Pasture Maintenance and Revitalization Following Drought

S. Ray Smith and Chris D. Teutsch
Forage Extension Specialists
Virginia Tech

The last few years have been a tough for pastures in many areas of Virginia. Dry weather and high temperatures have limited forage growth causing many pastures to be grazed closer than they should have been. Moisture is a primary factor limiting forage growth in Virginia. In most cases it is not total annual precipitation, but rather the seasonal distribution of rainfall. Even though we have had adequate precipitation lately, the effects of last years drought will still be with this spring and summer and we must be prepared for drought periods that will come in the future.

**Managing Drought Stressed Pastures**

In most cases drought alone rarely kills well-managed pasture grasses. However, drought coupled with others stresses can weaken, thin, and even kill pasture stands. These stresses include poor fertility, overgrazing (prior and during drought), and elevated pest pressure. Although droughts cannot be predicted or prevented, they can be prepared for. The best management strategy is to continuously prepare for drought. This is accomplished by using good pasture management. The following suggestions will help to maintain healthy pastures that will grow longer into a drought and recover faster after rain comes.

**Maintain correct soil pH**

Soil pH for grass-clover pastures should be maintained between 6.2 and 6.5. Lime pastures more frequently rather than waiting and applying large quantities of lime at once. Use dolomitic lime when magnesium levels are low.

**Maintain phosphorus and potassium**

Phosphorus and potassium levels should be maintained in the high range. Phosphorus is an important element in the compound ATP which is the energy currency in the plant. It is also plays a major role in root growth and survival of newly established seedlings. Potassium is required in relatively large quantities and substantial amounts are removed from hay fields. Potassium is involved in stand persistence especially for legumes. Proper levels of this element increase winter hardiness and disease resistance.

**Rotationally graze pastures**

Energy is required for pasture regrowth after grazing. The source of this energy is photosynthesis taking place in residual leaf area and carbohydrates stored in the plant. Rotational grazing allows producers (rather than the animal) to regulate the amount of leaf area retained after grazing and the amount of time pastures are rested between grazing events. Most pastures should not be grazed closer than 2-4 inches, but 4-6 inches would be better. Rest periods are important since they allow the plant time to recharge the carbohydrates that were utilized for regrowth after grazing. Rest period length will vary with season and weather conditions. In general shorter rest periods are required in the spring and fall when plants are actively growing while longer periods are required in the summer months when plant growth
is slowed by high temperatures and moisture stress. Rotationally grazed pastures recover from drought faster than continuously grazed pastures.

**Maintain stubble**

Maintaining 4-6" of stubble helps to shade the soil surface and prevent water evaporation. Stubble also shades grass crowns aiding in the survival of species such as orchardgrass and endophyte free tall fescue.

**Maintain healthy root systems**

Roots not only anchor plants to the soil, but also provide a means to absorb water and nutrients required for growth. Roots are out of sight and often out of the mind of many producers, but their importance to the overall health of the pasture should not be underestimated. Close and frequent grazing reduces the size and depth of the root system making the plant less tolerant to drought. Rotational grazing helps to maintain a healthy root system that can sustain plant growth longer going into a drought and speed growth after rain finally comes.

**Feed hay when pastures are not growing**

Pastures can easily be damaged by overgrazing during drought periods. A better alternative is to restrict animals to a single paddock and feed hay. This will isolate the damage to one paddock and will allow for rapid recovery of the other paddocks when rain finally comes. Resist the temptation to open all the gates and let the animals roam wherever they want.

**Stockpiling for Winter Grazing in Drought Years**

Stockpiling tall fescue is one the cheapest and best ways to provide winter grazing for livestock in Virginia. In good years, tall fescue pastures top-dressed with 60-80 lb nitrogen/A in mid August can produce 1-2 tons/acre hay equivalent. The question most often asked in drought years is: Does this recommendation work for dried up, overgrazed pastures? No pasture will respond to nitrogen until it rains. In addition, pastures that have been overgrazed have the least potential for fall growth. Applications of nitrogen for stockpiling should target pastures that have not been overgrazed or have been overgrazed the least. The next question is when and how much nitrogen to apply. In a drought year there are several approaches to stockpiling. The first is to apply nitrogen in mid August at normal rates and then pray for rain. The second is to delay applications until rain looks like a sure thing. This option requires more planning since nitrogen needs to be applied prior to the impending rain. As the application date becomes later decrease the amount of nitrogen since the grass will have less time to grow before frost and cool temperatures set in.

It is easy to say don't graze drought stressed pastures, but in many cases there may no way to avoid it. Most healthy pastures should be able to withstand some severe grazing (removing most of the leaf area, but not repeatedly) during a drought. However, pastures that are overgrazed (closely grazed and never allowed to rest) will be much more susceptible to injury from grazing during drought. In addition, not all plant species respond to drought and grazing in a similar manner. Below is a brief description of common forage species and their response to drought and grazing.
Alfalfa. Alfalfa possesses a deep taproot making it one of our most drought tolerant legumes. During periods of severe drought and high temperatures alfalfa will go dormant, but is generally not damaged. During these periods alfalfa will bloom at a short height, and can be grazed off without injuring the stand.

Red Clover. Red clover also possesses a taproot, but it is much shallower than alfalfa. Drought stress can injure established stands of red clover, shorting stand life. Hot and dry conditions are especially damaging to newly established seedlings.

Ladino and White Clover. Ladino and White clover are relatively shallow rooted legumes. Production during drought is low, but plants usually persist and regrow from either stolons or hard seed.

Orchardgrass. Orchardgrass is a strong perennial grass with fair drought tolerance. This grass will persist during hot and dry conditions if it is not overgrazed. It will not tolerate close and frequent grazing and therefore works best in rotationally grazed systems. Orchardgrass is not as well adapted to southern and eastern Virginia and does not persist well under poor management.

Tall Fescue. In Virginia, endophyte infected tall fescue is the best adapted cool-season grass and will in most cases survive even severe drought. It is more tolerant of mismanagement than orchardgrass, but also responds well to rotational grazing. The endophyte imparts grazing and drought tolerance to tall fescue, thus endophyte free varieties are not as tolerant to drought stress, but can survive with optimal management.

Kentucky Bluegrass. Bluegrass is a sod forming perennial cool-season grass that tolerates close and frequent grazing and is best adapted to the higher elevations and areas west of the Blue Ridge Mountains. This grass possesses a relatively shallow root system and is not drought tolerant. Bluegrass routinely goes dormant during the summer months when temperatures are high and moisture is limiting. However, bluegrass normally resumes growth in the fall when soil moisture is abundant and temperatures are lower.

Bermudagrass. Bermudagrass is a sod forming perennial warm-season grass that is best adapted to the Southern Piedmont and Coastal Plains Regions of Virginia. This grass tolerates close and frequent grazing and possesses excellent drought tolerance. Even bermudagrass though requires some water to remain productive. An advantage of bermudagrass is that it produces about twice as much dry matter per unit of water in comparison to most cool season grasses. It also responds well to smaller amounts of water supplied by summer thunderstorms compared with cool-season grasses.

**Revitalizing Drought Stressed Pastures**

Virginia's drought stressed pastures often look worse than they really are. This is especially true for pastures that were well managed prior to drought. In many cases pastures can be revived without reseeding. They key element of course is rain. The response of pastures to every input or management practice is dependent on moisture. In many cases,
pastures simply need to be rested and fertilized: 1) adjust the soil pH; 2) bring phosphorus and potassium to the high level; 3) and apply a small amount of nitrogen (40-50 lb/A) in November or early December (prior to a hard freeze). A late fall late nitrogen application will not produce a great deal of fall growth, but it will stimulate tiller production and root growth. Spring growth from these stands will be vigorous and thin areas will thicken faster.

Pasture legumes such as red and white clover are important components of pastures and in many cases could use thickening up even before drought. Pasture sod that has been suppressed by drought and overgrazing provide a perfect opportunity for interseeding clovers and alfalfa. Legumes can be either drilled in the fall or spring or frost seeded in late winter. Frost seeding works best with red and white clover. Alfalfa is better established using a no-till drill.

**Sod Suppression**

The existing sod must be suppressed and plant residue reduced prior to seeding. Sod can be suppressed by hard grazing in late fall and early winter. Overgrazing reduces the competitiveness of the sod and eliminates plant residue. This allows for seed to reach the soil surface and establish good soil-seed contact. Good soil-seed contact is essential for germination and emergence. Vegetation can also be suppressed using herbicides. A low rate of glyphosate can be applied prior to seeding, but paraquat is usually preferred since it results in a brittle residue that is easier to seed into. For fall seedings graze sod to a height of 2-4 inches and apply 0.8-1.5 pt/A of paraquat + surfactant approximately 2 weeks prior to seeding. For spring seedings apply 0.8-1.5 pt/A of paraquat + surfactant to a closely grazed sod in November. An additional treatment may be necessary in the spring to control winter annual weeds.

**Seeding Methods**

There are a number of seeding methods that can be used to introduce legumes and grasses into established sods. These include livestock seeding, frost seeding, minimum tillage, and no-tillage. Regardless of the seeding method, the goal is to achieve good soil-seed contact. Good soil-seed contact ensures that the seed will germinate and emerge in a timely manner. While all of these methods are biologically viable, minimum tillage and no-tillage produce the most consistent results. This is primarily due to the fact that both of these methods are putting the seed in contact with soil, and do not depend on nature to incorporate the seed.

**Livestock Seeding**

Livestock seeding is when seed is fed to the animals, passes through the rumen and lower gastrointestinal tract, and is deposited on the pasture in the manure of the animal. This method works best for legumes because they have a hard seed coat and pass through the animal intact. Grass seed are usually digested in the rumen, and therefore few remain viable. Although this method has been successful on large rangeland areas out west, it has several problems. The first problem is that manure is not uniformly distributed over the pasture area resulting in highly variable stands of legumes. A second problem is that germination and emergence from dung pats does not necessarily mean that interseeding was successful. In many cases seed will germinate and emerge from the dung pat, but the roots of the seedling
will never penetrate the soil. As the dung pats dry out many seedlings will die from desiccation. A third problem is that there is no way to successfully inoculate the legume seed with N fixing rhizobia since inoculum applied to the outside of the seed does not survive in the digestive tract of the animal.

Frost Seeding

Frost seeding is accomplished by broadcasting seed onto the soil surface in late winter/early spring. The freezing of the soil surface during the night and thawing during the day cause cracks to form. The formation of these cracks incorporates the seed into the soil. In order for frost seeding to be successful the seed must reach the soil surface. Therefore, reduction of plant residue on the soil surface is critical. In addition, the seed must be broadcast early enough that adequate freeze-thaw cycles take place to incorporate the seed (usually 4 to 6 weeks of frost action). In Virginia, frost seedings are most successful when seed is broadcast in late January to late February (depending on your location). This method is most successful with red and ladino or white clovers and annual lespedeza. It does not work as well with grasses and alfalfa. Seeding rates are shown in Table 1.

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Seeding Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Clover alone</td>
<td>8-10</td>
</tr>
<tr>
<td>Ladino or White Clover alone</td>
<td>1-3</td>
</tr>
<tr>
<td>Red Clover + Ladino or White Clover</td>
<td>4-6 and 1-2</td>
</tr>
<tr>
<td>Annual Lespedeza alone</td>
<td>15-20</td>
</tr>
<tr>
<td>Annual Lespedeza + Ladino or White Clover</td>
<td>8-10 and 1-2</td>
</tr>
</tbody>
</table>

Minimum Tillage Seeding

Minimum tillage seeding is accomplished by disturbing 40-60% of the established sod. This can be done using a disk, field cultivator, or other tillage implement. The tillage does not need to penetrate the soil more than 2-4 inches. The use of tillage helps to suppress the sod and expose bare soil. After tillage, the seed is broadcast onto the soil surface and cultipacked. In some cases a conventional grain drill can be used to distribute the seed. When establishing alfalfa, the majority of the sod should be disturbed. This seeding method can be used to reintroduce both perennial grasses and legumes or to overseed annual grasses and legumes into an established sod. Depending on the species being established this seeding method can be successful in either late summer or early spring. Seeding rates are shown in Table 2.

No-Tillage Seeding

No-tillage seeding is accomplished by using a no-till drill. A no-till drill possesses a coulter, which cuts slit in the sod. This coulter is followed by a double disk opener, which opens the slit and drops the seed in. The open furrow is closed and seed is pushed into contact with the soil by a press wheel. No-till seeding requires more effort and attention to detail, but produces more consistent results than the other seeding methods.
# Table 2. Seeding rates for minimum- and no-till seeding.

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Seeding Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Red Clover alone</td>
<td>8-10</td>
</tr>
<tr>
<td>Ladino or White Clover alone</td>
<td>1-3</td>
</tr>
<tr>
<td>Alfalfa alone</td>
<td>12-20</td>
</tr>
<tr>
<td>Red Clover + Ladino or White Clover</td>
<td>4-6 and 1-2</td>
</tr>
<tr>
<td>Annual Lespedeza alone</td>
<td>15-20</td>
</tr>
<tr>
<td>Annual Lespedeza + Ladino or White Clover</td>
<td>8-10 and 1-2</td>
</tr>
<tr>
<td>Red Clover + Ladino or White Clover + Orchardgrass</td>
<td>4-6 and 1-2 and 8-10</td>
</tr>
<tr>
<td>Red Clover + Ladino or White Clover + Tall Fescue</td>
<td>4-6 and 1-2 and 8-10</td>
</tr>
<tr>
<td>Annual Ryegrass</td>
<td>25-35</td>
</tr>
<tr>
<td>Annual Ryegrass + Crimson Clover</td>
<td>15-20 and 10</td>
</tr>
<tr>
<td>Small Grain</td>
<td>90-120</td>
</tr>
<tr>
<td>Small Grain + Crimson Clover</td>
<td>90 + 10</td>
</tr>
<tr>
<td>Small Grain + Annual Ryegrass</td>
<td>90 + 15</td>
</tr>
<tr>
<td>Small Grain + Annual Ryegrass + Crimson Clover</td>
<td>90 + 15 + 10</td>
</tr>
</tbody>
</table>

No-tillage seeding can be used to reintroduce perennial grasses and legumes or to overseed annual grasses and legumes into an established sod. This seeding method can be successfully implemented in either late summer or early spring. If clover is present in the sod, late summer seedings of alfalfa can become infected with sclerotinia crown and stem rot. Since this disease affects smaller seedlings, seeding in mid-August can help to reduce the severity of the infection. Another option is to seed alfalfa only in the early spring.

Since no-tillage seeding does not disturb the sod, it is especially important to suppress the sod before seeding. In many cases a herbicide application may be required, especially for alfalfa. Placing the seed too deep in the soil when no-till seeding is a common mistake that results in stand failures. In general, forage grasses and legumes should never be seeded deeper than one-half inch. It is critical that seeding depth is checked every time the drill is used since in both seeding depth varies with soil conditions. A general rule is that if a little seed cannot be seen beside the slit, then the seeding depth is too deep.

## Controlling Competition

Regardless of the seeding method, it is absolutely essential that competition from the existing sod and weeds be controlled after the seed has germinated and the seedlings have emerged. Failure to control competition during establishment allows weeds and established vegetation to successfully compete for water and nutrients and shade new seedlings. *This will lead to stand failure.* Competition can be successfully controlled by flash grazing or clipping at a height just above the growing seedlings. Flash grazing is accomplished by restricting a large number of animals to a relatively small area for a short period of time. This results in the quick removal of competing vegetation in a uniform a manner. It is important that clipping or grazing be done in a timely manner so that the competing vegetation does not get ahead of the seedlings. Grazing or clipping may damage or kill some seedlings, but the losses will be far less than if the competition is not controlled.
Key Points to Remember

- *Control Broadleaf Weeds.* Broadleaf weeds must be controlled prior to seeding legumes. This is best accomplished by controlling weeds the season prior to renovation.

- *Soil Test and Adjust Fertility.* In order for pasture renovation to be successful proper soil fertility is required. Lime and fertilize pastures according to soil test results. Lime should be applied six months prior to renovation.

- *Suppress Sod and Decrease Residue.* The existing sod must be suppressed and plant residue reduced prior to seeding. The reduction in plat residue facilitates good soil-seed contact. This can be accomplished by hard grazing in late fall and early winter or by using herbicides.

- *Ensure Good Soil-Seed Contact.* Regardless of what seeding method is chosen, good soil-seed contact is required for seed germination and emergence.

- *Seed on Proper Date.* Successful renovation can be done in either late summer or early spring. Prior planning and preparation are important so that seeding can be done in a timely manner.

- *Use High-Quality Seed of an Adapted Species.* Choose forage species that are adapted to the area and end use. Use either certified or proprietary seed to ensure high germination, seed genetics, and low noxious weed content. Cheap, low quality seed often cost more in the end due to lower production and thin stands.

- *Inoculate Legume Seed.* Always inoculate legume seed with the proper strain of nitrogen fixing bacteria prior to seeding. This is relatively inexpensive insurance that legume roots will be nodulated and efficient nitrogen fixation will take place.

- *Control Seeding Depth.* Small seeded forages should never be placed deeper than 1/2 inch. Always check seeding depth since it will vary with seedbed condition and soil moisture status. Placing forage seed too deep is one the most common causes of stand failures.

- *Control Post-Seeding Competition.* Failure to control post-seeding competition is one of the most common causes of stand failures. Clip or graze the existing vegetation to a height just above the developing seedlings. This must be done in a timely manner to ensure that the competing vegetation does not get ahead of the seedlings.

Summary

Drought rarely kills well-managed pasture plants. In most cases, drought stressed pastures are in better condition than they appear. Most pastures can be revived with rain, rest, and fertilization. Weakened sods provide a prime opportunity for incorporating legumes in established pastureland. With a little tender loving care this year's drought stressed pastures will be next year's profit. Remember grass is one of Virginia's most valuable resources.