https://doi.org/10.29321/MAJ.10.A03362

Madras agric. J. 63 (11—12) : 651—654, Nov.—Dec., 1976

Effect of Sodium Molybdate Incorporation on the Efficiency of Lignite as a Carrier Material

By

K. CHENDRAYAN[1] and N. N. PRASAD[2]

ABSTRACT

The effect of sodium molybdate was studied at 10, 20 and 30 per cent concentrations in lignite carrier. An augmentation in the efficiency of symbiosis was observed in groundnut in which the seeds were treated with the lignite-based *Rhizobium* inoculant immediately after incorporation of the chemical at 10 and 20 per cent levels. The highest concentration (30 per cent) exerted inhibitory effect on symbiosis. Incubation of the lignite-based *Rhizobium* inoculant with sodium molybdate exerted inhibitory effect on the survival of rhizobia.

INTRODUCTION

The seed inoculation with efficient *Rhizobium* cultures with a view to increase nodulation, is practiced generally. Effective symbiosis between rhizobia and their leguminous host depends, among other factors, upon adequate supply of molybdenum. Dramatic yield increases were obtained in many soils due to application of fertilizers cotaining very small quantities of molybdenum. The responses reported due to soaking seed in molybdate solutions (Donald and Spencer, 1951) suggested seed application as an alternate method of applying molybdenum fertilizers.

The application of molybdenum salts to leguminous seeds before planting is practical, effective and economical. Outstanding results from seed application of sodium molybdate have been reported with many crops (Hagstrom and Berger, 1963). Kandasamy and Prasad (1971) reported the use of lignite as a carrier material for rhizobia. In the present study, the effect of seed treatment with lignite based rhizobia which was treated with sodium molybdate on the symbiosis in groundnut was studied.

MATERIALS AND METHODS

The *Rhizobium* inoculum was prepared by growing the bacterial culture in the broth of Base medium '79' for 3 days under aerobic condition. The groundnut inoculant was prepared by adding the concentrated broth culture of *Rhizobium* to a finely pulverized, heat treated lignite. Sodium molybdate was added to the inoculant at the rate of 0, 10, 20 and 30 per cent as a chemicalpowder. All inoculants were kept in polyethylene bags. Population of rhizobial cells in the inoculant at initial and on 5th and 10th day was deter-

1-2 : Faculty of Agriculture, Annamalai University, Annamalainagar-608101.

mined using yeast extract mannitol agar medium.

Four sets of surface sterilized TMV-7 groundnut seeds, each replicated thrice, were treated with the above inoculants containing 0, 10, 20 and 30 per cent of sodium molybdate and the treated seeds were sown in sterilized mud pots. The growth, dry matter weight, nodulation, total nitrogen and leghemoglobin contten were determined on 40th day. Total nitrogen content of the plant was estimated by the method of Bremner (1960). Leghemoglobin content of nodules was estimated by the method of Schiffman and Lobel (1970).

RESULTS AND DISCUSSION

The results have clearly revealed an augmentation of growth at 10 and 20 per cent level of sodium molybdate by 14.1 and 11.6 per cent, respectively over the control, and dry matter weight by 5.6 and 10.2 per cent, respectively over the control in the case, where the lignite based inoculant was used immediately after the incorporation of sodium molybdate (Table I). Nodulation, leghemoglobin content of the nodules and total nitrogen content of the nodules increased in the above treatments. On the other hand, seeds treated with the inoculant 10 days after sodium molybdate incorporation exerted favourable effect on the above characters only in the case where the seeds were treated with lignite carrier containing 10 per cent of sodium molybdate. Whereas, treatment of seeds with the inoculant containing 20 per cent of sodium molybdate and after 10 days of incorporation exerted adverse effect (Table II). Giddens (1964) reported the reduction in nodulation of soybean due to seed treatment with molybdenum compounds and *Rhizobium* inoculants mixture which was used after a period of incubation.

TABLE I. Effect of seed treatment with lignite - based *Rhizobium* inoculant soon after sodium molybdate incorporation on groundnut.

Treatment	Growth (cm)*	Dry matter weight (g)*	Total number of nodules*	Total nitrogen content (g/100 g)	Leghemoglobin content (mg/g of fresh nodules)
Lignite carrier without sodium molybdate (control)	16.3	2.235	20.0	1.84	3.06
10% of sodium molybdate in the lignite carrier	15.6	2.360	23.0	2.00	3.20
20% of sodium molybdate in the lignite carrier	19.5	2.465	34.0	2.18	3.42
30% of sodium molybdate in the lignite carrier	15.7	2.220	25.0	1.97	3.15

*Mean of ten plants

TABLE II. Effect of seed treatment with lignite - based *Rhizobium* inoculant after 10 days of sodium molybdate incorporation on groundnut

Treatment	Growth (cm)*	Dry matter weight (g)*	Total number of nodules*	Total nitrogen content (g/100 g)	Leghemoglobin content (mg/g of fresh nodules)
Lignite carrier without sodium molybdate (control)	17.3	2.125	22.0	1.89	3.10
10% of sodium molybdate in the lignite carrier	18.0	2.230	20.0	1.74	3.20
20% of sodium molybdate in the lignite carrier	16.4	2.010	13.0	1.73	2.96
30% of sodium molybdate in the lignite carrier	14.4	1.815	9.0	1.47	2.75

*Mean of ten plants

Treatment of seeds with the inoculant containing 30 per cent of sodium molybdate has exerted adverse effect on all the characters in both the type of treatments i. e., seed treatment with the inoculant immediately after sodium molybdate incorporation and 10 days after incorporation. Raisenauer (1963) found that seed-applied molybdenum fertilizers produced significantly greater increases in vine nitrogen of soyabean. Burton and Curley (1966) obtained a highly effective nodulation when sodium molybdate and peat inoculant were mixed and applied to seed just before sowing.

Incubation of the lignite-based *Rhizobia* inoculant with sodium molybdate at 10, 20 and 30 per cent concentrations, for 10 days exerted an inhibitory effect on the survival of rhizobia (Table III). The inhibitory effect of the chemical increased with increasing concentration. The present results confirmed the earlier findings of Burton

TABLE III. Effect of sodium molybdate incorporation in lignite carrier on the survival of rhizobia

Treatment	Population of rhizobia in 10^8/g of inoculant		
	Initial	After 5 days	After 10 days
Lignite carrier without sodium molybdate (control)	13.70	16.05	18.24
10% of sodium molybdate in the lignite carrier	8.15	4.30	1.29
20% of sodium molybdate in the lignite carrier	7.65	2.70	0.95
30% of sodium molybdate in the lignite carrier	4.90	1.50	0.15

and Curley (1966) that treating soybean rhizobia with 8 per cent sodium molybdate in a peat carrier medium in the laboratory killed 99 per cent of rhizobia within four days.

REFERENCES

BREMNER, J. M. 1960. Determination of nitrogen by microkjeldahl method. *J. Agric. Sci.* 55 : 11-33.

BURTON, J. C. and R.L. CURLEY. 1966. Compatibility of *Rhizobium japonicum* and sodium molybdate when combined in a peat carrier medium. *Agron. J.* 58 : 327-30.

DONALD, C. M. and D. SPENCER. 1951. The control of molybdenum deficiency in subterranean clover by pre-soaking the seed in sodium molybdate solution. *Aust. J. agric. Res.* 2 : 295-301.

GIDDENS, J. 1964. Effect of adding molybdenum compounds to soybean inoculant. *Agron. J.* 56: 362-63.

HAGSTROM, G. R. and K. C. BERGER. 1963. Molybdenum status of three Wisconsin soils and its effect on four legume crops. *Agron. J.* 55 : 399-401.

KANDASAMY, R. and N. N. PRASAD. 1971. Lignite as a carrier of rhizobia. *Curr. Sci.* 40 : 496.

REISENAUER, H. M. 1963. Relative efficiency of seed and soil applied molybdenum fertilizer. *Agron. J.* 55 : 459-60.

SCHIFFMAN, J. and R. LOBEL. 1970. Haemoglobin determination and its value as an early indication of peanut *Rhizobium* efficiency. *Pl. Soil* 33 : 501-12.