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Short Communication

Influence of Gypsum Application on Yield and Visual Quality of Groundnut (*Arachis hypogaea* L.) Grown in Maspotha in Kurunegala District of Sri Lanka

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ABSTRACT: *Groundnut (Arachis hypogaea L.) is a high value oil crop in Sri Lanka. Low yields and poor quality are the major constraints in groundnut production. The crop is usually grown in well-drained soils with a pH of 6.5. Inadequate and unbalanced supply of nutrients may be one of the reasons for low yields in acidic and sandy soils. Therefore, a field experiment was conducted during the Maha season 2012/2013 to find out the effect of gypsum on the yield and quality of groundnut in Maspotha divisional secretariat area in the Kurunegala district. Soil pH and EC were measured to determine the acidity and salinity levels. Four treatments namely, 0, 125, 175, 250 kg/ha of gypsum were used in a Randomized Complete Block Design with three replicates. The crop management practices were done according to recommendations of DOA. The nut yield, number of pegs per plant, kernel and shell weight of fifty pegs per plot, dry weight of fifty seeds were measured. The seed quality and filling of seeds in each treatment were also evaluated. The results revealed that the application of 250 kg/ha of gypsum changed the soil pH from 4.1 to 5.0 and increased the mean pod dry weight from 618 to 865 g with high quality kernels (with good appearance and size)*

Keywords: *Groundnut, gypsum, kernel weight, shell weight*

INTRODUCTION

The groundnut, *Arachis hypogaea* L. was originated from South America and presently grown in tropical countries (Reddy, 1988). Department of Agriculture (DOA), Sri Lanka has developed four new varieties namely, Thissa, Indi, Walawa and Tikiri. These varieties are cultivated in the dry and intermediate zones of Sri Lanka mainly under rain fed in *Maha* season and, in paddy lands under irrigation during *Yala* season. Ground nut is mainly grown in Moneragala, Hambantota, Kurunagala, Anuradhapura, Mullative, Rathnapura and Puttalum districts (DOA, 2006). In Sri Lanka, Groundnut is used as an oil crop, as a snack and in confectionaries (DOA, 2006). According to the DOA statistics (2011), the cultivated groundnut extent was 9251 ha and the production was 16800 Mt. with an average yield of 1.8 Mt ha^{-1}. Groundnut is grown in well-drained sandy loam and clay loam soils. Deep well-drained soils having pH of 6.5 - 7.0 and high fertility are best suited for groundnut.

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According to the DOA (2006) the application of Calcium is important for proper kernel development in groundnut. Calcium carbonate can be used as a calcium source, but, compared to Gypsum, it is slow releasing due to less solubility. Therefore, Gypsum ($CaSO_4 \cdot 2H_2O$) can be used at flowering to ensure the adequate availability of Ca in the fruiting zone to enhance the pod development.

Chapman *et al.,* (1993) reported that the less amount of soluble calcium in the pegging zone cause low peg formation. The researchers found that the groundnut pegs and pods treated with gypsum had a significantly less pod rot, than the untreated (Chapman *et al.,* 1993).

Farmers in Dambulla area apply 60-350 kg ha^{-1} of gypsum for their cultivations and obtained a yield of 2500kg ha^{-1}. In Maspotha area, the yield of groundnut is around 750 - 1000 kg ha^{-1} (weerasekara, 2012). Therefore, this study was conducted to find out the effect of gypsum to obtain a higher yield in Maspotha area.

METHODOLOGY

This study was conducted at the Maspotha divisional secretariat area in Kurunegala district, which belongs to IL1a agro ecological region. The average annual rainfall is 1100-1400 mm. Soil type is reddish brown earth (Punyawardana, 2008).

The Groundnut variety Thissa was selected for this study due to the availability. The recommended time for planting in *Maha* is October and *Yala* is April. The recommended fertilizer rate is 30 kg ha^{-1} N , 45 kg ha^{-1} P_2O_5, 45 kg ha^{-1} K_2O (DOA, 2006) and no recommendation given for Gypsum.

Raised beds were used in high lands with the spacing of 45 cm x 15 cm. The plot size was 1 m x 3 m. Two rows of plants were planted as guard rows for each plot. The experiment was laid according to Randomized Complete Block Design (RCBD) with four treatments. Each Treatment had three replicates. The treatments were as follows

0 kg ha^{-1} of gypsum (control)	(T1)
125 kg ha^{-1} of gypsum	(T2)
175 kg ha^{-1} of gypsum	(T3)
250 kg ha^{-1} of gypsum	(T4)

Soil pH, Cation Exchange Capacity (CEC), and Electrical Conductivity (EC) were measured at the time of planting, 5 days after application (5 DAA) of gypsum at the pegging stage and at harvest. Yield data were collected from five randomly selected plants from each plot. Number of pegs per plant, fresh weights (g), and dry weight of pods (g), kernel and shell weight of 50 pods were measured. Dry weights of the seeds were taken after drying the seeds for three days using solar drying system. The quality of the kernel was assessed visually by sorting and grouping the seeds according to the size of the kernel of 50 pods into large, medium and small.

Data were analysed using the analysis of variance (ANOVA) procedure by statistical analyze system (SAS) and mean separation was done using Duncan's Multiple Range Test (DMRT) at p= 0.05.

RESULTS AND DISCUSSION

Soil Properties

Initial pH, showed that the soil was in the acidic range and it was below the recommended pH range for the ground nut (Table 1). The pH and EC values were slightly increased after five days of applying gypsum and slightly decreased at harvest. CEC also increased with applying gypsum and slightly decreased at harvest.

Table 1. Chemical properties of soil

Stage	Property	T1	T2	T3	T4
Initial	pH	4.2	4.1	4.2	4.1
Initial	CEC (cmol kg^{-1})	6.0	6.5	6.4	6.3
Initial	EC (µS cm^{-1})	205	220	200	210
5 DAA*	pH	4.3	4.4	4.3	5.0
5 DAA*	CEC (cmol kg^{-1})	7.2	7.5	7.7	7.8
5 DAA*	EC (µS cm^{-1})	230	250	260	270
at harvest	pH	4.3	4.3	4.2	4.8
at harvest	CEC (cmol kg^{-1})	7.1	7.4	7.5	7.7
at harvest	EC (µS cm^{-1})	210	235	245	260

* 5 days after application

Warren (2011) observed that the gypsum will improve the pod filling without changing the soil pH. The researcher also explained that a optimum soil EC level for ground nut will be somewhere above 200 µS cm^{-1} and below 1200 µS cm^{-1}. Any soils <200 µS cm^{-1} does not have enough available nutrients to the plant and may be a sterile soil with minimum microbial activity (Chapman, 1993). An EC above 1200 µS cm^{-1} may indicate that of high salt fertilizer or perhaps a salinity problem due to lack of drainage.

Plant performances

The number of pegs per plant significantly increased in T3 and T4 treatments over the control and T2 (Table 2). The treatment T4 showed the highest peg formation.

Table 2. Plant performances

Treatment	Number of pegs per plant	Mean pod fresh weight (g)	Mean Pod dry weight (g)
T1	23^{b}	937.67^{c}	618.00^{c}
T2	28^{b}	1101.67^{b}	772.33^{b}
T3	34^{a}	1118.33^{b}	774.00^{b}
T4	35^{a}	1297.67^{a}	865.11^{a}
CV%	26	23	25

Values within a column followed by a common letter are not significantly different at P=0.05, according to DMRT

The results of number of pegs per plant showed that there was no significant difference between T1 and T2, but there was a significant difference between T2 and T3 compared to T1. It appears that gypsum requirement for increased peg formation is more than 125 kg /ha.

The total number of plants per plot was 40. The mean pod fresh and dry weights are given in Table 2. The T4 treatment showed a significantly higher yield compared to other treatments. The yields of T2 and T3 treatments did not differ significantly, but T1 treatment without gypsum showed a significantly lower yield than T2, T3 and T4. Therefore, T4 treatment with 250 kg ha^{-1} of gypsum could be identified as the best treatment.

The treatment T4 showed significantly higher pod dry weight yield (yield on dry basis) than all other treatments (Table 2). The treatments T2 and T3 were not significantly different from each other. The treatment T1 gave the lowest yield. Therefore, T4 with 250 kg ha^{-1} of gypsum could be identified as the best treatment to obtain higher yields.

Mean kernel weight and mean shell weight of 50 pods

The mean kernel weight of 50 pods showed a significant difference ($p< 0.05$) among treatments (Table 3). The treatment T4 showed a significantly higher kernel yield and a good quality appearance compared to other treatments. The treatment T1 gave the lowest yield with half-filled nuts. Therefore, according to the results, the treatment T4 with 250 kg ha^{-1} of gypsum can be recommended as the best treatment to obtain higher kernel yield.

Table 3. The mean kernel weight and mean shell weight

Treatment	mean kernel weight (g)	mean shell weight (g)
T1	31.67^{d}	36.6^{a}
T2	43.67^{c}	37.6^{a}
T3	54.21^{b}	37.3^{a}
T4	62.35^{a}	39.6^{a}
CV%	25	24

Values within a column followed by a common letter are not significantly different at P=0.05, according to DMRT

The results showed that the mean shell weight per 50 pods did not differ significantly ($p< 0.05$) among treatments (Table 3).

Quality of the kernel

The results showed that the quality of the kernel of 50 pods was significantly different ($p< 0.05$) among treatments (Table 4). With the application of 250 kg ha^{-1} of gypsum, the T4 treatment gave better kernel size compared to other treatments. However, all the treatments with application of gypsum showed an improvement in kernel size.

Table 4. size of the kernel

Treatment	Size of the kernel		
	Large (%)	Medium (%)	Small (%)
T1	20[d]	30 [a]	50 [a]
T2	30[c]	30 [a]	40 [b]
T3	50[b]	20 [b]	30 [c]
T4	60[a]	20 [b]	20 [d]

Values within a column followed by a common letter are not significantly different at P=0.05, according to DMRT

CONCLUSION

The application of gypsum at a rate of 250 kg ha^{-1} increased the mean pod dry weight of groundnut by 39% (from 618 to 865 g) and quality of the kernels when grown in acidic soils at Maspotha in Kurunegala district. In addition, there was an increase in the number of pegs per plant and kernel weight.

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