

## ALLELOPATHIC INTERACTIONS IN VEGETABLE CROPS

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### INTRODUCTION

Allelopathy refers to both negative as well as positive biochemical interactions between all types of plants, including microorganisms, in both natural and agricultural systems, via the release of chemicals from plant parts via leaching, root exudation, vaporization, residue decomposition, and other processes. Allelopathy can have an impact on many aspects of plant ecology, including their occurrence, growth, and plant order, plant community structure, dominance, diversity, and plant productivity. Allelopathy is an epidemic that is not limited to a few plants. Some vegetables exhibiting potent allelopathic properties have been studied.

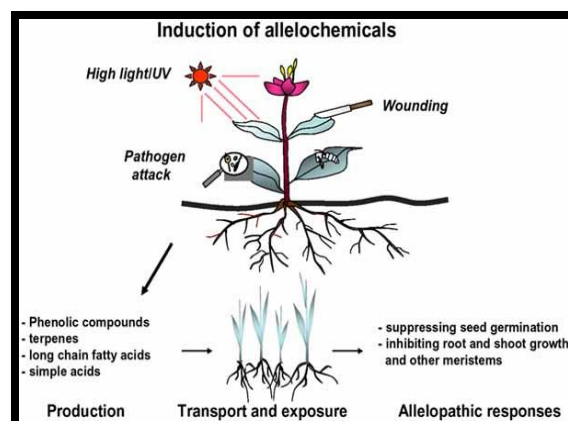
### EFFECTS OF VEGETABLE CROPS ON OTHER CROPS

The addition of crushed carrot and coriander seeds (*Coriandrum sativum*) increased wheat grain yield significantly. Carrot at all quantities and coriander at 4% reduced the population of *Heterodera avenae* cysts. The water-based extracts of fresh and dried Chinese cabbage roots minimised its own the radicle expansion, fresh and dry weight, and mustard (*Brassica campestris*) growth. Dried root extracts were more inhibiting than fresh root extracts. Mustard had more growth inhibition than Chinese cabbage. Examination of yellow squash

(*Cucurbita pepo*) and a couple cucumber (PI 165046 and PI 169391) accessions for the existence of permanent chemical factors that interfere with proso millet (*Panicum milliaceum*) germination and growth. Hexane, ethyl acetate, and water-soluble components, particularly those extracted from leaves, stems, or roots, were all inhibitory. At 50 mg DW equivalent per ml, extracts from these vegetation organs inhibited germination by 61 to 97%. At the same levels of extract (50 mg DW equivalent per ml), extracts from seed components inhibited germination by 18-64 %.

### EFFECTS OF OTHER CROPS ON VEGETABLE CROPS

Volatile emissions from the winter cover legumes Berseem clover (*Trifolium alexandrinum*), hairy vetch (*Vicia hirsute*), and crimson clover (*Trifolium incarnatum*) inhibited onion (*Allium cepa* L.), carrot, and tomato germination and seedling development. These residue emission mixtures contained



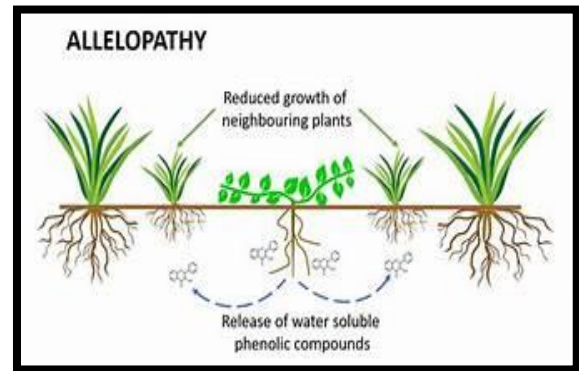
hydrocarbons, alcohols, aldehydes, esters, furans, and monoterpenes. Alfalfa residue was found to be toxic to cucumber seed sprouting and seedling growth in growth chamber tests. When lucerne roots (0.5% w/w, dry weight) were added to the growing medium, they inhibited germination. Alfalfa roots (0.5% w/w, dry weight) were also toxic to cucumber seedlings. Cucumber seedlings, on the other hand, grew normally if the medium to which surface roots were incorporated was irrigated to leach down substances and kept for more than one day before planting.

Cucumber, green bean (*Phaseolus vulgaris*), redroot pigweed (*Amaranthus retroflexus*), and annual Italian ryegrass (*Lolium multiflorum*) seeds were treated to kenaf (*Hibiscus cannabinus*) extract at 0, 16.7, 33.3, and 66.7 g L<sup>-1</sup>. As controls, distilled water and three strengths of polyethylene glycol (PEG) were used. When exposed to the maximum concentration of unweathered, tomato germination was reduced by 30%.

#### EFFECTS OF VEGETABLE CROPS ON VEGETABLE CROPS

Cucumber, squash (*Cucurbita moschata*), and melon seedling root exudates reduced tomato seed germination. Squash exudates had the largest impact, lowering germination from 91.4% to 76.8% (control). Squash root exudates decreased the seedling rate index from 0.46 (controls), to 0.43, but cucumber and melons root exudates boosted it to 0.50 and 0.48, respectively. The effects of root exudates on seedlings that were 30 or 45 days old were mixed. When applied to 30-day-old plants, all exudates lowered seedling DW but had no effect on embryonic DW when treated to 45 day old plants. When treated to 30 and 45 day old plants, squash and melon

exudates from the roots dramatically boosted root and seedling FW.



Allelopathy effects of solvent-based extracts from broccoli collected before to head development were assessed using biological tests on germination and root extension of broccoli, lettuce, and tomato seedlings. Chloroform extracts of broccoli dry matter and its chromatographic fractions shown strong allelopathic activity on seed germination and root elongation in broccoli, lettuce, and tomato. Allelopathic action was observed primarily as suppression of root extension rather than seed germination. Three of the five chromatographic portions were quite efficient, while subfractions produced from chloroform extract fraction II exhibited no significant allelopathic effects. Allelopathic activity may be assigned to a combination of non-polar chemicals because it diminished upon fractionation.

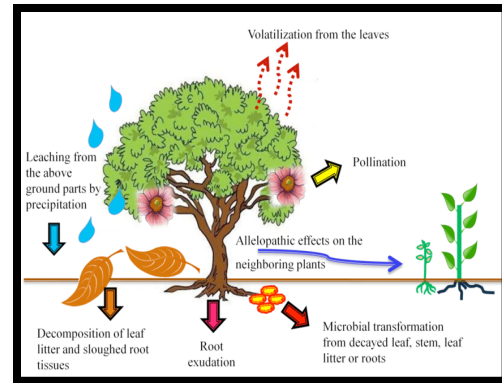
#### VEGETABLES AND WEEDS INTERACTIONS

The study of influencing weed pollen on okra/lady's finger (*Abelmoschus esculentus*) and brinjal pollen germination and pollen tube development in vitro. Pollen from *Cannabis sativa* and *Ricinus communis*, respectively, totally prevented pollen germination in brinjal (100% inhibition). The presence of weed pollens significantly reduced the germination of pollen and tube length in this crop. Neither

Cannabis nor Ricinus weed pollen had a significant suppressive allelopathic effect on pollen germination, pollen tube development, or germination time in okra.

The allelopathic effects of root exudates from seven weed species on pumpkin (*Cucurbita maxima*) and eggplant (*Echinochloa colonum*, *Amaranthus dubius*, *Sorghum halepense*, *Rottelia exalata*, and *Trianthema portulacastrum*). The treatments were as follows: (0) no root exudates; (3) root exudates administered on 3 alternate days for 6 weeks; and (5) root exudates treated on 5 consecutive days for 6 weeks. Root exudates from all weed species tested had an allelopathic impact on eggplant seedlings, resulting in reduced stem length and dry weight. In addition to the influence on vine length and dry weight, a loss of more than 50% in pumpkin yields was seen when weeds grew freely alongside the crop.

The impact of varying doses of *Cyperus rotundus* subterranean organ and leaf extracts on cucumber seed germination was investigated. *C. rotundus* underground organ and foliage extracts (5%) inhibited cucumber germination, decreased radicle and plumule lengths, fresh and dry weights, endogenous hormone content (auxins, gibberellins, and cytokinins), altered cucumber seedling protein pattern, and increased endogenous inhibitor content (ABA and phenols). The leaf extract was often more powerful. Many phenolic compounds are isolated using chromatography fractionations and bioassays of growth regulating agents.



### ALLELOPATHIC EFFECTS OF TREES ON VEGETABLE CROPS

The allelopathic beneficial effects of aqueous extracts of *Ocotea odorifera* leaf, stem, and root on lettuce and radish sprouting and development. *Ocotea odorifera* leaf extract significantly decreased the development of seeds in lettuce and radish, but stem and root extracts delayed germination. Vegetable roots were the most responsive to allelochemicals. Aqueous extracts of five mangrove tree species (*Avicennia marina*, *Aegiceras corniculata*, *Kandelia candel*, *Rhizophora stylosa*, and *Bruguiera gymnorrhiza*) inhibited cabbage germination and seedling growth. The allelopathic strength of aqueous extracts on cabbage rose as mangrove succession progressed.

### PESTICIDAL POTENTIAL OF VEGETABLE CROPS

#### Antibiotic Effects

The phytochemical tomatine is a steroidal glycoalkaloid found in the tissues of *Lycopersicon* members that has been proven to have antibiotic effect against a variety of pathogens. Many microbes are poisoned by secondary plant compounds. Tomatine and tomatidine (0.3 mM) reduced the development of three fungal bioherbicidal pathogenic organisms in growth media (agar). Both

chemicals suppressed *Alternaria cassiae*, the most sensitive pathogen, by 70%. Tomatine decreased the development of *Colletotrichum truncatum* and *Fusarium subglutinans* by 63% and 50%, respectively, whereas tomatidine inhibited the growth of these two more pathogens by 50% and 15%, respectively. These natural plant compounds exhibit a wide spectrum of phytotoxicity and fungitoxicity, which may play a role in plant defence systems. Tomatine is a saponin (steroidal glycol-alkaloid) that tomato and other Solanum plants make.

### **Nematicidal Effects**

The use of 5% rhizospheric soil drench of wheat flour to tomato cv. Pusa Ruby and okra cv. Parbhani Kranti plants (24 h after root inoculation with *Meloidogyne incognita* juveniles) decreased the infestation. Wheat flour, amylase inhibitor did not kill the nematodes in vitro, but did reduce amylase activity in infected tomato and okra roots. The root-knot was reduced when amylase inhibitor was given to tomato and okra plants infected with *M. incognita*. Both amylase and amylase inhibitors increased enzyme activity in inoculated roots of tomato and okra plants compared to non-inoculated roots.