Indian J. agric. Sci. **44**: 415–418, June 1974

Note on the nitrification-inhibitors in the seeds, bark and leaves of *Pongamia glabra* Vent.

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Received: 10 October 1973

Pongamia glabra Vent. contains a number of physiologically active compounds (mostly furano-flavonoids), and several workers have attempted to find a remunerative outlet for them (Seshadri, 1953). Singh (1966) attributed the utility of its seed-cake in improving soil fertility to its nitrification-inhibitory properties. These properties were therefore, studied in the extracts of seeds, bark and leaves of the tree.

Defatted seeds were extracted with hot ethanol. The solvent was removed and the extract without further purification was taken up for study. Fresh bark of the tree was ground and extracted with a 40 : 60 (V/V) mixture of petroleum ether-acetone and the extract was used similarly. The leaves were dried, ground and used as such.

Sandy clay-loam soil from the farm of the Institute (characteristics in Table 1), ground and sieved through a 2-mm sieve, was used for the laboratory incubation studies along with ammonium sulphate and urea as nitrogen sources to supply 200 ppm of ammoniacal nitrogen. In 500-ml beakers 200 g of the soil was incubated, in 2 replications, at 1/3 water-holding capacity at room temperature (30 ± 2°C). Water solutions of fertilizers were applied and the test inhibitors (except leaves) added at 5, 10, 20 and 30% concentrations of NH_4 N. The leaves were tested at 30% level.

Table. 1. Soil characteristic

Characteristics	Value
pH (1:2.5)	7.7
Total N (%)	0.07
Ammoniacal N (ppm)	4.4
Nitrate N (ppm)	9.0
Nitrite N (ppm)	Traces
Electrical conductivity (1:2.5) (millimhos/cm at 25°)	1.6
Water-holding capacity (%)	38.4
Mechanical analysis (%)	
Sand	61.0
Silt	15.0
Clay	24.0
Textural class	sandy clay-loam
Organic carbon (%)	0.60
Cation exchange capacity (meq/100 g soil)	11.6
Available N (kg/ha)	24.4
Available P_2O_5 (kg/ha)	62.3
Available K_2O (kg/ha)	353.0

only. Representative soil samples (10 g each) were drawn at intervals of 15, 30, 45, 60 and 75 days. They were extracted with Morgan's extractant ($CH_3COONa + CH_3COOH$, pH 4.8; Prasad, 1968) and analysed colorimetrically for ammoniacal, nitrite and nitrate N. Ammoniacal N was determined by modified Nesslerization method, avoiding precipitation (Schuffelen *et al.*, 1961) and nitrite and nitrate were determined by the method of Prince (1945).

The results (Table 2) reveal that the alcohol extract of the seeds has maximum effect on the conservation of ammoniacal N, followed by the bark extract. The leaves as such showed no inhibitory

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Table 2. Production of ammoniacal, nitrite and nitrate N (ppm, oven-dry basis) in soil incubated with test inhibitors

Test inhibitor		Ammoniacal N (ppm) at days					Nitrite N (ppm) at days					Nitrate N (ppm) at days				
Particulars	Level (% NH_4N)	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
							Ammonium sulphate									
Seed extract	0	110.60	62.80	29.70	20.90	17.90	Tr.	Tr.	Tr.	—	—	20.50	45.40	90.60	122.20	145.00
	5	115.90	56.70	29.40	22.70	15.50	0.58	Tr.	Tr.	—	—	18.50	46.60	88.10	110.40	147.90
	10	130.40	62.80	30.50	29.20	17.90	1.17	Tr.	Tr.	—	—	10.20	45.00	86.60	101.30	147.00
	20	165.60	137.90	50.10	38.50	18.30	1.63	0.58	Tr.	—	—	7.60	14.50	80.00	90.00	145.00
	30	185.00	137.10	60.20	47.20	21.40	2.34	1.00	Tr.	—	—	5.40	14.50	45.20	81.60	145.00
Bark extract	0	112.40	62.90	30.00	22.80	17.00	Tr.	0.125	Tr.	—	—	20.40	45.50	91.00	119.70	145.50
	5	128.80	64.90	35.50	20.90	15.50	1.17	Tr.	Tr.	—	—	18.00	40.00	91.40	120.20	147.20
	10	132.30	68.30	40.80	31.50	15.50	1.64	0.25	Tr.	—	—	12.80	39.20	80.70	101.00	146.90
	20	164.60	128.50	50.70	35.20	17.40	1.17	0.50	Tr.	—	—	10.20	13.80	55.40	99.80	145.50
	30	170.60	128.50	75.10	40.10	18.00	0.58	0.55	0.125	—	—	8.30	13.20	40.00	86.30	144.80
Leaves	0	100.00	60.80	30.40	21.90	16.70	0.125	Tr.	Tr.	—	—	20.40	45.80	91.00	120.30	145.50
	30	94.70	63.40	39.10	28.80	20.00	1.10	0.58	0.30	Tr.	—	21.40	40.90	81.50	117.40	144.60

Table 2. (*Continued*)

Test inhibitor		Ammoniacal N (ppm) at days					Nitrite N (ppm) at days					Nitrate N (ppm) at days				
Particulars	Level (% NH_4N)	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
							Urea									
Seed extract	0	85.50	59.00	31.00	19.80	9.70	0.28	Tr.	Tr.	—	—	17.90	50.00	88.80	123.90	142.80
	5	126.00	40.50	30.50	15.90	6.80	0.58	Tr.	Tr.	—	—	8.00	60.00	89.30	125.00	144.00
	10	138.80	76.80	40.70	19.80	9.40	0.58	Tr.	Tr.	—	—	6.80	41.30	75.30	122.70	140.00
	20	145.90	76.80	51.20	20.90	11.00	2.34	0.50	Tr.	—	—	6.00	40.00	46.00	110.90	146.30
	30	143.70	100.00	62.30	22.80	9.00	1.17	0.58	Tr.	0.125	—	5.30	20.70	43.80	110.30	141.80
Bark extract	0	84.40	55.80	31.30	19.80	9.60	0.58	Tr.	Tr.	—	—	18.20	46.40	88.70	123.50	143.75
	5	126.80	59.10	36.70	19.80	6.80	1.17	0.125	Tr.	—	—	10.50	42.80	88.00	122.90	144.30
	10	127.30	62.80	40.90	20.90	9.70	2.34	0.25	Tr.	—	—	9.20	41.00	88.00	121.60	142.70
	20	138.80	68.40	51.70	22.70	11.30	3.30	0.55	Tr.	—	—	8.00	40.20	47.20	120.00	145.50
	30	143.50	80.40	60.50	22.70	11.70	3.30	0.50	Tr.	—	—	5.70	30.80	42.20	119.40	135.60
Leaves	0	85.60	56.00	31.00	19.40	11.00	0.50	Tr.	—	—	—	18.90	46.00	88.30	126.00	143.40
	30	86.40	60.80	38.70	25.00	17.70	1.00	0.85	0.25	—	—	20.40	43.40	82.60	124.10	145.50

Tr = Traces; — Not detectable.

effect. Similar results were obtained with both ammonium sulphate and urea. The increased dose of test material did not proportionately increase inhibition but enhanced the persistence of ammoniacal N. The alcohol extract of the seeds was effective up to 60 days depending upon the concentration used. The lack of nitrite accumulation in any of the treatments indicates that the materials do not inhibit the conversion of nitrite to nitrate and specifically inhibit ammonia-oxidizing bacteria.

At 15 days, nitrate production was minimum; it increased gradually till all the ammonium was utilized. The suppression was more at higher doses of the extracts but the increased effect was not proportionate to the concentration. The increase in nitrate production with time indicates that the test inhibitors were effective up to a period, depending upon their nature and concentration.

The results indicate that the components of the alcohol extract of seeds may be usefully exploited in increasing the efficiency of ammoniacal fertilizers.

ACKNOWLEDGEMENTS

Thanks are due to (the late) Dr K. C. Gulati, Emeritus Scientist, Indian Agricultural Research Institute, New Delhi, for suggestions duing the initial stages of the work. The first author is thankful to the Indian Council of Agricultural Research, New Delhi, for providing a fellowship.

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