UtahStateUniversity
COOPERATIVE EXTENSION

September 2004 (pr) Ag/Forage & Pasture/2004-02

Alfalfa Variety Selection Guidelines

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Alfalfa is raised extensively in Utah in pure stands and in mixtures with grasses for use as hay, cubes and pellets, silage (*haylage*), direct-cut fresh forage (*green chop*), and pasture. It is produced under dryland and irrigated conditions for on-farm use and as a cash crop that is transported within and beyond Utah. Traits that make alfalfa a desirable crop include its perennial nature; abilities to obtain water and nutrients from greater soil depths than most other crops via deep roots, and supply its nitrogen needs through fixation of atmospheric nitrogen; and provision of high levels of energy, fiber, and protein for livestock. Alfalfa is in demand as a feed for various classes of livestock, can produce 8 or more tons of dry matter/ac, and can be profitable. Alfalfa also helps prevent soil erosion, provides diversity in crop rotations, and supports populations of beneficial insects.

Relative to other perennial forage crops, possible disadvantages of alfalfa include shorter stand life; bloat risk to ruminants, particularly under grazing; potentially excessive levels of crude protein and protein degradability in grazed or early-cut forage; and susceptibility to pests such as alfalfa weevil and nematodes and to mechanical injury from livestock grazing and machinery traffic.

More than 280 alfalfa varieties (*cultivars*) are commercially available within North America. Most of these are listed in an annually-updated bulletin from the National Alfalfa Alliance (www.alfalfa.org) that rates fall dormancy and pest resistance levels and lists seed marketers. Descriptive information for these varieties, as well as for older ones not on this list, is available on the North American Alfalfa Improvement Conference (NAAIC) website (www.naaic.org).

Well-known older alfalfa varieties such as Ranger (released in 1940), Vernal (1953), Lahontan (1954), and Vernema (1981) originated from public breeding programs. The vast majority of alfalfa varieties marketed today are proprietary materials from private breeding programs. The rapid proliferation and changing characteristics of new varieties can make selection a bewildering process. Suitability to site conditions, performance potential, stand persistence, and seed cost vary widely among varieties. Furthermore, seed quality, genetic conformity with published variety descriptions, and permissible weed seed levels vary among certified and non-certified (*common or variety not specified; VNS*) sources of seed.

When considering whether to plant seed of older varieties that may have performed acceptably in the past, vs. contemporary varieties with broader pest-resistance profiles, also consider the ways in which alfalfa management and production have changed over recent decades. Relative to the past, alfalfa plants are subjected to new pests and more physiologically-challenging cutting schedules that target higher forage quality. Older varieties may not persist as well under the stresses of frequent cutting as they did under less-aggressive harvesting regimens. Steps in the selection of appropriate varieties follow.

Preliminary Site and End-use Considerations

Is alfalfa the most appropriate species for your needs, environmental conditions, crop rotation sequence, intended level of management, and end uses or markets? Not all soil and environmental conditions in Utah are suitable for alfalfa production. Alfalfa performs best on deep, well-drained, and slightly alkaline soils. Alfalfa is not well-suited to saline or wet meadow sites or to grazing under heavy, continuous stocking. Alfalfa also provides less cover for soil and water conservation than sod-forming grasses, but is excellent as a nutrient-scavenging crop (such as where nutrients from long-term manure applications may have moved downward in the soil). In some cases, annual or perennial grasses or other legumes, including the non-bloating species birdsfoot trefoil, cicer milkvetch, and sainfoin, may be more suitable or profitable forage crops.

What are the known site and management limitations to alfalfa establishment and production? Stand life and returns on investment are likely to be greater on sites with higher production potential as controlled by climate; soil properties; season-long adequacy of fertility and irrigation inputs; crop management; pressures from pests including diseases, insects, nematodes, vertebrates, and weeds; and residual herbicides from previous cropping that could injure alfalfa. Sources of relevant information include soil surveys and other materials from USU Extension and USDA Natural Resources Conservation Service (NRCS) offices, and visits with Certified Crop Advisors and other seed and agricultural supply company representatives. While there are successful cases of new alfalfa stand establishment following a previous alfalfa crop, reseeding alfalfa following alfalfa is generally not recommended. This is because alfalfa residue can be autotoxic to new alfalfa seedlings and because rotation to an alternative crop can help disrupt alfalfa pest cycles.

Variety Selection Based on Plant Traits

Alfalfa varieties fall broadly into purple-flowered (*Medicago sativa* L. ssp. *sativa*) **and yellow-flowered** (*M. sativa* L. ssp. *falcata*) **subspecies, and their hybrids** (variegated alfalfa, *M. media*). Relative to purple-flowered alfalfas, yellow-flowered alfalfas tend to be more drought-tolerant, late-spring and early-fall dormant, winterhardy, and are slower to regrow and less productive across a growing season when water is not limiting. Yellow-flowered alfalfas often possess a more prostrate growth habit and broad, subsurface crowns (*junction between roots and shoots and region of regrowth buds*). Some yellow-flowered varieties are creeping-rooted or rhizomatous, having underground lateral structures from which new roots and shoots can emerge. Few yellow-flowered varieties are commercially available, and they are typically best suited to dryland applications.

Nearly all alfalfa varieties for irrigated production are purple-flowered. Within these are multifoliolate (*more than three leaflets per leaf*), grazing-, traffic-, and manure-tolerant, and high-digestibility types. Some of these specialty types have a less-complete disease-resistance package than conventional hay types, as shown in the National Alfalfa Alliance variety listing. Some of the grazing types were selected to withstand stresses of continuous stocking, but this trait may not be as important as high levels of disease resistance to a manager that practices rotational stocking. New alfalfa varieties with hybrid and reduced-bloating characteristics are being marketed, and genetically-modified alfalfas with traits such as resistance to the herbicide glyphosate (Roundup Ready®) have been developed for marketing in the near future.

Regrowth differences in mid-November at Kaysville, UT, between the less-dormant (FD 6) variety in the center and the more-dormant (FD 3-4) surrounding varieties.

Choose an appropriate level of fall dormancy (FD) for site conditions. Fall dormancy is a scheme for classifying alfalfa varieties on the basis of differences in growth response to decreasing daylengths and

temperatures in the fall, as shown in the photograph. Fall dormancy ratings relate fall regrowth height following a late summer cutting to the heights of known check varieties. Fall dormancy scores range from 1 (extremely FD) to 11 (extremely non-dormant) and are listed for certified alfalfa varieties in the National Alfalfa Alliance bulletin referenced above. Example FD ratings are Vernal=2, Ranger=3, Legend=4, Archer=5, and Lahontan=6.

In the past, FD was interpreted as an index of winterhardiness and survival, with FD as low as 1-2 being selected for the coldest sites in the Intermountain West. Relationships between FD and winterhardiness appear to be less strong in modern varieties, and separate winter survival ratings are being provided by some breeding and variety testing programs. Winter survival is currently rated on a scale of 1 (no injury) to 6 (dead plants). Ranges in Winter Survival Index from recent field tests at the Universities of Minnesota and Wisconsin are 1.6 - 3.0 for FD 2, 1.6 - 3.3 for FD 3, and 1.5 - 3.6 for FD 4. These ratings show that winter injury levels can range from minor to substantial within each of these FD classes. Less-dormant types generally exhibit faster recovery following cutting and higher total season yield potential than more dormant types. Selection of an appropriate FD level thus becomes an effort to balance seasonal yield potential and winter-injury risk. Most alfalfas planted in the Intermountain West are FD 3-5. For rotations where extended stand life is not a priority, selection of FD 6-7 alfalfas may provide some additional growth.

Choose an appropriate package of disease and pest resistance for your site, environmental conditions, and intended stand life. Determine what pests may have caused alfalfa stand decline in the past. Alfalfa breeders have dramatically improved the pest resistance of alfalfa since the release of Ranger and other early varieties. Common alfalfa pests in Utah for which resistant varieties are available include bacterial wilt, Verticillium wilt, Phytophthora root rot, and nematodes and aphids. Stem nematodes and northern root-knot nematodes are common throughout Utah, while southern root-knot nematodes are localized in parts of southwestern Utah. Aphid distribution in Utah is broadest for pea aphid, limited to southern areas for blue alfalfa aphid, and more limited to hotter, dryer, and southern parts of the state for spotted alfalfa aphid. While the fungus that causes Fusarium wilt is not widely observed in Utah, nearly all modern varieties have high levels of resistance to this pathogen. Disease resistance is not immunity, and resistant plants can become infected under severe disease pressure. Only a proportion of the individual plants in a population may be resistant to diseases that the variety is rated for. Disease pressure is typically less intense on dryland sites than in irrigated cropland, and may be of less concern when alfalfa is a short-term rotation crop. Disease and pest resistance profiles are provided on the National Alfalfa Alliance and NAAIC websites.

Compare rankings of alfalfa varieties in performance trials conducted under environmental and management conditions relevant to your situation. Utah trial summaries may be accessed via the USU Extension website, and results of trials in adjacent states may be accessed via links from the NAAIC website. In comparing rankings of alfalfa varieties in any trial, be aware that your location may have different pest and disease pressures and environmental conditions than trial locations, and compare averages from multiple years and locations. First-year production data are often more variable than in subsequent years and should not be used as a basis for selecting varieties.

Top-performing modern alfalfa varieties typically produce 0.5-1 ton/ac more dry matter annually than older standard varieties such as Ranger, and are likely to have longer stand life under disease and harvesting pressures.

Seed Quality and Treatment Considerations

Obtain high-quality seed from a reputable source, of which there are many in Utah and the Intermountain West. Examine seed labels for company warranties of quality, genetic identity, or performance. Take advantage of the benefits of certified or Plant Variety Protected (PVP) seed for assurance that genetic identity is as stated on the label. Certified seed will have a blue tag and PVP seed will be so labeled.

While common or VNS alfalfa seed is typically less expensive than certified or PVP seed, standards of seed quality, genetic purity, and permissible weed seeds are lower in non-certified seed. Differences in seed cost between common and certified or PVP seed are usually easily offset by increased production and stand life of modern varieties, and decreased importation of weed seeds. Permissible levels of prohibited noxious weed seed in certified lots is zero, with stringent tolerances on restricted and common weed seeds; uncertified lots may contain seed of extremely undesirable weeds. Seed brands and blends, which may be proprietary, may vary unpredictably in their genetic constitution among lots and years. Information on sources of suitable varieties may be obtained from local growers and dealers, popular farm publications, and marketers listed in the National Alfalfa Alliance bulletin referenced previously. Additional sources of certified seed may be found on the website for the Association of Official Seed Certifying Agencies (www.aosca.org) which lists state seed certification, seed grower, and foundation seed organizations.

Use seed tag information to understand levels of hard seed and weed seeds; seed treatments such as inoculum, fungicides, or nutrients; and pure live seed (PLS). Pure live seed concentration is obtained by multiplying the level of seed purity by the level of seed germination, e.g., 99% purity x 90% germination = 89% PLS (0.99 x 0.90 = 0.89). Economic comparisons may be made among seed lots on the basis of price/lb of PLS. Seed coatings may constitute as much as one-third of total packaged seed weight. Alfalfa seed coated with nutrient, fungicide, or inoculant layers may therefore have lower purity levels (e.g., 65-66%) than uncoated seed. These purity differences may require seeding rate adjustments to achieve target pure live seeding rates. Dates of germination tests should be displayed on seed tags, since germinability decreases with seed age.

If alfalfa seed is pre-inoculated with appropriate *Rhizobium* bacteria for nodulation and N_2 fixation, check the expiration date on the seed tag to confirm viability of the inoculum. Alternatively, purchase fresh inoculum and inoculate seed prior to or at time of planting. Use of sticking agents such as sugar solutions or evaporated milk, followed by drying, will improve adhesion of peat-based inoculum to seed. Sticking agents may be unnecessary for seed adherence of newer clay-based inoculants.

This publication is issued in furtherance of Cooperative Extension work. Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Jack M. Payne, Vice President and Director, Cooperative Extension Service, Utah State University.