

Alfalfa 식물을 이용한 생물학적 잡초방제 잠재성 평가

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BIOLOGICAL WEED CONTROL POTENTIAL ASSESSMENT BY USING ALFALFA
PLANT ON SOME WEED SPECIES

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Objectives:

To evaluate the effect of the phytotoxic substances released from alfalfa dry residue on the growth and development of some weed species, determine the effect on the toxicity of different extract methods on the weed germination and seedling growth, evaluate the effect of extract duration on weed germination, and investigate the effect of different population on weed emergence and survival was conducted.

Materials and Methods:

Dried alfalfa residues were extracted by warm (24c), cold (5c), and hot (80c) methods by shaking 15, 30, 45, and 60g with 100ml of distilled water for 24h. 30g residue was extracted by different incubation time (8, 16, 24, and 48h). Ground alfalfa residue was mixed silica sand at 0.5, 1.0, 1.5, and 2.0% (w/w). Weed emergence and survival percentage were investigated by different alfalfa population in the field. These studies were arranged in CRD with five replications. Tested weed species were lambsquarter, pigweed, velvetleaf, giant foxtail, cheatgrass, and crabgrass.

Results and Discussion:

Inhibition of weed seed germination was dependent on the extraction method, residue application rate, and weed species. The greatest inhibition of germination was 44% when 60% warm aqueous extract was applied to lambsquarter. Seedling growth also was inhibited by application at residue rates. Root length was more inhibited than increase in shoot length. The greatest inhibition of root length was 69%. Giant foxtail was the most resistant species, and lambsquarter was the most susceptible weed species to alfalfa aqueous extracts. Also, daily weed seed germination percentage decreased as incubation time increased. An extract incubated for 48h caused the greatest inhibition of velvetleaf seed germination (25%). When alfalfa dry residue was mixed with silica sand, the growth and development of lambsquarter, pigweed, velvetleaf, and crabgrass were significantly inhibited as the residue rate increased. The greatest inhibition of the total plant weight increase of pigweed was 83% at the 2.0% residue treatment. As the residue application rate increased, residue caused significant stimulation in giant foxtail and cheatgrass. The highest stimulation was 82% at the 2.0% residue treatment with cheat grass. In the field study, lambsquarter survival percentage was most inhibited by the different alfalfa density. Alfalfa plant might potentially be a natural herbicide source and that it may have an effect on weed growth and development due to the inhibitory or stimulatory effects of allelochemicals present in the residue. Many toxic substances may interact in an additive or synergistic manner to reduce or stimulate weed seed germination and growth.

Table 6.2. Seedling inhibition percentages of different concentrations of warm (24C) water dried alfalfa extracts on six weed species.

Weed Species		Concentration(%)				
		0	15	30	45	60
		Inhibition(%)				
Lambsquarter	Root	0.0a*	20.2b	38.3c	55.0d	66.7e
	Shoot	0.0a	22.7b	24.8b	33.0c	43.3d
	Total	0.0a	21.2b	32.3c	45.2d	56.2e
Pigweed	Root	0.0a	18.3b	42.1c	54.0d	69.1e
	Shoot	0.0a	16.5b	16.5b	20.6b	21.7b
	Total	0.0a	17.5b	32.7c	37.7c	48.4d
Velvetleaf	Root	0.0a	33.0b	50.5c	60.2d	70.9e
	Shoot	0.0a	3.5a	13.6b	18.2b	43.2c
	Total	0.0a	17.8b	33.5c	40.8d	58.1e
Giant Foxtail	Root	0.0a	9.5b	30.7c	35.8d	36.5d
	Shoot	0.0a	7.2ab	11.7b	11.7b	14.4b
	Total	0.0a	8.4b	22.2c	25.0c	26.6c
Cheatgrass	Root	0.0a	15.3b	31.3c	40.0d	46.0e
	Shoot	0.0a	7.4b	10.4bc	14.8c	13.3bc
	Total	0.0a	11.6b	21.4c	28.1d	30.5d
Crabgrass	Root	0.0a	28.9bc	25.8b	35.2c	43.0d
	Shoot	0.0a	6.0a	22.4b	24.1b	25.0b
	Total	0.0a	18.0b	25.4c	29.9cd	33.2d

* Values for each weed species within a row followed by the same letters are not significantly different at the 0.05 level as determined least significant difference (LSD).

Table 6.1. Germination inhibition percentages of different concentrations of hot (80C), cold (5C), and warm (24C) water dried alfalfa extracts on six weed species.

Weed Species	Method	Concentration(%)				
		0	15	30	45	60
		Inhibition(%)				
Lambsquarter	Hot	0.0a*	6.7a	14.1a	21.5a	27.6a
	Cold	0.0a	6.8a	14.7a	26.4a	34.4b
	Warm	0.0a	16.0b	28.2b	36.2b	43.6c
Pigweed	Hot	0.0a	6.3a	9.4a	18.1a	30.6a
	Cold	0.0a	9.6a	20.6b	25.6b	35.6b
	Warm	0.0a	21.3b	25.6b	33.1c	41.3c
Velvetleaf	Hot	0.0a	7.2a	14.1a	23.9a	30.8a
	Cold	0.0a	5.7ab	13.2a	28.3ab	35.2a
	Warm	0.0a	13.4b	23.9b	28.3b	41.5b
Giant Foxtail	Hot	0.0a	3.7a	9.9a	17.4a	22.4a
	Cold	0.0a	4.3a	10.6a	21.7ab	29.2ab
	Warm	0.0a	9.9b	14.3a	28.3b	37.9b
Cheatgrass	Hot	0.0a	5.0a	11.9a	18.2a	28.8a
	Cold	0.0a	6.3a	13.8ab	21.9a	30.6a
	Warm	0.0a	15.0b	22.5b	32.5b	45.0b
Crabgrass	Hot	0.0a	1.9a	7.6a	15.1a	28.9a
	Cold	0.0a	5.0a	15.1b	25.8b	34.6ab
	Warm	0.0a	13.8b	22.6c	32.7b	39.6b

* Values for each weed species within a column followed by the same letters are not significantly different at the 0.05 level as determined by least significant difference (LSD).

Table 6.4. Germination inhibition percentages produced by different incubation time on dried alfalfa residues at room temperature (24C) on six weed species.

Species	Incubation time(h)				
	0	8	16	24	48
Lambsquarter	0.0a*	-4.9ab	-8.6b	-19.0c	-20.9c
Pigweed	0.0a	-0.6a	-6.3a	-15.0a	-24.4c
Velvetleaf	0.0a	-1.9a	-6.9ab	-17.3c	-24.5d
Giant foxtail	0.0a	-1.2a	-4.4a	-13.0b	-13.7b
Cheatgrass	0.0a	-2.5a	-10.0b	-13.1b	-22.5c
Crabgrass	0.0a	-6.2ab	-7.5bc	-23.0d	-23.1d

* Values within a row followed by the same letter are not significantly different at the 0.05 level as determined by least significant difference (LSD).

Table 6.8. Effect of alfalfa residues on height, leaf area as well as shoot, leaf, root and total dry weight on giant foxtail grown in sand culture.

Residue level (W/W)	Plant height (cm)	Leaf area (cm ²)	Dry weight			
			shoot	leaf	root	total
			mg			
0.0	0.0c*	0.0d	0.0d	0.0d	0.0e	0.0e
0.5	+2.2c	+9.4c	+19.5c	+9.2d	+25.2d	+30.0d
1.0	+5.8c	+14.4c	+31.2c	+14.3c	+47.9c	+54.4c
1.5	+22.9b	+28.0b	+60.4b	+25.7b	+73.1b	+64.8b
2.0	+36.0a	+50.7a	+84.6a	+51.2a	+89.1a	+93.5a

* Values within a column followed by the same letter are not significantly different at the 0.05 level as determined by least significant difference (LSD).

Table 6.11: Emergence and survival percentage of lambsquarter by the different alfalfa density treatment in the field.

Density (Seedling/m ²)	Emergence (10 DAP)		Survival (20 DAP)	
	Emergence	Survival	Emergence	Survival
0.00	64.3a	60.0ab	87.6a	74.1b
50	60.0ab	56.8b	60.3c	51.4cd
100	56.8b	55.0bc	51.4cd	43.2d
150	55.0bc	51.5c		
200	51.5c			