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Managing Our Ground Water Resources

COLORADO FARM AND HOME RESEARCH
Vol. No. 5 March-April 1961

by

Morton W. Bittinger
Colorado State University

ENGINEERING RESEARCH
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COLORADO FARM AND HOME Research

Vol. 11, No. 5 March-April 1961

Presenting . . . .

JOHN HOLTORF

CSU Stockman of 1961

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Also in this Issue . . . . .

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WITH THE EDITORS

Just Visiting

There's much discussion today about agriculture and farming becoming big business, and this interesting statement and quotation was found in "The Division of Labor in Society," a book by a French sociologist, Emile Durkheim:

> " . . . . Modern industry advances steadily towards powerful machines, . . . great concentrations of forces and capital, and consequently to the extreme division of labor. Adam Smith and John Stuart Mill still hoped that agriculture, at least, would be an exception to the rule and they saw it as the last resort of small scale industry."
>
> "It is hard to deny today that the principal branches of the agricultural industry are steadily being drawn into the general movement."

The quotation in the last paragraph was taken from a French journal of economics (Journal des Economistes) dated November, 1884!

★ ★ ★

Who . . . and What

G. E. Klipple, Fort Collins, range conservationist and superintendent of the USDA's Central Plains Experimental Range . . . retired from the Agricultural Research Service. He has spent more than 30 years in research on range and pasture problems.

★ ★ ★

Chester Fithian, Fort Morgan, Morgan county extension agent . . . cited for outstanding work in the promotion and use of pure seed by Colorado Crop Improvement Assn.

★ ★ ★

Raymond C. Stack, former county agent in Montana . . . named wheat marketing specialist for CSU Extension Service at Fort Collins.

★ ★ ★

Albert Jeffers, Platteville . . . selected as Master Seedsman of 1960 by Colorado Seed Growers Assn.

★ ★ ★

James Coutts, Fort Collins . . . re-elected president of the Colorado Association of Soil Conservation Districts.

★ ★ ★

Dr. John A. Quist, Austin, assistant entomologist with CSU's Western Slope Branch Experiment Station . . . served as discussion leader and presented a technical paper at Western Co-operative Spray Project meeting at Portland, Ore.

★ ★ ★

Lloyd E. Churches, Golden turkey breeder . . . . showed grand champion bird at National Dressed Turkey Show in Chicago.

(Continued on Page 14)

Valuable, locally adapted hybrids may be developed from . . .

Colorado's Open-Pollinated Corn Varieties

*Dr. David W. Crumpacker**

An open-pollinated variety of corn (or, more simply, a "variety"), is one that has developed without any attempt to control pollination. That is, each season the pollen is allowed to be distributed throughout the field by natural agents such as wind and insects. This contrasts sharply with commercial hybrid corn which is produced by methods that utilize strict pollen control.

Some open-pollinated corn is still grown in the United States. This is especially true in Colorado, where 18.5 percent of the total corn acreage in 1959 was estimated to be non-hybrid as compared with 5.2 percent for the entire United States.

A field of open-pollinated corn is usually quite variable in appearance. If such a variety has been grown in one region for a number of years, it often possesses valuable adaptive traits for that environment. For example, it may have become adjusted to local moisture and temperature conditions. On the other hand, a field of commercial hybrid corn will appear relatively uniform. Hybrid corn is not necessarily adapted to any particular region. Its adaptability can be determined only by growing it in the region and observing its behavior.

In autumn of 1960 an attempt was made to collect a number of the open-pollinated varieties still available in Colorado. These are listed in the table and each has been assigned a collection number. In some cases, the varietal name gives an indication of the original source of the variety. A number of the varieties have no name. In some cases the number of years of culture is unknown.

The desirability of keeping a permanent collection of open-pollinated varieties becomes apparent when one considers the makeup of hybrid corn. Each hybrid consists of a combination of inbred lines, the most common number being four. A pair of inbreds are crossed to produce a "single cross." A pair of single crosses can be mated to produce a "double cross," which is the commercial hybrid grown by the farmer. All inbred lines have been developed, either directly or indirectly, through inbreeding in locally adapted open-pollinated varieties. So it is seen that all corn hybrids are composed of inbred lines which, in turn, were derived from open-pollinated varieties.

The inbred lines isolated thus far in the United States represent only a small part of the total variability which remains in these old varieties. It is obviously in the best interests of the nation to collect and preserve these sources of genetic variation before they disappear.

The basic need of a plant breeder is heritable variation among the plants with which he works. With adequate variation his chances of picking out different genetic types that are specifically suited to

(Continued on Page 5)

Dr. Crumpacker and H. H. Simpson of Fort Collins discuss the merits of a strain of Colorado 13 grown on the Western Slope. Simpson, former Boulder county agent, was primarily responsible for the introduction into Colorado of the original stock of Minnesota 13 from which Colorado 13 evolved.

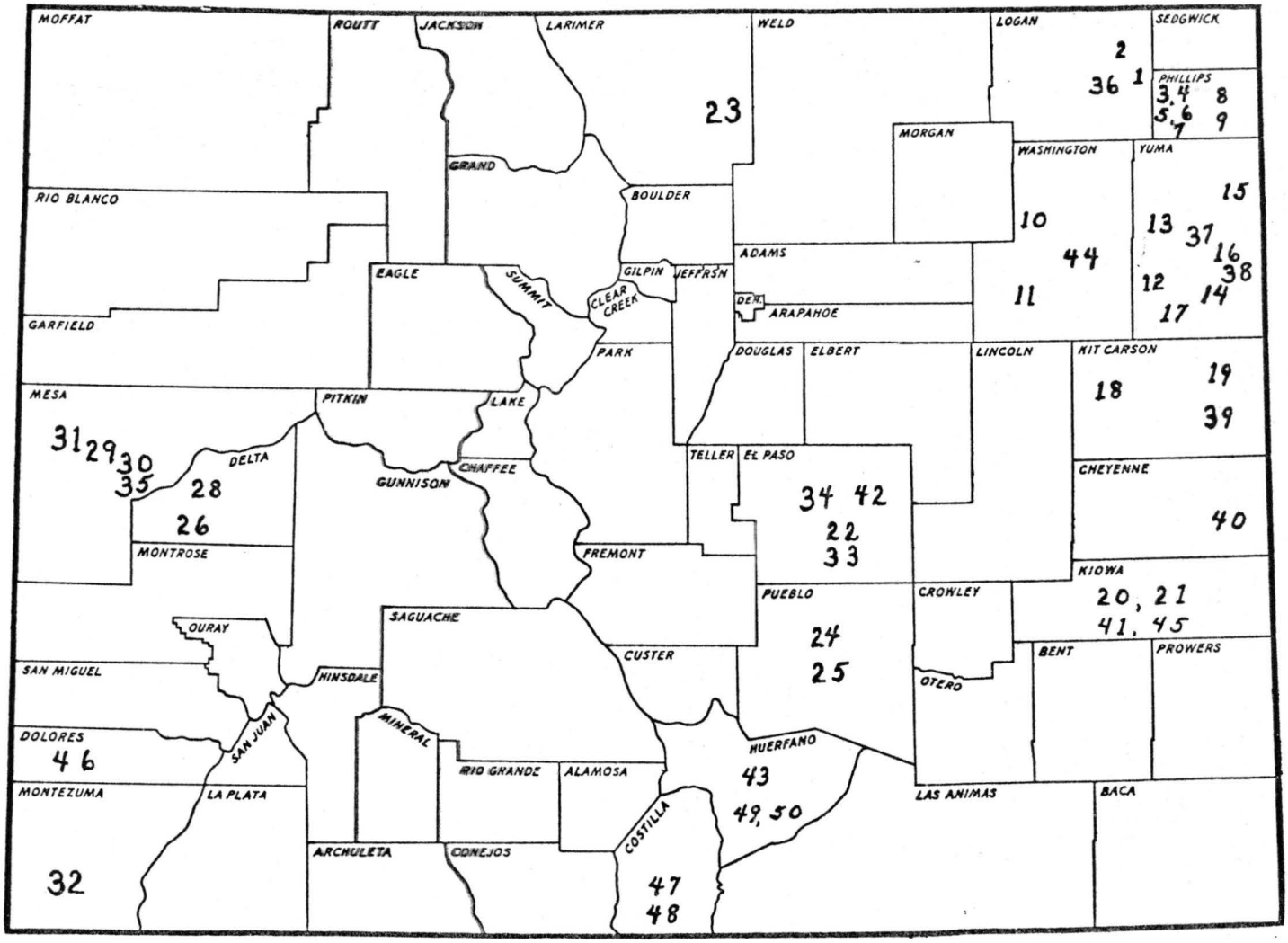
* *Assistant Agronomist, Colorado State University Experiment Station*

Open-Pollinated Corn Varieties Collected in Colorado During 1960-61

Collection Number	Varietal Name	Kernel Description	Contributor	Place of Culture	Years of Culture	County Agent Assisting[1]/
1		Yellow Dent	Wilbur Kipp	N.W. Haxtun, Logan Co.	13	John T. Haddan
2		Yellow Dent	W. W. Singleton	N.W. Dailey, Logan Co.	10	John T. Haddan
3		Yellow Dent	Eldred Atkins	N. Haxtun, Phillips Co.	14	John T. Haddan
4		Yellow Dent	Rex Meakins	N. Haxtun, Phillips Co.	37	John T. Haddan
5	Binbuster Colo. Yellow Dent	Yellow Dent	Joe Moon	N.W. Haxtun, Phillips Co.	36	John T. Haddan
6		Yellow Dent	Harold Pond	N. Haxtun, Phillips Co.	20	John T. Haddan
7		Yellow Dent	Hillard Yost	N.W. Haxtun, Phillips Co.	15	John T. Haddan
8	LeBlanc's 90-Day Corn	Yellow Dent	R. M. LeBlanc	N.W. Holyoke, Phillips Co.	10	John T. Haddan
9		Yellow Dent	Earl Schaeffer	S.W. Holyoke, Phillips Co.	9	John T. Haddan
10		Yellow Dent	Warren Harper	S.E. Brush, Washington Co.	20-30	Edwin H. Amend
11		Yellow Dent	Roy Vaughn	S. Akron, Washington Co.		Edwin H. Amend
12	Wacter's True Gold	Yellow Dent	Paul Renzelman	N.W. Yuma, Yuma Co.	1	
13		Yellow Dent	Gerald Smith	N.E. Yuma, Yuma Co.	10-15	Edwin H. Amend
14	Wacter's True Gold	Yellow Dent	John Clark	W. Wray, Yuma Co.	25	James A. Spiers
15		Yellow Dent	Elmer Oestman	N. Wray, Yuma Co.	10	James A. Spiers
16		Yellow Dent	John Smith	N.W. Wray, Yuma Co.	2	James A. Spiers
17		Yellow Dent	Roland Houston	S. Eckley, Yuma Co.	15	James A. Spiers
18	Minnesota 13	Yellow Dent	Art Brandenburg	N.E. Flagler, Kit Carson Co.	27	Donald K. Chadwick
19		Yellow Dent	Joe Paintin	N.E. Burlington, Kit Carson Co.	4	Donald K. Chadwick
20	Kattle Corn (12-row)	Yellow Dent	John Jacobs	N.W. Eads, Kiowa Co.	20*	Bruce G. Whitmore
21	Kattle Corn (14-row)	Yellow Dent	John Jacobs	N.W. Eads, Kiowa Co.	20*	Bruce G. Whitmore
22		Yellow Dent	Albert Henderson	E. Drennan, El Paso Co.	39	Forest T. McWilliams
23	Colorado 13	Yellow Dent	John G. Nesbitt	S.E. Fort Collins, Larimer Co.	12-15	
24	Colorado 13	Yellow Dent	John A. Williams	E. Pueblo, Pueblo Co.	35	
25	Reid Yellow Dent	Yellow Dent	John A. Williams	E. Pueblo, Pueblo Co.	82	
26	Colorado 13	Yellow Dent	J. H. Winters	Calif. Mesa, Delta Co.	42	Carl H. Powell
27	Golden Glow	Yellow Dent	Ralph Ferris	Western Slope		
28	Cedaredge Special	Yellow Dent	Fred McDowell	Fruita, Mesa Co.; Eckert, Delta Co.	35	Richard O. Woodfin
29	Iowa Goldmine	Yellow Dent	Floyd Mudge	N.E. Grand Junction, Mesa Co.	15*	
30	Iowa Yellow Dent	Yellow Dent	Fred Selan	N.E. Grand Junction, Mesa Co.	38	Richard O. Woodfin
31	Minnesota 13	Yellow Dent	Tony Serve	W. Fruita, Mesa Co.	3	
32	Hall's Corn	Yellow Dent	Walter Hall	W. Cortez, Montezuma Co.	30	Fred A. Fitzsimmons
33	Calico	Red-Yellow Dent	Albert Henderson	E. Drennan, El Paso Co.	12	Forest T. McWilliams
34	Calico	Red-Yellow Dent	Waite Whitney	S.E. Calhan, El Paso Co.		Forest T. McWilliams
35	Bloody Butcher	Red Dent	Wilbur Raber	Purdy Mesa, Mesa Co.		
36	Logan Co., White Dent	White Dent	Henry Lambert	S. Dailey, Logan Co.; Iliff, Logan Co.	36	John T. Haddan
37	Iowa Silvermine	White Dent	C. L. Brown	N.W. Wray, Yuma Co.	25	James A. Spiers
38		White Dent	Fred Oestman	N. Wray, Yuma Co.	15	James A. Spiers
39		White Dent	Bill Kroeger	N. Burlington, Kit Carson Co.	30	Donald K. Chadwick
40		White Dent	Carl Pedersen	Arapahoe area, Chyenne Co.	20*	Bert L. Ransom
41		White Dent	Robert Sallee, Wayne Singer	N.W. Eads, Kiowa Co.	30*	Bruce G. Whitmore
42	Iowa Silvermine	White Dent	Waite Whitney	Calhan area, El Paso Co.	50	Forest T. McWilliams
43		White Dent	Felix Arrellano	W. Walsenburg, Huerfano Co.	4	Angelo A. Blase
44		Varicolored Flint-Dent	E. W. Elliott	N.E. Platner, Washington Co.		Edwin H. Amend
45	Australian White Flint	White Flint	Robert Sallee, Wayne Singer	N.W. Eads, Kiowa Co.	54	Bruce G. Whitmore
46	Indian Corn	Varicolored Flint		Dolores Co.	1	Loren W. Alexander
47		Purple Flour	Cleofes Antencio	Chama, Costilla Co.		Abram J. Relyea
48		Purple Flour	Salvador Lopez	San Pablo, Costilla Co.	39	Abram J. Relyea
49	Indian Corn	Purple Flour	Felix Arrellano	W. Walsenburg, Huerfano Co.	43	Angelo A. Blase
50		White Flour	Felix Arrellano	W. Walsenburg, Huerfano Co.	90	Angelo A. Blase

[1]/ *These agents helped directly in making collections. Several other agents also either suggested names to contact or made unsuccessful searches in their counties.*

* *These varieties have been grown for at least the number of years indicated and may have been grown even longer.*



The map above shows the approximate locations of the different collections of open-pollinated varieties of corn in Colorado. Each collection number can be referred to the table on the opposite page for name and description.

certain conditions are greatly increased. Some idea of the range of variation within the collection can be obtained by noting the range among the varieties for certain characteristics. Average values for the different varieties were found to range from 0.19 to 0.39 grams in case of individual kernel weight, from 6 to 10 inches for ear length, from 10 to 22 for row number on the ear, and from 80 to 165 days for relative maturity (based on the number of days from planting to the well-dented stage).

The great reservoir of variability in the Colorado collection reflects the original sources of corn in the state (e. g., from many parts of the Corn Belt and from areas south of Colorado into Old Mexico), the diversity of climates and soils under which the varieties have been grown, and the different kinds of artificial selection practiced by local farmers. Corn is grown at elevations of 3,500 feet in the northeastern and southeastern corners of Colorado to more than 8,000 feet in the San Luis Valley. The growing season for corn varies from 100 days in the San Luis Valley to 190 days at Grand Junction.

Collection numbers in the table may be referred to the map of Colorado for their approximate locations. Sixteen of the 63 Colorado counties are represented. Although there is considerable "bunching" in certain regions, particularly in the drylands, care was taken to avoid duplicate collections. Two varieties grown in the same area were often found to be quite different. On the other hand, the different collections of Minnesota 13 and Colorado 13 (a selection out of Minnesota 13) are excellent examples of the "new varieties" that can be produced from one old variety by growing it in different environments and by selecting for different characteristics over a period of years.

If the world population continues to increase at the present rate, it will eventually become necessary to produce crops which are specifically adapted, or "tailor-made" for local areas in order to obtain maximum production. With the emphasis on efficiency of production in the United States, this situation may come sooner than expected. Such a situation would be intensified in Colorado, where areas close to each other on the map are widely separated with respect to climate and soil.

In order to produce hybrids with maximum yield potential in the

irrigated areas of Colorado (which accounted for 68 percent of the total corn acreage and 87 percent of the total production in 1958), it will probably be necessary to include in their makeup at least one inbred line with local adaptation. *Such lines are most likely to be obtained through inbreeding in open-pollinated varieties adapted to specific Colorado conditions.*

In the non-irrigated areas of eastern Colorado, adapted hybrids may not be the final answer. A number of Corn Belt hybrids, when tested under irrigation in Colorado, have produced excellent results. But few have proved satisfactory in the drylands. Thus the lack of adapted hybrids *per se* is probably not the only reason for generally poor hybrid performance in that region.

A more subtle explanation may be provided by the greater variability among plants of open-pollinated varieties. An unusual hot spell may cause a particular hybrid to shed the bulk of its pollen in less than a week, before many of the silks are exposed and receptive; whereas, under similar conditions, the greater variability of maturity among plants in a variety may allow some pollen to be shed over a period of several weeks. Similarly, a sudden hailstorm might break off most of the tassels or damage most of the ears in a relatively uniform hybrid, while the greater variability in a variety would allow more of its plants to escape serious damage.

In this region, it may be necessary to produce types of corn which maintain a reasonable level of hybrid vigor and, at the same time, retain enough genetic variability to allow the plants to take advantage of the highly variable environment. Conventional 4-line hybrids might be discarded in favor of such things as variety x variety crosses or inbred line x variety crosses.

In the 1960 commercial hybrid corn test near Haxtun in Phillips county, two locally adapted varieties and one from Nebraska were included, together with three crosses among them. Results were encouraging, since each variety cross outyielded its better parent, and the hybrid maturity (as indicated by kernel moisture at harvest) was earlier than the later parent in each cross.

Thus it might be possible to cross a locally adapted, early variety of Phillips County Yellow Dent with an inbred or variety of later maturity from the Corn Belt to produce a hybrid with superior yield and intermediate maturity for eastern Colorado. A program of this type would have the added advantage of bypassing that period in a breeding program which is normally devoted to inbreeding and selection of desirable inbred lines.

The Colorado open-pollinated corn collection represents an attempt to preserve valuable, adapted germ plasm for future use. The CSU agronomy section will continue to add to its collection until most varieties still grown in the state are included. This collection will be used for plant breeding work and genetic studies. Information concerning the whereabouts of open-pollinated corn varieties should be sent to Corn Improvement Project, Department of Agronomy, Colorado State University, Fort Collins; Colorado.

Samples of most of the varieties listed in the table have also been deposited in the National Seed Storage Laboratory at CSU. Here they will be stored under ideal conditions and subjected to periodic germination tests. When the germination percentage of a variety falls below a certain level, it will be increased in its area of adaptation and returned to the laboratory.

Since varieties collected in Colorado may be of use to breeders in other areas and to geneticists, a detailed description of each variety will be published in the 1961 issue of the *Maize Genetics Cooperation Newsletter*. This publication circulates among corn breeders and corn geneticists throughout the world. In this way, the people of Colorado can share one of their valuable resources with others.

Know your researchers

Crumpacker Specializes In Corn Improvement Work

Dr. David W. Crumpacker came to Colorado State University in 1959, where his research has been concerned primarily with corn improvement.

The 32-year-old scientist attended Davidson College at Davidson, North Carolina; the University of Colorado, Boulder; and was

Dr. David W. Crumpacker

graduated in 1951 from Oklahoma State University, Stillwater, with a B.S. degree in agronomy.

After training in meteorology at UCLA, he served from 1952 to 1955 with the United States Air Force as a weather forecaster and aerial weather observer at such diverse locations as Massachusetts, Guam and the state of Washington.

From 1955 to 1959 he attended the University of California at Davis, where he was awarded his Ph.D. in genetics.

Honorary societies in which he holds membership include Gamma Sigma Epsilon, Alpha Zeta, Phi Kappa Phi, Blue Key and Sigma Xi. He is also a member of such professional societies as Genetics Society of America, American Institute of Biological Sciences, American Association for the Advancement of Science, American Society of Agronomy, and Western Society of Crop Science.

Managing Our Ground Water Resources

*Morton W. Bittinger**

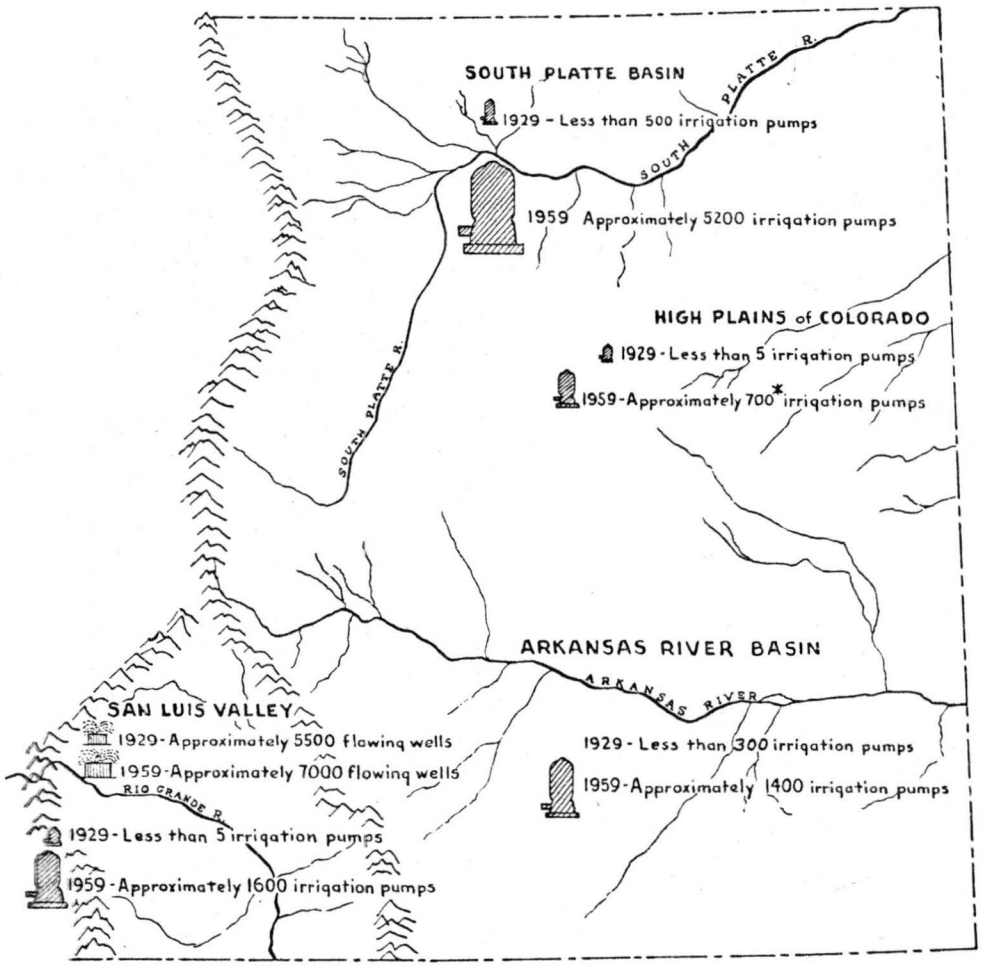
Colorado is blessed with an abundance of natural resources—including minerals, petroleum, soil, timber and water. Although minerals and petroleum must necessarily be exploited in order to produce wealth, this is not true of our soil, timber and water resources. These are *renewable resources* which under proper management can be productive for generations to come. In fact, the future of Colorado's growth and economic welfare depends upon how well we manage these resources.

A Renewable Resource

One of the newest members of the renewable resource family, in terms of the length of time it has been under development, is ground water. Over the past 30 years this resource has been the basis for significant income in terms of agricultural production and has played an important part in urban and industrial growth. More than 10,000 irrigation wells, over 1,000 municipal and industrial wells and uncounted numbers of domestic and stock wells are being used to withdraw water from our underground reservoirs.

The benefits of scientific management of soil and timber resources are generally accepted. Much research has been conducted in these fields, and even more is needed. Basin-wide management of surface-water resources is generally considered the way to accomplish the greatest beneficial use. Ground water is seldom considered as a part of these management programs, however, although it is often closely interrelated with the surface-water system. This lack of consideration has been because not enough was known about the ground water or because legal rights to it were not clear.

* *Assistant Civil Engineer, Colorado State University Experiment Station.*



This map shows the impressive development of irrigation pumping in Colorado's major ground-water reservoirs in the 30-year period, 1929-1959.

**This figure includes approximately 25 pumps in the High Plains region of El Paso and Lincoln counties and 150 pumps in Baca and Prowers counties.*

Little research has been directed toward solving ground-water reservoir management problems.

Ground-Water Management

Let's look at some of the similarities and differences involved in developing and managing three of our renewable resources—soil, timber and ground water. First of all these resources can be, and often are, developed by the initiative and finances of individuals. These resources do not as a rule require a large expenditure of funds to begin producing wealth—compared to the usual expenditures related to surface water control and development or to expenditures related to many of the nonrenewable resources. Thus the individual owner determines the manner in which the resource is managed or mistreated. But here the analogy ends. The owner of soil or timber resources can often individually do much to maintain or improve his production through good management, even though his neighbors may not. The user of ground water, on the other hand, is at the mercy of all those withdrawing ground water from the same aquifer. Ground-water management must necessarily be conducted on a reservoir-wide scale.

Because ground water can not

be seen, its occurrence and movements are often considered mysterious and beyond understanding. Thus to many, managing a ground-water reservoir may seem impossible. We do not deny that ground-water management may be complex, but if the physical situation is known *it is possible.*

Ground-water reservoirs can and eventually must be managed and operated on a scientifically sound basis. Well-guided management will include one or several of the following:

1. Consideration of ground water as a predictable entity, subject to the laws of nature.
2. Use of the ground-water reservoir as an integral part of the total water supply, conveyance and storage and distribution system within an area or basin.
3. Recognition of the relationships of surface water and ground water within an area (how use of one affects the other, etc.).
4. Use of ground-water reservoirs in the true sense of the word, i.e., dependence upon ground-water storage to help carry through extended drouth periods, but also provision of means to artificially recharge the supply rapidly during favorable periods. Efficient long-term storage is available in existing ground-water reservoirs.
5. Maintenance or improvement of the quality of ground water within a basin.
6. Provision for the equitable allocation of a diminishing supply where it is impossible to use the resource without depleting it.

A good management program for a particular ground-water reservoir depends upon many hydrologic, geologic, legal and economic factors. These factors not only vary from area to area, but some vary with time. Research is needed to develop sound operation and management techniques and programs. In addition, technical people must be trained to carry these programs forward in conjunction with the existent social and political environment.

Research Planned

Fortunately, Colorado has entered into cooperative agreements with the U.S. Geological Survey since 1945 to inventory our ground-water resources, to delineate and determine the pertinent characteristics of our water-bearing formations and to evaluate the current status of development. This information, along with long term water level records collected by the CSU Experiment Station for the past 30 years, is invaluable basic data for ground-water management research.

A small start on research in this field will begin in 1961. This will be a study of the problems involved in the management of the ground-water reservoir in conjuction with surface supplies along the main valleys of the South Platte and Arkansas Rivers. The project will be conducted cooperatively between the Colorado Department of Natural Resources, the U. S. Geological Survey, and the CSU Experiment Station if the legislature is able to appropriate funds.

The problem of the conflict of interest between ground-water users and surface-water rights is becoming increasingly serious. It will be the purpose of this research to determine the basic interrelationships involved in using water from the two sources, and determine the benefits that may be obtained by following a planned program of conjunctive use. Efforts will be made to develop optimum operational programs that will increase total beneficial use, stabilize supplies and alleviate conflicts without infringing upon present rights. This is physically and economically possible. It is hoped that our social customs and legal systems will be flexible enough to accept new concepts and programs as they are developed. As Professor L. G. Carpenter of CSU wrote 65 years ago:

The experience of all irrigation countries shows that their prosperity is largely bound up in the water question—in the certainty of water, in the security of their rights and the freedom from abuse. They have found themselves often bound by customs and laws, now become fixed, formed as the practice developed gradually. We are in danger of such here, mostly from the lack of knowledge of the condition.*

Professor Carpenter and many others of his day showed a great deal of foresight. Let us insure that future generations will not condemn us for lack of vision and foresight. We can obtain this insurance through research and a willingness to accept change.

* Quoted from Colorado Agricultural Experiment Station Bulletin No. 33, *Seepage or Return Waters From Irrigation*, published in January, 1896.

Know your researchers

Bittinger Heads CSU's Ground Water Research

Morton W. Bittinger, who discusses management of Colorado's ground water in the article on these pages has been with Colorado State University since June 1, 1957.

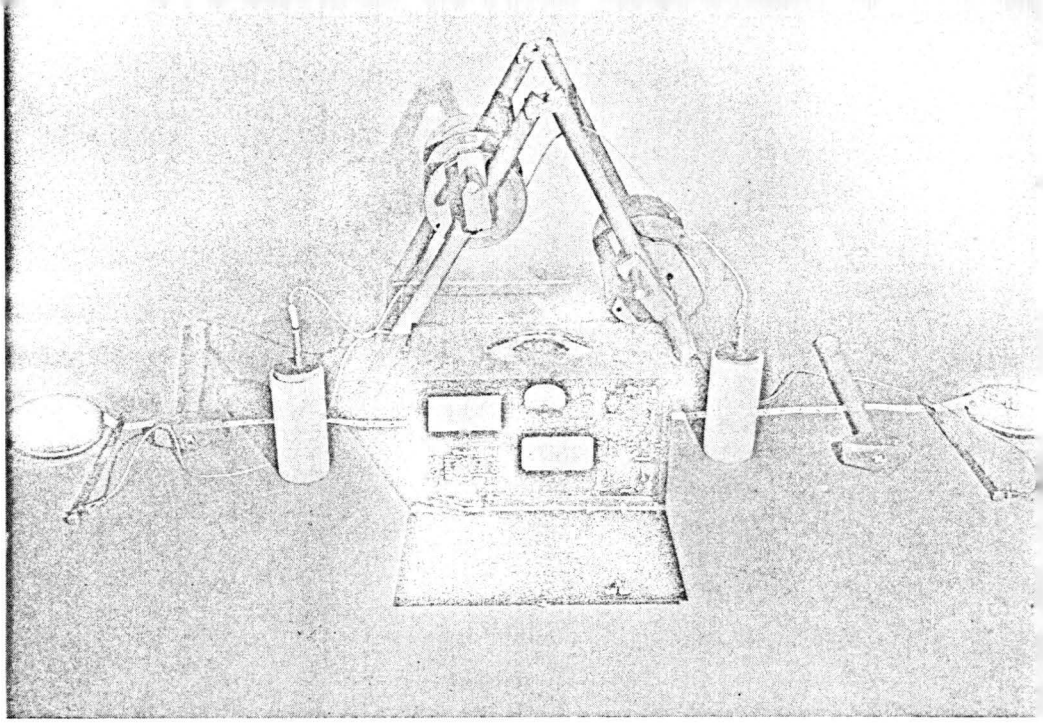
Morton Bittinger

He is in charge of engineering and hydrologic phases of ground-water research and works closely with the Colorado Department of Natural Resources and the Colorado Ground-Water Commission as a technical advisor.

He is the author of "Colorado's Ground-Water Problems," Bulletin 504-S, published by the Colorado State University Experiment Station in 1959. This bulletin was widely hailed as an exceptionally meaningful analysis of a complex and difficult subject. (Single copies are available to Colorado residents at no cost.)

Bittinger holds B. S. and M. S. degrees in agricultural engineering from Iowa State University. Prior to coming to CSU, he had six years experience in engineering teaching and research at Iowa State and two years as a consulting engineer in private practice.

CSU agricultural engineers adapt oil exploration technique for underground studies



This is the complete resistivity set built by agricultural engineers at Colorado State University. Oil exploration firms use instruments based on the same principle which cost $4,000 *to* $5,000. *The CSU instrument can be made by an electronics technician for around* $400.

Electronic Instrument Developed to Probe Underground Water, Drainage Conditions

*Norman A. Evans**

Engineers and geologists studying ground water or drainage need to find out what subsurface conditions are like. They want to know what stratification there is in the soils and rock to a considerable depth below the surface.

Location of water-bearing sands and gravels is an important part of locating and developing ground water supplies. To these ends, an electrical instrument has been built and used by agricultural engineers at Colorado State University which shows promise of taking much of the work and expense out of ground water and drainage investigations.

The idea was adapted from the geophysical technique used in oil field exploration known as the electrical resistivity method. However, CSU engineers have simplified the equipment and consequently it is a much less expensive instrument than that used by the oil industry.

An electric current is forced through the ground from a set of dry cell batteries. The resistance to current flow is measured, and since this varies with the type of material and moisture, the engineer can determine a great deal about the conditions underground from these measurements.

The instrument was used to great advantage in the Grand Valley of Colorado where the CSU Agricultural Experiment Station has conducted drainage and ground water research during the past six years. The instrument was used to map the layers of gravel and clay throughout the entire valley west of Grand Junction to Fruita at a relatively small cost.

The ground water recharge project which has been underway in the Kiowa and Bijou Valleys has made good use of the instrument in mapping underground strata in parts of those valleys. The instrument also was used on the CSU dairy farm to assist in locating the best sources of ground water for use at the dairy barn. Water-bearing gravel was mapped with the aid of the instrument and the area of thickest gravel was chosen as the site for the well.

Three of the instruments were built for the U. S. Department of Agriculture's Agricultural Research Service for use throughout the United States. One of the instruments is being used in the Mississippi Valley to map the deposits of various kinds of sands in the flood plain of the river. Engineers using the instrument report it is highly successful. Another research use for the instrument is determination of depth of penetration into deep soils.

A number of well drillers are considering trying the instrument to reduce the number of test hole drillings needed. In some areas where the water-bearing gravel formations are spotty, the instrument has possibilities in saving test drilling costs. However, the instrument cannot replace test drilling entirely, although it could reduce the amount of test drilling that is necessary.

* *Chief agricultural engineer, Colorado Agricultural Experiment Station.*

80 to 160 Pounds of Nitrogen Most Efficient Rate For Fertilizing Irrigated Grasses, CSU Study Shows

Annual applications of 80 to 160 pounds of nitrogen per acre on six forage grasses grown under irrigation proved to be the most efficient fertilization rate, a three-year study at Colorado State University indicates.

"The optimum rate fell somewhere between the 80- and 160-pound level depending on type of grass," explains Dr. A. D. Dotzenko, associate agronomist with the CSU Agricultural Experiment Station. "At this level farmers can economically increase yield and forage quality and maintain good stands of grass. Applications of 320 pounds or more caused grass stands to decline."

These studies were conducted with smooth-bromegrass, orchardgrass, tall fescue, tall oatgrass, intermediate and tall wheatgrasses at the CSU Agronomy Farm at Fort Collins. These are among the most important forage grasses grown under irrigation in Colorado.

Despite their importance little information is available on the response of these grasses to nitrogen fertilizer. A number of studies have indicated marked increases in yield and protein content under high altitude conditions in Colorado and Wyoming.

Highly significant increases in forage yields were obtained from the nitrogen applications in Dr. Dotzenko's study. Applications of 80, 160, 320 and 640 pounds of nitrogen per acre were made. A check plot received no nitrogen.

At the 80- and 160-pound rates intermediate and tall wheat-grasses produced the highest yields followed in order of decreasing yields by tall fescue and tall oatgrass with smooth-bromegrass and orchardgrass producing the lowest yields. The yields ranged from an average of 2.30 tons per acre for six grasses at the no-nitrogen level, 3.20 tons per acre under the 80-pound level, 3.75 tons under the 160-pound level, 4.25 tons under the 320-pound level and 4.45 tons under the 640-pound level.

Nitrogen applications increased the amount of total nitrogen in all of the grasses. Increased nitrogen content indicates a higher crude protein content. High rates of nitrogen fertilizer—320 and 640 pounds per acre—resulted in a loss of stand and reduced the percentage of nitrogen fertilizer recovered by the forage from the soil.

Generally, yields continued to increase at rates above 160 pounds, as did nitrogen content. However, the applied nitrogen recovery rate from the soil (the relation of the amount of nitrogen used by the plant to the amount applied) usually reached a peak at the 80- or 160-pound rate and declined sharply with the higher applications. This indicates that the most efficient, as well as the most economical use of fertilizer is obtained at the 80- to 160-pound rate.

Experimental plots were harvested when each of the grasses was in the early bloom stage, and then a second or aftermath cutting was made. There was little difference in forage production between the fertilized and non-fertilized grasses in the aftermath harvest.

At the higher application rates, some grasses showed improved color after the first cutting, but there was no improvement in forage production. This finding agrees with other studies, he noted.

On the basis of forage production, the grass species fell into three groups. The lowest producing group consisted of smooth-bromegrass and orchardgrass. These two grasses were the earliest blooming of the grasses.

Tall oatgrass and tall fescue made up the second group and they bloomed about six days later. Tall and intermediate wheatgrasses were the heaviest producers and bloomed about 14 days after the first group.

"It is possible that this early blooming characteristic is a factor which limits nitrogen response as measured by forage production. Other studies also have shown the least nitrogen response in the earlier blooming species, while later maturing species showed the greatest response," the researcher said.

During the third year of the study, a marked loss of stand was evident under the 320- and 640-pound nitrogen levels in all grass species. Heaviest losses were with tall oatgrass and orchardgrass which were reduced about 50 percent. Stands of tall fescue and tall wheatgrass had losses of about 30 percent. Smooth-bromegrass and intermediate wheatgrass showed a loss in stand of about 20 percent. In spite of decreased stands, relatively high yields were still obtained—but these may not be economical.

Dr. Dotzenko emphasizes that the 80-pound rate means 80 pounds of actual nitrogen per acre—not 80 pounds of nitrogen fertilizer. For instance, a nitrogen fertilizer containing 20 percent nitrogen would require 400 pounds of total fertilizer per acre to equal 80 pounds of actual nitrogen per acre. A fertilizer containing 33 percent nitrogen would have to be applied at 240 pounds per acre to provide 80 pounds of nitrogen.

Eight Crop Varieties Approved for State By CSU Committee

Eight seed varieties recently were approved for certification and recommended for growing in Colorado by the Colorado State University certification - recommendations committee.

The varieties are Warrior winter wheat, Betzes spring malting barley, Nebraska 501D hybrid corn, RS630 hybrid grain sorghum, RS 301F hybrid forage sorghum, Largo or Strain A-1876 tall wheatgrass, Topar Pubescent wheatgrass, and Woodward Strain of sand blue stem grass.

Warrior winter wheat is recommended to replace Pawnee variety for irrigated and dryland in Northeast Colorado.

Nebraska 501D hybrid corn is recommended for growing under irrigation in Northeast Colorado, the Arkansas Valley, Southeast Colorado and the Western Slope.

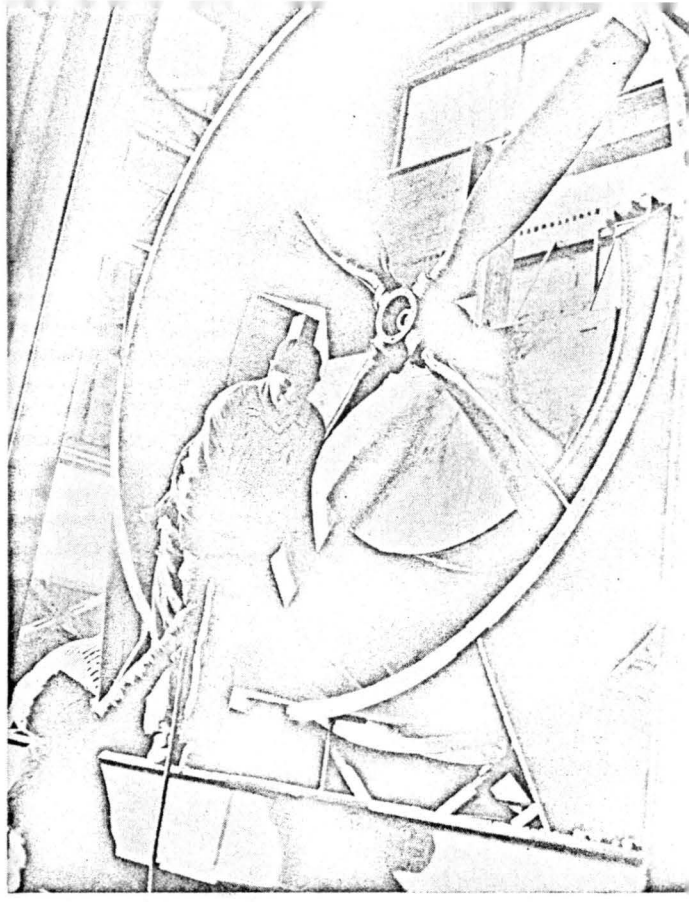
RS 630 hybrid grain sorghum is recommended for the Arkansas Valley and Southeast Colorado.

RS 301F hybrid forage sorghum is recommended for forage sorghum growing districts.

State SCD Association Endorses Conservation Lab

The Colorado Association of Soil Conservation Districts endorsed the idea of a soil moisture conservation laboratory for the Great Plains and urged its establishment at Colorado State University in Fort Collins.

The endorsement was contained in a series of resolutions during the group's recent annual meeting in Denver. The association "strongly endorsed" the laboratory's establishment and urged that the U. S. Congress appropriate needed funds to permit the U. S. Department of Agriculture to "initiate immediately this most urgent conservation research."



This large propeller will provide the air stream for a new wind tunnel research facility at CSU. The tunnel, under construction for several years, will be completed at the University's planned new research campus. CSU recently received a $276,000 contract from the U.S. Army Signal Supply Agency to finish the project.

$276,000 Contract Speeds CSU Aerodynamics Research Program

A $276,000 contract with the U. S. Army Signal Supply Agency has assured Colorado State University of an accelerated aerodynamics research program in the near future.

Dr. Jack E. Cermak, professor of engineering mechanics and civil engineering at CSU, said the recently-signed contract provides funds for completion of the large wind tunnel facility in the Aerodynamics Laboratory.

Construction of the tunnel began several years ago, but the work has been held up pending receipt of funds to finish the project.

The partially-built large tunnel currently is housed, along with a small tunnel, in the Aerodynamics Laboratory in the Industrial Research Building. But the entire laboratory, including both tunnels, is scheduled to be moved this summer to a new $200,000 building at the planned CSU research campus about two miles west of the main campus. The larger research facility will be completed at the new location, Cermak said.

At present the large tunnel is equipped well enough to handle diffusion and turbulence studies for the Agricultural Research Service, the Public Health Service and the National Science Foundation. But when completed with the addition of a power plant, an air conditioning system and other equipment, the facility will make possible a research program of considerably broader scope.

Plans call for a test section six feet square and 90 feet long in the tunnel, which will provide low-turbulence air flow with speeds from one to 150 mph, air temperatures from 30 to 200 degrees Fahrenheit and relative humidities up to 95 percent.

One of the major advantages of the better-equipped tunnel, Dr. Cermak explained, will be its capacity to provide a more realistic study of fluid flow problems near the earth's surface.

Dr. Cermak, aided by assistant research engineer Erich Plate, is in charge of designing and constructing the tunnel.

Research at CSU

Treatment for Pregnant Feedlot Heifers Tested

A 100-milligram injection of repositol-diethylstilbestrol in pregnant feedlot heifers resulted in abortions with little detrimental effects on gains or carcass quality in a CSU study.

Dr. C. D. Story, chief animal husbandman with the Experiment Station, says the material is about 90 percent effective in causing abortions when heifers are not more than 4 to 4½ months along in the pregnancy period. The effectiveness declines, however, in later stages of pregnancy.

The treatment did not materially affect feedlot gains as compared with open heifers in the feedlot. Also, no influence on carcass quality was noted when heifers were fed a sufficient time to get them into choice grade, Dr. Story said.

The latest study was conducted for 165 days. In an earlier test, some decrease in carcass grade was noted when heifers were fed only 123 days.

New Tall Wheatgrass Produces High Yields

Tests with Largo tall wheatgrass at the CSU Agricultural Experiment Station show this recently approved variety will produce high forage yields under proper conditions.

Dr. D. F. Hervey, chief range conservationist with the station, says the new grass is recommended for spring grazing on sub-irrigated saline sites such as found in the San Luis Valley, in bottom lands along the South Platte and Arkansas rivers, and on the greasewood flats of Western Colorado.

Largo, earlier known as Strain A1876 or Utah 109452, is a tall perennial bunchgrass widely used in reclaiming saline soils. A good seed producer, it is not as coarse or as stemmy as other wheatgrass varieties. The leafier growth provides more feed of a higher quality.

The grass produced excellent results in CSU studies conducted at the Fort Collins Foothills Experimental Range. A stand of Largo planted there in 1955 yielded an annual average of 3,864 air dry pounds of forage per acre over a five-year period. A later planting in 1957 produced an annual average of 6,027 pounds in a three-year period.

Dr. Hervey warns that ranchers cannot expect to equal the yields of the CSU tests. The high-yielding test plots seldom can be duplicated in the field.

CSU test results are valuable for comparison with other varieties, however. In the nursery, Largo outyielded all other varieties of wheatgrass in the study.

Value of Early-Cut Hay Demonstrated

The increased value of hay harvested earlier than is the normal practice was again demonstrated in winter feeding tests conducted by the Gunnison County Feeding Research Corporation.

Heifer calves wintered on a ration of hay harvested July 10 with no supplement outgained calves fed hay harvested August 10 and supplemented with cottonseed cake and corn. Calves fed the early-cut hay made an average daily gain of 1.17 pounds in the 93-day feeding period.

According to Hayden Rouse, USDA agricultural engineer at Gunnison, calves fed the hay harvested August 10 and receiving one pound of 41 percent protein cottonseed cake per day made an average daily gain of 1.12 pounds. Calves getting late-cut hay plus one pound of corn containing 9.9 percent protein and a half-pound of cottonseed cake per day made an average daily gain of .83 pounds.

A fourth lot of calves fed the August hay plus two pounds of corn per day, gained less than half a pound per day. Analyses showed the hay cut July 10 contained 8.5 percent crude protein, while that cut August 10 had only 5 percent protein.

The Gunnison county corporation is a non-profit organization of ranchers. Technical assistance for the studies is provided by the USDA's Agricultural Research Service and the CSU Experiment Station.

Experimental Dehydrated Alfalfa Shows Merit

A new experimental dehydrated alfalfa appears to have merit, a lamb feeding study at CSU shows.

Dr. A. L. Esplin, associate animal husbandman with the Experiment Station, says the experimental dehydrated alfalfa gave slightly better gains at less cost when compared to conventionally prepared dehydrated alfalfa in the CSU study.

The experimental dehydrated alfalfa is produced under what is called the "flash" method, he explains. The time that alfalfa is exposed to heat is reduced under this system.

Reason for the increased gain is not understood, Dr. Esplin says, because analyses show the crude protein and vitamin A content of the two types are about the same. The new dehydrating method is still in the developmental stage.

Treat your seeds

Seed Rotting, Soil Mold Diseases May Be Causing 'Germination' Problems

What appears to be poor field germination may not be the fault of the seed.

W. J. Henderson, extension plant pathologist at Colorado State University, says the apparent poor germination may be caused by seed rotting or seedlings blighted by soil molds which are normally active in damp spring soil.

Simple seed treatment will not only control diseases that attack the seed, but will control covered smut and loose smut of oats.

He recommends treatment of seeds with one of the following chemicals before planting.

Ceresan M may be used as a dust or slurry. Ceresan 75 is a ready-mix treatment. Ceresan 100 and Ceresan 200 can be used as a slurry. Panogen 15 is a liquid ready-mix. Panogen 42 can be used as a slurry. Mercad 7 and Mercad 48 are used as a slurry. Ortho LM is used as a slurry.

All of these chemicals are organic mercuries and should be used with care according to the recommendations of the manufacturer, Henderson adds.

Sheep Producers Must Have Accurate Records

Sheep producers must have accurate records to show them what they are producing and as a basis of selection in their flocks.

Louis Twombly, a CSU graduate student from Clayton, N. M., said a study he conducted on selecting replacement lambs on the basis of staple length of wool and weaning weights pointed up the need for records.

"You cannot accurately base selection upon visual inspection," he explained. "There is too much variation between years and between flocks."

John Holtorf Receives Second CSU 'Stockman of the Year' Award

John C. Holtorf, Akron rancher, was named Colorado State University's "Stockman of 1961."

Holtorf was designated for the award by a selection committee representing all major phases of the state's livestock industry, press and radio and the university.

Public recognition ceremonies were held during CSU's annual Livestock Days program. A life-size color portrait of Holtorf will be hung in the animal science building at CSU.

Holtorf is the second Colorado stockman to win the CSU award. Last year's recipient was R. B. "Bob" Broad, a Fort Collins swine grower.

Holtorf was nominated by both the Colorado Cattlemen's Assn. and the Colorado Swine Growers' Assn., two of seven major livestock organizations which annually submit nominees for the award.

A native of Edgmont, S.D., Holtorf was graduated from Sterling high school in 1925 and attended CSU from 1925 to 1929, where he majored in animal husbandry.

He began ranching on a share basis on the Buffalo Springs Ranch in 1930. Since buying the ranch in 1942, he has expanded the operation until it now comprises around 7,000 acres. He has carried out an extensive conservation management program on the ranch.

Holtorf is a Hereford breeder whose cow-calf-yearling operation is recognized as one of the best in Eastern Colorado. He has also established one of the top Duroc swine herds in the Western states.

He has taken leading roles in the formation and management of numerous organizations and associations concerned with problems of the livestock industry and agriculture in general.

Through these organizations, Holtorf has consistently backed efforts to promote research in both livestock and crops.

He has also been active in promoting both 4-H and Future Farmers of America programs. He is a much sought after judge for such events as the Little National Western at CSU, the collegiate stock judging contest at Denver's National Western and at numerous county fairs in eastern Colorado and Western Nebraska and Kansas.

In 1957, he was the first layman to win a citation and plaque from the Colorado Veterinary Medical Assn. for his contributions to the advancement of veterinary medicine and control of animal diseases.

He and Mrs. Holtorf, the former Margaret Keenan whom he married in 1933, have three children. Two sons, John Jr., 26, and Tom, 24, are associated with him in the ranching business. A daughter, Mary, 21, works for the Extension Service in Sterling.

Mastitis Widespread Among State Herds

Six out of each ten Colorado dairy cows have mastitis, according to a Colorado State University survey in the Colorado mastitis program.

O. J. Trenary, extension engineer, and Dawson Jordan, extension dairyman, who head up the CSU mastitis program, said about 1,000 cows have been checked since they started the program a year ago.

They are using the California Mastitis Test to detect the disease.

Most of the mastitis could be eliminated, the two men have concluded, through proper installation and adjustment of milking equipment in dairies.

Improper vacuum milking pump capacities, too small vacuum supply lines, improper vacuum controllers and pulsators are the chief causes of mastitis in dairy cows, they said.

Improper equipment causes irritations in the cows' udders which provide openings for mastitis.

Who . . . and What In the Headlines

(Continued from Page 2)

Gordon Hurley, Brighton . . . . elected president of Colorado Swine Growers Association during Livestock Days at CSU.

★ ★ ★

Jim Svedman, Fort Collins . . . chosen as president of Colorado State University Livestock Alumni.

★ ★ ★

Gordon T. Mickle, Fort Collins, CSU extension entomologist . . . . named district agent with the Extension Service effective July 1.

★ ★ ★

Edwin E. Winters, Akron rancher . . . elected chairman of the Eastern Colorado Range Station Advisory Board.

★ ★ ★

Paul Hosiko, Kersey . . . elected to the Colorado 4-H Club Foundation Board of Trustees.

★ ★ ★

A. R. Robinson, Fort Collins, agricultural engineer with the Western Soil and Water Conservation Branch of the ARS . . . . assisting with the United States exhibit at the International Agricultural Exhibition in Cairo, Egypt . . . . later to tour hydraulic laboratories in Italy, Switzerland, France, Belgium, The Netherlands, and England.

★ ★ ★

John Rahm, Parlin . . . . elected chairman of the Colorado Agriculture Planning Committee.

★ ★ ★

Harry Swift, Golden nurseryman . . . won Colorado Nurserymen's Assn. special award for outstanding contributions to the industry.

★ ★ ★

Philip D. Antes, Grand Junction, a CSU senior . . . . presented the National Plant Food Institute's agronomy achievement award.

★ ★ ★

Dr. Charles Terwilliger, Jr., assistant professor of range management at CSU . . . . selected as chairman of the range management division of the Society of American Foresters.

Home, lawn, and garden

CSU Wood Lab Contains Ideas For Homemaker, Home Builder

Fort Collins—Anybody thinking of building or remodeling a house would do well to take a trip through Colorado State University's Wood Utilization Laboratory. Though relatively new on the Fort Collins campus, it has what a contractor needs for a house, plus many ideas that a homemaker can use.

For instance, a standard birch kitchen cabinet on casters has been converted to movie projector storage. Slides are kept in drawers, the projector on a shelf below. The cabinet top is hard-finish, laminated plastic that doesn't scratch when the projector is placed on it. The cabinet can be wheeled wherever movies are to be shown.

New kitchen cabinets of Douglas-fir are being tested in the laboratory. The wood is cut through the growth streaks to give even wear. There's no shrinkage or warping. These cabinets have been given a dull finish with a satin varnish.

A handrail with door thresholding underneath is another new idea being tried in the Wood Utilization Laboratory. It makes the rail stronger and better looking; can be used for stairs or balcony railing. The thresholding is the usual door sill available from any lumber company.

Paneling that can be put on walls with clips is easy to install. The clips fit into slots to hold the paneling in place.

Aspen is one of the newest and most pleasing panelings. Light in color, it comes in boards 8 to 10 inches wide, and is made in Montrose. It's one of the few Colorado woods in the Wood Utilization Laboratory; most of them come from out of the state but can be purchased at various local lumber companies.

Fifty different kinds of wood and 17 kinds of particle board have been used in the laboratory. Particle board is made of particles of wood coated with a resin binder and pressed into panels that can be used for everything from floors to walls, but is most successful for furniture. When a veneer is glued to it, particle board—like plywood—becomes very strong. It's comparable in price, too.

Flooring of particle board comes in squares, like rubber or asphalt tile. It's being tested in an office at the laboratory and though in use two years has yet to show signs of wear. It's waxed every three months with liquid wax, but otherwise receives no special care.

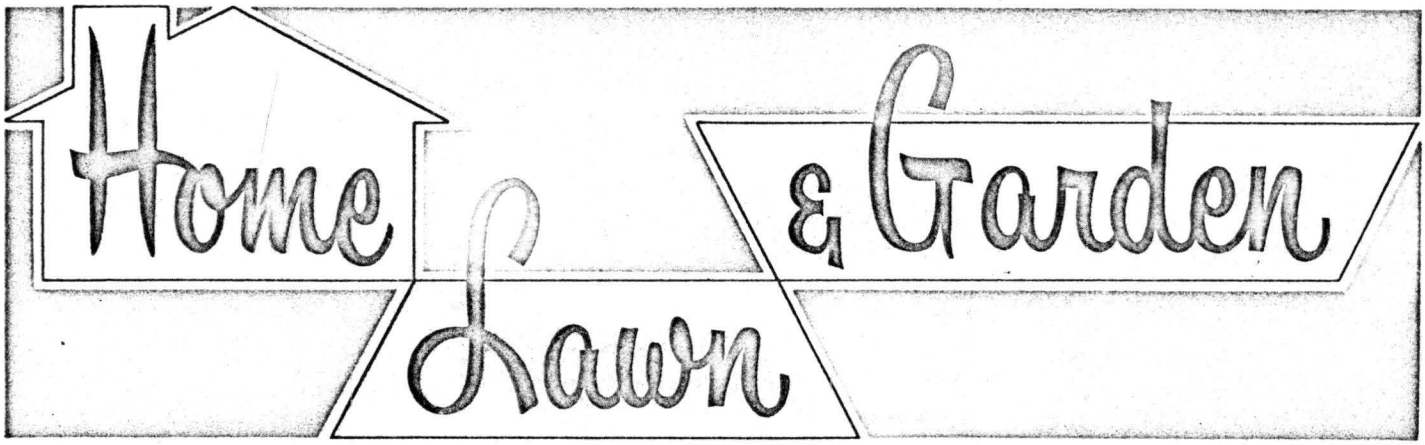
Clothing Specialist Offers Guides to Help When Selecting Chintz

Springtime in the Rockies usually means some refurbishing of house or wardrobe, and in case you're choosing chintz for brunch coats or bedspreads, Ann Jackson, extension clothing specialist at Colorado State University, has a couple of pointers about it.

The glazed finish on chintz is put on in either of two ways—one durable, thus dry-cleanable or hand-washable; the other not. The durable finish, Mrs. Jackson says, comes from treating a fabric with resin; the non-durable from starch. The starch finish is known as "friction glazing." Both give the chintz a high luster or polish, a stiff hand, and a gloss. So, how can you tell which is which?

Hang tags on the fabric or garment may say whether it's washable or dry cleanable. Another guide: most friction glazed chintz is imported and because the print is hand-blocked or hand-screened, it's more expensive than American-made chintz.

Resin-treated chintz may show loss of luster, and in some cases, finish may crack slightly upon dry cleaning. But the starch finish is removed altogether—both by dry cleaning and wet cleaning. Once lost, the starch finish cannot be restored.



PROPERTY LINE IS NOT BOUNDARY FOR LANDSCAPING

The property line is not the boundary for a landscape design, a Colorado State University horticulturist maintains.

George A. Beach, horticulturist with the CSU Agricultural Experiment Station, says the landscape boundary depends upon the position of the viewer and includes anything that can be seen off and beyond the grounds itself. A mountain view, picturesque cliff, lake, distant church steeple, or even a birdhouse in a neighboring yard can be incorporated into the landscape.

"Views to things such as these should be kept open and framed, not blocked," Beach says. "In some cases with established plantings, landscape design should involve the use of pruning shears or an axe.

"It is easy to over-plant or plant too thickly. We often have a 'woodman spare that tree' attitude toward trees and shrubs in the yard. But we should not hesitate to remove any plantings to improve the landscape."

When taking in distant views, Beach reminds landscapers to remember perspective. A small shrub close to the viewer can block a large area—"a nickle next to the eye blocks the view of a dollar at arm's length."

In some cases, the distant views need to be screened, Beach notes. Here, plantings can be of great value.

The CSU specialist also reminds homeowners that marking the boundaries of a small lot will make it look smaller. Homes set back 30 to 40 feet from the street with no property divisions allow the eye to take in the overall view and makes the individual grounds look larger, he suggests.

"In rural or suburban areas, an adjacent pasture or orchard can be made to look like an extension of the lawn and yard. When such areas do need physical separation, planting can be utilized to cover fence posts and to de-emphasize fences and walls."

All boundary divisions do not have to be constructed as a fence or wall. Often they can be made with plantings, or with a combination of planting and construction, he concludes.

Treat Grass Seed Before You Plant

Treating grass seed before planting a lawn takes only minutes, is inexpensive and can mean the difference between a good lawn and one that may have to be replanted.

W. J. Henderson, extension plant disease specialist at Colorado State University, said Arasan 75, Thiram 75 or Captan 75 may be used at a rate of one and one-third teaspoons per pound of grass seed.

The grass seed and treating material can be placed in a closed can or paper bag and shaken for one to two minutes until the seeds are coated.

Many of the poor stands of lawn grasses are blamed on poor germination and other things when either seed rot or damping off diseases or both were responsible, Henderson said. The above treatments will control both diseases.

Plan to Design House For Semi-Arid Climate

Designing a house for a semi-arid climate is a new Colorado State University research project.

The study is being conducted by Mrs. May Combs, associate professor of home management; Norman Evans, head of the agricultural engineering department; and Ralph W. Hansen, associate professor of agricultural engineering.

First phase of the project will be to develop experimental structures to use in measuring sunshine and wind. These first models will be mock-ups, built indoors so that variables that affect heat, such as the amount of radiation from the soil, can be ruled out. Later, actual homes may be constructed, Mrs. Combs said.

"In home economics, we want to find out how various kinds of materials affect heat loss," Mrs. Combs continued. "We'll compare lined and unlined draperies made of cotton and man-made fibers, venetian blinds and inside shutters. The purpose is to give an engineer or architect information as to what to allow for inside a house to keep the heat in."

California has been working on the other end of the problem, according to Mrs. Combs. They are trying to find ways to keep heat out of the house. California studies have involved vertical louvres, overhangs, and various kinds of roofs and roof paint.

The CSU study is part of a Western regional cooperative project financed by the federal government.

Select Tomato Varieties Carefully

Care in selecting tomato varieties for the home garden is as important as the care the plants receive later on.

W. J. Henderson, extension plant pathologist at Colorado State University, said home gardeners are often disappointed about time tomatoes bloom and develop fruit. Vines often turn yellow, spraddle out, wilt, leaves become stiff and leathery.

Selecting disease resistant varieties and some "preventive" medicine later on will control most of these conditions, he said.

Fusarium wilt resistant varieties and their length of growing season are Pritchard (75 days), Rutgers (80 days), Marglobe (79 days), Marbon (68 days), Early Baltimore (78 days), Chesapeak (75 days), and Kokomo (80 days).

Marbon has the shortest growing season and is high in disease resistance.

Mosaic disease which shows as a mottled or streaking of the leaves is best controlled by removing the infected plants and burning them. The disease can be transmitted from one plant to another through handling. Hands should be washed before handling healthy plants.

Psyllid insects which cause a yellowing of foliage can be controlled by a five per cent DDT dust or sulphur dust. Underside of leaves must be dusted. Bacterial Canker overwinters in tomato seeds. Home gardeners should ask if seed has been treated before buying either seed or plants, Henderson said.

Turkey Federation Aids CSU Projects

The Colorado Turkey Federation recently presented a $1,000 check to the poultry section of the Colorado State University Agricultural Experiment Station to help finance research with turkeys.

The check was presented to Dr. Robert E. Moreng, chief of the poultry section, by Paul E. Bornhoft, Fleming, president of the federation. The money will be used to finance current research projects designed to seek more efficient production methods.

Resistant Varieties Of Cabbage Recommended

If home gardeners would spend more time selecting resistant varieties of cabbage, they would not be so disappointed when the heads set, according to W. J. Henderson, extension plant pathologist at Colorado State University.

The disease that causes cabbage to turn yellow, form lop-sided heads or die about time of heading is caused by an organism that may live in the soil for as long as 20 years, he said.

Rotation is not satisfactory. But certain varieties have been developed which are resistant.

Resistant early varieties are Wisconsin Green Acre, Golden Acre, Resistant Detroit, and Racine Market.

Resistant midseason varieties are Globe, Jersey Queen, and Wisconsin Baldhead. Resistant nursery stock and seed should be available at reliable seed stores, Henderson said.

Read Label When Buying Lawn Seed

Selecting a lawn seed is easier than it used to be.

The buyer is assured of the following qualifications if the packaged seed bears the Lawn Institute "Seal of Approval."

The package will contain seed that is at least 75 percent normally perennial, will produce fine textured leaves and is spreading or sod forming.

Charles M. Drage, extension horticulturist at Colorado State University, said a number of seed firms are now cooperating in the Lawn Institute's program to protect customers from inferior mixtures that contain large amounts of bunch grass and annual grasses.

If seed bearing the seal of approval is not available, straight bluegrasses—Kentucky or the selection Merion—should be planted, Drage said.

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