

SEEDING RANGELAND SOLANO COUNTY



Agricultural Extension Service

University of California

Solano County - Fairfield, California

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SUITABLE SITES

In general, land qualifying for a range seeding program is land the owner wishes to keep in a dryland pasture for at least three years, and preferably longer. Land in a grain-fallow-grazing rotation is not well suited because it is not utilized as strictly grazing land long enough to properly or economically, establish improved dryland grasses and legumes. Land destined to be irrigated soon, also does not qualify.

A typical site for a seeding program is on reasonably open and often rolling pasture land, where normal grain and hay yields are often low enough to make these enterprises economically unattractive, or where the owner wishes to maintain a permanent "hard" sod for livestock grazing. Bottom or flat land that has little or no prospect of being placed under irrigation, and is too poorly drained in wet winters to risk growing a grain crop, is also a likely candidate. This would include basin soils of clay texture and low terrace soils with a clay pan near the surface. The site should also be one that receives sufficient moisture to set seed on the spring flowering annual plants and/or carry perennial grasses through the long (late spring through the early fall) dry season.

Moisture availability factors, including the rainfall pattern, fog, effective soil depth for water storage, and evapo-transpiration rates are probably the most important limiting factors in a range reseeding program. Land that tends to "run dry" because of insufficient rooting depth, or failure to store moisture, or both, is often unsuccessful. North facing slopes on rolling land often will succeed while the drier south facing slopes will not. Very steep land often fails too, because of shallow soil depth and lower fertility.

Montezuma Clay Adobe soil, in the Potrero Hills and Jamison Canyon areas of Solano County, has demonstrated outstanding ability to produce reseeding annual legumes, while the same soil type in parts of the Montezuma Hills has failed, apparently due to differences in usual rainfall patterns. Clay Pan soil, in the rolling English Hills area north of Vacaville, has failed in "dry" years, when essentially the same Clay Pan soil condition has succeeded on flat land where it presumably stored more moisture, or was in a part of the county receiving more rainfall.

In general, weather and rainfall patterns in Solano County, from Pleasant's Valley, southwestward through Fairfield, Suisun Valley, Cordelia, Green Valley, Benicia and Vallejo, are apt to provide more available moisture than the area north and east of Vacaville, and portions of the Montezuma Hills and Delta Region. In general, land having a history of better than average native grass and legume productivity is also apt to do better in a seeding program than sites where the reverse is true.

WHY SEED?

Seeding is feasible when land is retired from "farming" in order to provide protective soil cover and establish plants capable of improving the amount and quality of useful forage over the production of existing "native" plants. The word "native" is placed in quotes because few plants are truly native - most of them have been introduced at one time or another, and have become established over the years. Bur Clover, for instance, is often referred to as our most valuable "native clover"; when comparing it to other clovers. The truth is, Bur Clover was introduced many years ago - found the climate and soil conditions favorable, and gradually spread over much of the rangeland.

In spite of Bur Clover, the nitrogen levels of our rangeland have generally gone down. A low nitrogen status is the rule rather than the exception in Solano County, as it is in most parts of the state. This has tended to decrease grass production, especially. Theoretically, the nitrogen status can be improved in time by increasing the amount of legume growth on our ranges. A solid annual Sub Clover stand can well "fix" 100 to 150 pounds of actual nitrogen per acre. The legumes not only provide a source of high quality, high protein forage themselves, but also can benefit grass production by providing more available nitrogen. This is one of the main reasons why range agronomists have continued to search for range legumes capable of doing even better than Bur Clover. Clovers are desired that will provide a longer green feed period than Bur Clover, but will still be able to reseed themselves successfully. They should also be adaptable, if possible, to areas where Bur Clover grows erratically, or not at all. They should also be palatable to livestock. Little practical good can be achieved by introducing plants that grow well, but are poorly utilized by livestock.

SEEDBED PREPARATION AND METHODS OF SEEDING

There is nothing magic about growing plants on range. A range pasture is as much a crop as any other and should be given the same consideration, if at all possible. No farmer would think it proper to simply toss grain seed on top of a range pasture stand to get a grain crop. Yet, it seems that many think it should be possible to establish new range plants by broadcasting a few pounds per acre of seed on top an existing sod containing a good many more pounds of "native" seed. There have been very few successful seedings in Solano County achieved in this manner. The competition is simply too great in most cases, no matter how adaptable and aggressive the introduced plants may be.

A prepared seedbed greatly increases the possibility of producing a satisfactory and uniform start. The seedbed need not be deep and fine, but should provide sufficient loose material to cover broadcast or drilled seed to a depth of 1/2 to 1 inch, without excessive cloddiness. Often times, a single pass, with an offset disc and harrow at the right time will suffice. Too deep a cut, say to 4 or 5 inches, is inadvisable because it may produce too many large clods or may also bring up deeply buried weed seed which can add even more "native" plant competition than usual.

The time to make the seedbed depends upon the soil moisture and texture status. Medium textured soils may work up satisfactorily when dry. These can often be prepared and seeded before the fall rains arrive. Heavy textured (clay and clay loams) soils may have to receive a fall rain before they can be prepared. In any case, the seedbed should be prepared as early as possible in the late summer or early fall. The usual summer fallow program carried out before seeding grain is considered a very good way to prepare for a fall seeding of permanent range pasture.

It is possible to plant into grain stubble without further seedbed preparation because the soil is often sufficiently loose to do the job. This method has the added advantage of not bringing up more weed seed competition and benefits further by the amount of weedy competition already killed by the previous grain crop. Another adaptation of this method has been to introduce the range plants at the same time the grain is sowed. This method has been successful in a few cases in Solano County, but is considered risky. If the grain crop should be a good one, it can provide severe competition to the range plants for both sunlight and moisture. However, if the site is one where grain grows less well, such as poorly drained flat land in a wet year, this method may be worth trying. Of course, the grain must be planted first, followed by the range plants, because grain is normally covered deeper than range plant seed. Grain drills equipped with small seed hoppers can do the job at one time, but this type of equipment is usually scarce.

Most range seedings are done by broadcasting the seed, often by air. Airplane application is quite satisfactory when done by experienced pilots. It is possible to scatter the seed quickly and uniformly and avoid the problem of how to apply small amounts (often 10 pounds per acre or less) uniformly with a ground rig. If air application is not possible, other possible methods include use of hand, "belly grinder" seeders and certain "whirligig" tractor mounted seeders equipped with sufficiently small openings to stay within the desired seed rate per acre. Standard grain drills have even been used by mixing the range seed with rice hulls to carry them through the large grain openings and with all tension removed from the disc openers to prevent planting too deep. Commercial broadcast seeders which mount a small seed hopper between two sets of ground rollers are quite satisfactory.

One of the most important requirements in broadcast seeding methods is to be sure the seed is rolled or pushed into the soil in some manner, right after it is applied to the soil surface. Rollers of almost any kind are satisfactory for this job, including large smooth roller drums weighted by water, or smaller cultipacker type ring rollers. The use of livestock hooves to press the seed into the ground has even been utilized when other methods were unavailable. About the only time that rolling should not take place is when the soil is too wet to get on, or when rolling moist soil might result in a crust formation that would prevent range plant seedlings from breaking through. Drags or floats or close spike tooth harrows can also be used as a secondary choice to rolling, but are more apt to bury the seed too deep, than are rollers.

PELLET INOCULATION

One of the most important developments in the area of range reseeding to come out in the last two years has been that of pellet inoculation. It is very possible that many of the clover stand failures in the past have been due to inadequate or improper inoculation.

The specific and necessary Rhizobia bacteria required for nitrogen fixation on the plant root nodules are often not found in soil that hasn't grown these clovers. There has also been failures in achieving proper inoculation by placing dry inoculating powder on the seed before planting. The wet, slurry method is better, but airplane operators don't care for this, as the dampened seed doesn't flow as well as the dry. As a result, most airplane seeded seed has either been uninoculated or has been dry inoculated. It is now known that lack of moisture and exposure to sunlight and air can kill the Rhizobia bacteria in a matter of minutes. Some researchers feel most of the bacteria could well have died before touching the ground after leaving an airplane hopper. Further research, unhappily enough, has failed to establish the efficacy of protecting the bacteria by placing it under the seed coat with a vacuum process. This method apparently keeps the bacteria alive, but fails to release them to the plant roots.

Pellet inoculation was first successfully done in Australia. It involves mixing the inoculum with a vegetable glue, containing available moisture, applying the glue to seed, and wrapping the seed in a protective coating of lime to keep out sunlight and air. The resulting pellet is dry and can be flown on right after making it. It works beautifully in the airplane, and most important of all, can keep the Rhizobia alive for several weeks after the seed hits the ground. Any rain at all, even a small one, will dissolve the seed coat and put the Rhizobia in the soil where it lives much longer and is ready to intercept the clover roots as they germinate and penetrate the soil.

How To Make the Pellets at Home

Satisfactory pellets can be made at home, using any size cement mixer. Here is the "recipe" to use to prepare the pellets:---

1. Prepare 2-2/3 quarts of gum arabic glue per 100 pounds of seed by gradually dissolving the dry glue in warm water at the rate of four pounds of glue, to one gallon of water. This can be done the day or night before the pelleting, if desired. A big tub or drum is good for this and a power drill can be used with a paint mixer attachment for agitation. All lumps ought to be removed from the glue, if any form. The granular form of glue dissolves easier than the powdered glue.
2. After the glue has cooled down to room temperature, about 3 to 4 times the usual recommended amounts of specific Rhizobia powder should be added to the right amount of glue for each batch of seed to be pelletized. The vacuum sealed packages should be opened and immediately put into the glue. Agitation with the mixer can help get the job done again.

NOTE: Woogenelup Sub Clover requires its own brand of Rhizobia, so be sure to order it specifically when seed and inoculum supplies are bought.

3. Half fill a three gallon bucket with seed for each 100 pounds of seed to be pelletized. Pour all the Rhizobia containing glue for the whole batch into the bucket and hand mix with a paddle. This pre-mixed, and very wet seed is next poured into the cement mixer on top of the rest of the dry seed and the mixer turned on to thoroughly coat all the seed with glue.

4. After a few minutes run, the mixer is stopped and finely ground lime added, at the rate of 50 pounds per 100 pounds of seed.

Quicklime should not be used - it will kill the bacteria.

Another short mixer run and the seed is pelletized, ready to use. If lumps form, they can be screened out of the seed and broken up. This will not happen if the right proportions are used and mixer speed is fast enough for good agitation.

Seed houses are already using the pellet process in seed inoculation. The usual charge is 10¢ per pound. It is well worth the price, but caution is required not to buy seed that hasn't had at least three times the usual amount of inoculum applied and has been pelletized less than a week. The "shelf life" of these bacteria is short. If a rain doesn't get it into the ground within a few weeks, it will be dead. Your best chance of knowing the inoculum is fresh and at the right level is when you do it yourself.

WHEN TO PLANT

The first week in November is likely to be the best time to plant, because it is early enough to avoid damage from cold weather, while late enough to insure a rain within three weeks of planting. Rain is required within this time to keep the Rhizobia alive. Be sure the pelleting is done just before planting to insure keeping the Rhizobia alive as long as possible.

FERTILIZATION

Apply phosphorous or sulphur needs when making a seedbed to get it into the soil. A proper sodium bicarbonate soil extraction test can tell you whether phosphorous is required. Do not use nitrogen fertilizer on a clover seeding - it just inhibits the Rhizobia and creates grass competition. If phosphorous is required, apply at least 22 pounds of P (50 pounds P₂O₅) per acre.

ADAPTED GRASSES AND CLOVERS

Certain "native" plants exist that are considered quite useful and should be encouraged to remain and increase. Often times, it is either not possible to buy these varieties or it is unadvisable because the seed is already present. Included in this category are the following plants: Bur Clover, Annual Ryegrass, Soft Chess, Wild Oats and Filaree. Other plants that may be considered for range planting are as follows:

1. Annual Clovers, including Subterranean (Sub), Rose and Crimson. These three legumes have been tested extensively in Solano County since 1949. They exist well together.

Bloom Dates

A wide spread in bloom dates is found among the different varieties of Annual Clovers, Medics and Vetches. The following bloom dates were recorded in Solano County in a variety trial in 1967:--

<u>March 9, 1967</u>	Cyprus Barrel Medic in beginning bloom, Geraldton and Dwalganup Sub in early blossom.
<u>March 15, 1967</u>	Bur Clover in middle bloom, 173 Barrel Medic in beginning bud stage.
<u>March 22, 1967</u>	Yarloop and Woogenelup Sub Clover in beginning bloom.
<u>March 29, 1967</u>	Clare, Mt. Barker, and Dinninup Sub Clovers in bloom, Purple Clover in bud stage, Sirint Rose Clover in bud stage, Hykon Rose Clover in beginning bloom stage, Kondinin Rose Clover in beginning bud stage.
<u>April 7, 1967</u>	Bacchus Marsh Sub Clover in bloom
<u>April 25, 1967</u>	Dixie Crimson Clover in bloom, Black Medic in bloom Lana and Auburn Woollypod Vetch in early bud stage, Wilton (California Certified,) P.I. 170821 and S-6 Rose Clovers in bud stage, Tallarook Sub Clover in beginning bloom.

This wide spread in bloom dates indicates the need to select representative varieties that will insure a seed crop in any weather pattern. The fact, that Bur Clover is commonly found in many parts of our rangeland, is probably due to the fact that it blooms early and puts out a high percentage of hard seed that will make a new start when a previous crop is lost from lack of sufficient spring rainfall. It is possible to do the same thing with Rose and Sub Clover and still secure the longer green feed period these plants will put out in comparison to Bur Clover.

Sub Clover (developed in Australia and New Zealand) is perhaps the most useful of the annual clovers when it is finally established, because of its ability to produce a seed crop, even when closely and nearly continuously grazed. It manages this because it flowers low to the ground in small, inconspicuous self fertile single flowers that are located on the end of tendrils that attempt to bury the seed pod in a soil crack or under the sod, away from the reach of grazing animals. It actually seems to do a better job of seeding when grazed, than when ungrazed.

This characteristic, plus the added benefit of being quite palatable at all stages of growth make this a most useful and competitive plant. Mixed pasture stands have often been dominated in time by Sub Clover. It will not do as well in droughty soil as will Rose Clover, but will become well established in the flats, hollows, north facing slopes, etc., where moisture is most abundant.

Mt. Barker Sub Clover has been the standard variety planted and is still considered quite useful under usual climatic conditions. However, county survival trials have shown that Mt. Barker may be a relatively poor *'hard' seed producer. This lack of 'hard' seed weakens the chances for a return crop any year it is unable to set a seed crop because of drought. Two back to back 'dry' years in the early 1960's set Mt. Barker Sub Clover stands back badly. Current variety trials in Solano County have indicated the adaptability of Geraldton Sub for early blooming, Woogenelup for mid-bloom and Clare for late bloom. (Woogenelup is better than Clare on acid soils.)

Rose Clover is more drought tolerant than Sub and produces plenty of 'hard' seed. It is not as palatable as Sub Clover, but animals eat it well dry and eventually learn to eat it green. Rose Clover is sometimes seeded alone in droughty unfertile situations or where seedbeds cannot be made in oak-brush-grasslands. This variety of annual clover has exhibited its 'toughness' and will make a seed crop in most years. It is intermediate in height and produces seed at the top of the plant in shatter resistant heads. Grazing activity threshes these heads out and into the ground. 'Hard' seed often passes through grazing animals undigested and is scattered over the ground in the droppings.

Hykon and Kondinin are recommended for early bloom and Wilton (California Certified) for late bloom.

Crimson Clover is the tallest and showiest of the three. Its erect blossom is quite large and is a brilliant red in color- hence its name. The leaves are quite large and palatable. Because of its palatability and late erect seeding habit, Crimson Clover tends to weaken in a stand after a few years, but it is good feed while it lasts, and serves as a good 'indicator' to plant, as it is the most easily seen by casual observation. Crimson Clover is not essential in a range mix, so is not recommended, except where grazing is limited to the post-bloom period.

*'Hard' seed is seed that resists germination when first wet and may require one to several years to finally germinate.

2. Vetch - Two varieties especially bred for range pasture are Lana and Auburn Woollypod Vetch. Neither have been extensively grown in Solano County. Limited local tests have resulted in reasonably good first year stands, but poor subsequent seed production and reseeding. Part of the problem appears to be its palatability. Unlike most common vetches, Lana and Auburn are grazed green instead of in the usual dry stage. This apparently cuts down its ability to produce a large enough first year seed crop to insure later crops. It has been suggested that these plants would survive better if no grazing were allowed at all the first year, in order to maximize the seed crop. There may be merit to this suggestion, but it has not yet been tested locally. If vetch is desired, it should be planted alone and no grazing should be allowed the first year.

3. Perennial Grass - Only one perennial range grass has been reasonably successful in Solano County. Harding Grass has been successfully established in the brush hills after a burn has eliminated nearly all annual competition. It has also slowly established itself on clay and clay pan soil, where sufficient stored moisture is present to carry the crowns through the long dry period in the late spring through early fall. It has succeeded better when drilled alone over bands of nitrogen fertilizer to give it an added boost. Broadcast nitrogen usually results in too much "native" grass competition. Most failures in a seeding with competitive annuals have been due to its slowness in developing a root system in the critical first year after seeding. Competing, more early maturing plants, appear to remove the surface soil moisture before Harding Grass is able to get its roots down far enough to survive. Only in years of extremely wet springs has Harding Grass been easily established and strengthened. Once it is established, however, Harding Grass is quite tenacious and can be expected to survive indefinitely. It tends to thicken at the crown and is sometimes considered coarse and unpalatable for animals, but is generally well eaten and useful. No instances are yet known where it has been successfully established by over-seeding an established sod. A seed bed has been a must, including the use of brush burn ash to provide seed cover.

4. Annual Grass - No better grasses than those "native" ones discussed earlier have been made available. Annual Ryegrass seed can be purchased at reasonable cost, and is very useful in a brush burn seeding or other sites where vegetation has been removed sufficiently to pose an erosion hazard. Annual Ryegrass can establish itself early with a minimum of seed bed preparation. It is also quite palatable to all classes of livestock. It does require a high level of nitrogen, so tends to weaken in nitrogen depleted rangeland.

Soft Chess can also be bought under the name of Blando Brome. It may also be worth putting into a brush burn, but like Annual Ryegrass, is usually already present in most range pastures in Solano County.

SUGGESTED SEED MIXES

In general, ten pounds of total clover seed per acre is sufficient for seeding range pasture. This does not produce a thick stand the first year, but if a successful seed crop is produced, the subsequent years will see the stand thicken considerably. Sub Clover - 7 pounds, and Rose Clover - 3 pounds, would be satisfactory for most situations. When seeded alone, Rose Clover at 5 pounds is sufficient. Harding Grass should be planted at rates of 2-4 pounds per acre. Lana and Auburn Woollypod Vetch should be go on at 15-20 pounds per acre in most cases.

GRAZING MANAGEMENT FOLLOWING SEEDING

Contrary to logic, more new range seedings are lost through lack of grazing than from over-grazing. A proper grazing at the right time is a must. This period often occurs around March, when the native annuals are about to seed and before the seeded plants are very large or ready to seed. A short, but stiff, grazing is required then to eliminate the native plant competition and "open" the field for the spring growing clovers to develop and set seed with the remaining spring moisture. This will require a temporarily high stocking date. Animals should be removed while the clovers are in flower and setting seed - often in March, April and May. Once the seed has ripened, the field should once again be dry grazed to thresh out the seed and press it in the ground. One or two years of this kind of grazing management will help to thicken the stand to where no special grazing precautions may be necessary in later years.