Stockpiling cool-season perennial pastures

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One of the first things to understand as you begin the move to year-around grazing is the growing season and the grazing season are two entirely different things. Stockpiling is the process of accumulating standing forage during the growing season to be grazed during periods of little or no growth. While we generally think of stockpiling as a program for winter grazing, it can also be employed in some climates for standing forage during heat or drought induced summer dormancy.

Stockpiling is not a new concept. Wild ruminants and other grazers have survived on summer accumulated forage for millennia. Many farmers and ranchers have put livestock on regrown pastures or hay fields after frost as a routine practice for generations. What is different today is we are creating planned stockpiles of better quality standing forage based on proven, practical management practices.

University research in the US on managed stockpiling dates back into the mid-1950's. Most of these early studies were agronomic trials evaluating different forage species and fertilization programs. Kentucky and Virginia were leading states in this early research. In the 1960's, animal evaluation of stockpiled pasture began in earnest. Virginia, Kentucky, and Missouri were leaders in early livestock research with stockpiled pastures. During the 1970's grazing stockpiled winter pasture was already a standard management practice at the University of Missouri- Forage Systems Research Center. Virginia, Kentucky, Georgia, and Indiana all had animal trials on stockpiled pasture during the 1970's. Through the 1980's and into the new century, more and more states and provinces joined in the quest for extended winter grazing season with stockpiled pastures. What has been learned in all these trials provides us with a basis for reliably producing quality stockpiled pasture in most years

Properly stockpiled cool-season perennial pastures may be utilized through the entire winter period for some classes of livestock. Dry, pregnant cows, ewes, or nannies can be maintained throughout the winter months on stockpiled pasture as long as it is still accessible through the snow or ice cover. Simple availability and accessibility are more likely to limit the usefulness of stockpile cool-season forage than is nutritive content.

Growing high yielding and quality stockpile requires forward planning and management. The following is a step-by-step guide to growing such stockpiled pasture.

Choosing the right pasture

Basically any kind of pasture can be stockpiled but some pastures will do much better than others. Several early studies compared Kentucky bluegrass, orchardgrass, and tall fescue. In every comparison, tall fescue provided the most stockpiled forage. Other studies evaluated smooth bromegrass, timothy, reed canarygrass, and other lesser known species. Many of these small plot trials did not evaluate forage quality and none included any animal use.

When forage quality was evaluated, once again, tall fescue rose to the top of the class. For many researchers this was surprising as tall fescue was quickly developing a reputation as low quality forage among producers and county extension personnel. Then when animals were brought into the studies, we got another surprise when animals sought out and preferentially grazed stockpiled fescue after frosts. I have seen cows in late autumn walk by orchardgrass, timothy, and smooth brome to graze isolated clumps of fescue. And when they did graze them, it was nearly to the ground.

What makes tall fescue such a good crop for stockpiling? 1) It generally produces more forage in late summer and fall than any other perennial cool season grass. 2) Non-structural carbohydrates rapidly accumulate in the plant in response to cooler night time temperatures and shortening day length. 3) It endures more freezing and thawing while maintaining nutritive value better than most other grasses. 4) It forms a vigorous sod that can withstand much abuse during wet winters. 5) It generally recovers rapidly in the spring from close winter grazing.

Through the heart of the fescue belt, stockpiled tall fescue can be routinely expected to produce between 1 ½ to 3 tons of dry matter as standing forage. Most other grass species will produce between ½ and 2 tons of stockpiled forage. Soil fertility, moisture, and stand conditions determine the actual yield that will occur on your field. I have seen stockpile yields high as five tons/acre in exceptional growing conditions and I have seen absolutely no stockpile yield in exceptional conditions going the other direction. More about risk later.

All cool season grasses maintain a certain level of non-structural CHO throughout the growing season. These are stored CHO's that allow a plant to maintain basic maintenance respiration and regrow after all of its leaves have been removed. Without leaves, the plant has no photosynthetic factory so regrowth energy must come from stored energy. Many people seem to think all of these CHO's are stored below ground but the reality is they accumulate above ground in the lower stem bases of most grasses. The reason livestock graze fescue so close in the fall is they are trying to get those high-energy free sugars. They aren't dumb animals.

When you handle fescue leaves, it is easy to cut your hands due to the coarseness of the leaf. There are actually little jagged edges formed by silica crystals that create this saw-like effect. The leaf is also characterized by a heavy waxy layer known as the cuticle. It is this characteristic that makes fescue so durable to freezing and thawing. Contrast the feel with orchardgrass. It has a soft leaf making it very palatable to livestock in most growth stages. Because it is a soft leaf, it also breaks down very rapidly in response to freezing and thawing and its nutritive value quickly deteriorates.

Much of the fescue belt does not experience severe winters where the ground freezes solid for months at a time. Most of the region has periodic cold snaps interspersed among reasonably mild winter conditions. The result is soils continually going through freeze-thaw sequences resulting in lots of mud. Most bunch grass pastures like timothy or orchardgrass seem to have no bottom during the wet winter periods and stands can easily be destroyed. Fescue stands up to these conditions better than almost anything else available.

The last thing about fescue that makes it so good for winter pasture is you can do just about anything to it and it will come back in the spring. Sometimes you will want to damage the stand to make it

easier to interseed legumes or crabgrass, but most of the time there will always be a good stand of fescue come back.

Does this mean tall fescue is the only forage you should try to stockpile? Absolutely not. Even the most tender of forages can be stockpiled. Just plan on using it on the front side of winter and avoid grazing when soil conditions are overly wet. Over the years, I learned diverse mixtures containing as little as 30% tall fescue could stockpile almost as well as solid stands of fescue. Because tall fescue grows so well in the fall, it tends to overstory much of the rest of the pasture. The effect is basically the same as a barn. The more tender forages remain green and fresh under the fescue canopy much longer than if they were in their own monoculture.

This phenomena was really brought home to me when we started routinely seeding tall fescue, orchardgrass, timothy, smooth bromegrass, red clover, and birdsfoot trefoil as a mixture. When these pastures were stockpiled they had the typical browned-off look of stockpiled fescue when looking at them from the field edge. When we walked out into them and pulled back the frosted fescue leaves there would be soft green orchardgrass and timothy along with clover crowns below. This really contributes to the quality and palatability of the stockpile. It's even better when the pasture gets snow covered and stays that way for months. It's just like putting the forage in the freezer and storing it.

We have seen this same phenomena on stockpiled irrigated pastures in Idaho. Even in January, following months of cold weather with temperatures regularly dipping to double digit sub-zero readings, after a one-day strip is grazed off, the residual grass stubble is green. Not only does this tell you how protected the lower part of the canopy can be, it is also a testimony to the quality of properly stockpiled forage.

In the Western US and Northern Plains where meadow bromegrass is grown, it provides a lot of the same characteristics that tall fescue does in the East and South. Meadow brome grows very rapidly in the late summer and fall, as long as irrigation water is available. It is extremely palatable and retains its quality after frost. We only tried growing meadow brome in one study while I was in Missouri. It was a small plot grass variety evaluation including fescue, orchardgrass, perennial ryegrass, smooth bromegrass, and one cultivar of meadow brome. We had serious deer depredation problem there and one of the things we quickly observed was the meadow brome plots were kept grubbed to the ground all winter by the deer while adjacent plots of orchardgrass and perennial ryegrass were left nearly nongrazed.

One advantage for winter graziers in the West and on the Plains is mud is rarely a problem. Once the irrigation is shut off and the ground dries out, almost any part of the landscape can be grazed without damaging the plant community. Natural wetlands and sub-irrigated meadows can still be grazing challenges and should be grazed only when the ground freezes.

There are some pastures to avoid when it comes to stockpiling for winter. From the pasture species standpoint avoid reed canary grass and perennial ryegrass. Reed canarygrass becomes totally unpalatable after frost. Very few animals will ever eat it. Having some along a waterway for bedding and cover is fine. Just don't expect them to eat it. Perennial ryegrass gets infected with leaf diseases and rapidly melts down to nothing if you try to stockpile it. Carrying too much forage cover into

winter is a good way to kill perennial ryegrass stands.

Avoid fields with lots of weeds, particularly summer annual grasses. The nutritive value of summer weeds in the winter is pretty minimal. One exception is crabgrass. Cattle will still do a good job of utilizing stockpiled crabgrass even in the dead of winter. More about that later. Another problem with summer annual grasses in a field you are trying to stockpile is they are still actively growing at the time N fertilizer needs to be applied. The summer annuals can take up all the N and lock it up for the entire winter leaving nothing available for your cool-season grasses.

Lowland and persistently wet fields are not very well suited for winter grazing unless you have reliably cold winters that keep the ground frozen solid. They may grow a lot of stockpiled forage, but it is difficult to utilize the stockpile due to mud problems. If you are going to use wet fields, target them for grazing in the fall when they may be drier or wait until the ground is solidly frozen.

When to begin stockpiling

Stockpiled pasture is best suited for dry, pregnant females. It will work for cows, ewes, and does of all ruminant species. With proper planning and management, production animals like fall-calving cows, replacement females, and growing stock can also utilize stockpiled pasture for some or all of their winter nutrition. The type of livestock you will be wintering helps determine when to begin growing your stockpile. Longer stockpile periods result in lower quality forage while shorter stockpiling periods produce higher quality forage.

If we start from the idea that a square foot of ground can only capture so much solar energy, it becomes apparent the same square foot of ground can only support a finite quantity of forage growth. In typical late summer-early autumn growing conditions, it takes fescue about 60 to 75 days to reach its peak yield potential. Some other species such as orchardgrass or timothy will reach its peak yield in fewer days. If we stockpile a pasture for a longer period, we end up with approximately the same amount of yield, but lower quality forage.

A classic piece of Missouri stockpile research from the late 1960's, looked at stockpile yield from fields rested beginning in mid-June, mid-July, mid-August, and mid-September. The June, July, and August stockpiles all had the same yield while the September stockpile was significantly lower yielding than the first three. The June and July stockpiles had significantly lower crude protein and digestible energy compared to August. September had the highest nutritive value of any of the stockpile.

For dry, pregnant spring-calving cows, our target for stockpiled forage is usually maximum yield. We can expect dry-cow quality feed even at maximum yield. We need 60-75 days of growth to reach maximum yield. The way you determine when to begin stockpiling is to estimate your last day of grass growth and back up 60 to 75 days. In north Missouri, we considered November 1 to be the end of our grass growing season so we would begin stockpiling around August 15. Where we currently live in Idaho, grass growth is pretty well finished by October 1, so the target starting date is around July 15.

In a grazing situation, not every paddock is going to start stockpiling from the optimum date. Some paddocks you will graze for the last time 80 to 90 days before the end of growth while others may only have 50 days of rest. That's just the nature of rotational grazing. If you are accumulating stockpile on hay fields, it is much easier to have most of your acres starting closer to the optimum date.

Every year is going to be different due to moisture and temperature but this process gets you in the window of optimum stockpile growth. We have measured tall fescue still actively growing in early December, but the daily growth rate is quite slow compared to what it had been in September and October.

If the stockpile is planned for growing young stock or lactating females, shortening the stockpiling period can significantly increase nutritive value of the available forage. The increase in forage quality comes at the price of reduced forage yield. We have run fall calving cows the entire winter on nothing but stockpiled pasture and had excellent performance. The key factors with lactating females on stockpiled pasture is make sure they start the winter in good body condition and don't force them to eat every last scrap in the pasture.

Young stock are more sensitive to forage quality than even lactating females so their condition and performance needs to be closely monitored throughout the winter. Young stock are much more likely to require some level of supplementation to perform acceptably on stockpiled pasture.

How to begin the stockpiling process:

You want to start your stockpile growing from the best possible conditions to produce a high yielding, high quality stockpile. You want to grow forage, not weeds. You want to have mostly vegetative regrowth in the stockpile, not accumulated dead stems.

To accomplish this, start by grazing or clipping the pasture to about a three inch residual prior to target initiation date. If it is a pretty clean pasture and has been appropriately grazed for most of the season, you can start right from the last grazing residual. Your goal is to have an efficient solar panel going into the stockpile period. If a pasture has been grubbed down short all summer, it won't stockpile very well because it will take too long for the initial recovery of leaf cover. The gate may have been closed on August 15 but the pasture may not have really started regrowing until September 15.

If the pasture is weedy or has a heavy accumulation of dead forage stems, clipping the pasture is a good idea. Target clipping height should be three to four inches. Taking it shorter or leaving it taller will detract from having an efficient solar panel. If you leave the dead stuff standing, it will carry forward into winter and the average stockpile quality will be lowered.

For the pasture to grow vigorously in the late summer and fall, it needs to have available water and nitrogen. In natural rainfall areas, it is the amount of rain received in August and September that really determines the final stockpile yield. If you have received adequate precipitation in August and

there is water in the soil profile, stockpile growth takes off much better. It's the basic rule of grass grows grass. The sooner the grass canopy closes and captures most of the incoming solar radiation, the more rapidly the pasture grows.

On irrigated land, late season water availability is critical for growing high yielding, high quality stockpile. As a rule of thumb, every inch of water applied in August and September will produce 400 to 500 lb dry matter forage per acre. If you can only put on four inches of water, you will end up with 3/4 to 1 ton of forage with either tall fescue or meadow bromegrass. If you can apply eight inches of water, you should produce 1 ½ to 2 tons of stockpiled forage.

The need for nitrogen:

I once heard the definition of an agronomist as someone who never ceases to be amazed that nitrogen makes grass grow.

Yes, nitrogen makes grass grow and to have a high yielding stockpile, there must be nitrogen available in the soil. That nitrogen can come from soil organic matter, legumes in the pasture mix, applied manure, or commercial fertilizer. Every ton of grass forage at 15% crude protein contains between 45 and 50 lbs of nitrogen. If you want to grow two-ton stockpile, there has to be at least 100 lbs of N coming from somewhere.

Healthy, vigorous soils with organic matter greater than 3 ½ - 4 % can supply a substantial amount of this N. Unfortunately many of our agricultural soils have less than 2% organic matter, particularly through the rolling country of the Upper South and Lower Midwest where soil erosion has taken its toll. Most irrigated Western pastures, particularly those on sandy soils, also have low organic matter. Where you are most likely to find an adequate supply of N coming just from the organic fraction in the soil are long-term grass farms with a history of excellent grazing management and legumes use or with long term applications of manure.

Soils that have been under a grass-legume pasture for many years and have been grazed appropriately typically show low response to N fertilizer application. If 30 to 50% of the annual pasture production comes from a legume component, N fertilization generally doesn't pay. Legumes differ in their capability for N fixation with alfalfa and white clover having the highest capacity, red clover and birdsfoot trefoil at intermediate levels, and lespedeza having the least amount of N-fixation.

Applying poultry, feedlot, hog, or dairy manure can also provide N for stockpile growth. Using manures for stockpile fertilization also has the advantage of providing a long rest period between application and time of grazing use. Sometime livestock will reject pasture that has been recently treated with manures. That is rarely ever a problem on stockpile fields. The disadvantage of using manures for stockpile fertilization is it is usually warm to hot weather when the manure needs to be applied. This can lead to much higher N losses as ammonia if it is raw manure or slurry. The odor is much worse and if you are near non-agricultural neighbors you can receive a lot of complaints and maybe get hit with a lawsuit. Think before you use manures. Using composted manures greatly reduces both the gaseous N loss and any potential odor problems.

Commercial N fertilizer applied in late summer for winter pasture production is often the best return you can make on a dollar invested in fertilizer. Spring applied N produces a lot of grass but it is at a time when you generally already have a lot of grass. The late season application gives you grass when you don't normally have it. A pound of standing grass in December has much greater economic value than a pound of standing grass in June because the December alternative is high priced hay while the June alternative is just another pound of cheap grass.

Ammonium forms of N are preferred to urea (46-0-0) for summer applications. Urea fertilizers can rapidly break down to ammonia and escape into the atmosphere if they are not rapidly incorporated into the soil. As most pasture fertilizer application are surface broadcast, there is no incorporation except through dissolution by water and infiltration into the soil. If you have to use urea, avoid making applications early in the day. An evening application ahead of heavy dew fall will generally get most of your N into the soil. Applying urea ahead of forecast rain is a good option as long as it is not a downpour that generates a lot of runoff. Urea applied ahead of sprinkler irrigation is usually a safe bet.

Ammonium nitrate (34-0-0), diammonium phosphate (DAP 18-46-0), and ammonium sulfate (AMS 22-0-0) are more stable forms of N that do not require immediate soil incorporation to avoid loss. If the pasture also needs phosphorus, DAP is as good choice. If you are in an area with known sulfur deficiencies, try AMS as part of your N source.

How much N to apply depends on soil type and moisture conditions, as well as how intensively you plan to manage the stockpile. Sandy soils need more applied N due to their low organic matter content, but unfortunately they have less capability to bind N so potential N leaching into the groundwater is greatly increased. I advise sacrificing some yield potential for the benefit of water quality safety. Applications for sandy soils should be in the 40 to 60 lb range. If you really believe you can grow more stockpile than the 40-60 lb will produce, apply 40 lb at the beginning of the stockpile phase and another 40 lb a month into the stockpile growth period. Soils ranging from silt loam into the silty clays and clay loams can hold more N so the rate may be higher on these soils. Generally, I would recommend 60 to 80 lbs for these soils. On any soil type I recommend the lower rate in the recommendation range if the summer has been dry and use the upper rate if there has been good precipitation through the summer.

The more intensively the stockpile grazing is managed, the greater the harvest efficiency will be. You will harvest more forage per acre with daily strip grazing compared to three days compared to ten days and so on. The more of the produced forage you capture, the more you can afford to produce. In some research in Missouri, we saw near linear response of tall fescue up to 100 lb-N/acre. In 1990 I never would have recommended 100 lb-N to any farmer or rancher for stockpile production. If I am confident the graziers will manage the strip grazing aggressively enough, I will recommend up to 100 lbs of N for stockpiling predominantly tall fescue stands.

Whenever you evaluate the economics of N-fertilization for stockpile production, you always have to compare the cost of the stockpiled grass to the next lowest cost feed alternative. For most livestock producers, that next best alternative is hay. Here is a rule of thumb for estimating the relative value of N for stockpile vs buying hay. If the N efficiency is 20 lb of forage for each lb of

applied N, the price you can afford to pay for N fertilizer per pound is 1% of the value of the hay. For example, if hay costs $60/ton, you can afford to pay up to 60¢/lb for N fertilizer.

From one source or another, stockpiling pasture has to have adequate N available to produce enough forage to make it worth grazing. The lowest cost stockpile generally comes from a mixed grass-legume pasture with 30-50% of the annual production coming from the legume component and at least 30% fescue in the mix for the East and 30% tall fescue or meadow brome in the West.

What about legumes for stockpiling?

Legumes differ in how well they stockpile and maintain feed quality. Alfalfa might fix the most N and have the highest standing yield at the end of the growing season, but it loses feed quality rapidly in the face of freezing weather. Frosted leaves quickly drop from the plant and soon all you have left are stems and alfalfa stems tend not to be very digestible due to high levels of lignin. Does that mean never stockpile alfalfa? No, it just means use it on the front side of winter before all the leaves are gone.

Sainfoin has been tried in the West for stockpile but shares the same problems as alfalfa of rapid leaf loss and low stem digestibility. It can, however, make a significant N fixation contribution during the growing season and is a useful legume in both dryland and irrigated pasture mixes.

Annual lespedeza has the same problem as alfalfa in that it rapidly loses its leaves with the first frost, and sometimes before frost if it is an older cultivar susceptible to the many leaf diseases that affect lespedeza. Compound the low quality with low N fixation capability and lespedeza leaves a lot to be desired as a companion legume for stockpiling fescue. Its redeeming virtue is that it will thrive on a lot of soils where no other legume will even survive. It goes back to the old proverb. “The low quality forage you’ve got is still better than the high quality forage you don’t have.”

White clover makes very little fall growth and contributes little to stockpile yield except on wet soil sites. Another problem with white clover pastures is they tend to become overgrazed and spotty. If 40% of your pasture surface is short-grazed white clover, there won’t be much other pasture out there to stockpile. As a minor component in the pasture, white clover is fine, just don’t expect it to be a major contributor to winter grazing.

Birdsfoot trefoil in pure stand rapidly loses its leaves and become nearly unpalatable in the fall. But in a mixture it seems to hold its leaves much better and its stems do not become near as wiry. We have stockpiled a lot of pastures with trefoil as a 15 to 25% component and had animals fully utilize it and perform very well.

In my experience, red clover consistently provides the best companion legume for stockpiling. It makes good fall growth, produces adequate amount of N to boost grass growth, it does not weather as badly as alfalfa and lespedeza, and the stems remain fairly digestible right through the winter. Because it can flower and set seed even in the fall of the year, it also has the capability of reseeding itself following a stockpiled winter.

While in Missouri, we found alsike clover to be a wimpy plant with little value except in wet years on certain soil sites. However, it seems to be an entirely different plant in the West whether it be under irrigation or in natural subirrigated meadows. On our Idaho pastures, it is a very productive and persistent plant. We find it does very well as a component in stockpiled pastures.

Other legumes that have been used in various parts of the country in stockpile situations and bear comments. Winter annual legumes such as crimson clover, arrowleaf clover, and hairy vetch can be grown in stockpile situations but they contribute little to forage supply on the front side of winter. They can be very productive in the spring after the grass stockpile has been grazed. Some will reseed themselves for a few years, but most need to be reseeded each fall to ensure having them the following spring.

Berseem and ball clover are a couple of lesser known annual clovers that can make significant yield on both the front and back side of winter. Ball clover is best suited for the upper and mid-South, while berseem clover has been used in the Midwest and the Pacific Northwest, as well as the Southern states.

Nutritive value of stockpiled cool-season pastures:

Many people are really surprised when they learn what high quality stockpiled pastures can actually be. Of course, the quality can also be pretty low. It all depends on how the stockpile was grown. When a full season's growth is allowed to accumulate, a high percentage of the standing forage is seed stems. There are also leaves from early in the season that have died and withered and much of their nutritive value is gone, particularly in wetter environments. Because of the shading from the old growth, very little new growth occurred later in the season. This kind of stockpile may have crude protein level less than 6% and digestibility under 50%. In other words, it wouldn't even let a dry, pregnant cow maintain her body condition. She would be going steadily downhill.

This type of forage still has nutritional value to the animal if properly supplemented. Frequently a couple pounds of protein supplement will be enough to let the rumen microbes extract enough additional energy from the coarse fiber to meet the maintenance needs of the dry, pregnant female.

Managed stockpile as we have talked about growing over the preceding pages can be quite a different story. A properly grown N-fertilized tall fescue stockpile may start the winter with 16-18% crude protein and digestibility close to 70%. This is adequate nutrition for any class of beef animal or smaller ruminant. It would even keep a moderate producing dairy cow ticking along nicely. Feed quality will begin to deteriorate as winter progresses and by the end of winter most stockpiled pasture is down to cow maintenance quality. Stockpiled tall fescue may still be lactation quality feed even at the end of winter.

We have monitored the change in forage quality of various stockpiled pastures throughout the entire winter. Typically we see fescue stockpile ending up at 9-10% protein and digestibility in the mid-50% range. Mixed grass legume pastures may start the winter with even higher forage quality than N-fertilized fescue, but the mixed pastures deteriorate at a more rapid rate than fescue alone. By the

end of the winter, the two pasture types will be of similar quality.

Utilizing stockpiled cool-season pastures:

Most stockpiled cool-season pastures can be utilized to 70-80% of the standing forage. We still need to maintain adequate plant residual to keep pastures healthy and vigorous in the spring. Even in the winter, that should still amount to 500 to 1000 lb dry matter/acre or about 2-3 inches. Tall fescue dominant pastures can be grazed more severely than most other pastures and remain vigorous. In general species with leaves close to the ground (fescues, bluegrass, ryegrass, orchardgrass) may be grazed shorter than those with elevated leaves (smooth brome, timothy, western wheatgrass).