A GUIDE FOR

SUCCESSFUL FORAGE ESTABLISHMENT

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Forage crop planting at SAREC (Photo: Anowar Islam)

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Picture on cover page: A well-established alfalfa one-year stand at SAREC (Photo: Anowar Islam)

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Forage stand establishment depends upon several important factors and relates to the facts that the producer is returning to the forage production business, is increasing forage yield and desirable pasture species, and improving sustainability and profitability in the production systems.

Establishment success involves an understanding of forage needs and proven seeding methods. Successful stand establishment results in a highly productive pasture or hay field. Forage seeding is costly; therefore, failure to obtain a good stand can result in monetary and land use losses to the producer. The failure rate of forage establishment is higher than traditional crops; therefore, the risk and cost of forage establishment are substantial.

Thin and poorly established forage stands encourage weeds to invade, reduce forage yields, and shorten longevity of the stands. Considering all these negative consequences along with the risk and costs associated with poor forage stand establishment, increasing the chances for success is essential.

A few key factors need to be considered for successful forage stand establishment.

1. Planning Ahead

Remember, "Half the job is planning." Good, thoughtful planning is the number-one key for successful stand establishment. A number of activities that need to be completed well in advance include site selection, weed management, adjusting soil pH, fertilization, and species and variety selection. Once the forage is seeded, there is very limited option for controlling weeds. Soil pH adjustment (e.g., liming) is also very important. Many forage species can grow at a pH below 6.0; however, they will grow best and yield most at near neutral soil pH (pH closer to 7.0). Since soil pH affects nutrient availability, inadequate pH adjustments will limit forage production particularly in acidic soils.

Matching forage species or varieties to soil and environmental conditions is very important. Soil type, texture, pH (e.g., acidic, alkaline, sodic), soil fertility, water-holding capacity, drainage, and environmental conditions (temperature and precipitation) all effect the selected forage species or varieties.

Use unbiased information in selecting forage species or varieties. Obtain research-based information by contacting neighbors who had success or extension personnel (UW Extension educators or specialists). Species and varieties are often selected based upon personal or industry preferences without considering site characteristics and soil properties. Mistakes in the early planning and management phase cannot be corrected. Always remember the "seven Ps" – pre, prior planning prevents poor pasture performance.

2. Weed Control

Weed management during forage establishment is extremely important and needs to be developed and implemented long before the crop is seeded. Effects of residual herbicides from previous crops must be considered. Without an adequate weed control program, weed pressure along with hot and dry temperatures make spring forage establishment difficult.

3. Autotoxicity

A common problem associated with alfalfa stand establishment is "autotoxicity." This is the production of chemical compounds secreted by plants that inhibit the growth and development of nearby plants of the same species. This is often found when alfalfa is reseeded in fields in which alfalfa was a previous crop. There are many negative effects. The first is observed in the roots of young seedlings. Root growth will be inhibited or stopped, and plant growth will be stunted. Alfalfa yield will be significantly reduced. Avoid planting alfalfa immediately after destroying an old alfalfa stand. Affected plants may appear normal but as time progresses, yield reductions occur.

The effect of toxins may disappear over time, but its impact stays on plants throughout the life-cycle of the stand; therefore, affected alfalfa plants remain stunted and produce low yield after the autotoxicity effect disappears.

Now the question is how to prevent autotoxicity in alfalfa stands. Remember, there is no single recommendation for controlling autotoxicity in alfalfa. The following options may help in reducing the incidence of autotoxicity and increase alfalfa yield: (1) avoid planting alfalfa after alfalfa; instead, plant other crops for one or two years to avoid yield reduction; (2) kill the old alfalfa stand in fall and wait and plant new alfalfa seeds the following spring; (3) kill the old stand in spring and plant an annual crop (for example oats), and then plant new alfalfa in late summer; (4) in case of reseeding, delay planting at least three weeks after killing the previous alfalfa stand.

In all cases expect yield reduction in the new alfalfa stand except option (1). In the long-run, yield will be increased from healthier alfalfa stands and offset yields lost during initial stand establishment.

Seedbed preparation usually starts with plowing and disking to destroy previous vegetation, loosen soil, and mix fertilizer into soil. (Photo credit: David Koch)

4. Seeding at Proper Time

Plant forage seeds when the chances of success are best based upon rainfall patterns and temperatures. For proper germination, 40 degrees Fahrenheit or higher soil temperatures are needed. Too-high temperatures are detrimental because the soil surface will not stay moist. In general, rainfall patterns in Wyoming peak in May and June and decline until the end of the year (Figure 1).

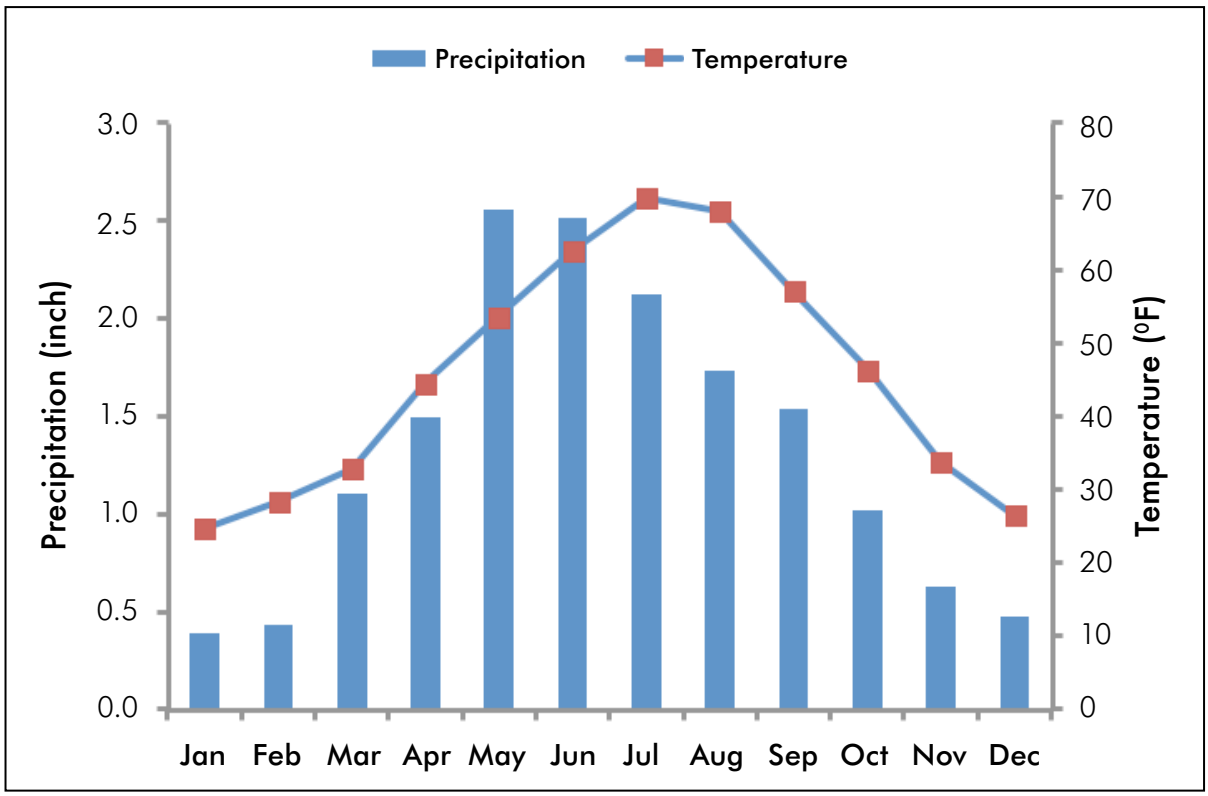

Figure 1. Trends of average precipitation and temperature in Wyoming. In general, precipitation peaks in May and June while temperature peaks in July.

May is the most common month for forage planting in Wyoming. There are usually several weeks of good growing conditions by then; however, it can get hot by the end of May in some areas. This can cause desiccation in poorly rooted seedlings resulting in poor stands. An alternative to May seeding is generally late summer (August) if water is available. This is a good time for forage seeding as weeds are less troublesome.

Early spring planting refers to March or April rather than May. This early planting generally helps seedlings be better rooted before the onset of hot weather; however, slight frost injury may occur due to hard frost after germination. Overall, there is less risk in early spring seeding than seeding in May (moisture stress) because of adequate rainfall and optimum temperatures.

Dormant planting, a time in which conditions are such seeds do not germinate, usually is November to March. This is common with perennial grasses in which seeds remain dormant in soil during the cooler months and get ready to germinate and grow as soon as conditions are favorable in the spring.

5. Seeding Rate

Recommendations of forage seeding rates vary considerably depending upon soil and environmental conditions. The larger the seed, the more pounds per acre needed. As a rule of thumb, these seeding rates should result in about 20-50 seeds per square foot (20 for the larger and 50 for the smaller seeds). For example, 10 pounds of alfalfa seeds per acre will result in 50 seedlings per square foot – 50 seeds per foot of row with 12-inch row spacing; 25 seeds per foot of row with 6-inch row spacing (seed every ½ inch). If half of the viable seeds produce seedlings, a good stand is expected. If more than half establish, they will generally self-thin over the first three months or so to about 25 plants per square foot. Less-than-ideal soil conditions (such as uneven stony field, not well-prepared seedbed, etc.) might justify planting at the higher end of the recommended range. Mortality will be greater with smaller-seeded forages than with larger seeds because of the initial less-growth vigor in smaller-seeded seedlings.

6. Seeding Depth

Planting too deep is the most common reason for forage seeding failure. The rule-of-thumb in agronomy is not to plant a seed deeper than five times its diameter. This means most forage seeds should not be planted deeper than 3/8 inch. Greater than 3/8 inch greatly increases the risks of poor emergence and thin stands.

Cultipacking or roller-harrowing helps level soil, break up clods, push rocks into the soil surface, and firm soil for good seed-to-soil contact. (Photo credit: David Koch)

Depth bands (front) and packer wheels (back) help keep drill from placing seed too deep and make good seed-to-soil contact. (Photo Credit: Anowar Islam)

A firm seedbed is critical to assure accurate seeding depths. Fluffy seedbeds interrupt the function of the depth band wheels of a seeder; as a result, seeds are frequently placed too deep.

Planting too deep is usually the result of a loose seedbed – it is sometimes hard to sufficiently firm a seedbed. Cultipacking or roller-harrowing will help in leveling and firming soils. Sandy soils (such as in many areas in Wyoming) dry out faster; therefore, it is better to use the deeper (3/4- to 1-inch) depth, particularly for grasses. Much research shows that the number of seedlings established sharply diminishes as depth of seeding increases from the optimum.

7. Seed-to-Soil Contact

Forage seeds require ample amount of water (about 100 percent of their own weight) to initiate the germination process. This water must move from soil to the seed. It is crucial the seed be in close contact with the soil. Good seed-to-soil contact results in good and uniform germination and increase the number of productive forage plants in the seeded stand. A well-prepared seedbed without clods helps ensure good seed-to-soil contact.

To determine whether the soil is firm enough to plant, the following can be used: a footprint of an adult should not be deeper than ¼ inch on a well-prepared seedbed; about 10 percent of the planted seeds should be on the surface of the soil after planting. No seeds visible on the surface indicate the planting was too deep.

8. Seeding with or without a Companion Crop

A companion or nurse crop of a small grain or a small grain with pea mixture is commonly used with spring forage seedings in the northern U.S. This provides quicker ground coverage than forage seedlings alone and helps reduce wind and water erosion and weed invasion during forage establishment. A companion crop provides forage in the establishment year. Any spring-seeded grain can be used as a companion crop; however, oat and triticale are found to be the most satisfactory. A recent study conducted at the University of Wyoming showed that using oats as a companion crop enhanced forage legume (e.g., alfalfa, sainfoin, cicer milkvetch, and medic) establishment by reducing weed competition (Figure 2).

Companion crops compete with young forage seedlings for light, water, and nutrients. Weeds, especially broadleaf, can be more competitive for a longer period than companion crops; therefore, care should be taken in deciding on a seeding rate for companion crops. Generally, seeding rate for spring-seeded small grains should not exceed 25 percent of the recommended rate for grain production. This will help decrease competition — especially in dry seasons — and reduce lodging in wet seasons. Additionally, high rates of fertilization with nitrogen should be avoided to reduce competition. Forage

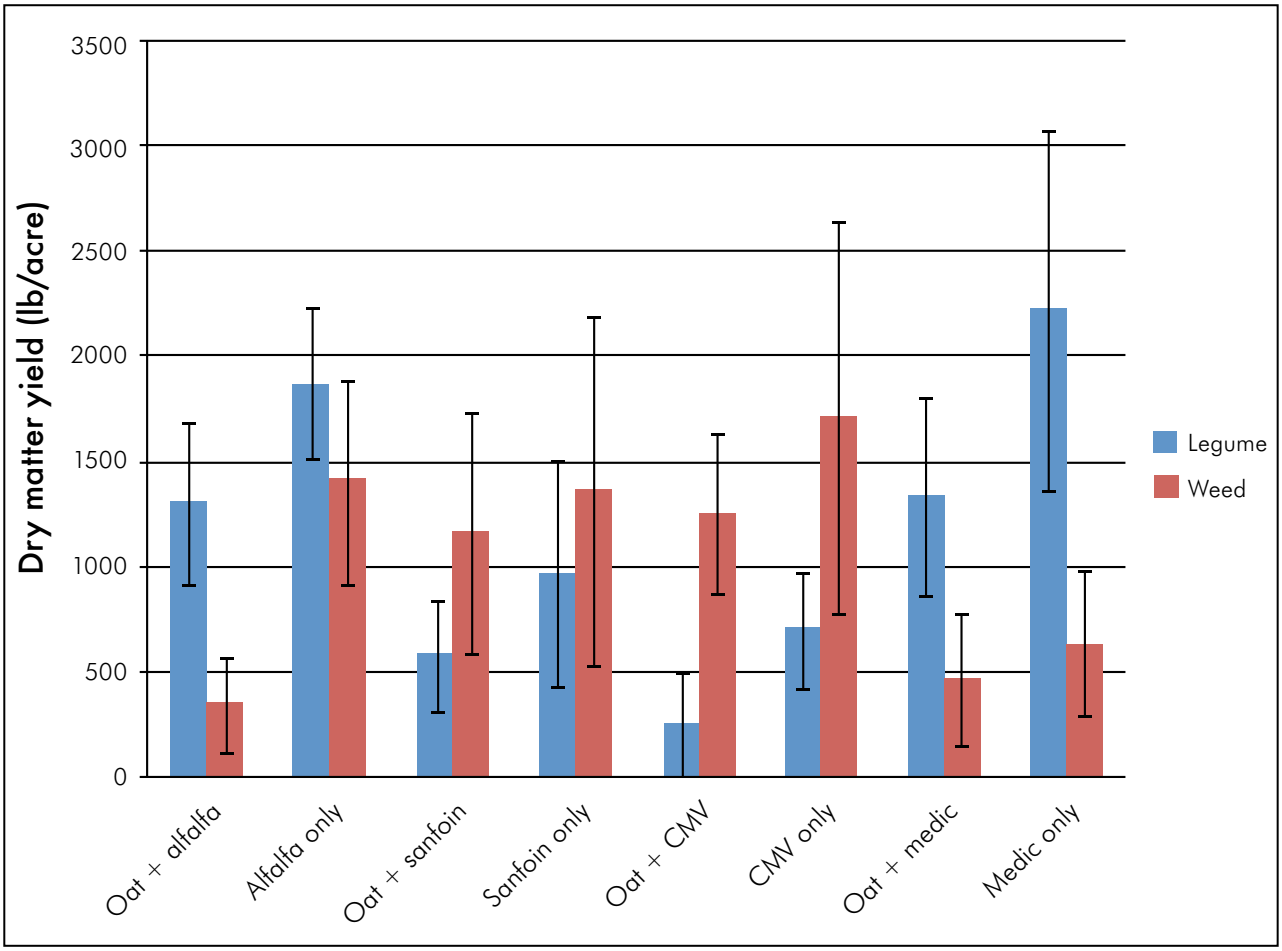

Figure 2. Dry matter yield of different forage legumes and weeds at the James C. Hageman Sustainable Agriculture Research and Extension Center (SAREC) near Lingle. Plots were harvested in September 2009. CMV = cicer milkvetch.

A well-established grass field in Powell Research and Extension Center (PREC) (Photo: Anowar Islam)

establishment can be favored by early harvesting of the companion crop or removing this as silage or pasture.

Using a companion crop (e.g., winter grains) in fall forage planting may not be a good option because of the long fall development period, which allows the companion crop to become more competitive. Although winter grains provide excellent quality forage, care should be taken to discontinue grazing before jointing if it is to be harvested for grain. Remove straw and stubble following harvest of grain companion crop to avoid smothering young forage seedlings. The forage crops can be harvested later if they reach early bloom stage.

Seeding forages without a companion crop is advantageous in many instances. For example, seeding perennial forages in late summer after the small grain harvest is complete is more practical than spring seeding with a companion crop. The forage seedlings do not need to compete with the companion crop or weeds. Additionally, there is no need to manage a companion crop to enhance forage seedling establishment; however, success of late summer seeding depends primarily upon adequate precipitation between the period of grain harvest and forage seeding.

Preemergence and postemergence herbicides may replace the need of a companion crop to manage weeds during forage establishment. The use of herbicides also reduces the seeding rate of forages; however, no herbicide is available to control weeds in grass-legume mixtures during establishment.

There are always some pros and cons no matter whether the forage will be seeded alone or with a companion crop. The decision to make for using a companion crop or an herbicide during forage establishment should be based on certain site-specific conditions, for example, weed intensity, soil erosion potential, and the need of forage during the year of establishment.

9. Management of New Seedlings

Management of new seedlings is important for the longevity and productive stand of forages. For optimum growth of new forage seedlings, minimizing weed and insect competition, maintaining optimum soil fertility, and employing optimum harvest management play an important role over the life of the forage stand. Weeds commonly invade new plantings and may reduce forage stand if not controlled. Clipping may be necessary but it should not be done too early because this will remove only the tops of the weeds and leave active buds to produce new branches and more competition. On the other hand, clipping too frequently can reduce seedling development and, as a result, yield reduction may occur the following year.

In summary, good planning is the key for successful forage stand establishment, and the planning needs to be made at least one year ahead. Forage and pasture improvement depends upon successful stand establishment and management. Healthy, thick, and vigorous stands are essential for high forage yields and quality. To obtain maximum benefits and yield, seeding at the right time is another key factor. Ideal seedbed preparation and close watch of weather patterns are important for successful establishment of highly productive forage stands. These offer unique opportunities for improving forage productivity, quality, and profitability. Additionally, site selection, species and variety selection, planting meth-

od, fertilization, liming, and weed management are also important factors to be considered. It is therefore essential to know all key factors responsible for a successful forage stand establishment.

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Alfalfa baling at SAREC (Photo: Anowar Islam)