

Allelopathic Influence of Tree Leaf Extracts on Greengram and Pigeonpea

In the traditional agroforestry system, several tree species are planted in or around agricultural fields as a source of fuel, fodder and timber. However, these trees adversely affect the productivity of crops grown in their vicinity by way of shade effects, leaching of water soluble inhibitors from foliage and trees with rains, root exudates, competition effect, etc. Some allelopathic studies have indicated differential effects on seed germination and seedling vigour of various field crops (Vidya Thakur and Bhardwaj 1992; Swaminathan 1996; Datta *et al.*, 1995 and Suresh and Vinayarai 1987). Since, information of allelopathic effect of different tree species on arable crops are scanty, the present study was conducted.

Fresh leaves of seven tree species viz., *Synzygium cumini* (T₁), *Acacia arabica* (T₂), *Tamarindus indica* (T₃), *Eucalyptus tereticornis* (T₄), *Tectona grandis* (T₅), *Samanea saman* (T₆) and *Azadirachta indica* (T₇) were collected, chopped into small pieces and 400 g of leaf material was soaked in water for 24 h from which 5 and 10 per cent concentration of aqueous solutions were prepared. The seed germination test on greengram and pigeonpea was conducted as per ISTA method (Anon., 1996) by wetting germination papers with above leaf extracts and water (control). The seedling length, vigour index (V1) = germination (%) x seedling length (cm) and seedling dry matter were recorded on 10 randomly selected seedlings from final count of germination test. The seed quality parameters were analysed in CRBD with replications and results are presented in table 1 and 2.

The results of the present study indicated that, irrespective of concentrations in greengram the per cent germination was significantly reduced due to *T. grandis* (87.25%) and *E. tereticornis* (90.12%) over control (91.75%), while it was

increased in other test tree species and was more (96.75%) in *A. indica*, followed by *A. arabica* (95.86%) and *T. indica* (94.87%). Seedling length was decreased compared to control in all the test tree species except *S. cumini*, *S. saman* and *A. indica*. The same trend was also observed with respect to vigour index. On the contrary the seedling dry matter was not reduced due to any of the tree leaf extracts. The concentrations of tree leaf extracts had no significant influence on germination, seedling length and dry matter except vigour index. At 10 compared to 5 per cent irrespective of tree leaf extract and concentration showed significant influence only on per cent germination and vigour index. Germination and vigour index were more at 5 per cent compared to 10 per cent concentration in all the tree species.

On the contrary in pigeonpea none of the tree leaf extracts showed beneficial effect on germination but seedling length, vigour index and seedling dry matter were increased due to *A. arabica*, *T. indica*, *E. tereticornis*, *S. saman* and *A. indica*. This may be due to differential influence of allelochemical of leaf extracts on germination and other seedling parameters in pigeonpea. The concentrations of tree leaf extracts showed significant influence only on germination and vigour index. High concentration (10%) of leaf extract was found to inhibit germination and vigour index. The interaction effect due to tree leaf extracts and their concentration showed marked influence on all the attributes. In general lower concentration (5%) of all tree leaf extracts were found to enhance germination, seedling length (except *S. cumini*, *A. arabica* and *T. indica*), vigour index (except *S. cumini*, *T. indica*, *S. saman* and *A. indica*) and seedling dry matter (except *S. saman*). Similar beneficial and harmful effect of tree leaf extracts on seed germination

Table 1. Effect of aqueous leaf extracts of seven tree species and their concentrations on germination (%) and seedling length (cm) in greengram and pigeonpea

| Treatments | Germination (%) | | | | | | Seedling length (cm) | | | | | | | |
|-------------------|---|-------|-------|--|-------|-------|--|-------|-------|--|------|------|------|------|
| | Greengram | | | Pigeonpea | | | Greengram | | | Pigeonpea | | | | |
| | Concentration (%) | | | | | | Concentration (%) | | | | | | | |
| | 5 | 10 | Mean | PIC | 5 | 10 | Mean | PIC | 5 | 10 | Mean | | | |
| T ₁ | 95.50 | 94.50 | 95.00 | 3.54 | 91.00 | 84.50 | 87.75 | -8.11 | 28.7 | 26.1 | 27.4 | 11.9 | 15.2 | 13.5 |
| T ₂ | 96.00 | 95.75 | 95.87 | -4.49 | 94.75 | 92.25 | 93.50 | -2.09 | 22.5 | 23.3 | 22.4 | 17.8 | 15.2 | 16.5 |
| T ₃ | 83.25 | 91.25 | 87.25 | -4.90 | 90.50 | 89.75 | 90.12 | -5.63 | 19.9 | 20.8 | 20.4 | 12.7 | 12.7 | 12.7 |
| T ₄ | 90.50 | 89.75 | 90.12 | -1.77 | 93.50 | 86.00 | 89.75 | -6.02 | 23.6 | 23.3 | 23.4 | 14.7 | 15.7 | 15.2 |
| T ₅ | 95.00 | 94.75 | 94.87 | 3.40 | 91.75 | 92.50 | 92.12 | -3.53 | 22.7 | 22.2 | 22.4 | 15.5 | 19.1 | 17.3 |
| T ₆ | 95.25 | 91.00 | 93.12 | 1.49 | 93.75 | 92.73 | 93.25 | -2.35 | 24.5 | 23.9 | 24.2 | 20.2 | 19.1 | 19.7 |
| T ₇ | 97.75 | 95.75 | 96.75 | 5.44 | 98.00 | 86.50 | 92.25 | -3.40 | 32.06 | 30.2 | 31.2 | 19.8 | 18.0 | 18.9 |
| T ₈ | - | - | 91.75 | - | - | - | 95.56 | - | - | - | 26.1 | - | - | 14.3 |
| Mean | 93.32 | 93.25 | - | - | 93.32 | 89.18 | - | - | 24.9 | 24.3 | - | 16.1 | 16.4 | - |
| For comparing | C.D (5%) | | | C.D (5%) | | | C.D (5%) | | | C.D (5%) | | | | |
| mean | 1.75 | | | 2.08 | | | 1.90 | | | 1.62 | | | | |
| Leaf Extract (E) | NS | | | NS | | | NS | | | NS | | | | |
| Concentration (C) | 2.48 | | | 2.95 | | | NS | | | 2.30 | | | | |
| EXC | T ₁ - <i>Sysygium cumini</i> | | | T ₅ - <i>Tamarindus indica</i> | | | T ₅ - <i>Tamarindus indica</i> | | | T ₅ - <i>Tamarindus indica</i> | | | | |
| | T ₂ - <i>Acacia arabica</i> | | | T ₆ - <i>Samanea saman</i> | | | T ₆ - <i>Samanea saman</i> | | | T ₆ - <i>Samanea saman</i> | | | | |
| | T ₃ - <i>Tectona grandis</i> | | | T ₇ - <i>Azadirachta indica</i> | | | T ₇ - <i>Azadirachta indica</i> | | | T ₇ - <i>Azadirachta indica</i> | | | | |
| | T ₄ - <i>Eucalyptus tereticornis</i> | | | T ₈ - Control (water) | | | T ₈ - Control (water) | | | T ₈ - Control (water) | | | | |
| | PIC- per cent increase over control | | | | | | | | | | | | | |

Table 2. Effect of aqueous leaf extracts of seven tree species and their concentrations on vigour index and seedling dry matter in greengram and pigeonpea

| Treatments | Vigour Index | | | | | | Seedling dry matter (mg) | | | | | |
|------------------------|-------------------|------|------|-------------------|------|------|--------------------------|------|-----|-------------------|------|------|
| | Greengram | | | Pigeonpea | | | Greengram | | | Pigeonpea | | |
| | Concentration (%) | | | Concentration (%) | | | Concentration (%) | | | Concentration (%) | | |
| 5 | 10 | Mean | 5 | 10 | Mean | 5 | 10 | Mean | 5 | 10 | Mean | 5 |
| T ₁ | 2740 | 2456 | 2603 | 1083 | 1287 | 1183 | 195 | 203 | 199 | 813 | 820 | 816 |
| T ₂ | 2159 | 2231 | 2195 | 1668 | 1402 | 1544 | 230 | 240 | 235 | 1060 | 1130 | 1095 |
| T ₃ | 1661 | 1898 | 1779 | 1149 | 1140 | 1144 | 225 | 218 | 221 | 828 | 810 | 819 |
| T ₄ | 2135 | 2091 | 2113 | 1374 | 1350 | 1362 | 230 | 220 | 225 | 1060 | 930 | 995 |
| T ₅ | 2147 | 2103 | 2125 | 1422 | 1766 | 1594 | 225 | 215 | 220 | 955 | 1038 | 996 |
| T ₆ | 2362 | 2202 | 2282 | 1893 | 1771 | 1832 | 213 | 245 | 229 | 958 | 1055 | 1006 |
| T ₇ | 3186 | 2891 | 3039 | 1940 | 1557 | 1748 | 213 | 197 | 208 | 787 | 855 | 821 |
| T ₈ | - | - | 2403 | - | - | 1365 | - | - | 195 | - | - | 805 |
| Mean | 23.41 | 2269 | - | 1507 | 1467 | - | 219 | 220 | - | 923 | 948 | - |
| For comparing C.D (5%) | | | | | | | | | | | | |
| mean | | | | | | | | | | | | |
| Leaf Extract (E) | 42 | | | 33 | | | | 19 | | | 60 | |
| Concentration (C) | 22 | | | 18 | | | | NS | | | NS | |
| EXC | 60 | | | 47 | | | | NS | | | 85 | |

Note : T₁ - *Sysygium cumini*
 T₂ - *Acacia arabica*
 T₃ - *Tectona grandis*
 T₄ - *Eucalyptus tereticornis*
 T₅ - *Tamarindus indica*
 T₆ - *Santanea saman*
 T₇ - *Azadirachta indica*
 T₈ - Control (water)

PlC- per cent increase over control

of field crops were reported in wheat and maize by Vidya Thakur and Bharadwaj (1992), Pigeonpea and same by Swaminathan (1996), mustard by Datta et al. (1995) and rice by Suresh and Vinayalai (1987). The differential influence on germination and other seedling

attributes in different crop seed may be due to presence of different allelopathic compounds.

From the present study, it may be inferred that the tree leaf extracts have differential influence on seed germination and other attributes of greengram and pigeonpea.

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