

# INTERSEEDING OF PASTURES AND HAYFIELDS

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## INTRODUCTION

To renovate a pasture is to make it new again, to make it a high producer of good quality forage. The primary method of renovating an established pasture or hayfield is by interseeding new species of grasses and legumes. Before attempting a renovation project, you must first ask yourself: Why do I want to renovate? Reasons to renovate may include replacing low producing species such as Kentucky bluegrass or weedy species such as foxtail barley, introducing nitrogen fixing legumes such as clover or alfalfa, or introducing a specialty grass like Garrison creeping meadow foxtail.

Before considering renovation of an established pasture or hayfield, look at your overall management starting with the irrigation system. Water is the number one factor limiting forage productivity in the western US and a poorly designed or inefficient irrigation system can translate to reduced forage production. You should be in control of your water. Put it where you want, when you want, and in the amount needed. Without control of irrigation water, all other changes in management, including renovation, will be limited in their effect. Secondly, determine if the existing forages are meeting your needs. The best management plan won't make the wrong species produce for you. Thirdly, once you have your irrigation water under control and the desired forages established, you can fine tune your pastures and hayfields with fertilization, grazing management, and weed control. Determine the weak link in your management and address it.

## Species Composition

When is a particular forage not working? This is a question you must answer for each individual situation. For example, a pasture dominated by Kentucky bluegrass may work well for a small horse pasture where durability of cover is more important than high forage production. On the other side of the coin, if you are raising steers for maximum daily gain, then the same Kentucky bluegrass pasture may not be acceptable.

Another example would be a wet, flood irrigated pasture or hayfield that is dominated by water loving plants such as sedges, rushes, or foxtail barley. In this instance, Garrison creeping meadow foxtail or timothy may be more desirable grasses.

Pastures and hayfields dominated by orchardgrass and smooth brome continually need nitrogen fertilizer to maintain production. A possible solution here would be to interseed a nitrogen fixing legume such as red clover or birdsfoot trefoil. If stands of smooth brome are hard to maintain in saline soil conditions, consider interseeding tall fescue or Newhy hybrid wheatgrass that are more adapted to these soils.

As a side note, do not overlook the power of applying nitrogen fertilizer to change the species composition of grass pastures and hayfields. The more common forage grasses, such as orchardgrass and smooth brome, respond extremely well to nitrogen fertilizer. Many times these species are

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present, but may not be productive due to low nitrogen fertility. If these species are present, even at low densities, then applying nitrogen may be all that is needed to stimulate their growth. As a consequence, these species become competitive to the point that less desirable species like Kentucky bluegrass completely disappear from the composition. In these situations, interseeding to thicken or add new species to the stand may not be required. Do not fertilize with nitrogen if legumes such as red clover or alfalfa are present and you desire them in the composition. As little as 30 lbs of nitrogen per acre can cause legumes to decrease when growing in mixed stands with grasses.

**The basic methods of renovating are:**

- Remove existing plants using conventional tillage (plow, disc, etc.) and reseed.
- Overseed desirable species into existing vegetation by broadcasting.
- Interseed desirable species into the existing vegetation by drilling.

**Renovation by Conventional Tillage**

The ultimate in renovation involves complete destruction of the existing plant cover and replacing it with another using conventional tillage and seeding practices. This method is machinery and labor intensive. Conventional tillage is often impractical due to rocky soil conditions, excessive sod build-up, or steepness of the ground. Costs can easily approach \$100 or more per acre. In mountain meadow areas, costs as high as \$500 per acre have been incurred due to the difficulty in breaking up the sod mat following plowing. Once the soil is exposed, it is susceptible to erosion and can be difficult to flood irrigate. Seedlings are also vulnerable to invasion by weeds.

On the plus side, this method does provide an excellent seedbed which leads to relatively quick establishment of the seeded forages compared to overseeding or interseeding. In addition, if the pasture or hayfield has been in production for a number of years, then tilling the soil can lead to large releases of tied up nutrients such as nitrogen and phosphorus. This release of nutrients can sometimes sustain yields for 3 to 5 years with little input of fertilizer.

As with most practices, you must ultimately weigh the costs against the potential benefits and risks as they pertain to your particular operation and level of comfort. Complete renovation is more costly compared to overseeding or interseeding, but the risks of stand failure are lower. Conversely, overseeding and interseeding are less costly, but you carry a higher risk of the plants you seeded not establishing. On the plus side, you have not tilled everything up and can generally still harvest or graze the existing plants. When renovating using complete tillage, you often lose an entire year's crop.

**Renovation by Broadcast Overseeding**

Overseeding by broadcasting the seed is an inexpensive, but marginally effective means of adding an improved grass or legume to an established pasture or hayfield. This method requires using a hand or mechanical broadcast spreader to distribute the seed. The major drawback with broadcast seeding is there is little or no seed-to-soil contact. Without seed-to-soil contact, seeds seldom germinate, and those that do wither and die before their tiny roots reach the soil. Forages with large seeds like smooth brome, wheatgrasses, and sainfoin are less likely to establish than forages with small seeds like timothy or red clover. The larger seeds hang up in the established forage and thatch whereas the smaller, denser seeds find their way to the soil where they can root and grow.

Success with broadcast seeding is greatly increased by harrowing or feeding hay to livestock on the new seeding. Dragging with an English harrow or meadow drag knocks the seed to the soil where it can germinate. The hoof action of animals imprints the seed into the soil, often planting it nearly as effectively as a grass drill.

Broadcast overseedings are generally more successful when planted in the fall. The freezing and thawing of the soil over the winter helps to incorporate the seed and improve seed-to-soil contact. Due to poor seed-to-soil contact with broadcast seeding, it is necessary that seeding rates be doubled over the recommended drilled rate.

The following tips will help improve the success of plant establishment when broadcast seeding:

1. Suppress the existing vegetation
  - Heavy grazing
    - This is the one time that you are allowed to overgraze
    - Use temporary electric fencing to concentrate animals
  - Close mowing
    - As close to the ground as possible
    - Flail-type mowers work well for this
  - Roundup herbicide
    - Goal is to suppress, not kill the existing vegetation
    - Rate will depend on species present, generally  $\frac{3}{4}$  to 1.5 qts/acre
      - Lighter rates for species such as Kentucky bluegrass and orchardgrass
      - Heavier rates for species such as smooth brome and tall fescue
    - Apply 2 to 3 weeks prior to seeding when existing plants are 6 to 8 inches tall
2. Rough up the soil surface with a harrow
  - English, spike, spring tooth, or disc-type harrow
3. Spread seed
  - Do not mix small, round, hard seeds (e.g. alfalfa) with large, odd-shaped seeds (e.g. smooth brome)
  - Results in uneven distribution of seed
4. Lightly harrow or drag pasture to cover seed
  - Can also graze for a short period of time (< 7 days)
5. Keep surface wet for 6 to 8 weeks with frequent, light irrigations

### **Renovation by Interseeding with a Drill**

Interseeding with a drill is an excellent alternative to conventional tillage and seeding or broadcast overseeding. Interseeding involves placing the seed directly into the existing sod which improves seed-to-soil contact compared to broadcast overseeding. Benefits of interseeding include lower costs compared to complete tillage and the existing plants act as a cover crop that suppresses weeds and reduces soil erosion potential, especially if flood irrigating. Depending on if the existing vegetation is suppressed or not and to what degree, generally at least a partial hay crop can be obtained during the year of seeding.

There are numerous types of interseeding or no-till type drills available that can be used to interseed into existing pastures and hayfields. Some are better than others when seeding into heavy sod conditions like those typically found in mountain meadows or perennial pastures and hayfields that have been in production for a number of years (10+). The John Deere 1550 Powr-till drill has been used successfully to interseed into mountain meadows and other heavy sod situations. It is the only drill available that has power-driven coulters to open slots in the sod. The coulters are powered by the PTO on the tractor and typically cut slots in the sod about ¾" deep by ¾" wide thus reducing competition in that narrow band. This drill works best for interseeding small seeded forages such as alfalfa, clovers, birdsfoot trefoil, and timothy. Although it has not been manufactured for a number of years, used units can be located if you look hard enough. Because of all the moving parts, maintenance and upkeep on this drill can be quite high.

There are numerous interseeders available that are ground driven (e.g. Great Plains, Tye, Haybuster, and Truax brands). Most have rolling coulters that slice the sod followed by double-disk openers that make a small furrow into which the seed is dropped. The openers are then followed by press wheels that close the furrow and firm the seed. For best results, the drill should have some form of depth control on the openers such as depth bands or gauge wheels to avoid planting the seed any deeper than ¼ to ½". Emergence of most forage seeds will be hindered if planted deeper than ½" (generally, the smaller the seed, the shallower it should be planted).

In addition to drills that have double-disk openers, there are a couple of manufactures that use leading coulters followed by either rigid or flexible shank openers. The Tar-King Plant-O-Vator uses an aggressive, rigid shank opener to create a furrow that is approximately 5" deep by 3" wide. It essentially tills the soil in the furrow which reduces competition from existing vegetation and creates a fine, mellow seedbed given that the soil is not too wet. Fertilizer can effectively be placed below the seed which is a nice feature. The two main drawbacks to this drill are that it seeds on 12" centers and fields with rocks in the top 6" are problematic, although spring loaded shanks are available as an option. The Atchison Seedmatic uses a spring tine shank with an inverted T opener (a.k.a. Baker Boot). Although not as aggressive as the Tar-King, it does loosen the soil and creates a shallow slot into which both seed and fertilizer can be dropped. The action of the inverted T opener prunes the surface roots of existing plants which reduces competition in the area of the slot. This drill works well in soils that do not have an accumulation of organic matter at the surface. Many mountain meadow soils have up to a 4" layer of organic matter (peat) and the openers on this drill do not work as well under those conditions.

Apart from the few exceptions noted above, most interseeding drills do little to reduce competition from the existing vegetation. Just as with broadcast overseeding (see above recommendations), reducing plant competition prior to interseeding greatly increases the success of stand establishment. The most successful method involves spraying with Roundup herbicide at least two weeks prior to seeding. Depending on the rate used, species present, and timing of application, control of the existing vegetation will range from just suppression to actual kill. Plants are more likely to only be suppressed following spring application of Roundup when they are growing rapidly versus fall application when they are moving carbohydrates into the root system. One quart of Roundup per acre is adequate to suppress most existing vegetation. Where herbicide usage is feasible, it can significantly improve establishment of seedlings by restricting competition. One significant drawback, however, is that the pasture or hayfield is opened up for possible weed invasion. To reduce plant competition in a pasture, existing plants can be heavily grazed before seeding and up until germination. Do not graze after germination as trampling and grazing will kill the emerging seedlings. For smaller acreages, close mowing is also a feasible option for reducing competition. For this method to be effective, mow as close to the ground as possible using a flail (preferred) or rotary-type mower.

There are 3 basic times in which to interseed. The first is in the spring prior to the start of irrigation. For most locations, this will occur sometime between early March and mid-May. The advantages of spring seedings are that plants have the entire growing season in which to establish plus irrigation water is readily available. The drawback to spring seeding is that the existing vegetation is extremely vigorous and must be suppressed, generally with herbicides to achieve the best results. The second time to seed is in late summer (August for most locations) following haying or heavy grazing. The major criteria are that you need late summer irrigation water and 6 to 8 weeks of growth before the first hard frost. For some mountain meadow areas, this means seeding needs to occur in mid July. The third time to interseed is during the dormant season (mid October to March). Generally, there is no need to seed during this time period if the site is irrigated. Why put the seed in the ground where it will lay for several months prior to germinating and can be scavenged by birds and rodents? Dormant season seedings are most useful when renovating dryland sites and you are trying to take advantage of winter moisture to germinate plants in the spring.

Once new plants are established, it is important to follow up with good management including grazing, water, and fertilizer management.

Cost of interseeding is somewhat expensive, approximately \$10 to \$25 per acre for drilling plus seed, herbicides, etc. Higher costs for drilling are associated with smaller acreages because of the extra time spent turning around at the end of the field. Ripper-type drills are also more expensive to operate because they require the use of higher horsepower tractors and you can only travel 3 to 3.5 mph. The John Deere Powr-till drill is also more expensive to operate because it is subject to slower ground speeds.

To give the seeds every opportunity to germinate and survive, follow these recommendations:

1. Graze, mow, or apply an herbicide to reduce plant competition.
2. Use a good interseeder that places the seed in contact with the soil at 0.2 to 0.5 inches deep.
3. For a given species, cut the recommended full seeding rate for drilling by 1/3 to 2/3 depending on your particular situation (i.e. amount of bareground present, ability to suppress existing vegetation, weed competition present, etc.). To assist you in your seeding rate decisions, contact your local NRCS or Cooperative Extension office.
4. Do not seed in wet soil conditions or during precipitation.
5. Seed parallel to contour ditches.
6. When using the John Deere Powr-till drill, drag a harrow across rows to help cover seed.
7. Graze after seeding but before germination to help pack seed and reduce competition from existing vegetation.
8. Do not graze seedlings in the first year.
9. Do not fertilize with nitrogen during establishment (nitrogen fertilizer can favor competing plants).

10. Fertilize with phosphorus, according to soil test recommendations, to assist legume establishment.
11. Irrigate with frequent, light applications of water to favor seedling establishment.
12. Be patient!! Newly interseeded grasses and legumes may not be obvious in the stand for two to three years.

### **Interseeding Birdsfoot Trefoil**

The following discussion will illustrate the potential benefits of interseeding legumes into grass dominated hay meadows using birdsfoot trefoil as an example. In this trial, five varieties of birdsfoot trefoil were interseeded into a mountain hay meadow in May using a John Deere 1550 Powr-till drill. Each variety was either directly seeded into the existing vegetation (control), plots in which the vegetation had been suppressed with 1.5 qts/acre of Roundup 2 weeks prior to seeding, or plots that were rototilled about 1.5 inches deep. The tilling treatment just scuffed the tops of the grasses off and set them back for a period of time. It was not severe enough to kill them.

In Table 1, yields of the 5 varieties that were interseeded into the grass are compared to the control that had no legumes. These values are averaged over the 2 suppression treatments and the unsuppressed control. All varieties lead to an increase in total hay yield ranging from 660 to 1320 lbs/acre compared to the unseeded control that was predominantly grass (83%) with a few forbs such as dandelions. Establishment varied among the varieties of birdsfoot trefoil with contributions to total yield ranging from 19 to 26%. The Leo and Norcen varieties were the top performers.

Table 1. Effect of interseeding various varieties of birdsfoot trefoil (BFT) on yield and composition of mountain meadow hay.

Variety	Yield	Grass	BFT	Forbs
	----lbs/acre----	-----%-----		
Control	3300	83	0	17
Carroll	4240	66	20	14
Empire	4240	65	19	16
Leo	4470	56	24	20
Norcen	4620	59	26	15
Tretana	3960	64	19	17

When you interseed legumes, you not only get a yield boost, but can also expect an increase in forage quality, especially crude protein content. Since all varieties of birdsfoot trefoil established fairly well, crude protein content of the hay increased from 1.9 to 3.0 percentage points compared to the unseeded control that was primarily grass (Table 2). Essentially, the quality of the hay with regards to crude protein went from marginal (7.5%) for dry, mature cows to adequate for most classes of beef cattle including growing heifers and steers. The digestibility of the hay went down slightly (2 to 3 percentage points) in relationship to most of the birdsfoot trefoil varieties, especially the Leo and Norcen varieties that established the best (Table2). This is not a significant decline with regards to the needs of most classes of beef cattle, but is worth noting. There are 2 probable causes. First, the trefoil competes with the grass, especially for light, which caused the grass plants to grow taller and put on more stem material. Stems are generally higher in fiber which is less digestible. In addition, legumes like trefoil fix nitrogen from the atmosphere in nodules that form on their roots. As these nodules slough off and decompose, they release nitrogen that can be taken up by the grass plants. Just as with the shading, nitrogen stimulates stem growth which is less digestible.

Table 2. Effect of interseeding birdsfoot trefoil on crude protein (CP) content and in vitro dry matter digestibility (IVDMD) of mountain meadow hay.

Variety	CP	IVDMD
	-----%-----	
Control	7.5	65.6
Carroll	9.4	64.5
Empire	9.8	65.0
Leo	10.5	63.2
Norcen	10.2	62.9
Tretana	9.5	65.2

Table 3 illustrates the effects of seeding method (i.e. seedbed preparation) on total hay yield and establishment of birdsfoot trefoil. The values presented in the table are averaged over the 5 varieties. Establishment of the trefoil was lowest in the plots that were directly interseeded with no effort to suppress the existing vegetation. In those plots, trefoil only contributed 12% to total hay yield. Compared to the direct seeded control, suppressing the existing vegetation by lightly tilling resulted in a 50% increase in contribution of the trefoil to total hay yield. Tilling also stimulated production of the existing grasses which made up 70% of the hay composition. Twice as much birdsfoot trefoil established in the plots sprayed with Roundup herbicide 2 weeks prior to interseeding compared to the direct seeded plots. Both methods illustrate the importance of suppressing the existing vegetation prior to interseeding. In most situations, you would like to see between 25 and 50% contribution of the legume to total yield following interseeding.

Table 3. Effect of method of seeding birdsfoot trefoil (BFT) on yield and composition of mountain meadow hay.

Seeding Method	Yield	Grass	BFT	Forbs
	----lbs/acre----	-----%-----		
Control	3670	67	12	21
Spray	4330	61	24	15
Till	4450	70	18	12

### **Band Application of Roundup**

Applying Roundup in strips or bands and then interseeding into those bands is another method that can be used to suppress the existing vegetation and improve establishment. We conducted a trial in which a Truax grass drill was outfitted with a spray boom that applied Roundup in 4 inch bands or a wiper apparatus that wiped concentrated Roundup on the plants in 4 inch bands. These 2 treatments were compared to no suppression or the more typical broadcast application in which Roundup was applied to all plants (Table 4).

This was a very productive mountain meadow (3.2 tons/acre), so the existing vegetation was extremely competitive. Very few trefoil plants established when seeded directly into the existing vegetation with no suppression (Table 4). With total suppression of the existing vegetation, 4 plants per square foot established. The band spray and wiper treatments were intermediate with about 2 plants per square foot. It may not seem like a lot plants established, but even 2 plants per square foot, if they survive over time, can contribute significantly to yield and quality. Just envision 2 mature alfalfa plants per square foot in a mix with grasses - not bad hay in my opinion.

In addition, both band application methods resulted in a partial hay crop of about 1 ton/acre. Although we attempted to apply Roundup to only half of the plants in the seeded area (the drill we

Table 4. Effect of method of applying roundup herbicide to suppress existing vegetation on establishment success of birdsfoot trefoil and year of seeding hay yield from a mountain meadow.

Suppression Method	Density plants/ft <sup>2</sup>	Hay Yield tons/acre
Control	0.4	3.2
Band	2.3	1.0
Wiper	1.8	1.1
Broadcast	4.0	0.0

used was set on 8 inch centers), we ended up suppressing more than half of the plants as indicated by the 1 ton/acre hay yield compared to the control at 3.2 tons/acre. We did not account for plants in which the leaves hung into the band where Roundup was applied, but yet were rooted outside the band. In hindsight, we should have applied Roundup in bands smaller than 4 inches (possibly 3 inches) to achieve a 4 inch suppressed band of plants.

One caution when applying Roundup and seeding at the same time is to make sure the ground is fairly dry so the seeds do not germinate right away. Roundup is generally tied up immediately once it comes in contact with mineral soil. However, when interseeding into perennial grass pastures or hayfields, there is often a buildup of litter or thatch and Roundup that comes in contact with that type of organic material is not immediately inactivated. If the soil is moist enough for the seeds to germinate within the first 7 to 10 days, they will often be killed. Trust me, I had that happen.

#### **Timing of Overstory Removal (Haying)**

When interseeding, many people think that having the right drill and getting the seed in the ground is the hard part. Following seeding, they go about their management as usual. Don't be fooled, management after the seed is in the ground is often more important. One critical factor that is often overlooked following interseeding is when to remove the existing forage (i.e. when do you take your hay crop?). Plants compete for water, nutrients, light, and space. For seedlings, light competition is an important factor that must be considered. If the overstory of existing plants is not removed in a timely manner, the seedlings begin to struggle for light, become pale and spindly, and will generally die.

The effect of timing of overstory removal on establishment of several legumes is illustrated in Figure 1. These legumes were interseeded in early May using the John Deere Powr-till drill. For the zero weeks treatment, we mowed the existing vegetation to about 3 inches just prior to seeding to simulate early spring grazing followed by seeding. For the other treatments, we interseeded the legumes and then removed the overstory vegetation at 3, 5, and 7 weeks post seeding. The 7 weeks treatment coincided with the normal haying time for this particular meadow, so therefore would be considered the control.

There was some variability among the various legumes tested, but in virtually every case, waiting until the normal haying time to remove the overstory resulted in the lowest number of plants per square foot (Fig. 1). Conversely, removing the overstory vegetation 5 weeks post seeding resulted in the highest number of plants per square foot, especially for birdsfoot trefoil and 2 of the alfalfa varieties. Alfalfa and red clover also responded fairly well to the simulated early spring grazing (0 weeks treatment). This data illustrates that even subtle changes in management (2 weeks earlier haying) can result in significant differences in establishment success of interseeded plants.

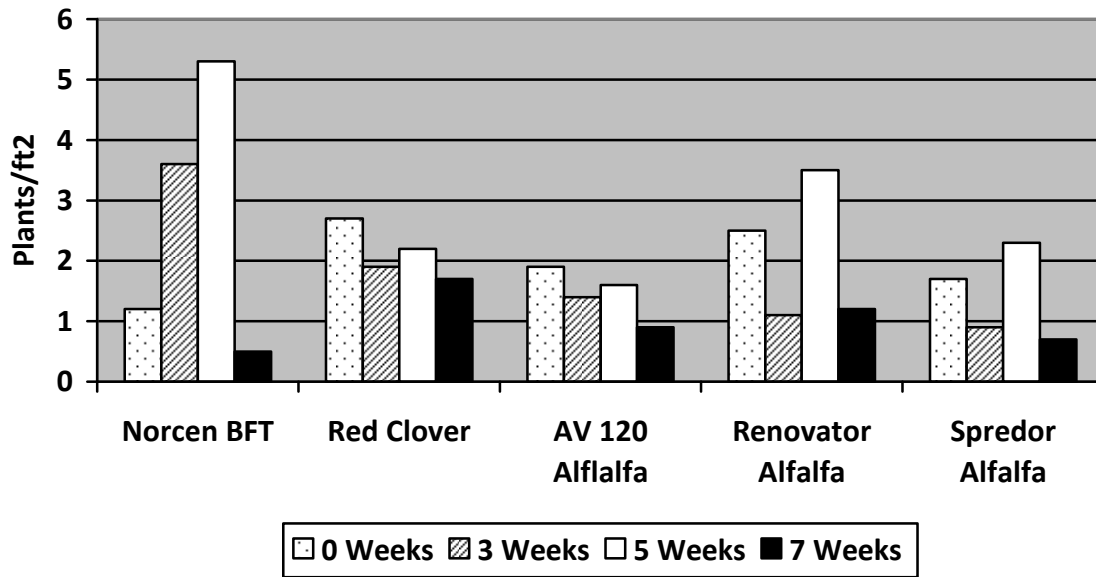


Fig. 1. Effect of timing of removal of the existing vegetation on establishment success of 5 legumes interseeded into a mountain hay meadow in the spring. The 7 weeks treatment coincides with the normal haying time for this meadow.

#### Early Haying Followed by Interseeding

There are advantages and disadvantages to interseeding in the spring. You have a longer growing season for the plants to establish, but competition from the existing vegetation can decrease establishment success. One simple method to minimize competition from the existing plants is to interseed later in the summer (August for most locations). At higher elevations, this may require taking the initial hay harvest about 2 weeks earlier than normal. Regrowth of most forage grasses is much slower and less vigorous later in the summer following haying. The canopy does not close as fast and the seedlings do not become light starved like they do with spring seedings.

Table 5 illustrates establishment of 5 alfalfa varieties and 1 trefoil variety following early haying in a meadow at about 6500 ft elevation. The trefoil did extremely well, especially when compared to the above trials where herbicides, early harvest, strip application of herbicides, etc, resulted in about the same plant densities. As mentioned above, 2 or more plants per square foot can be considered a successful interseeding in many situations, especially when adding legumes to grass.

Table 5. Evaluation of legume establishment following early haying (mid July).

Species	Density (plants/ft <sup>2</sup> )
Birdsfoot Trefoil	
Norcen	5.4
Alfalfa	
Renovator	3.0
Magnum III Wet	2.7
Webfoot MPR	2.6
AV 120	2.3
Spredor 3	2.1

## **SUMMARY**

Interseeding is a viable approach for improving the yield and quality of perennial forage stands. To be successful, you must be willing to alter your management of the particular pasture or hayfield during the year of seeding. Timing of water is critical. Light, frequent irrigations will favor establishment of the newly seeded plants. When interseeding in the spring, the existing vegetation must be suppressed using herbicides, grazing, or light tillage. Competition for light can be severe for the seedlings struggling in the understory, but can be easily relieved by harvesting earlier than normal. Simply interseeding later in the summer following haying can minimize competitive effects from the existing vegetation and result in successful establishment with few inputs. The potential cost savings of interseeding versus complete renovation with tillage makes this a practice worth exploring.