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G86-807 Where Do Weeds Come From?

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Where Do Weeds Come From?

This NebGuide discusses weed seed entry and loss from the soil, and provides examples of the density and diversity of the soil weed seed population.

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Weed Seed in the Soil

Most weeds owe their beginning to seed in the soil. The soil acts as a seed storage reservoir and a growth medium for weedy plants. The kind or species and numbers of seed in the soil is closely linked to the cropping history of the land. Grasslands contain seed associated with grassland plants and cropland contains seed affiliated with weeds growing on cultivated land. Grasslands that have been cultivated and then reseeded to grasses generally contain mixed weed populations.

When grassland is cultivated, the seed in the soil changes rapidly. In a study conducted in Washington State, grassland soils initially contained seed of 12 weeds, with seed of slimleaf lambsquarters and annual bursage accounting for 90% of the seed. After cropping the land for five years, the dominance of these seed declined to 8% of the total. Barnyardgrass, common lambsquarters, and pigweed seed increased to 90% of the seed in the soil.

The number of seed in the soil is variable and may range from 2 seeds per pound of surface soil in grassland to 140 seeds per pound of surface soil in cropland. In western Nebraska an average cropland soil contained 114 seeds per pound of surface soil. On a per acre basis, the seed content approached 200 million seeds per acre. Nineteen different species were found, with the seed generally fitting one of three groups. Group I consisted of redroot pigweed and common lambsquarters, and accounted for 86% of seed found. Group II accounted for 13% of the seed, and was primarily barnyardgrass, yellow foxtail, hairy nightshade, and common purslane. Group III was comprised of the remaining 13 species, and accounted for 1% of the seed found. The fact that two to four species will dominate the soil seed population is not unusual and seems to be fairly common. The dominate species will vary with region and type of cropping.

In grasslands a majority of the weed seed is located within 1 inch of the soil surface, while in cultivated soil the majority of the seed is located in the upper 6 inches of soil.

Studies have compared the distribution of seed in the soil following different methods of seedbed preparation. When the soil was annually plowed, seed was distributed in the upper 12 inches of the soil profile with 25% of the seed in the upper 0 to 3 inches. When a ridge planting system was used with reduced tillage of the soil, 50% of the weed seed was located in the upper 3 inches of the soil profile.

The popularity of no-tillage or reduced tillage systems of crop production is increasing, and as the intensity of tillage declines, the weed seed distribution in the soil moves closer to the soil surface. The weed seed is then in a more favorable position to germinate and interfere with crop production, or seedlings can be killed with tillage or herbicides.

Loss of Seed From the Soil

Seeds are lost from the soil due to feeding by rodents and insects, decay, or germination. The length of weed seed survival depends on the species, depth of burial, and tillage. Seeds from some weeds may only survive a year when buried in the soil, while others will remain viable for 30 years or more (*Table D*). Seeds tend to germinate more readily when they are buried close to the soil surface. As the depth of burial increases, the rate of seed decay declines. As soils are cultivated, seeds are exposed to light and moved closer to the soil surface, stimulating germination. If weed seed production is prevented, weed seed can be lost from the soil at a rate of 25% per year in cultivated soil and 12% per year in undisturbed soil. If soil moisture is good and soil temperatures are above 50°F, each cultivation of the soil may stimulate 0.5 to 6% of the weed seed in the soil to germinate. The quickest way to reduce seed numbers is to practice shallow tillage and prevent weeds from producing seed.

Cropping history plays an important role in weed seed decline and the species of seed present. In experiments conducted across Nebraska, weed seed decline was examined in continuous corn where atrazine was combined with cultivation for five consecutive years. After five years of preventing weeds from producing seed, the weed seed density was reduced 95%. During the sixth year, weed control efforts stopped and the weed seed density began to rapidly increase. Weed control must be continually practiced to prevent an increase of weed seed content in the soil.

Introduction of Weed Seed Into the Soil

Seed is introduced to the soil through several avenues, with the chief source being the production of seed by weeds allowed to mature. A single redroot pigweed or common lambsquarters growing without competition can produce approximately 70,000 seeds (*Table I*). Weed seed can also enter a field from outside sources, with the primary seed dispersal methods being wind, water, animals, and man. Wind easily blows seeds from plants such as kochia and thistle, thereby distributing them. Weeds growing along field margins mature and weed seed is easily carried into fields. Controlling weeds along field margins is an inexpensive way of reducing the introduction of new weed species.

Surface irrigation water has also been shown to carry many kinds of weed seed into cropland. A study conducted in western Nebraska showed that surface irrigation water could contain up to 77 different kinds of weed seed and deposit 9 seeds per square yard, or approximately 38,000 seeds per acre during an irrigation season. The removal of weed seed from irrigation water with seed screens and the control of weeds on ditch-banks provides an effective way to reduce weed seed in irrigation water.

Man also introduces weed seed into cropland. As crop seed is planted, weed seed is often a contaminant.

A wheat drill box study conducted in Kansas in 1984 indicated that 29% of the 662 wheat samples analyzed contained weed seed. In a similar survey conducted in Nebraska, 95% of the bin run alfalfa seed sampled contained weed seed. Each pound of alfalfa seed contained an average of 400 weed seeds per pound. If the alfalfa seeds are planted at a rate of 10 pounds per acre, approximately 4000 weed seeds will have been planted per acre.

Combines also play an important role in spreading weed seed. Jointed goatgrass was spread throughout most of the wheat belt as custom combine crews moved north with the wheat harvest. On a smaller scale, as a farmer combines his crops and moves from field to field, he may contaminate the entire farm with numerous weed seeds.

Many weed seeds pass through the digestive tracts of animals and remain viable. Results of feeding weed seed to five different types of animals have shown that an average of 14% of the seed fed remained viable. When manure is used to fertilize cropland, weed seeds are systematically introduced across fields.

Of the avenues of seed introduction discussed, the production of seed by mature plants in the field introduces the largest quantity of seed into the soil. The dissemination of seed by water, wind, man, and animals is of importance in introducing new species to an area. Once the species has been introduced, if the seed germinates and the seedling develops and matures, the seed produced will be added to the seed bank.

Table I. Examples of weed seed production and length of seed survival in soil of weeds found in Nebraska.

Weed species	Number of seeds^a produced/plant	Length of seed^b survival in undisturbed soil (years)
Ball mustard	490	10
Canada thistle	680/stem	21
Common cocklebur	900	8
Common lambsquarters	72,450	39
Common mullein	223,200	39
Common purslane	52,300	30
Common ragweed	3,380	39
Common sunflower	7,200	8
Curly dock	29,500	39
Curlycup gumweed	29,700	10
Dandelion	15,000	6
Devils beggarticks	7,000	10
Downy brome	700	2
Field pennycress	7,000	8
Great burdock	31,600	21
Green foxtail	34,000	39

Longspine sandbur	1,000	7
Pennsylvania smartweed	19,300	30
Prickly lettuce	27,900	9
Redroot pigweed	117,400	10
Shattercane	2,000	13
Sheperdspurse	38,500	16
Velvetleaf	2,000	10
Wild oats	250	1
Yellow foxtail	6,420	30
^a Amended from: Stevens, O. A. 1954. "Weed seed facts," N. Dak. Agr. Coll. Ext., Cir., A-218, 4 pages. ^b Amended from: Toole, E. H. and E. Brown. 1946. "Final results of the Duvel buried seed experiment." J. Agri. Res., 72, 201-210.		

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