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EFFECT OF MULCH ON YIELD OF GROUND NUT (*ARACHIS HYPOGAEA* L. VAR.WALAWE) EXPOSED TO HEAT STRESS

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INTRODUCTION

Groundnut (*Arachis hypogaea* L) is an important cash crop grown in the dry zone of Sri Lanka. Heat and/or drought-induced stresses are the major environmental factors limiting pod yields of Groundnut. The optimum day/night temperature for vegetative and reproductive growth and development in groundnut ranges from 25/25° C (Wood, 1968) to 30/26 ° C (Cox, 1979) and from 25/20 ° C (Wood, 1968) to26/22 ° C (Cox, 1979), respectively. However with global warming the temperature in globe is predicted to increase in coming years therefore it is imperative to find adaptation measures to cultivate groundnut as it plays major role in rural economy of Sri Lanka. The main aim of this paper is to quantify the effects of high air temperature on nodulation and pod yield of groundnut and to identify the best mulch which contributed to reduce high temperature effects on groundnut.

METHODOLOGY

This study was conducted during the October 2010 to May of 2011 in temperature regulated poly tunnels constructed in the agricultural field of the Open University of Sri Lanka, Nawala, Nugegoda. One set of two poly tunnels was maintained at 32°C maximum temperature. Another set of two poly tunnel was maintained at 34°C and one experimental set outside the tunnels as ambient Ground nut (Walawe) seeds were planted in pots filled with compost and reddish brown earth soil mixture. Three types of mulches were used (coir dust, straw, saw dust and no mulch) and the plants were maintained without water stress by applying water to keep the soil moisture at field capacity level throughout the growing season (Table 1).

Table 1: Three different environment conditions of the experiment

No	*Environmental conditions*
Condition 1 Poly Tunnel	Increased the temperature by 2 ^{0}C more than the average day time temperature of Anuradhapura (32-34^{0}C). Diurnal pattern is considered) Three types of mulches were used on the soil –Ground nut plants in pots. • **coir dust (M1) /straw (M2)/sawdust (M3)/No mulch (M0)**
Condition 2 Poly Tunnel	Ambient temperature of Anuradhapura (30-32^{0}C) Three types of mulches were used on the soil –Ground nut plants in pots. • **coir dust (M1) /straw (M2)/sawdust (M3)/No mulch (M0)**
Condition 3 *Open Space*	Ambient temperature Three types of mulches were used on the soil – Ground nut plants in pots. • **coir dust (M1) /straw (M2)/sawdust (M3)/No mulch (M0)**

Data collection and analysis

Transplant success (survival rate) was estimated by the percentage of plants that showed successful establishment at 3 weeks after planting (WAP).Plant height were measured at monthly intervals up to 16WAP. Yield was collected at the end of 4 months after planting. The average of five replicates were taken as yield per plant. Harvesting was done in May 2011 and dry plant weights and pod weight were measured using a digital balance. Number of nodules per plant was counted manually.

Statistical Analysis

The experimental design was Completely Randomized Design (CRD) with factorial treatment structure. Temperature and mulches were taken as factors.
All extraction runs and analyses were carried out at least in duplicate and in randomized order with the mean values being reported. Analysis of variance (ANOVA) of the results was performed using General Linear Model procedure of Mini tab (Software Version 14).

RESULTS AND DISCUSSION

Number of pegs

Number of pegs per plant was reduced in no mulch condition at 34^0C maximum temperature polytonal, but plants mulched with coir dust, straw and saw dust were significantly high. This may due to the effect of mulches to reduce the soil temperature in pots (Figure 1). Soil temperatures greater than 33^0 C significantly reduce the number of pegs (Minchin,etal .1981) agrees with the results obtained in this study as the number of pegs is lowest in 34^0C poly tunnel compared to the plants in ambient and 32^0C poly tunnel.

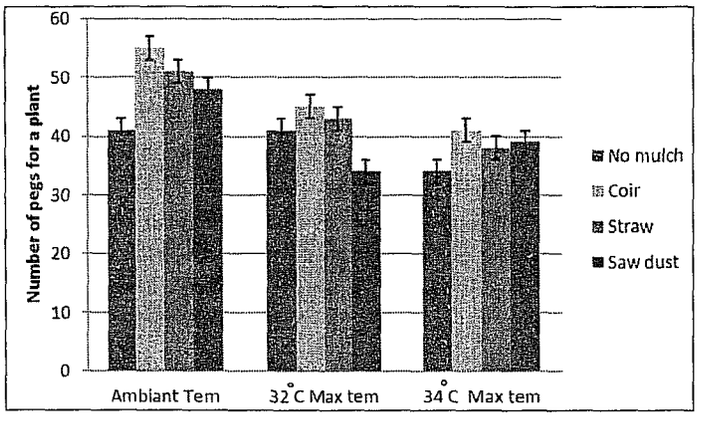

Figure 1. Effect of coir dust, straw and saw dust mulches on number of pegs per plant.

Number of nodules per plant

The number of nodules per plant significantly reduced by high soil temperature (Figure 2). This is reduced by the mulches in ambient temperature and 32°C maximum temperature. Further straw and coir dust mulches have improved the number of nodules compared to saw dust and no mulch conditions. Studies on other grain legumes have shown that in plants dependent on symbiotic N_2, application of small quantities of inorganic N can stimulate nodulation, increase N_2 fixation and lead to greater seed yield even at high air temperatures (Summerfield.,et al 1978). Here the heat stress simulated at 34 °C has drastically reduces the nodule per plant even with mulch.

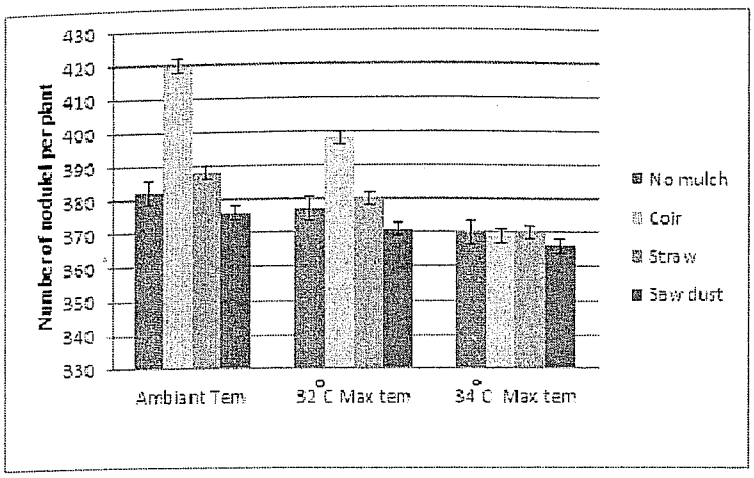

Figure 2. Effect of coir dust, straw and saw dust as mulch on number of nodules per plant.

Pod Yield

The pod yield is the most important character when the economic importance of this crop is considad.Coir and straw mulches show a significantly high yield compared with the other mulches(Figer3). This may be due to the higher nodulation induced by coir and straw mulches increased the pod yield. Pod yield reduce proportionately with the temperature. When temperature increases pod yield has reduced the optimum air temperature for growth and development of groundnut is between 25^0 C and 30^0 C (Williams and Boote, 1995). It has been shown, for example, that the numbers of pegs and pods were reduced by 33% by exposure to a day temperature of 35^0 C compared with 30^0 C (Ketring, 1984). The results of this study agree with findings of Ketring (1984) as the number of pegs and pods were reduced in the 34 ^{0}C maximum temperature poly tunnel.

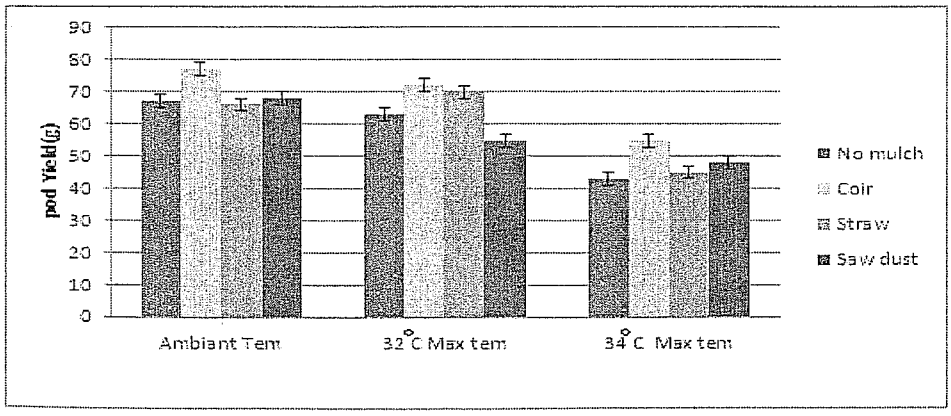

Figure 3. Effect of coir dust, straw and saw dust as mulch on average pod yield

CONCLUSIONS

Temperature has drastically affected the number of pegs, nodules and pod yield as it is high in ambient temperature and decreased with increased temperature. However coir dust has significant effect even on high temperature by having highest number of peg and pod yield. Saw dust mulch also performed well in plants exposed to heat stress compared to saw dust mulch. Even though there is temperature stress to plants due to global warming, by applying

adequate water without water stress along with coir dust mulch yield could be obtained without significant reduction. This study is on progress and the results will be confirmed after conducting 3-4 seasons. Findings of this study will help the farmers in dry zone to cope with temperature stress in coming years due to climate change.

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