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EFFECT OF LIMING AND APPLICATION OF MUSSOORIE PHOSPHATE ON THE YIELD OF GREEN GRAM, VAR. CO-1, GROWN IN THE UPLAND LATERITES OF KERALA STATE

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Though it has been proved beyond doubt that application of lime and phosphates is essential for growing pulses in the lateritic soils of Kerala (Senan and Money, 1963; Mohamed Kunju, 1976) the possibilities of using cheaper sources of phosphates particularly rock phosphates had not been investigated earlier. The unit value of P_2O_5 in a rock phosphate like Mussoorie phosphate is much lower that in both single superphosphate and a complex fertilizer Factomphos (16:20). Apart from this Mussoorie phosphate contains about 45% CaO. It has also been reported that Mussoorie Phosphate contains several trace elements.

Kerala has a massive pulse development programme which is expected to cover the summer fallow in paddy lands and as an tntercrop in coconut areas. In such a programme considerable savings can be achieved by using cheaper sources of phosphates. The present study with green gram is mainly aimed to investigate the efficiency of Mussoorie rock phosphate in comparison to single superphosphate and a complex fertilizer, Factomphos (16:20).

Materials and Methods

A field experiment with a short duration green gram variety CO-1 (80—90 days) with different levels and forms of phosphates was lard out in the laterite loam of the Instructional farm attached to the College of Agriculture, Vellayani. The treatments consisted of a control, lime (CaO) at 500 kg/ha and 3 forms and 3 levels of phosphates superimposing the lime treatment at a uniform dose of 500 kg of CaO ha. The forms of phosphates tried were Mussoorie phosphate, super phosphate and Factomphos (16:20). The levels tried were 15, 30 and 45 kg P_2O_5/ha. There were thus 11 treatment combinations. Nitrogen and Potash (K_2O) were applied at the uniform rate of 20 and 10 kg/ha respectively as Ammonium sulphate and Muriate of Potash.

Since Mussoorie phosphate containe 45% CaO proportionate reduction in the dose of lime was made in treatments that included Mussoorie phosphate. In plots receiving Factomphos similar proportionate reduction in the Ammonium sulphate doses were made taking the nitrogen content of the complex into consideration and the quantities applied on the basis of P_2O_5 treatment. Lime and all the fertilizers were applied basally.

Net plot size was 2.3×2.3M. A spacing of 15x15 cm. was adopted and the seeds were dibbled with each dibble having 2 seeds.

Results and Discussion

Table 1 presents the data on the yield of green gram grain and haulm. The results show that green gram CO-1 variety responds to application of lime at 500 kg/ha. The increase in yield over control is about 15 per cent. Superimposing this treatment with phosphatic fertilizer treatments significantly increases the yield of pulses both over the control and the treatment receiving lime alone. The combination of lime with phosphates increases the yield by about 80 per cent over control. The response to phosphatic fertilizers becomes evident even at the lowest level of 15 kg of P_2O_5/ha irrespective of the form of the phosphate tried. Thus Mussoorie phosphate compares very well with both superphosphate as well as Factomphos (16:20) as a source of phosphate for pulses. Though higher levels of 30 and 45 kg P_2O_5/ha show a tendency to increase the yields, significant response over the 15 kg dose is not observed.

Table 1. Yield of green gram grain and haulm and the cost of produce

	Grain yield kg/ha	Straw yield kg/ha	Cost of grain Rs. 5/40 per kg. in Rs.
Control (T1)	145.0	637.5	783.00
Lime at 500 kg/ha (T2)	166.6	676.6	899. 64
-do- + 15 kg P_2O_5/ha as M. P. (T3)	266.1	727.6	1,404.54
-do- + 15 kg P_2O_5/ha as S. P. (T4)	255.8	745.1	1,381.32
-do- + 15 kg P_2O_5/ha as F. P. (T5)	262.8	767,2	1,491.12
-do- + 30 kg P_2O_5/ha as M. P. (T6)	258.4	753.1	1,393,56
-do- + 30 kg P_2O_5/ha as S. P.	256.7	748.0	1,386.18
-do- + 30 kg P_2O_5/ha as F. P. (T8)	260,1	736.6	1.404.53
-do- + 45 kg P_2O_5/ha as M. P. (T9)	255.0	739.5	1,377.CO
-do- + 45 kg P_2O_5/ha as S. P, (T10)	258.9	753.6	1,398.05
-do- + 45 kg P_2O_5/ha as F. P. (T11)	260.6	742.4	1,407.24
CD	17.18	40.32	—

(M. P. Mussoorie Phosphate, S. P. Superphosphate F. P. Factom Phosphate)

Similar spectacular increases in yield of pulses by application of phosphates and lime in laterite soil have been reported by Sen and Rao (1953) and Senen and Money (1963). However, at doses higher than 15 kg P_2O_5/ha there is no significant increase in the yield of green gram. Under Vellayani conditions Mohamed Kunju (1976) reported response of cowpea upto 60 kg p_2O_5/ha. The marked difference observed in the response has to be attributed to the difference in the nature of the pulse crop grown. The green gram variety grown viz., CO-1 is a short duration one (80 days) and it is possible that compared with cowpea, its requirements of P are much lower.

Table 2 presents data on the N and P content of grain and haulm of the green gram while Table 3 presents N and P removal by the crop. It may be seen that there is a general tendency to increase the phosphorus content of both the grain and straw with increasing levels of phosphatic fertilizers. The forms of phosphatic fertilizers do not appear to have any effect in their ability to increase the phosphours and nitrogen content of grain and haulm. In view of the increased yield of haulm and thus the increased quantities of nitrogen present in them, after harvest, this organic matter if recycled, will add on about 15 kg of N to the soil, which is nearly 3/4 of the nitrogen

Table 2. Nitrogen and phosphorus content of grain and haulm. (in percentage)

Treatment	Grain		Straw	
	N	P	N	P
T1	4.06	0.45	2.10	0.21
T2	4.10	0.46	2.17	0.22
T3	4.20	0.47	2.20	0.23
T4	4.25	0.47	2.23	0.23
T5	4.27	0.48	2.27	0.23
T6	4.32	0.49	2.30	0.25
T7	4.34	0.49	2.35	0.25
T8	4.35	0.49	2.38	0.27
T9	4.43	0.50	2.42	0.26
T10	4.46	0.53	2.44	0.26
T11	4.48	0.54	2.48	0.26

that has been added to the soil as fertilizer nitrogen. Further from Table 3 it is evident that when the basal dose of N application is only 20 kg per hectare, the removal of N in kg/ha in all treatments which include phosphates is of

Table 3. Nitrogen and phosphorus uptake of pulse vari: Co1 (kg/ha)

Treatment	Grain N	Straw N	Grain + Straw N	Grain P	Straw P	Grains + Straw P
Ti	5.S9	13.39	19.28	0.653	1.34	1.99
T2	6.83	14.68	21.51	0.766	1.48	2.25
T3	11.18	16.00	27.18	1.25	1.67	2,92
T4	10.87	16.61	27.48	1.20	1.71	2.91
T5	11.22	17.42	28.64	1.26	1.76	3.02
T6	11.16	17.32	28.48	1.27	1.88	3.15
T7	11.14	17.58	28.72	1.26	1.87	3.13
T8	11.31	17.53	28.84	1.27	1.99	3.26
T9	11.30	17.89	29. 19	1.35	1.92	3.27
T10	11.55	18.39	29.94	1.37	1.96	3.33
T11	11.67	18.41	30.03	1.41	1.93	3.34

the order of about 27 to 30 kg. These results indicate a possible stimulation of the N fixing meachanism by the application of phosphates. The removal of phosphates in treatments containing Mussoorie phosphate is very nearly equal to the treatments with soluble phosphates. This significantly shows that there is enough solubilisation of the rock phosphates in the acidic lateritic soils.

Taking into consideration the quantity of CaO present in the Mussoorie phosphate (45% CaO) the amount of lime applied in the Mussoorie phosphate treated plots had been reduced from 500 kg to 465 kg. This also entails an additional gain of Rs. 25 per ha in the cost of inputs. The lower price of Rs. 600 per ton for Mussoorie phosphate brings about a net gain of Rs. 50 per ha in the cost of inputs alone while the application of the phosphate at 15 kg P_2O_5/ha in superimposing the lime treatment enhances the income from the grain of gresn gram by about Rs. 504. In soil conditions, where response is obtainable for pulses, only at higher doses, use of Mussoorie phosphate in the place of superphosphate will further enhance the net saving in the cost of phosphate inputs. Taking into consideration the cost of cultivation, the pulse crop green gram can give a net return of Rs. 500 per ha under Kerala conditions.

Summary

Green gram variety Co-1 was grown with different forms and levels of phosphates superimposing a treatment of fully burnt lime at 500 kg/ha.

The forms of phosphates compared were Mussoorie phosphate, single superphosphate and a complex fertilizer, factomphos (16:20). The results indicate that the response of green gram variety Co-1 is limited up to 15 kg P_2O_5/ha and that between the forms, there is no significant difference, The use of Mussoorie phosphate entails a net saving of Rs. 50 per ha at application rates of 15 kg P_2O_5/ha. After harvest, if the tops are recycled three-fourths of the N applied will be returned to the soil. It has been shown that the pulse crop can give a net profit of Rs, 500 per ha under Kerala conditions.

സംഗ്രഹം

നീറുകമ്മായപ്രയോഗത്തിനുശേഷം വിവിധ ഫോസ്ഫേറ് രാസവളങ്ങളുടെ പ്രയോഗം Co. 1 ഇനം ചെറുപയർ കൃഷിയിൽ ഉളവാക്കുന്ന പ്രത്യേകതകളെപ്പറ്റി പരീക്ഷണങ്ങൾ നടത്തി. ഒരു ഹെക്ടറിന് 500 കി. ഗ്രാം എന്ന തോതിൽ നീറുകമ്മായവും, നിശ്ചിത തോതിൽ മുസോറിഫോസ്ഫേറ്, സിംഗിൾ സൂപ്പർ ഫോസ്ഫേറ് ഫാക്കംഫോസ് (16:20) എന്നിവ പ്രയോഗിക്കപ്പെട്ടു. ഒരു ഹെക്ടറിൽ പതിനഞ്ചു കി. ഗ്രാം (P_2O_5) ഫോസ്ഫറസ്സ് Co. 1 ചെറുപയറിൽ ഉത്തമമെന്നും, ഫോസ്ഫേറ് ഏതു രൂപത്തിലുള്ളതായാലും പ്രത്യേകതയൊന്നുമില്ലെന്നും തെളിഞ്ഞു. മറ്റ് ഫോസ്ഫേറ് raocrutugeoeng അപേക്ഷിച്ച് മുസോറി ഫോസ്ഫേറ് പയർകൃഷിക്ക് ഹെക്ടറിൽ 15 കി. ഗ്രാം എന്ന തോതിൽ പ്രയോഗിക്കുന്നതുമൂലം ഏകദേശം 50 രൂപയുടെ rar^soouo ഉണ്ടാകുമെന്ന് കണ്ടു. വിളവെടുപ്പിനുശേഷം പയറിന്റെ അവശിഷ്ടങ്ങൾ മണ്ണിൽ ചേർക്കുന്നതുമൂലം അതിനാവശ്യമുള്ള നൈട്രജന്റെ ഏകദേശം എഴപത്തഞ്ചുശതമാനം നൈട്രജൻ മണ്ണിലേയ്ക്കു തിരികെ ചേർക്കാനും സാദ്ധ്യമാകുന്നു. ചെറുപയറുകൃഷിമൂലം ഉദ്ദേശം ഹെക്ടറിൽ 500 രൂപാ ലാഭമുണ്ടാക്കാമെന്നും കണ്ടു.

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