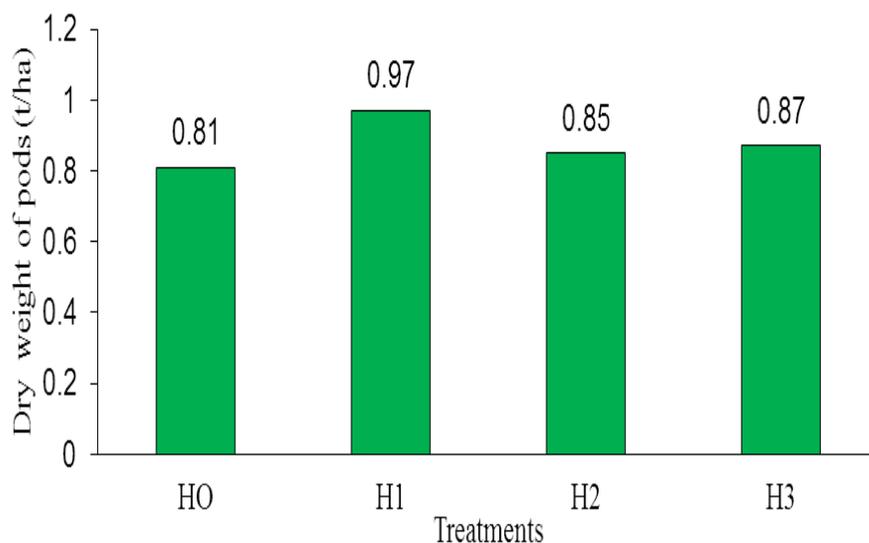


Figure 6: Dry weight of pods at different treatments of groundnut.

Normally earthing up is practiced by farmers to allow pegs from higher nodes to enter the soil. This is an important yield limiting factor as it influences pod formation of the lower highly productive nodes and promote growth of stem rot caused by fungus (*Sclerotium rolfsii*). It also deteriorates the quality of earlier set mature pods while waiting for the later set

Pods to mature (http://pmil.caes.uga.edu/documents/UGA203/Publication_UGA203_Deom_FY2015_GroundnutSeedProductionManualforUganda-Okello.pdf). Earthing up especially in the early stage has an influence on plant development leading to deformed plants with poor or no production at the lower nodes. Flowers cannot develop at the nodes and thus no pegs or pods are formed. Earthing up later in the stage normally does not lead to deformed plants but does lead to lower yields (http://pmil.caes.uga.edu/documents/UGA203/Publication_UGA203_Deom_FY2015_GroundnutSeedProductionManualforUganda-Okello.pdf).

In other hand, variation among number of pods per plant and 100 kernel weight may largely be due to earthing up operation. Varieties in which earthing operation was performed had maximum pods per plant and 100 kernel weight as compared to check variety where no earthing up was done (Naeem Ahmad *et al.*, 2015). The increase in yield may be due to covering of stem above the soil surface with earthing up procedure which eases up the process of pegs penetration. This variation may also be due genetic characteristics of these varieties (Naeem Ahmad *et al.*, 2015). The results are in agreement with Prasad and Muralidhrudu, 1991; Mkandawire and Sibuga 2002 and Ouedraogo *et al.* 2012.

7. Yield and Income

Average yield and net profit obtained from earthing up to the height of 5 cm were given in table 4.

Table 4: Net profit under earthing up height of 5 cm.

Treatment	Labour requirement	Unit price	Total cost for earthing up	Yield (kg)	Price of Groundnut (Rs 200/kg)
No earthing up	0	0	0	810	162000
Earthing up to 5 cm	10	1000	10000	970	194000
Net Profit					Rs 22,000

Even though cost involved in earthing up treatment, yield was increased at earthing up treatment of 5 cm compared to no earthing up treatment. Yield increment of 160 kg gave additional income of Rs 22,000. Swanevelder (1998) reported that earthing up has a positive influence on the groundnut yield.

Therefore, study results showed that earthing up to the height of 5 cm was enough for peg penetration into the soil 35 days after planting and to form quality pods in groundnut. In 0 cm earthing up (no earthing up), performance of groundnut was better than other earthing up

treatments of 10 and 15 cm. Earthing up treatment did not increase biomass due to that no quantity changes occurred in ground nut cultivation. Earthing up practice increased the shelling percentage and yield at the height 5 cm of earthing up. It was the quality improvement observed in ground nut cultivation.

In the field of groundnut, farmers do not do the earthing up practice, due to this reason damage of pods by vertebrates are high and farmers are getting lower yield than expected after harvesting of groundnut. Therefore, it can be recommended that practicing earthing up to the height of 5 cm is enough and efficient for ground nut to get an economical yield at 35 days after planting. Labour requirement for doing earthing up to the height of 10 and 15 cm is very much higher and it increases the cost of cultivation. And also mounding the soil to the heights of 10 and 15 cm is very difficult because of limited spacing available to get the soil in between the groundnut due to semi spreading habit of growth. Results were obtained from this study revealed that, earthing up agronomic practice is not compulsory for the cultivation of groundnut but also it enhanced the yield and additional income.

CONCLUSION

It can be recommended that practicing earthing up to the height of 5 cm is enough and efficient for ground nut to get an economical yield at 35 days after planting. Earthing up practice is not compulsory for the cultivation of groundnut but it enhanced the yield and gave additional income to farmers.

SUGGESTIONS

This study can be done by using other recommended varieties of groundnut and time of doing earthing up can be changed with the height of earthing up.

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