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Effect of Different Levels of Gypsum and Pressmud cake on Drymatter Production, Yield and Uptake of Nitrogen, Phosphorus and Potassium in groundnut

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ABSTRACT

A field experiment was conducted to evaluate effect of different levels of gypsum and pressmud cake on drymatter production, yield and uptake of nitrogen, phosphorus and potassium in groundnut on a sandy clay loam soil (Typic Haplustalfs) during *rabi,* 2009-2010 at wet land farm, S.V. Agricultural College, (ANGRAU) Tirupati. Application of pressmud cake @ 5 t ha^{-1} along with application of gypsum @ 500 kg ha^{-1} each at basal and flowering recorded the highest haulm and pod yield in groundnut. Further, application of pressmud cake @ 5 t ha^{-1} along with application of gypsum @ 500 kg ha^{-1} each at basal and flowering registered the highest uptake of N, P and K by plants at flowering and haulms and seeds at harvest.

Key words : Drymatter Production, Groundnut, Gypsum, Nutrient uptake, Pressmud cake, Yield.

Groundnut is a major oil seed crop in India and in many developing countries. It is a multipurpose crop providing cooking oil, vegetable protein and is a rich sources of vitamins such as A, B and B_2 group. Gypsum application improves the soil structure and reclaims alkali soils and also supplies Ca (23%) and S (18.7%) to soils. Presence of Ca in adequate quantities in the rooting zone is necessary for proper filling of pods and also to meet the growing demands of the rapidly developing pods and consequently enhance the yield of groundnut (De *et al.,* 1982).

Pressmud is a good organic amendment, contain some nutritional enrichment and beneficial effect on soil physico-chemical properties and also a rich source of calcium (61% $CaCO_3$), organic matter (25%) and also at acts as an effective ameliorant for sodic soils. Keeping the above facts in view an attempt was made to study the effect of different levels of gypsum and pressmud cake on drymatter production, yield and uptake of nutrients in groundnut.

MATERIAL AND METHODS

A field experiment was conducted at wet land farm, S.V. Agricultural College (ANGRAU), Tirupati. The soil is sandy clay loam (Typic Haplustalfs) in texture, slightly alkaline (7.90) in reaction, non-saline and low in available N and P and high in available K. The experiment was laid out in a randomized block design with factorial concept. The treatments comprises of 3 levels of pressmud cake (0, 5and 10 t ha^{-1}) and 4 levels of gypsum (0 kg ha^{-1}, 500 kg ha^{-1} at basal, 500 kg ha^{-1} at flowering and 500 kg ha^{-1} each at basal and flowering) with 12 treatment combination and replicated thrice. The groundnut variety Narayani was selected as a test crop.

The plant samples were collected at two stages of plant growth. The first sample was collected at the flowering stage and the second sample was taken at the time of harvest. The root part was removed and the shoot was washed in sequence with tap water, 0.1 *N* HCl solution and deionized water and extra moisture was wiped-out and dried in shade to exhaust the moisture content. Finally, the sample were dried in hot air oven at 70°C and dried samples were powdered in Willey Grind Mill and preserved in butter paper covers for chemical analysis of N, P and K. Nitrogen content of plant samples was estimated by Microkjeldhal distillation method (AOAC, 1970). Phosphorus content in plant samples was estimated by Vanodomolybdo phosphoric acid yellow colour method (Jackson, 1973) potassium content in plant samples was determined using the flame photometer (Jackson, 1973).

RESULTS AND DISCUSSION

Haulm and pod yield

The halum and pod yield (Table 1) increased significantly with graded levels of pressmud cake from 0 to 5 t ha^{-1}. Application of pressmud cake @ 5 t ha^{-1} recorded the highest haulm (2716.34 kg ha^{-1})

Table 1. Effect of pressmud cake and gypsum on halum and pod yield of groundnut (kg ha^{-1}).

Treatments	Haulm yield	Pod yield
Pressmud cake levels (PMC)		
Pressmud cake 0 t ha^{-1}	2609.14	2600.00
Pressmud cake 5 t ha^{-1}	2716.34	2700.30
Pressmud cake 10 t ha^{-1}	2646.67	2688.67
CD (0.05)	78.94	93.03
Gypsum levels (G)		
Gypsum 0 kg ha^{-1}	2289.77	2284.06
Gypsum 500 kg ha^{-1} as basal	2651.70	2591.42
Gypsum 500 kg ha^{-1} as flowering	2799.20	2698.84
Gypsum 500 kg ha^{-1} each at basal and flowering	2888.86	2730.12
CD (0.05)	91.15	107.42
Pressmud cake levels (PMC) x Gypsum levels (G)		
PMC 0 t ha^{-1} x G 0 kg ha^{-1}	2382.03	2237.78
PMC 0 t ha^{-1} x G 500 kg ha^{-1} at basal	2629.59	2424.38
PMC 0 t ha^{-1} x G 500 kg ha^{-1} at flowering	2641.32	2610.98
PMC 0 t ha^{-1} x G 500 kg ha^{-1} each at basal and flowering	2783.62	2320.21
PMC 5 t ha^{-1} x G 0 kg ha^{-1}	2249.50	2506.81
PMC 5 t ha^{-1} x G 500 kg ha^{-1} at basal	2670.54	2693.41
PMC 5 t ha^{-1} x G 500 kg ha^{-1} at flowering	2773.86	2699.23
PMC 5 t ha^{-1} x G 500 kg ha^{-1} each at basal and flowering	2990.20	2895.83
PMC 10 t ha^{-1} x G 0 kg ha^{-1}	2237.78	2520.99
PMC 10 t ha^{-1} x G 500 kg ha^{-1} at basal	2654.97	2697.59
PMC 10 t ha^{-1} x G 500 kg ha^{-1} at flowering	2982.43	2699.97
PMC 10 t ha^{-1} x G 500 kg ha^{-1} each at basal and flowering	2892.20	2883.54
CD (0.05)	157.88	186.60

and pod (2700.30 kg ha^{-1}) yield. The increase in pod and haulm yield with the application of pressmud cake might be due to improved soil physical and chemical properties and microbial activities resulting in increased availability of nutrients in soil which made the plants to absorb more nutrients and thereby increased the haulm and pod yield of groundnut. These results were in agreement with the findings of Badole *et al.,* (2001).

Application of gypsum significantly increased the haulm and pod yield. The highest haulm (2888.86 kg ha^{-1}) and pod (2730.12 kg ha^{-1}) yields were recorded when gypsum was applied @ 500 kg ha^{-1} each at basal and flowering. The increased pod and haulm yield due to application of gypsum was attributed to concomitant influence of sulphur released from the gypsum on availability of other nutrients from the soil and their extraction by the plant seems to have provided congenial nutritional environment for the plants. Further, calcium plays an important role in the reproductive development of the groundnut crop, thereby increased the pod yield. These results are in agreement with the findings of Rao and Shaktawat (2005).

The interaction effect between pressmud cake levels and gypsum levels on haulm (2990.20 kg ha^{-1}) and pod yield (2895.83 kg ha^{-1}) were found to be significant. The highest haulm and pod yields were recorded with application of pressmud cake @ 5 t ha^{-1} along with gypsum @ 500 kg ha^{-1} each at basal and flowering. The combined application of pressmud cake and gypsum improved the physical and chemical properties of soil leading to increased availability of nutrients from the native pool. Furthermore, increased availability of nutrients due to mineralization of pressmud cake and supply of calcium and sulphur by gypsum lead to the highest pod and haulm yield in groundnut.

Nitrogen, phosphorus and potassium uptake

N, P and K uptake (Table 2) by plants at flowering and haulms and seed at harvest increased significantly with graded levels of pressmud cake from 0 to10 t ha^{-1}. Application of pressmud cake @

Table 2. Effect of pressmud cake levels and gypsum levels on uptake of nitrogen, phosphorus and potassium (kg ha^{-1}) in groundnut.

Treatments	Nitrogen			Phosphorus			Potassium		
	Plants at flowering	At harvest		Plants at flowering	At harvest		Plants at flowering	At harvest	
		Haulms	Seeds		Haulms	Seeds		Haulms	Seeds
Pressmud cake levels (PMC)									
Pressmud cake 0 t ha^{-1}	18.87	39.22	85.02	2.05	3.04	5.68	7.89	14.54	15.69
Pressmud cake 5 t ha^{-1}	19.95	40.43	87.14	2.14	3.17	5.70	7.98	14.84	16.61
Pressmud cake 10 t ha^{-1}	19.97	41.11	88.86	2.15	3.24	5.72	8.00	14.96	16.64
CD (0.05)	0.53	0.57	0.97	0.03	0.04	0.04	0.06	0.28	0.45
Gypsum levels (G)									
Gypsum 0 kg ha^{-1}	16.65	34.33	69.14	1.68	2.84	5.13	6.03	13.75	12.85
Gypsum 500 kg ha^{-1} as basal	19.06	39.33	84.67	1.88	2.98	5.63	7.92	14.74	15.45
Gypsum 500 kg ha^{-1} as flowering	21.10	43.66	95.20	2.36	3.3	5.96	8.75	15.18	18.17
Gypsum 500 kg ha^{-1} each at basal and flowering	21.57	43.71	98.87	2.52	3.49	6.13	9.12	15.22	18.79
CD (0.05)	0.61	0.66	1.12	0.03	0.05	0.04	0.06	0.32	0.52
Pressmud cake levels (PMC) x Gypsum levels (G)									
PMC 0 t ha^{-1} x G 0 kg ha^{-1}	14.22	32.47	68.58	1.59	2.78	4.99	5.93	12.81	11.71
PMC 0 t ha^{-1} x G 500 kg ha^{-1} at basal	18.03	40.16	78.92	1.67	3.01	5.79	8.65	15.51	16.49
PMC 0 t ha^{-1} x G 500 kg ha^{-1} at flowering	19.99	41.50	93.33	1.70	3.03	5.9	8.02	14.92	16.67
PMC 0 t ha^{-1} x G 500 kg ha^{-1} each at basal and flowering	21.17	42.75	99.23	2.43	3.35	6.05	8.95	14.90	17.90
PMC 5 t ha^{-1} x G 0 kg ha^{-1}	18.57	36.00	68.24	2.00	2.82	5.11	6.18	13.61	13.28
PMC 5 t ha^{-1} x G 500 kg ha^{-1} at basal	20.09	38.83	90.33	2.17	2.95	5.39	7.85	14.17	14.68
PMC 5 t ha^{-1} x G 500 kg ha^{-1} at flowering	20.99	45.23	91.60	2.53	3.33	6.13	8.47	15.15	18.95
PMC 5 t ha^{-1} x G 500 kg ha^{-1} each at basal and flowering	22.31	47.95	100.67	2.64	3.79	6.30	9.75	15.79	19.52
PMC 10 t ha^{-1} x G 0 kg ha^{-1}	17.17	34.51	70.60	1.76	2.92	5.30	5.98	14.83	13.57
PMC 10 t ha^{-1} x G 500 kg ha^{-1} at basal	19.05	38.99	84.75	1.96	2.97	5.69	7.27	14.55	18.17
PMC 10 t ha^{-1} x G 500 kg ha^{-1} at flowering	21.33	41.67	97.67	2.27	3.38	5.66	9.00	14.97	18.33
PMC 10 t ha^{-1}xG 500 kg ha^{-1} each at basal and flowering	22.21	43.00	99.42	2.56	3.59	6.21	9.42	15.50	19.51
CD (0.05)	1.06	1.13	1.94	0.06	0.08	0.08	0.11	0.56	0.89

10 t ha^{-1} recorded the highest nitrogen (19.97, 41.11 and 88.86 kg ha^{-1}), phosphorus (2.15, 3.24 and 5.72 kg ha^{-1}) and potassium (8.00, 14.96 and 16.64 kg ha^{-1}) uptake by plant at flowering and haulms and seed at harvest. This might be due to increased availability of these nutrients by the mineralization of pressmud cake which in turn increased the drymatter production at flowering and haulm and seed yield at harvest, finally leading to increased the uptake of nitrogen, phosphorous and potassium. Similar results were reported by Badole *et al.,* (2001).

Application of gypsum significantly increased the uptake of nitrogen (21.57, 43.71 and 98.87 kg ha^{-1}),phosphorus (2.52, 3.49 and 6.13 kg ha^{-}) and potassium (9.12, 15.22 and 18.79 kg ha^{-1}) was recorded with application of gypsum@ 500 kg ha^{-1} each at basal and flowering by plants at flowering and haulms and seed at harvest. This might be due to improvement in the physical properties of soil due to application of gypsum which may also hastened the microbial process leading to increased the supply of nitrogen, phosphorus and potassium from the native pools. These results are in agreement with the findings of Sreelatha *et al*., (2004).

The interaction effect between pressmud cake levels and gypsum levels on uptake N, P and K was found to be significant. The highest nitrogen (22.31, 47.95 and 100.67 kg ha^{-1}), phosphorus (2.64, 3.71 and 6.30 kg ha^{-1}) and potassium (9.75, 15.79 and 19.52 kg ha^{-1}) uptake was recorded with the application of pressmud cake @ 5 t ha^{-1} along with application of gypsum @ 500 kg ha^{-1} each at basal and flowering. It might be due to improvement of physical properties of soil by the gypsum along with increased solubility of N, P and K by the organic acids produced during the mineralization of pressmud cake.

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