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EVALUATION OF MUSSOORIE ROCK PHOSPHATE AND PYRITE AS SOURCES OF PHOSPHORUS AND IRON FOR SUGARCANE

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ABSTRACT

Application of P in the form of Mussooriephos recorded higher Brix, Sucrose, Purity, Cane yield and Commercial cane sugar per cent (CCS %) than P in the form of DAP for sugarcane. NPK + Pyrite 100 kg (P as Mussooriephos) recorded significantly higher CCS %, brix, sucrose and purity. The highest cane yield (103.5 t/ha) was obtained with NPK (Mussooriephos) + Pyrite at 300 kg/ha. Foliar application of $FeSO_4$ was better than soil application of $FeSO_4$ for all the above quality parameters. Pyrite upto 300 kg/ha with FYM at 10 t/ha and P as Mussooriephos recorded higher available micronutrients especially iron.

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Sugarcane yield is affected due to non-availability of micronutrients, in soils. Among the micronutrients, deficiencies of Fe and Zn affect the yield and quality of sugarcane. Chlorosis is of common occurance in calcareous soils and it is termed as lime induced chlorosis. Iron chlorosis is corrected by the application of $FeSO_4$ to soil or by applying $FeSO_4$ as foliar spray (Kumaresan et al. 1985). Pyrite is a naturally occurring iron containing ore which is cheaper too and can be used for calcareous soils for overcoming iron deficiency. Mussooriephos is one of the sources of phosphorus which is a natural phosphatic material and can be used in soils when phosphorus is released slowly and is also a cheaper source of phosphatic fertilizer. The influence of pyrite and Mussooriephos as sources of iron and phosphorus were tried in this experiment to increase the yield and quality of sugarcane.

MATERIALS AND METHODS

A field experiment was conducted in a farmer's holding at Krishnapuram. There were 14 treatments and 3 replications with 3 levels of pyrite at 100, 200 and 300 kg/ha. Pyrite was applied with DAP source of P, with Mussooriphos source of P and with FYM at 10 t/ha also. Soil application of 100 kg $FeSO_4$ /ha and foliar spray of $FeSO_4$ alone and in combination with 0.1% citric acid were also compared. Sugarcane variety COC 671 was used as test crop. The initial soil available DTPA extractable Zn, Cu Fe and Mn were 4.46, 7.4, 4.3 and 8.5 ppm (Table 1) respectively (Lindsay and Norwell, 1978). Sugarcane juice samples were clarified as per Homes dry lead subacetate method (Meade-chem, 1977) before feeding to the analyser. The sucrose content was estimated with the help of a sucrolyser. The brix, purity and CCS % were worked out. Post harvest soil samples were collected and analysed for DTPA extractable Zn, Cu, Fe and Mn.

TABLE 1 : Initial Soil, Mussoorie Rock Phosphate and Pyrite Nutrient Contents.

I.	Initial Soil	
1.	Total Nitrogen (ppm)	650
2.	Total Phoshorus (ppm)	860
3.	Total Potassium (ppm)	8000
4.	Available Nitrogen (ppm)	110
5.	Available Phosphorus (ppm)	3.5
6.	Available Potassium	125
7.	E.C. (ds/m)	0.45
8.	pH	8.2
9.	Organic carbon (%)	0.62
10.	Available Zn (ppm)	4.46
11.	Available Cu (ppm)	7.4
12.	Available Fe (ppm)	4.3
13.	Available Mn (ppm)	8.5
II.	Mussoorie Rock Phosphate	
1.	Total P_2O_5%	21.2
2.	Total K_2O %	0.25
3.	Iron (Fe_2O_3)%	4.41
III.	Pyrite	
1.	Iron (Fe) %	13.2
2.	Sulphur %	22.2

RESULTS AND DISCUSSION

Sugarcane yield varied from 81.0 t/ha under NPK (DAP) - control to 103.5 t/ha under NPK (Mussooriephos) + pyrite at 300 kg/ha. As the level of pyrite increased the yield also increased when applied alone or in combination with either FYM or Mussooriephos P. This might be due to the increase in the availability of P with FYM application

TABLE 2 : Effect of Mussooriephos and pyrite on the quality of sugarcane.

Treatments	Cane yield t/ha	Brix %	Sucrose %	Purity %	CCS %
NPK (150 : 153 : 105)	81.0	18.9	15.8	83.5	10.6
NPK (P as Mussooriephos)	85.0	20.9	18.5	88.3	12.8
NPK+Pyrite 100 kg/ha	93.0	19.5	16.9	86.5	11.6
NPK+Pyrite 200 kg/ha	93.0	19.9	17.7	88.8	12.3
NPK+Pyrite 300 kg/ha	94.0	20.3	18.0	88.7	12.5
NPK+$FeSO_4$ 100 kg/ha+FYM 10 t	89.5	19.2	16.2	84.4	11.0
NPK+Pyrite 100 kg/ha+FYM 10 t	93.0	19.6	16.9	86.2	11.4
NPK+Pyrite 200 kg/ha+FYM 10 t/ha	94.0	20.1	17.8	88.4	12.3
NPK+Pyrite 300 kg/ha+FYM 10 t	94.0	19.3	17.0	87.8	11.7
NPK+2% $FeSO_4$ (Foliar Spray)	91.5	20.9	18.6	89.0	12.9
NPK+2% $FeSO_4$ + 0.1% Citric acid (Foliar spray)	98.0	19.9	17.2	86.1	11.7
NPK+Pyrite 200 kg (P as Mussorip)	90.0	21.1	18.8	89.4	13.1
NPK+Pyrite 200 kg (P as Mussorip)	92.5	20.4	17.9	88.0	12.4
NPK+Pyrite 200 kg (P as Mussorip)	103.5	19.2	16.7	86.6	11.4
C.D.	8.3	1.6	1.0	4.0	1.5

(Chaudhary et al. 1981). Foliar spray of $FeSO_4$ recorded 91.5 and soil application of $FeSO_4$ at 100 kg/ha + FYM recorded 89.5 t/ha. This is in line with the findings of Kumaresan et al. (1985). When foliar spray was mixed with 0.1% citric acid the response was still better (98.0 t/ha).

Sucrose content varied from 15.8 to 18.8%. NPK + Pyrite increased sucrose content than NPK alone. Foliar application of $FeSO_4$was better than soil application of $FeSO_4$. Phosphorus in the form of Mussooriephos was found to record higher sucrose per cent (18.5) than P in the form of DAP (15.8). Pyrite 100 kg/ha + NPK with P as Mussooriephos recorded the highest value of 18.8%.

Brix values ranged from 18.9 to 21.1 and the lower value was recorded under NPK and the highest value was recorded by NPK + pyrite at 100 kg/ha with P as Mussooriephos. Foliar application was found to be better than soil application of $FeSO_4$. Purity per cent varied from 83.5% in NPK to 89.4 per cent in NPK + pyrite 100 kg/ha with P as Mussooriephos. The quality parameters such as brix, sucrose, CCS % and purity were favourably increased by P as Mussooriephos. This is in line with the findings of Kabeerathumma et al. (1986).

Available Zn content varied from 3.57 ppm to 4.87 ppm. The highest value was recorded under NPK (P as Mussooriephos) + 300 kg pyrite/ha level. When pyrite + NPK was applied, as the

dose of pyrite increased from 100 kg to 300 kg, available Zn content also increased from 4.03 to 4.27 ppm. Similarly when P was used as Mussooriephos with pyrite from 100 kg to 300 kg/ha level, the available Zn content increased from 4.53 to 4.87 ppm. Available Cu contents varied from 4.83 to 7.87 ppm and the highest value was recorded by NPK (P as Mussooriephos) + pyrite at 200 kg/ha level. Available Fe contents varied from 4.1 ppm to 13.6 ppm. When P was applied as Mussooriephos there was increase in available Fe content compared to P as DAP form at all the three levels of pyrite. As the dose of pyrite increased irrespective of the combination of either alone or with FYM or with Mussooriephos there was an increase in the available Fe content of the soil.

CONCLUSION

Application of P in the form of Mussooriephos recorded higher brix, sucrose, purity, cane yield and CCS%, than P in the form of DAP for sugarcane. The highest cane yield was obtained with NPK (Mussooriephos + pyrite 300 kg/ha level. Foliar application of $FeSO_4$ was better than soil application of $FeSO_4$ in calcareous soils for all the above quality parameters.

Table 3 : Effect of Mussooriephos and pyrite to sugarcane on micronutrients availability

Available micronutrients (ppm)			
Zn	Cu	Fe	Mn
4.03	4.83	4.1	16.2
4.47	6.17	5.1	19.2
4.03	5.67	5.5	17.3
4.17	7.00	6.3	19.7
4.27	6.33	5.8	17.6
4.33	6.00	7.2	21.3
4.40	7.50	8.1	24.3
4.13	7.17	8.2	20.2
3.73	6.67	9.7	22.3
3.57	2.67	5.0	17.2
3.67	5.83	5.4	22.4
4.53	7.50	6.6	17.5
4.80	7.67	8.4	21.2
4.87	6.67	13.6	16.4
CD 0.48	2.05	3.19	3.52

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