

Alfalfa Production and Pest Management in South Dakota



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The South Dakota Project of the North-Central Pest Management Center is an integrated agricultural program conducted at South Dakota State University by the South Dakota Cooperative Extension Service and the South Dakota Agricultural Experiment Station, Plant Science Department. The South Dakota program is part of the North-Central Pest Management Center, one of four regional pest management centers which developed from the former National Agricultural Pesticide Impact Assessment Program (NAPIAP). The U.S. Department of Agriculture established NAPIAP in 1976 with an overall mission of promoting informed regulatory decisions concerning registered pesticides. The Pest Management Centers continue to pursue this mission through management and coordination of state activities. Center scientists develop, compile, and analyze information on pesticide use and pest control practices; determine impacts of pesticide regulations on agricultural productivity, the supply of agricultural products, and product prices; and address pest control issues related to human health and the environment.



Pest Management Center

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CONTENTS

Crop Profile for Alfalfa and Other Hay Production in South Dakota	5
General Production Information	
Description, Cultural Practices and Integrated Pest Management	6
Description	6
Cultural practices	6
Pest Management/ Integrated Pest Management	6
 Insect pests	7
Alfalfa Weevil	7
Variegated Cutworm and Army cutworm	9
Potato Leafhopper	10
Aphids	11
Grasshoppers	12
Blister Beetle	12
Lygus Bug	12
 Diseases	14
 Rodents	14
 Photo credits	15
 References	15
 Key contact personnel	15

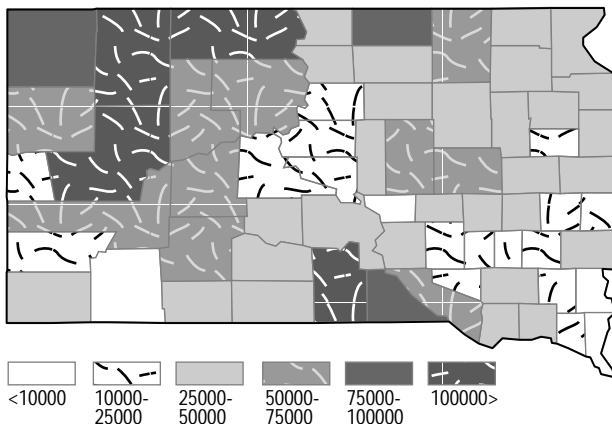
Crop Profile for Alfalfa and Other Hay Production in South Dakota

General Production Information

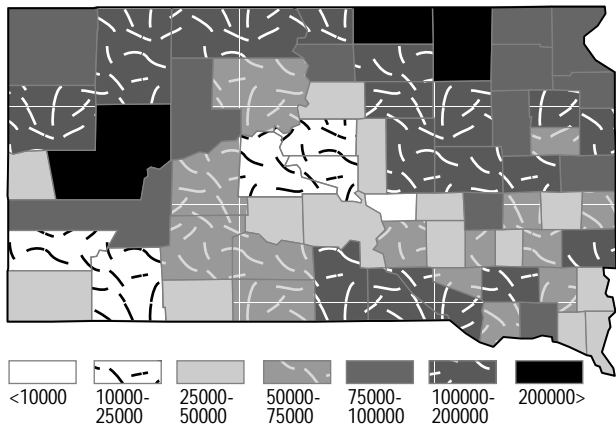
- During 2001, South Dakota ranked second in the nation in production of alfalfa hay, harvesting approximately 6.6 million tons. Only California with approximately 7.3 million tons had greater alfalfa hay production during 2001. South Dakota ranked third in 2000 (5.4 million tons).
- During 2001, South Dakota ranked second in the nation in all hay production, with approximately 9.2 million tons produced. Texas led in total hay, producing 10.8 million tons of all types of hay during 2001.
- South Dakota ranked seventh in the U.S. in hay production other than alfalfa hay during 2001.
- Alfalfa is grown for hay on a statewide basis. For the nine crop reporting districts, Agricultural Statistics Service data show that all districts, with the exception of the Southwest, harvest alfalfa acreage equal to or greater than 225,000 acres.
- Statewide harvested acres of alfalfa hay are most numerous in the Northwest District, with 506,000 acres harvested in 2000. The West-Central District (384,000 harvested acres) and the North-Central District (354,000 harvested acres) are also significant production areas.
- Statewide total harvested acres of alfalfa hay were 2.65 million acres in 2000, up from 2.4 million in both 1998 and 1999.

- Average statewide yield was 2.05 tons of alfalfa hay per acre in 2000, down from the 2.8 tons per acre average yield in 1999. Highest production per acre is in the Northeast District, where the average was 3.04 tons per acre in 2000. The Southeast District led production in 1999, with 3.91 tons per acre.
- Acreage of hay crops other than alfalfa is greatest in the Central, South-Central and North-Central districts, with over 638,000 acres harvested for hay in these combined areas.
- Statewide average yield per acre for other hay production was 1.40 tons per acre during 2000, with average production ranging from a high of 1.87 tons per acre in the North-Central to 1.08 tons per acre in the South-Central.
- Primary pests of alfalfa and other hays in the state include alfalfa weevil, grasshoppers, perennial broadleaf weeds, and pocket gophers.
- Average price received for alfalfa hay was \$70 per ton in July, 2001, up \$11 from 2000. Average price received for other hay was \$45 per ton in 2000, up from \$35 per ton in 1999.
- Total cash receipts from the sale of all hay in South Dakota during 1999 was \$111,935,000. This represented 2.6% of total farm cash receipts for the year.

Alfalfa Hay, Acres Harvested- Year 2000



Alfalfa Hay Production, Tons- Year 2000



Description, Cultural Practices and Integrated Pest Management

Description

Alfalfa is a herbaceous perennial forage crop in the plant family *Medicago*. Alfalfa is well adapted to growing conditions in South Dakota if a variety with good winter hardiness has been selected. Several vegetative stems are produced from the crown during each growth cycle, and the plant has a deep, branched taproot system that allows it to produce acceptable forage yields, even under relatively dry conditions.

South Dakota is one of the leading alfalfa growing states in the U.S., annually producing more than six million tons of alfalfa hay for all uses.

Cultural Practices

Alfalfa is generally grown as a perennial crop in South Dakota, with fields kept in production for an average 5.66 years before replanting (Ruden, 2001). It is primarily a dryland crop, but irrigated alfalfa is common in some regions.

New alfalfa plantings are established most often in the spring as soon as soil temperatures have risen, usually during April. Other producers prefer to fall plant. In either case, seedbeds are generally tilled fields and must be firm. The seed must be placed properly and have excellent seed-to-soil contact to establish a successful stand. Usually, between 15 and 20 pounds of pure live seed per acre are planted.

Alfalfa may be clear seeded with or without the addition of selective herbicides, or it may be planted with a "nurse" crop, traditionally oats. The nurse crop provides rapid soil protection and chokes out early weed growth. The nurse crop is often cut early for forage, usually at the milk stage of reproductive growth, providing high quality forage and allowing the alfalfa to grow and spread. Selective herbicides can be used to kill the nurse crop after a few weeks of establishment.

Alfalfa is also commonly raised as a mixed forage crop along with a stand of native or improved grass hay. A recent survey by the South Dakota Project of the North-Central Pest Management Center (SD-NCPMC) indicated that approximately 68% of the producers questioned maintained stands of pure alfalfa hay and 43% also had mixed alfalfa/grass hay.

Alfalfa, being a leguminous crop, generally does not require additional inputs of nitrogen for adequate growth. However, addition of phosphate and potassium fertilizers can significantly increase forage production and quality.

Alfalfa production systems vary in South Dakota from one region of the state to the other. The crop is both a feed source for livestock and a marketable commodity for cash sales.

Some alfalfa growers concentrate on producing quality hay or dairy-quality hay for marketing. Most alfalfa for this purpose is grown in the Southeast and East-Central crop districts and under irrigation in the Northwest district. Quality hay is most often marketed as forage hay; however, some is channeled into processed pellet production.

A second focus is alfalfa seed production in a small region centered in the North-Central district of the state. Here the crop is generally raised under dryland conditions.

Alfalfa in the balance of the state is grown as a feed source for the local livestock industry, which consists primarily of beef and sheep. No organic alfalfa enterprises were found in recent surveys.

Generally, one to four cuttings are taken per year, depending on location. Producers in western parts of the state often can harvest only one cutting due to low rainfall. Southeast South Dakota usually can support four and occasionally five cuttings per year. Highest quality hay is taken when alfalfa plants are in pre-bud to early bud stages of development.

Pest Management/ Integrated Pest Management

What the producer intends to do with the alfalfa after harvest will somewhat determine the vigor with which pest management is approached.

If alfalfa is to be marketed as quality hay or alfalfa products, there will be greater emphasis on managing and controlling pests, such as insects, weeds, and diseases. If the intention is to use the crop for seed production, then weeds and seed-damaging insects such as grasshoppers are more

important than if the crop is to be used for livestock feed. Producers responding to a recent pest management survey stated that weeds and insects were nearly of equal concern, with diseases and rodent management ranking as lesser issues.

The most common pest of concern in alfalfa in recent years is the alfalfa weevil. Populations of this pest have had major economic impact in the last four to five years for the central north-south corridor of counties in the state.

Traditionally, weevils had been more of a problem in the southwest and south-central areas of the state. In these areas, producers commonly managed the weevils by cultural/mechanical means including early harvest, light tillage of fields in early spring, and burning/flaming fields. In recent years, heavy weevil infestations in the central counties of South Dakota have caused producers to turn to chemical insecticides and early harvest as primary weevil management tools.

A biological control program involving release of parasitic wasps for alfalfa weevil was started in 1957 in South Dakota and continued through 1988. There are two strains—eastern and western— of alfalfa weevils in the state. Most of the parasitic wasps were specific to the eastern strain, allowing the western weevils to increase. Consequently, this biological control has become less effective in recent years.

Chemicals used for control of insect pests of other crops also have had a negative effect on parasitic wasp populations.

Other alfalfa insects of concern include variegated cutworm, potato leafhopper, aphids, blister beetles, grasshoppers, and occasionally lygus bugs.

Weed control has become more of an issue as more quality alfalfa has been marketed by South Dakota producers. The two major time frames for weed control are establishment (primarily for annual grass control) and mature stands (to aid in stand persistence). Weeds of concern in established stands include the winter annuals (mustards and cheatgrasses) and perennial weeds such as dandelion and Canada thistle. Alfalfa dodder is also a concern in the seed growing area.

Alfalfa diseases have not been a major problem. There are, however, localized outbreaks of seedling diseases, foliar diseases (leaf spot), stem/crown rots, and wilt diseases, with environmental conditions determining the severity of the problem. Normally, drier conditions during the growing season and alfalfa's long winter dormancy keep diseases in check.

Rodent control, specifically for the pocket gopher, is becoming more of a problem in the northern area of the state. Many producers manage this pest with crop rotation, traps, and approved rodenticides.

Producers have used an integrated approach to pest management in alfalfa for many years. These strategies started well over 40 years ago, continue in use today, and will be valuable for many years to come.

Insect Pests

Alfalfa Weevil

Surveys show that, for every year since 1998, alfalfa weevils have become a primary concern for alfalfa producers (Ruden, 2001).

History

The alfalfa weevil (*Hypera postica*) was first detected in Utah in 1904, and 32 years later it showed up in southwestern South Dakota. A strain originating on the East Coast may have entered southeastern South Dakota in 1972. The alfalfa weevil is currently present in all counties in the state (Catangui, 2001).

Eastern and western strains are identical in ap-

pearance but can be separated by cross-mating experiments and by examining their reproductive cells. If cross-mated in the laboratory, the alfalfa weevil strains will not reproduce normally.

Management of both strains is identical, for all practical purposes. However, strain determination was important during the releases of parasitic wasps in the 1980s. Some parasitic wasps were efficient predators only on one alfalfa weevil strain and not on the other.

Alfalfa weevils often reach economic numbers in the central north-south corridor of counties in South Dakota. For some unknown reason, alfalfa



Figure 1. Alfalfa weevil adult (left), larvae (center), and pupae in cocoon (right). Alfalfa weevils can reach economically damaging populations in South Dakota alfalfa.

weevils are usually not a problem in eastern South Dakota. Perhaps there are natural enemies here that keep the weevils from reaching economic numbers. Parasitic wasps and a bacterial disease are known to affect alfalfa weevil populations.

Biology

Alfalfa weevils overwinter as adults under soil clods and plant residues in the field, in shelter belts, and in ditches and along fence lines. Adult

weevils are about 3/16 inch long and brown in color, with a dark triangular marking on the back. In the spring, an adult female bores a hole on an alfalfa stem and inserts her eggs. Eggs are bright yellow and can be seen with the naked eye if an infested stem is split open. Each hole may contain 1 to 25 tiny eggs, and each female can lay between 500 to 2,000 eggs during her life span.

In South Dakota, alfalfa weevil larvae can typically be seen in the field from late April to early June, making them mainly pests of first cutting alfalfa. Hatching is not simultaneous; hence, larvae of different sizes will be found.

Larvae are voracious consumers of leaf tissues. They do not consume entire leaves but rather "skeletonize" them, leaving the stems and leaf veins intact. Infested plants take on a whitish or "frosted" appearance when viewed from a distance.

From late May to early June, larvae stop feeding and drop to the soil to transform into cocoons, which look like tiny white balls of woven silk around pieces of dried alfalfa leaves. After about two weeks, adult weevils emerge from the cocoons. Adults generally do not cause economic

Insecticides- Alfalfa weevil

Brand name	Active ingredient	Product per acre	Pre-harvest interval (days)
Ambush *	permethrin	6.4-12.8 fluid ounces	0-14 depending on rate used
Ambush 25W WP *	permethrin	6.4-12.8 fluid ounces	0-14 depending on rate used
Ambush 25W WSP *	permethrin	6.4-12.8 fluid ounces	0-14 depending on rate used
Baythroid 2 *	cyfluthrin	1.6-2.8 fluid ounces	7
Dimethoate 4 E.C.	dimethoate	0.5-1 pint	10
Dimethoate 400	dimethoate	0.5-1 pint	10
Dimethoate, 5 lb	dimethoate	6.4-12.8 fluid ounces	10
Furadan 4 F *	carbofuran	0.5-2 pints	7-28 depending on rate used
Imidan 70-WSB	phosmet	1.33 pounds	7
Lannate LV *	methomyl	3 pints	7
Lannate SP *	methomyl	1 pound	7
Lorsban 4E	chlorpyrifos	1-2 pints	14-21 depending on rate used
Malathion 57 EC	malathion	1.5-2.25 pints	0
PennCap-M *	methyl parathion	2-3 pints	15 (and a 2-day reentry interval)
Pounce 3.2 EC *	permethrin	4-8 fluid ounces	0-14 depending on rate used
Pounce 25 WP *	permethrin	6.4-12.8 ounces	0-14 depending on rate used
Pounce WSB *	permethrin	0.1-0.2 pound	0-14 depending on rate used
Sevin 4F	carbaryl	1.5 quarts	7
Sevin 80WSP	carbaryl	1.875 pounds	7
Sevin XLR PLUS	carbaryl	1.5 quarts	7
Warrior T *	lambda-cyhalothrin	2.56-3.84 fluid ounces	1-Forage, 7-Hay

* Restricted Use Pesticide. Always read and follow label directions.

damage on alfalfa although they can drill holes on the leaves.

It takes about three months for an alfalfa weevil to complete its development from egg to larva, pupa (inside a cocoon), and adult. Adult weevils are hardy and can survive harsh South Dakota winters to start their life cycles anew in the spring.

Alfalfa weevil management can be cultural or chemical. Early harvest of the alfalfa crop (generally the first cutting) can greatly reduce alfalfa weevil numbers, as the food source for the weevil is eliminated for a short time. Care must be taken, however, to monitor the alfalfa field for adequate regrowth, as the remaining weevil larvae will actively feed on leaves of emerging alfalfa stems. Insecticides for weevils have become common in recent years. Light tillage in the spring can also significantly reduce weevil populations.

Estimates of the number of producers using the various management strategies for weevil control are: early cutting (35%), insecticides (27%), tillage (4%), and flaming (<1%) (Ruden, 2001).

Variegated Cutworm and Army Cutworm

The variegated cutworm, *Peridroma saucia* (Hübner) is always a threat to alfalfa in South Dakota. Yet the blame for the injury they inflict on alfalfa regrowth often falls on alfalfa weevils. During 2001, alfalfa weevil infestations were not as severe as in 2000, and it was possible to clearly see the damage caused by variegated cutworms caused in alfalfa stands. In addition to alfalfa, variegated cutworms will also feed on the leaves of corn, soybeans, turf, and many vegetables in home gardens.

This cutworm is most likely to damage alfalfa after the first cutting. Delayed regrowth and brown or bare patches in the field are symptoms

of cutworm infestation and damage. Treatment for cutworm infestations is usually insecticide application.

Variegated cutworms are commonly mistaken for true armyworms which usually occur later in the season, in late June through July, in South Dakota. Variegated cutworms are usually seen earlier, in April and May. It is important to be able to differentiate between armyworms and variegated cutworms because the word "armyworm" evokes unnecessary fear among growers and the public.

Army cutworms live over winter as partially grown larvae in the soil. In early spring, these cutworms emerge and begin feeding on any available vegetation. Significant infestations have been present in certain areas of South Dakota in 2002 and 2001, affecting primarily winter wheat but also alfalfa to some extent early in the season. Larvae pupate in the soil during late May to early June, emerge as adults in late June and lay eggs in late August to October. Young larvae emerge in the fall and forage until the soil freezes.

Insecticides labeled for use on alfalfa to control cutworms include Ambush 2E, Baythroid, Lorsban



Figure 2. Variegated cutworms larvae, *Peridroma saucia*. Note the distinct spots along the back of the larvae.

Cutworm Insecticides

Brand name	Active ingredient	Product per acre	Pre-harvest interval (days)
Ambush *	permethrin	3.2-12.8 fluid ounces	0-14 depending on rate used
Baythroid 2 *	cyfluthrin	0.8-1.6 fluid ounces	7
Lorsban 4E	chlorpyrifos	1-2 pints	14-21 depending on rate used
Pounce 3.2 EC *	permethrin	2-8 fluid ounces	0-14 depending on rate used
Sevin XLR PLUS	carbaryl	1-1.6 quarts	7
Warrior T *	lambda-cyhalothrin	1.92-3.20 fluid ounces	1-Forage, 7-Hay

* Restricted Use Pesticide. Always read and follow label directions.



Figure 3. Potato Leafhopper, *Empoasca fabae* (Harris). Adults are minute insects, approximately 1/8 inch in length.

4E, Pounce 3.2 EC, and Warrior T. Sevin XLR PLUS may also be used for cutworms on alfalfa. The economic threshold of variegated cutworms on alfalfa is 2-4 larvae per square foot. Economic threshold can also be expressed as the number of days of delayed regrowth that can be tolerated. The thresholds vary with the cutting schedule of the grower, cost of treatment, and the market value of the alfalfa on the field.

Potato Leafhopper

The potato leafhopper can become an economic pest in the state in any given year. It does not overwinter in South Dakota, but migrates in from

southern states each year. This migration often limits damage to alfalfa after the first cutting of the year.

The potato leafhopper is very small, approximately 1/8 inch long, with piercing-sucking mouthparts. The nymphs often move sideways and backwards in a “crab-like” manner. Damage can be mistaken for drought stress; yellowing occurs on the leaves from the tip downward in a wedge shaped, or “v” pattern. Feeding results in stunting of plants, loss in yield, loss in plant vigor, and especially loss in hay quality. Protein content of



Figure 4. Potato Leafhopper damage. “Hopperburn” from the insect’s toxin is noted first as wedge-shaped yellow areas on leaf tips.

Potato Leafhopper Insecticides

Brand name	Active ingredient	Product per acre	Pre-harvest interval (days)
Ambush *	permethrin	3.2-12.8 fluid ounces	0-14 depending on rate used
Ambush 25W WP *	permethrin	3.2-12.8 fluid ounces	0-14 depending on rate used
Ambush 25W WSP *	permethrin	3.2-12.8 fluid ounces	0-14 depending on rate used
Baythroid 2 *	cyfluthrin	0.8-1.6 fluid ounces	7
Chlorpyrifos 4E AG	chlorpyrifos	1-2 pints	14-21 depending on rate used
Dimethoate 4 E.C.	dimethoate	0.5-1 pint	10
Dimethoate 400	dimethoate	0.5-1 pint	10
Dimethoate, 5 lb	dimethoate	6.4-12.8 fluid ounces	10
Furadan 4 F *	carbofuran	1-2 pints	14-28 depending on rate used
Lorsban 4E	chlorpyrifos	0.5-1 pint	7-21 depending on rate used
Malathion 57 EC	malathion	1.5-2.25 pints	0
PennCap-M *	methyl parathion	2-3 pints	15 (and a 2-day reentry interval)
Pounce 3.2 EC *	permethrin	4-8 fluid ounces	0-14 depending on rate used
Pounce 25 WP *	permethrin	6.4-12.8 ounces	0-14 depending on rate used
Pounce WSB *	permethrin	0.1-0.2 pound	0-14 depending on rate used
Sevin 4F	carbaryl	1 quart	7
Sevin 80WSP	carbaryl	1.25 pounds	7
Sevin XLR PLUS	carbaryl	1 quart	7
Warrior T *	lambda-cyhalothrin	1.92-3.20 fluid ounces	1-Forage, 7-Hay

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Aphid Insecticides

Brand name	Active ingredient	Product per acre	Pre-harvest interval (days)
Ambush 2E*	permethrin	6.4-12.8 fluid ounces	0-14 depending on rate used
Baythroid 2 *	cyfluthrin	0.8-1.6 fluid ounces	7
Dimethoate 4 E.C.	dimethoate	0.5-1 pint	10
Dimethoate 400	dimethoate	0.5-1 pint	10
Dimethoate, 5 lb	dimethoate	6.4-12.8 fluid ounces	10
Furadan 4 F *	carbofuran	1-2 pints	14-28 depending on rate used
Lorsban 4E	chlorpyrifos	0.5-1 pint	7-21 depending on rate used
Malathion 57 EC	malathion	1.5-2.25 pints	0
Penncap-M *	methyl parathion	2-3 pints	15 (and a 2-day reentry interval)
Pounce 3.2 EC *	permethrin	4-8 fluid ounces	0-14 depending on rate used
Pounce 25 WP *	permethrin	6.4-12.8 ounces	0-14 depending on rate used
Pounce WSB *	permethrin	0.1-0.2 pound	0-14 depending on rate used
Warrior T *	lambda-cyhalothrin	2.56-3.84 fluid ounces	1-Forage, 7-Hay

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the alfalfa can be greatly reduced. Reduced plant vigor can also result in slow regrowth and winter kill.

Aphids

The pea aphid and occasionally the spotted alfalfa aphid can potentially damage alfalfa in the state. Spotted alfalfa aphids, the smaller of the two species, are about 1/16 inch long and have four to six rows of spots on the back. This aphid injects a toxin into the plant when feeding, which causes leaf drop, and damage can be severe in seedling alfalfa stands. The pea aphid is larger in size, about 1/8 inch long and yellow to blue-green in color. This aphid can cause alfalfa to wilt if infestations are heavy. Pea aphid infestations are favored by cool, dry weather; where as spotted alfalfa aphid infestations are favored in hot, dry conditions.



Figure 5. Spotted Alfalfa Aphid nymphs, *Therioaphis maculata* (Buckton). These insects most often cause damage during hot, dry weather. Note the molted skins of an adult (lower left) and of nymphs (lower center) and the parasitic chalcid wasp (top center).

Grasshopper Insecticides

Brand name	Active ingredient	Product per acre	Pre-harvest interval (days)
Baythroid 2*	cyfluthrin	2.0-.2.8 fluid ounces	7
Chlorpyrifos 4E AG	chlorpyrifos	0.5-1 pint	14-21 depending on rate used
Dimethoate 400	dimethoate	1 pint	10
Dimethoate 4EC	dimethoate	1 pint	10
Dimethoate, 5 lb.	dimethoate	12.8 fluid ounces	10
Furadan 4F *	carbofuran	0.25-0.50 pint	14-28 depending on rate used
Lorsban 4E	chlorpyrifos	0.5-1 pint	7-21 depending on rate used
Penncap-M *	methyl parathion	2-3 pints	15 (and a 2-day reentry interval)
Sevin 4F	carbaryl	1-3 pints	7
Sevin 80WSP	carbaryl	0.667-1.875 pounds	7
Sevin XLR PLUS	carbaryl	1-3 pints	7
Warrior T *	lambda-cyhalothrin	2.56-3.84 fluid ounces	1-Forage, 7-Hay

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Grasshopper

Several species of grasshoppers are capable of damaging alfalfa in South Dakota. Traditionally, grasshoppers are more of a concern in arid, western areas of the state, but damage on a statewide basis is possible in any given year.

The two-striped grasshopper, migratory grasshopper, redlegged grasshopper, and the differential grasshopper are just a few of the species present in South Dakota. Most of the damaging species overwinter as eggs in the soil. Egg hatch begins in May and extends into June, depending on species.



Figure 6. Migratory Grasshopper on legume. Many species of grasshoppers feed on alfalfa in South Dakota.

Blister Beetles

Blister beetles do not damage the alfalfa crop directly, but they are highly toxic when ingested, especially by horses (the toxin is cantharadin). Blister beetles are a pest in later alfalfa cuttings, especially those cut in July, August, and September.



Figure 8. Blister Beetle, *Epicauta* spp. Several species of blister beetles can be found in alfalfa, including gray, black, margined and the striped blister beetle shown here.



Figure 7. Differential Grasshopper. Occasionally, grasshoppers reach economically damaging populations in South Dakota.

Killing the beetles with insecticide may not solve the problem, as the dead insects still contain the toxin and their bodies may be raked and baled into the hay. The best alternative is to cut the alfalfa with a windrower that does not crush the plants and to selectively market the hay from later cuttings. This avoids the chance of feeding potentially contaminated hay to highly sensitive types of livestock.



Figure 9. Lygus Bug Adults, *Lygus hesperus*. Lygus bugs and other plant bug feeding can cause severe damage to seed development in alfalfa.

Lygus Bug

Lygus bugs and other plant bugs damage alfalfa by feeding on buds, flowers, and seeds with their piercing-sucking mouthparts. Alfalfa buds will die and drop a few days after feeding takes place. Feeding on pods also causes damage. These feeding habits make this group of insects a concern when growing alfalfa for seed. Although these insects have not been of economic significance in recent years, the threat is still present. Insecticides for plant bug control include Ambush, Baythroid, dimethoate products, Furadan, Lorsban, malathion, Pounce and Warrior T.

Weed Control

Weed control is an issue for alfalfa producers, both at the time of stand establishment and when stands are mature. Emergence of annual grasses at stand establishment and of invasive winter annual grasses and broadleaf weeds in established stands have required producers to use integrated approaches to control them.

Sound cultural weed control prior to stand establishment can greatly reduce the numbers of weeds competing with young alfalfa plants during stand establishment. In established stands, less than 5% of the alfalfa producers in a survey by the SD-NCPMC project used herbicides to control weeds.

During stand establishment, producers use various management practices, including cultural methods and/or herbicides to reduce weed competition. Producers establishing new alfalfa stands used the following management practices: clear seeding without herbicide (33%), clear seeding with a herbicide (55%), and nurse crop and clipping of the nurse crop (22%). No producers used a nurse crop and then killed it with a herbicide after establishment.

Legume Establishment Without Nurse Crop

Brand name	Active ingredient	Product per acre	Special Notes
Eptam	EPTC	2-4 lb a.i.	NA
Treflan	trifluralin	.5-.75 lb a.i.	NA
Pursuit	imazethapyr	.047-.094 lb a.i.	NA
Poast or Poast Plus	sethoxydim	.15-.5 lb a.i.	NA
Butyrac 200	2,4-DB	.5-1.5 lb a.i.	NA
Buctril	bromoxynil	.25-.38 lb a.i.	NA
Gramoxone Extra	paraquat	.75-1 lb a.i.	NA
Roundup	glyphosate	.38-3 lb a.i.	NA
Prowl	pendimethalin	.5-1.25 lb a.i.	Do not feed or graze- CRP or set-aside only.

Herbicides- Grass Pasture and Range

Brand name	Active ingredient	Product per acre	Pre-harvest interval (days)
2,4-D Ester or Amine	2,4-D	.5-2 lb a.i.	7 or 14-grazing, 30-harvesting
Banvel	dicamba	.5-8 lb a.i.	7 to 60, depending on rate
Tordon 22K	picloram	.125-2 lb a.i.	None-if rate 1qt/a or less; 2 weeks if greater than 1 qt/a
Ally	metsulfuron methyl	.004-.012 lb a.i.	None. Do not use on grasses grown for seed.
Amber	triasulfuron	.013-.026 lb a.i.	Grazing- none; 30- hay
Curtail	clopyralid + 2,4-D	.19 + 1 - .38 + 2 lb a.i.	14- dairy cattle grazing; 30- hay
Stinger or Transline	clopyralid	.12-.5 lb a.i.	Grazing-none
Crossbow	triclopyr + 2,4-D	.25 + .5 - 1 + 2 lb a.i.	14- dairy grazing; 14- hay for non-dairy. Do not cut hay for dairy until next season.
Gramoxone Extra	paraquat	.25-.5 lb a.i.	Pasture renovation
Roundup	glyphosate	.28-3 lb a.i.	Pasture renovation

Herbicides- Established Alfalfa Stands

Brand name	Active ingredient	Product per acre	Pre-harvest interval (days)
Sencor or Lexone	metribuzin	.38-1 lb a.i.	28 grazing
Poast or Poast Plus	sethoxydim	.2-.5 lb a.i.	7 wet forage, 14 dry forage
Pursuit	imazethapyr	.047-.094 lb a.i.	30
Butyrac 200	2,4-DB	.5-1.5 lb a.i.	30
Treflan	trifluralin	.75-2 b a.i.	Fall application only
Kerb	pronamide	.75-2 lb a.i.	25
Sinbar	terbacil	.4-1.2 lb a.i.	Fall application
Diquat	diquat	.25-.5 lb a.i.	Harvest aide- Do not graze or feed
Gramoxone Extra	paraquat	.25-.7 lb a.i.	60
Roundup Ultra	glyphosate	.38-3 lb a.i.	Spot treatment only. 14-forage + graze

Fungicides- Seed Treatment

Brand name	Active ingredient	Product per acre	Special Notes
Allegiance FI	metalaxyl	0.75-1.5 fl oz (28.35% ai)	n/a
Allegiance LS	metalaxyl	1.2-2.4 (17.7% ai)	n/a
Apron FL	metalaxyl	1.5 fl oz (28.35% ai)	n/a
Apron XL	mefanoxam	0.64 fl oz (32.3% ai)	n/a
Captan 30 DD	captan	6.5 fl oz (28.7% ai)	n/a
Captan 400	captan	5-8 fl oz (37.4% ai)	n/a
Captan 400 C	captan	5-8 fl oz (37.4% ai)	n/a
42S Thiram	thiram	8 oz (42% ai)	Do not exceed 32# ai/A
Thiram 50WP	thiram	8 oz (50% ai)	Do not exceed 32# ai/A

Diseases

Leaf spotting diseases, crown and stem rots, and wilt diseases are some of the many diseases that can appear in alfalfa. However, very few disease outbreaks occur in South Dakota. Environmental conditions in the state are dry throughout the growing season, and this tends to limit disease.

South Dakota also has a long winter dormancy period, further limiting disease development. Spring blackstem, a cool-season leaf spotting disease, can occasionally show up, usually during cool spring and fall seasons. This disease is generally effectively managed with early cutting of the hay crop.

Crown rots become more noticeable as the alfalfa stand ages. The SD-NCPMC indicated recently

that none of the producers it surveyed were treating for alfalfa diseases.

Due to feeding restrictions, foliar fungicides are used only on seed-production alfalfa. Seed producers in South Dakota are located in the drier areas of the state, which have lower disease pressure. They have not reported use of foliar fungicides to manage diseases.

Pythium and *Phytophthora* may cause serious seedling disease during stand establishment. These are generally managed effectively with fungicidal seed coatings. Seed treatment is an affordable way to facilitate optimal plant populations. Labeled seed treatments are listed.

Rodents

The primary rodent pest in South Dakota alfalfa fields is the pocket gopher. It damages the crop by feeding on roots and piling dirt on the surface, but more significant is the equipment damage that can occur from the rough fields and from running dirt mounds through equipment.

Controls have been rotation, trapping, and selective rodenticides such as phosphine tablets placed in go-

pher burrows and zinc phosphide baits and strychnine baits placed below ground.

Approximately 8% of producers in a recent survey indicated severe problems with pocket gophers and treated for these pests, while 40% indicated slight concern and used cultural management, trapping, or no treatment.

Photo Credits

Figure 2.

Mike Catangui, Extension Entomologist, SDSU, Brookings, S.D.

Figures 1, 3-9

South Dakota State University, SDSU Extension Entomology archives, SDSU, Brookings, S.D.

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Cutworm Larvae



Lygus Bug



Alfalfa Weevil



Blister Beetle



Potato Leafhopper



Differential Grasshopper



Migratory Grasshopper



Spotted Alfalfa Aphid



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