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EVALUATION OF BOWL SLUDGE AS FERTILIZER FOR IMMATURE RUBBER AND COVER CROP

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ABSTRACT

Bowl sludge, a waste material obtained from latex concentrate factories was evaluated as a source of phosphorus for rubber budded stumps and *Pueraria phaseoloides*, the commonly cultivated cover crop in rubber plantations. Results of incubation and field studies indicated that bowl sludge was as good as super phosphate in promoting growth and uptake of phosphorus. Utilisation of the bowl sludge as an alternative source of phosphorus not only results in saving of fertilizer cost but also solves disposal problems of the waste material which when left to accumulate could lead to environmental pollution problems.

INTRODUCTION

Bowl sludge is a waste product and it contains magnesium ammonium phosphate formed by the reaction between magnesium present in the latex and diammonium phosphate added to it. The sludge material is formed in the bowl of the machinery used for latex concentration and hence the name bowl sludge. Since this material contains magnesium ammonium phosphate, the possibity of utilising it as a source of plant nutrients was undertaken in Malaysia and it is being recommended for fish ponds and pasture grasses as a source of phosphorus. (Tan et al, 1975). Results of investigations carried out to evaluate this material as an alternate source of phosphorus under Indian conditions are presented in this paper.

MATERIALS AND METHODS

Bowl sludge collected from the centrifuge factory at Mundakkayam was dried, powdered, sieved and analysed for N, P, K, Ca and Mg as per standard procedure, (AOAC, 1970) Nutrient contents of the bowl sludge are given in Table I. The material was compared against mussoorie rock phosphate and super phosphate by incubation and pot culture studies with budded stumps and cover crops.

Table I. *Nutrient content of bowl sludge* (%)

N	P	K	Mg	Ca
5.1	14.27	0.68	8.52	7.1

Incubation study

Three phosphatic sources under test were added in the soil and the soil physicochemical properties are given in Table II. The soil was incubated at field capacity. Soil samples were drawn at 15, 30, 45, 60, 75 and 90 days interval and analysed for available phosphorus (Bray and Kurtz, 1945) and pH at soil water ratio of 1:2.5 using glass electrode.

Pot culture study – with rubber

The experiment was carried out with 7 treatments and 20 replications in polybags. The treatments consisted of the 3 sources of phosphatic fertilizer *viz*; super phosphate, mussoorie rock phosphate and bowl sludge each applied at 30 and 45 kg P_2O_5/ha with a control. Growth measurements, height and diameter of the plants, were recorded at periodic intervals. At the end of one year, the plants were uprooted for determining the dry matter content and uptake of nutrients.

Pot culture study – with cover crops

The experiment was carried out with the same 7 treatments but with 25 replications. Fertilizers were applied on the surface of the soil in which 3 pre-germinated seedlings were grown. Plants were uprooted after a year and dry matter content and uptake of nutrients were estimated.

RESULTS

Results obtained in the incubation study are given in Table III. More phosphorus was found to be extracted from super phosphate, mussoorie rock phosphate and bowl sludge, when different doses were tried. A gradual increase in available phosphorus content was noticed in the 15th and 30th day of incubation with a sharp decline in the 45th day in all the treatments. Significant difference in pH was not noticed in soil by the application of these different sources and at different incubation periods.

The effect of different phosphorus sources on dry matter production and uptake of nutrients by covercrop, *Pueraria phaseoloides* is given in Table IV. Application of phosphate sources significantly increased the dry matter production in cover crop. Of the three sources tried, 30 kg P_2O_5/ha bowl

Table II. *Physico chemical properties of soil*

Organic carbon (%)	pH	Av. nutrients (Mg/100 g soil)				Sand (%)	Silt (%)	Clay (%)
		P	K	Ca	Mg			
2.01	5.0	0.63	1.82	7.40	1.46	33.9	9.1	50.0

Table III. *Available P content on mg/100 g soil at different sampling dates*

Source	Dose kg ha⁻¹	Days after incubation					
		15	30	45	60	75	90
Super phosphate	20	0.12	0.12	0.15	0.22	0.35	0.30
	40	0.23	0.27	0.23	0.25	0.37	0.32
	60	0.24	0.30	0.24	0.27	0.40	0.33
Mussoorie rock phosphate	20	0.24	0.27	0.24	0.27	0.37	0.29
	40	0.30	0.33	0.30	0.33	0.40	0.27
	60	0.33	0.39	0.33	0.37	0.45	0.39
Bowl sludge	20	0.09	0.11	0.09	0.20	0.37	0.24
	40	0.18	0.23	0.18	0.23	0.40	0.29
	60	0.18	0.33	0.30	0.27	0.47	0.32
Control	0	0.03	0.07	0.09	0.08	0.10	0.12
CD 0.05%		0.112	0.101	0.104	0.108	0.076	0.069
CD 0.01%		0.154	0.138	0.142	0.148	0.105	0.094
SE		0.037	0.034	0.035	0.034	0.026	0.023

sludge was found superior to mussoorie rock phosphate and super phosphate. Application of phosphate fertilizer has significantly increased the uptake of nitrogen, phosphorus and potassium in cover crop. Regarding the uptake of nutrients, bowl sludge was found superior than super phosphate and mussoorie rock phosphate. Data on the effect of super phosphate, mussoorie rock phosphate and bowl sludge on dry matter production and uptake of nutrients by rubber is given in Table V. Bowl sludge was found significantly superior in increasing the dry matter production in rubber budded stumps. In the case of rubber budded stumps also bowl sludge was found superior in the uptake of nitrogen, phosphorus, potassium and magnesium. Effect of these phosphate sources on growth parameters is given in Table VI. Bowl sludge, mussoorie rock phosphate and super phosphate were found to be significantly superior in increasing the height and diameter of rubber budded stumps.

DISCUSSION

The results of the laboratory as well as

Table IV. *Effect of different phosphorus sources in dry matter production and uptake of nutrients by* Pueraria phaseoloides

Source	Dose P_2O_5 kg ha^{-1}	Nitrogen g	Phosphorus g	Potassium g	Dry wt. g/plant
Super phosphate	30	1.31	0.063	0.59	37.9
	45	2.81	0.164	1.36	80.0
Mussoorie rock phosphate	30	1.00	0.037	0.44	27.1
	45	0.92	0.048	0.48	27.3
Bowl sludge	30	1.98	0.103	0.98	55.9
	45	2.59	0.150	1.18	71.3
Control	0	0.57	0.019	0.27	16.8
	CD 5%	0.33	0.025	0.166	9.6
	SE	0.12	0.009	0.06	3.4

Table V. *Effect of different phosphorus sources on dry matter production and uptake of nutrients by rubber*

Source	Dose kg ha^{-1}	Nitrogen g/plant	Phosphorus g/plant	Potassium g/plant	Magnesium g/plant	Dry wt. g/plant
Super phosphate	30	2.48	0.08	0.85	0.20	141.15
	45	2.62	0.10	0.91	0.21	141.95
Mussoorie rock phosphate	30	2.31	0.09	0.75	0.19	147.93
	45	2.56	0.12	1.21	0.22	165.74
Bowl sludge	30	2.83	0.15	1.41	0.58	188.91
	45	3.79	0.23	1.62	0.75	236.95
Control	0	1.73	0.07	0.72	0.18	125.95
					CD 5%	46.11
					SE	16.43

Table VI. *Effect of different phosphorus sources on growth of rubber*

Source	Dose P_2O_5 kg ha^{-1}	Height cm	Diameter mm
Super phosphate	30	75.1	12.7
	45	79.9	13.1
Mussoorie rock phosphate	30	76.2	12.4
	45	79.8	13.0
Bowl sludge	30	82.6	13.2
	45	98.5	14.2
Control	0	58.0	10.5
	CD 5%	15.0	1.8
	SE	5.3	0.7

glass house studies highlighted the possible utilisation of bowl sludge, a waste product obtained from latex centrifuging factories as a source of nutrient for cover crop as well as rubber budded stumps. Results of incubation study indicated that addition of phosphatic fertilizer resulted in an increase in the available phosphorus content of soil which is in confirmity with the observations of Pushpadas, Subbarayulu and George, 1978. During the initial phase of incubation an increase in phosphorus extracted was obtained at the three levels tried. At 45th day of incubation a decrease in phosphorus extracted was noticed for all the three sources. This might be attributed to the temporary dying up or immobilisation of phosphorus by micro organisms. Similar observation of reduction in phosphorus content was reported by Dasrath Singh et al (1976). After 45th day a gradual increase is noticed in the quantity of phosphorus extracted. A possible explanation for this phenomenon may be the reduced fixation of phosphorus by iron and aluminium due to the chelating effect of organic acids produced in soil (Firman Bear, 1965). The beneficial effect of phosphorus application for cover crop is illustrative from Table IV. The advantages obtainable due to manuring of cover crop has been established earlier. (Karthikakutty Amma and Krishnakumar, 1986, Mathew, Pushpadas and Abdul Kalam, 1978). For dry matter production as well as in uptake of nutrients by cover crop, bowl sludge was found superior than the other sources tried. The results confirmed the suggestion of Mahmud Bin Hj. Wahb (1976) that bowl sludge as an effective source of manure for cover crop. Effect of bowl sludge as a source of nutrient for rubber budded stumps is evident from Table V and VI. Phosphorus present in sludge as ammonium phosphate could be attributed to the superiority observed in bowl sludge applied plants in growth as well as in uptake of nutrients. Favourable effect of soluble form of phosphatic fertilizer in early immaturity period of rubber is in confirmity with previous finding Sivanadyan et al (1973). The presence of rubber particles in sludge also might have encapsulated the nutrients, thereby releasing the nutrients slowly to the crop.

To conclude, it can be stated that bowl sludge can be recommended as a nutrient source for cover crop. For recommending the same for budded stumps, further investigations in field conditions are envisaged. Being a waste product obtainable at cheap rate, use of bowl sludge as a nutrient source for cover crop is worth considering not only from economic point of view but also as a novel method for reducing atmospheric pollution problem.

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