FYM+NPK FERTILIZATION TO CONTROL ALLELLOCHEMICAL EFFECTS OF MANGIFERA INDICA L. LEAF LEACHATE ON LENSS CULINARIS L.

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ABSTRACT

The optimum access of growing crop to essential nutrients reduced the risk for being eliminated or affected by allelopaths. In the given research an aqueous leaf leachate of Mangifera indica L. (mango) was used to investigate their effects on growth yield of Lens culinaris L. (lentil) and also to evaluate the control of allelochemical inhibitory effect by supplying proper nutrient as organic and inorganic fertilizer. Leaf litter of mango tree were crushed and soaked for 24h in water; the filtrates were diluted to make different concentration (i.e. 1%, 5% and 10%) and used to investigate their effect on the test crops. The experiment was carried out in sterilized Petri plates lined with moist filter paper, kept under natural light dark cycle at 25 ± 0.5°C and was replicated three times. The aqueous leaf leachate of M. indica was found to have both stimulatory and inhibitory effect on shoot, root elongation and dry matter of treated plants. Result indicated that the inhibitory effect was much more pronounced at higher leachate concentrations, while the lower concentration showed stimulatory effect in some cases. The inhibitory effect was much pronounced (P<0.001) in shoot and root length as compared to the dry weight of the receptor crop.

Keywords: Allelopaths; Mangifera indica; allelochemicals; leachate.

1. INTRODUCTION

Allelopathy refers to the beneficial or harmful effects of one plant on another plant (Rice, 1984) by the release of chemicals from plant parts (Anonymous, 1972) by plant degradation, leaching from plant leaves and stem (Bertin et al., 2003; Weir et al., 2004), root exudation (Bhatt, B.P. and N.P. Todaria, 1990) volatilization (Anonymous, 1976), plant residue decomposition (Putnam, A.R., 1985; Rice E.L., 1984) and other processes in both natural and agricultural systems. These compounds serve a multitude of functions such as improving nutrient uptake, root lubrication, plant growth regulation, microorganism defense, and waste removal (Bertin et al., 2003; Fan et al. 1997; Uren 2000). Subsequently, some of these compounds which are known as allelochemicals alter the growth or physiological functions of receiving species. Many allelochemicals Compounds have been identified as a variety of chemical classes such as phenolic acids, cinnamic and benzoic acids, coumarins, benzoquinones, terpenoids, glucosinolates, flavonoids, and tannins (Singh et al., 2003; Chung et al. 2002; Vyvyan 2002; Seigler 1996). These allelochemicals are found in many plant species from woody to herbaceous plants, grasses and broadleaves, weeds and crops. A large proportion of identified allelochemicals are noted to be secondary compounds formed during photosynthetic processes (Einhellig 1995). Several studies have indicated that the allelochemicals are toxics which may inhibit shoot/root growth, nutrient uptake, or may attack a naturally occurring symbiotic relationship thereby destroying the usable source of plants of a nutrient. The consequent effects may be inhibited or retarded germination rate, reduced roots or radical and shoot or coleoptile extension, lack of root hairs, swelling or necrosis of root tips, curling of root axis, increased number of seminal roots, discolouration, reduced dry weight accumulation and lower reproductive capacity (Ayeni, A.O., et al., 1997). The reduction in germination (Bawa, R. and R.S. Singh, 1982), cell division, mineral uptake, hinder or augments respiration, hamper the production of protein and leghemoglobin in certain crops (Rice, E.L., 1974). In a few instances, these chemicals can kill a plant, or prevent it from becoming established by reducing plant growth. Plants that are under stress, such as those with pests, diseases, or less than optimum access to nutrients, sun, or moisture, are at an even higher risk for being eliminated by allelopaths. Analyses of the aqueous extracts of mango leaves by HPLC have indicated the presence of caffie acid, coumaric acid, vaneic acid, benzoic acid and other phenolic acid (El- Rokiek et al., 2010), M. indica has demonstrated the presence of phenolic constituents, triterpenes, flavonoids phytosterols and polyphenols (Anjaneyulu, V., et al., 1994; Kharn, M.A. et al., 1994; Saleh, N.A. et al., 1975, Selles, 2002, Singh,U.P.,2004). Mango leaves are reported to contain 43-46.7% euxanthin acid (C10H8O10) and also some euxanthon (C13H4O2), hippuric acid and benzoic acids and 4% mangin (Beyer, W.F. and I. Fridovich, 1987; Nott, P.E. and J.C. Roberts, 1967). Mango is in the same family as poison ivy. It is worthy to mention that dried mango leaf powder completely inhibited germination and growth of weeds and crops (James and Bala, 2003; Yang. G.,2006). The present study was aimed at investigating the
effects of different concentration of aqueous leachate of *M. indica on Lens culinaris L.* and its control through soil fertilization to assess the compatibility among them so that appropriate combination can be suggested to enhance the home garden productivity.

2. MATERIALS AND METHOD
To prepare the leachates, *Mangifera indica* L. crushed leaf litter were immersed in water for 24 hours in the ratio of 1:10 w/v (leaf:water). After 24 hours, leachates were filtered using No.1 Whatman filter paper. From the leachates three different concentrations (1%, 5% & 10%) were prepared. NPK was applied @ 120:60:30 and FYM @ 10 ton/ha. Chemically sterilized seeds of *Lens culinaris* L. were placed in sterilized petri plates lined with moist double filter paper. Three replicates per treatment and 10 seeds per replicate were supplied with respective leachate concentration alone and along with FYM 7 NPK. The set up was laid in completely randomized design under laboratory condition. The filter paper was constantly moistened daily using the respective leachate concentrations and distilled water as control. After 6 days, seedling growth was assessed by harvesting five individuals/treatment and different growth parameters including fresh and dry weights were determined.

RESULT AND DISCUSSION
The study revealed that the inhibitory effect of leaf leachate on the plant growth was a concentration dependent phenomenon i.e. increases in concentration exerted more inhibition (Rice E.L., 1984) and studied plants varied in their response to different leachates (Assaeed, A.M. and A.A. Al-Doss, 1997). Table-1 showed the toxicity level mango leaves allelochemicals on *lens culinaris* growth with differential concentration. 1% leachate was found beneficent at all parameters of growth including shoot length, root length and shoot fresh weight when compare to control un treated plants while root and shoot dry weight also promoted significantly at 1% leachate when compare to plant treated with FYM extract alone and along with NPK dose (Fig-3). The given research was actually performed to evaluate the efficiency of FYM and NPK to compensate the toxicity of allelochemicals present in ground by altering the uptake of toxic metabolites from the soil and providing essential nutrients to the crop to tolerate allelochemicals stress. The highest inhibitory effect of 19.08% and 33.33% was recorded at 10% leachate dose on shoot length and root length respectively. The inhibition of shoot length by *Mangifera indica* may be due to the presence of higher amount of phenols like caffeic acid, coumaric acid, vanelic acid, benzoic acid and greatly inhibited with the increasing of concentration of other phenolic acid (El-Rokiek et al., 2010). These phenolic compounds might have interfered with the phosphorylation pathway or inhibiting the activation of Mg2+ and ATPase activity or might be due to decreased synthesis of total carbohydrates, proteins and nucleic acids (DNA and RNA) or interference in cell division, mineral uptake and biosynthetic processes (Sasikumar, K., et al., 2002). Impaired metabolic activities caused by allelochemicals decreased root and shoot length. Allelochemicals decreased elongation, expansion and division of cells which are growth prerequisite (Ein hellig, F.A., 1996). Also, allelochemicals inhibit absorption of ions (Qasem, J.R. and T.R. Hill, 1989) and therefore, resulted in arrested growth (Dos Santos, et al., 2004). The amendment of FYM and FYM+NPK both has significant effect to reduce inhibition percentage and promoted the length at both parameters. Similar observation was also found by Mousawi et al. 1975, Kalitha, et al. 1996, Sazada et al.2009.

REFERENCES


### Table-1:
Allelopathic Effect of Leaf Leachate of *Mangifera indica* L. on growth of *Lens culinaris* L., (lentil) and its control through FYM +NPK fertilization

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>LENGTH (cm)</th>
<th>FRESH WEIGHT (gm)</th>
<th>DRY WEIGHT (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SHOOT</td>
<td>ROOT</td>
<td>SHOOT</td>
</tr>
<tr>
<td>NO LEACHATE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONTROL</td>
<td>4.82 i</td>
<td>4.8 e</td>
<td>0.028 i</td>
</tr>
<tr>
<td>FYM</td>
<td>5.6 g</td>
<td>4.9 d</td>
<td>0.085 e</td>
</tr>
<tr>
<td>FYM + NPK</td>
<td>5.9 d</td>
<td>5.0</td>
<td>0.091 d</td>
</tr>
<tr>
<td>1% LEACHATE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONTROL</td>
<td>7.5 a</td>
<td>5.2 c</td>
<td>0.045 h</td>
</tr>
<tr>
<td>FYM</td>
<td>6.93 b</td>
<td>5.6 b</td>
<td>0.028 i</td>
</tr>
<tr>
<td>FYM + NPK</td>
<td>6.96 b</td>
<td>5.8 a</td>
<td>0.051 g</td>
</tr>
<tr>
<td>5% LEACHATE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONTROL</td>
<td>3.92 j</td>
<td>3.4 g</td>
<td>0.023 j</td>
</tr>
<tr>
<td>FYM</td>
<td>5.8 e</td>
<td>4.87 d</td>
<td>0.057 f</td>
</tr>
<tr>
<td>FYM + NPK</td>
<td>6.8 c</td>
<td>5.23 c</td>
<td>0.142 b</td>
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<tr>
<td>10% LEACHATE</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>CONTROL</td>
<td>3.9 j</td>
<td>3.2 h</td>
<td>0.085 e</td>
</tr>
<tr>
<td>FYM</td>
<td>5.2 h</td>
<td>3.9 f</td>
<td>0.113 c</td>
</tr>
<tr>
<td>FYM + NPK</td>
<td>5.7 f</td>
<td>5.2 c</td>
<td>0.198 a</td>
</tr>
</tbody>
</table>

Value in parenthesis indicate percent increase (+) or decrease (-) over control.
Means followed by letter shows significant result at the level of + Standard deviation.
Aamir & Ibrahim • Effects of *Mangifera Indica* L. Leaf Leachate

**Fig-1**

![Graph showing shoot length](image)

**Fig-2**

![Graph showing fresh weight](image)

**Fig-3**

![Graph showing dry weight](image)