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# DISTRIBUTION OF ORGANIC CARBON AND FORMS OF NITROGEN IN SOIL UNDER MAHOGANY AND TEAK

**M. Balagopalan* and A. I, Jose**

Department of soil Science & Agricultural Chemistry,
College of Horticulture, Vellanikkara Trichur-680 654 Kerala

Mahogany (*Swietenia macrophylla* King) is an evergreen tree, native to tropical America, Mexico and S. America. It has been introduced into forest plantations in many parts of India, including Kerala. The wood is used for jetty piles, furniture and plywood.

Teak (*Tectona grandis* Linn. f.) is a fairly quick growing tree and is indigenous in peninsular India, north-eastern drier part of Java and other islands of Indian archipelago. It is a versatile wood, used for building construction, decorative plywood, furniture, cabinets etc.

Studies of Nath and Oeori (1976) and Palaniappan *et al.* (1978) show that organic carbon content and different forms of nitrogen increase with altitude. An increase in organic matter content of forest soils due to altitude was also reported by Rajamannar and Krishnamoorthy (1978). Recent work of Minhas and Bora (1982) on Himachal Pradesh soils shows similar result

Studies of Jose and Koshy (1972) and Alexander er *al.* (1981) show the distribution of organic carbon in soils under teak, but very few studies have so far been done on different forms of nitrogen in soils under teak as well as mahogany. A study was undertaken to find out the distribution of organic carbon and different forms of nitrogen in soils under mahogany and teak plantations.

## Materials and Methods

The experimental site is the permanent preservation plot of mohogany and a teak plantation, both established in 1939 at Nilambur adjacent to Karimpuzha river. The presence of these two vegetations in an adjacent area of rather similar parent material and topography (level) provides an excellent site for assessing the effect of vegetation on soil characteristics. Two profile pits were dug representing each vegetation and soil samples were collected from each profile for depths of 0-15 cm, 1 5-50 cm and 50-100 cm separately. The profile descriptions are furnished in Table 1 -

Soil pH, organic carbon and total, available, ammoniaca! and nitrate forms of nitrogen were determined following standard analytical procedures (Jackson, 1958).

* Division of Soil Science, Kerala Forest Research Institute, Peechi-680 653

Table 1

Profile characteristics of soils under mahogany and teak vegetation

| | |
|---|---|
| | Mahogany |
| Site: | Panayamcode |
| *Profile I* | level, 50 m asi, moderately well drained, very few undergrowth. |
| Depth (cm) | |
| 0-15 | Very dark greyish brown (10 YR 3/2), loamy sand, granular, friable, abundant roots, slightly acid. |
| 15-50 | Dark yellowish brcwn (10 YR 4/6) loam, blocky. firm, few fine roots, medium acid. |
| 50–100 | Reddish brown (5 YR 5/3), loam, massive, firm, very few very fine roots, medium acid. |
| *Profile II* | Level, 50 m asl, moderately well drained, no undergrowth. |
| Depth (cm) | |
| 0–15 | Greyish brown (10 YR 5/2), loamy sand, granular, friable, abundant roots, slightly acid. |
| 15-50 | Yellowish brown (10 YR 5/6), loam, blocky, friable, few fine roots, medium acid. |
| 50-100 | Light reddish brown (5 YR 6/4), loam, massive, firm, very few very fine roots, medium acid. |
| | Teak |
| Site: | Panayamcode |
| *Profile III* | Level, 50 m asl, well drained, good undergrowth of eupatorium *(Chromolaena odorata)* |
| Depth (cm) | |
| 0–15 | Dark yellowish brown (10 YR 3/4), loamy sand, granular, firm, abundant medium roots, strongly acid. |
| 15-50 | Reddish brown (5 YR 4/4), few mottles, loamy sand, granular to single grain, firm, few fine roots, medium acid. |
| 50–100 | Yellowish red (5 YR 5/6), abundant mottles, loam, massive, firm, very few, very fine roots, medium acid. |
| *Profile IV* | Level 50 m asl, well drained, good undergrowth of eupatorium. |
| Depth (cm) | |
| 0-15 | Light yellowish brown (10 YR 6/4), loamy sand, granular, firm, abundant medium roots, strongly acid. |
| 15-50 | Dark reddish grey (5 YR 4/2) very few mottles, loamy sand, blocky, firm, very few, very fine roots, medium acid. |
| 50-100 | Yellowish red (5 YR 5/6), few mottles, loam, massive, firm, very few very fine roots, medium acid. |

Table 2

Characteristics of soils under mahogany and teak

| Profile No. | Depth (cm) | pH in water | Organic carbon % | Total N (ppm) | Available N (ppm) | Ammoniacal N (ppm) | Nitrate N (ppm) | C/N ratio |
|---|---|---|---|---|---|---|---|---|
| | | | | Mahogany | | | | |
| I | 0- 15 | 6.2 | 1.34 | 1917 | 198 | 25.2 | 13.7 | 6.99 |
| | 15– 50 | 58 | 1.01 | 1460 | 149 | 18.7 | 9.4 | 6.92 |
| | 50-100 | 5.6 | 0.80 | 1007 | 98 | 127 | 5.8 | 7.99 |
| II | 0- 15 | 6.2 | 1.31 | 1893 | 189 | 24.7 | 13.1 | 6.92 |
| | 15- 50 | 5.9 | 1.00 | 1473 | 151 | 18,1 | 9.1 | 6.79 |
| | 50-100 | 5.6 | 0.81 | 1001 | 97 | 12.1 | 5.0 | 8.09 |
| Mean | 0- 15 | 6.2 | 1.33 | 1905 | 193 | 25.0 | 13.4 | 6.96 |
| | 15- 50 | 5.9 | 1.00 | 1467 | 151 | 18.4 | 9.3 | 6.86 |
| | 50-1000 | 56 | 0.80 | 1004 | 98 | 12.4 | 5.4 | 8.04 |
| | | | | Teak | | | | |
| I | 0- 15 | 5.5 | 1.13 | 1717 | 181 | 23.1 | 12.1 | 6.58 |
| | 15– 50 | 5.6 | 0,61 | 910 | 87 | 10.7 | 6.4 | 6.70 |
| | 50-100 | 5.7 | 0 44 | 674 | 61 | 7.3 | 4.2 | 6,53 |
| II | 0- 15 | 5.5 | 1.20 | 1697 | 170 | 22.7 | 12.0 | 7.07 |
| | 15– 50 | 5.7 | 0.70 | 903 | 83 | 101 | 6.1 | 7.75 |
| | 50-100 | 5.8 | 0.48 | 663 | 60 | 7.1 | 4.1 | 7.24 |
| Mean | 0- 15 | 5.5 | 1.17 | 1707 | 176 | 22.9 | 12.1 | 6.83 |
| | 15– 50 | 5.7 | 0.66 | 907 | 85 | 10.4 | 6.3 | 7.23 |
| | 50-100 | 5.8 | 0.46 | 669 | 61 | 7.2 | 4.2 | 6.89 |

Table 3

Ratios of total N to different forms of N under mahogany and teak vegetation

| Profile No. | Depth (cm) | Ratio of | | |
|---|---|---|---|---|
| | | Total *HI* Available N | Total N/ Ammoniacal N | Total N/ Nitrate N |
| | | Mahogany | | |
| I | 0- 15 | 9.68 | 76.07 | 139.93 |
| | 15– 50 | 9.80 | 78.07 | 155.32 |
| | 50-100 | 10.28 | 79.29 | 173.62 |
| II | 0- 15 | 10.02 | 76.64 | 144.50 |
| | 15- 50 | 9.63 | 81.38 | 161.81 |
| | 50-100 | 10.32 | 82.73 | 200 20 |
| Mean | 0- 15 | 9.85 | 76.36 | 142.22 |
| | 15- 50 | 9.72 | 79.73 | 158.60 |
| | 50-100 | 10.30 | 81.01 | 186.91 |
| | | Teak | | |
| MI | 0- 15 | 9.49 | 74.33 | 141.90 |
| | 15- 50 | 10.46 | 85.05 | 142.19 |
| | 50-100 | 11.05 | 92.33 | 160,48 |
| IV | 0– 15 | 9.98 | 74.76 | 148.42 |
| | 15- 50 | 10.88 | 89.41 | 141.03 |
| | 50–100 | 11.05 | 93.38 | 161,71 |
| Mean | 0- 15 | 9.74 | 74.55 | 141.66 |
| | 15- 50 | 10.67 | 87,23 | 145.11 |
| | 50-100 | 11.05 | 92.86 | 161.10 |

## Results and Discussion

Observations (Table 2} revealed that the pH of the soil varied from 5.6 to 6.2 in soils under mahogany and 5,5 to 5.7 under teak. In general, deciduous trees tend to add more bases to the surface soil. But in this study it is observed that soil under teak is more acidic. Perhaps, teak being a deciduous tree, the soil under teak is more subject to the action of environmental factors leading to the enhanced leaching of bases and decomposition of organic matter. This may lead to relatively high

acidity of soil under teak as compared to that under mahogany. Soils under mahogany retained relatively higher content of organic matter. In general, under both the vegetations, the contents of organic matter decreased with increase in depth of profile.

As in the case of organic carbon, total as well as different forms of N decreased with increasing depth. Again, the content of total and different forms of N was relatively more in soils under mahogany. This is obviously due to the close inter-relationship of carbon and nitrogen in soil organic matter. Data presented in Table 3 indicated that, in general, there was only a narrow range of variation in C:N ratio of soil (6.53 to 8.03) depthwise as well as under the influence of vegetations.

The ratios of total N to available N, total N to ammoniacal N and total N to nitrate N increased with increasing depth irrespective of the type of vegetation. Both the total as well as different forms of N decreased with depth. However, the rate of decrease in the case of available, ammoniacal and nitrate forms of N was more pronounced with the depth as compared to that of total nitrogen, thus resulting in higher values for these ratios for increased depths.

## Summary

A study was made on the influence of mahogany and teak vegetation on soil characteristics, namely, pH, organic carbon and different forms of nitrogen. Soils under teak were more acidic than those under mahogany. The content of organic matter decreased with depth. Accumulation of organic matter was more under mahogany vegetation. This was true in the case of total nitrogen also. The C:N ratio of the soil was little influenced either by depth or by the type of vegetation. The ratios of total N to available N, total N to ammoniacal N and total N to nitrate N increased with increase in depth of the profile under both type of vegetation.

## സംഗ്രഹം

1939 ൽ നിലമ്പൂർ വനപ്രദേശങ്ങളിൽ നട്ടുപിടിപ്പിച്ച മഹാഗണി തോട്ടങ്ങളും തേക്കിൻ തോട്ടങ്ങളും മണ്ണിന്റെ രാസസ്വഭാവങ്ങളെ എങ്ങിനെ സ്വാധീനിക്കുന്നുവെന്ന് ഒരു താരതമ്യ പഠനം നടത്തുകയുണ്ടായി. മഹാഗണി തോട്ടങ്ങളിലെ മണ്ണ് കൂടുതൽ അമ്ള സ്വഭാവമുള്ളതായും കൂടുതൽ പാക്യജനകവും ജൈവാംശവും അടങ്ങുന്നതായും കാണപ്പെട്ടു. കാർബൺ നൈട്രജൻ അനുപാതത്തിൽ മഹോഗണി തോട്ടങ്ങളിലെയും തേക്കിൻ തോട്ടങ്ങളിലെയും മണ്ണ് കാര്യമായ വ്യത്യാസം കാണിച്ചില്ല. വിവിധ ro^nj(0nn1ejj§g പാക്യജനകത്തിന്റെ അളവിലും അനുപാതത്തിലുമുള്ള വ്യത്യാസങ്ങൾ പ്രതിപാദിച്ചിരിക്കുന്നു.

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