Effect of Phosphorus Fertilizer on Groundnut Yield in Poor Alluvial and Sandy Soils of Thua Thien Hue

By Tran Thi Thu Ha

Although groundnut (peanut) yield in Thua Thien Hue Province is improving, current productivity levels are still low. Phosphorus (P) fertilization of groundnut is considered as one limiting yield factor common to several soil types in this province. This research helps to identify the appropriate application rates for sustained, high-yielding groundnut in poor alluvial and sandy soils.

Groundnut is one of the main annual crops of Thua Thien Hue Province. The cultivated area of this crop occupies about 4,200 hectares (ha). The crop's adaptability to different soil types allows it to be grown on a large area covering all districts of the province having acid upland soil, sandy coastal soil, and poor alluvial soil. Also, groundnut's adaptability enables production in low yielding and rainfed situations. Although cultivated area of this crop increases year by year, groundnut yield in Thua Thien Hue is still low (1.43 t/ha) compared with the country's average (1.58 t/ha). Inadequate fertilizer use is one of the main factors limiting yield in the province. The amount of fertilizer applied to the crop depends on farmer experience and capital. For these reasons, the role of P fertilizer receives little attention.

This study evaluated the effect of P fertilization on groundnut yield in the poor alluvial and sandy soils and identified the most appropriate P fertilizer rate for good dry nut yield and farmer profit.

Field experiments were established in each of the three spring seasons from 2000 to 2002. Groundnut was grown with 33,000 plants per ha. At sowing, the soils (pH <5.0) contained 1.85% (poor alluvial soil) and 1.67% organic matter (sandy soil), respectively. Total nitrogen (N), P, and potassium (K), available P, and exchangeable K in these soils were all low.

Table 1. Groundnut yield (t/ha) response to P fertilization, Thua Thien Hue Province.

Treatment, kg P_2O_5/ha	Poor alluvial soil				Sandy soil			
	2000	2001	2002	Mean	2000	2001	2002	Mean
0	1.40	1.38	1.40	1.39	1.64	1.60	1.52	1.59
30	1.90	1.82	1.71	1.81	1.86	1.83	1.71	1.80
60	2.58	2.53	2.54	2.55	2.15	2.10	2.14	2.13
90	2.62	2.56	2.60	2.59	2.48	2.50	2.60	2.53
120	2.65	2.58	2.60	2.61	2.52	2.54	2.65	2.57
150	2.60	2.60	2.57	2.59	2.54	2.54	2.60	2.56
LSD (p = 0.05)	0.17	0.21	0.25		0.16	0.16	0.25	
CV (%)	26.8	27.1	8.6		18.5	19.6	8.8	

Treatments included five P rates: 30, 60, 90, 120 and 150 kg P_2O_5/ha, based

Table 2. Agronomic efficiency and profit resulting from various rates of P fertilization, Thua Thien Hue Province.

Treatment, kg P_2O_5/ha	Poor alluvial soil						Sandy soil					
	2000		2001		2002		2000		2001		2002	
	AE_p[1]	Profit[2]	AE_p	Profit	AE_p	Profit	AE_p	Profit	AE_p	Profit	AE_p	Profit
0	-	50	-	60	-	40	-	58	-	44	-	18
30	16.7	136	14.6	114	10.3	77	7.33	120	7.66	110	6.30	103
60	22.7	356	23.7	351	27.6	343	9.7	209	9.00	188	14.3	202
90	1.33	355	1.0	338	2.0	332	11.0	311	13.3	311	15.3	344
120	1.03	353	0.6	330	-	330	1.33	306	1.33	273	1.67	336
150	-	330		329	-	296	0.6	302	1.33	302	-	322

[1]AE_p Agronomic efficiency for P fertilizer (kg dry nut/kg P_2O_5); [2]US$/ha

on 8t of farm yard manure (FYM), 40 kg N, 60 kg K_2O, and 500 kg lime/ha (poor alluvial soil); and 30 kg N, 60 kg K_2O, and 300 kg lime/ha (sandy soil). The experiment used plots 20 m^2 in randomized complete block design with three replications. Phosphorus was applied as single superphosphate, N as urea, K as potassium chloride, and lime as calcium oxide.

Groundnut Yield, Agronomic Efficiency, and Profit Response to P

Phosphorus fertilizer significantly increased groundnut yield in both poor alluvial and sandy soils (**Table 1**). The set of test treatments delivered a similar yield maximum at both sites. However, the two soil types did respond differently to P fertilization. In poor alluvial soil, yield was significantly higher than the control with 60 kg P_2O_5/ha while the sandy soil required 90 kg P_2O_5/ha to produce a significantly higher yield. Agronomic efficiency for P showed a similar trend and was maximized at 60 and 90 kg P_2O_5/ha, in the poor alluvial and sandy soils, respectively (**Table 2**). Net profit margins for the different P fertilizer rates were calculated using local input prices and results agreed with yield and agronomic efficiency data.

Conclusion

This study has shown that the most appropriate P application rate for groundnut is 60 kg P_2O_5/ha for poor alluvial soil and 90 kg P_2O_5/ha for sandy soil (based on 8 t of FYM, 30 kg N, 60 kg K_2O, and 500 kg of lime per ha). These recommendations provide for a new yield plateau, which is much higher than the current country average, as well as vastly improved profit margins that can provide a sustained income stream from these resource poor soils. **BCI**

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