# Range Grazing Capacity Raised

## program of seeding annual clovers, fertilization and grazing management resulted in improved forage quality and quantity

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**A threefold increase** in grazing capacity was achieved in a five-year range improvement program involving the seeding of adapted clovers, phosphorus fertilization, and grazing management on over 500 acres. Grazing records and quadrat harvests demonstrate the marked success of the improvement methods.

The grazing capacity of the range increased because of the improvement in the bulk and in the quality of the feed.

The seeded legumes, rose, crimson, and subclovers, were able to make better use of nutrients supplied in phosphate fertilizers than were the resident plant species. As a result of the improved level of fertility, the clovers produced a feed high in protein and also increased the phosphorus content of the feed.

The improvement program was started in the fall of 1950 as part of a commercial cattle operation near Lincoln in Placer County.

The ranch is in the 20″ annual rainfall zone, and over 80% of the rain occurs during the months of November through March. The soil is gently undulating terrace land, classified as Placentia gravelly loam. It is an acid soil developed from granitic alluvium and contains a dense clay pan at the depth of 18″ to 24″. The land had previously been used as an annual forage range with part of it farmed annually to oats and vetch for hay.

**Response of seeded annual clovers to the application of phosphate fertilizer—*dark strips*. Photo was taken March 30, 1953, in Field No. 3 after 40 days without rain.**

One field of 50 acres—Field No. *1*—was seeded in October 1950, prior to the fall rains, with a mixture of rose clover, crimson clover, and Mt. Barker and Tallarook subclovers. The first operation was the application of 200 pounds per acre of single superphosphate. A seedbed was prepared by disking, and inoculated seed was broadcast by plane. The final operation was ringrolling to cover the seed and firm the seedbed. Field No. *2* and Field No. *3* were seeded by the same procedure in the fall of 1951. In 1952 an additional 130 acres in Field No. *4* were seeded with a home-grown mixture of rose clover and crimson clover to which Mt. Barker and Tallarook subclovers were added.

In 1952, Field No. *5*—on an adjacent ranch—was seeded by air to a mixture of the same species without seedbed preparation.

On March 20, 1951, 50 Hereford cows with their calves were turned into Field No. *1*. The clovers were getting ahead of the cattle, so an additional 100 head with their calves were turned in on April 1. When the animals were removed on

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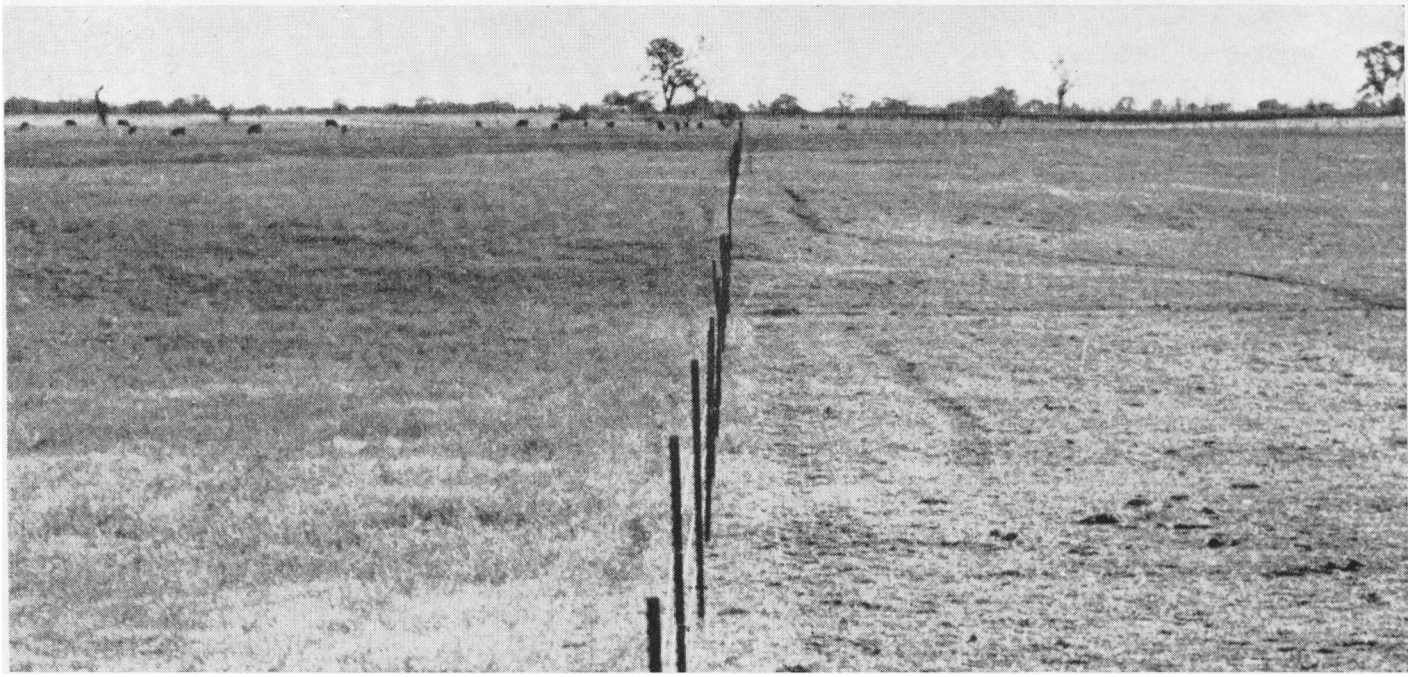
**Cattle in the east half—*left*—of Field No. 3, after grazing the west half—*right*—since September 4, 1953. Photo was taken December 1, 1953. The difference in cover indicates the ready utilization of the dry clovers by beef cattle, as the whole field was seeded and fertilized with 200 pounds of single superphosphate per acre in fall, 1951.**



## RANGE

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April 30, there was enough feed left to produce a seed crop of about 20 pounds per acre of rose and crimson clovers harvested by combine. The subclovers set seed too low for a combine. In addition, from June 10 to July 1, 100 head in an adjacent irrigated pasture had free access to the 50 acres of dry clover and native grass.

The cost of the seed, fertilizer, and seeding operations in 1951 was about $20 per acre—an investment that was more than returned the first season.

In 1952, 50 cows and their calves were carried in Field No. *1* from March 9 to May 20, and 100 cows with their calves from May 20 to June 10. In 1953, 60 cows with their calves were turned in on February 15. Fifteen cows were removed March 10, the remainder staying on until May 22 when they were turned onto irrigated pasture but allowed access to Field No. *1* until June 15.

The carrying capacity calculated without allowance for the grazing which was supplementary to the irrigated pasture was 3.30 animal unit months per acre in 1951, 3.47 in 1952, and 3.10 in 1953. This may be compared to the grazing capacity of 1.00 animal unit months per acre in 1950, the year prior to improvement, when 25 cows were carried two months in this field.

With the improvement program well under way, feed was plentiful enough so that Fields No. *2* and No. *3* were not grazed to capacity in 1952 and 1953. During the spring of 1953, Field No. *2* was subjected to a short period of heavy grazing by 60 cows from March 10 to April 17.

Grazing was deferred on Field No. *3* for fall dry feed and to permit a seed crop to be taken in both 1952 and 1953. Grazing use in 1952 was 105 cows from September 4 to December 8 or 1.58 animal unit months per acre after 13,000 pounds of crimson and rose clover seed had been produced. The dry feed was supplemented with one pound of cottonseed cake per head per day during the last week of grazing since the feed had been rained on by then. Early in 1953, the field was cross fenced and 105 acres produced a harvested seed crop followed by fall grazing by 85 cows from September 4 to December 1, or 2.27 animal unit months per acre. The other half was grazed lightly in the spring of 1953, seed was harvested in June, and the 85 cows were turned in on December 1 to utilize the stubble.

## Phosphate Fertilizer

Between May 22 and 27, 1953, about one hundred one-square-foot areas were harvested by hand to determine the effect of the phosphate fertilizer on forage production, botanical composition, and feeding value of the seeded range. The clovers were mature when harvested, with about half the heads shattering when gently hand threshed. The fertilizer had a very striking effect on dry matter production. The clovers in Fields Nos. *2* and *3* were volunteer stands resulting from natural reseeding from the 1951–52 crop. The single column table on this page shows the effect of fertilizer on recovery of Field No. *2* after it was grazed by 60 cows from March 10 to April 17, a grazing use of 1.12 animal unit months. There was less than a half ton of dry forage aftermath on the unfertilized check strips compared with more than 1.6 tons on the fertilized areas.

Fields Nos. *4* and *5* were seeded in the fall of 1952, and grazing on both was deferred for dry feed in 1953. The forage production on Field No. *4*, when fertilized, was over six times that of the check strips. The production in Field No. *5*, although showing a highly significant response to fertilization, did not increase as much as Field No. *4* because of the lack of seedbed preparation and the resulting poorer initial legume stand, as indicated by the botanical separation data in the large table on page 14. Nevertheless, the results were gratifying

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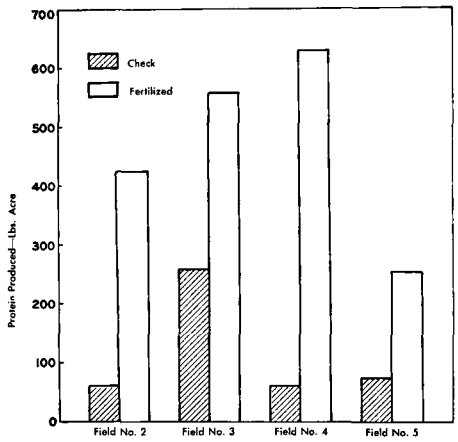


**The effect of phosphorus fertilization on the production of protein by range seeded with annual clovers—harvested May 22–27, 1953. Fields Nos. 2 and 3 received 200 pounds of single superphosphate in the fall, 1951; Field No. 4, 150 pounds of treble superphosphate; and Field No. 5, 150 pounds of single superphosphate per acre in the fall, 1952.**

**Effect of Phosphorus Fertilization on Forage Production on Range Seeded with Annual Clovers**

| Field and Treatment | Dry Forage: Harvested May 22–27 1953 | Dry Forage: Harvested May 17–20 1954 |
|---|---|---|
| | lbs/acre | |
| **Seeded and Fertilized Fall 1951** | | |
| **Field No. 2** | | |
| Check | 880 | 990 |
| 200 lbs/A superphosphate | 3,280** | 4,490** |
| **Field No. 3** | | |
| Check | 2,370 | 1,970 |
| 200 lbs/A superphosphate | 4,360** | 3,420** |
| **Seeded and Fertilized Fall 1952** | | |
| **Field No. 4** | | |
| Check | 660 | 860 |
| 150 lbs/A treble superphosphate | 4,190** | 2,850** |
| **Field No. 5** | | |
| Check | 850 | 1,740 |
| 150 lbs/A superphosphate* | 2,180** | 4,390** |

* Additional 300 pounds of superphosphate per acre applied in fall 1953.
** Difference significant at 1% level.

**Seed Mixtures and Fertilization of Range Improvement Program in Placer County**

| Field | Acreage | Seed Mixture: Rose clover | Seed Mixture: Crimson clover | Seed Mixture: Mt. Barker subclover | Seed Mixture: Tallarook subclover | Rate of superphosphate applied | Date of seeding and fertilizer applications |
|---|---|---|---|---|---|---|---|
| | | lbs/acre | | | | lbs/acre | |
| 1 | 50 | 3 | 3 | 1½ | 1½ | 200 | Oct. 1950 |
| 2 | 68 | 3 | 3 | 1½ | 1½ | 200 | Oct. 1951 |
| 3 | 210 | 3 | 3 | 1½ | 1½ | 200 | Oct. 1951 |
| 4 | 130 | 2 | 4 | 2 | 2 | 150* | Oct. 1952 |
| 5 | 30 | 3 | 3 | 2 | 2 | 150 | Oct. 1952 |
| 5 | | | | | | 300 | Oct. 1953** |

* Treble superphosphate. ** Fertilizer application only.

**Effect of Phosphorus Fertilization on the Composition (Dry Basis) of Forage on Range Seeded with Annual Clovers. Average of All Fields**

| Forage | Treatment | Protein | Fiber | Fat | Ash | Nitrogen free extract | Phosphorus | Calcium |
|---|---|---|---|---|---|---|---|---|
| | | % | % | % | % | % | % | % |
| Clovers | Check | 12.1 | 30.6 | 1.7 | 5.5 | 49.6 | .098 | 1.37 |
| | Fert. | 14.3 | 30.8 | 1.7 | 4.9 | 48.5 | .144 | 1.37 |
| Resident Annuals | Check | 6.6 | 30.0 | 1.9 | 6.9 | 54.6 | .103 | 1.56 |
| | Fert. | 8.2 | 29.2 | 1.8 | 7.1 | 53.7 | .120 | 1.58 |
| Total Feed | Check | 9.0 | 30.6 | 1.8 | 6.2 | 52.5 | .099 | 1.46 |
| | Fert. | 13.1 | 30.6 | 1.6 | 5.3 | 49.4 | .136 | 1.40 |

## ZINC-DEFICIENT

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pounds per acre, and the chelates at 25 pounds per acre. As indicated in the above table, spray applications were more effective than soil applications, which is probably due to the fixing capacity of this particular soil for zinc. The data in the table also show that no yield increases were obtained by the use of manganese sprays or soil applications.

Similar tests on tomatoes in nearby spots did not materially correct the deficiency troubles—either because the tomatoes did not readily absorb the zinc through the leaves or because some other deficiency existed.

Tests on field corn using spray application indicated much the same response as was found in greenhouse tests. The yields per acre were 121 bushels for zinc sulfate sprays, 12.6 bushels for manganese sulfate sprays, 108 bushels for zinc and manganese sulfate together, and 16.3 bushels for the check. It is apparent that manganese treatments failed to increase yields as they did in the greenhouse.

These tests indicate that foliar sprays may be more efficient than soil applications—in some crops—in correcting certain micro-nutrient deficiencies. The soil can therefore be eliminated as an interfering factor in the absorption of these nutrients. Four pounds of zinc sulfate per acre applied as a foliar spray produced greater yields of sugar beets than did fifty pounds side-dressed. Inasmuch as zinc sulfate is rather expensive, this means that sizable savings in material can be realized. Zinc chelate—because it complexes the zinc inside a large organic molecule which breaks down slowly in the soil, releasing the zinc—was superior to zinc sulfate for soil application. When used in a spray, however, zinc chelate did not appear to correct the deficiency as well as zinc sulfate.

The many factors affecting the absorption of zinc by various crops are being studied.

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*The above progress report is based on Research Project No. 1591.*

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because the establishment of adequate stands without disturbing the sod eliminates the hazard of erosion, and stock are able to graze the fields during wet weather with less deterioration of the stand and soil structure than when a seedbed is prepared.

At the time the 1953 sample areas were hand harvested, the forage was separated as rose clover, crimson clover, subclover, and resident annuals. The latter group consisted mainly of broad leaf filaree—*Erodium botrys* Bertol.—wild oats—*Avena fatua* L.—and soft chess—*Bromus mollis* L. In the four fields sampled, the fertilizer increased the proportion of seeded legumes in the forage at the expense of the resident annuals.

Under conditions of low fertility, rose clover was the dominant legume in all four fields. In Fields Nos. *2, 3,* and *5,* the percentage of rose clover was further increased by fertilization at the expense of the resident annuals. Fertilization increased the proportion of crimson clover in all fields except Field No. *3* where the proportion remained unchanged, but still increased in absolute production since total forage increased. In Field No. *4,* crimson clover became dominant with fertilization because this seed mixture contained twice as much crimson clover as rose clover. Crimson clover did not make a very strong initial showing in Field No. *5* where no seedbed was prepared.

Subclover was present in minor amounts, irrespective of fertilization, in Fields Nos. *3, 4,* and *5.* The difference in growth habit between the prostrate subclover and the upright rose and crimson clovers placed the subclover at a disadvantage under the management program in those fields involving deferred grazing and seed harvesting. In Field No. *2*—subjected to moderate spring grazing—subclover made more of a showing where fertilized.

An additional series of samples was harvested on May 17–20, 1954, from sites comparable to the 1953 series. Yields of forage were again markedly increased by the phosphorus fertilizer even though no reapplication was made during this season except on Field No. *5,* which received 300 pounds per acre of single superphosphate in 1953 in addition to the initial 150 pounds applied in 1952. Forage production was much improved in Field No. *5* over that of the previous year. Although seeded in sod, Field No. *5* was fully as productive in the second year as Field No. *4,* seeded at the same time but on a prepared seedbed.

Yields on the fertilized strips on Fields Nos. *3* and *4* were less than in 1953, since both were grazed early in 1954 and the harvested samples were a measure of recovery. Grazing on Fields Nos. *2* and *5* was deferred for dry feed in 1954.

The botanical composition data for 1954 are not quite as accurate as those for 1953 since the samples dried somewhat before the separations could be completed, and some shattering resulted. However, several trends are evident. Crimson clover was reduced in Fields Nos. *2* and *3* and remained substantially unchanged on the fertilized areas of Fields Nos. *4* and *5.* This seems to be related to the age of the stand. Rose

**Effect of Phosphorus Fertilization on the Botanical Composition of Forage on Range Seeded with Annual Clovers**

| Field and treatment | Botanical Composition | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Harvested May 22–27 1953 | | | | Harvested May 17–20 1954 | | | |
| | Rose clover | Crimson clover | Subclover | Resident annuals | Rose clover | Crimson clover | Subclover | Resident annuals |
| | % | | | | % | | | |
| **Seeded and Fertilized, Fall 1951** | | | | | | | | |
| **Field No. 2** | | | | | | | | |
| Check | 16 | 3 | 5 | 76 | 35 | 0 | 1 | 64 |
| 200 lbs/A superphosphate | 44 | 20 | 10 | 26 | 62 | 0 | 13 | 25 |
| **Field No. 3** | | | | | | | | |
| Check | 61 | 22 | 2 | 15 | 44 | 4 | 0 | 52 |
| 200 lbs/A superphosphate | 68 | 22 | 1 | 9 | 57 | 12 | 0 | 31 |
| **Seeded and Fertilized, Fall 1952** | | | | | | | | |
| **Field No. 4** | | | | | | | | |
| Check | 28 | 16 | 5 | 51 | 31 | 8 | 12 | 49 |
| 150 lbs/A treble superphosphate | 26 | 59 | 4 | 11 | 8 | 58 | 6 | 28 |
| **Field No. 5** | | | | | | | | |
| Check | 22 | 4 | 2 | 72 | 69 | 2 | 1 | 28 |
| 150 lbs/A superphosphate* | 36 | 9 | 2 | 53 | 71 | 12 | 0 | 17 |

* Additional 300 lbs/A of superphosphate applied in fall, 1953.