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# EFFECT OF AGRICULTURAL AND INDUSTRIAL WASTE ON THE AVAILABILITY OF NUTRIENTS AND YIELD OF GROUNDNUT

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A study was carried out at the Regional Research Station, Vriddhachalam to find out the effect of various agricultural and industrial wastes on the availability of nutrients and yield of groundnut. The results indicated that groundnut shell, rice husk and dry water hyacinth had significant effect on the yield of groundnut and availability of NPK in the soil during the growth of groundnut.

A number of waste materials and by-products are produced in the farm industries such as pressmud, sugarcane begasse, rice husk, groundnut shell etc. The disposal of these by-products and waste materials poses serious problems at times. The different by-products and wastes contain good amount of plant nutrients also and thus can profitably be utilized for increasing crop production and also for the improvement of physical and chemical properties of soils. Indira Raja and Raj (1981) have reported an increase in *ragi* yields due to press-mud application Ravikumar and Krishnamoorthy (1980a and b) have reported an improvement in physical and chemical properties of soils due to the application of industrial waste materials and organic amendments. However, information on the effect of different agricultural and industrial waste materials on the yield of groundnut is lacking and hence investigations were carried out at the Regional Research Station, Vriddhachalam.

## MATERIALS AND METHODS

Field experiments were conducted at the Regional Research Station, Vriddhachalam for two seasons during 1981-83 in a red sandy loam soil (Lateritic-Oxisols). The initial fertility status of the experimental soils are reported in Table I. The soils are low in available N and medium in available P & K. The experiment was laid out in a randomized block design with three replications and nineteen treatments. The details of the treatments are given in the Table II.

Treatments include superimposition of the agricultural waste materials over and above the recommended doses of NPK as inorganics. Groundnut CO-1 was grown as the test crop. The crop was crown to maturity and at harvest, the pods from different treatments were collected, dried and the weight of dry pods was recorded Post-harvest soil samples were collected at 0-20 cm depth and analysed for pH, EC, avail-

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able N, P and K. Undisturbed core soil samples were collected and bulk density was estimated as the ratio between the weight of soil to its volume under field condition (Dakshinamurthy and Gupta, 1968). Soil pH and EC were estimated in 1:2 soil water suspension. The available N status was estimated by the alkaline permanganate method (Subbiah and Asija, 1956) and the available P by the method of Olsen *et al.* (1954). The available K was estimated in the neutral normal ammonium acetate extract of soil using flame photometer.

## RESULTS AND DISCUSSION

The yield of dry pods obtained during the two years are reported in Table II. There is a significant increase in the yield of pods by the application of groundnut shell at 5 tons/ha ($T_8$), rice husk at 10 tons/ha ($T_9$), saw dust at 5 and 10 tons/ha ($T_{11}$ and $T_{12}$) and water hyacinth at 5 and 10 tons/ha ($T_{16}$ and $T_{17}$) during 1981-82. The yield of dry pods in these treatments were 1659, 1426, 1407, 1337, 1274 and 1281 kg/ha respectively which were 101, 73, 71, 62, 55 and 56 per cent increase over control (822 kg/ha). The results of the experiment conducted during 1982-83 also showed a similar trend. It has been found that application of rice husk at 5, and 10 tons/ha ($T_8$ and $T_9$), water hyacinth at 5 and 10 tons/ha ($T_{16}$ and $T_{17}$) and groundnut shell at 5 tons/ha ($T_8$) have given 72, 69, 61, 54 and 54 per cent increased yields over control during 1982-83. Press mud, farm yard manure, sugarcane begasse and digested slurry have increased the yields marginally over control. Saw dust gave higher yields only during 1981-82.

The results of bulk density, pH and EC of post-harvest soil samples are reported in Table III. The bulk density was found decreased due to the application of various farm waste materials. Plots treated with groundnut shell, rice husk and water hyacinth have recorded lower values of bulk density as compared to the other treatments. Such a reduction in bulk density can be attributed to the favourable effect of the various farm waste materials in the aggregation of soil particles by their action as cementing agents. Morachan *et al.* (1972) reported a similar decrease in bulk density of soil by the application of organic residues.

The pH of the post-harvest soil samples showed that the soil reaction was not significantly altered due to the application of the various farm wastes. However, there was a slight decrease of pH in the various treatments as compared to the control. Such a decrease in pH might be attributed to the organic acids released during the decomposition of the various farm wastes. The electrical conductivity also did not show any significant variation due to the various treatments. This suggests the absence of salinity and sodicity hazards due to the application of various farm wastes.

The available NPK status are reported in Table IV. There was a significant increase in the available N status due to the application of the various farm waste materials. During 1981-82 the plots treated with groundnut shell at 5 tons/ha ($T_8$), rice husk at 5

Table I. Initial Fertility Status of the Experimental Field

| Nutrients | Initial fertility status during 1981-82 | 1982-83 |
|---|---|---|
| pH | 7.0 | 7.4 |
| EC (Millimhos/cm³) | less than 0.20 | less than 0.1 |
| Available N (kg/ha) | 280.00 | 280.00 |
| Available P (kg/ha) | 18.50 | 20.00 |
| Available K (kg/ha) | 144.00 | 180.00 |
| Bulk Density | 1.40 | 1·32 |

Table II. Yield of Dry Pods (kg/ha) (Mean of three replications)

| Treatments | 1981-82 Yield | 1981-82 % over control | 1982-83 Yield | 1982-83 % over control |
|---|---|---|---|---|
| $T_1$ — Control (NPK alone at 10 : 10 : 45 kg/ha) | 822 | — | 933 | — |
| $T_2$ — Groundnut shell 5 tons/ha | 1659 | 101 | 1433 | 54 |
| $T_3$ — Groundnut shell 10 tons/ha | 1120 | 36 | 1260 | 35 |
| $T_4$ — Pressmud 5 tons/ha | 1012 | 23 | 1140 | 22 |
| $T_5$ — Pressmud 10 tons/ha | 1029 | 25 | 1160 | 24 |
| $T_6$ — Farmyard manure 5 tons/ha | 1048 | 27 | 1177 | 26 |
| $T_7$ — Farmyard manure 10 tons/ha | 1048 | 27 | 1180 | 26 |
| $T_8$ — Rice husk 5 tons/ha | 1118 | 36 | 1580 | 69 |
| $T_9$ — Rice husk 10 tons/ha | 1426 | 73 | 1603 | 72 |
| $T_{10}$ — Sugarcane bagasse 5 tons/ha | 1109 | 35 | 1243 | 33 |
| $T_{11}$ — Sugarcane begasse 10 tons/ha | 1055 | 28 | 1187 | 27 |
| $T_{12}$ — Saw dust 5 tons/ha | 1407 | 71 | 1253 | 34 |
| $T_{13}$ — Saw dust 10 tons/ha | 1337 | 62 | 1290 | 38 |
| $T_{14}$ — Varagu straw 5 tons/ha | 974 | 18 | 1093 | 17 |
| $T_{15}$ — Varagu straw 10 tons/ha | 1152 | 40 | 1297 | 39 |
| $T_{16}$ — Water hyacinth 5 tons/ha | 1274 | 55 | 1503 | 61 |
| $T_{17}$ — Water hyacinth 10 tons/ha | 1281 | 56 | 1440 | 54 |
| $T_{18}$ — Digested slurry 5 tons/ha | 1028 | 25 | 1153 | 24 |
| $T_{19}$ — Digested slurry 10 tons/ha | 994 | 21 | 1187 | 20 |
| SE± | 122.23 | — | 133.0 | |
| CD (0.05) | 248.12 | — | 270.0 | |

Table III. Bulk density, Soil Reaction (pH) and Electrical Conductivity of Post-Harvest Soil Samples (Mean of three replications)

| Treatments | Bulk density (g/cc) | | Soil Reaction (pH) | | E. C. (Millimhos/cm$_s$) | |
|---|---|---|---|---|---|---|
| | 1981-82 | 1982-83 | 1981-82 | 1982-83 | 1981-82 | 1982-83 |
| $T_1$ | 1.47 | 1.40 | 7.3 | 7.4 | 0.10 | 0.10 |
| $T_2$ | 1.39 | 1.32 | 7.1 | 7.0 | 0.10 | 0.10 |
| $T_3$ | 1.44 | 1.37 | 7.1 | 7.0 | 0.11 | 0.10 |
| $T_4$ | 1.43 | 1.36 | 7.3 | 7.0 | 0.10 | 0.10 |
| $T_5$ | 1.43 | 1.36 | 7.2 | 7.0 | 0.19 | 0.10 |
| $T_6$ | 1.44 | 1.37 | 7.2 | 7.2 | 0.10 | 0.10 |
| $T_7$ | 1.44 | 1.47 | 7 3 | 7.0 | 0.11 | 0.10 |
| $T_8$ | 1.42 | 1.35 | 7.1 | 7.0 | 0 09 | 0.10 |
| $T_9$ | 1.41 | 1.34 | 7.0 | 7.2 | 0.09 | 0 10 |
| $T_{10}$ | 1.43 | 1.36 | 7.2 | 7.1 | 0.10 | 0.10 |
| $T_{11}$ | 1.45 | 1.38 | 7.1 | 7.2 | 0.09 | 0.10 |
| $T_{12}$ | 1.44 | 1.37 | 7.2 | 7.2 | 0.10 | 0.11 |
| $T_{13}$ | 1.44 | 1.37 | 7.1 | 7.0 | 0.11 | 0 09 |
| $T_{14}$ | 1.43 | 1.34 | 7 1 | 7.2 | 0.09 | 0.11 |
| $T_{15}$ | 1.42 | 1.35 | 7.2 | 7.2 | 0.10 | 0.09 |
| $T_{16}$ | 1.42 | 1.35 | 7.2 | 7 2 | 0.11 | 0.10 |
| $T_{17}$ | 1.41 | 1.34 | 7.2 | 7.1 | 0 11 | 0.09 |
| $T_{18}$ | 1.44 | 1.37 | 7 2 | 7.1 | 0,09 | 0.10 |
| $T_{19}$ | 1.45 | 1.38 | 7.1 | 7.2 | 0.10 | 0.11 |
| SE± | 0 0110 | 0,014 | 0.057 | 0.054 | 0.01 | 0 0093 |
| CD (0i0) | 0.0223 | 0.029 | N.S. | N.S. | N.S | N.S |

Table IV. Soil Available Nutrients (kg/ha) (Mean of three replications)

| Treatmentments | Available Nitrogen | | Available Phosphorus | | Available Potrassium | |
|---|---|---|---|---|---|---|
| | 1981-82 | 1982-83 | 1981-82 | 1982-83 | 1981-82 | 1982-83 |
| $T_1$ | 200 | 180 | 10 | 12 | 138 | 117 |
| $T_2$ | 280 | 267 | 18 | 22 | 207 | 173 |
| $T_3$ | 227 | 207 | 15 | 18 | 159 | 130 |
| $T_4$ | 237 | 218 | 15 | 18 | 157 | 133 |
| $T_5$ | 223 | 210 | 15 | 18 | 156 | 132 |
| $T_6$ | 243 | 210 | 16 | 19 | 163 | 132 |
| $T_7$ | 233 | 220 | 15 | 18 | 153 | 182 |
| $T_8$ | 267 | 273 | 17 | 20 | 155 | 125 |
| $T_9$ | 290 | 275 | 18 | 22 | 202 | 160 |
| $T_{10}$ | 230 | 215 | 14 | 18 | 157 | 133 |
| $T_{11}$ | 240 | 220 | 15 | 18 | 163 | 140 |
| $T_{12}$ | 220 | 158 | 14 | 17 | 157 | 128 |
| $T_{13}$ | 233 | 215 | 16 | 19 | 163 | 140 |
| $T_{14}$ | 223 | 203 | 16 | 19 | 150 | 123 |
| $T_{15}$ | 237 | 223 | 15 | 18 | 146 | 123 |
| $T_{16}$ | 270 | 273 | 15 | 18 | 152 | 127 |
| $T_{17}$ | 280 | 267 | 13 | 16 | 153 | 132 |
| $T_{18}$ | 260 | 223 | 14 | 17 | 152 | 130 |
| $T_{19}$ | 233 | 207 | 13 | 16 | 153 | 127 |
| SE± | 9.72 | 11.91 | 1.15 | 1.55 | 8.03 | 5.50 |
| CD (0.05) | 19.73 | 24.20 | 2 34 | 3.15 | 16.30 | 11.17 |

and 10 tons/ha $T_8$ and $T_9$) and water hyacinth at 5 and 10 tons/ha ($T_{16}$ and $T_{17}$) have recorded 280, 267, 280, 270 and 280 kg/ha of available N respectively as compared to 200 kg/ha in the NPK control. These treatments were on par with each other and significantly superior to all other treatments. Similar trend was observed in 1982-83 also. Indira Raja and Raj (1981) have reported increase in available N status due to pressmud application. The available P status was also significantly increased by the application of the various farm waste materials, particularly due to groundnut shell, rice husk and water hyacinth. In respect of available K, application of groundnut shell at 5 tons/ha ($T_7$) and rice husk at 10 tons/ha ($T_9$) have considerably increased the available K status and were found to be significantly superior to all other treatments.

Thus there seems to be an overall improvement in the physical and chemical properties of the soil which have been responsible for the higher yields in the treatments.

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# STUDIES ON GROWTH AND YIELD OF CHICK PEA CULTIVARS AS AFFECTED BY SOWING DATES

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Field experiments were conducted at Jobner (Asalpur Farm) during winter season of 1980-81 and 1981-82. The treatmenrs comprised of three sowing dates (October 22, November 6 and 21) and four varieties (RS-10, RS-11, RSG-2 and C-235 in first year and five varieties (RS-10, RS-11, RSG-2 Pant G-114 and Local) in second year. Planting of chick pea on 22nd october was significantly superior to other dates. Varieties RS-11, G-114 and RSG-2 being at par were found better than others.

To obtain remunerative yield from different crops they should be provided with optimum environment during their various stages of growth and

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