



RANGE ROUNDUP

COUNTY BUILDING
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RANGE FERTILIZATION DOES MORE THAN BOOST GROWTH

Sharp livestock operators in Glenn and Colusa Counties use range fertilization as a management tool. The combination of favorable rainfall (16-20 inches annually), nutrient-deficient clay loam soils and responsive plants make this possible. In addition, an ASCS cost share program helps--especially on the smaller ranches.

Many years of field research, observations and experience have shown that there is more reason to fertilize range than simply to "grow more grass". It's true a major reason is to increase feed production, but there are other important benefits. These include:

1. improving soils
2. reducing production variability
3. deferring pastures
4. changing seasonal use
5. extending the grazing season
6. influencing plant species
7. raising nutrient content
8. increasing palatability
9. more equitably distributing livestock
10. improving digestability
11. saving supplemental feed
12. reducing labor
13. improving uniformity of intake.

The range plants in this area are mostly annual grasses, forbs and legumes. Filaree often dominates the shallower, gravelly "early" soils whereas annual grasses predominate on the deeper clay soils. During early rain and warm winter years, the resident annual legume, bur clover is favored. Starting in the 1950's, other legumes such as rose and subterranean clover have

been seeded on dry range in order to increase productivity and the number of grazing days. These better plant species will dramatically respond to fertilizer.

The range soils in Glenn and Colusa Counties are deficient in nitrogen and sulfur and some are low in phosphorus. Most soils are acidic (pH 5 to 6) with a few neutral to basic (pH 7 to 9). As little as ten pounds of nitrogen per acre will give a visible growth and color response, but we found that around 60 pounds per acre nitrogen will result in the greatest return for the fertilizer dollar. This amount will generally double feed production during the year of application.

Ammonium sulfate usually is competitively priced with other dry nitrogen sources and since it contains 24% sulfur it is the obvious choice. With adequate nitrogen on our soils, added sulfur stimulates better yields but the main payoff to sulfur fertilization is the dramatic increase in growth of bur, sub and rose clover. During bur clover years, I have seen swales in fertilized fields with solid stands of bur clover. (Sometimes it is too much of a good thing, however, killing cattle and sheep from bloat or enterotoxemia.)

Phosphorus is the third most limiting nutrient in Glenn-Colusa soils. Phosphorus, like sulfur, is important in establishing and maintaining clover stands. The very acid soils (low pH) are particularly low in available phosphorus.

The effect of pH, sulfur and phosphorus on sub clover production has been clearly demonstrated on Corning-Newville gravelly loam soils north and west of Orland. Phosphorus alone does little good. Sulfur alone may even depress yields, possibly by reducing the pH. On these soils, lime applications will raise the pH and increase feed production--particularly the yield of clover. Phosphorus and sulfur applied together also increase yield but all three--lime, phosphorus and sulfur - are additive and result in the greatest clover growth. Soil may be accurately tested for pH and phosphorus and less accurately for nitrogen and sulfur.

Fertilize a portion of the range each year.

Livestock operators seldom have the resources to fertilize and double the stocking rate of the entire ranch even when it is profitable to do so. A more reasonable approach is to fertilize about 20% of the grazing land each year on a rotational basis. There is nutrient carry over in the soil and also a residual effect of fertilizing on the plants that lasts two years or more. We figure on clover ranges there is a 30% increase in production for two of the three years following application of 300 lbs. per acre ammonium sulfate. The effects of elemental sulfur will last eight years or more. The ASCS cost share program is set up for a five year practice life, which is another reason to fertilize one-fifth each year. Currently the ASCS will pay 50% of the cost up to \$3,500 per farm, and this incentive should not be overlooked. In other situations, you may want to get consistently higher yields in the "shipping pasture" or favor specific plants in certain fields by fertilizing every year.

Range managers also use the differential effect of fertilizers on grass and clover to extend the growing season. For example, nitrogen applied in the fall will stimulate grass to grow faster after the opening rains. That is a critical time of year for forage production in this area because snow is pushing cattlemen out of Klamath and Sierra pastures, and the dry feed on our annual ranges is very low in quality, particularly protein. The cost of fertilized grass competes favorably with the expensive supplementing especially when labor and management problems are considered. It is difficult at best and sometimes impossible to supplement cattle or sheep on rangeland due to rough terrain, mud, etc. Areas around the supplemental feed troughs or grounds often are badly trampled. Furthermore, research has shown that the protein equivalent from the non-protein nitrogen in supplements is poorly utilized by livestock on low energy roughage.

Other studies have shown a tremendous variation in daily consumption of supplements among animals and over time. Often the young stock that need the supplemental feed the most get pushed away by the larger, more aggressive animals. Fertilized range avoids some of these problems.

Increased Palatability

If stock water is available, fertilized range will pull cattle into country inaccessible by vehicle because, in addition to more rapid growth, fertilizing increases the palatability of feed. This effect is not restricted to grass and clover. We see more browsing on brush that happens to be a fertilized field. In fact, one way to reduce an unpalatable species such as medusa head or rip gut is to ferti-

lize and stock heavily. I recall one rancher who fertilized a scattered oak-grass pasture with ammonium sulfate and then was unable to graze the field until the following summer. When the cattle were turned into the field of rank dry wild oats and rip gut, they slicked it off right up to the tree trunks and stayed in good flesh all summer. The following year the field was "solid" bur clover, a result of close grazing and residual sulfur from the ammonium sulfate.

This was a case where, instead of early feed, fertilization extended the feed into the summer. If the field mentioned above had been open and rolling, as many are, the rancher could have swathed the fertilized grass for hay or grazed the windrows.

Midwinter is a flat spot in feed production. The plants are there, soil moisture is adequate, but it is too cold for growth. Clover growth is particularly depressed. Stockers may show a net gain of 200 pounds over the entire grazing season, but what actually happens is zero gain or a loss in January followed by a compensatory gain in April. Compensatory gain almost but not quite makes up for the loss. Applied fertilizer--nitrogen, sulfur, and phosphorus--allows the grass and clover to grow more in midwinter. The grass responds more to nitrogen and sulfur and the clover to phosphorus and sulfur.

A combination of grazing management and fertilization can change the species mix of a pasture. While it is generally true that nitrogen favors grass and phosphorus favors clover, this effect can be reversed depending upon the fertilizer nutrient combination, frequency of application, timing and intensity of grazing, and, of course, the weather. The example cited above in which cattle grazed dry pasture that

had been previously fertilized is one example. Another in which I was involved was clover seeding on public land bordering a reservoir. We had a demonstration where the seeding rate, the phosphorus and sulfur application and an ideal year produced a solid stand of sub clover. This small field was not grazed. The following year the grass and filaree were dark green and lush, obviously benefiting from the legume-fixed nitrogen. Again, the field was not grazed and has not been since. Today, it's difficult to find a single sub clover plant in this area. The point is that grazing or lack of it can change the result of fertilization.

Increased Digestibility

Australian range scientists have come up with some interesting data that helps explain some of the less obvious benefits from fertilization. They found that in addition to stimulating greater growth, phosphorus, sulfur and calcium each increased the digestibility of the feed. In their experiments they compared feed intake and gain of sheep grazing grass or clover fertilized with various rates of phosphorus, sulfur, and calcium (the components of single super). They also fed these minerals as a supplement to see if the results were due to a deficiency of the mineral in the diet. They reported: "thus apart from increasing pasture growth, the three main elements in super phosphate had further reaching effects for livestock. When sheep were just supplemented with these minerals both phosphorus and sulphur promoted their appetites and sulphur also improved the proportion they digested, but calcium did nothing. However, when these elements were applied to the pasture in fertilizer, the sheep ate more and found their feed easier to digest."

Interestingly, a local sheepman has observed his sheep not only selectively grazing fields that have been fertilized with sulfur. But, also, the wool and lamb growth was better than he expected from the increase in pasture. However, we could not separate the effect of the increased clover stand vs. increased digestibility as the Australians did.

We usually recommend fertilizing the potentially more productive pastures. However, test plot results show a greater percentage increase due to fertilizing the poorer sites. For example, a soil that produces 800 lbs. of dry matter (DM) unfertilized may produce 2,000 when fertilized where a 3,000 lb DM site may increase to 6,000 lbs. when fertilized. The poorer soil production was increased by 150% ($1200 \div 800 \times 100\%$) and the better soil production by 100% ($3000 \div 3000 \times 100\%$). This has the effect of making different portions of a pasture and different pastures of the ranch more uniform in productivity--an advantage in grazing management. In dry years

applied fertilizer carries over but in years of high early water run off there are nutrient losses.

Costs of Fertilizing

Livestock operators I know carefully pencil out management alternatives such as range fertilization that increase production per unit, reduce seasonal and annual variability, save labor and add flexibility to the range livestock enterprise. Of course, costs are an important consideration.

An example of the economics of fertilizing range is shown in Table 1 and Figure 1.

With these prices fertilizing range that produces more than 40 lbs. gain per acre is profitable. The advantage of fertilizer increases as production or rent increases. The tendency to obtain a greater percentage increase in forage production on poorer soils and the \$3,500 per farm ASCS incentive are not figured in the table.

Table 1. Gross Return Above Range Rent and Fertilizer Costs

- Assumptions:
- (1) Live weight gain value \$.60 per pound.
 - (2) Fertilizer cost \$30 per acre applied.
 - (3) Fertilizer doubles the amount of feed the first year and the carryover increased second year feed by 30%.
 - (4) 20% of the range is fertilized each year.

Figures are rounded to nearest pound or dollar.

Figure 1.

Figure 1. <u>Not Fertilized</u>						<u>20% Fertilized; \$30 5 = \$6/Ac</u>						
lbs. gain per acre	Gain Value @ 60¢/lb	Return Above Range Rent \$5	\$10	\$15	\$20	lbs. gain per acre	Gain Value @ 60¢/lb	Return Above Range and Fertilizer Cost \$11	\$16	\$21	\$26	
20	\$ 12	7	2	-3	-8	25	\$ 15	4	-1	-6	-11	
40	24	19	14	9	4	50	30	19	14	9	4	
80	48	43	38	33	28	101	61	50	45	40	35	
140	84	79	74	69	64	176	106	95	90	85	80	
200	120	115	110	105	100	252	151	140	135	130	125	

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