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Role of Two Irrigation Water Sources in Composing Weed Flora of Bean Fields in Erzincan Province

Türkçe Başlık: *Erzincan İli Fasulye Tarlalarındaki Yabancı Ot Florası ve Yoğunlukları Üzerine İki Farklı Su Kaynağı ile Sulamanın Etkisi*

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ÖZET

Birçok yabancı ot türü kazara yeni bölgelere girmekte ve bunlardan bazıları doğal bitki örtüsünün bir parçası haline gelmektedir. Erzincan yöresinde istilacı yabancı ot türlerini belirlemek ve yabancı ot florası üzerinde tarımsal uygulamaların etkisini belirlemek amacıyla, 1999 yılında kanal (uzak mesafeden gelen) (5 tarla) ve kaynaktan (kısa mesafeden gelen) (4 tarla) sağlanan iki su kaynağının sonuçları karşılaştırılmıştır. Kanal suyu ile sulanan fasulye alanlarında 29 farklı yabancı ot türü belirlenirken, kaynak suyu ile sulanan fasulye alanlarında 18 farklı yabancı ot türü tespit edilmiştir. Köygöçüren (*Cirsium arvense* (L.) Scop.), yabani hardal (*Sinapis arvensis* L.), boğumlu çobandeğneği (*Polygonum lapathifolium* L.), italyan sığırdili (*Anchusa azurea* Miller) ve yapışkan kazayağı sadece kaynak suyu ile sulanan fasulye tarlalarında belirlenirken, kanal suyu ile sulanan fasulye tarlalarında ise dar yapraklı horoz ibiği (*Amaranthus graecizans* L.), sürünücü horoz ibiği (*Amaranthus blitoides* S. Watson), bozot (*Heliotropium europaeum* L.), bambul otu (*Chrozophora tinctoria* (L.) Rafin.), demir dikeni (*Tribulus terrestris* L.), ufak çayır güzeli (*Eragrostis minor* Host.), adi soda otu (*Salsola kali* L.), yemlik (*Tragopogon* sp.), sütlü sarmaşık (*Cynanchum acutum* L.), tarhana otu (*Echinophora tenuifolia* L.), kokulu sarı yonca (*Melilotus officinalis* (L.) Desr.), boz tarla sarmaşığı (*Convolvulus galaticus* Rostan ex Choisy), sofora (*Sophora alopecuroides* L.), kekre (*Acroptilon repens* (L.) DC.) ve sütleğen (*Chamaesyce glyptosperma* (Engelm.) Small) tespit edilmiştir. Kanal suyu ile sulanan fasulye tarlalarında semizotu (*Portulaca oleracea* L.), kırmızı köklü tilki kuyruğu (*Amaranthus retroflexus* L.), köpek dişi ayrığı (*Cynodon dactylon* (L.) Perss.), tarla sarmaşığı (*Convolvulus arvensis* L.), yabani bamya (*Hibiscus trionum* L.), akhindiba (*Chondrilla juncea* L.), darıcan (*Echinochloa crus-galli* (L.) P. Beauv) ve akkazayağı (*Chenopodium album* L.) en yaygın türler olarak belirlenmiştir. Kaynak suyu ile sulanan fasulye alanlarında ise yabani bamya (*H. trionum*), akkazayağı (*C. album*), horoz ibiği (*A. retroflexus*), semizotu (*P. olarecea*), köpek dişi ayrığı (*C. dactylon*), köpek üzümü (*Solanum nigrum* L.), yeşil kirpi darı (*Setaria viridis* (L.) P. Beauv), tarla sarmaşığı (*C. arvensis*) ve darıcan (*E. crus-galli*) en yaygın türler olarak saptanmıştır.

Anahtar kelimeler: Fasulye, yabancı ot, su kaynakları

ABSTRACT

Many weed species are accidently introduced to new regions and some of them become component of natural flora. In order to identify invasive weed species in Erzincan Province and to determine the influence of agricultural practices on the distribution of weed flora; two sources of irrigation water [spring (4 fields) and canal (5 fields)] were compared in 1999. In spite of 29 weed species were recorded in bean fields irrigated by canal water, 18 weed species were identified in bean fields irrigated by spring water. Canada thistle (*Cirsium arvense* (L.) Scop.), wild mustard (*Sinapis arvensis* L.), pale smartweed (*Polygonum lapathifolium* L.), garden anchusa (*Anchusa azurea* Miller) and jerusalem goosefoot (*Chenopodium botrys* L.) were only recorded in the fields receiving spring water. Likely, spreading pigweed (*Amaranthus graecizans* L.), prostrate pigweed (*Amaranthus blitoides* S. Watson), common heliotrope (*Heliotropium europaeum* L.), turnsoler weed (*Chrozophora tinctoria* (L.) Rafin.), puncture vine (*Tribulus terrestris* L.), little love grass (*Eragrostis minor* Host.), russian thistle (*Salsola kali* L.), goat's beard (*Tragopogon* sp.), swallow wort (*Cynanchum acutum* L.), prickly parsnip (*Echinophora tenuifolia* L.), yellow sweet clover (*Melilotus officinalis* (L.) Desr.), wild morning-glory (*Convolvulus galaticus* Rostan ex Choisy), sophora (*Sophora alopecuroides* L.), russian knapweed (*Acroptilon repens* (L.) DC.) and ribseed sandmat (*Chamaesyce glyptosperma* (Engelm.) Small) were found in the fields irrigated by canal water. The most frequently recorded weed species in canal water irrigated fields were common purslane (*Portulaca oleracea* L.), redroot pigweed (*Amaranthus retroflexus* L.), bermuda grass (*Cynodon dactylon* (L.) Perss.), field bindweed (*Convolvulus arvensis* L.), venice mallow (*Hibiscus trionum* L.), rush skeletonweed (*Chondrilla juncea* L.), barnyard grass (*Echinochloa crus-galli* (L.) P. Beauv) and lamb's quarters (*Chenopodium album* L.). Similarly, venice mallow (*H. trionum*), lamb's quarters (*C. album*), redroot pigweed (*A. retroflexus*), common purslane (*P. olarecea*), bermuda grass (*C. dactylon*), black nightshade (*Solanum nigrum* L.), green foxtail (*Setaria viridis* (L.) P. Beauv), field bindweed (*C. arvensis*) and barnyard grass (*E. crus-galli*) were the most commonly observed weed species in spring irrigated bean fields. It is concluded that different sources of irrigation water can exert significant effects on the composition of natural weed flora at regional scales. Therefore, proper management options must be employed keeping in view the sources of irrigation water used in a particular region.

Keywords: Bean, weed, sources of water, Turkey

Introduction

Weeds are always present in agro-ecosystems, and alternative control methods have been used to control them in different crops (Powell and Justum, 1993). However, many seeds of exotic species are accidently introduced into new regions and some of them may settle and become component of the natural flora (Jauzein, 1998; Maillet and Lopez-Garcia, 2000).

In the Western United States and other areas where irrigation is common, seeds of many weed species are dispersed by water. In Nebraska, Wilson (1980) found seeds of 77 different plant species in three main irrigation canals over two seasons. Researcher collected a total of 30346 seeds of which approximately 30% were viable, and about 26 times more seeds were found at the tale than beginning of canals. Most seeds floated over long disatnces, and redroot pigweed was 40% of the total seed. Researcher also estimated that 120000 seeds per acre per year entered fields from irrigation water. In the Western U.S. alone, surface water irrigates more than 7.7 million hectares each year and is an often unrecognized source of weeds in irrigated fields.

The objective of this study was to determine the role of two different sources of irrigation for causing weed infestation in bean fields of Erzincan province, Turkey.

Materials and Methods

Field surveys were carried out in bean (*Phaseolus vulgaris* L.) fields irrigated by canal (5 fields) and spring water (4 fields) in Erzincan province in 1999.
The bean fields were randomly selected and sampling procedure was made depending on field size. The number of quadrates (1 m^{-2}) thrown in a field varied depending on field size; i.e., 3 for 1-5 da^{-1}, 6 for >5 da^{-1}.

All weed species in each quadrate were recorded and counted in the field. In order to eliminate the influence of field edge on survey, sampling was conducted inside of the fields. In addition, frequency and density of each observed weed species were calculated according to Odum (1971).

$$\text{Frequency } (\%) = \frac{\text{Number of frames where a species occurred}}{\text{Number of total frames}} \text{ x } 100$$

$$\text{Density of species (plants } m^{-2}) = \frac{\text{Total number of each species}}{\text{Number of total frames}}$$

Similarity index between two sources of irrigation water were calculated by using SI = (2C/(A+B)) x 100 equation (Odum 1971).

Here;

SI : Similarity index

A : Number of weed species in the irrigated fields by spring water

B : Number of weed species in the irrigated fields by canal water

C : Number of similar weeds species in both fields irrigated by different sources of irrigation water.

The weed species were identified following Flora of Turkey and the East Aegean Islands (Davis, 1965-1988).

Results and Discussion

The number of weed species was found absolutely different in both areas. A total of 18 weed species were recorded in the irrigated fields by spring water (Table 1), whereas, 29 weed species were identified in the fields irrigated by canal water (Table 2). In both surveyed fields, some weed species couldn't be recognized in species level. The highest weed densities were found in the bean fields irrigated by spring water, and the lowest in the fields irrigated by canal water.

Seeds are known to be dispersed by run-off in drainage or irrigation ditches (Wilson 1980, Hope, 1927). Comes *et al*. (1978) found 82 species in irrigation water in Washington.

Surface irrigation water has also been shown to transport many kinds of weed seed into croplands. A study conducted in western Nebraska showed that surface irrigation water could contain seeds of up to 77 different kinds of weed species and deposit 9 seeds per square yard, or approximately 38000 seeds per acre during an irrigation season (Wilson, 1980). The removal of weed seeds from irrigation water with seed screens and the control of weeds on ditch-banks provide an effective way to reduce weed seeds in irrigation water.

Weed density is other way to explain changes in weed flora in a certain area. Weed seeds can be introduced as contaminants of crop seeds or irrigation water. According to density, the most common species in fields irrigated by canal water were *Portulaca olaracea* L., *Amaranthus retroflexus* L., *Cynodon dactylon* (L.) Pers., *Convolvulus arvensis* L., *Hibiscus trionum* L., *Chondrilla juncea* L., *Echinocloa crus-galli* (L.) P. Beauv. and *Chenopodium album* L. (Table 1). In the others fields irrigated by spring water, it was found that *Hibiscus trionum* L., *Chenopodium album* L., *Amaranthus retroflexus* L., *Portulaca oleracea* L., *Cynodon dactylon* (L.) Pers., *Solanum nigrum* L., *Setaria viridis* (L.) P.B., *Convolvulus arvensis* L. and *Echinocloa crus-galli* (L.) P. Beauv. were common (Table 2).

Table 1. Scientific names of weeds, average density, average cover (%) and frequency (%) in the bean fields irrigated by spring water in Erzincan Province.

Weed Species	**AD (number m^{-2})**	**AC (%)**	**F (%)**
Amaranthus retroflexus L.	7.33	1.72	66.67
Anchusa azurea Miller	0.11	0.06	5.56
Chenopodium album L.	10.89	1.72	55.56
Chenopodium botrys L.	0.06	0.06	5.56
Chondrilla juncea L.	0.94	0.78	33.33
Cirsium arvense (L.) Scop.	0.61	0.61	16.67
Convolvulus arvensis L.	2.06	3.06	55.56
Cynodon dactylon (L.) Pers.	4.44	7.17	27.78
Echinochloa crus-galli (L.) P. Beauv.	1.72	2.11	27.78
Euphorbia falcata L.	0.06	0.11	5.56
Hibiscus trionum L.	13.89	4.00	94.44
Medicago sativa L.	0.06	0.11	5.56
Polygonum lapathifolium L.	0.06	0.56	5.56
Portulaca oleracea L.	5.56	1.28	50.00
Setaria viridis (L.) P. Beauv.	2.44	1.83	33.33
Sinapis arvensis L.	0.11	0.11	11.11
Solanum nigrum L.	4.00	1.61	83.33
Sonchus oleraceus L.	0.22	0.22	22.22
Total	54.56	27.11	

AD = average density, AC = average cover, F = frequency

The common species were *H. trionum S. nigrum*, *A. retroflexus*, *C. arvensis*, *C. album* and *P. oleracea* in the fields irrigated by canal water, and *A. retroflexus*, *C. dactylon*, *H. trionum*, *P. oleracea* and *E. crus-galli* in the spring water irrigated fields.

The species having highest percentage coverage were; *C. dactylon*, *H. trionum*, *C. arvensis* and *E. crus-galli* in the fields irrigated by spring water, and *C. dactylon*, *A. retroflexus*, *P. oleracea*, *C. arvensis*, *Amaranthus graecizans* L. and *H. trionum* in the fields

irrigated by canal water.

Cirsium arvense (L.) Scop., *Sinapis arvensis* L., *Polygonum lapathifolium* L., *Anchusa azurea* Miller and *Chenopodium botrys* L. were only found in the fields irrigated by spring water. Although, *Amaranthus graecizans* L., *Amaranthus blitoides* S. Watson, *Heliotropium europaeum* L., *Chrozophora tinctoria* (L.) Rafin., *Tribulus terrestris* L., *Eragrostis minor* Host., *Salsola kali* L., *Tragopogon* sp., *Cynanchum acutum* L., *Echinophora tenuifolia* L., *Melilotus officinalis* (L.) Desr., *Convolvulus galaticus* Rostan ex Choisy, *Sophora alopecuroides* L., *Acroptilon repens* (L.) DC. and *Euphorbia glytosperma* Engelm. were found in the fields irrigated by canal water.

Table 2. Scientific names of weeds, average density, average cover (%) and frequency (%) in the bean fields irrigated by canal water in Erzincan Province.

Weed Species	**AD (number m^{-2})**	**AC (%)**	**F (%)**
Acroptilon repens (L.) DC.	0.28	1.20	4.00
Amaranthus blitoides S. Watson	0.08	0.2	8.00
Amaranthus graecizans L.	0.32	3.6	8.00
Amaranthus retroflexus L.	10.76	7.12	56.00
Chenopodium album L.	1.08	1.00	36.00
Chondrilla juncea L.	1.52	1.12	20.00
Chrozophora tinctoria (L.) Rafin.	0.36	0.72	16.00
Convolvulus arvensis L.	2.40	4.16	36.00
Convolvulus galaticus Rostan ex Choisy	1.44	2.80	24.00
Cynanchum acutum L.	0.32	0.40	4.00
Cynodon dactylon (L.) Pers.	5.36	9.72	56.00
Datura stramonium L.	0.08	0.80	4.00
Echinochloa crus-galli (L.) P. Beauv.	1.48	1.20	44.00
Echinophora tenuifolia L.	0.96	1.20	24.00
Eragrostis minor Host.	0.16	0.24	12.00
Euphorbia falcata L.	0.08	0.32	8.00
Euphorbia glytosperma Engelm.	0.12	0.20	4.00
Heliotropium europaeum L.	0.48	0.76	20.00
Hibiscus trionum L.	1.68	3.44	52.00
Medicago sativa L.	0.12	0.20	4.00
Melilotus officinalis (L.) Desr.	0.08	0.16	8.00
Portulaca oleracea L.	12.20	6.72	44.00
Salsola kali L.	0.08	0.08	8.00
Setaria viridis (L.) P. Beauv.	0.52	0.28	16.00
Solanum nigrum L.	0.48	0.44	20.00
Sonchus oleraceus L.	0.12	0.24	8.00
Sophora alopecuroides L.	0.08	0.20	4.00
Tragopogon sp.	0.28	0.20	4.00
Tribulus terrestris L.	0.24	0.28	20.00
Total	43.16	49.00	

AD = average density, AC = average cover, F = frequency

Weed similarity index between two irrigation resources was 55.32 %.

Density and composition of weed flora are strongly affected by crop production systems and agricultural practices. Zengin (1999) determined 71 different weed species belonging to 20 families with an intensity of 48.44 weed per square meter in bean fields in Erzurum province. Twenty-seven different weed species belonging to 13 families in bean fields in Erzincan provinces were also found in another study (Zengin, 1998). Additionally, the weed species having higher infestation rate and density were found as follows; *H. trionum, C. dactylon, A. retroflexus, E. crus-galli, S. nigrum, C. arvensis, C. album, X. strumarium, C. juncea and Anethum graveolens* (L.) Dill. (Saltabaş and Zengin, 2001).

Water from canals and ditches is almost always contaminated with weed seeds. Irrigating with this water continually adds weed seeds to the fields. Screens or filters can reduce, but not totally eliminate the introduction of weed seeds from the contaminated water sources. Irrigating from wells or culinary systems may eliminate this problem, but are often quite expensive.

The ripe fruitlets have also been observed to be transported by irrigation waters (Hope, 1927).

Weed seed can be introduced as contaminants of crop seed or irrigation water. If possible use certified crop seed that has been tested for the presence of weeds. Irrigation water can be a source of weed seed. Some weed seeds can survive for long periods of time in water. Excluding weed seeds by filtering or screening irrigation water before using on vegetable crop. Destroying stands of problematic weeds along irrigation ditches and field borders can reduce the potential for introducing weeds into the field or a water source.

If weeds are introduced, they should be eliminated at first observation before the spread and infestation. Scouting is very important for identifying these new infestations, because it is far easier to control, for example, managing a five feet patch of a newly observed weed is much easier to manage than a whole infested field. Intensive management techniques such as hand-weeding, or spot treatments with herbicides, can also be used to eliminate the small infestations.

Weeds interfere with water management in irrigated agriculture. Water is consumed and flow is impeded by weeds growing in and along irrigation ditches. Weeds consume water intended for crops, cause water loss by evaporation and transpiration, and reduce water flow in irrigation ditches (Özer et al., 2001).

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