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EFFECT OF MUSSOORIE PHOS ON THE GROWTH OF EUCALYPTUS TERETICORNIS SEEDLINGS

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ABSTRACT

Mussoorie Phos (MP) has phosphorus and calcium as major and magnesium, iron, sulphur, potassium, zinc, molybdenum and copper as minor constituents. Consonant with the current stress on increasing productivity in forest plantations, this project was initiated to study the effect of MP on the growth of *Eucalyptus tereticornis* seedlings.

An experiment with 0, 25, 50, 75 and 1009 MP/kg of soil was done in sextuplicates on strongly to medium acidic surface soils (0-20cm) from four eucalypt plantations One-month old eucalypt seedling was grown on 1 kg soil contained in plastic pot for 19 weeks and there was good response to MP inputs as evidenced by the shoot and root dry matter yield. An in-depth experiment was conducted in quintuplicates on a medium acidic surface soil in concrete pots of 35 cm length and 25 cm diameter with control and 50,100,150 and 2009 MP/pot at 10, 20, and 30cm depths, Three-month old eucalypt seedling raised in polypot was planted in each pot at 20 cm and shoot as well as root were harvested after 19 weeks. A pilot field trial in quintuplicates was run on a medium acidic soil with 0, 100 and 200g MP/ seedling and after 20 months height and girth at 30cm of saplings were measured.

Pot trial of eucalypt seedlings in strongly to medium acidic soil indicates good response to MP inputs. Concrete pot experiment on the medium acidic soil shows that 150g MP placed at 20 cm depth has maximum effect on root growth of seedlings. Pilot field trial on the medium acidic soil discloses significant increase in girth of saplings on addition of 100g MP/seedling. Hence, 100-150g MP is recommended for application in the pit at planting time, 10-20cm deep and 1Ocm away from seedling for better establishment and growth of eucalypt seedlings in medium to strongly acidic soils. As of December 1983, lOOg MP costs 6.5 paise.

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Key words: Mussoorie Phos, *Eucalyptus tereticornis,* seedlings and saplings, shoot and root dry matter, height and girth of saplings.

INTRODUCTION

Fertiliser treatment of forest soils along with other soil inputs has a role in increasing productivity of plantations. In line with the current emphasis on enhancing productivity in tree plantations, the present project, the first of a series on fertiliser inputs was conceived. Mussoorie Phos (MP), an indigenous rock phosphate, is a recommended fertiliser for acidic soils (PPCL 1978). It contains 10% phosphorus and 30% calcium as major and magnesium, iron, sulphur, potassium, zinc, molybdenum as well as copper as minor constituents (PPCL 1978).

Previous studies on addition of lime in soils contained in polypots revealed good growth and vigour of eucalypt seedlings (Balagopalan and Alexander 1981, KFRI Division of Soil Science 1979.) As MP is both a source of phosphorus as well as lime, it may improve the shoot and root growth of eucalypt seedlings. This project was initiated to study the effect of MP on the growth of ***Eucalyptus tereticornis*** seedlings.

MATERIALS AND METHODS

Surface soil samples (0-20cm) were collected from Thenmala, Alimuk, Muthanga and Tirunelli eucalypt plantations of Thenmala, Punalur, Kozhikode and Wynad Forest Divisions for a pot trial to assay MP dosage (Table 1). MP treatments of 0, 25, 50, 75 and 100g/kg of soil were replicated six times. MP was applied in split quantities at 4 and 8cm depths in plastic pot containing 1 kg

Table 1. Properties of soils used in the pot and field trials

Soil	Depth (cm)	Sand	Silt	Clay	pH	Organic carbon (%)	Exchange acidity (me%)	Exchangeable bases (me%)
		(.....%.....)						
Thenmala	0–20	84	8	8	5.8	2.02	9.4	10.3
Alimuk	0–20	81	8	11	5.1	1.57	4.8	9.5
Muthanga	0-20	85	7	8	5.6	1.85	8.0	9.2
Tirunelli	0–20	76	13	11	5.3	1.96	5.0	9.0
Peechi	0-20	81	8	11	5.9	1.71	3.0	9.1
Sankili	0–20	80	8	12	6.0	2.22	8.3	8.8
	20–40	76	10	14	5.4	1.90	7.6	10.4
	40–60	74	10	16	5.3	1.59	7.7	10.5

soil. One–month old eucalypt seedling was transplanted to the pot in July 1981 and soil was kept at maximum waterholding capacity by periodic watering. After 19 weeks shoot and root were harvested and dried at **70°C** for determination of

dry matter yield. Alimuk and Tirunelli are strongly acidic whereas, Thenmala and Muthanga are medium acidic soils (Table 1). Response to MP was more in the former than in the latter soils and no toxicity to MP inputs was observed (Fig 1).

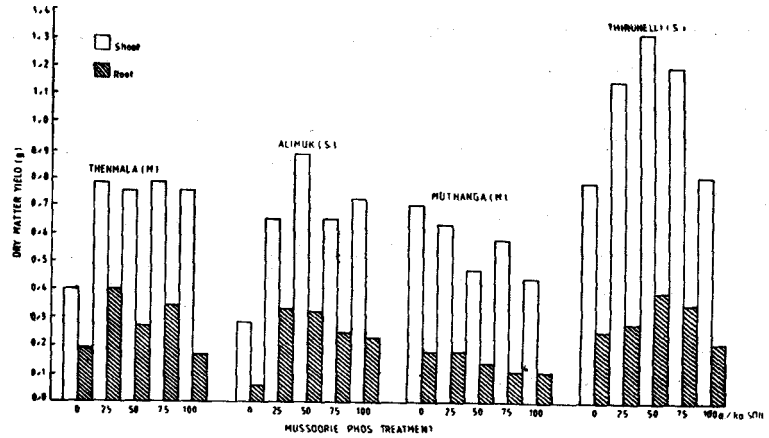

Fig 1 EFFECT OF MUSSOORIE PHOS ON THE DRY MATTER YIELD OF EUCALYPT SEEDLINGS GROWN FOR NINETEEN WEEKS IN STRONGLY(S) m MEDIUM(M) ACIDIC SOILS IN PLASTIC POTS

The pH of these soils changed from 5.1 to 6.6, 5.3 to 6.8, 5.8 to 7.1 and 5.6 to 7.1 respectively on 19 weeks of incubation with 100g MP. Based on the results of this pot trial, 50, 100, 150 and 200g doses of MP were taken for in-depth study with surface soil from KFRI Campus, the characteristics of which are given in Table 1.

Concrete pot of 35 cm height and 25 cm diameter was designed to simulate planting pit (3Ox30x30cm) conditions. Treatments of control and 50, 100, 150 and 200g MP/pot at 10, 20, and 30cm depths were replicated five times. Each pot was filled to the required depth with soil and MP was applied in a circular band 1Ocm away from the centre. Three-month old eucalypt seedling raised in polypot was planted in the pot at 20cm depth and filled with soil. The soil was kept at maximum waterholding capacity by periodic addition of water. After 19 weeks, shoot and root were harvested and dried at 70°C for dry matter assay.

Concurrent with the concrete pot experiment, a pilot field trial was run in June 1982 eucalypt plantation (1.5x1.5m spacing) at Sankili, Arippa in Trivandrum Forest Division. The soil characteristics of the field plot are given in Table 1. As there was visible response to 100, 150 and 2009 MP inputs in the concrete pot experiment, 100 and 200g doses were chosen for field trial. The MP treatments of 0, 100 and 200g/seedling, each one with five seedlings in a row, were replicated five times. MP was applied in July in a circular band, 2.5cm wide and 5cm deep, 10cm away from the seedling. Height and girth (at 30cm) of saplings were measured after **20** months.

RESULTS AND DISCUSSION

Shoot and root dry matter yields from concrete pot experiment are presented in Table 2 and Fig 2 depicts- heir mean values for different treatments. Shoot yield is highest for 150g at 20cm followed by 2009 at 30cm, 1OOg at 20cm and 200g at 20cm. Root yield is highest for 150g at 20cm followed by 50g at 10cm, 200g at 20cm and 100g at 10cm. The maximum and control yields are 60.5 and 48.8g for shoot and 33.6 and 23.09 for root.

Analysis of variance (ANOVA) for the Randomised Block Design (Table 3) reveals no significant effect of MP doses or depths of application on shoot and root yields. In the case of ANOVA for root yield. doses x depths interaction and replicates F-values are significant. Doses x depths interaction significance suggests that root yield is influenced by depths of placement of MP and this is brought out by the data in Table 2. The replicates significance suggests that significant variation occurs among the replicates; however the overall variation as expressed by the coefficient of variation is 19% for the root and 18% for the shoot yields. The relatively high F-value of control vs rest is indicatory of the positive effect of MP addition on root yield. Further studies will be necessary to elaborate effect of different doses and depths of placement on root growth of eucalypt seedlings.

Data from pilot field trial show that height and girth are highest for 100g dose followed by 200g and control (Table 4)ANOVA for the Randomised Block Design (Table 5) reveals no significant effect of 'MP on height, but effect on girth is significant. Critical difference is 2.1cm and hence 100g MP addition has marked effect on girth. The 200g MP addition does not result in significant increase of girth.

Thus the data from concrete pot experiment and pilot field trial indicate that addition of MP during planting results in better root and girth growth. Based on the results, 100-150g MP is recommended for application in the pit at planting time, 10-20cm deep and 10cm away from seedling for better establishment and growth of eucalypt seedlings in medium to strongly acidic soils. As of December 1983, 100g MP costs 6.5 paise and specific doses for different sites will depend on the soil conditions,

CONCLUSION

Pot trial of eucalypt seedlings in strongly to medium acidic surface soils from eucalypt plantations indicates good response to MP inputs of 25, 50, 75 and 100g/kg of soil. Concrete pot experiment on a medium acidic surface soil shows that 150g MP placed at 20cm has maximum effect on root growth of seedlings. Pilot field trial run for 20 months on a medium acidic soil reveals significant increase in girth of saplings on addition of 100g MP/seedling. Thus, placement of 100-150g MP in the pit at planting time, 10-20cm deep and 10cm away from seedling is recommended for better establishment and growth of eucalypt seedling in medium to strongly acidic soils. As of December 1983, 100g MP costs 6.5 paise.

Table 2. Shoot and root dry matter yield (9) of eucalypt seedings grown for 19 weeks in a medium acidic soil in concrete pots (35cm height, 25cm diameter) with Mussoorie Phos at three depths

Mussoorie Phos (g)	Replicate I	II	III	IV	V	Mean
Shoot						
0	48.5	49.5	55.0	39.0	52.0	48.8
			10cm			
50	41.5	73.5	55.5	53.5	42.5	53.3
100	53.0	63.0	60.5	42.5	60.5	55.9
150	62.0	51.5	51.**0**	46.5	51.5	52.5
200	43.5	45.0	65.0	53.0	51.5	51.6
			20cm			
50	74.5	46.0	48.0	46.5	55.5	54.1
100	62.5	**50.0**	58.5	52.5	**33.0**	51.3
150	59.5	65.0	70.5	46.5	61.**0**	60.5
200	54.5	53.5	62.5	58.0	46.0	54.9
			30cm			
50	62.0	58.0	47.0	35.5	49.0	50.3
100	46.0	44.0	65.0	44.0	39.0	47.6
150	56.0	53.5	43.5	44.0	43.5	48.1
200	56.0	45.5	72.0	82.5	44.0	60.0
Root						
0	18.0	25.9	20.5	23.5	27.0	23.0
			1**0cm**			
50	23.0	40.5	29.5	35.0	28.0	31.2
100	26.5	30.0	20.5	36.5	38.5	30.4
150	26.0	20.5	19.5	33.5	36.0	27.1
200	23.5	21.0	20.5	35.0	19.5	23.9
			20cm			
50	27.0	28.0	18.5	25.0	19.0	23.5
100	24.0	30.0	21.5	31.5	20.5	25.5
150	36.5	41.**0**	32.0	26.0	32.5	33.6
200	29.5	33.0	25.5	41.**0**	27.0	31.2
			30cm			
50	29.0	32.5	25.5	24.0	28.0	27.8
100	21.5	31.**0**	26.0	16.0	23.5	23.6
150	20.0	27.5	22.0	31.**0**	29.0	25.9
200	23.0	31.**0**	26.0	38.0	17.0	27.0

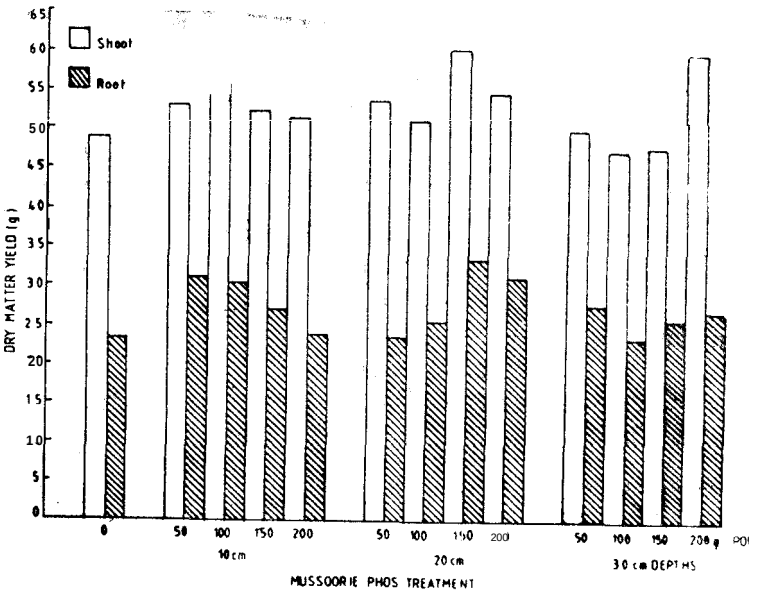

Fig 2. EFFECT OF MUSSOORIE PHOS ON THE DRY MATTER YIELD OF EUCALYPT SEEDLINGS GROWN FOR 19 WEEKS IN A MEDIUM ACIDIC SOIL IN CONCRETE POTS

Table 3 Analysis of variance for the shoot and root dry matter yield of eucalypt seedlings grown for 19 weeks in a medium acidic soil with 50, 100, 150 and 2009 Mussoorie Phos at three depths

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F
Shoot				
Doses	**3**	126.32	42.1 1	0.46
Depths	2	136.92	68.46	0.75
Doses x Depths	6	650.41	108.40	1.19
Control vs Rest	1	95.20	95.20	1.05
Replicates	4	834.48	208.87	2.30
Error	48	4356.92	90.77	
Total	64	6201.25		
Root				
Doses	3	43.08	14.36	0.52
Depths	2	66.91	33.46	1.21
Doses x Depths	6	510.96	85.1 6	3.07*
Control vs Rest	1	96.74	96.74	3.49
Replicates	4	472.05	118.01	4.25**
Error	48	1331.46	27.74	
Total	64	2521.20		

***F** – Value is significant at **P** **Significant at P = 0.01.

Table 4. Height and girth of eucalypt saplings grown for 20 months at Sankili, Arippa with 0, 100 and 200g Mussoorie Phos/seedling

Mussoorie Phos (g)	Replicate I	II	III	IV	V	Mean
Height (m)						
0	4.70"	4.15	4.10	4.15	4.55	4.33
100	4.65	4.60	4.60	4.80	5.20	4.77
200	4.10	4.40	4.75	4.75	5.15	4.63
Girth at 30cm (cm)						
0	77.0	13.5	13.2	13.2	14.6	14.3
100	16.1	16.3	16.9	17.5	18.3	17.0
200	13.8	14.7	16.1	16.5	17.5	15.7

* Average of five saplings in a row.

Table 5. Analysis of variance for the height and girth of eucalypt saplings grown for 20 months at Sankili, Arippa with 0, 100 and 150g Mussoorie Phos/seedling

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F
Height				
Doses	2	0.5053	0.2526	3.53
Replicates	4	0.6210	0.1552	2.17
Error	8	0 5730	0.0716	
Total	14	1.6993		
Girth at 30cm				
Doses	2	18.508	9.254	4.58"
Replicates	4	6.164	1.541	0.76
Error	8	16.172	2.022	
Total	14	40.844		

* F-value is significant at P=0.05.

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