

# **Planting and Managing Switchgrass for Forage, Wildlife, and Conservation**

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## **Introduction**

Switchgrass is a tall-growing, warm-season, perennial grass that is native to much of the United States including Virginia. Switchgrass (SG) was widespread in open areas before settlers populated an area and remained in one place year after year. Their livestock were free roaming and would graze the new switchgrass growth in the spring before the new plants were tall enough to withstand defoliation. This mismanagement weakened the stands and eventually led to their demise. They were replaced by cool-season grasses introduced from other countries such as bluegrass, tall fescue, and orchardgrass. These cool-season grasses began growth much earlier in the spring so they could tolerate the early season grazing by cattle. As a result, the native warm-season grasses such as SG were destroyed and can now only be found growing wild in abandoned sites such as old cemeteries or roadways.

Switchgrass breaks winter dormancy in late April and can provide some grazing in late May, but makes the most of its growth in June, July, and August. Since it is a tall-growing grass, the management must differ from that used for cool-season grasses. Switchgrass provides excellent erosion control when used as filter strips, grass hedges, or cover such as river levee banks. It is also beneficial for wildlife. The upright growth provides wildlife some overhead cover for protection, quality nest sites, and free movement which facilitates food searching. In established stands, there is little disease problem and no insect pests. Since it is a perennial, properly managed SG should never need to be replanted.

## **Planting Year Management Strategies**

### **Selecting the field:**

Switchgrass does well on a wide variety of soil types. Unlike cool-season grasses, it is drought-tolerant and produces well on shallow, rocky soils. It is also as tolerant of wet areas as reed canarygrass. Because no-till seeding is ideal for SG, steep slopes can be planted without having to deal with such tillage problems as soil erosion and rock exposure. It is important when planting steep slopes to select a drill or make the necessary adjustments so that the disk opener follows the leading coulter. A drill with a rigid, fixed-position coulter-disk opener assembly will not caster downhill.

Soil pH should be 5.0 or above. If soil tests indicate medium or higher P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, then no fertilizer is needed at planting. No nitrogen should be applied at planting; however, if a good weed-free stand is obtained by early August, then 30 to 40 lb of

N/acre can be applied on fields where growth is slow and plants are a pale yellow color from nitrogen deficiency. SG is a good scavenger of nutrients; therefore, N is seldom needed in the establishment year.

### **Previous crop:**

Weeds can be a major obstacle for SG establishment, especially summer annuals such as barnyard grass, crabgrass, foxtail, and panic grass. These can be reduced by planning ahead. One year before planting SG, a smother crop such as dwarf pearl millet should be planted, followed by a cereal grain in the winter. Since foxtail (German) millet is a one-cut crop, dwarf pearl millet is preferred as a smother crop. It will grow longer and give several grazings or two hay cuts. Cereal grain can be grazed or cut for hay by late April or mid May, making it easy to control the regrowth of weeds before SG planting.

Soybeans or corn can be used as a previous crop. If corn was harvested for grain, the stalks may need to be raked and bailed or incorporated into the soil to eliminate excess trash. A cereal grain could be planted after corn is removed for silage. One year prior to SG planting, a field should be plowed or chisel plowed, if needed, to bury excess trash, increase infiltration, or smooth the land where it is too rough for operating machinery.

### **Minimize surface residue:**

As with no-till alfalfa and other small-seeded forages, SG cannot be planted into very much surface residue. Many perennial grasses in pastures or hay fields accumulate too much trash which prevents good seed to soil contact. The trash often is pushed down in front of the coulter and seed is placed in the fold (hair pinning). About 50 percent or more bare ground is desirable before planting. Burning surface trash is ideal if it is dense enough to carry a fire. When properly timed, the burn will kill small weeds and be equivalent to the use of an herbicide. Local fire departments, soil conservation units, or forestry service personnel may be sources of help in safe burning.

### **Previous sod crop:**

Graze the area as close as possible or make hay before May 1. If the area cannot be grazed then an herbicide may be needed in early April to prevent excess growth. About mid to late May when adequate leaf area has developed on the vegetation, spray with glyphosate (Roundup). If you use low rate technology then two quarts per acre (2 lb. a.i.) will be adequate. Alternatively, paraquat (Gramoxone) at 2 pints/acre can be used if the weeds and grasses present can be controlled with this contact herbicide. About 4 to 6 weeks later or as close to the day of planting as possible, spray again. Paraquat at 1 to 2 pints/acre should be sufficient for the second application. If persistent weeds or perennial grasses are present, use a second application of glyphosate. As mentioned earlier, excess trash can be a serious problem. Use of an herbicide followed by burning is an ideal combination. Glyphosate in mid April or paraquat in early May will cause desiccation of vegetation by mid May that can be burned. Then 3 to 4 weeks later another application of an herbicide can be used immediately before planting.

## **Selecting a variety:**

Cave-in-rock is the preferred variety where grazing or hay will be all or part of the intended usage. It is ready to graze in late May and has little growth in September. Alamo and Kanlow are both best suited to wildlife and soil conservation plantings. They begin growth later in the spring and stay green later in the fall than Cave-in-rock. Properly managed, they are good for grazing and may fit best in some forage systems where some grazing is needed in September. Due to their very stiff straw, they may be preferred for wildlife plantings and for hedge rows.

## **Seed germination and quality:**

Planting seed with a high degree of germination is important in obtaining a good stand. SG seed often has a high proportion of dormant seed when harvested. This dormancy evolved so the seed could survive in nature. Dormancy is broken when seed is stored dry for 2 to 4 years in a warm place. Dormancy is also broken when exposed to cold-wet conditions (stratification) such as will occur in nature when left on the ground during the winter after falling from the plant in late summer. Adequate cold-wet conditions will occur naturally in the field if planted in late winter to about May 1. However, when planted early enough to be stratified in the soil, weed competition may be serious enough to crowd out small seedling SG.

Seed should always be purchased on a pure live seed basis (PLS). The seed tag will usually indicate a very high germination that has been obtained by official (ideal) conditions which include stratification. The hard (or firm) seed are those that are viable but will not germinate after stratification. When planting after the soil warms up, you cannot depend on using the official germination test printed on the seed tag as a true indicator of what your seed germination will be. Instead, you must obtain, or conduct, a germination test without stratification. A "ragdoll" test, which a producer can easily conduct, is adequate if the instructions below are followed. If germination, without wet pre-chill, is less than 40 percent, you should plan to do a bulk stratification ("wet pre-chill") or use an increased seeding rate.

## **"Ragdoll" test for seed germination:**

Before planting, test your seed in a flower pot with soil or in a "ragdoll." A "ragdoll" is a tube of wet paper containing the seeds to be tested for germination; it is placed in a jar or plastic bag and kept in a warm place for several days. Then it is opened and the seedlings are counted as they are removed, giving you the percentage germination.

Properly used, the ragdoll test is of great value, but some suggestions will help you obtain the best results:

1. Use a firm paper towel such as a brown hand towel or its equivalent. The "soft," very absorbent paper toweling often used in a kitchen makes poor ragdolls. It allows roots and tops to penetrate the fiber, making seedlings difficult to remove

- for counting. If kitchen towels must be used, be sure to squeeze all excess water from them to prevent seed rotting. Too much water causes a lack of oxygen and the roots of seedlings (radical) will be more retarded than the top.
2. After the towel has been squeezed rather hard, lay the wet towel flat. Count out 100 seeds and place them on one half of the towel. Fold the towel in half and roll it into a tube. Place the tube upright in a jar or plastic bag. This position causes roots to grow down and shoots to grow up so that seedlings are more easily removed during counting. The ragdoll should be kept in a warm place, preferably on top of a water heater or refrigerator. A temperature of 80 to 85°F is best but seeds will do fine at room temperature.
  3. Make the first count in about 4 days. Open the towel and count the seedlings as you remove them. After another 3 to 4 days, make a second count. If you had 100 seeds, the number of seedlings removed equals the percentage germination. If seeds were not counted initially, count the remaining seeds and calculate percentage germination. You should always save a small amount of any seed you plant (1/4 cup is plenty) so that, if the stand is poor, you can check germination again to be sure the problem was not bad seed. If the seed won't germinate in an ideal environment like a "ragdoll," then don't expect much success when the seed is dealing with all the hazards found in a field situation.

It is always a good idea to test the ragdoll procedure by placing a few seeds of millet or alfalfa, etc., that you know will germinate in it. If these seeds germinate well, then you know the ragdoll is working properly. If these seedlings are stunted, then the ragdoll may be too wet.

### **Wet-chill to break dormancy:**

If germination is low (less than 40 percent), seed should be wet-chilled to break the dormancy. In nature this wet-chill, called stratification, occurs naturally during the winter. If the wet-chill treatment is required, follow the procedure outlined below:

1. Put the seed in a cold place to be chilled before soaking.
2. Soak the seed in cold water for about 24 hours in plastic-mesh feed sacks.
3. Then remove the sacks from water and hang them in a cool place for about 24 hours to drip dry.
4. After draining, place the sacks in plastic garbage bags to prevent excessive drying during the chill period. Measure the temperature inside the wet seed to be sure of safe conditions. Place the outdoor sensor of an indoor/outdoor thermometer inside the bags. These units are inexpensive and can be used later for other purposes. Remove the sacks from the garbage bags during the last week of chilling to aid in the drying process. Place the sacks in a refrigerator and chill at 38-42 degrees F. for 4 weeks. Freezing the seed doesn't harm it, but it does prevent the seed from breaking dormancy. You can take seed samples at 7-day intervals during the chilling process and test them to see whether germination percentage has increased. Usually, it takes 28 days to break dormancy.

5. Remove seed from the refrigerator and dry it by placing it on a dry tarp less than 3 inches deep with a fan blowing over it. Dry the seed until it flows freely. Plant the chill-treated seed as soon as possible. If planting must be delayed, chill-treated seed will be safe if stored in a dry place.

### **Seeding date:**

Switchgrass germinates very slowly when soil temperature is below 60°F. If moist seed is maintained at 85°F for 3 days, many of the seedlings will germinate and grow to a height of approximately 1 inch with a 1-inch deep root. The planting time is similar to that for millet or sorghum-sudan. Plant conventional seedings from June 1 to 15 since soil moisture may be a concern. Plant no-till seedings between June 15 and July 15 because the soil moisture will be less of a problem. In situations where weeds are not a problem, planting can be done 2 weeks earlier. Planting as late as possible will provide adequate time for weed seed germination and a better chance of controlling annual grassy weeds. The newly seeded SG can be 14 to 20 inches tall and well established 8 weeks after planting. After a seedling develops tillers, it should survive the winter.

### **Seeding rate:**

Consider using 10 lb of pure live seed per acre for conventional plantings. For no-till or drill seedings, 8 lb per acre should be adequate. The germination should be based on a test made after stratification, if needed. Pounds of bulk seed needed can be calculated [lb. needed = lb. per acre — (germination x purity)] where germination and purity are expressed as decimal values. There is no sense (or dollars) in planting seed that may not germinate. As stated above, if you can't make the seed germinate in the ideal conditions of a ragdoll, it doesn't have much of a chance in a hostile field environment. Stratification will increase the chance of germination. Cave-in-rock SG usually has 250,000 seeds per lb. (Alamo may have 454,000 seeds per lb.). Ten lb. of PLS will have about 58 potential seedlings per square foot.

### **Seeding into a conventional seedbed:**

Field operations typically used for other small seeded forages can be used to prepare a clean seedbed. Take care to insure that the soil is especially firm at planting. If a pickup truck driving over the field leaves a noticeable wheel track depression, then more packing may be needed. Conventional seeding may not be ideal because tillage will cause the soil to lose water in the warm dry weather during mid June when these operations are needed. Seed can be broadcast and then cultipacked. Seed placement in rows with a grain drill that has a small seed attachment would be ideal. Seed should be placed no deeper than 1/4 to 1/2 inch. Consider cultipacking after drill planting in order to obtain good seed-soil contact. Weed problems may be greater than with no-till plantings since germinable seed will be brought to the soil surface during tillage.

### **No-till planting:**

No-till seeding methods conserve soil, require less time and fuel, and allow rocks to remain below the soil surface. Proper procedures will reduce water run-off and evaporation, which improves the water supply to the seedling. If herbicides are used to suppress existing vegetation during the 6 to 8 weeks before planting, there should be adequate water for rapid germination.

A standard grain drill with a box for small seed like clover can be used if there is minimal trash and the soil is soft, such as when planting into a previous soybean, corn, millet, or cereal grain crop. A drag chain and packer wheel should follow each drill opener. If needed, a cultipacker should be used to firm the soil. With no-till methods, you are tempted to plant when the soil is too wet and seed is placed too deep. Ideally the soil surface should be rather dry. When trash is dry and soil is firm, the disk or coulter can cut a clean seed slot without hair pinning. Some granular soil should result from the disk opener. Seed should be placed about 1/4 to 1/2 inch deep. Rainfall can wash soil to fill the furrow left by the disk opener and cover the seed much deeper than when originally planted. When placed at a 1/2 inch depth, the seed will probably be in moist soil. Germination and emergence may occur in 5 to 7 days when the soil is warm and moist.

### **Insect concerns:**

Grasshoppers, crickets, corn flea beetles, and other insects can be a problem with new seedlings. When all green plant food is killed with herbicides, hungry insects may cause severe damage to newly emerging seedlings. Horse nettle is a host for corn flea beetle. If small pin size holes appear in horse nettle leaves, then corn flea beetles are present in the field. No insecticide has label clearance for use on SG because low usage does not provide an economical incentive for a company to do the necessary testing. However, research data have shown a consistent advantage to the use of a granular systemic insecticide placed in the row with the seed at planting. Careful monitoring of early seedling growth is essential. If seedlings become unthrifty or have necrotic streaks along the leaf, then an insecticide may be needed.

### **Post emergence management in the seeding year:**

Grassy weed competition can be minimized by clipping above the leaves of seedlings. SG leaf removal should not be made in the seedling year. Broadleaf weeds can be controlled with light rates of 2,4-D and/or Banvel, but apply only after the seedlings have 4 fully expanded leaves. Delay the use of herbicides as long as weeds are not competing for sunlight or soil water to reduce the potential for seedling damage. Growth by mid September may be 20 to 30 inches tall. At this time, cattle could be used to graze enough to remove about 1/2 the leaf area. Be careful not to overgraze or the stand may be weakened. Once frost has killed the leaves, cattle can graze without restriction. The fine stems and leaves will have low protein, but will provide considerable value as stockpiled forage. After frost the SG can be cut to leave a 10-inch stubble and baled for hay.

### **Management of Established Stands**

Use of an herbicide would be ideal in the first year after seeding or any time weeds are a problem in an established stand. Research has shown established SG to be very tolerant of simazine; however, there is no label clearance for its use. Simazine at 2 lb. a.i./acre applied in early May has been effective for weed control in research tests. Simazine can be applied after SG has developed leaf area with no concern for foliar burn. Thus, if perennial, triazine-tolerant broadleaf weeds are present, a tank mix that includes simazine, 2,4-D and/or Banvel can be used after SG and problem weeds emerge.

### **Maintenance fertility:**

Apply phosphate and potash as needed to maintain medium soil test levels. Applications may not be needed, especially if SG is used for grazing, since animals return most of the nutrients as manure and urine. Nitrogen may be needed at about 40 to 50 lb./acre after the first hay cut, or the first time a paddock is rotationally grazed. Where early season growth is slow and yellowish or maximum first growth is needed, then nitrogen applied at 40 to 50 lb./acre may be needed in mid May.

### **Hay harvest:**

First hay harvest should be taken at late boot stage of development. This will occur by June 15 to 25. Cutting at 8 to 10 inches will benefit regrowth. Cutting closer will not give much more hay value because few leaves remain on the stubble. Leaving nodes (joints) on the stems in the stubble will give sites for axillary tiller formation. These tillers will provide leaf area and energy for fast regrowth. The stubble will discourage overgrazing of regrowth if pastured. A second hay cut can be expected in mid August.

### **Grazing management:**

Grazing can begin about May 20-25. Growth is very rapid for the first few weeks. Begin grazing when there are about 18 inches of growth for the first early growth. Cattle should graze to leave a 12-inch stubble. Controlled grazing is the best management. Begin early and initially rotate often. About 5 weeks are needed for approximately 28 to 32 inches of regrowth before grazing a paddock again. If the next paddock is ready for grazing before the current paddock is grazed close enough, consider making hay and skipping to another paddock in the sequence. Consider creep grazing where calves have access to high quality pasture while the cows clean up before moving on. Simply lifting the electric fence can allow for a creep. Continue grazing until late August if enough forage is available.

### **Grazing productivity:**

Each acre will produce about 200 animal unit days (AUD) of grazing. This assumes one AUD is equivalent to feed required by one 1000 lb. mature nonlactating cow maintaining constant body weight. The one AUD is also equal to 17.6 lb. of forage intake per day (1.76 percent of body weight) if the feed source is 60 percent digestible (60 percent TDN). If the grazing season is 90 days, then each acre can support 2.2 AU. This would be

0.45 acres per AU. For controlled grazing, with 5 days of grazing per paddock before rotating and 35 days rest, eight paddocks would be needed in the system. A 600 lb stocker (0.7 AU) should gain 2 lb. per day. Each acre could handle 3.2 stockers (2.2 — 0.7) which is 6.4 lb. live weight gain per day per acre. For the 90-day season, there could be a potential of 576 lb. live weight per acre. Clipping pastures after grazing usually will not be needed. If a stubble of 10 to 12 inches exists then intense close spot grazing will be minimized.

The number of SG acres needed depends on individual situations. A 12-month grazing system for beef cattle would be ideal. A 12-month system would perhaps require 1 acre of stockpiled tall fescue per animal unit. The tall fescue will provide pasture for 3 to 4 months in December through March and some pasturage or hay in the spring. Switchgrass, as noted above, can provide forage for one AU for 90 days from 0.45 acre (2.2 AU per acre). Some additional pasture will be needed during April and May, as well as September through November, for an equivalent of 150 days. If the additional pasture has a production potential of 150 AUD/acre, then 2.45 acres of pasture may be needed for a 12-month grazing program (1 acre tall fescue, 0.45 acre of switchgrass and 1 acre of native cool-season pasture). This would be 15-20 percent of the pasture acreage as SG. Another option would be to have about 0.4 acre of SG per AU.

### **Late season management:**

Little growth will occur after late August. Growth in September until killed by frost will allow the plants to get ready for the winter. After leaves turn brown, cattle can graze without hurting the stand since the plants are dormant. Where cool-season grasses or weeds occur in the spring, cattle can graze until new growth of SG emerges in late April to early May.