STATEWIDE SMALL LOT ACREAGE PROGRAM (COLORADO)

for Horse Owners

BOULDER VALLEY SOIL CONSERVATION DISTRICT JULY, 1992

NONPOINT SOURCE WATER QUALITY IMPROVEMENT PROJECT

By: Gregory A. Parsons
Nonpoint Source Coordinator, Colorado Department of Health, Denver

The Boulder Valley Soil Conservation District has been working for the past year on a project which is designed to help improve water quality through the proper use of lands devoted to small lot grazing. Small lot grazing is a common feature in not only Boulder County, but throughout the rapidly urbanizing areas of Colorado.

Many people in Colorado prefer a rural setting for their residence; often times these people purchase "ranchettes" or other small acreages which provide for a pasture for horses, or other grazing animals. These rural setting provide for a wonderful way of life, but may also lead to water quality problems if these lands are not properly managed. Overgrazing of these "small lots" and a lack of manure management can lead to polluted runoff, which originates when water from either rainstorms or snow falls on these areas. These water-producing events can transport bacteria and nutrients from manure, and soil particles from bare exposed lands, to local streams from small lots.

Water quality problems which originate from agricultural practices, inactive mining operations, timber harvesting, urban runoff, and construction sites are referred to as "nonpoint source" water pollution. This term simply means that these sources are generally diffuse, rather than conveyed through a pipe, and that the permit provisions of the Federal Clean Water Act do not usually apply to these sites. The Colorado Department of Health has identified nearly 3,500 stream miles and 26,000 surface acres of lakes which are impacted by these nonpoint sources. The Boulder Valley small lot grazing project is funded through a contract with the Colorado Department of Health which is intended to reduce nonpoint source water pollution.

The Boulder Valley project is the first small lot grazing project in Colorado. The objective of the project is to provide information to small lot owners about grazing and manure composting options. Often times, small lot owners are not aware of the problems which overgrazing of their lands may create. The project is also providing examples of both proper grazing management for small lots and composting techniques which may be used for small scale manure producers.

The small lot grazing project may provide many benefits to the people of Colo-

Continued Page **2**

rado. Besides improving grazing and manure management, and resultant water quality improvements, the project may lead to a load reduction on local landfills which are often called upon to dispose of manure. As composting becomes more accepted, the ability to use compost as an amendment to fertilizer will expand the recycling of manure. The project will provide an information base which will be applicable to many areas in Colorado.

COMPOSTING ON A SMALL HORSE PASTURE

By: Bill Hass
Cost- share Participant, Small Lot Acreage Program

When we were invited to participate in the pasture improvement project, my wife and I eagerly agreed. Although we have had several years of experience in horses and horsemanship, we were relatively new to the problems of maintaining pastures and improving the land.

We own a small place east of Boulder, about four acres of pasture and a barn with four stalls, and, of course, four horses. We keep the horses in the barn at night, which causes a bit more work, but ultimately has some advantages. We inspect the horses morning and night, and keeping them in the barn allows the pasture twelve hours of rest a day. We use pine shavings as bedding ("planer mill" rather than "hammer mill" shavings), which we buy in twenty-six cubic yard increments. The combination of the pine shavings and the horse manure (or "horse by-products"), plus the other ingredients amounts to about 80 to 100 cubic yards of material a year. Before entering the program, I was giving this material away to a neighbor (a landscape architect).

However, now that I've learned something about compost, I would be reluctant to go back to giving away this excellent source of compost. I've discovered that the effort needed to turn this "waste material" into the stuff that can make the difference between a beautiful pasture and a dirt lot is not nearly as intimidating as it first appeared. I have been pleasantly surprised to learn that the mixture of horse manure, pine shavings, urine, weeds and grass clippings becomes an active compost almost immediately. We use a tractor to move and pile the compost pile, and we've discovered that if the pile is made as tall as possible (about eight feet using the tractor), with the addition of water, it will take off pretty much on its own.

When we first considered what we needed to do, the compost process seemed complicated and failure imminent. We obtained some pallets from a local business and placed these under one end of the pile. We bought several bags of grass fertilizer (27-5-5) on sale at the local hardware store and threw extra nitrogen into the pile for insurance. But, it seems to me that the truly necessary tools for a compost pile boil down to a garden hose and a compost thermometer. The thermometer is essential, because only the temperature of the pile will tell you if you are dealing with a large pile of wet manure or an actively composting pile. Probably the only thing that keeps your current manure pile from being an active compost is the mois-

ture content, which should be about like a damp sponge.

When we set up the current pile in April of this year, we started monitoring the temperature immediately. The pile maintained a temperature of 155 degrees (at the end that was placed on the pallets) and 135 degrees at the other end. Now, almost three months later, the pile is still maintaining a temperature of more than 130 degrees over the pallets and more than 120 degrees at the other end. This pile is about 20 feet long, 16 feet wide and was eight feet tall when we started it. It has now reduced itself to about four and a half feet tall. Anything over 140 degrees (for three to four days) will eliminate parasites and weed seeds, and any temperature over 113 degrees indicates that composting is going on. The thermometer was an excellent $13 investment.

The importance of compost isn't purely that you are eliminating waste material and turning it into something "good". We believed, as many horse people do, that simply returning manure back into the soil will improve the pasture. It may, but the difference between a compost product and raw manure (no matter how old it is), should be understood. The finished compost is returned into the pasture as a material that improves the quality of the soil enormously. The compost will retain over nine times its weight in water, very important even when you have irrigated pasture as we do, but far more important if the pasture isn't irrigated. The compost material is similar to peat moss found naturally, and releases nitrogen at a very slow and controlled rate. Comparisons of roots of grasses grown in a pasture where there was compost added, versus the roots of grasses that were grown using commercial fertilizer are striking. The roots that came from "good" soil have a robust, dendritic pattern that is clearly much healthier.

The Small Lot Acreage program is especially important to horse owners who are concerned about the environment. The program was started because of concerns that the large number of small horse ranches were forming a profile, where small acreage places were being overgrazed with hardpan pastures which allow the runoff from manure piles to become a watershed pollutant in its own right. As most horse owners would agree, we would rather have the horses turned out in a lush pasture in the first place. The problems of maintaining good pasture aren't obvious, and some effort must be undertaken to avoid overgrazing. The pastures themselves should be gone over with a "crust-buster" (ripping bars, or similar device), which will break up the hardened layers that develop from horses traveling over moist ground and packing the soil.

Weed control is difficult when soil is not conducive to good grass growth. The best weed control is essentially to out-compete the weeds with the desired pasture grasses. I must admit we have a ways to go in this department. We also go to some lengths to maintain our pastures parasite free, collecting whatever manure we can from the pastures and adding this to the compost. We have a large lawn, and we collect about a cubic yard or so of clippings per week during the summer. This goes right into the pile, as it is high in nitrogen and therefore improves the composting process.

The economics of developing compost are, of course, relative. If you are already using stalls and bedding as we are, then you already have the materials. The use of a tractor (with a front loader) is an important point. We are trying to improve our pastures, rotating the horses over four sections that have been cross fenced, at a week or ten days per section. We purchase about three tons of hay per horse a year. We also supplement with a couple of pounds of grain a day per horse. When you add the cost of worming, normal vet bills, and some outings, you will reach the same conclusion most horse owners have lived with over the years: horses are

Continued Page 4

an expensive hobby. However, the return on investment from the compost is threefold: less grass hay purchased, the satisfaction of a beautiful pasture, and the knowledge and confidence that you are participating in a sound ecological program.

PREPARING THAT SEEDBED

By: Peter G. Moller
Project Coordinator, Small Lot Acreage Project

Often the most significant part of improving the quality of a pasture is the land preparation prior to planting. Steps should be taken to improve any of the following problems: soil compaction (perhaps from the hoof action of horses, especially on clay soils); poor drainage; lack of organic matter and/or fertility; an uneven or cloddy surface; and an abundance of weeds (discussed in another article).

Breaking up compacted soil facilitates the movement of air and water, promoting the growth of roots. It will also aid drainage where water puddling is apt to occur. When a small tractor and disc are used, the soil (especially clay) should be moist (neither dry nor wet). Where sod is present, a ripping bar may be needed to prepare the new seedbed. Ripping bars are also effective in "subsoiling" to break up impermeable layers more than 16 inches below the surface. This practice, which causes a minimum of disturbance to the surface soil, can also improve the spread of water in flood irrigation. If the intent is to break up a layer less than 16 inches below the surface (also with a minimum of mixing), then "chiseling" should be done, preferably when the soil is relatively dry.

If the surface is uneven or cloddy, typically the case after discing, or even ripping, a smoother seedbed is needed to obtain more uniform planting depths and improve drainage. This is typically done with a harrow or land plane. However, where loss of topsoil from wind erosion is a problem, as on soils with little or no cover, it is best to have a rough surface. This is particularly important when pastures lie fallow during critical erosion periods. Tillage implements that reach only three to six inches are effective in bringing up compact clods from discing, a desirable condition for limited time periods since a rougher surface is created. This roughening should be done at right angles to the direction of the prevailing winds. Large clods, of course, should be broken up before planting.

One of the best ways to take care of accumulated horse manure is to compost it and work it into the soil. This is especially important for pastures that have relatively little water holding capacity and low levels of fertility due to little organic matter. Application rates vary, depending on soil conditions, however, 10 to 15 tons per acre is often a good amount. On the average there are about 2 and 1/2 yards of compost per ton. A disc or harrow can be used to incorporate the material into the topsoil.

Every few years a soil test should be done on the pasture. If phosphorus (a nutrient needed for early growth) is needed, work it into the soil a few inches. In the ground (unlike in plant tissue), phosphorus is immobile and roots must grow to come into contact

with it. By applying it in the fall (with ammonium forms of nitrogen) the length of the next growing season can be maximized.

For pastures that are run down and need an "overhaul", allowing the land to rest for a year without any vegetation may be a good idea. Levels of soil moisture and fertility can thereby be increased, but weeds and erosion must be controlled. In the latter case the use of mulch or tackifiers (chemical stabilizers) may be needed.

Finally, in establishing a new pasture a cover crop (planted separately from the perennial seed mix) should be considered. This is a fast growing annual species that will provide protection from wind and sun for the slower growing perennial species that will provide permanent cover. The use of a cover crop may be especially important when a native seed mix is used on a dryland pasture. Several cover crops are available. In the plains of Boulder County, the long season (120 day) grain sorghum is often used. By using a sterile (hybrid) form of the seed, it will not reproduce to compete with the perennials. This is a tall growing, drought-resistant plant that does not require a mulch to get started. It should be planted in the late spring while there is still enough rain to get it established.

In early November (at least on the Front Range of Colorado), the cover crop should be cut to about four inches off the ground with a rotary mower or similar device that will shred the plant. Leave strips at least one foot wide standing perpendicular to the direction of the prevailing winds. The distance between these strips should be about ten times the height of the cover crop. Disc (or harrow) the cut and shredded plants into the soil, making sure not to disturb the strips left standing. Harrow or smooth out the sections before planting the perennial mix.

WEED MANAGEMENT IN PASTURES

By: Larry Benner
Extension Agent/Agronomy, C.S.U. Cooperative Extension

Weeds can significantly impact the quality of a pasture. This impact is generally most noticeable on poorly managed pastures. A properly managed pasture encourages the production of desirable plant species. These desirable species compete with weeds and inhibit their establishment. Therefore, good pasture management (proper stocking rates and grazing practices, proper fertilization and irrigation, and use of adapted forage species) will promote desirable plant growth and discourage weed establishment.

Various site characteristics, environmental factors, and weed characteristics must be considered when determining appropriate weed management measures. It is important to identify the weed species, to evaluate the severity and to map the location of infestations. It is also important to determine if the weeds are annual, biennial, or perennial in growth habit. Occurrence of surface water, depth to groundwater, kind and occurrence of desirable plant species and animal species, and proximity of residences and wells to weed infestations require consideration.

There are three general weed management strategies: prevention, eradication, and

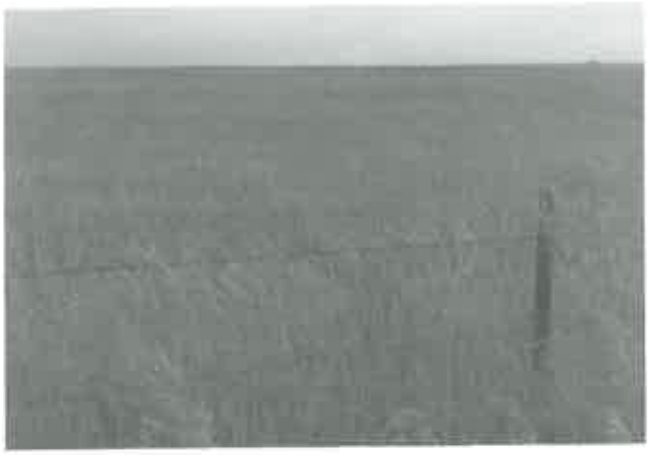
Continued Page 6

control. Of these, prevention is the preferred strategy. Prevention discourages the introduction into and the proliferation of weeds in an area. Eradication is the complete removal of a weed species from an area such that reinfestation will not occur unless the weed is reintroduced. Control is the most widely practiced strategy and is used to reduce established weed infestations to manageable or acceptable levels.

The control strategy includes cultural, mechanical, chemical, and biological control methods. Cultural control methods favor desirable plant growth and include the practices mentioned previously (i.e., grazing management, proper fertilization and irrigation, and use of adapted desirable competitive forage species). Mechanical control methods physically disrupt weed growth and include tillage, mowing, and burning. Chemical control methods utilize herbicides. Biological control methods use disease or insect organisms or grazing animals to inhibit weeds. Good weed management systems integrate at least two or more of these control measures.

In summary, good pasture management that encourages a vigorous, competitive forage stand will do more than most any other measure to prevent and keep weeds in check. However, should a weed problem arise, early detection, proper identification, and integration of methods to control the weed in a safe, effective and environmentally acceptable manner are essential.

For more specific information, please contact your local extension agent or other qualified weed control specialist.



A TWO HORSE PASTURE

By: Creighton & Karen Stewart
Members of "Boulder County Horsemen's Association"

Two years ago our three acre pasture yielded 253 bales of good weed-free grass hay, last year 170, and this year we expect around 225 bales. Many factors contribute to yield. Water frequency and volume, fertilization, weather-intensity and duration, root strength, weeds, grazing and maintenance. We've been grazing and producing on our three acre parcel for the past five years. The pasture was already established when we got involved, so we didn't have that challenge. However, we had never managed a pasture before, so everything about it was a new experience. Whether what we've done is right or wrong is debatable, but it has worked for us - so far.

We've read about the things to do, listened to advice, and watched others. Our routine has evolved into the following pattern. It should be noted that we are fortunate to have irrigation water available three to four times during the growing season at 12 hours a shot, and we have an irrigation well that allows us to put water on those spots that need extra attention.

So, here we are having just put up 200 bales, now what? If the crop was weak, we give it a chance to restore itself after the first cutting in early July. We keep the horses off and let it continue to grow undisturbed. This allows the root system to gain strength and store nutrients for the winter ahead. The horses won't start grazing until after a second cutting, sometime around the first to middle of September. Then we graze

two horses until the end of February or middle of March. We corral the horses at night so their grazing is restricted to day shift only and grazing is only supplemental feed for them. If the crop from the first cutting was good, we'll pass on a second cutting and start grazing by the end of July.

We irrigate as soon after the first cutting as we can, then if water is still available, once in August, and again in early September. The horses are kept off the pasture after irrigating, heavy rains, or snows until some drying out takes place, so they don't dig up the turf while romping through their playground.

We section off the three acres into four grazing sections. If grazing during July, August, and September, the horses stay on one section for about two weeks and are then rotated to the next section. We may pull them off altogether for a two-week period, or put them on a fifth section we have available. This rests each parcel for about eight weeks before the horses are returned. Into the fall when growing has obviously stopped, rotation is every two to three days.

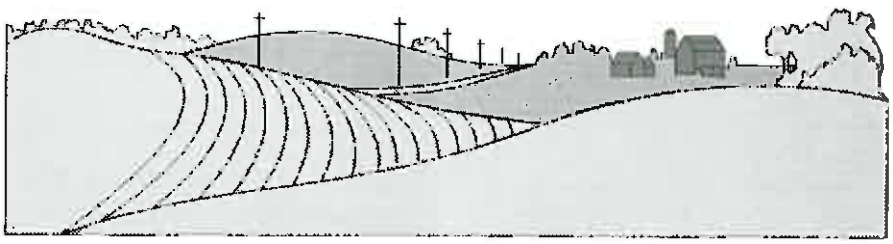
Eventually, spring is once again on the horizon and it's time to look to a new crop. Toward the end of February, we take the horses off the pasture and look for a rise in temperature, a drying out, and no wind. This is when we burn those clumps of grass that the horses haven't eaten for one reason or another, clumps that have been laid over by the snow that tend to breed mold and impede new growth. We call the sheriff, get an OK to burn, and have at it. This also clears the irrigation ditches

About every three years we will spread the past three years' worth of composted horse manure over the pasture. Whether or not manure is spread, we do a very shallow rip of the pasture with a tooth drag to break the surface slightly, flip up rocks, and prepare a fertilizer bed. Next we pick up rocks. It's amazing how rocks grow where last there were none. Our neighbor who does the cutting and bailing appreciates this detail since it tends to keep his equipment out of trouble.

Then it's off to the fertilizer place for fertilizer. We hope to put fertilizer down such that within 48 hours there will be a nice, easy, steady, early spring rain. There have been times when the timing was perfect - other times we've missed it by weeks. Then like magic as March moves toward April, the growing starts.

Dandelions are troublesome early on. They get doused with 2, 4-D. Most other weeds we hand pick. We were very lucky to have taken on a relatively weed free pasture. When you have few weeds, hand picking is not as ridiculous as it sounds. Except for bindweed and dandelions, we have seen reductions in weeds over the past few years.

As we watch the grass grow, we hope for rain and/or enough irrigation water to get a good crop. We hope for a dry week at cutting, bailing, and putting up time. After it's up, we discuss how we'll do it different next year. Then we rest a little. Then the cycle starts over again.

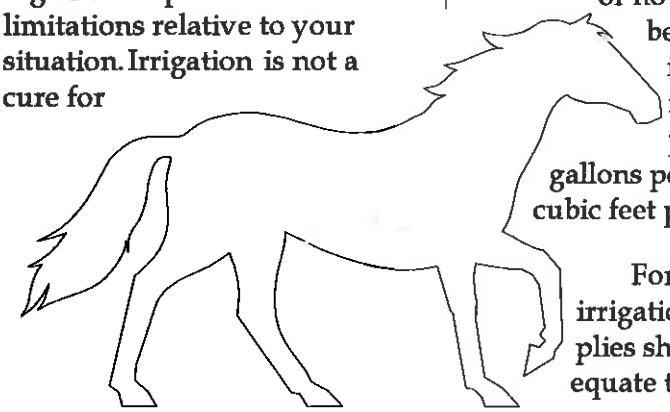


IRRIGATING SMALL PASTURES

By: Paul Gallegos
Soil Conservation Technician, Soil Conservation Service, Longmont

Proper irrigation of small pastures can greatly improve forage production. There is a tremendous amount of variability in the types of irrigation systems being used in our area. An irrigation system that works well in one pasture may not in another. In selecting the best way to irrigate your land, try and develop an understanding of the capabilities and limitations relative to your situation. Irrigation is not a cure for improper management, but must be used in combination with other management practices such as proper grazing use and weed control to maximize production without adversely affecting the resource. The irrigation supply should be carefully tailored for the types of grasses being grown. When limited irrigation water is available, it is very important to use the water as efficiently as possible and the timing of irrigations becomes more critical.

One of the biggest constraints regarding irrigation is water availability. To evaluate whether an ample water supply exists one must consider two factors. 1) Total water availability. This is the seasonal volume of water available for irrigation and is usually expressed in terms of acre feet per year. 2) Water available per irrigation. This is the flow rate or how much water is being used per irrigation event; it is often expressed as gallons per minute or cubic feet per second.



For best results irrigation water supplies should be adequate to meet the seasonal water requirements of the crop being grown. For optimum growth, many irrigated pasture grasses such as orchardgrass, smooth brome and timothy require about 25 inches of water annually. Some of the water needed by the grasses is provided by Mother Nature. During the growing season we typically receive around 7 inches of water from precipitation. Therefore, the average net irrigation requirement for an irrigated pasture would be around 18 inches. Locally, most gravity irrigation systems are less than 50% efficient. In order to meet the seasonal water requirements of an irrigated pasture in the Longmont-Boulder area, about 36 inches of water per acre or 3 acre feet per acre is required. Many small acreages do not have ample water supplies to meet the consumptive use of the grasses being grown. Under watering of some grass varieties will result in a stand reduction, allowing less desirable plants to invade. If a limited water supply is available, consideration should be given toward timing irrigations during critical plant growth stages. For cool season irrigated grasses the most critical growth stages are early in the growing season and after grazing. If irrigation water is available only during periods of spring runoff, consideration should be given to planting more drought tolerant grasses such as many of the wheatgrass species or possibly a

mixture of native warm season grasses.

Knowing the flow rate or the amount of water being applied per irrigation is necessary to ensure that the soil water deficit in the root zone is being replenished. A flow rate of one cubic foot per second (CFS) is the equivalent of approximately 450 gallons per minute (GPM). A flow rate of 1cfs for an hour covers one acre of land to a one inch depth. In a twelve hour period 1cfs will apply one acre foot of water. Without knowing the flow rate of water being delivered to the field, it is impossible to determine how much water is being applied per irrigation. This results in applying either too much or not enough water than is needed to fill the root zone; both are undesirable. If the flow rate being delivered to the field is unknown, it is very difficult to make proper adjustments to improve any portion of the irrigation watering system. There are many ditch companies in the area and most water allocations are expressed as shares. The amount of water a share represents will vary from one ditch company to another and may change from one year to another depending upon the amount of storage water available. If you don't know what a share represents in your irrigation system, ask your ditch rider or irrigation company representative.

Knowing how much water is available for irrigation and the water requirements of the crop being grown is a good starting point to becoming a good irrigator. Learning the best way to irrigate a field requires a lot of trial and error. It is important to study and observe the effectiveness of an irrigation event, and then make adjustments based on results. Eventually, you will develop a system compatible with your situation.

PASTURE MANAGEMENT

By: Vickie Cashman
Cost-share Participant, Small Lot Acreage Program

For 18 years now, I have lived on a five acre plot of land looking at the foothills of Boulder, Colorado. Five years ago, I acquired four horses and thought there would be plenty of pasture, only to find out that the pasture could handle two horses comfortably with good pasture management. This meant rotating pastures and dividing one in half, thus giving me four sections to have the horses graze. Since I had let the horses eat the grass to the roots for four years, I found much of the grass weakened and weeds taking over.

A land conservation and pasture management specialist, Pete Moller, arrived on the scene at a friend's farm. So I asked him to look at my situation. We decided to replant the southwest pasture with more seed and proceed each year to re-seed different sections. To do this, I had to harrow the section to dig up the surface. I saw it as fluffing the surface so the seeds could nestle into the dirt. Reseeding was relatively easy with a hand seeder and by this time, I was starting to feel like a farmer and began appreciating the labor of love they put into their fields and crops.

Continued Page 10

Besides reseeding and keeping the horses from eating the grass down too far on any one section, the issue of composting the horse manure arose. Pete taught me how to mix 35% grass clippings, 35% horse manure, 15% vegetable compost from the kitchen and 15% wood chips or shavings on top of wooden pallets. Air can come into the pile from the bottom and through the perforated PVC pipes going through the middle. The addition of water every other day seems to get it cooking and breaking down. I will put this composed pile onto the fields (to renourish the soil) in the fall for the next reseeding in the spring.

Even though at times this project has taken many hours, and seemed overwhelming at first, it has been worth the knowledge gained. Next spring this will be a much easier project.

COMPOSTING HORSE MANURE

By: Peter G. Moller
Project Coordinator, Small Lot Acreage Project

What is the simplest, least expensive, and most effective way of converting horse manure (a potential waste management problem) into compost (a product that will return its nutrients to the soil, instead of to waterways)? How can other organic waste material be combined with horse manure to produce a useful product? The Small Lot Acreage program for horse pastures has dealt with these issues since last August.

After completing research, I decided to construct a system that would compare the efficiency of static piles (receiving no mechanized treatment) with piles receiving warm, humidified air. The former was watered manually, while the latter involved a humidifier, as well as a blower and duct heater. Five of the six mechanized piles each had a different combination of waste materials, horse manure (with shavings) being the common ingredient. The three static piles ("control plots') had the same materials as three of the mechanized piles.

Numerous adjustments were made to lower the air pressure through the 4" diameter PVC pipe until an acceptable level of about 500 CFM (for a 1 HP blower motor) was attained. The humidity of the piles increased slightly, but not the temperatures. Later it was discovered that by increasing the pile size from 3.5 to 11 cubic yards (about 11' x 11' x 5.5' in a somewhat pyramidal or conical shape) and manually watering each pile for 12 minutes, the piles would start "cooking". During the next few days, temperatures doubled and steam started flowing, especially from those piles covered with straw and black netting (to hold in heat and moisture).

Furthermore, temperatures were maintained between 140 and 160 degrees F. for over a week (more than enough to kill weed seed and pathogenic organisms in manure). As the heat in the piles went down, more water was applied to the static pile, increasing its temperature by 30 degrees within

two to three days. It was obvious that a larger humidifier was needed in the mechanized piles as no temperature increase occurred during the same time period.

One way of speeding up the composting process is by shredding, however, it is not always necessary. The large chipper/shredders sold for home garden use are not efficient in breaking up large volumes of waste. Industrial or farm shredders work well, though. About 2/3 of the horse manure in these piles was shredded with a "Royer" shredder (large farm equipment).

Several lessons were learned about other types of organic waste that could be included. Newspaper must be shredded into small pieces (like half-dollar size — not strips). Leaves are relatively high in carbon, slow to break down, and hard to shred. Conifer needles are also slow to decompose and hard to shred, but they offer the advantage of lowering the pH from an alkaline level to a more desirable neutral one.

The following worked the best to elevate temperatures: 45% horse manure, 35% grass clippings, 10% topsoil, and 10% bark. However, since horse manure has only half the density of other types of manure, it is very porous and dries rapidly in the arid environment of Colorado. To maintain high levels of moisture (50 to 65% of an oven-dry weight basis considered desirable initially), it was found that mixing turkey manure and grass clippings with horse manure worked well. This was a triple blessing since both of these materials are high in nitrogen (horse manure having a relatively high carbon to nitrogen ratio) and are locally available. By using old turkey manure, no objectionable odors were produced.

It is now planned to construct two new large piles, one receiving forced, humidified air, the other having no treatment, although a line of wooden pallets (with a screen on top) is placed on the bottom in the center to facilitate air movement into the pile. Each pile will have the following mixture: 30 % horse manure, 20% grass clippings, 20% turkey manure, 15% conifer needles, and 15% bark. This mixture should produce high levels of both temperature and moisture. Bark or wood chips facilitate the circulation of air and moisture throughout the pile, thereby decreasing the need for aerating the piles, especially significant for the static pile.

Material costs are minimal if static piles are used (no mechanized treatment). If a forced air system is used, estimated material costs would be between $600 and $900, the largest variable probably being the humidifier; this assumes no heater and only one pile. Basic materials would include: a blower (1/3 HP or less motor), a humidifier, some duct work, a ball valve (to regulate air flow into the pile), a manometer (to determine static pressure of the piles, or air flow into them), PVC pipe (4"), fittings, screen (to put over 1/2" perforations of pipe at bottom of pile), dark netting, mulch, and a compost thermometer. A small soil oven for determining moisture content can be purchased for $280 and would be extra.

The three most important factors to consider in composting horse manure are humidity, nitrogen, and mass. The addition of both grass clippings and turkey manure provides for the humidity and nitrogen. If turkey manure is not available, good compost can be made, but piles will have to be watered more often. It is estimated that a final product can be produced in about three months, counting one month in a curing pile for final degradation.

SMALL PASTURE SEEDINGS

By: Harvey Sprock
Range Conservationist, Soil Conservation Service, Greeley, CO

The following are some seeding basics that over many years have proven most successful in Eastern Colorado:

1) Weed Control — Any perennial weeds, such as field bindweed, Canada thistle, etc., should be controlled prior to the seedbed preparation. One or more years may be required to bring these weeds under control. If herbicides are used to control weeds, care should be taken so no chemical carryover will affect the cover crop or permanent seeding. Check with your local Extension Service office for recommendations.

2) Seedbed — A weedfree, clipped (8-12"), dead, sterile forage sorghum cover crop drilled into a well prepared (plowed, disked or rototilled, firmed, and smoothed) soil makes an excellent seedbed for the permanent seeding. Organic matter, such as weedfree composted manure, is best worked into the soil with the tillage operation(s) before planting the sorghum. The seedbed preparation and seeding of the cover crop (forage sorghum) should take place from May 15 - June 10.

3) Permanent Seeding — The best time to make the permanent seeding is generally from November 1 - April 30 when the soil is not frozen. Drilling the seed with a good grassland drill — one with seedbox agitator, picker wheels, double disk furrow openers, seed tubes dropping between the furrow openers, separate fine seedbox, and adjustable press wheels — has proven most successful. This kind of drill can place the seed accurately at the correct seeding depth (1/3 - 3/4" deep depending on the species) and firm the soil around the seed. If broadcast seeding is used (extremely small areas or very steep and/or rocky areas) double the seeding rate, rake the seed into the soil to get adequate soil coverage, and compact or roll the soil to get good soil seed contact. A mulch consisting of 3,000 - 4,000 lbs./acre of weedfree native hay should then be uniformly spread and crimped four inches into the soil to protect seeded areas susceptible to erosion.

4) Species Selection — Specific needs and soils type should determine the species selected.

Native species over the long run have proven superior to introduced species. If properly managed after establishment, native species should produce indefinitely. This is not the situation for introduced species. It is a good idea to include a sodforming species in the seed mixture. A small amount of a non-bloating legume would be desirable in a seeding to be grazed. However, there is no commercial source for any of our many native legumes.

Introduced non-bloating legumes have not persisted in our area. Check with your local Soil Conservation Ser-

vice office for specific seeding recommendations (species, varieties, seeding rates, etc.).

5) Irrigation — If irrigation water is available, it can be applied as required. With any flood type irrigation extreme care must be taken to avoid washing out the seed.

6) Weed Control — After seeding, weeds should be mowed to avoid competition for moisture, nutrients, and sunlight.

7) Grazing should not be permitted until the stand is established. This may take 1 - 4 years for a dryland setting.

8) Grazing Management — After stand establishment on dryland pastures, if animals are allowed to graze, then a planned grazing system that requires adequate growing season deferment (at least 30 days after light to moderate grazing in the spring and 60 days after successive periods of grazing) is required to maintain production. If an adequate grazing system is not applied, the seeding will deteriorate. Check with your local Soil Conservation Service for specific requirements.

HOW GRASSES GROW

By: Dr. Roy Roath
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A grass plant is not a single unit. It is a combination of growth units called tillers, each capable of producing leaves, stems, and seed heads. A tiller has roots, a crown, and a growing point. Roots arise from the basal area of a stem called the crown. The crown area has a number of buds (growing points) that are capable of producing new tillers which are anatomically and physiologically connected to the previous tiller. Therefore, several tillers may all be sharing resources. Collectively they form a plant. If one tiller is injured or dies, the adjacent tillers will continue to live.

Tillers can be divided into two categories: vegetative and reproductive. Vegetative tillers are characterized by extension of leaves, but the growing point remains near the soil surface. Vegetative tillers have leaves and few stems and dominate when conditions are favorable for plant growth. These tillers provide the bulk of the annual forage production, and represent the quality component for grazing use. Reproductive tillers are notable because the growing point is extended considerably above the ground and by having leaves, stems and seed heads. A tiller's fate to become reproductive is controlled by environmental and internal mechanisms. At some point in the growth, environmental conditions cause changes in the plant that initiates the development of reproductive tillers and subsequent seed heads. However, factors like drought or grazing can interrupt the process of forming reproductive parts. Drought causes growth to cease. When cessation of growth occurs, the plant becomes quiescent (unable to complete growth and nutrient storage).

Leaves and tillers have a definite life span. The first leaf produced in the spring will

Continued Page 14

normally die during the summer. When the rate of photosynthesis is no longer sufficient to produce enough energy for that leaf, it will die. The process is one of continual production of new leaves to replace the older leaves until growth is no longer possible either because of lack of moisture availability or change in the physiological status of the plant.

Grasses have the capability of producing a large amount of the leaf growth in the spring (vegetative growth period). Since these plants are well adapted to produce leaf material at this time, and because leaves are aging and being continuously replaced, a portion of these leaves can be harvested with grazing. However, enough photosynthetic area must be left to continue producing new leaves. This defoliation process can continue as long as there is adequate moisture or the temperature is within the growth range of the grasses. At the point where moisture ceases to be available or the temperature of the environment moves outside of the range where it is optimum, either the rate of growth is slowed or the production of more fibrous materials (stems) is prevalent. Stem material is less desirable than leaves, the latter being of high value for the grazing animal.

There are two distinct phases of grass growth: 1) a rapid growth period of vegetative material, and 2) production of reproductive structures. The forage quality for grazing animals is much higher during the rapid spring growth of vegetative material. Therefore, it would be an advantage for grazing animals to maintain plants in this period as long as possible. Additionally, when grasses are in the vegetative growth period, there is rapid turnover and replacement of leaves. If one leaf is partially or completely removed, the plant will replace that leaf with another leaf. Because 60% or more of the growth of each leaf is produced from the base of the plant, removal of some of the leaf material does not reduce the capability of that plant to produce new leaf material, given two moderating factors: 1) that grazing animals consistently leave enough leaf material to provide for the photosynthetic needs of the plants and the production of new leaf material, and 2) that the animals consistently utilize the leaf material on a given plant only once or twice before there is an opportunity for that plant to produce new leaf material without subsequent removal by grazing. Unlike during the reproductive stage, or at least often so, grazing during the vegetative growth period is not detrimental to the plant, provided the plant is allowed to produce new leaves while the conditions are right for regrowth. Therefore, grasses are quite well adapted to survive and prosper under grazing use without the grazing being detrimental to the grass plant.

Appropriate grazing will incorporate some rest during the time when there is enough moisture available to allow the plant to regrow when temperatures are still within the range that will allow plant growth. It is quite evident that as plants regrow, they need adequate leaf surface area for photosynthesis to support the production of new leaves. Therefore, there is an interaction between the intensity of utilization and its opportunity to regrow. Management of regrowth opportunity and leaf area remaining is the key to designing grazing management strategies for long-term health and productivity of the grazing resource.

Note: This article has been abridged.

This section is for your note taking and/or questions which you can return to the Boulder Valley Soil Conservation District for their response.

STOCKING RATE AND PROPER GRAZING

By : Richard J. Mullaney
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NRCS

"Take half and leave half" is the rule of thumb used by SCS to discuss proper pasture NRCS management. It is extremely important that enough leaves on plants remain throughout the growing season to manufacture food. Overgrazed grasses can not remain healthy, vigorous, and productive without a large enough food producing factory —its leaves. The amount of leaf volume removed has a direct effect on the growth of new roots. Root growth can stop for up to 12 days when 80 percent of the leaves are removed. Removal of 90 percent of the leaves can stop root growth for up to 18 days. When only 50 percent of the leaves are removed, roots continue to grow actively. A grass plant produces twice the volume of leaves that is needed to complete its growth functions and remain productive. Therefore, during a growing season half of the plant weight can be utilized without harming the plant. To determine what is actually half of the plant, cut a small clump of ungrazed grass at ground level and bind it together with string or a rubber band. Find the point the plant balances on your finger. Above this point is the part that can be utilized by the grazing animal.

The animal-unit (AU) is the common denominator used to calculate relative grazing impacts of different kinds of grazing animals. One AU is equivalent to a one thousand pound cow or 1200 pounds of usable forage in eastern Colorado, 40 or more acres are generally required to feed one animal-unit for a year. It is easy to see that small acreage horse lots will need to supplement most of the animals' forage needs.

Proper grazing can help to increase the stocking rate of an area. When animals graze in a field, they will utilize forage in a small area and move away and start again. In a continuous grazing system the animals will come back to the grazed area and enjoy the young shoots of grass that have started to regrow. This will have an adverse impact on the grass. It will eventually die and less desirable plants will move into the area. To reduce this harmful practice, some type of grazing system needs to be developed. One of the most commonly used is a high-impact, short duration system. Larger fields need to be fenced into smaller areas where animals are contained during grazing. This forces the animals to utilize all the forage in that area before they are moved to the next paddock or field.

In a rotational grazing system on dryland pasture, the main factor is the period of rest the plant has to grow back after

Continued Page 16

grazing; not how long the animals are on a field. During the spring and fall as the plants are growing fast, the rest period should be around 30-45 days. As the hot summer days come on and plants slow in their growth, the rest period should expand to 60 days. or even 75 days or more.

Fencing is a very inexpensive management tool. Utilizing existing structures such as watering tanks, outbuildings and older fences, and installing new fences, smaller fields can be developed for a grazing rotation. Temporary electric fences can be utilized for this purpose also. For smaller acreages, animals should be allowed to graze one to three hours a day.

From a resource management standpoint it is important to maintain a healthy stand of grass. Grass slows water runoff which increases water infiltration into the soil. Grass also slows soil erosion and helps maintain water quality by reducing sediment, and other chemicals from entering our water supply. It is up to each individual landowner to maintain conservation on their property in order to protect the natural resources for the future.

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