

HOW TO  
IMPROVE  
NAPA COUNTY  
RANGELAND  
BY  
SEEDING

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A C K N O W L E D G E M E N T

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Irving Grover, Farm Advisor  
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## HOW TO IMPROVE NAPA COUNTY RANGELAND BY SEEDING

No rangeland or dryland pasture with a good stand of good quality grass and a fair to large amount of bur clover growing in it will benefit substantially from being seeded. If you have grazing resources of this kind, you can benefit most by a fertilizer program. See our publication "How To Improve Napa County Rangeland by Fertilization" for details.

### WHERE TO SEED

All parts of Napa County receive sufficient rainfall to make range and dryland seeding feasible provided soil and site conditions are favorable. Therefore an understanding of what soil and site conditions are needed is helpful in making your plans.

#### Situations Where Seeding May Be Profitable

1. Rolling hills with reasonably open grassland where cultivation is practical and where the present forage quality could be improved by introducing better grasses and/or clover.
2. Nearly level land that cannot be profitably used for crops, vineyard or orchard. Some factors which make this type of land a candidate for dryland pasture seeding include claypan subsoil, poor drainage, poor soil quality for crops.
3. Hay or grainlands that will not pay their way when these crops are grown on them.
4. Soil areas suitable for crops, orchard, or vineyard that are too isolated or small in size. For instance, some predominantly livestock ranches have relatively small areas of good soil otherwise suited to a higher use than pasture, but they may not furnish a large enough base for developing a crop or fruit enterprise. Yet if improved, as dryland pasture, these areas can be valuable assets to the ranch.
5. Land cleared of brush by bulldozer provided the soil is of moderate depth. If the brush, before being cleared, was growing vigorously and in a thick stand, the soil quality is probably good enough for seeding. For details, see "How To Improve Rangeland By Controlling Competing Brush and Trees in Napa County".
6. Land cleared of brush by fire. Again the condition of the brush before being burned is a good indication of soil quality. For details, see "How To Improve Rangeland By Controlling Competing Brush and Trees in Napa County".
7. Grassland from which the old grass has been thoroughly removed by a fire, provided soil quality is suitable.

### Situations Where Seeding Should Not Be Attempted

1. Land with slopes too steep to be easily cultivated. For exceptions see items, 5, 6, and 7 in the preceding section.
2. Areas with thin, droughty soil. Late spring is a good time to evaluate suitability from this standpoint. Any site where the native grasses dry up abnormally early in the spring should be avoided.
3. Seeding should never be attempted on serpentine soils or on valley soils built up by the outwash from serpentine hills.
4. Wooded or even fairly open wooded areas where tree spacing averages less than 250 feet.
5. Areas where a seedbed will not be prepared. See items 5, 6, and 7 in the preceding section for exceptions.

### General Factors

Other things being equal, north and east slopes are more favorable for seeding than are west and south exposures.

Land subject to fogs and moist, cool air will likely provide a situation more conducive to successful seeding than interior valleys where the humidity is usually lower.

Areas with rainfall averaging above 30 inches are more favorable to seeding success than where the average precipitation is less. Where the precipitation averages below 20 inches, more care must be taken in choosing areas to be seeded.

### WHAT DO YOU STAND TO GAIN FROM SEEDING?

Under the conditions listed on page 1, and assuming your seeding efforts are properly carried out to produce the desired results, you should be repaid with the following types of benefits:

1. If Hardinggrass is seeded, green grass will be available earlier in the fall and later in the spring than from annual grasses.
2. The introduction of suitable clover varieties, properly fertilized will provide two benefits. First, the clover in itself will improve the quality of the forage by improving protein content and increasing total digestible nutrients. Secondly, a vigorously growing clover stand will fix 100 to 150 pounds of actual nitrogen per acre. This in turn, stimulates grass growth and improves its quality as livestock feed. A dense stand of clover can do as much for you as \$15 spent per acre for a nitrogen fertilizer.

### Dollar Values

You are, of course, interested in what a range or dryland pasture seeding program will do for your ranch income. At the end of this publication sample costs and returns are presented for 3 assumed conditions.

In one column, sample figures for the assumed conditions are given. An adjacent blank column is provided so you can do a similar calculation for your own conditions if you feel they vary importantly from those in the "sample" column.

For your immediate information, one of these samples of costs and returns show the following:

	First Year Profit (per acre)	Annual Profit after 1st yr. (per acre)
Seeding and fertilizing where no seedbed preparation is needed.	\$0.48	\$6.48
Seeding and fertilizing where a seedbed must be prepared.	\$1.78	\$10.78

### PREPARING THE LAND FOR SEEDING

#### Fertilization

Most soils on which range and dryland pastures are to be planted are deficient in both nitrogen and phosphorous. However, at the time of planting, no nitrogen fertilizer should be applied. To do so will increase weed competition. If a good stand of clover is obtained, nitrogen fertilizers will not be needed in subsequent years. But phosphorous fertilization before seeding is a necessity in order to quickly establish a vigorous stand of clover. Use 500 pounds of single superphosphate per acre before seeding. If large-scale airplane applications are to be made, consult your farm advisor regarding the possibility of using treble superphosphate to reduce weight and flying costs.

#### Seedbed Preparation

If a range seeding is to succeed, seed must come into contact with mineral soil. The seed needs to be covered, but not too deeply. If a perennial grass is planted, weed competition must be reduced. Cultivation to accomplish weed control can be an integral part of the seedbed preparation and need not be an added expense.

If a perennial grass is to be included in the seed mixture, the land to be planted must be cultivated in the spring before the native plants bloom and set seed. Your seedbed preparations will usually consist of either plowing or disking the land, harrowing to break up the clods, followed by a cultipacking operation to form a firm seedbed. Ideally, there should be no clods larger than walnuts. The soil between the clods should be fine enough to prevent the seeds sifting down to a depth of more than  $\frac{1}{2}$  inch of soil in the covering operation.

### HOW TO PLANT THE SEED

Seed may be planted by broadcasting, by using a grain drill with or without a small seed attachment, with seeders made especially for pasture and range seeding, or by airplane. One of these pieces of equipment made especially for pasture seeding, is the Brillion seeder. It consists of tandem gangs of cultipackers. A seedbox on top feeds seed down between the two gangs of rollers. Thus, seeding and rolling is accomplished with one piece of equipment.

### Broadcast Seeding

If you use a broadcast method, you should sow the clover seeds in one operation and the grass seed in a second. This is because the clover seed is thrown out farther than the grass seed. Consequently, when sowing grass seed, the passes across the field must be closer together than when sowing clover seed. Cover the seed with a cultipacker to just barely press the seed into the soil. If you cannot possibly secure the use of a cultipacker or similar implement, seed may be covered by using a spike-tooth harrow with the teeth slanted back as far as possible. Do not use a harrow with rigid spikes. It will bury the seed too deeply.

### Grain Drills

Grain drills can be used to do a very good job of sowing grass and legume seed on a prepared seedbed. Unless the drill is provided with a small seed attachment, you will have to dilute the seed with rice hulls in order to spread the small volume of seed evenly over the area to be seeded.

Usually only 10 to 15 pounds of seed will be needed per acre and the seed is much smaller than the grain seed which the drill is designed to handle. Mix 20 pounds of rice hulls with whatever amount of seed you wish to sow per acre. Then set the drill to sow 160 pounds of barley per acre. This setting should result in evenly spreading the 20 pounds of rice hulls plus seed over one acre. Stir the seeds and rice hulls occasionally to keep them evenly mixed.

Grain drills vary in performance depending on their age and the make. So, until you are sure that the seed and rice hull mixture is flowing out at the correct rate, check frequently.

If you sow the seed through the drill's disc furrow openers the seed is likely to be covered too deeply. To avoid this, pull the down-spouts out of the furrow-opener boots. This will allow the seed to fall freely onto the soil surface.

To cover the seed, pull a cultipacker behind the drill. Or you can cultipack the seeded area in a separate operation.

The seed can be drilled into the furrows if the furrow openers are equipped with depth regulators. Depth regulators should be arranged so that furrows will be no more than three quarters of an inch deep.

### Other Methods

Specially-made seeders, such as the Brillion seeder, have already been mentioned. Usually they are made so they can be adjusted to correctly sow small seed without diluting it with rice hulls or other inert materials.

Airplane seeding is quick and easy. It is a good way to sow seed but not very practical unless there are 100 acres or more involved. On prepared seedbeds, the seed should be covered by a cultipacker. By combining acreages, two or more nearby ranches may be able to provide enough area to make airplane seeding of smaller acreages feasible.

SEED MIXTURES
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Where the seedbed has been prepared by cultivating in the spring, the seed mixture will normally consist of a perennial grass and two or three subclover varieties. A typical mixture, good for most situations, is as follows:

<u>Variety</u>	<u>Pounds Seed Per Acre</u>
Hardinggrass	4
*Mt. Barker subclover	4
Woogenellup subclover	4
Geraldton subclover	2

In order to boost winter and early spring clover forage production, a fourth clover, Yarloop subclover may be added as in the following mixture:

<u>Variety</u>	<u>Pounds Seed Per Acre</u>
Hardinggrass	4
*Mt. Barker subclover	3
Woogenellup subclover	3
Geraldton subclover	2
Yarloop subclover	2

#### Seeding Burned Grassland

Experience has shown that subclover can be introduced successfully into native grassland following a fire which quite thoroughly burns up the old grass. Hundreds of acres in Napa County were successfully seeded following the series of wild fires in 1966.

Three factors contribute to the success of this type of seeding:

1. The area must be well fertilized with phosphorous.
2. The seed must be pellet inoculated, and
3. Rain in sufficient quantity to sprout the seed should fall within 10 days or 2 weeks after the seed is sown. A good seed mixture for this type of seeding follows:

<u>Variety</u>	<u>Pounds Seed Per Acre</u>
*Mt. Barker subclover	3
Woogenellup subclover	3
Geraldton subclover	2
Yarloop subclover	2

- \* Where less than 20 inches of rain can usually be expected, omit Mt. Barker and increase Woogenellup by the same number of pounds per acre.

#### Seeding After Fall Cultivation

Many ranchers have native rangeland with good quality grass, but there is no clover growing with the grass. A light discing in the fall to provide a seedbed onto which clover can be seeded will produce a better quality and greater quantity of forage. Sow the same seed mixture as recommended for seeding burned grassland on this page.

Poorly Drained Areas

Many ranches have poorly drained areas that produce very little quality forage. If you have this type of land, and if it dries out enough to cultivate it in the summer or early fall, the following seed mixture is valuable for improving forage production.

<u>Variety</u>	<u>Pounds Seed Per Acre</u>
Hardinggrass	4
Salina strawberry clover	4
Yarloop subclover	5

Some ranches have areas in the valleys where the soil is of high quality, but for one reason or another, it is not feasible to grow crops on them. If the soil in this type of situation is neutral or only very slightly acid (pH 6.5 to 7.0), Clare subclover can be a very heavy producer of high quality forage. Provided the area has been cultivated in the spring, the following mixture is recommended:

<u>Variety</u>	<u>Pounds Seed Per Acre</u>
Hardinggrass	4
Clare subclover	5
Yarloop subclover	5

Annual Grass Substitutes For Perennial Grass

You may, in some cases, wish to substitute an annual grass for the perennial Hardinggrass in these mixtures. If you cannot fallow the land to be seeded in the spring to reduce native plant competition, and if you need a better type of annual grass than already exists on the area, you can substitute one of two annual grasses. The better of the two is the native soft chess. A selection of this grass, the seed of which is produced commercially, is Blando brome. Sow 10 pounds per acre. On north and east slopes, annual ryegrass can be substituted for Hardinggrass. Sow 5 pounds of ryegrass per acre.

Horse Pasture

If your dryland pasture or range seeding is primarily to provide horse pasture, you may wish to produce forage with a higher proportion of grass to clover. To accomplish this, reduce the amount of clover seed in the mixtures given by 50%.

CLOVER SEEDS MUST BE INOCULATED

Clovers (and all other legume forage plants) must have certain bacteria, called rhizobia (pronounced rye-zoe-be-uh), in contact with their roots if they are to grow vigorously and maintain themselves in a pasture area.

These rhizobia form nodules on the clover roots. The bacteria in the nodules have the ability to extract nitrogen from the air in the soil and change it into ammonia compounds. Clovers themselves and grasses growing with them can use the ammonia compounds directly or after they have been converted to nitrates.



Research has shown that a good stand of clover, with the right kind of bacteria-forming nodules on the roots, can fix 100 to 150 pounds of nitrogen per acre every year. In commercial fertilizers, the value of this much nitrogen at current prices is at least \$12 to \$18. This extra value that you can receive from seeding clover and maintaining a good stand after establishment, is one of the principal factors in making a reseeding program profitable.

Almost every species of legume needs a certain kind of rhyzobium. For instance the rhyzobium required by bur clover is quite different from that required by vetch. And the true clovers need other kinds of rhyzobia. Be sure to use the kind of inoculum recommended for each different legume you seed.

### Pellet Inoculation Is Essential

Pellet inoculation originated in Australia. The process was introduced to Napa County ranchers in the fall of 1964 and has been widely and successfully used since that time in this county.

The process consists of mixing the inoculant with gum arabic glue, adding this slurry to the seed in a mixing device and finally coating the seed with very finely ground calcium carbonate.

Any rancher can pellet inoculate his own seed on the ranch and this is recommended for reasons given below. There is at least one commercial custom processor of pellet inoculated seed. To our best knowledge, this processor is reputable and does an excellent job of pellet inoculation.

However, there are compelling reasons why it is often better to do the pellet inoculation on your own ranch. The plant where the pellet inoculation is done commercially is about one hundred miles from Napa. If shipped by commercial carrier, delivery may be delayed. If you go after the treated seed yourself, you are faced with spending several hours of driving time and the transportation cost.

It is hard to gauge weather conditions at the time of year the seed should be sowed. You may order the seed only to be faced by an unexpected and prolonged rainstorm. This means holding the seed. In the meantime the value of the inoculation is being lost. The seed should germinate within 3 weeks of the time it is pellet inoculated. If stormy weather persists too long, it may be advisable to delay sowing the seed until next year. You will then have the added expense of reinoculating the seed.

At the time this is written, the commercial charge for pellet inoculation is about 10¢ per pound. If you do the job yourself, it will cost you just about the same amount, especially if you have to pay someone to help you. Generally speaking, pellet inoculation on the ranch requires a minimum of 2 people. For large quantities, 3 or 4 people may be required to get the job done quickly and efficiently.

One of the major seed companies has, and still is, offering seed pre-inoculated by a vacuum process. The University of California at the Hopland Field Station has compared results obtained by sowing subclover seed inoculated by two different inoculation processes and seed not inoculated. The following shows the results:

<u>Inoculation Method</u>	<u>Per Cent Of A Full Stand of Healthy Subclover Plants Obtained</u>
Not inoculated	10%
Vacuum inoculation process	12%
Pellet inoculation process	96%

The University of California publication, "Seed Pelleting As An Aid To Legume Seed Inoculation" shows in pictures how clover plants benefit when grown from pellet inoculated seed. These pictures show both the increased vigor of the plant and the greater yield of forage.

The publication just mentioned also describes in detail how to pellet inoculate legume seed on the ranch. In the appendix to this publication, another set of instructions is given. These differ somewhat from the University publication. The instructions in the appendix are based on the experience of the author working with ranchers in Napa County. He has found the suggested changes make the job easier and more successful.

Nevertheless, the University publication contains much useful supplementary information.

#### WHEN TO PLANT

The maximum expected life of the rhizobia, even in pellet inoculated seed is about three weeks. Therefore, it is essential that the seed be planted at a time of year when enough rain to sprout the seed can be reasonably expected within a 10-day to 2-week period. (Usually, about one inch of rain will be needed to sprout the seed unless recent rains have wet the soil to a depth of about six inches or more.)

On the other hand, the seed must be planted early enough so the seedlings can establish a root system large enough to resist soil heaving before the first soil-freezing temperatures arrive.

To meet these conditions, planting during the first two or three weeks in November will usually give best results. No planting should be attempted after December 1. The pattern of rainfall in October and November in Napa during a recent eleven-year period is shown in the following chart:

RAINFALL DURING TEN-DAY INTERVALS AT NAPA, CALIFORNIA  
During October and November 1956 thru 1966

Rainfall Seasons	October			November		
	10	20	30	10	20	30
1956-57	none	none	1.86"	0.08"	none	none
1957-58	0.07"	3.01"	0.78"	none	0.82"	none
1958-59	none	0.04"	none	0.05"	none	none
1959-60	none	none	none	none	none	none
1960-61	0.30"	none	0.02"	0.32"	1.74"	1.59"
1961-62	none	none	0.10"	none	none	2.87"
1962-63	none	9.75"	0.03"	0.11"	0.09"	0.69"
1963-64	0.15"	2.28"	0.09"	3.09"	1.72"	1.09"
1964-65	0.15"	none	1.65"	1.10"	2.19"	none
1965-66	none	none	none	0.23"	2.45"	1.02"
1966-67	none	none	none	0.80"	5.62"	1.09"

MANAGEMENT AFTER PLANTING
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During The First Season

If the seed was planted on a prepared seedbed, grazing animals must be excluded from the seeded area when the soil is soft enough from rain that the animals' hooves will damage the young plants. Livestock can also cause damage if allowed to graze the young plants before they develop enough roots to keep them from being pulled up.

However, grazing can be a valuable method of controlling excessive weed competition. Before weeds become large enough to seriously compete with the seeded plants, the newly seeded area should be grazed. Enough animals should be turned in on the area to clean up the weed growth in a few days. Be sure to do this when the soil is firm enough to support the animals' hooves.

Weed control grazing should be repeated as often as necessary during the first spring after planting. A substitute method is to mow the weeds as often as necessary.

After The First Year

After the first year, grazing should be managed as much as possible to favor the planted species and discourage the undersirable plants. Early, close grazing tends to discourage early-seeding, undesirable grasses such as annual fescue and foxtail.

Soft chess (Blando brome) and Hardinggrass can be encouraged by easing the grazing load for awhile near the end of the rainy season to allow them to form seed. The seeded clovers (subclover) and bur clover are favored by more or less continuous, moderately-close grazing which prevents excessive height growth by grasses and weeds.

Hardinggrass, especially after the second season, should be kept grazed closely enough to prevent formation of tall, coarse clumps.

Conditions vary so much from year to year, you will have to use the above information to adjust your grazing practices to fit current conditions. In general, if you have too much clover, lighten the grazing load in the spring for awhile near the end of the season to favor the grasses. If grasses are crowding out the clovers, closer grazing throughout the spring months will probably help.

Whatever grazing management policy you follow, it will usually be necessary to re-apply phosphate fertilizer every three or four years in order to hold the clover in the seeded area. The same amount of  $P_2O_5$  should be re-applied as you used before planting.



## APPENDIX

Sample Costs and Returns From Improving Rangeland Or  
Dryland Pasture Where A Seedbed Can Be Prepared  
to Permit Seeding Hardinggrass & Clover

Assumed conditions: Cropland to be converted to dryland pasture or gently rolling rangeland with slopes generally 20% or less. Soil quality is assumed to be such that, if in native grass cover of good quality, 10 acres could be expected to carry a cow and calf. Assume the area to be seeded will be plowed and/or disced the spring before planting to reduce weed competition so that a good stand of Hardinggrass and subclover is obtained the first year and that the seeded species form a dense stand the second season after seeding. Assume that the carrying capacity will double the first season after seeding and will triple in the second season, remaining at about that level for at least 10 years. This is a reasonable expectation if 500 pounds of single superphosphate per acre, or its equivalent is applied every 4 years. Clover seed must be pellet inoculated before seeding.

Use the second column on the right of the following sample costs to figure possible costs and returns from seeding land on your ranch. Substitute carrying capacity, costs and other factors to fit your situation.

<u>Fertilizing, land preparation and seeding costs per acre:</u>	Sample	Your Ranch
Fertilize before discing:		
Equipment and labor	\$ 1.97	
Single superphosphate (0-20-0)	13.50	
Total fertilizing costs (at time of seeding & every 4 years)	\$15.47	
Yearly cost, total amortized over 4 yrs (\$15.47 4)	\$ 3.87	
Seedbed preparation, seed, and seeding:		
Labor and equipment	\$ 8.28	
Seed and legume seed inoculation	12.50	
Total seeding costs (expected lifetime 10 yrs.)	\$20.78	
Yearly cost, total amortized over 10 yrs (\$20.78 10)	\$ 2.08	
<u>Total yearly costs per acre:</u>		
Fertilizing	\$ 3.87	
Interest on $\frac{1}{2}$ of fertilizer cost ( $\$15.47 \div 2$ ) x .07 =	0.54	
Seeding	2.08	
Interest on $\frac{1}{2}$ of seeding cost $\$20.78 \div 2$ ) x .07 =	0.73	
Total yearly cost per acre	\$ 7.22	
<u>First season returns - carrying capacity increased to 2 cow and calf pairs per 10 acres:</u>		
720 lbs. beef produced 1st yr. after seeding and valued at 25¢ per pound	\$180.00	
360 lbs. beef, production from 10 acres before seeding and valued @ 25¢ per pound	90.00	
Value of extra meat produced on 10 acres	\$ 90.00	
Value of extra meat produced per acre ( $\$90 \div 10$ )	9.00	
Less annual cost of improvements	7.22	
Profit (first season only) per acre	\$ 1.78	

(Continued next page)

Annual returns after the first season - carrying capacity

<u>Increased 300 cows and calves pairs per 10 acres:</u>	<u>Sample</u>	<u>Your Ranch</u>
1080 lbs. beef produced starting the second year following seeding and valued @ 25¢ per pound	\$270.00	
360 lbs. beef (production from 10 acres before seeding and valued @ 25¢ per pound)	90.00	
Value of extra meat produced on 10 acres	\$180.00	
Value of extra meat produced per acre ( $\$180 \div 10$ )	18.00	
Less annual improvement	7.22	
Profit per acre each yr. after the first season	\$ 10.78	

**NOTE:** These returns are dependent on securing a satisfactory stand of the seeded clovers and Hardinggrass and maintaining that stand by proper management. This includes reapplication of phosphorous at least every 4 years at the recommended rate to maintain a high percentage of clover in the stand.

Sample Costs And Returns From Improving Rangeland Or  
Dryland Pasture Where Only Clover Will Be Seeded  
Following Seedbed Preparation In The Fall

Assumed conditions: Gently rolling rangeland with slopes up to 25% or 30% with inferior forage species and few or no palatable legumes, or croplands with a compacted surface which will be converted to dryland pasture. Areas to be seeded will be lightly disced in the fall to provide a seedbed. Soil quality is assumed to be such that if in native grass cover of good quality, 15 acres could be expected to carry a cow and calf. Assume that a good stand of sub-clover is obtained the first season after seeding and will triple in the second season, remaining at that level for at least 10 years. This is a reasonable expectation if 500 pounds of single superphosphate per acre or its equivalent, is applied every 4 years. Clover seed must be pellet inoculated before seeding.

Use the second column on the right of the following sample costs to figure possible costs and returns from seeding land on your ranch. Substitute carrying capacity, costs, and other factors to fit your situation.

	Sample	Your Ranch
Original carrying capacity, cow and calf pairs per 15 acres	1	
Carrying capacity, 1st season after improvement, cow and calf pairs per 15 acres	2	
Carrying capacity after 1st season cow and calf pairs per 15 acres	3	
Average calf crop, average weaned weight per calf, 425 Lbs	85%	
Pounds beef produced per cow in herd(85% of 425 lbs.)	360	
<u>Fertilizing, land preparation, and seeding costs per acre:</u>		
Fertilize before discing:		
Equipment and labor	\$ 1.97	
Single superphosphate (0-20-0)	13.50	
Total fertilizing costs(at time of seeding and every 4 years)	<u>\$15.47</u>	
Yearly cost amortized over 4 yrs ( $\$15.47 \div 4$ )	\$ 3.87	
Seedbed preparation, seed, and seeding:		
Labor and equipment, land preparation	\$ 4.01	
Seed and legume seed inoculation	7.50	
Labor and equipment, seeding	2.87	
Total seeding costs (expected lifetime, at least 10 yrs.)	<u>\$14.38</u>	
Yearly cost amortized over 10 yrs( $\$14.38 \div 10$ )	\$ 1.44	
<u>Total yearly costs per acre:</u>		
Fertilizing	\$ 3.87	
Interest on $\frac{1}{2}$ of total fertilizing cost @ 7% ( $\$15.47 \div 2$ ) x .07 =	.54	
Seeding	1.44	
Interest on $\frac{1}{2}$ of total seeding cost @ 7% ( $\$14.38 \div 2$ ) x .07 =	.55	
Total yearly cost	<u>\$ 6.40</u>	

	Sample	Your Ranch
<u>First season returns - carrying capacity increased to 2 cow and calf pairs per 15 acres:</u>		
720 lbs. beef produced from 20 acres 1st yr. after seeding & fertilizing, valued @ 25¢ per pound	\$180.00	
360 lbs. beef, production from 15 acres before improvement, valued @ 25¢ per pound	90.00	
Value of extra meat produced on 15 acres	\$ 90.00	
Value of extra meat produced per acre ( $\$90 \div 15$ )	6.00	
Less annual cost of improvements	6.40	
Loss (1st year only) per acre	\$ 0.40	
<u>Annual returns after the first season - carrying capacity increased to 3 cow &amp; calf pairs per 15 acres:</u>		
1080 lbs. beef produced from 15 acres starting the 2nd year following seeding & fertilizing, valued @ 25¢ per pound	\$270.00	
360 lbs. beef, production from 15 acres before improvement, valued @ 25¢ per pound	90.00	
Value of extra meat produced on 15 acres	\$180.00	
Value of extra meat produced per acre ( $\$180 \div 15$ )	\$ 12.00	
Less annual cost of improvements	6.40	
Profit per acre each year after the first season	\$ 5.60	

NOTE: These returns are dependent on securing a satisfactory stand of the seeded clovers and maintaining that stand by proper management. This includes reapplication of phosphorous at least every 4 years at the recommended rate to maintain a high percentage of clover in the stand.



Sample Costs And Returns From Improving Open Rangeland  
By Seeding Clover Following A Grass Fire

Assumed Conditions: A fire has burned all the old grass so that seed can come in contact with mineral soil. Soil quality is assumed to be such that, if in native grass cover of good quality, 15 acres could be expected to carry a cow and calf. Assume that a good stand of seeded clover is obtained the first year and that it forms a dense stand the second season after seeding. Assume that the carrying capacity about doubles the first season after seeding and triples in the second season. Thereafter, carrying capacity remains at about that level for at least ten years. This is a reasonable expectation if 500 pounds of single superphosphate per acre, or its equivalent is applied every 4 years. Clover seed must be pellet inoculated before seeding.

Use the second column on the right of the following sample costs to figure possible costs and returns from seeding land on your ranch. Substitute carrying capacity, costs, and other factors to fit your situation.

	Sample	Your Ranch
Original carrying capacity, cow and calf pairs per 15 acres	1	
Carrying capacity, 1st season after improvement, cow and calf pairs per 15 acres	2	
Carrying capacity after 1st season, cow and calf pairs per 15 acres	3	
Average calf crop, average weaned weight per calf 425 lbs.	85%	
Pounds beef produced per cow (85% of 425 lbs.)	360	
<u>Seeding costs per acre:</u>		
Seed and legume seed inoculation	\$ 7.50	
Airplane seeding (combined with fertilizer spreading)	0.20	
Total	\$7.70	
Yearly cost, total amortized over 10 yrs. ( $\$7.70 \div 10$ )	\$0.77	
<u>Fertilizer costs per acre:</u>		
Treble superphosphate (0-45-0)	\$13.00	
Airplane costs for spreading	2.72	
Total	\$15.72	
Yearly cost, total amortized over 4 yrs. ( $\$15.72 \div 4$ )	\$ 3.93	
<u>Total yearly costs per acre:</u>		
Seeding	\$ 0.77	
Interest on $\frac{1}{2}$ of the total seeding investment @ 7% ( $\$7.70 \div 2$ ) x .07 =	0.27	
Fertilizing	3.93	
Interest on $\frac{1}{2}$ of the \$15.72 total fertilizer investment @ 7% ( $\$15.72 \div 2$ ) x .07 =	0.55	
Yearly costs per acre	\$ 5.52	

(continued next page)

First season returns - carrying capacity increased  
to 2 cow and calf pairs per 15 acres:

720 lbs. beef produced 1st year after seeding and fertilizing, valued @ 25¢ per pound	\$180.00
360 lbs. beef; production from 15 acres before improve- ment, valued @ 25¢ per pound	90.00
Value of extra meat produced on 15 acres	\$ 90.00
Value of extra meat produced per acre ( $\$90 \div 15$ )	6.00
Less annual cost of improvements	5.52
Profit per acre, first season.	\$ 0.48

Annual returns after the first season - carrying capacity  
increased to 3 cow and calf pairs per 15 acres:

1080 lbs. beef produced starting the 2nd year following seeding & fertilizing, valued at 25¢ per pound	\$270.00
360 lbs. beef; production from 15 acres before improve- ment, valued @ 25¢ per pound	90.00
Value of extra meat produced on 15 acres	\$180.00
Value of extra meat produced per acre ( $\$180 \div 15$ )	12.00
Less annual cost of improvements	5.52
Profit per acre each year after the first season	\$ 6.48

NOTE: These returns are dependent on securing a satisfactory stand of the seeded clovers and maintaining that stand by proper management. This includes reapplication of phosphorous at least every 4 years at the recommended rate to maintain a high percentage of clover in the stand.

## HOW TO PELLET INOCULATE LEGUME SEED ON THE RANCH

### Equipment

The principal equipment needed is a concrete mixer. Small, electric mixers work well but no more than 20 to 25 pounds should be pelleted in one batch. Larger gasoline-engine-driven mixers will handle larger quantities in proportion to their size.

The so-called one-bag size will handle 50 pounds of seed per batch. If many hundred pounds of seed are to be pelleted, concrete mixers such as building contractors use will reduce the time required and make the work easier.

If a ton or more seed is to be treated, renting a medium-to-large size transit mix truck may be worthwhile. An 8-yard transit mix truck will treat up to 4000 pounds in one batch. No fewer than 5 men should be available to load in the seed and pelleting materials and resack the seed after treatment. A group of ranchers used this method a few years ago to treat about 10 tons of seed. Since transit-mix truck rental rates are fairly high, the pelleting operation must be carefully planned to make full use of the equipment all the time it is being rented.

### Materials

The pelleting materials consist of gum arabic and very finely ground calcium carbonate, 80% of which will pass through a 200-mesh screen. The gum arabic must contain no preservative. See page 1 of "Seed Pelleting As An Aid To Legume Seed Inoculation" for more information on these materials.

The inoculating material is generally sold in plastic envelopes. Use four times as much of this material as is recommended on the package. Be sure the inoculum is not outdated and that it is designed for the clover you wish to plant. If two or more clovers are to be in a mixture, inoculate each kind separately with the right kind of inoculum, then mix the pelleted seeds together. The concrete mixer can be used to mix together the different kinds of pelleted seed and grass seed if it is to be in the mixture.

### The Pelleting Process

Hot water is needed to dissolve the gum arabic. This material comes in powder form or in small flakes or granules. The author prefers the flake or granular form as being easier to dissolve without forming lumps. Be sure the gum arabic contains no preservative.

1. Prepare at the rate of 4 pounds of gum arabic in one gallon of hot water to form about 6 quarts of glue. Add the gum arabic slowly. Stir the mixture during this process and continue until none settles out when stirring stops. A large tub or 55 gallon oil drum is suitable for mixing large batches. This may take 15 to 20 minutes. Set the resulting glue aside to cool. This may be done the day before the seed is to be pelleted. The glue will spoil in 2 or 3 days if not used. If the weather is warm, spoilage will be hastened. Do not use spoiled glue; it may kill the inoculating rhizobia.

2. You will need about 2 2/3 quarts of the glue for each 100 pounds of seed to be pelleted. When the glue has cooled to air temperature, add the rhyzobia inoculum packaged specifically for the seed you are pelleting. Be sure to use 4 times as much rhyzobia as is recommended on the package. Stir it into the glue until thoroughly mixed. See the next section of this appendix for information on the type of rhyzobia needed for each kind of seed.

3. Place about 10% to 15% of the seed to be mixed in one batch in a bucket or other suitable container. Pour the entire amount of glue-rhyzobia mixture required for one batch onto the seed in the bucket and mix thoroughly.

4. Place the remainder of the seed for the batch in the mixer and start the mixer revolving. Pour the seed-glue-rhyzobia mixture on the seed in the mixer. Adding the pre-mix to the remaining dry seed helps reduce the amount of seed and glue which will stick to the sides of the mixer.

5. Have the right amount of lime (calcium carbonate) ready in a bucket. When all the seed and glue is thoroughly mixed (usually only 2 or 3 minutes), and while the mixer is still revolving, throw in all the lime at one time. In another 2 or 3 minutes, all the seeds will be individually coated and will be free-flowing. Use about 50 pounds of lime per 100 pounds of seed. The seed should come out of the mixer white and dry with very little free lime. If too dusty, reduce the amount of lime on the next batch. If the seed is not dry enough, leave it in the mixer and add more lime until the seed is well-coated and dry. If the pelleted seed is not well-coated and white with lime, and if free lime remains in the mixer, more glue should be used on the next batch. Caution: Too much glue will cause excessive lumping.

Do not use quick lime - it will kill the rhyzobia.

Do not use ordinary agricultural lime - it is not fine enough.

6. Sack the seed. You will need about twice as many sacks for the pelleted seed as the number of sacks the seed came in.

7. Be sure to pellet inoculate the seed no more than a day or two before it will be planted.

8. Read paragraphs 7, through 10, (pages 4 and 5) in "Seed Pelleting As An Aid To Legume Seed Inoculation".

INFORMATION ABOUT GRASSES AND LEGUMES FOR  
RANGE IMPROVEMENT IN NAPA COUNTY

GRASSES -

1. Annual ryegrass. Must reseed itself each year. Best adapted to north and east exposures. Not generally recommended for dryland pasture or range seeding because it does not usually stay in the stand more than 2 years.

2. Perennial ryegrass. Short-lived perennial (2 to 3 years). Best adapted to north and east exposures. Not recommended because it does not reseed itself successfully.

3. Blando Brome. A selection of soft chess, a naturally-occurring annual grass in California. A good seed producer and one of the best annual grasses for seeding rangeland. Recommended for all sites except very thin, droughty soils. Holds its seeds in the heads well into the summer. This makes it more valuable as dry summer feed than most annual grasses.

4. Palestine Orchardgrass. A long-lived perennial. A hardy grass that competes well with the native vegetation. Palestine orchardgrass seedlings are stronger competitors than Hardinggrass seedlings. Does not produce as much forage as Hardinggrass, but has less tendency to form coarse clumps.

5. Hardinggrass. A long-lived perennial. It has been an outstanding forage producer in Napa County in field trials and ranch plantings. A weak competitor with resident annuals in the seedling stage. Once established, Hardinggrass cannot be crowded out by other plants. Must be kept grazed down to prevent forming coarse clumps.

6. Not recommended for Napa County.

- a. Alta fescue, Kentucky 31 fescue, Goar's fescue
- b. Smilo
- c. Veldtgrass
- d. All orchardgrasses except Palestine
- e. All wheat grasses. An exception; tall wheatgrass should be worth trying on soils with a slight salinity problem.
- f. Timothy

#### LEGUMES OTHER THAN CLOVER

1. Lana vetch. Lana wooly pod vetch is an annual legume that must reseed itself each year. It is a late bloomer which rules it out for all droughty sites. The author has worked with several ranchers testing Lana vetch under ranch conditions. Invariably, it disappears from or becomes a very minor part of the stand within two years. Field-scale plantings have met a similar fate.

2. Bur clover. The leaves look like clover but this plant is closely related to alfalfa. This legume, one of our foremost range forage plants, was introduced into California on livestock brought here by Spanish colonists. It has probably already spread to all areas in California where it will do well. Therefore, it is useless to plant it. Bur clover will not grow on acid soils (an acidity rating below pH6.5 is generally unfavorable). Bur clover also has a high phosphorous requirement. Bur clover forage production can fluctuate widely from year to year depending on fall weather conditions. In general, early fall rains result in good bur clover years. In our comparative field tests, bur clover has been one of the earliest legumes to bloom and set seed. (Blooms about March 7).

3. Other annual medics such as barrel medic, black medic and button medic have not done well in Napa County field tests.

4. Creeping-rooted alfalfa varieties such as Rambler have been tested in Napa County field tests. Stand are difficult to establish and forage production from individual plants has been light. Plants are perennial. Not recommended.

5. Birdsfoot trefoil. These perennial legumes (both erect types and prostrate varieties) have been field tested in Napa County range tests. Establishment and survival have been unsatisfactory. Birdsfoot trefoil is principally a summer-growing plant and requires soil moisture at that time. Conditions on range and dryland pasture provide adequate soil moisture only during the winter and spring when birdsfoot trefoil is either dormant or growing very slowly.

#### TRUE CLOVERS

##### Subclovers (subterranean clovers)

It is believed subclover originated in the African and European countries bordering the Mediterranean Sea. However the selection and development of improved varieties took place in Australia. It is from this country that these valuable forage plants were introduced into California. Australia continues to be the principal source of subclover seed.

##### Mt. Barker subclover.

Blooms about April 7 or three weeks earlier than Tallarook. This has been the standard subclover variety for several years in Napa County seedings. In years when rainfall extends well into April, Mt. Barker may out-produce all other subclover varieties in Napa County. Inoculate seed with regular rhyzobia for subclover.

##### Woogenellup subclover. Blooms about April 1.

Produces as much or more forage as Mt. Barker. Especially in deficient rainfall years, Woogenellup is likely to out-produce Mt. Barker. Inoculate seed with rhyzobia specific to this variety.

Clare subclover. Blooms about March 25. Clare requires a nearly neutral soil similar to bur clover. A heavy forage producer like Woogenellup but seed is quite expensive. Inoculate seed with regular subclover rhyzobia. Seed is larger than seed of other black-seeded varieties.

Yarloop subclover. Tolerates saturated soil conditions better than any other subclover. It produces more early forage than other subclovers which makes it a valuable addition to clover mixtures. Inoculate seed with rhyzobia specific to this variety. Seed is white, unlike other subclovers. Blooms about March 25.

Geraldton subclover. Because of its early flowering, about March 10, this subclover should be included in subclover mixes to be used where there are areas of droughty, thin soils which dry early. Geraldton may be the only subclover to use when seeding areas of thin soil which have been cleared of brush by burning. Inoculate seed with regular subclover rhyzobia.

Other Subclover varieties you may hear about, but which we are not, at this time, recommending: Tallarook, a very late-blooming (about May 1) variety; Bacchus Marsh (blooms about March 25); and early maturing varieties such as Carmanah, Dwalganup, and Dinninup. These bloom very early in March.

Rose Clover Varieties are most useful on soils with low fertility where they will hang on in a stand longer than subclover. Rose clover, regardless of variety, is less palatable than subclover. Also because the flowers form near the top of the plant, a stand can be more easily damaged by close grazing, particularly during the bloom period. Inoculate seed of all varieties with regular rose clover rhyzobia.

Cyprus rose clover and Kondinin rose clover are early-blooming varieties (about April 1) which could be useful for seeding droughty and infertile soils. These could be used in a mixture containing one or more subclover varieties. Be sure to ask specifically for one of these varieties. If you order "rose clover", your dealer will probably supply you with the Wilton variety.

Other rose clover varieties you may hear about, but which we are not, at this time, recommending: Wilton, a late-blooming variety (about May 1); Sirint, Spain, and Hyton are earlier-blooming varieties (about March 27).

Crimson Clover Varieties, Dixie and Chief, have been tested with other clover varieties and appear to have little value in seed mixtures in Napa County. They disappear quickly from a stand. This is due to a combination of the late-blooming and the fact that livestock eat the blossoms readily, preventing reseeding. The main value of crimson clover is that it establishes itself quickly and therefore produces a large volume of forage the first season after it is planted. Also, because of its prominent, brilliant red blossoms, it acts as an indicator of the degree of success in your seeding efforts. On the other hand, the extra seed costs may detract from the financial benefits you hope to derive from the seeding.





RANCHERS HAVE HELPED DEVELOP THE INFORMATION  
IN THIS PUBLICATION

Without the cooperation of many ranchers in the county, it would have been impossible to gather all the information needed for a practical range improvement publication designed to fit Napa County conditions. I have drawn freely on the experiences of many ranchers who have done a successful job of range improvement seeding. Some have also cooperated with trial plantings and test plots. These tests have yielded much valuable specific information on varieties and fertilizer requirements here in Napa County.

For all this help, I am most grateful. Especially I wish to acknowledge the help given by the following:

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