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Studies on the Causes of Poor Nodulation in Groundnut in Soils of Tamil Nadu

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One of the reasons for poor nodulation in leguminous crops, is the absence of proper *Rhizobia* in the soil (Masefield, 1958). Physical factors like temperature, moisture content and aeration and chemical factors such as presence of adequate amounts of lime, phosphorus and potash as well as trace elements have also been associated with proper nodulation in legumes (Van Schrevan, 1958). Extremes of pH, presence of phages and nematodes have also been reported to affect nodulated legumes.

A random survey of the extent of nodulation in groundnut *(Arachis hypogea)* in soils of Tamil Nadu revealed that nodulation was generally poor in almost all the soils where the crop is grown. Attempts were therefore made to find out the causes of poor nodulation of groundnut in these soils and the results of the study are reported in this paper.

Materials and Methods: Soil and plant samples were collected from six different groundnut growing areas of Tamil Nadu namely Tindivanam, Dharmapuri, Karur, Salem, Madathukulam and Pattukottai. In these six areas, four localities were selected and two soils, one from fields where the growth of the groundnut crop was good and the other from fields where the crop growth was comparatively poor were collected. Groundnut plant samples were also collected from the spots from where the soil samples were taken.

The 48 soil samples thus collected were subjected to certain important physical and chemical characteristics. Counts of bacteria were estimated in these soils. The plant samples were examined for extent of nodulation, nodular tissue weight and dry matter yield. The data obtained were subjected to statistical scrutiny.

Results & Discussion: a) *Soil Studies:* There are indications from literature summarised by Fred, Baldwin and McCoy (1932) that aeration of the substrate may be beneficial to nodulation but the data on the physical characteristics of the soils studied (Table 1) indicate that none of the physical constants were significantly different between the soils from the two series.

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TABLE 1. *Mean values for physical constants of soils*

Heads of analysis	Where crop growth is good	Where crop growth is comparatively poor	Conclusion
Apparent specific gravity	1.42	1.42	Not significant
Real specific gravity	2.40	2.29	"
Pore space percentage	44.4	44.7	"
Volume expansion on wetting	10.5	11.3	"
Moisture holding capacity	34.5	33.9	"

Among the chemical factors studied (Table 2), there was no significant difference in the total nitrogen, total phosphorus or total potash within the two groups of soils. Available phosphorus was significantly higher in the soils where the crop growth was better, but not either available nitrogen or potash. Total calcium, and magnesium were also not significantly different in the two groups of soils.

TABLE 2. *Mean values for chemical characteristics of soils*

Head of analysis	Mean values for 24 soils		Conclusion
	Where crop growth is good	Where crop growth is comparatively poor	
Total N (mg/100 g soil)	51.4	51.8	Not significant
Total P (mg/100 g soil)	79.2	82.1	"
Total K (mg/100 g soil)	719	683	"
Available N (lb/acre)	153	168	"
Available P (lb/acre)	16.8	11.0	Significant at P=0.01
Available K (lb/acre)	308	260	Not significant
Lime (CaO%)	0.84	0.98	"
Magnesia (MgO%)	0.45	0.38	"
Exchangeable Ca (me/100 g soil)	6.7	6.9	"
Exchangeable Mg (me/100 g soil)	3.0	2.9	"
Organic matter %	0.71	0.78	"
pH	7.5	7.5	"

The studies indicate the important role of adequate level of phosphate in the soil for proper growth and nodulation in groundnut. Bumpus (1957) has also reported the beneficial effect of P on nodulation in Kenya soils.

Counts of bacteria in soils with better crop growth were significantly higher as compared to the rest of the soils, though no such difference was observed between these soils in their capacity to evolve carbon dioxide.

b) *Plant studies:* Data given in Table 3 indicate that the number of nodules as well as the nodular tissue weight were directly correlated with plant growth.

TABLE 3. *Mean values for biological characteristicts*

Heads of analysis	Where crop growth good	Where crop growth is comparatively poor	Conclusion
Bacterial population (in 1000s)	1051	526	Significant at P=0.01
Carbon dioxide evolution (mg/100 g soil)	1.84	1.61	Not Significant
Average number of nodules per plant	195	46	Significant at P=0.01
Mean nodular tissue weight - dry (mg/plant)	190	36	Significant at P=0.01

Correlations were worked between the different soil factors and plant characters and significant correlations were observed between nodular tissue weight and available potassium, calcium, carbon dioxide and pH of the soils, indicating thereby that potassium, calcium and pH influence crop growth indirectly, through increased nodulation whereas available phosphate exerted a direct influence on crop growth.

TABLE 4. *Coefficient of correlations*

Correlation between	'r' value
Available potash vs nodule weight	0.579***
Total calcium vs nodule weight	0.466***
Exchangeable calcium vs nodule weight	0.489***
pH vs nodule weight	0.283*

Summary and Conclusion: With a view to ascertain the factors that are responsible for poor nodulation in groundnut in the soils of Tamil Nadu, soils collected from areas where there was good crop growth and from areas where the growth of the crop was comparatively poor, were compared.

The studies reveal that one of the major factors affecting nodulation in groundnut in soils of Tamil Nadu is the inadequacy of available phosphate in the soils. Soils which exhibited better nodulation in groundnut had a higher content of magnesium, though this did not attain the level of statistical significance. The application of phosphate and magnesium are likely to be beneficial and further work is necessary in this direction. Again the response

to certain trace elements especially molybdenum and boron in these soils has to be studied, for proper assessment of the factors, responsible for poor nodulation in groundnut.

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Sorghum Research Trends in the U. S. A.

by

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Introduction: Unlike corn, sorghum is comparatively a new crop in the United States of America. It appears to have come in here sometime in the 1850's from the tropics of Africa and India. A few years ago, sorghum was reported as a "promising crop" here and today it is an important crop. In the 1930's, sorghum acreage and production was only 6 8 million acres and 93.7 million bushels respectively (Martin, 1936). As against this, in 1968 the U.S. produced 777 million bushels of grain sorghum; 4.3 million tons of forage and 10.3 million tons of silage, from a total acreage of 19.2 million acres (Anonymous, 1968).

The first seed of any kind of sorghum appears to have been brought to the U.S.A. in the slave ships of Africa. Broom corn was introduced during the 18th century from Europe; Johnson grass from Turkey in about 1930; sweet sorghum or sorgo from France in 1853; and sudan grass in 1909. By 1900 the U.S.A. had further introduced more than 1000 lots of sorghum from China, Manchuria, India and Africa. Today, different groups of sorghum are grown in the U.S. for distinct uses such as, grain mainly as feed grain for livestock; sorgos for forage or syrup; broom corn to make brooms; and sudan grass and sorghum-sudan hybrids exclusively for pasture or hay.

Summary of Past Work (1850 to 1950): Barring a few, most of the sorghum introductions required some sort of selection or "taming" to adapt them to modern domestic agriculture. The first artificial grain sorghum crosses were made in 1914. The selection of desirable variations, hybrids, and mutations

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