Virginia Cooperative Extension
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Part II.

Forage Crops

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Pastures

Pastures are the backbone of Virginia's beef, sheep, and goat industries. They are also essential for the state's pasture-based dairies and are of great importance to horse owners. The over 2 million acres of pasture in Virginia provide feed for grazing livestock; with proper management, these lands can meet nutritional needs with relatively low labor and equipment inputs. In much of the state, pastures are grown on soils or topography that is unsuitable for row cropping, and livestock create economic opportunity by converting these forages to meat, milk, and fiber for human use. In 2017, Virginia's combined beef, dairy, and small ruminant sales were worth over $1 billion to the state's economy. The hay and haylage produced in the state were valued at $354 million (2020 estimates). Pastures and forage crops are the backbone of the feed resources for the state's livestock industries, and under proper management, they provide conservation services (e.g., preventing erosion) on sites that might otherwise be unsuitable for agriculture. Greatest success is achieved when species and management are tailored to match the soils and climate of the state's diverse regions.

Species Selection, Pasture Establishment, and Frost Seeding

Pasture species recommendations depend on the types of pasture already available in the system, its intended use, and the type of soil, climatic conditions, and intended management. Details given in **table 1 (page 55)** will be helpful in selecting the mixture for individual needs. Remember, no species is a silver bullet; management is key to long-lived, productive stands. More information on maintaining pasture stands is in the sections on fertility management and grazing management to support forage growth and composition.

Seeding may be done in prepared seedbeds (by plowing, disking, and firming with cultipacker or roller) or by no-till establishment. No-till is generally preferred for lower environmental impacts and energy costs, but getting a successful stand from no-till requires advanced planning. Please see **table 2** for recommended steps for successful no-till. Before seeding, consult an Extension agent who is familiar with local growing conditions and can provide specific recommendations for pasture establishment.

Table 2. Basic rules for a successful no-till establishment.
1. Prepare well ahead to seed in the proper season.
2. Properly test soils and amend accordingly. If lime is needed, apply several months in advance.
3. Minimize competition or access by preventing weeds and removing heavy thatch or residues. **To plant in existing sod:** • Closely graze or mow off fields at least 45 days ahead of the planting date. • Allow the plants to regrow 3" - 4" of new growth then apply a "burn down" herbicide. • Apply burn down herbicide again to kill new weeds and escapes at about the time of planting. • Fall/spring or spring/summer burn down regimes also work to prepare fields. **To plant in crop fields:** • Bale or burn crop residues the previous fall. Planting through crop residues can be a challenge if the field is full of thick stalks.
4. In fields with broadleaf weed pressure, establish grasses first and then add legumes.
5. Use high-quality seed.
6. Control seeding depth: 1/8" to 1/4" is typical for small-seeded species and challenging to achieve through crop residue.
7. Monitor developing stand and control emerging weeds. This can be achieved with periodic flash grazing, clipping, or judicious herbicide application.

Adapted in part from No-Till Seeding of Forage Grasses and Legumes, Virginia Cooperative Extension publication SPES-92P. https://vtechworks.lib.vt.edu/bitstream/handle/10919/93065/SPES-92P.pdf?sequence=1&isAllowed=y.

Table 1. Recommendations for pasture seedings in Virginia

Use	Species	Seeding rate (lb/ac)	Soil adaptation	Establishment tips
Frost seeding legumes into grass pasture	Red clover	3-6	Grow clovers on medium- to heavy-textured soils with pH > 5.8 and medium or greater fertility.	Graze grass sod closely by February and then broadcast seed. Allow livestock to tread seed into the ground for 1 week.
	White/ladino clover	1-2		
	Annual lespedeza	10-15	Grow annual lespedeza on more acidic, lower fertility soils.	Frost seed every 2-3 years as legume abundance declines.
Cool-season grass pasture and hay fields[1]	Cool-season grass mixtures	15-20	Broad drainage tolerance with pH > 5.8 and medium or greater fertility.	Late summer/fall seeding typically recommended. For no-till plantings, kill existing stands about 3 weeks before seeding and re-treat at time of seeding to kill any escapes.
	Orchardgrass	8-12		When novel fescue is to replace KY31 pasture, do not allow the KY31 seedheads to develop within 18 months of the scheduled planting. This can be managed by close grazing or clipping seedheads in spring ahead of a fall planting. Growing smother crops or warm-season annuals for forage ahead of fall seeding helps to meet forage supply needs.
	Novel fescue	15-25		
Warm-season grass pasture and hay fields	Hybrid bermudagrass	12-20 (bu/ac)	Lighter textured, well-drained soils.	Where bermudagrass is commonly grown, sprigs are planted with a sprigger, but hybrid sprigs can be spread onto tilled ground with a manure spreader then disked in. Light grazing or haying is preferred in the establishment year.
	Switchgrass	6-10[2]	Medium- to well-drained soils. Good flooding tolerance.	Late fall to early spring plantings can work, but fields must be kept weed-free to reduce competition. Late spring to early summer plantings can work if seeds are not highly dormant. Again, keep fields weed-free. Success and longevity are increased if stands are not hayed or grazed in the first year.
	Pearl millet	15-30[3]	Millet yields can be higher on heavy-textured soils.	
	Sudan	15-20		
	Sorghum-sudan	20-30		

[1] Seeding mixtures of perennial grasses and legumes is generally not recommended. Success with mixed seedings is particularly difficult in renovated pastures due to weed pressure from the existing seedbank. General recommendations are to first plant grasses and control broadleaf weeds. Once the grass stand is successfully established, legumes can be frost seeded or drilled into the grass stand. Exceptions include sowing cool-season perennial mixtures into crop fields (with limited weed pressure) or planting summer- or winter-annual cover crop mixtures.

[2] General recommendations are to base planting rate on percent pure live seed (PLS), but switchgrass and other native grasses can have both high PLS and high dormancy.

[3] Drilled seeding rate.

Seed after the first good rain in August or September or between Feb. 15 and April 15, depending on the area of the state. Fall seedings are generally preferred, although some legumes may be sensitive to pathogenic diseases (e.g., Sclerotinia and Phytophthora) that more typically occur in fall. Generally, as one moves from the west to the east of the state, seeding can occur later in the fall and earlier in the spring. A reliable rule to follow is to seed 30-40 days before the first killing frost in the fall or 30 days before the last frost in the spring.

Frost seeding clovers is an excellent way to establish clovers and thicken pasture stands. Graze or mow the sod very closely by midwinter and then broadcast the seed on the soil surface during the month of February. Freezing and thawing of the soil, plus traffic and early spring grazing by livestock, should result in good seed-to-soil contact for clover establishment.

Grazing for Profitable Livestock Operations

Most ruminant livestock production systems achieve an optimum economic output at roughly 280-300 days of grazing each year. Stocking rates that require feeding more than about 65-90 days add costs above the value of the additional animals produced. Making and feeding hay is one of the most expensive parts of forage-livestock operations, and high stocking rates usually lower individual animal performance.

The basics for achieving 300 days of grazing include maintaining appropriate stocking rates and adequate soil fertility, combined with proper grazing management to support forage growth. Minimizing periods of forage deficit is critical. To reduce summer slump, producers can stockpile excess spring growth or grow warm-season annual or perennial forages to fill the seasonal production gap **(e.g., see fig. 1)**. Grazing summer-stockpiled forage and feeding hay in late summer can also support fall growth that makes up the winter stockpile. Feeding hay during dry periods to prevent overgrazing also allows pastures to quickly respond to returning rains.

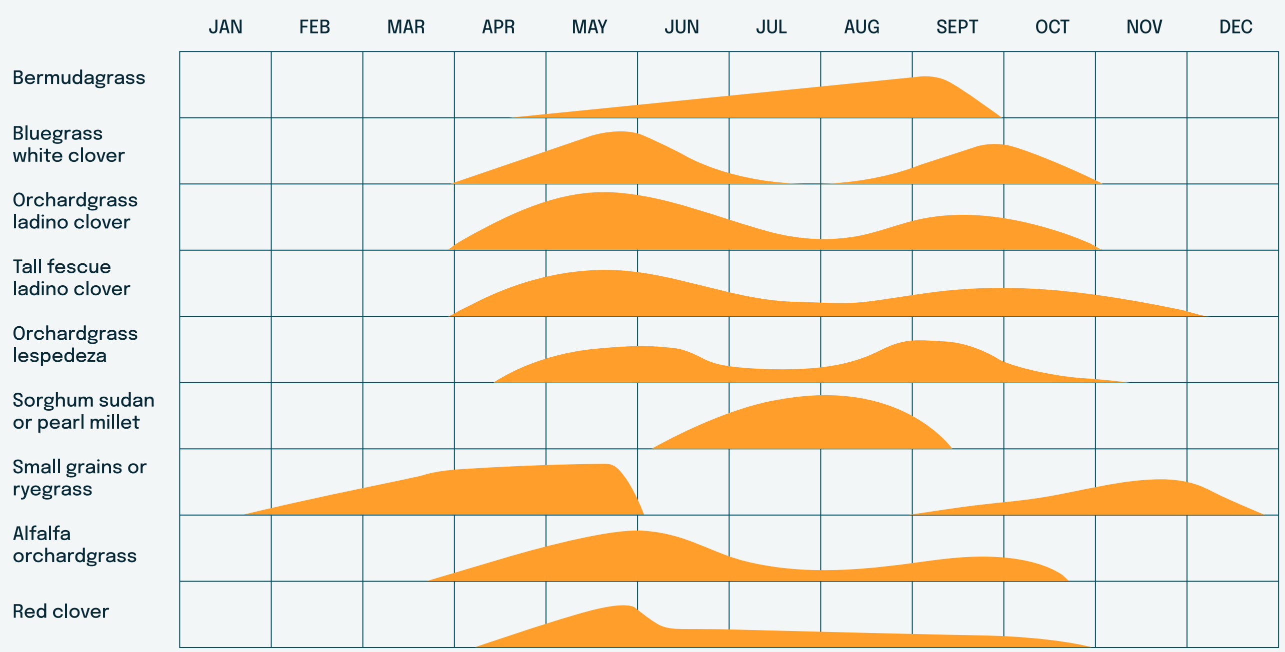

Figure 1. Generalized seasonal growth curves of several cool- and warm-season forage species.

Delayed grazing (or haying) also can benefit wildlife (particularly grassland bird survival). Producers interested in additional management information on grazing 300 days per season can find more at **Virginia Cooperative Extension's Graze 300 VA website:** https://ext.vt.edu/agriculture/graze-300.html.

Appropriate Stocking Rates

Matching stocking rates to the land base requires an understanding of animal needs and the potential productivity of a site. Soil productivity values are available through soil surveys and the National Resource Conservation Services' Web Soil Survey, found online. Your local agent or NRCS can help you use these tools that describe soil productivity in terms of animal unit months (AUM). An AUM represents the amount of forage required to sustain an animal unit for 30 days. (An animal unit (AU) is defined as a 1,000-pound cow with calf, two 500-pound steers, or five ewes with lambs. Note that the AU is based on body size and predicted intake, so adjustments for AUs must be made for heavier cows with larger frame size.) The AUMs for a soil map unit represent the months that one AU could graze on an acre. However, AUM ratings assume good pasture conditions and management (i.e., good ground cover, soil fertility maintenance, weed management, and rotational stocking of pastures). Actual productivity may be less than the soil's potential if past mismanagement (e.g., overgrazing or poor fertility practices) has degraded the soil resource. Thus, soil sample data, knowledge of site history, or both are important in understanding potential productivity and stocking capacity of a soil. General rules of thumb are that 1 acre of excellent pasture can feed an AU through the grazing season, whereas an AU needs about 1.5 acres of good pasture, 3 acres of average pasture, and as much as 6.5 acres of poor pasture to meet its needs for a season.

Fertility Management To Support Forage Growth and Composition

Meeting soil fertility requirements is foundational for productive forage crops and pastures that support good animal performance. In cool-season pastures, prioritize fertility management that supports legume growth. Most research indicates greater profitability for pasture systems that have abundant legumes. High quality pastures typically will contain 25%-40% clover. Pastures with a significant proportion of legumes also have lower total production costs because the legumes contribute nitrogen to the production system, minimizing or eliminating the need for supplemental nitrogen fertility inputs.

Soil testing provides benchmarks of fertility status for pastures and fields and provides a basis for lime and fertilizer inputs. Soil acidity often limits forage production, and liming is often the most impactful of fertility inputs to support improved forage production and species composition. Legumes generally require higher soil pH levels and greater soil phosphorus and potassium concentrations than forage grasses. Not all forages need higher pH levels, but most cool-season forages will do well in Virginia at a pH above 6.0 (see Part VIII. Soil Testing and Plant Analysis, Figure 1. Relationship Between Soil pH and the Availability of Minerals That Are Essential for Plant Growth).

Nitrogen fertilization for cool-season pasture or hay production should occur in early spring to support spring growth, or it may be applied in late summer to support production of fall stockpiled forage. Summer annual grasses should be fertilized in late spring to support summer growth. NOTE: No, or **limited, economic response** to applied nitrogen often occurs when fertilizer is applied to long-term pastures with high levels of soil organic matter, abundant clover, or both. Fertility timing, source, and climatic conditions can further affect this. Response to nitrogen is generally much greater on recently converted crop fields or soils with low organic matter. Nitrogen applications also must be managed to mitigate tall fescue toxicosis.

Grazing Management To Support Forage Growth and Composition

Successful grazing systems utilize livestock both as tools to manage the forage stands and as products for farm profitability. The challenge is to maintain optimal animal performance without compromising plant vigor. Rotational stocking management can give producers greater control over the livestock "tools" than continuous stocking and allows producers to make decisions about timing, intensity, and frequency of grazing events. Overgrazing pastures leads to weed invasion, increased soil temperatures (reducing cool-season plant growth), and reduced rain infiltration (increasing runoff, soil erosion, and nutrient losses among other negative effects). When to start and stop grazing will necessarily vary by species, season, and growing conditions. **Table 3** provides rough estimates for some common forage species.

Grazing Management To Support Animal Performance

Producers should strive to utilize the available forage without damaging the pasture, although forage management and stocking rate strategies will vary depending on markets and goals. Plan pasture rotations so that young, growing livestock have access to the highest quality grazing. Strategies for increased gain include use of leader-follower and creep grazing systems.

Table 3. Rule of thumb start and stop grazing heights and rest period length for common forage species.

Species	Start (inches)	Stop (inches)	Rest (days)
Alfalfa	10-16	2-4	30-40
Bermudagrass	4-8	1-2	7-15
Kentucky bluegrass	4-8	1-3	7-15
Orchardgrass	8-12	3-6	15-30
Pearl millet	20-24	8-12	10-20
Switchgrass	18-22	8-12	30-45
Tall fescue	8-10	2-3	15-30

Managing Excess Forage

To capture the excess forage that grows in spring, options are harvesting the forage, bringing in additional stock to graze the excess, or deferring grazing/harvest and using it as stockpile (see the following section, Stockpiling To Extend Grazing) during the summer deficit period. To harvest or stockpile, take pastures or hay fields that will have excess growth out of the rotation and allow livestock access only to those pastures that can be adequately grazed during the spring flush. When growth slows during the summer, make more pasture acreage available (or if animals were brought in, remove these extra stock). Occasionally, clipping pastures can be useful to remove tough, mature plant growth and prevent seed production by weeds. Generally, the best timing for clipping is around mid-June or late August, but proper grazing management helps minimize the need for clipping.

Mitigating Tall Fescue Toxicosis

Tall fescue is the predominant forage for livestock systems in Virginia. Most of this fescue contains a wild-type, fungal endophyte which supports the growth of the plant but which also produces toxic alkaloids that cause a number of health and production issues for grazing livestock. Alkaloid synthesis (and plant tissue concentrations) largely follow plant productivity; seasonality and management practices that support greater growth generally result in greater alkaloid concentrations. Alkaloid concentrations also vary by plant part, with highest concentrations in seedheads and stem bases. Alkaloids decay in standing forages during freeze-thaw events and also degrade with hay making. A longstanding idea is that toxins can be diluted by adding clover to pasture systems. However, the benefit from clovers is largely from improved intake, and the only way to eliminate toxicosis entirely is to remove toxic fescue from the diet. A number of strategies can help with mitigating toxicosis, and these are described in brief in **table 4**.

Table 4. Tips for mitigating alkaloid levels and the effects of fescue toxicosis.
1. Keep fescue vegetative. Remove seedheads or allow seed to drop before grazing (as with summer stockpiling).
2. Don't overgraze. Grazing into stem bases increases alkaloid intake.
3. Manage pastures and farm for greater forage diversity. Adding more species within fields or adding fields of other forage species (e.g., warm season grasses for summer grazing) can reduce overall fescue intake.
4. Incorporate legumes into pastures. Legumes can increase forage intake, and some legumes (e.g., red clover, trefoil, lespedezas,) contain compounds that bind or counter the effects of alkaloids.
5. Target fields dominated by fescue for hay production, stockpiling, and frost seeding with clover. Alkaloids decay during hay curing and also during freeze-thaw events in fall and winter. Grazing stockpiled fields creates better conditions for successful frost seeding.
6. Fertilize pastures sparingly with nitrogen, particularly in spring.
7. Harvest fescue hay in the boot stage.

Stockpiling To Extend Grazing

Winter Stockpiling

Additional grazing days in winter can be obtained by grazing or clipping tall fescue stands in August and then permitting plant growth to accumulate through late fall. Typical recommendations are to apply 40-80 pounds of applied nitrogen per acre following clipping/grazing. If necessary, feed hay during late summer to allow stockpiled pastures to grow. This is generally more economical (and logistically easier) than feeding hay in winter because it both supports forage growth (which doesn't happen in winter) and it can be done when soil and weather conditions are easier to navigate. Pasture that produces 3,500 pounds of forage by December can support 120 days of winter grazing for one AU, assuming intake is 2% of body weight each day and pasture utilization reaches 70%. Strip graze winter stockpile for greatest use efficiency.

Summer Stockpiling

Summer stockpiling is a more recent development in cool-season forage management. The basic protocol is to remove the livestock from a field by April 15 and allow the forage to grow throughout the spring and early summer. Leave the forage ungrazed or unmown until late summer. The standing forage shades the soil, retaining moisture and reducing the opportunity for summer annual weeds to develop. This forage is typically grazed between August and October. Summer stockpiling works well for dry cows, and the forage can be used as the primary feed resource when other pastures are stockpiling for winter. The same basic forage management principles apply to summer stockpiling in that strip grazing is recommended to increase efficiency of use and grazing days.

Making Hay and Haylage

Red clover, alfalfa, orchardgrass, and tall fescue are the most widely grown hay crops in Virginia. However, any forage that can be cut, dried, and stored can be used for hay. Refer to **table 1 (page 55)** for details on pasture and hay seedings.

Harvest hay or haylage in a timely fashion. Timely hay harvest can be challenged with variable weather, but harvesting hay well after the boot stage (when weather is usually drier) is a poor strategy. It may generate more bales, but the hay will be of low quality.Making haylage opens up the harvest window because less time is needed for wilting (rather than fully curing). This allows for earlier harvest, makes variable spring weather less of a harvest constraint, and allows for greater forage quality than overmature hay. NOTE: Making haylage with toxic (KY31) tall fescue is not recommended.

Cutting and Drying

Don't cut hay too close to the ground. Disc mowers allow significantly lower cutting heights and may need special shoes to keep cutting heights high enough. Cutting forage grasses as low as possible removes part of the stem bases and the energy reserves needed for regrowth. This also opens up the stand, allowing for greater weed invasion and higher soil temperatures (which negatively affects cool-season forages). Close cutting is made worse when the hay stand is cut late, and it also can result in significant contamination with dirt, which reduces forage quality. Desired cutting heights are similar to residual grazing heights described above.

Rapid drying is essential for making quality hay and haylage, and sunlight is the biggest driver of drying speed. Make wide swaths-cover at least 70% of the cut area-to increase solar exposure. Drying stemmy crops (e.g., alfalfa or sudex) is facilitated by crushing stems (conditioning) at the time of mowing. This permits the stems to dry at nearly the same rate as the leaves. Conditioning reduces curing time about one day for large-stemmed plants. Tedding hay turns and spreads the crop, increasing exposure to sunlight and reducing drying time. It is important to ted when the crop is moist to reduce leaf shatter. Rake, too, while hay is moist (about 40% moisture) and bale before hay is crisp (16%-20% moisture) to reduce field losses.

For haylage or baleage, the forage crop typically is chopped or baled after wilting, at moisture levels between 40% and 60%. Because the crop is harvested moist, field losses can be reduced. Critical components for ensiling forage include having moisture low enough and tight wrapping to avoid air pockets. Grasses generally ensile better than legumes because pH levels (which must be low enough to preserve the forage) are buffered by minerals in the legumes.

Hay Storage Losses

Hay baled with excess moisture results in mold growth and heating; this increases dry matter losses and decreases forage quality. Safe moisture levels for storage are 20% for rectangular bales, 18% for round bales, and 16% for large rectangular bales.

Hay dry matter and quality losses during storage can be high, particularly for round bales kept outside. For a 5-foot-diameter round bale, a 3-inch, 6-inch, or 12-inch layer of rot around the bale translates to a 10%, 19%, and 36% dry matter loss, respectively. **Table 5** summarizes losses with different storage systems.

Forage nutritive value also declines with dry matter loss from baling or storing moist hay. Soluble carbohydrates are lost while fiber and lignin concentrations increase. Protein concentrations may change little over time, but after weathering, the remaining protein will usually be less digestible. Losses in quality are usually greater for legumes than for grasses.

Factors to reduce outside storage losses of round bales:

1. The denser or more tightly the hay is baled, the lower the amount of spoilage as long as hay is baled at or below 18% moisture. Bale density is affected by the baling machine, the care/experience of the operator, and forage species. Fine-stemmed hays naturally produce a tighter bale. The density of round bales should be a minimum of 10 pounds of hay per cubic foot.
2. Closer twine spacing reduces storage losses but increases costs. Net wrap usually reduces storage losses compared to twine. Although it costs more than twine, net wrap is faster than twine wrap and bale form is generally more stable, making handling and storage easier.

Table 5. Summary of research results* on hay storage losses: percentage of dry matter lost after six months in storage.

	On bare ground	On gravel or pallets		On bare ground, covered			Inside a building
Source	**No cover**	**No cover**	**Covered**	**Tarp**	**Wraps**	**Roof**	
Michigan State University	35	30		15	23		12
Penn State University	15-40						4
Iowa State University	10-25	11					5
University of Georgia	50	35	14	10			4
• J. Production Ag. review							
• Anderson et al.	14						
• Belyea et al.	15			6			3
• Verma and Nelson	28-40			12	11		2
• Atwal et al.	40			30			2-9
• Baxter	33-35						9
University of Wisconsin (Holmes)	9.5	8	4				3-7
Oklahoma State (Huhnke)	5-20	3-15	2-4	5-10		2-5	2
University of Wisconsin (Saxe)	5-61	3-46	2-17		4-8	2-10	2
West Virginia University (Rayburn)	7-61	28-39	5-10				
Average loss after 6 mo. storage	**27**	**22**	**8**	**13**	**13**	**5**	**5**

Source: Iowa State University Extension and Outreach, Ag Decision Maker, November 2017.

3. Store bales on well-drained upland sites. Hay/soil contact should be avoided if possible. Wooden pallets, telephone posts, scrap pipe, cross ties, and rock pads are all effective.
4. If a multiple-bale cover is NOT being used, bales should be stored in rows with rounded sides at least 3 feet apart. Flat ends should be firmly butted against one another. Align rows north and south to allow maximum exposure of the rounded sides to the sun. A gently sloping site will allow rapid drainage of rainwater. Bales should be oriented up and down the slope near the top of slope, preferably with southern exposure. Never store bales under trees.
5. Place three or five rows of bales in triangular stacks under a tarp or plastic sheet that is secured firmly. Inside storage is the best way to ensure low storage losses. Investment in barns for hay storage is more easily justified with (1) increasing hay value or porosity, (2) the greater and/or more frequent the rainfall, (3) the longer the period of storage. For example, with an estimated construction cost of $7.50 per square foot, it pays to build a barn to store hay valued at $60 per ton that otherwise would experience losses of 20% or more when stored outside. Hay valued at $100 per ton justifies barn construction if outside storage losses approach 15%.

Feeding To Minimize Hay Losses

Several strategies can be utilized for hay feeding. Hay ring feeders are available to help limit wastage and their utility will vary with design. Using ring feeders but feeding from a stationary position can also cause significant disturbance to soils that need to be smoothed and reseeded. Producers might roll hay out on the ground, though this can result in large amounts of lost feed. Using a portable electric fence can reduce trampling and fouling losses. Newer approaches include “bale grazing” and fence line feeding. With bale grazing, bales are set out in late fall, and the cow herd is rotated through the pasture later in winter using portable fencing to control animal access in the pasture and ring feeders to reduce bale waste. This approach can keep nutrients in the field and better distributed, though some reseeding may be needed. With fence line feeding, the feeder stations are part of the fence line and provide multiple feeding points along a hardened access road. This approach can add significant nutrient loading around the feeder, but it minimizes traffic over wet pastures.

Making Silage

Most crops grown for livestock feed can be allowed to ferment and be fed as silage. **Table 6 (page 63)** provides generally expected yields, crude fiber, and acid detergent fiber of several silage crops.

Handling of the crop for silage should always favor proper fermentation. **Figure 2 (page 63)** describes what actually occurs during ensiling. The quantity and quality of silage varies with crop species.

Grain-crop silages such as corn, barley, wheat, oats, and grain sorghum are normally harvested directly as they stand in the field when the grain reaches the dough stage. The relatively high dry matter content of the grain in such silage, plus the drying effects of advancing maturity, results in silage within the desirable dry matter range (35%-42%).

When these same crops are harvested at a less mature stage or when the traditional hay crops are handled as silage, it is necessary to partially dry or “wilt” the plants in the field before ensiling. Wilting usually requires about one day under favorable drying conditions. Crushing the stems with a conditioner hastens the drying process.

Experience and good judgment are needed to determine when the crop is wilted to the proper dry matter level. The “grab test” is useful as a guide to determine forage dry matter content. Collect a fistful of fine forage and squeeze tightly for 90 seconds. Release and observe the condition of the ball based on the descriptions below in **table 7 (page 64)**.

Table 6. Annual yield and composition of silage crops.

Crop	Stage	Yield (ton/acre, 35% DM)	Crude protein (%, DM basis)	ADF* (%, DM basis)
Corn	Hard dough	15-25	8	28
Grain sorghum	Dough	10-15	9	42
Forage sorghum	Early head	10-15	11	29
Sorghum sudan	Early head	7-15	12	45
Barley	Dough	7-15	9	36
Wheat	Dough	7-15	9	36
Oats	Dough	5-10	10	38
Rye	Boot	4-6	13	40
Alfalfa (4X)	Late bud/early bloom	10-12	18	33
Red clover	Early bloom	7-8	12	43

*ADF = acid detergent fiber.

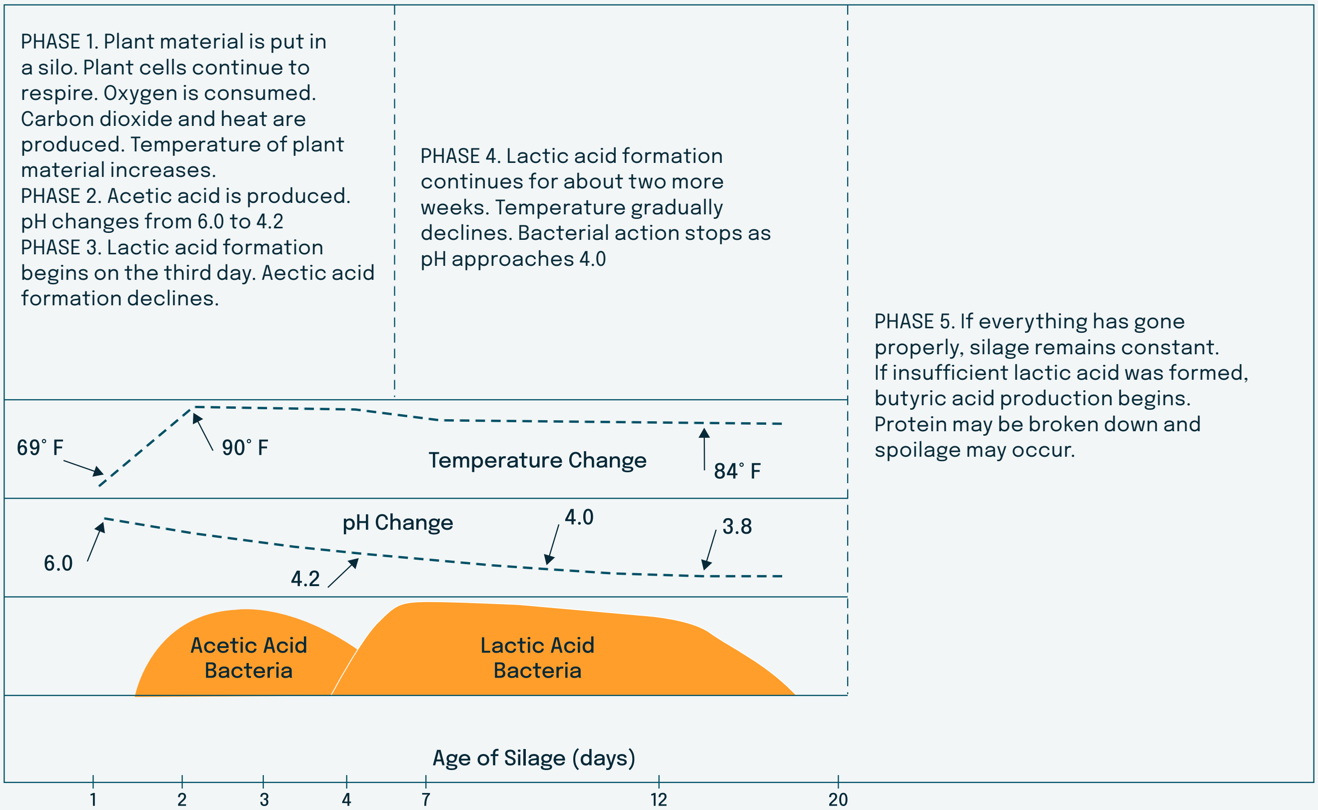

Figure 2. Changes in bacteria concentrations, pH, and temperature during the ensiling process.

Table 7. Estimated forage dry matter content based on a forage ball's characteristics.

Description of a forage ball	Approximate dry matter content (%)
Holds its shape but has considerable free juice	<25%
Holds its shape, hand is moist, little very free juice	25%-30%
Expands slowly with no free juice	30%-40%
Springs out and falls apart rapidly	>40%

High Moisture Corn and Earlage

Harvesting crops for silage generally utilizes the full plant. In some instances, only a portion of the plant is harvested. Corn ears can be harvested and ensiled as "earlage," or in some cases, the corn grain can be shelled and then fermented. This harvest method provides for grain storage without the costs of drying as well as a source of grain for balancing rations. These high-moisture materials can be easily mixed and fed with silage. Fewer harvest losses from shattering occur, and harvesting can be done two to three weeks earlier than dry corn, thus reducing lodging losses in some years and providing additional time for establishing cover crops.

High-moisture shelled corn and earlage should be harvested when the ear reaches physiological maturity. At this stage, kernels are well dented, and those near the center of the ear show the typical black layer at the base where they are attached to the cob.

Conventional concrete stave silos or oxygen-limiting units are effective means for storing high-moisture shelled corn or earlage. If stored in concrete stave silos taller than 60-70 feet, placing extra hoops around the bottom 30 feet of the silo is suggested. Fermentation is complete in 15-20 days. The suggested moisture level for storing high-moisture shelled corn is 28%, with a range of 25%-30%. It should be ground or rolled before being fed.

For earlage, the moisture range of the kernel is 28%-30%, with 28% considered ideal. Because the cob will contain 40%-50% moisture, the moisture content of the earlage will be about 32%. Earlage must be ground before it is stored. The main objective is to break the kernels, so fine grinding is not necessary. Holes in the screens of hammer mills or recutters range in size from 0.5 inch to 1 inch.