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UTAH SCIENCE

Agricultural Experiment Station
Volume 36 Number 4



**1875
AGRICULTURE'S CENTENNIAL
1975**



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UTAH SCIENCE

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Glen L. Taggart, President

Doyle J. Matthews,
 Director
 Agricultural Experiment Station

Joan K. Shaw, Editor
 Lynne Paoletti Heimerdinger
 Assistant Editor
 Lois M. Cox, Science Writer
 Susan Truxes
 Editorial Assistant

Due to the great interest shown in the article concerning the costs of subdivisions, "Subdivisions out in the County Can Be Expensive," the complete model and directions for its utilization will be printed in this March issue of UTAH SCIENCE.



The Centennial Year for Agriculture

Agricultural Research: An Urgent Need

Whether it's a problem of politics, religion, or distribution, the reality of a world food crisis remains. Right now more than one-third of the earth's four billion people go to bed hungry at night, and the world's population is expected to double by 2010. The desperate struggle to keep barely alive is itself an affront to human dignity among the suffering millions now scabbling for food; how many more will join them in the next 35 years?

There is no lack of charges, re-cremations, and censure on who and what has caused the crisis. Socialist countries denounce the capitalists, third world countries

blame colonialism, developed countries deplore religious dietary taboos, political squabbles, and nonacceptance by the people of technological advances in agriculture. Food conferences are held in Rome, in Chicago, in Woods Hole, Massachusetts, in which discussions involve political, socioeconomic, and institutional topics as well as the more traditional ones of energy resources, water, and changing climatic conditions.

Meanwhile, imminent starvation and bankruptcy face no fewer than 32 nations and food prices are soaring around the world — in destitute India as well as in the United States.

Whether it's a problem of politics, religion, or distribution, the reality of a food crisis remains

Research Imperative

The situation calls for a drastic transfusion of research into fields crucial to feeding our world population. S.H. Wittwer, Director of the Michigan Agricultural Experiment Station, has called for a "massive program in agricultural science and technology" the main thrust of which would be to "minimize the nonrenewable resource inputs (lands, water, energy, fertilizer, pesticides, time) and maximize the outputs"(1). While research funding in other areas has risen dramatically, Wittwer contends agriculture has lagged far behind. Among the areas he suggests as frontiers of agricultural research are greater photosynthetic efficiency, genetic research for disease resistant and faster growing crops and livestock, improved water and fertilizer management, biological control of weeds, increased efficiency of ruminants as converters of grass and other nonhuman food to meat protein, and increased rates of gain, litter size, and twinning in sheep and cattle.

International Research

Many concerned people are calling for more cooperative research among nations, rich and poor, and there exists now an international network of agricultural research centers(2). Hoping to continue the work of the Green Revolution, scientists are now studying the major food producing zones of the third world. Among the results hoped for from international research is a more accurate index of what's necessary and what's not in achieving a standard or healthful level of human nutrition in a variety of climates and situations. A UNICEF representative in India reports that "marginal" people in that country spend 80 to 90 percent of their income on food and diets are therefore

cut to a minimum(3). Thus an Indian family featured in this NATIONAL OBSERVER piece, appears to remain healthy on a diet costing 95 cents per family member per week. Containing as it does the equivalent of barely 2,000 calories per adult per day, the diet is 400 calories behind that considered necessary for good health and 1300 calories behind that of the average adult American. This sort of study has much implication, not only in the planning of diets within the drastically limited resources of the third world countries, but in the nutrition of Americans whose main and most alarming problem, so far as health is concerned, is overeating or unwise eating.

Agricultural Research in the United States

International agricultural research, of course, depends on research carried on by cooperating countries, much of it government supported. In the United States, government support established a network of agricultural experiment stations — one to a state. The first one established was the Connecticut Agricultural Experiment Station, inspired by those already beginning in Europe, and officially opened on October 1, 1875. Among the first agricultural studies in the stations was analyzing food (long before the Food and Drug Administration came into being) and checking pesticides and feed. Early work by Station scientists in Connecticut and Wisconsin forms the basis of much of the knowledge on human nutrition, and production of hybrid corn owes its conception to Donald F. Jones, a geneticist at the Connecticut Station who developed the process in 1917.

The experiment station idea spread throughout the United States until it became a national movement, made official by the federal government through the Hatch

Many concerned people are calling for more cooperative research among nations, rich and poor

Act passed in March of 1887.

The Agricultural Experiment Station System

This act appropriated \$15,000 for the establishment of an experiment station in conjunction with each state or territorial agricultural college — for those having one. Utah didn't have one, but the Territorial Legislature of 1888 set about to correct the situation. It established through the territory's treasury the Agricultural College of Utah, thus guaranteeing their receipt of the federal fund.

The Utah Station was established the same year and found itself in January 1890 with eighty-five acres of sagebrush-covered bench land and the hope of a \$15,000 appropriation from Congress. By June the land was plowed, fenced, and planted to forage, grain, vegetables, and forest and fruit trees. By November it issued the first of its bulletins dealing with Station research results: "Plow Trials."

Research in Agriculture expanded in the Utah Station and in stations across the country. A Wisconsin farmer who asked his station's scientists why sweet clover was killing his cattle set in operation the research which produced the drug dicumarol for blood clot prevention. Streptomycin was discovered at the New Jersey Agricultural Experiment Station and pioneer work on insects and diseases was done in California and continues across the nation, notably in biological control to decrease reliance on undesirable chemical pesticides.

Improved technology and enhancement of food and fiber production were the basic outcomes of Station research with research in the related areas of economics, sociology, nutrition, engineering, and the biological sciences in-

cluded as their applicability became apparent.

The Utah Station

In Utah of the 1890s, problems were beyond the solution of individual farmers: alkali accumulation, water logged lands, outbreaks of insects and diseases, overgrazing, and erosion. Work at the Station generally centered around these problems during the early years with overall emphasis on increased animal production. At this time Utah farms averaged fifty acres.

By 1920, the average farm size increased to sixty-seven acres, sheep were the most common farm animals, and wheat led the field in Utah grains. But wheat was being threatened by "stinking smut" — a fungus that dwarfed the plant and filled wheat kernels with black and smelly masses of spores. Smut caused yield losses of up to 50 percent in some fields.

This threat to Utah's wheat production produced a series of smut resistant wheat varieties beginning with Relief — a hard red winter wheat released for commercial production in 1931. Smut proved discouragingly adaptable and Relief was followed by seven other varieties released by the Station; the latest two were Cardon and Hansel, both developed by Wade Dewey in 1973.

Research on disease and increased crop and livestock production was augmented during the depression years by studies in agricultural economics and rural sociology. Post World War II years produced important energy and atmospheric research as well as research in recreation and tourism.

Agricultural Education

Because of their close association with institutions of higher learning,



By 1920, wheat was being threatened by "stinking smut"

personnel of agricultural experiment stations have traditionally been involved with education as well as research. The Utah Station is no exception.

Although its staff members are primarily committed to research, they also teach graduate and undergraduate courses and direct the research of graduate students. The station is thus an integral part of the University — its projects produce both practical results and help train the scientists who will do tomorrow's research.

Some Station projects can be accomplished largely in laboratories or on small plots of land. Others require extensive acreages of land to generate valid results.

Flexibility

The Utah Station has consistently changed with the times, seeking the most efficient ways to solve current problems and to satisfy the needs of farmers and consumers. From the Station's early days considerable effort finds its way into projects devoted to developing an understanding of how best to apply Utah's limited water to agricultural production. By the 1940s, a prime focus was on field and laboratory studies of Utah's ranges and the animals that convert range forage to items we can use. Around the same time, crops such as sugarbeets, tomatoes, and wheat received concentrated attention as researchers found ways to combat diseases that were dramatically lowering production. Food processing methods and nutritional values began to be investigated as US consumers found themselves enjoying an unprecedented array of foods throughout the year.

Then, for a brief time in the 1960s, it seemed to some as if the nation's experiment stations' general goal of increasing agricultural production had been over-achieved as surpluses of some crops outran storage

capacity. But that short-lived interlude was followed by the turnaround of the 1970s, when previously scoffed-at doom and gloom predictions about a coming food-versus-people crisis began to look uncomfortably imminent.

Strange as it seems, the widespread acknowledgement of the world's food predicament did not generate a surge of new support for agricultural experiment station programs. Despite impressive records of solving past problems, all of the stations, including Utah's, skidded into exceedingly tight financial times. The decline in financial support was especially difficult to comprehend since investment in agricultural research has had an annual rate of return of close to 50 percent on a national basis (4). The puzzle is further compounded if you consider G. A. Pavelis's discovery that public investment in agricultural research and extension was the most important factor in influencing growth in real farm output, which increased at an average rate of 1 percent per year, and in farm efficiency which increased 1.75 percent per year from 1929 to 1972. From 81 percent to 83 percent of the general tendency for increased real farm output and from 60 percent to 70 percent of the increase in farm productivity is explained by research and extension activities (5). All of this, of course, leads to saving and convenience to the consumer.

The Consumers

We are all consumers of agricultural products and at this time of short supply and high demand of agricultural products, all of us are concerned with their availability, quality, and distribution.

Food prices, for instance, have doubled since the early 1960s, reflecting not only inflation but increased complexity in the assembly, transport, processing, and distribu-

Personnel of agricultural experiment stations have traditionally been involved with education as well as research

Food marketing adds about \$1.50 to every dollar's worth of food coming from a farmer's land



tion of farm output. In fact, food marketing provides jobs for almost 1 in 4 Americans and adds about \$1.50 to every dollar's worth of food coming from a farmer's land. It also includes innovation and creativity in processing and packaging in the teeth of rising costs in order to assure a good share of the market. Meanwhile processors are becoming fewer and larger as economies of size make it more and more difficult for small firms to compete.

But although our food bills have spiraled upward, a Bureau of Labor Statistics' study reports that American families spent only 16 percent of their income on food in 1972-1973 compared with 20 percent in 1960-1961(6). It might be small comfort, but other things seem to be going up in price faster than food.

So the 1970s have seen all segments of the American public beset by soaring inflation and sagging budgets — including Utah's Agricultural Experiment Station. As we all know, inflation is an impartial adversary that can disrupt the best laid plans of institutions as well as of individuals. Utah's Station is one such institution. Dependent upon funds from federal and state governments, experiment stations have seen their budgets minimally increased while purchasing power was devastatingly eroded in the market place.

Research at the Utah Station has nevertheless continued to grow in output and sophistication, not only at the main location in Logan but at substations, experimental farms, and temporary research sites throughout the state. In all, land owned and operated in Utah for experimental work by the Station has grown from the original 85 acres in Cache Valley to 20,920 acres in 1975.

Oldest Dryland Station

A few words about the research in

these outlying areas might be in order here. It was not long after the Station was operating that the need became evident for facilities useful in this kind of research — research in experimental fields and laboratories close to local people, local problems, and local soils and plant types. The first acreage acquired by the Station was located in Nephi.

Nephi, the oldest continuing dryland station in North America, began in 1903 under the direction of John A. Widtsoe. From this station came the currently recommended practices of alternate wheat and fallow, application of nitrogen fertilizers, and minimum tillage during the fallow year. Research at Nephi also showed that crops such as potatoes, corn, and alfalfa and production practices such as deep tillage and rotations were not adaptable to dryland farming in Utah.

But now Utah's dryland crop research can be and is being done more efficiently at Bluecreek, a recently acquired farm in Box Elder County. At the same time, recent work at the Nephi Station on shrubs has confirmed its potential productivity along these lines. For one thing, the soil at Nephi is especially suitable for shrub studies that will be relevant throughout Utah and some of the other western states.

The preliminary work that has been completed there has been designed to define some of the existing strengths and weaknesses of various shrub types such as sagebrush, fourwing saltbush, rabbit brush, antelope bitterbrush, and winterfat. The plants are being evaluated in terms of their genetic potentials for providing forage to domestic and wild animals, as rejuvenators of disturbed lands, and as ornamentals in arid locations. One prime objective is to devise ways to persuade the shrubs to produce seeds prolifically, or to other-

wise facilitate their introduction on various sites in large quantities.

The Snow Field Station

Flexible versatility has been a prime characteristic of the Snow Field Station ever since Snow College and the Utah Agricultural Experiment Station agreed in 1956 to cooperatively develop and manage the facilities. Past years have seen research and demonstrations in dairying, agronomy, and agricultural education.

Today, the research focus is on turkeys and shrubs. Since 1960, the turkey efforts have involved and been substantially financed by the Utah Turkey Industry and the Moroni Feed Company. Shrubs and native forbs research at the Snow Station has been carried on since 1969 by both UAES and US Forest Service personnel. In addition, approximately 15 acres of UAES-managed land are devoted to growing agronomic crops. These are sold and the proceeds become part of the next year's operating funds.



The research focus at the Snow Field Station is on turkeys and shrubs

Shrubs

Some of the Snow Field Station facilities support the Nephi shrub research and are used for relatively small, tightly controlled projects designed to furnish plant and seed materials of certain genetic potentials. The laboratory and greenhouse at the Snow Station facilitate such efforts as well as the collection, cleaning, and storing of plants and seeds.

Turkeys

About 11,000 turkeys are involved each year in the turkey research at Snow. Emphasis has been on solving production-management problems, evaluating strains of commercial turkeys under Utah conditions, and clarifying nu-

tritional needs of the birds.

Research results to date in terms of identifying efficient strains of birds, effective feeding management, and disease control have been impressive enough to earn continuing enthusiastic support from the industry. Unfortunately, the industry's ability to support the research program fluctuates with the profit picture.

To help build consumer demand for turkey meat and simultaneously provide consumers with uniquely nutritious foods (high-quality protein and minimal fat and cholesterol), Station scientists initiated intensive research into processing techniques and potentials. Turkey has thereby been removed from the purely "specialty food" category and put into the realm of everyday and even every-meal consideration. Thanks largely to Station work, consumers now encounter (and apparently like) turkey in frankfurters, bologna, and salami, and as ground meat, bacon, and ham.

Panguitch Farm

The Panguitch Farm was first set up in 1909 by the Bureau of Indian Affairs as a training farm for Indians. When few Indians came into the training program, the Bureau gave the 155 acres of irrigated land, a brick house, and a large barn to the state of Utah.

The farm was assigned to the Utah Station in 1911, and it was first operated as a demonstration dairy farm. It thereby helped establish some successful dairy herds in the area.

Next, the Station maintained a herd of Shorthorn cattle at the farm to serve as seedstock for the area.

During the depression years of the thirties, the Station closed the Panguitch farm along with several other small research operations.

The increased research ability of the Station following World War II allowed us to re-open the farm. Most of the dry and irrigated land in the surrounding area is used to produce forage to support a substantial livestock population. The high altitude (approximately 6,600 feet) means a short grazing season and frequent summer frosts. Forage yields, particularly of alfalfa, were very low and the farmers sought help from the Utah Agricultural Experiment Station.

Research

In 1950, we initiated research on forage production on the farm. We found that the soils were very phosphorus-deficient and that forages, alfalfa in particular, gave up to three-fold yield increases when properly phosphorus-supplemented. Better irrigation methods were demonstrated and widely adopted. Suitable pasture mixtures for the area were designed and demonstrated. Forage research, however, has been carried out extensively in many other parts of the state; the Greenville and Evans farms, for instance, have been the sites of much significant research as has been the field station at Farmington.

To complement the forage research at Panguitch, purebred Hereford cattle from the herd at Logan were put on the Panguitch farm. The animals were part of the regional genetic study of cattle and also served to measure the forage-producing capacity of the farm and a demonstration of farm productivity in that high altitude area.

Forage research was terminated in 1969 and the cattle genetic research in 1970. Since then, the cattle have been used in a regional beef marketing study and as a source of animals for a USU teaching program. By maintaining the cow herd at Panguitch, young stock can be moved to Logan for teaching pur-

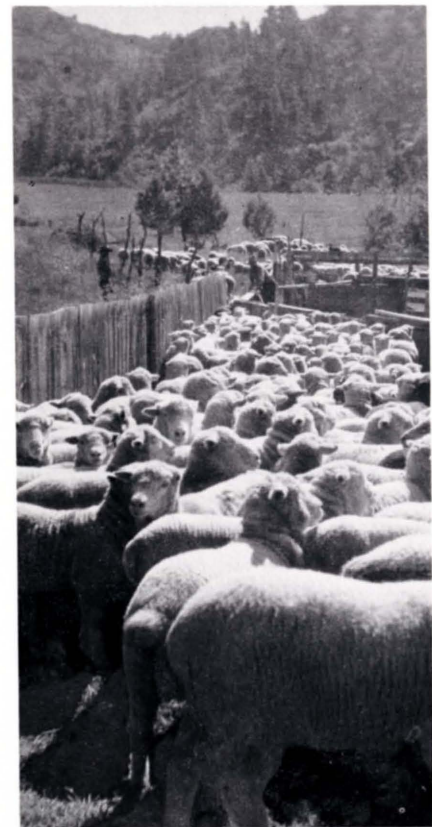
poses, while most of the beef facilities at Logan can be used for technical research.

Sheep Research Substation — Cedar City, Utah

The Cedar City research Station was established in 1944-1945 as a result of continuing requests from area sheep producers for information about breeds of sheep best adapted to local range conditions and management practices to increase lambing rates. The facilities for housing sheep and collecting research information, together with 743 acres of farm land and permanent pasture, are located on the Valley Farm 3 miles west of Cedar City. The sheep (up to 900 breeding ewes plus lambs) are managed on BLM land on the Utah-Nevada border southwest of Modena, Utah, during the winter and on state-owned and leased pasture on Cedar Mountain during the summer. The total operation is administered under an agreement between the Utah Agricultural Experiment Station at Utah State University, and Southern Utah State College. The main thrust of past research has been to evaluate existing and develop new sheep genotypes that would increase lamb and wool production potentials. An accompanying major effort has been to perfect practical management programs.

Contributions

Research done at the Cedar City station has benefited both the sheep producer and the consumer by increasing lamb production. Specific past accomplishments include: 1) establishing the relative production levels of Rambouillet, Columbia, and Targhee range ewes during the period when the latter two were being introduced, and determining the overall superiority of the Targhee; 2) determining that range



lamb production can be substantially increased by use of Suffolk x Targhee ewes over straightbred Targhee under various range conditions; 3) demonstrating the advantages and application of controlled pasture breeding as a management tool in increasing breeding efficiency and preparing ewes for winter range. Our scientists have also: 1) demonstrated the advantages and soundness of shed-lambing as a way to increase lamb viability, long term survival, and subsequent production; 2) measured the relative values of winter drylot feeding of ewes versus letting them forage prior to first lambing; 3) established causes of death loss in new born lambs and devised management procedures to reduce them; and 4) demonstrated that the use of hormones could increase lamb production by initiating production at an earlier age and sustaining an accelerated production rate. The value of our results is reflected in the fact that nearly all sheep producers in the area are shed-lambing and breeding on pasture.

Goal: More Acceptance of Lamb

Current studies have been designed in response to our changing world. New methods of processing meats seem likely to promote both packers' and consumers' acceptance of lamb. The need to produce more meat from forages than from grains also operates to enhance the value of sheep since they are superb foraging machines.

The high energy expending methods of producing red meat (feedlot fattening) promote higher prices under current conditions. This is the time to move forward in research toward expanded use of sheep in producing meat and wool with maximum efficiency in energy use.

Our present operation of and pro-

jected plans for the Cedar City Station, therefore, emphasize ways to increase production. Crossbreeding efforts are looking to semiexotic as well as other domestic breeds for more productive genotypes. In addition, physiological studies involving hormone manipulation are being combined with intensified management to induce ewes to lamb at one year of age.

Utah Rangelands

In rangeland resources Utah is eleventh in the US with 92 percent of its ranges in natural vegetation. About 78 percent of the state's 52 million acres is grazed by livestock. Another 12 percent is grazed by big game animals so that, in all, 90 percent of Utah is grazing land — almost 75,000 square miles! In the Intermountain Region about 50 million acres can be classed as sagebrush dominated.

Even at that, about 40 percent of Utah's total agricultural income comes from range cattle and sheep. Over 50 percent of the annual feed requirements of beef cattle and 90 percent of those of sheep are satisfied by forage from rangelands. In 1974 there were about 700,000 beef cattle in Utah and 780,000 sheep valued at \$220 million and \$30 million, respectively.

200-300 Percent Increase Possible

Products from rangelands in Utah could be increased at least 2-fold if already developed knowledge were widely applied. With the application of results from additional research, 200 to 300 percent increases could be realized. Unfortunately, application of knowledge comes slowly on both publicly and privately owned ranges because of two shortages: money and understanding. Obviously, Utah needs a vigorous program through which good range and ranch management practices can be dramatically demon-

New methods of processing meats seem likely to promote acceptance of lamb



strated and explained to range owners and users throughout the state.

Benmore and Tintic — Two Unique Sites

The Benmore and Tintic range research areas lie southwest of Salt Lake City at the south end of Rush Valley in Tooele County. The elevation is between 5,000 and 6,000 feet and annual precipitation averages 13 inches. About 75 percent of the precipitation comes between October and May, with approximately 60 percent of the total arriving as snow. These ranges typify the lands that support the majority of Utah's wild game during the winter months and her livestock during much of the remainder of the year.

Prior to 1900 this land produced abundant grasses and provided excellent grazing for livestock. Eventually, around Benmore and Tintic, the plow took over and dryland wheat farming began. This proved to be an uneconomical use of the land, and in 1934-1935 3,240 acres in the Benmore area were purchased by the federal government and set aside for research.

Station personnel fenced 28 100-acre pastures out of the 3,240 acres and seeded them to crested wheatgrass. Most of the remaining acres were fenced as nativegrass pastures so that the performance of cattle grazing on the two types of forages could be compared. Water was piped to all the pastures for livestock use. The Tintic Valley Cooperative Research Project was initiated in 1949 and comprises 4,500 acres in the study area. This includes 24 70-acre pastures which were cleared of sage brush and juniper and planted with various combinations and varieties of range grasses.

Results from investigations at these two uniquely valuable areas have come from long-term studies devoted to finding ways to restore

the land's productivity and then to measuring cattle responses to various management techniques. Truly pioneering efforts (which have been acclaimed in many countries) showed that crested wheatgrass could be grazed at an intensity of 65 percent without causing the grass to deteriorate. All the various systems of grazing that were tested proved satisfactory. However, the removed-10-days-early system produced more daily gain, while the rotation process was best for the grass.

Grazing System Developed

Our scientists extended their work until they could confidently recommend that a rancher who has limited permits for cattle on a national forest range or does not have meadow pastures for summer grazing should develop a system wherein his crested wheatgrass is grazed from April to December, assuming he is in a zone where rainfall averages about 13 inches. In the spring, cattle may be grazed for about 60 days in a given pasture, but in the summer and fall they should be moved to a new pasture about every 30 to 45 days.

Additionally, we know that re-seeding sagebrush and depleted dryland farm acreages to drought-resistant grasses (crested, intermediate, or tall wheatgrass, Russian wildrye, or the species crosses being investigated at our Evansville farm) would permit such lands to support far more cattle than they do at present. For example, it takes 5 to 25 acres of sagebrush land to maintain a cow and calf for 60 days in the spring. While on this range the cow will gain only about 1.1 pounds and her calf about 1.47 pounds. When reseeded to crested wheatgrass and properly managed, a maximum of 5 acres of such land will support that same cow and calf for the same time, while the potential gains become 2.49 to 3.06 pounds for the cow and 1.8 pounds for the calf.

Some in-progress experiments are designed to clarify the effects of applying nitrogen fertilizer to crested wheatgrass ranges. Results to date indicate a 40 to 50 percent increased grazing capacity in pastures receiving 50 to 100 pounds of nitrogen. These efforts are being continued through 1976 to determine carry-over effects of nitrogen in the soil.

Where To Now?

We have entered a period when worldwide pressures are encouraging an increase in cereal grain production and the direct use of these grains as human food rather than as livestock feed. The recently prevalent practice in the United States of finishing cattle on high concentrate diets is destined for drastic change. To meet today's requirements, production systems and genetic strains of cattle must be developed that will produce desirable beef with a reduced use of feed grains and increased use of forages.

Farmington Field Station

The Farmington Station originated in 1920 primarily as a vegetable and fruit research station; ornamental studies began a few years later. In 1947 an additional farm of 50 acres was purchased (giving us a total of 90 acres) and work was expanded to include sugar beets, cereal grains, irrigation efficiencies, and weed control. The results of our research work at Farmington have affected agriculture and food production far beyond Utah's borders.

Disease-resistant tomatoes developed at Farmington between 1936 and 1945 have been widely used as breeding stock for new varieties. One of the largest canners in the business (H.J. Heinz) has estimated that 80 percent of the tomatoes grown in the United States trace their disease resistance to Utah stock. Onion hybrids de-

veloped at Farmington have been widely used because of their superior eating quality. A new Lima bean variety from Farmington is now grown on several hundred thousand acres. A variety of sweet cherries (Angela) that is resistant to the western X disease has been made available to commercial growers following years of work by a USDA scientist using our Farmington facilities.

Contribution Significant

Significant contributions in weed control, orchard management, irrigation efficiency, and many other areas have grown out of work at Farmington. These improved practices have been adopted by Utah's farmers and have thereby returned a hundredfold on the original investment to the citizens of the state.

The Farmington Station is uniquely well located for research on ornamental plants — half the citizens of the state live within 30 miles of these grounds. Thus, each year hundreds of visitors can and do spend thousands of hours in these gardens. They come to obtain ideas for their own home landscaping and simply to enjoy the beauty of the plants our researchers are developing to meet Utah's environmental conditions.

Except for Utah's Dixie, Farmington represents the longest growing season in Utah. Also, Farmington's light soil is exceptionally well adapted to studies of the movement of nutrients in the soil. The farm allows full sprinkling pressure capability without pumping. It is an excellent research farm where programs should be continued and stimulated.

A start has been made on a "native" garden at Farmington in which our scientists would grow all of Utah's native plants that may have ornamental value.

Bluecreek

The Bluecreek Experimental Farm is a 40-acre dryland research station located in the heart of Box Elder County's wheat growing country. The farm was purchased and donated to Utah State University in 1963 by far-sighted grain growers of Cache and Box Elder counties who wanted dryland research conducted in this major grain-growing region of the state. Bluecreek is actually two farms in one. Part of the land has a relatively steep slope, facilitating erosion control and contour-farming studies. The remainder slopes only slightly and lends itself well to varietal trials and other types of testing where land uniformity is necessary.

Past and Present

Prior to the acquisition of the Bluecreek Farm, dryland research in Utah north of Nephi was carried out on a year-to-year personal arrangement basis between individual researchers and farmers. While some important contributions to dryland agriculture were made under these conditions, the lack of total control over the land and growing conditions by the researchers made almost impossible the long-term studies of tillage and fertility practices, soil moisture accumulation, and depletion patterns as a function of tillage, fallow, and rotation systems.

With a prime research site now available on a continuing basis, we have instituted studies on these problems. The result has been significant progress toward an understanding of and solutions to dryland agriculture problems in Utah.

Particularly notable has been the increasing of wheat yields and protein contents by the manipulation of soil moisture through the proper timing and type of tillage opera-

tions, timeliness of seeding date, and appropriate timing and rates of fertilization. We achieved effective control of the destructive disease called "snowmold" by removing snow cover with surface applications of such solar energy absorbing materials as furnace ash. The Bluecreek Farm has provided a testing site for new experimental wheat lines coming from our breeding program. Varieties developed through this program now occupy the majority of Utah's dryland wheat acreage. Recently released, smut-resistant varieties that received their advanced testing at Bluecreek are now saving growers of northern Utah hundreds of thousands of dollars each year.

Evans and Greenville Farms

The close proximity of these two farms to the USU campus make them the backbone of our agronomic research. It is on these grounds that researchers can best carry out the precisely controlled, initial investigations that underlay virtually all new varieties, recommendations for irrigation and fertilization practices, and more efficient management procedures.

WOODSY OWL HOOTS:

**Soil is for plants,
Not for tire tracks.**



GIVE A HOOT. DON'T POLLUTE



UTAH SCIENCE

The Evans and Greenville farms were the birthplace of wheat varieties such as Relief and Cache that have periodically saved Utah's wheat industry from oblivion. Velvon barley, widely grown in the western United States and Canada, was also developed at these farms. Initial pollinations made by hand here in the 1950s are the basis for new grass hybrids between crested wheat and quackgrass. These hybrids are showing promise as rangeland forages. Most of Utah's irrigated pastures are currently planted to mixtures whose value were first demonstrated here in the 1940s.

Irrigation and Soil Research

USU's pioneering work in irrigation and soil research began in 1903 on these farms. The results include definition of how the timing and quantity of water applications can affect moisture movement in the soil and the ultimate crop quality. The life cycles of the destructive beet leaf hopper and alfalfa weevil were elaborated here; both were international classics in entomology.

Today's research efforts include development of cereal varieties resistant to dwarf smut and snowmold; drip irrigation techniques that can save water and fertility; nematode resistant alfalfa; and more effective nonchemical weed control methods.

A Top Dairy Program

Dairying (with a population of 76,000 cows) is the second most important agricultural enterprise in Utah, exceeded only by the beef industry. In 1973 the farm cash receipts from the sale of dairy products was over \$60 million, or 18.2 percent of the total farm cash sales of agricultural products in the state. In addition, sales of surplus dairy animals amounted to over \$21 million, or approximately 20 percent of the total sales of cattle and calves in

the state.

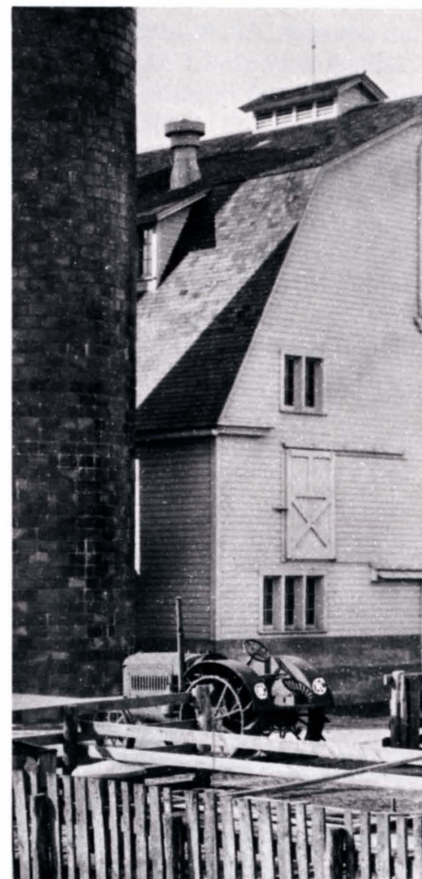
Utah State University researchers have developed productive pasture varieties and management practices and defined the effects of fluorine on dairy animals. Although pasturing has been almost abandoned in recent years, current energy shortages and high fuel and feed costs relative to milk prices point to a possible return to having dairy animals harvest their own forage from pastures. Current USU research is defining the efficiency with which feed, especially forages, can be converted to milk and finding ways to use a waste product (whey) as a feed for dairy animals.

Utah State University is among the top 20 universities in the United States in dairy research programs. It is one of the few universities in the West with a viable dairy curriculum. Our new vocational-technical course for dairy herdsmen is unique among western schools and fills a critical need of the dairy industry.

The dairy program at USU has been greatly strengthened since 1961. That was the year that Logan became one of three USDA dairy research centers in the United States, and research in dairy production at Logan became a joint effort between USU and ARS scientists. The ARS scientists also enhance our teaching and extension programs. About 40 percent of the present dairy research herd was provided by ARS and substantially extended our research capacity. Income from the sale of milk and cattle from the ARS herd is returned to USU as payment for feeding and caring for these animals. The continuance by ARS of a cooperative program with USU is dependent upon USU maintaining viable dairy programs and facilities.

Breeding

The USU Dairy Research Farm



Dairying is the second most important agricultural enterprise in Utah, exceeded only by the beef industry

has developed outstanding genetic material through its dairy breeding program. Twelve bulls bred in the USU herd have been selected and used nationally for the artificial insemination of dairy cows. This is more than from any other university in the country. As an indication of the esteem accorded USU bulls by dairymen, 86,000 ampules of semen were sold from USU bulls in 1971.

The bulls bred and developed by USU have contributed greatly to the genetic improvement of dairy cattle throughout the United States. A recent study at the Virginia Polytechnical Institute ranked the USU dairy

herd as number one in the United States in the average production of daughters of all bulls born and tested from that herd.

The results of the research and breeding programs at USU have enabled Utah's dairy industry to increase rapidly its levels of production (2.55 percent per year for the past 20 years). Part of this increase can be traced to the growing efficiency of carefully bred dairy cows in converting feed to milk; part has resulted from improved feeding and management practices. Consumers reap their benefits from dairy research when they pay prices for

milk that are 50 percent below what they would be if milk production per cow had held at the 1955 level.

In 1890, Utah's first Agricultural Experiment Station Director, Jeremiah Sanborne struggled to create and maintain a viable program under short funds and long lists of research needs for Utah's people. Eighty-four years later amidst world food and energy crises, a rising urban population in the state, technology-created health problems, and an inflation-recession economy, the Utah Station's research assignments continue to be of grave importance to world survival.



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- (1) SCIENCE 188:4188, p 579.
 - (2) SCIENCE 188:4188, p 585.
 - (3) September 21, 1974, 1+.
 - (4) Maury Bredahl, Unpublished PhD Dissertation, University of Minnesota, 1975.
 - (5) THE FARM INDEX, USDA, July 1975.
 - (6) "Food Expenditures of Families, 1972-1973," Corrine LeBouit. IN NATIONAL FOOD SITUATION, NSF-152, May 1975.

Education in Utah — A Historical Comparison

Michael Toney and Michael V.
MacFarlane

The attainment of high levels of education has been a basic value of American society. In 1940 the Census Bureau first began computing median* years of education. Ever since then, Utah has ranked well above the median for the total United States population. Utah's median years of education was 10.2 in 1940, 1.6 years above the national average (Table 1). By 1950, the median years of education were 12.0 for Utah's population and 9.4 for the entire US population, 2.7 years below Utah's level. By 1970, however, Utah's median of 12.5 was only .4 years above the national average, the smallest difference for the 1940-1970 period. Nevertheless, it is interesting that Utah's median years of education were higher for each of the decades than were those calculated for the country at the succeeding period.

Even more noteworthy is the fact that Utah's median years of education have exceeded those for any other state during this time. In 1940, only the District of Columbia had a higher level of education (10.3) than Utah (10.2). In 1950 both the District of Columbia and Utah had median levels of 12.0 years. The 12.2 median in 1960 and the 12.5 in 1970

*The median is defined as the number of years of schooling at which half the population are above and half are below.

put Utah in first place, .1 of a year above a group of six other states for those years. The spread between Utah and the lowest ranking state (Kentucky) is large, 3.7 years in 1940 and 2.6 years in 1970. The 9.9 median years of educational attainment by the 1970 population of Kentucky was not as high as Utah's 1940 level of 10.2.

The higher levels of education attained by the overall Utah population cannot be totally explained by its low proportion of rural and nonwhite populations. As the data in Table 1 indicate, Utah's rural, urban, white, and nonwhite populations were all more highly educated than their counterparts in the United States as a whole. Because educational attainment is consistently lower for rural populations than for urban populations throughout the nation, it is especially noteworthy that Utah's rural population surpasses the urban population of the United States in median years of education for 1940, 1950, 1960, and 1970.

Utah has had a larger proportion of its school age population, 5-19 years of age, enrolled in school than has the nation as a whole since 1900 (Table 2). The difference was greatest in 1900 with Utah's 63.3 percent being 12.7 percent higher than the national figure. The gap

Since 1940, Utah has ranked well above the median in years of education attained for the total US population

closed to less than one percent in 1960, but had spread to 3.3 percentage points in 1970, with Utah having over 9 out of every 10 of its school-aged children enrolled in school. In 1970, Utah was second to Connecticut in percentage of school age population enrolled in school.

In percentage point differences Utah has never ranked far below the leading state with the greatest difference being in 1910, when Vermont had 68.4 percent of its school age population enrolled to Utah's 65.4. On the other hand, the gap between Utah and the lowest ranking state has been consistently at least 10 percentage points, meaning that these states have had at least 10 more children per 100 out of school than has Utah. In 1900 the state with the smallest percentage of school age children enrolled in school, Louisiana, had only 28.3 percent while Utah had 62.8 percent of its school age population attending school.

The data do not allow a clear cut determination of why Utah's population has attained such a high level of education. The explanation may well reside in the efforts of the state and local governments and in the social and cultural composition of people populating the state. While the absolute amounts spent on education in the State of Utah are not great when compared to those states with higher tax bases, the percentage of the state and local government expenditures devoted to education was higher than the percentage spent by any other state for the 1971-1972 school year. This seems to indicate a strong commitment by the state's leaders to providing public education. It may also imply that the state's citizens value education highly.

Michael B. Toney is Assistant Professor of Sociology, Social Work, and Anthropology, Utah State University.

Michael V. Macfarlane is a Graduate Research Assistant in Sociology, Utah State University.

Table 1. Median Years of Education for Utah and the United States by type of Residence and Race for 1940, 1950, 1960, and 1970

	<u>Utah</u>				
	<u>Total</u>	<u>Urban</u>	<u>Rural</u>	<u>White</u>	<u>Non-White</u>
1940	10.2	10.8	9.4	10.2	6.6
1950	12.0	12.1	11.0	12.0	8.9
1960	12.2	12.3	12.0	12.2	10.1
1970	12.5	12.6	12.3	12.5	12.0

	<u>U.S.</u>				
	<u>Total</u>	<u>Urban</u>	<u>Rural</u>	<u>White</u>	<u>Non-White</u>
1940	8.4	8.7	8.1	8.1	6.3
1950	9.3	10.2	8.6	9.7	6.9
1960	10.6	11.1	9.2	10.9	9.2
1970	12.1	12.2	11.0	12.1	10.0

Source: U.S. Bureau of the Census, *Census of Population*, U.S. Government Printing Office, Washington, D.C., various issues.

Table 2. Percent of school age (5-19 years) population enrolled in school

		<u>Utah's Rank</u>	<u>Utah %</u>	<u>U.S. %</u>	<u>U.S.</u>	
					<u>Highest %</u>	<u>Lowest %</u>
1900	Utah	6	62.8	50.6	63.1	28.3
1910	Utah	6	65.4	62.6	68.4	40.6
1920	Utah	1	73.0	67.4	73.0	53.0
1930	Utah	2	76.8	73.4	78.5	60.1
1940	Utah	2	77.2	74.8	78.2	63.9
1950	Utah	7	78.8	78.7	79.8	65.9
1960	Utah	17	85.3	84.4	86.1	72.2
1970	Utah	2	91.5	87.9	92.8	81.5

Source: U.S. Bureau of the Census, *Census of Population*, U.S. Government Printing Office, Washington, D.C., various issues.

UTAH RECREATION FOR UTAHANS

John D. Hunt

Two things stand out in Utah's resident recreation picture. First, Utah residents make "out-of-home-community" recreation expenditures in Utah which have an impact upon local and regional economies. In some cases, money spent by Utah resident recreationists may be as important to the economies of certain regions of the state as money spent by out-of-state tourists. In other cases, it may be even more important. Consequently, a region which has only limited potential for building a tourist industry around the nonresident may yet have a good opportunity to attract the residents.

Second, independent of economic factors, it is important to consider where Utahans participate in recreation and, consequently, the type of public recreation opportunities that may be provided for their use.

The Utah resident recreation picture is not really complete without an analysis of the community-oriented recreation activities and patterns in which private, local, county, and state agencies can and do provide many opportunities. Since this is a very local problem, however, it has not been considered in this analysis. Rather, we've tried to identify those of the nine travel promotion regions which have the

greatest economic dependency on resident recreation travel as well as the most out-of-home-community recreation use.

This analysis, then, concerns the relative importance of resident recreation expenditures to Utah's nine promotional regions* as well as their resident recreation potential. As in the nonresident tourism analysis published in these pages earlier (December 1974 UTAH SCIENCE) many factors could be considered here. In this preliminary analysis, however, only three variables are analyzed in the nine promotional regions 1) resident recreation expenditure dependency, 2) recreational visits, and 3) resident skier visits. At this stage in the study of Utah resident recreation, two regions, Canyonlands and Castle Country, had to be combined; these regions will be examined separately in future work.

Each promotional region scored from eight to one, depending upon the relative magnitude of each of the variables and from which we calculate an average. We've assumed that regions with high scores presently exhibit greater resident recreation activity and popularity. Although

*Developed by the Utah Division of Travel Development.

Where do Utahans spend their recreation dollars?

these factors represent only a crude estimation and future changes in the economy, land use, public and private development, highway development, and recreation technology may cause changes in regional potential, those areas with extremely low or extremely high scores are likely to maintain their status regardless of future changes.

Who Depends on Resident Recreation?

The staff of USU's Institute for the Study of Outdoor Recreation and Tourism have developed over a period of several years a method to assess tourism importance to the various states. Using state traveler expenditures from the National Travel Expenditure Study (US Travel Data Center, 1973), 1970 state populations, state per capita personal income, and gross state products (Congressional Record, October 15, 1973), two measures of the relative importance of tourism to a state's economy were developed. One measure compared the per capita amount of money spent for recreation and travel in a state to the state's per capita personal income, suggesting the relative importance of tourism to individual wealth. The second measure was a comparison of total tourist and recreation expenditure in a state to the state's gross product, suggesting the relative importance of tourism to the state's economy.

Because some states have more people, bigger and more diversified industry, and very different sizes of overall economies, the impact of tourism within the states is likewise different. Thus tourism, recreation, and other travel-related expenditures in California which total nearly \$4 billion annually, are less important to the state's total economy than in Utah where expenditures reach less than \$0.4 billion.

Using this same procedure, a re-

sident recreation impact factor can be developed for Utah's promotional regions (Table 1).

Although the same regions that are relatively dependent on out-of-state tourists are generally dependent on resident recreation expenditures as well, some exceptions do occur. Color Country appears as the most dependent on both types of recreationists while Great Salt Lake Country and the Golden Spike Empire seem the least dependent.

The most notable exception is Bridgerland which ranks higher in relative resident recreation expenditure dependency than it did in

tourism dependency. This is attributable, in part, to the active skiing of Cache and Box Elder county residents at Beaver Mountain during the winter and heavy use of Logan Canyon and Bear Lake by many local and Wasatch Front residents in the summer. Likewise, Dinosaurland appears more resident dependent than Panoramaland which is just the reverse of their relative tourism dependency ranking.

The Utah Recreationist

Although Utah residents visited many of the same attractions as the out-of-state tourists they engage in

Table 1. Resident recreation impact factors for the Utah travel promotion regions

Region	Resident Recreation Expenditures ^a (000)	Per Capita Recreation Expenditures	Resident Recreation Impact Factor ^b	Relative Importance Score
Bridgerland	6,900	140.53	4.0	4
Canyonlands and Castle Country	6,400	154.96	4.3	5
Color Country	11,000	262.53	7.6	8
Dinosaurland	5,600	197.88	5.8	7
Golden Spike Empire	11,500	40.82	1.0	2
Great Salt Lake Country	22,000	42.47	0.9	1
Mountainland	12,200	70.52	2.2	3
Panoramaland	6,900	167.88	4.7	6

^a Source: Resident recreation expenditures from Institute for the Study of Outdoor Recreation and Tourism, Utah State University. Population and per capita personal income from Bureau of Economic and Business Research, University of Utah. The recreation expenditure figures are estimates of only "out-of-home-community" expenditures that Utahans made for recreation in 1973-1974 (December-November). Of course, many other related expenditures are incurred at home.

^b $\frac{\text{Total resident recreation expenditure}}{\text{Resident population}}$ = per capita recreation expenditures

$\frac{\text{Per capita recreation expenditures}}{\text{Per capita personal income}} \times 100 = \text{Resident Recreation Impact Factor}$

considerably more dispersed recreation. They camp, fish, backpack, jeep, cross-country ski, hunt, and do many other things in areas seldom frequented by the tourist. In order to further identify a region's popularity and potential for resident recreation we examined the number of recreation party visits to it (Table 2). We identify visits as an overnight stay, visit to an attraction, or participation in a recreation activity within a region. Great Salt Lake County and Mountainland are the most heavily visited regions for recreation by Utah residents. The fact that about three-quarters of Utah's population resides in these two regions accounts for much of their recreation use; however, the canyons and mountains of the Wasatch and Uinta ranges hold great appeal as well. The Golden Spike Empire receives heavy recreation use by residents. The remaining regions, although receiving over one and one-half million recreation party visits, do not compare in use levels with the others.

Residents ski heavily in Great Salt Lake Country and Mountainland (Table 3). The Golden Spike Empire also receives a large share of the resident skier use. Bridgerland is considerably lower in ski use than the heavy use regions but higher than the regions remaining.

Where Will the Residents Go?

Comparing the relative importance scores from Tables 1, 2, and 3, several regions emerge as popular resident recreation regions (Table 4). Great Salt Lake Country and Mountainland undoubtedly have the opportunity to serve many of the recreation needs of Utah residents. They have many outstanding recreation opportunities and a large neighboring population to draw from. If the cost of gasoline and other recreation-related expenditures continues to rise, these areas will receive increasing recreation use. Color Country is a low population region which attracts both its

Table 2. Number of recreation visits made to Utah travel promotion regions by Utah residents in 1973-1974 (December-November) ^a.

Region	Number of Party Visits	Relative Importance Score
Bridgerland	300,000	3
Canyonlands and Castle Country	272,000	2
Color Country	362,000	5
Dinosaurland	232,000	1
Golden Spike Empire	841,000	6
Great Salt Lake Country	1,368,000	8
Mountainland	1,194,000	7
Panoramaland	354,000	4

Color Country appears dependent on both resident and nonresident recreation expenditures

^a Source: Institute for the Study of Outdoor Recreation and Tourism, Utah State University.

Table 3. Resident skier visits in ski areas in the Utah travel promotion regions, 1974-1975^a.

Region	Resident Ski Visits	Relative Importance Score
Bridgerland	51,000	5
Canyonlands and Castle Country	9,000	3
Color Country	17,000	4
Dinosaurland	0	0
Golden Spike Empire	147,000	6
Great Salt Lake Country	404,000	8
Mountainland	226,000	7
Panoramaland	0	0

^a Source: Institute for the Study of Outdoor Recreation and Tourism, Utah State University, and Ski Area Operators.

^b Although there is a ski area in Panoramaland its level of resident use is insignificant.

Table 4. Relative importance scores for resident recreation impact factors, recreation visits, and resident skier visits for Utah travel promotion regions.

Region	RRIF	Recreation Visits	Skier Days	Average
Bridgerland	4	3	5	4.00
Canyonlands and Castle Country	5	2	3	3.33
Color Country	8	5	4	5.67
Dinosaurland	7	1	0	2.67
Golden Spike Empire	2	6	6	4.67
Great Salt Lake Country	1	8	8	5.67
Mountainland	3	7	7	5.67
Panoramaland	6	4	0	3.33

Most significant is the emergence of the Golden Spike Empire and Bridgerland as resident recreation regions

own and other regional residents for recreation. Interestingly, these three regions have the greatest potential for nonresident tourism development, also. This speaks highly for their scenic variety and recreational diversity, since much of the nonresident use of the regions is different from that of the resident.

Probably most significant in this analysis is the emergence of the Golden Spike Empire and Bridgerland as resident recreation regions. Both these regions ranked relatively low in nonresident tourism development potential and might find programs directed to the Utah resident more economically beneficial.

While Canyonlands, Castle Country, Panoramaland, and Dinousaurland will always be valuable sources of resident recreation opportunities, they do not presently appear highly popular, relatively, among Utah residents. With the growing use of Utah's west desert and the canyon country, the potential crowding in the populated regions, and massive energy developments, however, this situation may change.

As more information becomes available about Utah tourism and resident recreation, attempts should be made to refine this analysis or develop new means to assess development potential and needs. While all citizens of Utah should have a broad spectrum of recreational opportunities, it is critical that scarce resources be allocated according to need and opportunity.

John Hunt is Professor, Department of Forestry and Outdoor Recreation; Chairman, Institute for the Study of Outdoor Recreation and Tourism; and Assistant Dean, College of Natural Resources, Utah State University.

Pinyon Juniper Symposium

— Now in Print

Over 75,000 square miles of the southwestern United States are dominated by pinyon pines and juniper. Although many researchers have worked on the management of this type of woodland, their efforts have been fragmentary and unsystematic.

Fred Gifford and Fee Busby, themselves workers in pinyon-juniper woodland research, decided to remedy this situation by organizing a symposium synthesizing as much of the current knowledge on pinyon-juniper as possible. The symposium, a rousing success, was held in the College of Natural Resources at USU in May of this year.

The papers read at this symposium, 18 in all, have been published by the Agricultural Experiment Station and the College of Natural Resources and are available for \$10.00. The title of the collection is THE PINYON-JUNIPER ECOSYSTEM: A SYMPOSIUM. A list of papers included in the book follow:

Pinyon Pines and Junipers of the Southwestern Woodlands. Ronald M. Lanner, Associate Professor, Department of Forestry and Outdoor Recreation, College of Natural Resources, Utah State University, Logan, Utah

Present and Future Multiple Use Demands on the Pinyon-Juniper Type. Warren P. Clary, Principal Plant Ecologist, Rocky Mountain Forest and Range Experiment Station, Flagstaff, Arizona

Autecology of Pinyon-Juniper Species of the Great Basin and Colorado Plateau. Paul T. Tueller, Professor of Range Ecology, and James E. Clark, Graduate Student, University of Nevada, Reno, Nevada

Basic Synecological Relationships in Juniper-Pinyon Woodlands. Neil E. West, Associate Professor, Kenneth H. Rea, Graduate Student, and Robin J. Tausch, Graduate Student, Department of Range Science, College of Natural Resources, Utah State University, Logan, Utah

Native Faunal Relationships within the Pinyon-Juniper Ecosystem. Neil C. Frischknecht, USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah

Pinyon-Juniper Woodland Manipulation with Mechanical Methods. Richard S. Aro, Ecologist, Ecology Consultants, Inc. Ft. Collins, Colorado

Some Aspects in the Biological Control of Juniper and Pinyon. Richard Stevens, Bruce C. Giunta, Wildlife Resources Biologists, Utah Division of Wildlife Resources, Great Basin Experimental Area, Ephraim, Utah, and A. Perry Plummer, Range Scientist and Project Scientist and Project Leader, USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah

The Role of Herbicides in Man-

agement of Pinyon-Juniper Woodlands. Raymond A. Evans, Richard E. Eckert, Jr., and James A. Young, Range Scientists, ARS, US Department of Agriculture, University of Nevada Renewable Resources Center, 920 Valley Road, Reno, Nevada

Use of Fire in Manipulation of the Pinyon-Juniper Ecosystem. Wilbert H. Blackburn, Assistant Professor of Range and Watershed Management, and Allen D. Bruner, Research Associate, Renewable Natural Resources Division, University of Nevada, Reno, Nevada

Response of Livestock Forage to Manipulation of the Pinyon-Juniper Ecosystem. Don D. Dwyer, Range Science Department, Utah State University, Logan, Utah

Pinyon-Juniper Conversion: Its Impact on Mule Deer and Other Wildlife. Dr. Ted L. Terrel, De-

partment of Zoology and Entomology, Auburn University, Auburn, Alabama 36830, and J. Juan Spillett, Utah Cooperative Wildlife Research Unit, Utah State University, Logan, Utah

Pinyon-Juniper Forests: Asset or Liability. Carl M. Johnson, Associate Professor, Department of Forestry and Outdoor Recreation, Utah State University, Logan

Impacts of Pinyon-Juniper Manipulation on Watershed Values. Gerald F. Gifford, Range Science Department, Utah State University, Logan, Utah

Impacts of Pinyon-Juniper Manipulation On Recreation and Aesthetics. Richard Schreyer and Lawrence E. Royer, Assistant Professors, Department of Forestry and Outdoor Recreation, Utah State University, Logan, Utah

A Test of the Impact of Pinyon-

Juniper Chaining on Archeological Sites. Evan I. DeBloois, Dee F. Green, and Henry G. Wylie, US Forest Service Archeology Laboratory, Ogden, Utah

Pinyon-Juniper manipulation – Some Socio-Economic Considerations. John P. Workman, Assistant Professor of Range Economics and Charles R. Kienast, Graduate Research Assistant and Range Conservationist, Fishlake National Forest, Department of Range Science, Utah State University, Logan, Utah

Environmental Concerns of Pinyon-Juniper Management. Verne Huser, Environmental Communications Representative and Paul Rokich, Kennecott Copper Corporation, Salt Lake City, Utah

Management Strategies Within the Pinyon-Juniper Ecosystem. William D. Hurst, Regional Forester, Southwestern Region Forest Service, USDA, Albuquerque, New Mexico

1975 Yearbook of Agriculture

Contributions to consumers made by the nation's state agricultural experiment stations — ranging from the discovery of vitamins to the creation of hybrid corn — are featured in the 1975 Yearbook of Agriculture, *THAT WE MAY EAT*, published in November of this year.

Consumers, students, and the general public will find this an easy book to read. It will give them an insight into the fascinating search for ways to help increase food and fiber supplies and provide a better life for consumers.

As a striking example of the

payoff from agricultural research, Secretary of Agriculture Earl L. Butz in his foreword to the Yearbook cites the development of a vaccine to keep poultry healthy and add to consumer meat supplies. He notes that the estimated worldwide economic value of just this one piece of research on Newcastle Disease, at the Virginia Agricultural Experiment Station, is \$1 billion.

"You are directly helped in many ways by agricultural research," the Secretary writes. "The experiment stations had a hand in developing today's meaty, tasty, economical chicken. Their research made pos-

sible the fried chicken that you eat at the neighborhood fast-food establishments."

Experiment stations "controlled hog cholera which used to destroy millions of pounds of pork each year," Secretary Butz' foreword continues. "They curbed the wheat rust epidemics that threatened to wipe out wheat — and bread.

"They devised new ways to irrigate dry parts of the country so that we could have larger, more economical supplies of food and fibers . . .

"Agricultural scientists even discovered dicumarol to control blood

clots in humans, streptomycin to treat TB and other diseases, and they discovered the significance of amino acids in your diets.

“Scientists also played a star role in stopping the corn blight of 1970 — the most destructive disease ever to hit corn. It killed off 15 percent of our huge corn crop that year . . .

“The miracles are so commonplace we can’t report them all!”

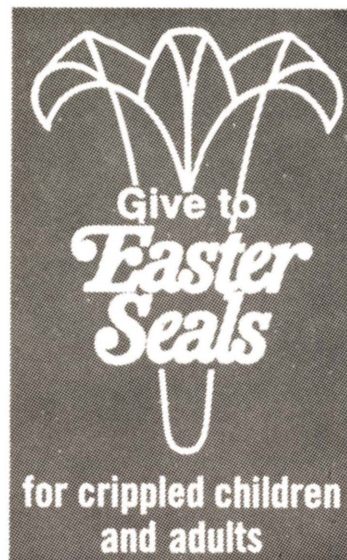
A copy of *THAT WE MAY EAT*, the 1975 Yearbook of Agriculture, may be obtained for \$7.30 at government bookstores or by mailing a check or money order payable to the Superintendent of Documents and addressed to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. In addition, each member of Congress has a limited number of copies for

free distribution to constituents.

The Agriculture Department produced the book but has no copies for public distribution or sale.

Chapter authors in the new Yearbook are from experiment stations for the most part, and so are members of the committee that planned the 400-page hardbound book. The book covers ongoing research as well as past successes. It includes a 32-page photo section in full color. Elsewhere in the book are 220 black and white photos.

D. Wynne Thorne, Utah’s Agricultural Experiment Station Director for many years and retired Vice President for Research at USU, has written a chapter on his own specialty: “A Million Gallons of Water for a Single Acre of Food.”



Utah Agricultural Experiment Station
Utah State University
Logan, Utah 84322

Doyle J. Matthews
Director

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SALT CART REVISITED

How may I obtain a copy or reprint of the picture of the old salt cart on the cover of UTAH SCIENCE, June 1975 issue?

My husband, Mr. Hopkin, built the cart years ago — no 4-wheel drive then — to take salt into the hills for the cattle. So it stands over by the corral, unused, but a priceless part of “the range” unit where house, barns, and granary stand.

I'd appreciate whatever you may be able to do to help me secure a copy of this particular picture.

Thank you,
Joye W. Hopkin
(Mrs. Samuel F. Hopkin)

Editor's note:

The salt cart photo Mrs. Hopkin refers to (see inset) was taken by John Workman, Associate Professor in USU's Department of Range Science. John sent Mrs. Hopkin a print of the photo as well as one of the old barn standing near the salt cart and

one of the wagon frame and wheels north of the barn.

As John explained in his note to Mrs. Hopkin, he took these photos while on a range tour in August 1974. The tour was sponsored by the Utah Section, Society for Range Management and held to honor Stu Hopkin. Stu had just been named “1973 Rancher of the Year” by the SRM Utah Section.

The cart, barn, and wagon frame stand on Stu Hopkin's large summer range located about 35 miles east of Morgan, Utah.

