The Effect of Plant Residual on Establishment of Crops

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ABSTRACT

In order to evaluation of plant residual on establishment of crops an experiment was conducted during 2006-2007 in Sharood Universiy of Technology in Iran. The experiment was as factorial in Completely Randomized Design with 4 replications. The residual of Triticum aestivum, Beta vulgaris, Zea mays and Brassica napus and distilled water as check were tested on themselves and other crops. The results showed residual of crops had different effect on growth of themselves and other crops. Germination percentage, speed of germination, root dry weight, stem dry eight, root length, stem length, root/shoot ratio and plant growth traits were significantly affected by residual of Beta vulgaris, Zea mays, Triticum aestivum and Brassica napus respectively.

Keywords: Residual plants, growth, growth

INTRODUCTION

Plant growth and development are influenced by a wide rang of fluctuating abiotic and biotic conditions that usually create less than an optimal cropproduction evironment. Allelochemicals produced and released by certain plants and microorganisms are only one component of the stresses that influence plant growth. The complexities of ecological processes mandate that the effect of an allelochemical must be recognized and evaluated in a context where interdependence with other growth conditions is the rule.

Several basic facts about the science of allelopathy provide a prelude to amplifying these objectives. First, a diverse array of more than 300 secondary plant and microbial compounds representing many chemical classes have been implicated as the agents of allelopathy (Rice, 1984; Gross and Parthier, 1994; Einhellig, 1995a), and additional allelochemical are being recognized as studies of allelopathy continue. This diversity among allelochemical structures is a major hindrance to predicting their action in allelopathy (Einhellig, 1995b). Another complication is that the origin of an allelochemical often is obscure, and its biological activity may be reduced or enhanced by microbial action, oxidation, and other transformations. It is an error to assume that there must be enough of a single compound present in a field situation to affect growth of a receiving plant. Investigations of allelopathy consistently isolate several chemicals, often representing different families of compounds, from the allelopathic plant or associated soil. A variety of experiments have established that combinations of allelochemicals act additively or synergistically to inhibit growth (Table 1). This joint action is especially important because the concentration of a single substance in field situations is generally below its inhibition threshold.

Various combinations of allelochemicals may be encountered through the aqueous medium or vapor phase. Bradow and Connick (1990) reported that residues of several weeds and legume cover crops caused allelopathic interference by emissions of volatile hydrocarbons, alcohols, aldehydes, ketones, esters, furans, and monoterpenes into the soil atmosphere. They identified an array of methyl ketones and aliphatic alcohols and aldehydes in volatiles released from residues of Palmer amaranth (Amaranthus palmeri S. Wats.) and concluded that the inhibitory activity of these compounds was additive (Bradow and Connick, 1988a, b).

Possible sources of allelochemicals in the crop environment include numerous microorganisms, certain weeds, a previous crop, or the current crop. Similarity, the affected species could be microorganisms, weeds, or the crop. Bhowmik and Doll (1983) found that inhibition of corn by residues of redroot pigweed and yellow foxtail [Setaria glauca(L.) Beauv.] was influenced by photosynthetic photon flux densities (PPFD) and temperature. Residues of the weeds were less inhibitory when corn was grown under 30/20 C day/ night conditions and moderate PPFD (380-570 mol photons), as compared with lower temperature and irradiance. In contrast, inhibitory effects of the weed residues on soybean showed little response to temperature or PPFD. The higher temperature and irradiance are cloer to optimal conditions pected to minimize allelopathy. Interactive effects between irradiance and response to allelochemicals need further investigation.

MATERIALS and METHODS

In order to evaluation of the effect of plant residual on establishment of rotate crops an experiment was carried out as factorial in compeletly randomized design with 4 replications in shahrood university of technology. First factor included wheat, sugerbeet, corn and water distilled(chek) and second factor included rotate crops: wheat, corn, barly and rapeseed.The senescent residual plant of wheet, sugerbeet and corn were gently sprayed with distilled water and the leached water passing through the plants gathered. The plant residual allowed to decay for 24h in distilled water in the ratio of 1:10 w/v (plant residual : water). The extract were allowed to decay at room temperature (25 c) following which the extract . Seeds were transferred to Petri dishes containing two layers of Whatman filter paper. Germination measured from secondary days and continued until 10 days. In order to avoid water losses, edges of Petri dishes were tightly sealed with an impermeable colorless Para film. Seed were germinated when radical was 2 mm long (ISTA 1996). Germination rate was measured from Agarval method. Germination percentage was measured conforming according to International Seed Test Association (ISTA). Radical dry weight, (my plant) stem dry weight (mg plant), Root to shoot length ratio were estimated by dividing root length to shoot length . Radical length, stem length, was measured. Dry weight of seeds and seedling Parts were measured after drying samples at 70 in an oven until a constant weight is achieved. Transformation of data (Arc sin $\sqrt{x}$)

carried out with Minitab program. The data were statistically analyzed by MSTAT-C computer program..

RESULTS

Analysis of variance results are shown in table 1. Seed germination time delayed when allelochemicals added to Petri dishes and allelochemical extracted from different plants had different effects on germination of seeds. Germination percentage(%) according to Agarval method(1982) declined when allelochemicals added to petri dishes. Therefore germination process started at different times in various allelochemical solution. Sugarbeet allelochemicals declined seed germination, germination percentage, root length, shoot length, root to shoot length, root dry weight, shoot dry weight more than other plants allelochemicals and corn, wheat and distilled water were respectively. The visible effects of allelochemicals on plant processes are only secondary signs of primary changes. Therefore, studies on the effects of allelochemical on germination and/ or growth are only the manifestation of primary effects occurring at the molecular level. Although a strong tendency is being developed to look into the actual mechanism of action, the experimental work is in its infancy. The mode of action of allelochemical can broadly be divided into indirect and direct action. Indirect action may include effects through alteration of soil property, its nutritional status and an altered population and/ or activity of harmful/ beneficial organisms like microorganisms , insects, nematodes, etc. This is relatively a less studied aspect. On the other hand, the direct mode of action, which includes effects of allelochemicals on various aspects of plant growth and metabolism, has received fairly wide attention. Rotate crops had different reactions to allelochemicals and wheat had minimum reaction to allelochemicals and barely had maximum reaction.

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Table 1- Analysis of Variance

S.O.V	G.P.	G.R.	R.L.	S.L.	S.F.W.	S.D.W.	R:S
Plant allelochemical (A)	**	**	*	*	**	*	*
crops (B)	**	*	*	**	**	*	*
(A*B)	**	*	*	*	*	*	**

*, ** Significant at 5 and 1%
G.P. Germination Percentage
G.R. Germination Rate
R.L. Root Length
S. L. Stem Length
S.F.L. Seedling Fresh Weight
S.D.W. Seedling Dry Weight
Root : Shoot