CULTURAL AND MANAGEMENT PRACTICES

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Timing of irrigation is critical for effective seed production. It should promote good flowering but not encourage excessive growth. Low seeding rates produce thin stands that enhance pollination and control of detrimental insects. Combines must be adjusted to thresh seed without loss.

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MANY FACTORS affect alfalfa seed production in the West. The three most critical are proper control of detrimental insects, an adequate supply of effective pollinators, and the skillful application of irrigation water to establish the most desirable moisture stress on the flowering alfalfa plants. A seed grower who fails to keep these three factors in an optimum balance will be unable to produce alfalfa seed yields in the range of 1,000 pounds per acre or more. The grower may have perfect control of any two of these factors, but failure in good management of the third may result in near crop failure. Other factors affect seed production but, with the exception of adverse weather, usually not to the extent that these three do. Pollinators and control of detrimental insects are covered in other sections of this publication.

IRRIGATION RATES AND TIMING

Irrigation is necessary in the arid West where precipitation in the seed-production areas ranges from about 6 to 14 inches annually. Water may be effectively applied by furrow, flood, or sprinkler irrigation, but timing and rate of application are most critical and vary with soil types and soil depth.

Depending upon soil depth, soil type, and the availability of irrigation water, seed growers usually go into the growing season with the soil profile quite moist. Subsequent irrigation should only be sufficient to keep the alfalfa plants growing slowly and to promote continuous flowering. On soils 8–20 feet deep with good moisture-holding capacity, little additional water should be required. If the soil is shallow and/or coarse textured, frequent light applications of irrigation water are advisable over infrequent heavy applications. Unless the soil depth is very shallow, irrigation should be discontinued when a good seed set is evident and flowering has noticeably declined. Experienced growers have usually developed good irrigation practices for their specific areas, soil types, and soil depths. New growers can learn valuable tips from experienced growers in their area and also by trying two or three irrigation rates on their own fields to learn which produces the best yields. Over-irrigation produces excessive vegetative growth and/or second growth with fewer flowers; insufficient irrigation places too much stress on the plants and causes blossoms and immature seed to drop. Maximum yields are obtained only when the available moisture promotes good flowering but does not encourage growth beyond that necessary to bear a continuous pro-

Fig. 1—This 80-acre field was planted in 36-inch rows, two months before the photograph was taken, using 1 pound of seed per acre. It yielded 471 pounds of clean seed in the year of planting.

Fig. 2—Tractor-drawn seeder being checked for calibration to assure a 1 pound per acre planting rate.

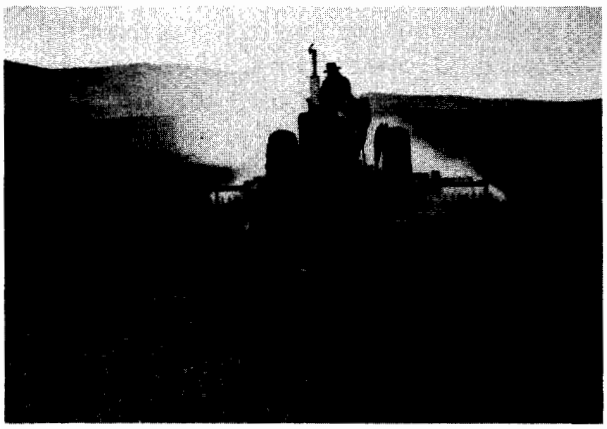

Fig. 3—Second year field being cultivated in the spring to destroy spring weeds, volunteer seedlings, and to incorporate refuse into the soil.

cession of flowers. It is difficult to recover from a significant early season mistake in irrigation, whether over- or under-irrigation.

PLANTING RATES AND TIMING

Alfalfa may be planted for seed production either in early spring or early fall. When spring plantings are made without a companion crop and weeds are effectively controlled, seed yields of 500 to 800 pounds per acre can be realized in the year of planting (Fig. 1). Well-established fall plantings should yield near maximum seed yields the following year. Seeding rates of ¾ to 1 pound of seed per acre in rows 18 to 36 inches apart are adequate to produce seed yields in excess of 1,000 pounds per acre (Fig. 2). Row plantings facilitate mechanical cultivation as a part of the weed and alfalfa seed chalcid control programs (Fig. 3). Thin stands enhance pollination and control of detrimental insects. Although not recommended for commercial seed production, research has shown as few as 8,970 plants per acre will produce seed yields in excess of 1,000 pounds in the second and third years of production.

EFFECT OF WEEDS

Perennial noxious weeds and dodder must be controlled in the production of certified alfalfa seed. These weeds should also be controlled in production of common seed to assure the clean seed will meet state and federal laws. Canada thistle and dodder probably are the two most difficult noxious weeds to keep under control. They are found in most production areas and establish quickly and easily in seed fields if growers fail to maintain a constant vigil. Uncontrolled weeds suppress alfalfa by competing for light, nutrients, and moisture. Some harbor insect pests. They also interfere with uniform application of insecticides and desiccants, cause problems in harvesting, and increase seed losses during removal of weed seeds while cleaning the crop.

Effective herbicides and technology are available to seed growers to control most weeds satisfactorily in alfalfa seed production. New her-

bicides and new technology continue to become available to help growers better deal with specific problems. Seed growers should check with their local county agent to obtain new information as it becomes available.

EFFECT OF DISEASES

Diseases do not affect alfalfa grown for seed nearly so much as that grown for hay. This is undoubtedly due to less frequent irrigation and cutting and the dry field conditions as the seed crop matures. Further, loss of some plants in seed production fields is not as serious as in forage production since much fewer plants are required.

The bacterial wilt organism is present in most soils where alfalfa is grown in the West; in 3–5 years after planting it will reduce stands of nonresistant alfalfa grown for seed. Stem nematodes also infest many soils in the West, but stand losses are minimal in seed production fields. Anthracnose and *Phytophthora* root rot have been found in the Pacific Northwest but are not problems in seed production fields. In 1976, Verticillium wilt of alfalfa was found and identified for the first time in the Pacific Northwest and in the United States. Since it was found over a fairly wide geographic area, one would speculate that the organism had been present but undetected for a number of years.

Thus far, Verticillium wilt has not caused any apparent reduction in the seed production potential of fields but has caused considerable concern regarding shipping of seed out of the area into U.S. and Canadian trade channels. The importance of seed in spreading the disease has not been determined, but the disease organism has been found on the surface of some seeds and in plant debris in a small percentage of seed lots checked. Researchers are working to learn more about how Verticillium is spread and how to prevent its spread. Plant breeders are also striving to develop wilt-resistant varieties for forage production.

SELECTION OF VARIETIES

There are many varieties of alfalfa, perhaps too many, and seed yields do vary among varieties. A variety that produces low seed yields in one area, however, might produce high seed yields in a different area or under different management practices. Narragansett is a classic example of a historically poor seed producer that turned out bumper seed yields in southwestern Idaho. Generally, if a seed grower can learn the specific production requirements for a given variety, good seed yields can be produced with most varieties presently grown. Proper irrigation is often the key to obtaining good seed production when pollination and control of detrimental insects have not been limiting factors.

The large number of varieties makes it difficult to meet field isolation requirements and increases the chance of mechanical mixtures during harvesting and processing of the seed crop. In 1978, there were 127 varieties of alfalfa being grown under certification in Washington state. When many varieties are grown in the same production area, growers have difficulty providing field isolation. Production within a given area can be limited by the many isolation zones removing available land from seed production.

CLIPPING

Spring growth is often clipped in established fields to coordinate the alfalfa bloom period with the emergence of wild bee pollinators and also to help reduce damage from alfalfa seed chalcids (Fig. 4). Clipping can be accomplished through use of swathers, rotary mowers, or roto-beaters. Removing the first spring growth the last week of April in the earlier areas enables regrowth to begin flowering the first week of June when the first alfalfa leafcutting bees begin emerging naturally. The clipping date should be adjusted earlier if leafcutting bees are being incubated to emerge earlier. Likewise, the clipping date should be delayed if alkali bees are the principal pollinator or if the grower is deliberately delaying incubation of the leafcutting bees. Unclipped alfalfa will begin flowering well in advance of wild bee emergence; early flowering also increases the length of time detrimental insects need to be controlled.

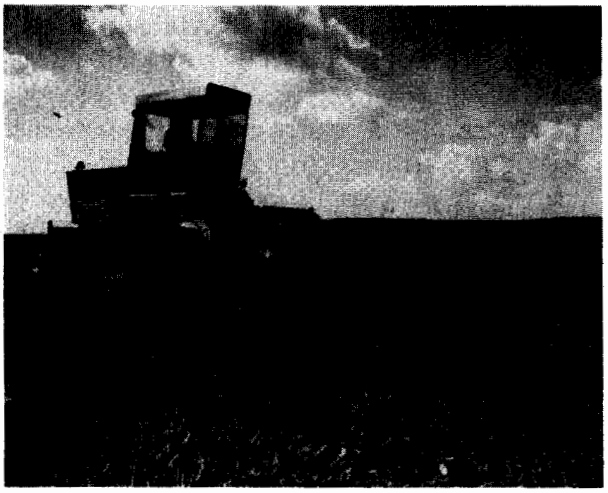

Fig. 4—Spring growth is often clipped to better coordinate flowering with the emergence of wild bee pollinators. This photo shows a swather being used to remove the early spring growth. Mowers and forage choppers can be used to accomplish the same results.

PESTICIDE SELECTION

Alfalfa seed growers must use pesticides to control detrimental insects, but they also must carefully choose the proper insecticides so that pollinators and other beneficial insects will not be harmed. Insecticides used in other crops are usually highly toxic to leafcutting and alkali bees, and their use could result in reduced bee populations. It will be difficult to continue alfalfa seed production in those areas where specialty crops such as mint, sweet corn, grapes, fruit trees, and hops are widely grown because of the highly toxic pesticides used in these crops.

HARVEST

Harvesting is now done almost exclusively by self-propelled grain combines modified for threshing alfalfa seed. The crop is usually harvested standing after pre-harvest treatment with a desiccant (Figs. 5 and 6). Depending upon local restrictions and the length of time available for the desiccant to be effective, Des-i-cate or Diquat is used on alfalfa seed fields. Des-i-cate requires more time to dry the seed crop than Diquat. The practice of swathing the crop has declined in recent years and is not generally recommended because of the hazzard of losing much seed by a strong wind storm rolling the swaths into piles or off the field entirely. Additionally, if rain stops harvest, more seed will be lost from seed sprouting in the swath than from standing alfalfa.

Threshing of alfalfa seed should not begin until the seedpods and leaves are thoroughly dry. The combine cylinder speed should be reduced to about 4,000–5,000 feet per minute peripheral speed. This translates to about 1,200 r.p.m. on a 15-inch cylinder and 1,000 r.p.m. on an 18-inch cylinder. Excessive cylinder speeds damage the seeds, resulting in lower seed viability. They also chop up the stems to a greater degree, increasing the amount of material on the chaffer and making separation more difficult. The cylinder-concave clearance should be adjusted to about ¼ to ⅜ inch. Open the chaffer as wide as you can without plugging the tailings return; this is usually about ⅜ to ½ inch. Use as much air as possible without blowing seed out in the air stream. It is important that the combine be fed uniformly. An air setting that will not blow seed out at a certain feeding rate may blow it out when you lessen the amount of material on the chaffer. It is important to check not only for seed losses over the back of the combine but also for seed losses from small holes in the combine. A large piece of canvas or sheet plastic tied under a combine will soon reveal whether or not seed is leaking. Duct or masking tape applied over holes can save many pounds of seed in a harvest season.

To estimate the loss of free (threshed) seed over the cleaning shoe, use a 4/64 round-hole dockage screen on top of a 1-square-foot blank pan. Hold the two pans in a horizontal position behind the chaffer or cleaning shoe and shake vigorously while following the combine for four steps (11 feet). A close-packed, single layer of alfalfa seeds in the pan contains about 250 seeds per square inch. The effect of air and chaffer adjustments can be observed by the increasing or decreasing amounts of seed caught in the dockage pan. Seed

losses cannot be completely eliminated, but an effort to keep them at a minimum means dollars and cents in the grower's pocket.

WEATHER

The West is generally blessed with an ideal climate for alfalfa seed production. Clear, sunny, warm summer days with little or no rain promote good flowering of the alfalfa and provide for many hours of pollinating activity. However, occasionally a cool, late spring will delay emergence of pollinators or keep them inactive during a period when they would normally be pollinating. The much more serious weather situation occurs in those years with a week or more of unseasonal rains in August or September. When this occurs, high seed losses can and do result since wet, mature seeds germinate in the pods before harvest or the wet pods split as they dry, permitting seed to shatter onto the ground should a wind follow. Seed losses as high as 50% have occurred in certain areas from fall rains. Adverse weather, however, is a production problem over which seed growers have no control.

Alfalfa Seed Production In the Western United States

State	1978	1982
	Clean seed in 1,000 pounds[1]	
Arizona	380	315
California	19,803	43,911
Colorado	482	428
Idaho	12,559	10,981
Montana	1,526	2,616
Nevada	7,583	6,745
New Mexico	249	290
Oregon	4,807	3,590
Utah	4,073	2,056
Washington	10,889	10,705
Wyoming	— —	63
Total Western Production	62,351	81,700
Percent of U.S. Total	80%	92%
U.S. Total	77,877	88,522

[1] Census of Agriculture, 1978 and 1982

Fig. 5—Self-propelled combine, adapted for alfalfa seed, harvesting seed directly from standing plants after the crop was preconditioned for harvest with a desiccant.

Fig. 6.—Some growers pull a trailer behind their combines to remove the refuse from their fields as the seed is harvested. A special blower is used to blow the materials coming off the straw walkers and cleaning shoe into the trailer. The refuse can be rethresed to recover lost seed if losses warrant. Removing refuse removes chaff, weed seeds, and seed chalcids from the field. The field does not need to be burned to clean it up for the next seed crop.