Short Note

Journal of AgriSearch 2(3): 229-232
Peer Reviewed Quarterly

ISSN : 2348-8808 (Print), 2348-8867 (Online)

Effect of Levels of Phosphorus and Lime on the Yield Attributes and Pod Yield of Irrigated Summer Groundnut

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ARTICLE INFO

Received on	: 10.08.2015
Accepted on	: 20.08.2015
Published online	: 01.09.2015

ABSTRACT

A field experiment was conducted at the Instructional-cum-Research Farm, Assam Agricultural University, Jorhat district of Assam, during summer season to study the effect of levels of Phosphorus and lime on the yield attributes and pod yield of irrigated summer groundnut. Yield attributing characters viz. number of kernels per pod, pod weight per plant, kernel weight per plant, and 100-kernel weights were highest in plot received 25 per cent of its lime required. Both under limed and un-lime conditions, the yield attributing characters including pod yield increased significantly with increase in the levels of applied phosphorus up to 50 kg P_2O_5 / ha.

Keywords: Phosphorus, Lime, Yield and Groundnut

India is the world leader in production, consumption and import as well in case of vegetable oils. India imports 9.2 Mt of vegetable oils during 2010-11. Currently India is in the mid-way of self-sustaining in oilseeds production. By the 2050, India as a whole will be able to sustain their production. Indian will produced plenty with respect the non-food commodity i.e. oilseeds. India may emerged as net exporter from being net importer for century the with respect to oilseed (Singh *et al*., 2013). Considering the socio-political situation and poor land to man ratio in eastern region the likelihood for oilseeds is not at all in bad shape (Singh *et al*., 2014).Groundnut (*Arachishypogaea* L.) is an important oilseed crop of India ranking first among the oilseed crops(Kumar and Sachan, 2015). This crop is grown in both *kharif* and *rabi*seasons. However, a major percentage of total groundnut production of the country comes from *kharif* cultivation. It can also be grown during summer season either under assured irrigation or under residual soil moisture after harvest of paddy. The crop mainly cultivated under irrigated in summer season is not subjected to vagaries of monsoon and is also less exposed to diseases and pests. Since the water use efficiency of groundnut is more, it could be replace many competitive crops in summer. Therefore, the possibilities of increasing productivity and stabilizing production of groundnut are immense during summer season.In Assam groundnut is a nonconventional crop having limited area under its cultivation. Most of the soils of Assam are acidic in reaction, which stands as one of the major limiting factors responsible for relatively low productivity of various legume crops in the state. Liming is a standard practice to ameliorate such soil, which increases availability of most of the native as well as applied nutrients to plants. Lime neutralizes the exchangeable acidity and also precipitates the exchangeable Al^{3+} the constant proton supplier in acid soils that creates a favorable condition for plant growth. Another important factor for getting good yield of groundnut is the management of phosphoric fertilizer (Singh and Kumar, 2009).Phosphorus availability is a limiting factor for plant production in many agricultural soils. In regions of the world without a history of use of phosphorus fertilizers, phosphorus deficiency is very common (Kumar *et al*., 2015). A large portion of applied fertilizer phosphorus may be fixed to iron and aluminium oxides and is then not available for plant uptake (Pal *et al*., 2014).It has been reported that groundnut is a good feeder of phosphorus. Likewise, ample evidence in literature is there to show a positive effect of phosphorus on groundnut production (Pasricha *et al*., 1980; Birajdar and Ingle, 1977). Nair *et al.* (1969) reported that low level of phosphorus was one of the

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causes for poor nodulation of groundnut. Hence, an attempt was thus made to find out the response of yield attributes and pod yield of summer groundnut to phosphorus and lime under irrigated condition. An experiment with five different phosphorus levels i.e. 0 (P_0), 25 (P_1), 50 (P_2), 75 (P_3) and 100 (P_4) kg P_2O_5/ha were compared under no lime (L_0), 25 (L_1) and 50 (L_2) per cent of lime requirement. The experiment was laid out in a split-plot design with 3 replications in fixed plots of 3m X 2.4m area keeping treatments of lime in main plots and levels of phosphorus in sub plots. The soil of the experimental site was sandy loam in texture, acidic in reaction (pH 5.1), low in available N (215.75 kg/ha), available potassium (132.56kg/ha), exchangeable Ca^{2+} [0.22 cmol(P)$^+$/kg], exchangeable Mg^{2+} [0.14 cmol(P)$^+$/kg], medium in available P (23.75 kg/ha) and organic carbon content (0.64%). All the plots received recommended doses of 20 Kg N and 30 Kg K_2O/ha in the form of urea and nutrient of potash respectively. The groundnut variety 'AK-12-24' was sown on 19th February 2012. Total rainfall received during the cropping period was 741.5 mm.

The experimental findings of this investigation clearly indicate the significance difference in pod yield of summer groundnut due to liming at 25 and 50 per cent levels. Increased yield due to liming was reported by Mathur *et al.* (1985) in soybean and groundnut, Mishra *et al.* (1990) in groundnut. The highest pod yield was records by 25 per cent lime, which was significantly higher over than that of 50 per cent. The increase in pod yield was 10.52 and 2.80 per cent due to application of 25 and 50 per cent lime respectively. Lime is known to favour plant growth and pod yield by nutritional involvement directly as well as by its effect in maintaining a favorable cationic environment in the soil indirectly. In the present case, the soil of the experimental are had a very low exchangeable Ca^{2+}, exchangeable Mg^{2+} and available K. Therefore, the decrease in yield at higher level of liming due to imbalance of Ca, Mg, K ratios in plant was brought about by the marked increase in Ca, Mg concentration (Patiram *et al.*, 1989). The data in table 1 reveal that the number of kernels per pod, pod weight per plant, 100-kernal weight increased significantly due to application lime.

However the effect of lime on shelling percentage was not statistically significant, for almost all the yield attributing characters, 25 per cent lime had a lead over than of 50 per cent lime, which ultimately resulted in significantly higher pod yield for 25 per cent lime over that of 50 per cent lime.Pod yield of summer groundnut increased significantly due to application phosphorus (Table 2). Application of 75 kg P_2O_5/ha, which was statistically at par with 50 kg P_2O_5/ha showed a positive effect over those of control and 25 kg P_2O_5/ha. Better

Table 1:Yield attributing characters of summer groundnut as affected by different levels of lime and phosphorus

Treatment	Total no of Pod Pods/plant	Total no of kernels / pod	Pod weight / plant (gm)	kernel weight / plant(gm)	100-kernal weight(gm)	Shelling Percentage
Lime						
L_0	18.77	1.61	10.91	6.71	27.76	61.60
L_1	20.77	1.80	12.89	8.05	30.74	62.43
L_2	23.57	1.65	11.80	7.36	28.04	62.26
SEd (±)	1.06	0.04	0.51	0.33	0.54	0.68
$CD_{0.05}$	2.94	0.11	1.42	0.92	1.50	NS
Phosphorus						
P_0	18.42	1.53	10.24	6.30	27.87	61.37
P_1	20.51	1.62	11.29	6.93	28.55	61.43
P_2	22.47	1.76	12.58	7.86	29.83	62.53
P_3	23.29	1.84	13.02	8.20	29.43	62.98
P_4	20.82	1.69	12.22	7.59	28.57	62.11
SEd (±)	0.60	0.08	0.81	0.51	1.76	0.85
$CD_{0.05}$	1.24	0.17	1.67	1.05	NS	NS
Interaction (L X P)						
SEd (±)	1.04	0.13	1.40	0.88	3.06	1.46
$CD_{0.05}$	NS	NS	NS	NS	NS	NS

result in pod yield due to application of phosphorus was reported by Singh *et al.* (1994) and Kulkarni *et al.* (1986) in groundnut. Phosphorus is known to increase the root and shoot growth of the crop and higher nodule formation, which ultimately helped in increasing pod yield. A reference to data in table 1 would reveal that number of kernels per pod, pod weight, kernel weight increased significantly due to application of 50 kg P_2O_5/ha. But the effect of phosphorus on 100-kernal weight and shelling percentage was not statistically significant. Increasing trend of yield due to application of phosphorus was up to 50 kg P_2O_5/ha. However, yield obtained with 75 kg P_2O_5/ha was at par with the yield at 50kg P_2O_5/ha. This may be attributed to the little effect of higher doses of P on almost all yield attributing characters.

Table 2: Pod yield (Q/ha) of summer groundnut as affected by different levels of lime and phosphorus

phosphorus	Lime levels			Mean
	L_0	L_1	L_2	
P_0	14.31	16.90	15.97	15.73
P_1	15.46	17.13	16.11	16.24
P_2	16.94	19.95	16.58	17.82
P_3	17.69	18.98	18.84	18.50
P_4	17.82	17.92	17.04	17.59
Mean	16.45	18.18	16.91	
Treatments			SEd(±)	$CD_{0.05}$
Between any two mean of 'L'			0.34	0.93
Between any two mean of 'P'			0.40	0.83
Between any two mean of 'L' at the same level 'P'			0.66	1.47
Between any two mean of 'P' at the same level 'L'			0.69	1.42

The interaction effect between lime and phosphorus was found to be significant in respect of pod yield. The highest and the lowest values were being recorded at 25 per cent lime and no lime respectively. Hence, it is evident that the increase in pod yield due to application lime was the result of nutritional involvement and by its effect in maintaining favourable environment in the soil. Under no lime (Lo) the highest value being recorded at 100 kg P_2O_5 /ha, which was statistically at par with 50 and 75 kg P_2O_5 /ha. But these three levels were superior to other phosphorus levels. Under 25 percent lime (L_1) the highest value was recorded by 50 kg P_2O_5 /ha, which but significantly higher than those of other phosphorus levels. Again, under 50 percent lime the highest value being recorded at 75kg availability of nutrients like N, P and K in the soil. The better result for phosphorus application i.e. 50 Kg P_2O_5 /ha under 25 per cent lime may be that the optimum beneficial effect of liming can be obtained with 25 per cent lime level resulting in minimum of no antagonistic effect of phosphorus, calcium was statistically at par with 75 kg P_2O_5 /ha. The reason of increase in yield due to different treatment combinations might be explained in the light of increase in and other nutrients. Application of 25 per cent lime may be attributed to greater phosphorus use efficiency, which ultimately reflected in pod yield. Beneficial effect of lime and phosphorus on yield has also been reported by Mathew and Koshy (1982).

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Citation:

Kalita B, Barman PD, Gogoi B and Deori BB.2015. Effect of levels of phosphorus and lime on the yield attributes and pod yield of irrigated summer groundnut.*Journal of AgriSearch***2** (3)**:** 229-232