

Range Improvement Experiments on the Arthur E. Brown Ranch, California

R. MERTON LOVE

Professor of Agronomy, University of California, Davis

IN THE passing of Arthur E. Brown, July 16, 1951, the range improvement project of the Division of Agronomy lost a wonderful cooperator and true friend.

In 1944 Art asked what grasses could be seeded on 45 acres of non-irrigated hardpan land he had recently purchased near Wilton, Sacramento County. Native purple stipa (*Stipa pulchra*) would grow, but forage production was extremely low.

The land had been farmed to cereals for 40 years. It was producing from one-half to one ton of cereal hay every other year with a negligible amount of volunteer pasture in alternate years. In summer the fields were green, but this was due to vinegar weed (*Trichostema lanceolatum*) and tarweed (*Hemizonia* spp.), both unpalatable and odoriferous.

We agreed to work together to discover what could be done to improve the forage. Our results would apply to many thousands of acres of red land on the east side of the Sacramento Valley, where the annual rainfall approximates 16 to 20 inches.

METHOD AND PROCEDURE

In 1944 we seeded 11 acres to a "duke's mixture" which reads like a seed catalogue: one pound each of annual ryegrass (*Lolium multiflorum*), perennial ryegrass (*L. perenne*), orchardgrass (*Dactylis glomerata*), Hardinggrass (*Phalaris tuberosa*), tall fescue (*Festuca arundinacea*), burnet (*Sanguisorba minor*), burclover (*Medicago hispida*), yellow sweetclover (*Melilotus officinalis*), birdsfoot trefoil (*Lotus corniculatus*), and California common alfalfa

(*Medicago sativa*). Plots for single varieties were reserved in the middle of the field. These included 40 strains of nodding stipa (*Stipa cernua*), 30 strains of purple stipa, and 22 other grasses and legumes.

The results were not very encouraging. But Art, Bill Coupé (his ranch superintendent) and I decided to have a Field Day in early June, 1945. "We should take the ranchers along with us," said Art. "They have a right to see the failures as well as the successes" (Fig. 1). Thirty persons attended that first range field day.

In 1945 we seeded another five acres to seven varieties. Our plots included a total of 35 varieties of grasses and legumes. About 70 persons attended the field day in May, 1946. At that time three species appeared likely to be successful: rose clover (*Trifolium hirtum*), Hardinggrass, and alfalfa. The stipas did well, but we now had other more productive plants.

For the 1947 field day we had an additional five-acre planting. More Hardinggrass and alfalfa were showing up in Field I, and rose clover was spreading from its one-hundredth acre plot to other parts of the field. In Field III, rose clover was the only success.

Field II was the "eye-opener." In the upper part of the field there had been an old corral bed where the seeding rate of one pound per acre each of Hardinggrass and alfalfa produced not only a good stand but also healthy, productive plants. As soil fertility decreased down the hill, so did the stand and vigor of the plants.

Thus, a new concept entered our thinking. It had been taken for granted that

moisture was the limiting factor in California range production. Here obviously, fertility—or lack of it—was more limiting

than the rainfall, for the same amount of rain fell on the good and poor soil alike. Dr. John P. Conrad, of the Agronomy Division, put out the first fertilizer



FIGURE 1. Arthur E. Brown and B. A. Madson, Agronomy Division, Davis, California at the Field Day, May 1949. Photo Courtesy Sacramento Bee.

trials in 1945. For several years the results were discouraging for everything except manure. By 1948 it was realized that little success was likely in seeding Harding and alfalfa on worn-out land. The newcomer, rose clover, would grow where burclover or subclover (*Trifolium subterraneum*) would not. It prepared the way for desirable grasses. Even ryegrass, which had done poorly in initial plantings, was volunteering in areas where rose clover had been growing for several years.

So in 1949 Field II was replanted, this time with a mixture of rose clover, subclover, and crimson clover (*Trifolium incarnatum*) at the total rate of 10 pounds per acre. Treble superphosphate was applied at 200 pounds per acre. It was disked dry, seeded, and cultipacked before the fall rains began (Fig. 2). A new field, V, was similarly treated.

At the 1950 field day, Dr. Conrad reported that there were worthwhile responses from fertilizers applied 1.5 and 2.5 years before and up to 1949 little used by range plants. Rose clover especially was responding apparently to the residual phosphates applied more than two years before. Two examples of Dr. Conrad's results as of April 11, 1951, serve to point up the possibilities of increasing forage yield through fertilization of annual legumes.

Treatments	Pounds dry matter per acre
1. Check plot.....	900
218 lb. TSP applied 1948.....	4250
2. Check plot.....	1738
218 lb. TSP applied 1948.....	5625

RESULTS AND DISCUSSION

Work at the Brown ranch and elsewhere, (Jones and Love, 1945; Love and Jones, Revised 1952) has shown that the

herbaceous range plants of California can be grouped into three main types: undesirable annuals, desirable annuals

Perennials

Examples are Hardinggrass and alfalfa. In general this group is characterized by

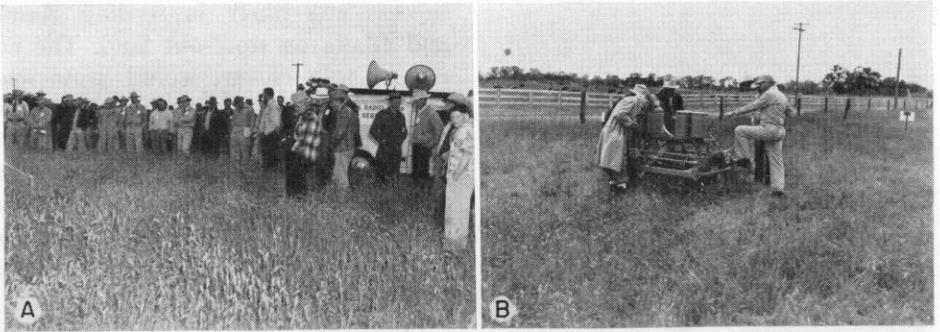


FIGURE 2. SEVENTH FIELD DAY, MAY, 1951

A. Visitors inspect Field II containing ideal range mixture of soft chess, annual legumes and scattered Hardinggrass. B. Two-row range seeder developed by the Agronomy and Agricultural Engineering Divisions. Photos by J. E. Street.

and short-lived perennials, and long-lived perennials.

Undesirable Annuals

Examples of winter growers are fescues (*Festuca myuros*, etc.) and ripgut (*Bromus rigidus*). They have strong seedling vigor, mature early, are heavy seed producers, and are obnoxious when ripe because of rough awns on the panicles that fail to shatter readily. Many are good feed when green, but their season of use is short.

Examples of summer growers are vinegar weed and tarweed. These are unpalatable.

Desirable Annuals and Short-lived Perennials

Examples are soft chess (*Bromus molis*), burelover, rose clover and mountain brome (*Bromus marginatus*), respectively. Seedling vigor is not quite so strong and they are not quite as competitive as the undesirable annuals. They mature later than the first group and provide good feed even when mature. They have no obnoxious seed characteristics.

poor seedling vigor and low competitive value the first year. They remain green later than the annuals in the spring, and provide range-readiness earlier in the fall. They are particularly susceptible to continuous summer grazing if practised year after year.

The season of use by livestock has a profound effect upon the quality of forage under a Mediterranean-type climate. Livestock use should be based on a knowledge of the types of plants present on a range. Removal of animals before the last spring rains will allow the desirable annuals and perennials to recover and set seed. If this is done at least once in three years there will be a gradual reduction of undesirable annuals, even including the summer annuals which depend upon residual moisture for their growth. When this moisture is used by the desirable annuals and perennials there is none to support the summer weeds. Deferring grazing has the opposite effect and results in a decrease of desirable annuals. Data for this have been presented elsewhere (Love, 1944).

The improved fields at the Brown ranch now carry three times the livestock possible in the unimproved fields. This verifies the yield results obtained by Dr. Conrad.

CONCLUSIONS

Six fundamental points have emerged from the work at the ranch and verified in other parts of the State:

1. Soil fertility must be improved before good stands and high production of annuals or perennials can be expected.

2. Soil fertility can be improved by a combination of winter annual legumes and phosphate fertilizer (or soil amendments that encourage legume growth).

3. Even 18 inches of rainfall is sufficient for profitable dryland pastures of alfalfa, Hardinggrass, rose clover, and soft chess once soil fertility is sufficient to support their growth.

4. Protection is not the answer to California's annual-type range problem. Protection only increases the undesirable annuals.

5. Seasonal use, involving if necessary a heavy stocking rate before the weedy annuals mature, with removal of stock to irrigated pastures or the mountains before the last spring rains, will increase the desirable annuals and perennials (both grasses and legumes).

6. Rose clover is an ideal plant for infertile lands and should be included in most range seeding mixtures in California. It should be retested in other areas where the climate is such that burclovers and crimson clovers would survive.

Truly, the Arthur Brown Hereford Ranch has been an outlying experiment station for the range improvement project. Besides the cooperation throughout the years, Art's generosity as host at the field days has been outstanding. The attendance has grown from 30 in 1945 to about 300 in 1951. Visitors have come from all over the state and from Nevada. Perhaps even more important is the fact that many ranchers in the upper Sacramento Valley and even in other parts of the state (notably Santa Clara County) are now applying these new techniques to improving their own ranches.

The Arthur Brown Hereford Ranch has achieved international recognition because of distinguished visitors from many foreign countries, including Britain, Canada, France, Italy, Greece, Israel, South Africa, Morocco, Argentina, Brazil, Uruguay, Chile, Mexico, New Zealand, Australia, India, China, and Japan. All who have seen the experiments and enjoyed meeting Art will join with us in mourning his passing, but in a prayer of thankfulness that it was our privilege to have known him.

LITERATURE CITED

- JONES, B. J. AND R. M. LOVE. 1945. Improving California Ranges. Calif. Agr. Ext. Serv. Cir. 129, 48 pp.
- LOVE, R. M. 1944. Preliminary trials on the effect of management on the establishment of perennial grasses and legumes at Davis, California. Jour. Amer. Soc. Agron. 36: 699-703.
- LOVE, R. M. AND B. J. JONES. 1952. Revised by Love, Sumner and Osterli. Improving California Brush Ranges. Calif. Agr. Expt. Sta. Cir. 371, 38 pp.