

Allelopathic Effect of Some Tree Species on Sunflower and Soybean

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Abstract : Studies on allelopathic effect of seven tree leaf extracts viz., *Syzygium cumini*, *Acacia arabica*, *Tectona grandis*, *Eucalyptus tereticornis*, *Tamarindus indica*, *Samanea saman* and *Azadirachta indica* each at 5 and 10 per cent concentration on sunflower and soybean indicated that, germination of sunflower was increased by *T. grandis*, *T. indica* and *S. saman* each at 5 and 10 per cent concentration than control. Soybean germination was increased by *A. arabica*, *T. grandis*, *S. saman* and *A. indica* at both concentrations over control. Similarly seedling length, vigour index and seedling dry matter were also influenced by tree leaf extracts at different concentrations.

Introduction

In agro-forestry system plant- plant interactions are of paramount importance. Plants produce and release large number of chemical compounds and affect the growth of another plant(s) or even own species present near by (Sharma *et al.*, 1982). Inhibition of associated crops has been reported in several tree species. However, information on allelopathic effects of different multipurpose tree species on arable crops is scanty. Hence, a study was conducted to ascertain the effect of tree leaf extracts on seed germination and vigour of sunflower and soybean.

Material and Methods

Four hundred gram of fresh leaves of seven tree species (Table 1) were collected, chopped into small pieces and soaked in 1000 ml of water for 24 h from which 5 and 10 per cent solutions were prepared. The germination test on sunflower and soybean seeds was conducted as per ISTA method (Anonymous, 1996) by moistening the germination papers with tree leaf extracts and with water as control. The observations on seedling length, vigour index and seedling dry matter on 10 randomly normal

seedlings selected on 8th (sorghum) and 10th (sunflower) day of germination test was made.

Results and Discussion

Tree leaf extracts had differential influence on germination of sunflower and soybean seeds. The germination in sunflower was stimulated by *T. indica*, *S. saman*, *T. grandis* and *A. indica* while, it was suppressed by *E. tereticornis* and *A. arabica* as compared to control. In case of soybean, germination was increased by *A. arabica*, *S. saman*, *A. indica* and *T. grandis* and decreased only by *T. indica* as compared to control.

Irrespective of extracts concentrations of tree leaf extracts found to reduce the germination of soybean seeds but not sunflower seeds. Germination of sunflower seeds was decreased by 2.76 and 4.85 per cent at both 5 and 10 per cent concentrations, respectively. While in soybean at 10 per cent concentration germination was marginally reduced.

The germination of sunflower seeds was also marginally affected due to interaction effect of tree leaf extracts and their concentrations. In sunflower, germination was slightly decreased

Table 1. Effect of aqueous leaf extracts of seven tree species and their concentrations on germination and seedling length in sunflower and soybean.

| Treatments | Germination (%) | | | | | | Seedling length (cm) | | | | | | | |
|---------------------|-------------------|-------|-------|-----------|-------|-------|----------------------|-------|------|-----------|------|------|------|------|
| | Sunflower | | | Soybean | | | Sunflower | | | Soybean | | | | |
| | Concentration (%) | | | | | | Concentration (%) | | | | | | | |
| | 5 | 10 | Mean | PIC | 5 | 10 | Mean | PIC | 5 | 10 | Mean | 5 | 10 | Mean |
| T ₁ | 91.25 | 91.00 | 91.12 | -0.40 | 79.25 | 78.50 | 78.87 | -0.47 | 32.3 | 33.3 | 32.8 | 32.5 | 33.4 | 32.9 |
| T ₂ | 92.73 | 82.50 | 87.62 | -3.44 | 90.25 | 83.75 | 87.00 | 9.77 | 28.0 | 25.5 | 26.7 | 35.1 | 32.1 | 33.6 |
| T ₃ | 91.00 | 94.75 | 92.87 | 2.33 | 85.50 | 82.00 | 83.75 | 5.67 | 25.2 | 23.8 | 24.5 | 32.4 | 34.1 | 33.2 |
| T ₄ | 83.25 | 81.50 | 82.37 | -9.23 | 79.75 | 79.25 | 79.50 | -0.31 | 24.1 | 26.5 | 25.3 | 32.8 | 31.7 | 32.3 |
| T ₅ | 95.25 | 94.25 | 94.75 | 4.40 | 76.25 | 75.50 | 75.85 | -4.21 | 25.6 | 26.9 | 26.3 | 30.0 | 34.5 | 32.2 |
| T ₆ | 92.50 | 95.75 | 94.12 | 3.71 | 83.75 | 86.00 | 84.87 | 7.09 | 26.8 | 26.2 | 26.5 | 30.9 | 31.4 | 31.1 |
| T ₇ | 94.50 | 90.00 | 92.25 | 1.65 | 87.00 | 85.25 | 86.12 | 8.66 | 29.7 | 27.2 | 28.5 | 32.8 | 32.6 | 32.7 |
| T ₈ | - | - | 90.75 | - | - | - | 79.25 | - | - | - | 23.8 | - | - | 31.8 |
| Mean | 91.50 | 89.96 | - | - | 83.10 | 81.46 | - | - | 27.4 | 27.0 | - | 32.4 | 32.8 | - |
| For comparing means | C.D. (5%) | | | C.D. (5%) | | | C.D. (5%) | | | C.D. (5%) | | | | |
| Leaf Extract (E) | 2.10 | | | 2.56 | | | 2.50 | | | N.S. | | | | |
| Concentration (C) | 1.12 | | | N.S. | | | N.S. | | | N.S. | | | | |
| E x C | 8.97 | | | N.S. | | | N.S. | | | 2.5 | | | | |

Note : T₁ - *Syzygium cumini*; T₂ - *Eucalyptus tereticornis*; T₃ - *Acacia arabica*; T₄ - *Tamarindus indica*; T₅ - *Tactona grandis*; T₆ - *Samaranea samari*; T₇ - *Azadirachta indica*; T₈ - Control (water); PIC - Per cent increase over control.

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due to *A. arabica* and *E. tereticornis* and 10 per cent concentration over control. In the remaining leaf extracts the germination was marginally increased at both 5 and 10 per cent concentration. In case of soybean except *S. cumini* at both the concentrations the germination was increased and was greatest with *A. arabica* and *A. indica* at 5 per cent concentration. Similar beneficial and harmful effects of tree leaf extracts at highest concentrations were reported in field crops (Datta *et al.*, 1985) which was related to presence of various allelochemicals in different organs of tree (Rice, 1984) and sensitiveness of seeds (Suresh and Vinayalai, 1987).

The seedling length (Table 1) of sunflower was found to differ significantly due to effect of tree leaf extracts. In sunflower it increased significantly by *S. cunini*, *A. indica*, *A. arabica* and *S. saman* compared to control, while, in soybean though seedling length was not significantly influenced but all the test tree leaf extracts found to increase seedling length more than control.

The concentration of leaf extracts had no significant influence on seedling length, but relatively more seedling length was observed than control in both the crops.

With respect to interaction effect of tree leaf extracts and their concentrations the seedling length was significantly influenced only in soybean. *A. arabica* and *S. saman* both at 5 and 10 per cent respectively found to increase seedling length of soybean compared to control. Similar differential response on seedling length was attributed to quantum and nature of allelochemicals present in tree leaf (Challamuthu *et al.*, 1997).

The vigour index (Table 2) was found to be significantly influenced by tree leaf extracts in sunflower and soybean. Almost all the test

tree leaf extracts found to enhance vigour index compared to control in sunflower whereas, only *T. grandis*, *A. arabica* and *A. indica* found to increase vigour index in soybean.

Effect of concentration on vigour index was found significant in sunflower and soybean. In both the crop the vigour index was found to be increased at 5 and 10 per cent concentrations than control.

The interactions effect due to tree leaf extract and their concentrations on vigour index was also significant in sunflower and soybean. In sunflower *A. Indica*, *A. saman*, *T. grandis*, *T. indica* and *S. cumini* and in soybean *A. arabica*, *T. grandis* and *A. indica* each at 5 and 10 per cent found to increase vigour index compared to control. Similar differential influence of tree leaf extracts on vigour index was reported by Vidya Thakur and Bharadwaj (1992).

The seedling dry matter (Table 2) was markedly decreased by *A. arabica*, *E. tereticornis*, *T. indica* and *A. indica* in sunflower and the remaining tree extracts found to increase SDM marginally over control. In soybean almost all test tree leaf extracts found to decrease seedling dry matter except *E. tereticornis*. The concentration effect on seedling dry matter was found non significant. However, seedling dry matter in both the crops was found to be numerically less compared to control.

The interaction effect due to tree leaf extracts and their concentrations found significant on seedling dry matter. In sunflower seedling dry matter was significantly decreased by *A. arabica* and *T. indica* at 5 and 10 per cent and *S. saman* at 5 per cent than control. In soybean seedling dry matter was significantly decreased by *S. cumini*, *T. grandis* and *T. indica* at 5 and 10 per cent concentration. Suresh and Vinayalai (1987) have also reported similar influence of tree leaf extracts on seedling dry

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

| Treatments | Vigour index | | | | | | Seedling dry matter (mg) | | | | | |
|---------------------|-------------------|------|-------|-----------|------|------|--------------------------|-----|------|-----------|-----|------|
| | Sunflower | | | Soybean | | | Sunflower | | | Soybean | | |
| | Concentration (%) | | | | | | Concentration (%) | | | | | |
| | 5 | 10 | Mean | 5 | 10 | Mean | 5 | 10 | Mean | 5 | 10 | Mean |
| T ₁ | 2947 | 3030 | 2988 | 2575 | 2621 | 2598 | 230 | 205 | 218 | 877 | 820 | 849 |
| T ₂ | 2597 | 2104 | 2350 | 3167 | 2688 | 2998 | 193 | 190 | 191 | 890 | 868 | 879 |
| T ₃ | 2293 | 2255 | 2274 | 2770 | 2796 | 2783 | 218 | 225 | 221 | 833 | 825 | 892 |
| T ₄ | 2006 | 2159 | 2082 | 2615 | 2512 | 2564 | 205 | 208 | 206 | 933 | 903 | 918 |
| T ₅ | 2438 | 2535 | 2487 | 2287 | 2597 | 2442 | 200 | 175 | 188 | 792 | 847 | 820 |
| T ₆ | 2479 | 2441 | 2460 | 2579 | 2485 | 2532 | 178 | 223 | 200 | 840 | 913 | 876 |
| T ₇ | 2806 | 2448 | 2627 | 2853 | 2779 | 2816 | 210 | 210 | 210 | 888 | 885 | 886 |
| T ₈ | - | - | 90.75 | - | - | - | - | - | 228 | - | - | 928 |
| Mean | 2509 | 2424 | - | 2692 | 2640 | 2520 | 204 | 205 | - | 865 | 866 | - |
| For comparing means | C.D. (5%) | | | C.D. (5%) | | | C.D. (5%) | | | C.D. (5%) | | |
| Leaf Extract (E) | 56 | | | 82 | | | 16 | | | 30 | | |
| Concentration (C) | 30 | | | 43 | | | N.S. | | | N.S. | | |
| E x C | 79 | | | 116 | | | 23 | | | 43 | | |

Note : T₁ - Syzygium cumini; T₄ - Eucalyptus tereticornis; T₇ - Azadirachta indica;
 T₂ - Acacia arabica; T₅ - Tamarindus indica; T₈ - Control (water);
 T₃ - Tactona grandis; T₆ - Samanea samani;
 PIC - Per cent increase over control.

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matter in cowpea and rice. The present study revealed that allelopathy has both beneficial and

harmful effect on seed germination and seedling vigour of sunflower and soybean.

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