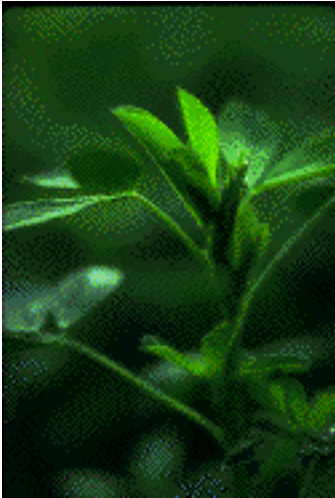


# Crop Profile for Alfalfa in West Virginia

Prepared: June 1, 1999

## General Production Information



- West Virginia ranked 33<sup>rd</sup> in United States alfalfa hay production in 1996 (1).
- West Virginia contributed 0.15% to total U.S. production of alfalfa hay in 1997 (2).
- A total of 40,000 acres of alfalfa hay was harvested with an average yield of 2.8 tons per acre and a total production of 112,000 tons in 1996 (1).
- A total of \$10,864,000 of alfalfa was harvested in 1996 (1).

## Production Regions

West Virginia's alfalfa crop is mainly concentrated in the eastern and northern regions; however, some pockets also exist in the northwestern parts of the state. Jefferson County (the state's northeastern most county) leads alfalfa production (14,000 tons), followed by Preston (11,000), Monroe (9,700), Greenbrier (9,500), Berkeley (8,900), Mason (7,000), and Pendleton (4,700) counties. The above-mentioned counties produced more than 57% of total alfalfa hay in 1996 (1).

## Cultural Practices

A well-drained soil is essential for optimum alfalfa production. Deep soil with adequate water-holding capacity gives alfalfa excellent drought tolerance. Plowing and preparing the soil 30 to 60 or more days before seeding is ideal. In general, alfalfa seed must not be planted deeper than 1/4 inch in heavy soil and 1/2 inch in light soil. A firm seedbed is an important factor in the successful establishment of new stands. When seeding alfalfa on sloping fields, a companion crop (e.g., perennial grass) or reduced tillage should be used to minimize soil erosion.

Alfalfa greatly uses soil nutrients, so an annual soil test should be made to monitor soil fertility. Well-

nodulated stands need no nitrogen, but lime, phosphorus, and potassium must be added as soil tests indicate. A soil pH of 6.5-6.8 should be maintained for optimum alfalfa yield production (3).

## Insect Pests

Alfalfa weevil, potato leafhopper, aphids and spittlebug are the most common pests reported by alfalfa farmers in West Virginia. Other insect pests include, armyworm, cutworm, and grasshopper (4).

### Alfalfa Weevil (*Hypera postica*)

- **Damage:** The weevil has caused serious damage to more than 40% of the alfalfa fields in the state (4). The adults feed on the growing plant tips and skeletonize the leaves, and the larvae bore in the stalks and buds. Both can cause major damage by feeding on the first cutting of alfalfa, and on cut hay lying in the field for several days (5 and 6).
- **Life cycle:** In early spring or late fall, adults migrate to alfalfa fields to feed and mate. After mating, the female inserts her eggs in the stem center. Larvae emerge after five to 10 days and feed in the shoot apex for about three weeks, then drop to the ground and pupate. Adults emerge after a few weeks and feed for two to four weeks before entering aestivation (the resting period) (5 and 6).
- **Chemical control:** In West Virginia, alfalfa up to six inches in height may need treatment if 50% or more of stubble shows feeding damage and more than two live larvae per stem. Alfalfa 10-18 inches in height should be treated if counts exceed 45 weevils per 60 sweeps (8). Recommended insecticides include (7):
  - **\*Carbofuran (Furadan 4F):** Applied at 0.25-1.0 lb. a.i./acre. Should not apply more than once per cutting or twice per season.
  - **Chlorpyrifos (Lorsban 4E):** Maximum of one application per cutting, applied at 0.5-1.0 lb. a.i./acre.
  - **\*Cyfluthrin (Baythroid 2E):** Maximum of one aerial or ground application per cutting, applied at 0.025-0.044 lb. a.i./acre.
  - **\*Methomyl (Lannate LV 2.4E, or 90SP):** Applied at 0.9 lb. a.i. /acre. Do not apply to

dormant alfalfa when temperature is 50 F or below.

- **\*Azinphos-methyl (Guthion 3)**: Applied at 0.25-0.75 lb. a.i./acre with a minimum of 10 gallons of water/acre.
- **\*Methyl-parathion (PennCap-M 2F)**: Applied at 0.5-0.75 lb. a.i./acre. Must not be sprayed when alfalfa is in bloom.
- **\*Permethrin (Pounce 3.2EC, Ambush 2E)**: Applied at 0.1-0.2 lb. a.i./acre. Highly toxic to fish.
- **Phosmet (Imidan 50 WP)**: Applied at 1.0 lb. a.i./acre.

\*Restricted use

- Alternatives: It is estimated that a decrease in alfalfa yield of 10-90% results, when the pest is not treated (3). Cultural and biological control measures normally are effective.
- Cultural control practices: Harvest early instead of treating with insecticides. Remove last crop by grazing or harvesting as hay. If sprays are required, leave untreated portions of fields as a nursery to maintain beneficial insects for the next cutting or next year (7).
- Biological control: Several parasitic wasp species (*Bathyplectes curculionis*, *B. anurus*, *B. stenostigma*, *Tetrastichus incertus*, *Diabrachoides druso*, and *Microtonus aethiopoidea*) have been released as biological agents in West Virginia (9). Also, predator insect species (e.g., carabid, coccinellid beetles, and the hemipterans, *Nabis*, *Collops* and *Orius*), and two major fungal pathogens (*Zoophythora phytonomi* and *Erynia sp.*) were present in the state and proved their effectiveness in controlling alfalfa weevil and consequently reduced dependency on insecticides (9 and 10). If substantial populations of these parasitic wasps are to be maintained, chemicals for control of the weevil must be used in a judicious manner and preferably as recommended through an active scouting program associated with an integrated pest management program. Even when chemical control is necessary, leaving a portion of a field untreated would help maintain a reservoir of beneficial insects in alfalfa fields (11).

### **Potato Leafhopper** (*Empoasca fabae* [Harris])

- Damage: Adults and nymphs feed on leaf veins and petioles, causing a characteristic V-shaped yellowing, stunting, reduced forage protein, carotene, and yield (5 and 6).
- Life cycle: The females lay eggs in main veins or in petioles on the undersides of leaves. Both

mature and immature stages attack tips and sides of leaves causing a blight-like condition, and then overwinter in either the adult or egg stage; there are 2-3 generations a year (5 and 6).

- Chemical control: Examples of two thresholds for potato leafhopper in West Virginia indicate that alfalfa 6 and 12 inches in height should be treated if average counts exceed 0.5 and 1 leafhopper per sweep, respectively (9). Recommended insecticides include (7):
  - **\*Azinphos-methyl (Guthion 3)**: Applied at 0.25-0.5 lb. a.i./acre with a minimum of 10 gallons of water/acre.
  - **\*Carbofuran (Furadan 4F)**: Applied at 0.5-1.0 lb. a.i./acre. Should not apply more than once per cutting or twice per season.
  - **Chlorpyrifos (Lorsban 4E)**: Maximum of one application per cutting, applied at 0.5-1.0 lb. a.i./acre.
  - **\*Cyfluthrin (Baythroid 2E)**: Maximum of one aerial or ground application per cutting, applied at 0.0125-0.025 lb. a.i./acre.
  - **Dimethoate 4 EC**: Maximum of one application per cutting, applied at 0.25-0.5 lb. a.i./acre.
  - **\*Methyl-parathion (PennCap-M 2F)**: Applied at 0.5-0.75 lb. a.i./acre. Must not be sprayed when alfalfa is in bloom.
  - **\*Permethrin (Pounce 3.2EC, Ambush 2E)**: Applied at 0.05-0.2 lb. a.i./acre. Highly toxic to fish.
  
- \*Restricted use
  
- Cultural control practices: It has been demonstrated that planting oats with alfalfa significantly reduced the density of potato leafhopper (7). Heavily infested fields should be cut and the crop removed to force out the adults and starve the young nymphs.
  
- Biological control: Parasitic wasp species, several predator insect species (e.g., big-eyed bugs and lady beetles), and two major fungus diseases were effective in controlling alfalfa potato leafhopper and consequently reducing dependency on insecticides (7).

### **Aphids** (*Acyrtosiphon spp.*)

- **Damage:** Aphids attack young, tender shoots and terminal buds, causing stunted growth, leaf curling, yellowing, and leaf drop (5 and 6).
- **Life cycle:** As temperatures rise in early spring, the females give birth to young aphids (nymphs). Newborn nymphs take about six days to become winged or wingless adults. Adults produce multi-generations of offsprings and then overwinter in protected areas at the base of the alfalfa crowns (5 and 6).
- **Chemical Control:** Treatment is rarely needed, because several natural predators control this pest. In highly infested areas, it may be necessary to use the recommended insecticides (7):
  - **\*Carbofuran (Furadan 4F):** Applied at 0.25-1.0 lb. a.i./acre. Should not apply more than once per cutting or twice per season.
  - **\*Cyfluthrin (Baythroid 2E):** Maximum of one aerial or ground application per cutting. Applied at 0.025-0.044 lb. a.i./acre.
  - **Dimethoate 4 EC:** Maximum of one application per cutting, applied at 0.5 lb. a.i./acre.
  - **Malathion (Cythion 57%EC):** Applied at 1.25 lb. a.i./acre.
  - **\*Methomyl (Lannate LV 2.4E, or 90SP):** Applied at 0.9 lb. a.i. LV 2.4E /acre, or at 0.225-0.9 lb. a.i. 90SP/acre. Do not apply to dormant alfalfa when temperature is 50 degree F or below.
  - **\*Methyl-parathion (PennCap-M 2F):** Applied at 0.5-0.75 lb. a.i./acre. Must not be sprayed when alfalfa is in bloom.

\* Restricted use

- **Cultural control practices:** Harvest early instead of treating with insecticides. Remove last crop by grazing or harvesting as hay. If sprays are required, leave untreated portions of fields as a nursery to maintain beneficial insects for the next cutting or next year (7).
- **Biological control:** Ratios of 1 or more adult or larval ladybird beetles to 10-50 aphids provide good control (7). In addition, several parasitic wasp species, and two major fungus diseases proved their effectiveness in controlling alfalfa aphids.

**Spittlebug** (*Philaenus leucophthalmus* [Linn])

- **Damage:** Spittlebug causes stunting and distortion of plants. If infestation is severe (100 spittlebugs/plant), hay and seed yield may be reduced by 25 to 50% and seedling crops can be almost entirely lost (12).
- **Life cycle:** In the spring, nymphs hatch and surround themselves with a spittle-like mass. After the last molt, the insect leaves the spittle, moves freely, and causes damage by sucking plant juices. Adults may be more severe in number in areas of high humidity (5, 6, and 12).
- **Chemical control:** Treatment is rarely needed, because several natural predators control this pest. In highly infested areas, it may be necessary to use pesticides.
- **Cultural control practices:** Harvest early instead of treating with insecticides. Remove last crop by grazing or harvesting as hay. If sprays are required, leave untreated portions of fields as a nursery to maintain beneficial insects for the next cutting or next year.

### **Critically-needed Insecticides:**

The following insecticides were reported as critically needed for alfalfa pest control in West Virginia. These insecticides include:

- Chlorpyrifos (Lorsban 4E) and permethrin (Pounce 3.2 EC, Ambush 2E) for alfalfa weevils and potato leafhoppers control.
- Azinphos-methyl (Guthion 3) for alfalfa weevil control.
- Malathion (Cythion 57% EC) for aphid control.

## **Diseases**

In general, wet soil conditions and poor crop management favor fungal plant pathogens, which cause losses in alfalfa fields. *Phytophthora* root rot, *Fusarium* root and crown rots, anthracnose, downy mildew, bacterial wilt, spring and summer black stem and leaf spot, *Leptosphaerulina* leaf spot, common leaf spot, yellow leaf blotch, *Stemphylium* or zonate leaf spot, and *Sclerotinia* root and crown rot are examples of diseases caused by these plant pathogens. Other pathogens that may cause economic damage to alfalfa plants include stem and root-knot nematodes, bacteria, and viruses.

## *Phytophthora* Root Rot

Caused by the fungus (*Phytophthora megasperma*)

- **Damage:** It is one of the most devastating alfalfa diseases. It occurs primarily in low-lying and poorly drained and managed soils. Infected plants are stunted; leaves wilt and die. The infection may spread up the tap root to the crown, and the root may eventually rot off. Plants weakened by this fungus are very susceptible to winter injury ( 7, 13, and 14).
- **Symptoms:** Infected taproot shows brown to black lesions an inch or two below the soil surface and shows discoloration of the central cylinder. Plants suddenly turn yellow or red, wilt, and die (15 and 16).
- **Chemical control:** Currently, seed and soil fungicides are the only preventive chemical control options recommended against seed- and soil-borne plant pathogens (7).

- Seed Treatment Fungicides:

- **Metalaxyl (Apron 50W, Apron FL, and Apron XL LS):** Applied as a seed treatment in a slurry or with commercial mist-type equipment.
- **Captan (Captan 400, and Captan 400-DD):** Applied as a slurry or mist.
- **Thiram (Thiram-30 Flowable):** Applied as a slurry or mist.

- Soil Treatment Fungicides:

Treated plants must not be fed to animals as green forage or as cut hay for 60 days following applications.

- **Metalaxyl (Ridomil 2E):** Applied as a broadcast surface spray at planting at a rate of 1-2 pt./acre with a minimum of 20 gallons of water.
- **Mefenoxam (Ridomil Gold EC):** Applied as a broadcast surface spray at planting at a rate of 0.25-0.5 pt./acre with a minimum of 20 gallons of water.
- **Cultural control practices:** Selection of disease-resistant cultivars (use certified seed of a recommended variety). Examples of resistant varieties are Evolution, DK 122, WL 225, Warngler, Achieva, Arrow, Attainer, Blazer XL, Crown II, Dart, and others. Proper crop and soil management can be used to prevent or reduce yield losses from diseases. Management practices

may include allowing alfalfa to go into the winter after the last cutting with enough growth to provide protection against winter injury, controlling insects to prevent weakening the plants, deep tillage to improve internal percolation of water through the soil, and early harvesting (7). Avoid seeding alfalfa in soils where alfalfa or clover was grown the preceding years. Also, proper fertilization, especially with K, helps plants become more vigorous.

### **Fusarium Root and Crown Rots**

Caused by several species of the fungus (*Fusarium spp.*)

- Damage: The fungus may kill alfalfa seedlings by rotting the crown center and extending into the taproot.
- Symptoms: Irregularly shaped lesions with dark brown or reddish color occur anywhere on the crown, taproot, or lateral roots. Plant vigor declines as more of the root system rots (15).
- Cultural control: Adequate potash helps reduce *Fusarium* root and crown rot severity. Insect feedings (i.e., pea aphids and potato leafhopper) stress plants and increase *Fusarium* severity (16). Avoid mechanical injury as much as possible (15). Examples of resistant varieties are Evolution, Profit, Viking1, WL 225, Achieva, Attainer, Blazer XL, Crown II, Dart, and others (7).

### **Anthracnose**

Caused by the fungus (*Colletotrichum trifolii*)

- Damage: The fungus causes large, sunken, elliptical stem lesions near the soil line, which progressively girdle the stem and kill it (16).
- Symptoms: It varies from a few irregular-shaped, blackened areas on resistant stems to a large sunken, oval to diamond-shaped lesions on stems of susceptible plants. The lesions are straw-colored with brown borders. Bluish-black discoloration of invaded tissue characterizes the crown rot phase of anthracnose. Other symptoms of anthracnose include blackening and killing of petioles and occasional formation of a shepherd's crook when the stem dies suddenly while wilted (15).
- Cultural control: Plant resistant cultivars; i.e., Evolution, DK 122, Achieva, Attainer, Blazer XL, Crown II, Dk 125, Magestic, Multistar, and others (7). Keep all harvesting equipment clean before the first harvest and during the growing season (15).

## **Downy Mildew**

Caused by the fungus (*Peronosopra trifoliorum*)

- **Damage:** Downy mildew is most severe during cool wet or humid conditions. It occurs commonly on young plants, weakening them and causing defoliation. Infected leaves may be curled and distorted. Stems of severely infected plants may be thickened and shortened (16). In established stands, significant forage loss due to downy mildew is restricted to the first cutting (15).
- **Symptoms:** Upper leaves are attacked first and become light green; they later become yellow, twisted, and rolled. Large irregular-shaped necrotic areas also may develop on the leaves. A fine, gray, mold-like growth develops on the underside of leaves. The fungus is systemic in new shoots, where it causes stunting and yellowing. If the entire stem is affected, all leaves and the stem become yellow, with stems being larger in diameter and shorter than normal. The fungus survives the winter inside the plant and on seed.
- **Cultural control:** Use resistant cultivars. If mildew is severe, alfalfa can be cut in pre-bloom stage to save foliage. Spring seeding reduces the chances of seedling stand reduction from mildew (15).

## **Bacterial Wilt**

Caused by a bacterium (*Corynebacterium insidiosum*)

- **Damage:** Bacterial wilt causes stunting and yellowing of the entire plant. The disease is favored by abundant moisture and is usually most severe in low, poorly-drained spots in alfalfa fields.
- **Symptoms:** It can first be noticed as the dying of scattered plants in the field. Shortened stems cause bunched growth with plants showing yellowish or bleached color and cupped leaves. During warm, dry weather, plants may wilt and die rapidly. At first only the tips of stems droop; then wilting and dying follow. Stunting is most evident during re-growth following cutting; progressively less growth is produced after each cutting. Severely diseased plants usually do not survive the winter.
- **Cultural control:** Use of resistant varieties offers a practical means of controlling wilt. Examples of resistant varieties are Baker, Evolution, DK 122, Profit, Arrow, Attainer, Blazer, Crown II, Dk 125, Multistar, and others (7). The producer also should follow cultural practices which may aid in maintaining diseased stands and in retarding disease development in new areas: maintaining

high soil fertility levels, particularly potassium and phosphorous; preventing injuries to crown and roots; mowing when plants are dry; avoiding contamination of young healthy stands by mowing them before mowing the older diseased fields; waiting to re-seed old alfalfa fields until complete rotting of the infected roots has occurred; not seeding fields that receive surface drainage from infested areas; and rotating to another crop until old roots and crowns are thoroughly decomposed (15 and 16).

### **Spring Black Stem and Leaf Spot**

Caused by the fungus *Phoma medicaginis* (*Ascochyta imperfecta*)

- **Damage:** The fungus attacks leaves, petioles, and stems, frequently causing defoliation and death of plant parts. In cool, moist periods, the organism causing this disease causes reduced yield and quality of forage and may diminish seed yield. Also, severe losses may occur when cutting is delayed (15 and 16).
- **Symptoms:** In early spring, small brown to black spots develop on stems and leaves. Young lesions on stems are at first outlined by a watery border. During the growing season, they enlarge and merge until much of the stem is blackened. If the plants are left to mature, the fungus also may attack pods and seeds. From late fall until spring, brown to black fungal bodies are visible on the dead stems and petioles. The irregular lesions on the leaves increase in size and may become lighter brown and somewhat banded. Diseased leaves turn yellow and soon wither and fall. The fungus overwinters principally on plant residue. In early spring, spores come out and are splashed by rain onto new shoots. The fungus is carried within the seed and in soil, thus providing other sources of infection (15 and 16).
- **Cultural control:** If severe primary infection occurs in the spring, early harvesting to remove the diseased growth helps reduce secondary infection. Seed should be treated with a fungicide to prevent seed-borne introduction of the disease. If the infection is severe, the field should be plowed under. In addition, attempts are being made to develop disease-resistant strains of alfalfa (16).

### **Summer Black Stem and Leaf Spot**

Caused by the fungus *Cercospora medicaginis* (*C. Zebrina*)

- **Damage:** The fungus attacks leaves, peduncles, petioles, and stems, frequently causing defoliation and death of plant parts, however plants are not killed in the field by this disease. Under hot (80-90 degree F) and humid conditions (near 100%), the disease causes 20% or more

yield loss and reduces forage quality (15 and 16).

- Symptoms: Small gray-brown spots on both leaf surfaces near the midrib enlarge to form irregular to roughly circular lesions. Tissue around these spots soon turns yellow and leaflets drop within days. Spores are produced in diseased leaves and carried by wind to new infection sites. The fungus overwinters on old infected stems and produces conidia under warm, moist conditions (15 and 16).
- Cultural control: Harvesting the crop on schedule reduces losses from summer black stem disease. Varieties vary in their susceptibility to the disease, but no resistant varieties are available (15 and 16).

### **Leptosphaerulina Leaf Spot**

Caused by the fungus *Leptosphaerulina briosiana* (*Pseudopeziza briosiana*)

- Damage: This disease was a minor disease of alfalfa in the United States until 1956-1960, when it reached epidemic proportions in the eastern and central states. It continues to be economically important during cool, wet summers in Canada and the United States. In northern areas, the disease is generally more prevalent in the spring, in early summer, and again in the fall. If favorable, moist weather exists, epidemics may occur at any time during the growing season.
- Symptoms: Young leaves are primarily affected, but petioles and older leaves can sometimes be attacked. Leaf symptoms vary with the environment and the leaf's physiological state. Lesions often start as small, black spots and remain as "pepper spots" or may enlarge to "eyespot" 1-3 mm in diameter. The lesions have light brown to tan centers with dark brown borders and are often surrounded by a chlorotic area. When conditions favoring infection and disease development coincide with rapid regrowth, lesions are large and coalesce into a bleached area. Under these conditions, leaflets are killed and will remain attached for a short time. Early infection on spring growth can cause stunting.
- Cultural control: No adequate control exists except to practice good cultural practices. Cutting the stand early can save foliage and allow plants to dry out (16).

### **Common Leaf Spot**

Caused by the fungus (*Pseudopeziza medicaginis*)

- **Damage:** This is also called *Pseudopeziza* Leaf Spot. Although plants are not killed by the disease, defoliation causes loss of vigor and reduces hay quality and yield. In general, the second and third hay crops are damaged more than the first. During cool, wet weather, only the topmost leaves may escape infection, particularly if the plants are growing slowly. Stands that are grown under a thick cover crop can be severely diseased.
- **Symptoms:** Small, circular, brown spots approximately 1/16 inch in diameter develop on the leaflets. When spots are fully developed, the centers become thickened and a tiny, light-brown, cup-shaped fruiting body forms on the upper surface of green leaves. There is a sharp line between spots and the healthy-appearing tissue, which is usually not discolored. Spores are discharged from the fruiting body and are carried by wind to other plants. The fungus overwinters on dead leaves that have not decayed. The pathogen is probably not seed-borne (15).
- **Cultural control:** although adapted varieties of alfalfa are only moderately resistant to leaf spot, highly resistant lines have been selected and are being incorporated into new varieties. Harvesting before much defoliation occurs and destroying plants in waste areas may reduce damage by removing sources of infection (15). This should be done in pre-bloom or bud stage before foliage falls.

### **Yellow Leaf Blotch**

Caused by the fungus *Leptotrochila medicaginis* (*Pseudopeziza jonesii*)

- **Damage:** The fungus occurs in temperate climates. The fungus may cause leaf losses as high as 40% at harvest time or 80% at pod formation time (15). In cool, moist weather particularly if cutting has been delayed and stands are high the disease develops rapidly, and damage may become quite severe.
- **Symptoms:** Yellow, elongated blotches develop parallel to the veins on the leaflets. Blotches often extend from the mid-rib to the leaf margin. Small, orange to black fruiting bodies develop on the upper surface of diseased areas. Diseased leaflets do not wither and die immediately, but after a period of wet weather, considerable defoliation may result. Dark brown blotches occasionally appear on the stems. On dead leaves in late summer and fall, many cup-shaped bodies form on the lower leaf surface. Small, oval, colorless spores are discharged from the fruiting bodies and are carried by wind to other plants. In late spring, spores from overwintered bodies supply the initial infection.
- **Cultural control:** Severity of the disease on the subsequent crop may be reduced by cutting or grazing diseased leaves before much defoliation occurs. Cultivars with *Medicago falcata* germ plasm tend to have some resistance (15 and 16). Crop rotation for two years with a non-susceptible host such as corn can help to control disease.

### **Stemphylium or Zonate Leaf Spot**

Caused by the fungus *Stemphylium botryosum* (*Pleospora herbarum*)

- Damage: On alfalfa, this leaf spot is serious in wet years, particularly in dense stands.
- Symptoms: Spots on leaves are oval and slightly sunken, dark brown with lighter centers, and usually surrounded by a pale yellow halo. Older lesions may be concentrically ringed and may resemble a target. Usually, a single, large lesion causes the leaflet to yellow and fall prematurely. Black areas may appear on the peduncles, petioles, and stems.
- Cultural Control: Cultivars vary from low to moderate resistance and some will show less leaf loss than others in the field. Harvest should be on schedule or earlier if necessary to prevent leaf loss and further spread of the disease (15).

### **Sclerotinia Root and Crown Rot**

Caused by the fungus (*Sclerotinia trifoliorum*)

- Damage: The fungus causes decay of stem and crown bases of plant seedlings under wet and cool conditions. Losses due to the disease varies and may involve entire fields or areas as small as 6-8 cm in diameter (15 and 16).
- Symptoms: The fungus causes a soft, light-brown decay of stem and crown. Infected leaves and stems become yellow and flaccid and finally collapse. Under unsuitable environmental conditions, the fungus produces hard black sclerotia on or in stem and crown tissue (15 and 16).
- Cultural control: Plow deep to bury sclerotia. Plant seed-free of sclerotia. Maintain a three- to four-year interval between forage legumes in rotations (15 and 16).

### **Alfalfa Mosaic Virus**

- Damage: The virus causes leaflets to stunt and crinkle; the whole plant is sometimes stunted. The virus infects other plants, is transmitted by aphids, and it can be seed-borne (16).

- Symptoms: The virus causes mottling and light green to yellow streaks between leaflet veins.
- Cultural control: No practical field control measures have been developed, but aphid- resistant varieties might be affected less (16).

### **General Disease Management Recommendations**

All parts of the plant and plants in all stages of growth are susceptible to attack by one or more of the disease-causing fungi, bacteria, or viruses. Some disease-producing organisms live for long periods in the soil; others live on the residue of plants killed by disease. Others remain within diseased, living plants which then become reservoirs of infection for neighboring plants. Although resistant varieties are the best means of controlling disease, no such varieties exist for many of the most destructive diseases. Good farm practices (i.e., crop rotation, clean cultivations, and plowing under old, diseased plant material) help reduce the incidence of disease.

### **Critically Needed Fungicides**

The following fungicides were reported as critically needed for alfalfa pest control in West Virginia. These fungicides include:

- Captan (Captan 400, and 400-DD) for use as seed-treatment fungicides for *Phytophthora* root rot control.
- Metalaxyl (Ridomil 2E) and mefenoxam (Ridomil Gold EC) for use as soil-treatment fungicides for *Phytophthora* root rot control.

## **Nematodes**

### **Stem Nematodes**

Caused by the nematode (*Ditylenchus dipsaci*)

- Damage: The nematode infects buds and stems and causes stunted growth and reduction in alfalfa

yield and stands. Growth often resumes with warm, dry weather (16).

- Symptoms: Infected plants appear bushy with excessive crown bud proliferation. Buds and stems are often swollen, shortened, and sometimes are pale-colored and brittle (16).
- Cultural control: Use uninfested seeds to prevent introduction of the pest. Practice crop rotation to corn, sorghum, beans, or small grains. Fall burning of alfalfa fields for weed control also decreases nematode infection the following spring (15). Use stem nematode-resistant varieties (16).

## **Root-Knot Nematodes**

Caused by the nematode (*Meloidogyne spp.*)

- Damage: The root-knot nematode can cause considerable loss in alfalfa. It causes reduced growth and yield, and a decline in vigor and stand. It is most serious on sandy soils (16).
- Symptoms: Roots of infested plants have small, pea-sized galls and lack small feeder roots.
- Cultural control: Use of resistant varieties such as Achieva, and a moderate resistant varieties such as Vernal, WL 225, WL 317, WL 320, Royalty, Allstar, and Chief (7).

## **Weeds**

Broadleaf weeds and annual grasses that invade alfalfa fields include barnyardgrass, annual bluegrass, carpetweed, chickweed, crabgrass, foxtail (giant, green, and yellow), goosegrass, johnsongrass, lambsquarters, fall panicum, pusley (Florida), pigweed, purslane, sandbur, annual ryegrass, orchardgrass, bermudagrass, bindweed, curly dock, canarygrass, cattail, prickly lettuce, quackgrass, velvetleaf, ragweed, and dogbane (7).

- Chemical control: Herbicides are applied as preplant or postemergence. Incorporation of such herbicides two to four inches into the soil is needed to obtain better weed control results (7).
  - Preplant Treatment:
    - **Benefin (Balan 60DF)**: Applied to the soil surface no more than 10 weeks before

planting at 1.2-1.5 lb. a.i./acre.

- **EPTC (Eptam 7E)**: Applied to freshly prepared soil at 3-4 lb. a.i./acre.
- **Paraquat +surfactant (Gramoxone Extra +surfactant)**: Applied for no-till establishment of alfalfa into perennial grass sods in two split applications at 0.625-0.937 lb. a.i. +surfactant /acre.
- **Glyphosate (Roundup Ultra)**: Applied to control emerged vegetation before the establishment of alfalfa at 0.75-5.0 lb. a.i./acre.

○ Postemergence Treatment:

- Applied when weed seedlings are actively growing, but do not exceed four-leaf stage. Applied during the fall or early winter.
- **Bromoxynil (Buctril 2EC)**: Applied at 0.25-0.375 lb. a.i. /acre.
- **2,4-DB (Butyrac 200)**: Applied at 0.5-1.5 lb. a.i. /acre. Treated fields should not be grazed or harvested for 30 days.
- **Pronamide (Kerb 50W)**: Applied at 0.5-1.5 lb. a.i. /acre. Treated fields should not be grazed or harvested for 120 days.
- **Paraquat +surfactant (Gramoxone Extra +surfactant)**: Applied as broadcast application at 0.47-0.626 lb. a.i./acre in 20 to 60 gallon of water. Treated fields should not be grazed or harvested for 60 days.
- **Diuron (Karmex 80DF)**: Applied in March and early April at 1.2-1.6 lb. a.i./acre. Do not apply to alfalfa/grass mixtures.
- **Metribuzin (Lexone 4L, Sencor 4F)**: Applied in the fall or in the spring before new growth starts at 0.375-1.0 lb. a.i./ acre. Treated fields should not be grazed or harvested for 28 days. Provides good control of chickweed.
- **MCPA (MCPA)**: Applied after frost when alfalfa is dormant at 0.5 lb. a.i. /acre.
- **Sethoxydim+crop oil concentrate (Poast Plus+crop oil)**: Applied at 0.09-0.31 lb. a.i. /acre. Treated fields should not be grazed or harvested for 14 days.
- **Terbacil (Sinbar 80W)**: Applied at 0.26-0.4 lb. a.i. /acre. Provides good control of

chickweed.

- **Hexazinone (Velpar 90W):** Applied at 0.45-1.35 lb. a.i. /acre. Treated fields should not be grazed or harvested for 30 days.
- Cultural control practices: Practice crop rotations, land preparation, fertilizer/fungicide incorporation, and proper crop management (7). The main cultural control practice is to know the weed threshold that can be tolerated. For beef cattle, palatable grassy and broad-leaf weeds can be tolerated in an alfalfa stand. Using a companion grass grown with the alfalfa is one of the best ways to provide competition which will keep many weeds out of the stand. For dairy cattle, clear seeded alfalfa and weed control can be justified, but the producer needs to know their local economics.

### **Critically Needed Herbicides**

The following herbicides were reported as critically needed for alfalfa weed control in West Virginia. These herbicides include:

- Benefin (Balan 60DF), EPTC (Eptam 7E) and glyphosate (Roundup Ultra) are used as preplant treatments.
- Bromoxynil (Buctril 2EC), 2,4-DB (Butyrac 200), paraquat +surfactant (Gramoxone Extra +surfactant), and sethoxydim+crop oil concentrate (Poast Plus+crop oil) are used as postemergence treatment.

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