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Range Grass and Reseeding Experiments in California

complexity of range improvement problem requires long-term research program involving allied fields of study

R. Merton Love[1]

More than 2,900 accessions of forage plants—including grasses, legumes, and forbs—have been tested at Davis and at Berkeley in a long-term research program. In 1950, 90 species and varieties were planted which have never before been tried in California. These include 40 strains of subterranean clover.

From among the many plants tested few have been chosen. Smilo—*Oryzopsis miliacea*—appears to be ideally adapted to seeding in the ash of brush burns, whereas on the best of prepared seedbeds it is extremely difficult to be certain of obtaining a stand. Introduced in 1879 it received spasmodic attention from time to time, but not until it was tried in the ash of brush burns was its place in revegetating this type of land recognized.

Other introductions that have demonstrated their usefulness on the California range include: Hardinggrass, alfalfa, birdsfoot trefoil, subterranean clover, crimson clover, rose clover; several species of bromegrasses, orchardgrass, tall fescue, tall oatgrass, perennial veldtgrass, the ryegrasses; and burnet. New species and new strains are being obtained continually from all parts of the world. A recent shipment included a rust resistant annual ryegrass from Uruguay and a non-shattering strain of Australian veldtgrass.

Introduced some time ago from Africa by way of Australia a perennial veldtgrass has given a god account of itself on the coastal sand areas, particularly in Orange County. An attempt is being made to select a more cold-resistant type. Later, it is hoped to combine this with the recently arrived non-shattering type.

Native Plants

The seed of numerous plants native to California have been collected ant tested at Davis and Berkeley—for the coastal species—and in Humboldt County—for the northern type species.

Wild populations of plants contain many types. Mix up the seeds of thousands of barley varieties, and this would give an idea of the multitude of types that can be selected out of a wild species.

Nodding and purple stipas are two species among the hardiest of the native perennial bunchgrasses.

In 1940, 5,000 spaced plants of nodding stipa and 2,500 plants of purple stipa were planted. From these initial plant populations were selected 12 strains each, after six years of selection for superior types. The best were bulked in 1947 to serve as foundation seed.

California oatgrass is another outstanding native bunchgrass which is found along the coastal ranges from Monterey County north to Vancouver Island, and in the Sierra Nevada at higher elevations. A small planting is doing very well on a ranch in Sacramento County, far below its normal range. The objective is to obtain strains with better germination characteristics. Such superiority can only be proven by several years of testing under range conditions. So these years must be added to those it takes to make the selections.

[1] *R. Merton Love is Associate Professor of Agronomy, University of California College of Agriculture, Davis*

Hybridization

A number of hybrids have been made artificially—and also found in nature—between several species of stipa.

The first generation hybrids, though completely sterile are extremely vigorous and usually remain green among longer than the parents. It may be possible to interplant strains of two species on the range and, since natural hybridization occurs fairly frequently, there will be produced a population of vigorous hybrids interspersed among the parents

Another natural hybrid holds much promise. This is a cross between Reed canarygrass—*Phalaris arundinacea*—and Hardinggrass—*P. tuberosa*. The parents are quite dissimilar. The first is a sodfarmer, a summer grower—in a northerly climate—and it goes completely dormant in the winter. The second is a bunchgrass, a winter grower—in most of California—and goes dormant in the summer when moisture is too limited for growth. This natural hybrid, found in the grass nursery at Davis in 1940, is partially fertile. There are possibilities of obtaining both dry range and irrigated pasture types in later generations out of this material.

Cells, Structural Forms

Studies in cytology—dealing with the individual plant cell, and its intrinsic characters and functions—and studies in morphology—treating with the form and structure of the plants—have supplied information on chromosome number and behavior which has been invaluable in some of the work on forage plants. Chromosomes are structures within the cells in which the genes—the factors which control heritable characters—are located and are normally paired in a constant number.

When making the early collections of purple stipa one particular type was noticeable. This was especially slender-stemmed, with fire leaves, and a nodding panicle. The cytological studies demonstrated that the plant had a chromosome number that differed from that found in all the other variations—which were true Stipa pulchra. Typical purple stipa has 64 chromosomes—32 pairs—and the slender type now called nodding stipa—Stipa cernua—has 70 chromosomes-35 pairs.

Different strains of a species can be used in a strain-building program through hybridization but these fundamental studies saved time and money by indicating that the two species of stipa could no be so used.

Plant Growth Studies

Physiological studies—dealing with the growth habits of normal, healthy plants—are under way to determine more about the role the different species may be expected to play in forage production.

These studies have shown that Clorox is a material aid to rapid germination and emergence of smilo and much has been learned about what constitutes dormancy in pine bluegrass, Poa scabrella.

The species differences of seed germination in the presence of high temperatures are also being studied.

The main objective of the physiological studies is to provide methods of testing new selections for dormancy, drought tolerance, and so on. This should eventually save years of testing under natural conditions.

Field Experiments

Field trials have varied all the way from detailed studies at Davis, to less detailed studies in Humboldt, Mendocino, Napa, Colusa, Sacramento, and Orange counties.

Methods of range improvement vary—depending on the type of cover already present—but *range improvement is nothing more nor less than the process of replacing a relatively undesirable population of plants with more desirable forage*—an ever-continuing process.

Although there are thousands of species of range plants, forage falls into three rather distinct groups: 1, perennials; 2, short-lived perennials and the better type annuals; and 3, the weedy, often obnoxious annuals. From the range improvement standpoint this classification is extremely important because it reduces the multitudinous plants to three workable groups.

Season-of-use is an important factor to be considered with the three groups of range plants.

The perennials turn green in the fall, often before the first rains, and they remain green longer into the spring than do the annuals.

The better annuals such as soft chess—*Bromus mollis*—wildoats—*Avena barbata* and *A. fatua*—and bur clover—*Medicago hispida*—are excellent feed when green, and provide fair quality hay that can be used for fall feeding. They usually mature a little ahead of the perennials.

The weedy annuals such as the foxtail barleys—*Hordeum murinum* and *H. gussoneanum*—ripgut bromegrass—*Bromus rigidus*—and most of the annual fescues—for example *Festuca megalura*—must be grazed early in order to obtain any feed value from them. They mature very early and should not be grazed when mature because of the obnoxious character of the mature seeds with their barbed awns.

Adaptation Trials

Since 1937 some 200 species and varieties of plants have been seeded in more than 1,400 plots in the 51 counties served by the Farm Advisors. In many counties these were followed by acreage seedings.

As a result of this work, together with outlying experimental plots, it has been possible to zone the state according to the adaptations of the various grasses and legumes.

Range Fertilization

The level of soil fertility is an important factor that can no longer be ignored.

If no production can be obtained from a species, it is of no practical value to know the zone in the state where a species is well adapted, to know how to establish it, or even to know how to maintain it on the range.

Co-workers have conducted intensive fertilizer tests on cereals, particularly the phosphate-bur clover-cereal cycle.

At the same time, tests with superphosphate and ammonium phosphate applied to range lands—both natural and artificially seeded—are being made.

These fertilizer tests suggest new possibilities of increased forage production, and indicate that in spite of the high cost of fertilizers, a proper fertilizer program should pay dividends on many of the range areas. The use of annual legumes is an ideal way to initiate a range improvement program.

Another important part fertilization can play is its help in the establishment and growth of competitive plants—such as subclover—in controlling non-palatable weedy grasses—such as hairy oatgrass *Danthonia pilosa*. Work in Humboldt County is demonstrating this.

Mechanical Developments

The Division of Agricultural Engineering and the Division of Agronomy have designed to establish plantings of desired grasses and legumes on the sod so that the necessity of complete field cultivation is eliminated.

A beater type of harvester has been developed which does a satisfactory job of harvesting seed of stipas and may be adapted for veldtgrass.

Sound work in all the ramifications of a range improvement program is essential, but no less important is the willingness to discard prejudices and preconceived ideas.

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