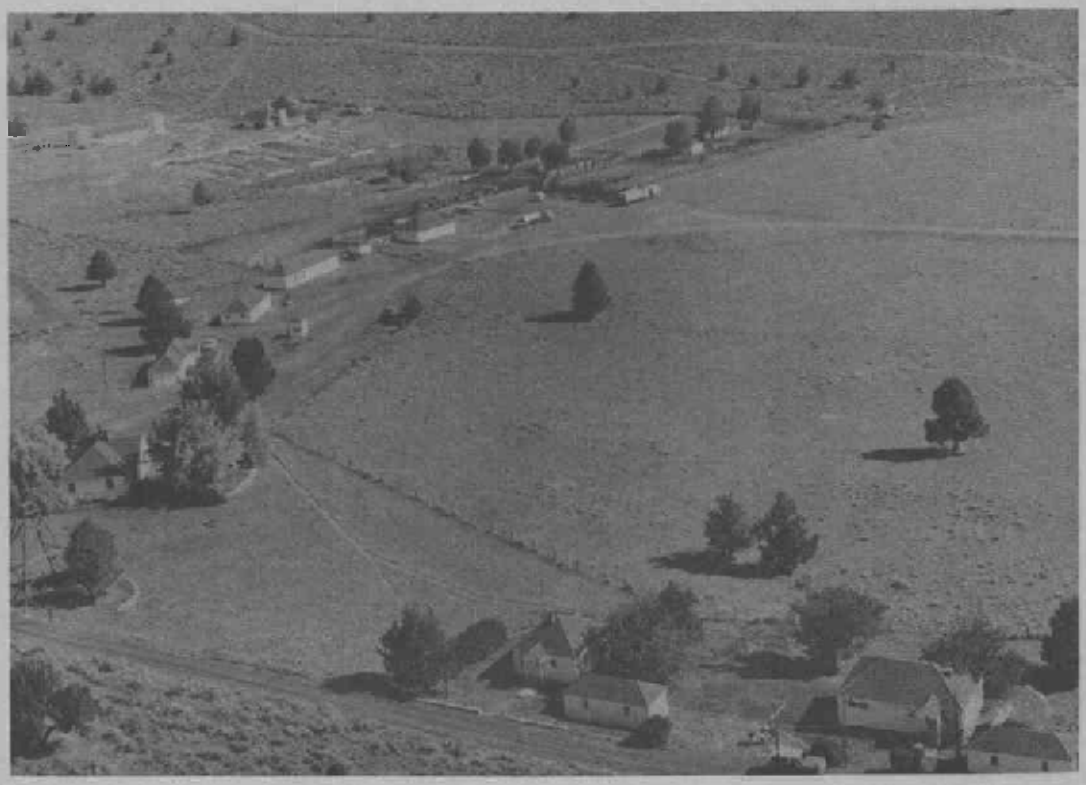
The Squaw Butte Experiment Station: Its Development, Program, and Accomplishments 1935-1969



Headquarters—Squaw Butte Range Unit

Special Report 599 September 1980
Agricultural Experiment Station
Oregon State University, Corvallis

Foreword

This report is primarily a history of the Squaw Butte Experiment Station from 1935 to 1969, a time of change and growth. This history reflects the efforts of many people to keep it alive and develop it into the station it is today. W. A. Sawyer, the superintendent from 1944 until his retirement in 1969, worked tirelessly to develop an effective research program that is today recognized throughout most of the world for its research in range improvement and range livestock nutrition and management.

In 1974, the Squaw Butte Experiment Station and the Eastern Oregon Experiment Station at Union, Oregon, were combined to make one administrative and coordinating unit named the Eastern Oregon Agricultural Research Center with headquarters at Burns, Oregon. These two stations represent the various range types of ecosystems in eastern Oregon, ranging from the desertlands to the forested rangelands and represent most of the range livestock industry in the state of Oregon. The research at the Center has a direct application to the total sagebrush-bunchgrass ecosystem as well as the forested rangelands in that system.

The Center is jointly operated and financed by the Oregon Agricultural Experiment Station of Oregon State University and the Science and Education Administration - Agricultural Research, United States Department of Agriculture. Cooperative research programs involve staff of various departments of the university and a graduate student program. Various publications and reports involving research on the station are available upon request.

Robert J. Raleigh
Superintendent & Professor
Eastern Oregon
Agricultural Research Center

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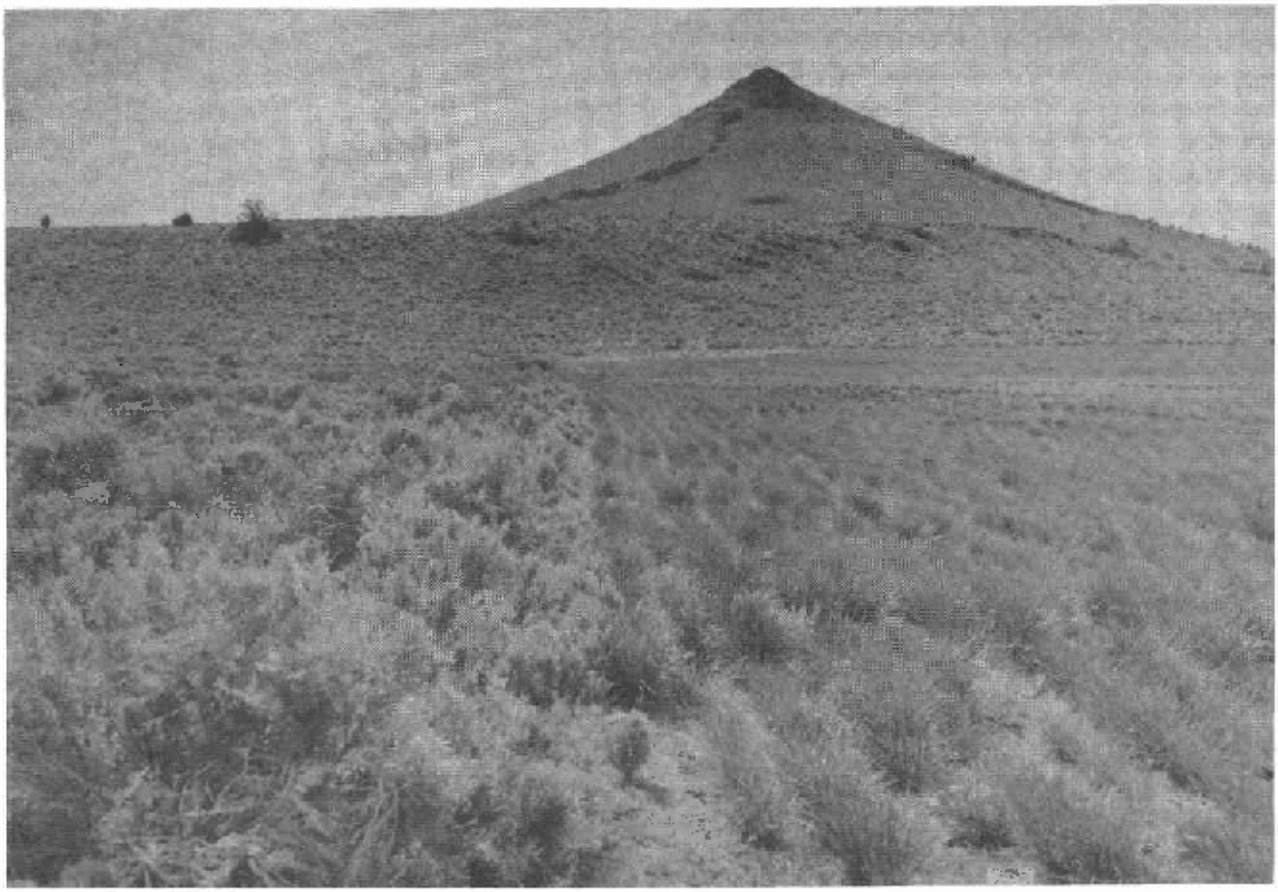
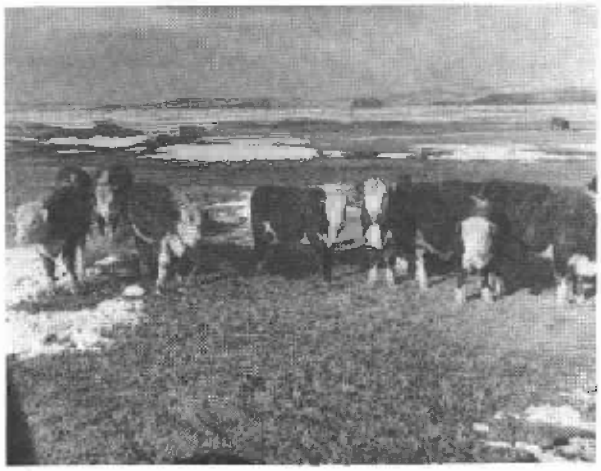
AUTHORS: W. A. Sawyer, professor emeritus of animal and range science, Oregon State University, was superintendent of Squaw Butte Experiment Station from 1944 to 1969; the late Ralph S. Besse was associate director emeritus of the Oregon Agricultural Experiment Station.



Squaw Butte in the background, crested wheatgrass planting on right, sagebrush on left in foreground.

Cattle are wintered at the Section 5 unit of the station.



Cattle grazing crested wheatgrass pasture - Squaw Butte range unit.

THE SQUAW BUTTE EXPERIMENT STATION:

ITS DEVELOPMENT, PROGRAM, AND ACCOMPLISHMENTS

1935 to 1969

W. A. Sawyer and Ralph S. Besse

INTRODUCTION

A brief review of the historical background and sequence of events is essential to understanding the history and program accomplishments of Squaw Butte Experiment Station research. The first section of this report relates a bit of history and philosophy to the evolution of what became the Squaw Butte Station.

Beyond this first section the reader will find a more detailed discussion of the development and research accomplishment of each time period and/or program identity that is now the Squaw Butte Experiment Station.

Research began on the Harney Branch Station in 1912. The Squaw Butte Range Livestock Station came into being in the late fall of 1935. In 1948, the Section 5 meadow unit was purchased and became the winter base for the Squaw Butte cattle herd. In 1944, Squaw Butte and Harney Branch were combined to become the Squaw Butte Harney Range and Livestock Experiment Station. In 1954, the old Harney Branch land unit was abandoned and the Section 5 meadow and the Squaw Butte Range became the Squaw Butte Experiment Station.

THE ORIGIN OF THE STATION

When beef cattle were moved into southeastern Oregon in the 1860s, forage on the range lands and the marsh meadows was generally free for the taking. Over a period of 50 to 60 years, the appearance of the area gradually changed from a sagebrush-grass aspect to one of sagebrush. Drought, rodents, big game, horses, cattle, and sheep were all factors in the increase of brush and gradual decline of grass. Another factor in the decline of range production was the plowing of thousands of acres of native range land by homesteaders.

For more than 20 years during the National Homestead era (shortly after 1900 to the late 1920s), hundreds of settlers came to Harney County to file on public lands and establish homes. There were then millions of acres of sagebrush-covered dry land in southeastern Oregon available for homesteading. Areas like Harney, Catlow, Wildhorse, and Stinkingwater valleys of Harney County were completely covered with dry farm homesteads. The soils of these valleys ranged from sandy loams to heavy clays with varying degrees of salinity and alkalinity.

The settlers came with high hopes and all their belongings, but, unfortunately, with very limited information concerning the rigors of producing crops and making a living in a semi-arid area (10 to 12 inches annual precipitation) where the growing seasons averaged 65 days between killing frosts. Many were without previous farm experience and had little capital to tide them over the rather long period required to become established.

By 1911, many homesteaders were in financial trouble. Some had already abandoned their places and moved elsewhere. The deserted shacks, broken-down machinery, and dust from the cultivated areas were mute evidence of the blighted hopes and disappointments.

The problems faced by the homesteaders who remained on their land pointed clearly to the urgent need for technical guidance in what and how to grow crops under the prevailing conditions.

Branch Experiment Station Established

Requests made of the Oregon Legislature resulted in an appropriation of $4,000 annually (Chapter 75, Session Laws, 1911), "That in order to investigate and demonstrate the conditions under which useful plants may be grown on dry, arid, or non-irrigated lands of the State of Oregon, and to determine the kind of plants best adapted for growth on said lands, there be and is hereby established an Agricultural Experiment Station, which shall be located in Harney County, Oregon." By this act, the Harney Branch Experiment Station came into being.

Squaw Butte Range Livestock Experiment Station Established

Range livestock production continued to dominate the scene even though thousands of homesteads now occupied the valleys which had once been covered by sagebrush and grass.

In the early days, cattle were marketed at two to four years of age and were driven long distances to a railroad or a market center. About the only expense in producing cattle was the wages and food for the cowhands. In those early days, if a cow produced a calf and the calf lived to maturity, it could be marketed. If the cow did not produce a calf, maybe she would next year. Likewise, if a cow made it through the winter, one more cow could be put on grass in the spring. If she did not make it, they would just have to save another heifer to take her place.

From that early beginning, the beef cattle industry has made enormous changes. An annual calf crop of 30 to 50 percent and a two-year-old steer weighing under 700 pounds were normal in the early day beef cattle business. This is in contrast with the now attainable goal of a calf crop of about 90 percent and a yearling steer being marketed at 700 pounds.

The federal Taylor Grazing Act, which brought all public domain lands of the West under controlled management for the purpose of stabilizing the livestock industry and improving the range, was passed in 1934. It soon became apparent that much research was needed to accomplish the purposes of the grazing act.

The Oregon Legislature concurred in the need of more research on range and livestock problems, and under Chapter 26, Oregon Laws 1935, enacted legislation "To provide for the purchase of livestock and other capital outlays to be used in establishing a range and livestock experiment station near Burns, Oregon, in cooperation with the United States Department of Interior and to appropriate any money therefor."

The advent of the Grazing Service created by the Taylor Grazing Act, the increase of land values, and the development of a market for grain-fed young beef, began to change beef cattle ranching by the early 1940s. There was no longer a ready market for a three-year-old steer. If a rancher was going to buy and use modern machinery and keep up with the developments of the time, he had to produce more beef at a greater return. Cattlemen began to winter their stock better, thereby placing more production demand on their meadows.

Winter Quarters Developed at Section 5 Meadow Station

Native flood-irrigated meadows in southeastern Oregon provide the winter feed for about 90 percent of the range livestock produced in the area. With only minor modifications, these meadows are about the same as they were when white men first settled this part of the west. The meadows primaily contain rush, sedge, and grasses tolerant to water alkali.

The meadows have been continuously cut for hay since the 1880s. Before this station was established, no meadow development had been done except to further extend or distribute the flood irrigation water. The yield of meadow hay is quite erratic between years and is dependent upon the duration and depth of wild-flood irrigation. Meadow hay quality is considered to be low. The ease and relatively low cost of production of native meadow hay are major assets in the livestock economy of the area. Conversion of native meadowlands to the production of improved tame meadows or alfalfa is costly and difficult without water storage, a drainage system, and a water distribution system.

In 1938, Harney County ranchers working with the county agent pointed out the need for research on native meadow improvement. They also recognized the need for methods of increasing the return from livestock wintering on meadow hay. These were expressed in the Harney County Agricultural Outlook and Planning Conference Report of 1938. The Section 5 meadow unit of the Squaw Butte Experiment Station had its beginning with a survey conducted in the summer of 1940 when a site for the meadow unit of the station was located.

Up to 1955, Harney Branch, Squaw Butte and Section 5 had been operating as a single unit by mutual agreement between Oregon State University and the U.S. Department of Interior's Bureau of Land Management. This operation was formalized by a cooperative agreement and a memorandum of understanding to the cooperative agreement drawn up as a working document without real legal authority. State Legislative action in 1955 legalized the operation of the various land units as one.

The Legislature of the State of Oregon, by enacting statutes 567, 405, 410, 430, and 435 in 1955, approved the inclusion of the Section 5 unit to the Squaw Butte and Harney stations. This action also authorized cooperation with other branches of county, state, and federal government and with individuals in the conduct of research. The development of Section 5 was legalized by statute, and the Oregon Agricultural Experiment Station was given authority to make other changes as needed. Thus, legislative authority was given to developments and changes that had been taking place over a number of years.

THE HARNEY EXPERIMENT STATION, 1911 TO 1954

In 1911, Harney County purchased a tract of 186.6 acres six miles east of Burns and assigned it to the state for as long as it was used to conduct agricultural research. The soil on the lang selected was thought to be mostly typical of the soils in the four major valleys of the county and, therefore, the results would apply to the entire area.

The land was cleared of sagebrush with a 24-foot-long timber (12 X 12 inches) shod with iron and pulled by a six-horse team. Two planks were attached to the timber to drag behind and prevent the timber from turning over. By dragging the timber first in one direction and then the opposite, most of the brush was pulled up or broken off and raked into windrows and burned. The brush clearing cost about $2 per acre.

Plowing of the cleared land began about the first of November 1911. Before the ground froze for the winter, about 100 acres were plowed 10 inches deep with a disc plow pulled by an eight-horse team. In the spring of 1912, peeled juniper fence posts were set in place to enclose the experimental tract of land. Rabbit-proof wire fencing was ordered but could not be delivered from Bend until July because of muddy roads. The fence was put up as soon as it was delivered, but by this time the rabbits had already done considerable damage to experimental crops. Several hundred rabbits remained with the new enclosure, requiring extensive procedures to exterminate them. Without excluding the rabbits, experimental work was impossible. The farmers also were faced with the cost of rabbit tight fences before they could grow any crops.

Buildings and Equipment

The buildings, constructed by the county, consisted of a residence, mess house, barn and seed room, machine shed, wood house, cellar , and well. Construction was completed in June 1912 at a cost of about $9,000. The cost was high because all building materials, except lumber, had to be shipped in via railroad from Portland to Vale, Oregon, 130 miles away, and hauled from Vale to the Station by team and wagon. The county retained ownership of the land and buildings. All laboratory equipment and farm machinery essential to research and practical field operations were purchased by the Oregon Agricultural College.

Technical Positions and Personnel

The following technical personnel contributed directly to the initiation of a broad effective research program:

Name	Position	Dates
L. R. Breithaupt	Superintendent	1911 - Feb. 1918
J. R. Fleming	Asst. Supt. and Asst. Co. Agric. Agent	Jan. 1914 - June 1914
Obil Shattuck	Asst. Supt.	June 1914 - Jan. 1915
John H. Martin	Superintendent	Jan. 1915 - April 1918
Obil Shattuck	Superintendent	Feb. 1919 - Oct. 1943
Oby E. Hutchinson	Asst. Supt.	July 1925 - Sept. 1926
Roy E. Hutchinson	Asst. Supt.	March 1927 - 1942
Eber Eldred	Asst. Supt.	Sept. 1943 - Jan. 1944

The station had the benefit of counsel and direct technical assistance of scientists in related departments at Oregon Agricultural College. The Division of Cereal Investigations of the Bureau of Plant Industry, United States Department of Agriculture, under an agreement with the Oregon Agricultural Experiment Station, cooperated in the early phases of the research program with cereal crops. This assistance and the additional technical skills aided in the development of a broader research program.

Problems, Projects, and Progress

The Harney Experiment Station was established in 1911 to determine what crops were adapted to the high desert country under dryland conditions and to find the most suitable methods of producing those crops. During the years of its operation the station's program consisted of three distinct phases: dryland farming research, pump irrigation research, and livestock and feed production (as part of the Squaw Butte Experiment Station).

Research on Dryland Farming

In its search for adapted crop varieties under a dryland summer-fallow system of farming, the station tested hundreds of varieties of wheat, oats, barley, rye, flax, field peas, alfalfa, clover, sunflowers, and root crops. Those found most suitable were selected and grown in the area.

Extensive investigations were made to measure the effect of fertilizers, crop rotation, and cultural practices on these crops. The results of these investigations guided homesteaders in what to do and what not to do in producing crops on dryland, thereby enabling them to avoid unsatisfactory varieties and methods. Ladak alfalfa, Federation wheat, Markton oats, Trebi and Hancheon barley, Early Rose potatoes, and Canadian field peas were found most suitable to the area. The station became a source of improved seed of recommended varieties.

Summer fallow was recommended as a standard dry farm practice. Planting dates, rates of seeding, rotation practices, fertilizer use, harvesting methods, and quality control were determined for the dryland farmers.

Many specialty crops such as sunflower, kale, sugar beets, carrots, and flax were tested. None of these offered hope for dry farm crops.

Although the results of the investigations under the dryland farming conditions on the station were significant, the homesteaders continued to move out, creating a serious economic impact on the county and the whole southeastern area of the state. This adverse situation caused the Experiment Station to shift its emphasis from research on dryland farming to that of irrigation farming. Dry farming studies were continued though with decreasing emphasis.

Deep Well Pump Irrigation Investigated

Limited irrigation was started in 1916 by using water from the domestic well near the station residence. Even this restricted irrigation caused a marked increase in yields. Because of this, in 1917 the station drilled an 8-inch well 218 feet deep in a convenient location in the experimental area. The well yielded 325 gallons of water per minute. The total cost of the well and its equipment, with the exception of power for pumping was $824.32. The engine used for pumping had previously been used for grain threshing.

The new well permitted the station to greatly expand its research into all aspects of pump irrigation farming. The investigations demonstrated the application of pump irrigation on 80 acres of land handled on a regular farm operation basis. This included the determination of the cost of installation, land leveling, water distribution, and crop production.

Research indicated that most of the major crops that had been tested under dry farming conditions would produce good yields under irrigation, and it was found that many of these crops could be grown with supplemental or limited irrigation. The economics of production was such that farmers did not develop irrigation programs. They continued to abandon their farms and move away.

Consolidation with Squaw Butte Range Livestock Station

The Experiment Station again shifted its research emphasis, this time from that of irrigated cash-crop farming to that of the livestock economy of southeastern Oregon. The crops research work was terminated in 1944. The facilities, budget, and supervision of the Harney Experiment Station were combined with Squaw Butte to form a single operating unit with the objective of working on all aspects of beef cattle production including range and winter forage.

Recognition of the need for cooperation between the Harney Experiment Station and the new Squaw Butte Range Station (discussed later) was spelled out in a memorandum April 16, 1936. The desirability of a combined research program, showing the objectives of the research and the responsibilities of the personnel in charge, was contained in a memorandum in the spring of 1937. Also, the Harney County Economic Outlook and Planning Conference and the Harney County Land-Use Committee recommended that the Harney Station should include in its program research on flood-irrigated meadows, the improvement of quantity and quality of hay, and the efficient utilization of meadow hay and cropland or aftermath pasture.

Although the objectives of the desired research program with respect to the livestock economy were never fully realized prior to consolidation, the Harney Station did serve jointly with the Squaw Butte Station from 1937 to 1943 in utilizing its facilities for producing alfalfa hay and in wintering and fattening cattle owned by the livestock station.

Personnel of the Harney Station had also established off-station trials beginning in 1939 on native meadows on the Bell-A and the O. D. Hotchkiss ranches, but these experiments were too limited in scope to meet the needs of the producers.

Harney Station Closed in 1954

Even under consolidation it was found that the Harney Experiment Station could not adequately contribute to research on off-station problems dealing with native meadows and livestock production. In the belief that the funds available could be better utilized by concentrating the research on the facilities of the Squaw Butte Station, the Harney Station was closed in 1954 and the land was returned to Harney County.

Publications

The work on the Harney Experiment Station produced nine publications reporting on: (a) crop varieties and farming practices for dryland production, (b) crop varieties, practices, and economics of pump irrigation, and (c) engineering and mechanical problems in developing a pump irrigation program.

THE SQUAW BUTTE EXPERIMENT STATION RANGE UNIT

In 1934, a committee of beef cattle operators, representatives from Oregon State University and representatives from the U.S. Department of Interior was formed to locate a site for a grazing experiment station and to take steps to activate a grazing-land research program. Members of this committee were E. L. (Dad) Potter and R. G. Johnson, Animal Science Department, Oregon State University; D. E. Richards, superintendent of Union Experiment Station; J. C. Cecil, Harney County rancher; Jim Jones, Malheur County rancher and banker, and representatives of the Grazing Service, U.S. Department of Interior.

An interesting and humorous (though factual) sidelight is that the committee was made up of beef cattle producers and public officials (no sheepmen) and the site chosen for the station was a sheepman's range.

Typical Rangeland Selected and Livestock Purchased

Twenty-five square miles of sagebrush-bunchgrass range with the picturesque Squaw Butte located in its approximate center was chosen for the station. This area was determined to be quite similar to about 60 million acres of public domain grazing lands in southeastern Oregon, southern Idaho, northern Nevada, and northeastern California and with some degree of similarity to about 110 million acres of public domain lands in the 11 western states.

The Squaw Butte range unit of the station was to be owned by the federal government and operated with both federal and state funds and was determined to be a regional experiment station rather than an Oregon Agricultural Experiment Station.

In the winter of 1935, the Civilian Conservation Corps began development of fences, buildings, and other facilities. The contruction work continued into the winter of 1941.

Livestock was purchased in the fall of 1936, 1937, and part of 1938. The original plan called for a combination of range, sheep, and beef cattle research. Sheep were purchased in the fall of 1936, but the sheep program was abandoned in 1939 because of the cost of the sheep operation and the fact that the Squaw Butte facilities could be used for sheep only during late April, May, and most of June. The sheep had to be grazed or wintered wherever feed could be purchased for the rest of the year, and this was not conducive to a sound sheep research program.

Squaw Butte Operated by Several Agencies

The range unit was under the direction of the Grazing Service of the U.S. Department of the Interior from 1935 to June 30, 1946; Oregon State University, July 1 to August 15, 1946; Forest and Range Experiment Station of the Forest Service, U.S. Department of Agriculture, August 16 to October 9, 1946; Bureau of Land Management, U.S. Department of the Interior, October 10, 1946 to June 30, 1956; and the Agriculture Research Service of the U.S. Department of Agriculture, July 1, 1956 to date. Except for the period of July 1 to August 15, 1946, when Oregon State University was operator of the range unit, the research has been a co-operative endeavor between the University and the various federal departments listed.

Research Facilities and Physical Plant at the Range Unit

The Civilian Conservation Corps at Squaw Butte built most of the present facilities at Squaw Butte. The range unit contains 16,830.8 acres of land, including 960 acres leased from the Oregon State Land Board by the Grazing Service of the U.S. Department of Interior, and 1,280 acres leased from Harney County by Oregon State University. The balance is federal land withdrawn from the public land reserve for experimental purposes.

There are now 30 fenced fields within the confines of the Squaw Butte range, varying in size from a few acres to as much as 2,100 acres. These fields are enclosed with more than 70 miles of fence, more than 60 miles built by the Civilian Conservation Corps. About 50 miles of range road have been constructed on the station. At least 20 miles of this was built in the last few years to permit hauling water to the various pastures.

As of 1969, sagebrush has been killed by spraying with 2,4-D on about 1,200 acres of crested wheatgrass and 4,000 acres of range. The balance of the area is still in its native state.

Squaw Butte has 27 buildings: four residences, one duplex apartment building, an office and laboratory building, a shop, a barn, and numerous utility and storage buildings.

The land, real property improvements, equipment, and supplies owned and provided by the Agricultural Research Service of the U.S. Department of Agriculture have a value approaching one-half million dollars, assuming a value of $10 per acre for land. An individual could not buy range land of this quality for $10 per acre now.

Office Facilities

Prior to January 15, 1944, the superintendent of the Squaw Butte range lived and made his headquarters at Squaw Butte, 42 miles west of Burns, and the superintendent of the Harney Experiment Station lived and made his headquarters at the Harney Station, 6 miles east of Burns. When the two stations were combined into a single operating unit and one superintendent was placed in charge of the entire operation, it was decided that the superintendent should live in Burns and the station office should be there. Office headquarters were set up in the Post Office Building and presently consist of six rooms for clerical and staff personnel, one room for a library and conference room and a basement storage room. Having research personnel in Burns necessitates a great deal of travel to the land units of the station, but probably has contributed very much to the productivity of the staff. Well-equipped offices with adequate clerical personnel would have been much more difficult to obtain if the offices had been located at either the Squaw Butte range or the winter quarters.

Personnel of the Squaw Butte Experiment Station Prior to Consolidation With the Harney Station

Name	Position	Dates
R. G. Johnson	Superintendent	Fall 1936 - July 1939
K. B. Platt	Superintendent	July 1939 - June 1941
R. G. Johnson	Livestock Superintendent	July 1939 - Sept. 1941
Bob Frichtel	Range Examiner	July 1939 - May 1941
K. C. Ikler	Superintendent	Sept. 1941 - Dec. 1943
Art Holmgren	Range Examiner	June 1941
J. B. Price	Range Examiner	Jan. 1942 - Jan. 1943
William Peek	Range Examiner	June 1942 - Jan. 1943
A. J. Singley	Range Examiner	Sept. 1943 - Jan. 1944

Personnel of the Consolidated Squaw Butte-Harney Experiment Station

Name	Position	Dates
W. A. Sawyer	Superintendent	Jan. 1944 - June 1969
A. J. Singley	Range Examiner	Jan. 1944 - July 1946
Eber Eldred	Assistant Superintendent	Jan. 1944 - July 1944
Milo Demming	Range Examiner	Sept. 1946 - 1949
N. Tamadge Nelson	Range Examiner	March 1948 - April 1949
Donald N. Hyder	Range Research	Aug. 1949 - Aug. 1961
Farris Hubbert	Livestock Research	April 1950 - March 1954
Elmer Sniff	Range Research	May 1950 - Dec. 1950
Clee S. Cooper	Agronomy Research	Jan. 1951 - Jan. 1958

Personnel of the Consolidated Squaw Butte-Harney Experiment Station (cont.)

Name	Position	Dates
Forrest A. Sneva	Range Research	April 1952 - To date
Warren F. Brannon	Livestock Research	Sept. 1954 - March 1956
Robert R. Wheeler	Livestock Research	Jan. 1955 - Sept. 1958
Farris Hubbert	Livestock Research	July 1957 - Sept. 1959
C. B. Rumburg	Agronomy Research	July 1958 - To date
Joe Wallace	Livestock Research	Nov. 1958 - Sept. 1966
(on sabbatical leave August 1966 to date)		
Robert J. Raleigh	Livestock Research	Feb. 1960 - To date
Ralph Phillips	Livestock Research	July 1966 - To date
(on military leave Sept. 1966 to date)		
Harley A. Turner	Livestock Research	Oct. 1966 - To date

Research Program Developed

From 1936 to 1938, a detailed forage inventory was made on the station range land and an outline of proposed studies was developed. In general, the plan provided for operating the range unit of the Squaw Butte Station in a manner similar to the operation of a livestock ranch. Careful records were kept with the belief that range and livestock industry problems could be solved without controlled experimentation.

During the early years, many good foundation data were accumulated, but major accomplishments did not meet expectations. As a result, several times during the period ending in 1948 serious consideration was given to closing the Squaw Butte Station. This sentiment was intensified by the shifting of the federal interest in the station in which personnel, policies, and bureaus were frequently changed. On July 1, 1956, federal interest in the station, including the land and all facilities, was turned over to the Agricultural Research Service of the U.S. Department of Agriculture, which has maintained control of the federal facilities since.

Broader Program of Research Devised

Financing of research and operation of the station was critically short after the Civilian Conservation Corps camp was closed. Not until 1948 did finances improve to the point where plans could begin to be activated. The first man trained as a research scientist was employed in the summer of 1949. This marked the beginning of an era in planned and controlled experimentation.

Various cooperative agreements were drawn up and amended to legalize and make possible the cooperation of Oregon State University and the Federal Bureau in operating the Squaw Butte Station.

Likewise, these agreements from time to time provided for coordination of the Harney Experiment Station and the Squaw Butte Station in a joint program with the Harney Station to serve as the base property and winter base for the

livestock herd. Prior to 1944, the two station units were operated separately, under separate supervision, and cooperative endeavor in research and operation was never fully realized.

Programs and Facilities Consolidated

In January 1944, a complete change in the operating policy of the station was initiated, which permitted a single superintendent to have complete charge of all land units, coordination of research programs, budgeting, and operation. His salary was paid jointly by the federal bureau concerned and Oregon State University. The superintendent was given the responsibility of employing both state and federal personnel with the approval of both agencies to whom he was responsible. This change in policy set the stage for developments and progress which had to await better financing in 1948 to gain momentum.

Service Area of the Station

The Squaw Butte Experiment Station has a defined service area having similar conditions to those on the station. This includes southeastern Oregon, southern Idaho, northern Nevada, and northeastern California. Results of work at the station may be applicable over the entire sagebrush-bunchgrass range country. Some of the research is applicable wherever cattle are produced and where pasturage, range, forage, or hay is grown.

Range Research at Squaw Butte

When the Squaw Butte Experiment Station came into being in 1935, beef cattle production in southeastern Oregon had progressed only to the extent that the annual calf crop was 50 to 55 percent and a yearling steer weighed about 500 pounds. The Experiment Station cannot take all the credit for the changes that have taken place since 1935. The station can, however, take credit for providing information that contributed substantially to every major advance of the industry during the last 30 years. These advances and resulting economic gains came through the use of information obtained from controlled experimentation.

The following are some of the more important contributions of the station to the beef cattle industry of southeastern Oregon.

Range improvement. The physical improvements and changes in practice on the Squaw Butte range have almost doubled the AUM's (animal unit months) of feed produced. In 1937, the survey showed the availability of 1,230 AUM's. Seeding 1,200 acres of crested wheatgrass added 250 AUM's. The control of sagebrush on 4,000 acres added 650 more, and the delayed turnout of cattle and water hauling provided 220 additional AUM's. The estimated AUM's at the present time (1969) are 2,350.

Imbalance between livestock and range forage. By the early 1930s, livestock producers became aware of the gradual deterioration of the range. They were also aware of the problems of obtaining satisfactory results with controlled grazing alone. In studying the broad problem of range improvement, the Experiment Station found that the number of livestock and the available range forage supply were out of balance. It was also found that the heavy early spring grazing deterred range improvement. This pointed out the necessity of more intensive research on the broad problems of range production, range use, and range management.

Water hauling reduces areas of overgrazing and undergrazing. Overuse of the range near water holes and underuse as the distance from water increases is a well-known fact. Station studies of water hauling to portable troughs, that could be moved easily, has shown that all the range area was equally grazed when water was available. Improved water distribution is estimated to have had the effect of increasing the size of the station's range by 35 percent because of additional feed being made available to the cattle.

Stocking adjusted to forage supply. The station found that maintaining a sizable reserve of hay permits flexibility in the length of the range grazing season. This reserve permitted turning out the cattle as late as May 10 in 1951 and bringing them back as early as September 11 in 1961. This flexibility cushions the problems created by adverse weather conditions and by major variations in forage growth. This is especially important in a cow-calf operation.

Increased forage by sagebrush control. The control of sagebrush, rabbitbrush, and selective control in bitterbrush by aerial spraying with 2,4-D on about 4,000 acres of the station land provided a threefold increase of forage production. This added about 650 AUM's of forage to the station feed supply. Other methods of controlling the sagebrush proved to be either ineffective or too costly.

The 4,000 acres of sagebrush-cleared land grew forage that produced 15 pounds of beef per acre, whereas the same land before sagebrush clearing produced only 5 pounds per acre. This effective method of controlling sagebrush has already been used on nearly one-half million acres in Oregon and could be used on six million or more acres.

Effective procedures for seeding range-type land. Experiments proved the necessity of properly placing the seed in a firm seedbed to obtain higher germination and quicker establishment. In cooperation with the OSU Department of Agricultural Engineering, a press-wheel seeder was developed that proved to be effective in seeding dry, fluffy seedbed areas. Although the press-wheel seeder machine is not being used extensively now, the overall research of the station has resulted in much better seeding practices, making seeding failures an exception rather than the rule.

Importance and practicability of crested wheatgrass. The station found that established crested wheatgrass, depending upon brush density and degree of range deterioration, produces 5 to 40 times more forage than the native state. It proved this grass can be grazed heavily in the spring without loss of stand, which makes it ideal for reducing the detrimental effect of early spring grazing of native grasses

Tests showed crested wheatgrass to be palatable and to produce beef cattle gains equal to native grass. It was found that crested wheatgrass must be grazed heavily enough to prevent accumulation of old growth.

These findings have generally changed the opinion regarding the value of crested wheatgrass and its method of use and management over the last 10 years. The Experiment Station has recommended that every livestock operator should have not less than 5 percent of his total range area in crested wheatgrass. It is estimated that this grass could be produced on more than three million acres in southeastern Oregon.

Poisonous weeds controlled. Effective methods of controlling poison larkspur and death camas with 2,4-D have been worked out at the Experiment Station. These plants have caused heavy death lossed in livestock and adversely affect grazing management. This achievement has saved the livestock industry many thousands of dollars annually.

Forage yields calculated. The station has developed a relatively simple method of using precipitation records to calculate the yield of range forage. This is not only a valuable research tool but is also of importance in predicting the livestock-carrying capacity of range early in the season for purposes of calculating the number of animals and days or months of use on range at the beginning of the grazing season. The procedure is also valuable in making range improvement and management decisions.

WINTER QUARTERS UNIT (SECTION 5)

The winter quarters of the Squaw Butte Experiment Station came into being, as a necessity, to provide winter feed and a base for the range livestock owned by Oregon State University and summered on the Squaw Butte range. In the fall of 1936, when cattle were first purchased for use at Squaw Butte, the herd was wintered wherever meadowland and hay could be leased or purchased. Most of the cattle herd was wintered on lands leased from Malheur Wildlife Refuge in the Buena Vista area from 1936 to 1941. During the summer of 1940, the superintendent of the Harney Experiment Station, the Harney County Extension Agent, and representatives from Oregon State University made extensive surveys of possible locations for a meadowland experimental winter quarters area in the vicinity of Burns.

Meadowland Acquired for Winter Quarters

As a result of this survey, the land known as Section 5, owned by the William Hanley Company, was leased effective June 1, 1941, for 10 years with an option to buy at or before the expiration of the lease. The lease provided that $1,200 annually would be paid with $600 to apply to the purchase of the land at $40 per acre if the option were taken up. The lease agreement and option covered approximately 560 acres of Section 5, including all the section lying south of the Union Pacific railroad right-of-way.

A detailed study of the botanical composition of the meadows of the station winter quarters was made by Dr. LeRoy Hansen of Oregon State University in the summer of 1942. He identified 79 species of plants -- 12 grasses, 10 were rush and sedge species, 11 were clovers, and 46 were weeds or forbs.

This meadow area was determined to be somewhat typical of about one million acres of flood meadow in southeastern Oregon, northern Nevada, northeastern California, and southern Idaho.

In the fall and winter of 1941, the Civilian Conservation Corps at Squaw Butte built enough facilities at Section 5 to permit livestock on the land that winter. From 1941 to 1948, real property improvements including buildings, fences, and stock water wells were made by the University at an estimated cost of $12,600. These improvements were necessary for the proper handling of livestock, and harvesting and handling of hay, and carrying out a limited experimental program.

In the spring of 1948, the option to buy, as provided in the lease with the William Hanley Company, was taken. It was also decided to purchase that portion of Section 5 lying north of the Union Pacific Railroad right-of-way, making a total of 661 acres to be purchased at $40 per acre for a total cost of $26,440. Deducted was $4,200 because of the annual lease credit to the purchase price provided in the option. The purchase agreement was consummated July 23, 1948, with $4,240 of accrued station funds from the sale of livestock applied on the purchase price. Eighteen thousand dollars was borrowed from the State Board of Higher Education with an agreement that the Squaw Butte Experiment Station would repay these funds, with interest, at the rate of $2,000 per year from receipts from livestock sales. The obligation with the State Board of Higher Education was met on schedule and the note was paid off on June 30, 1957.

Beginning in 1948, buildings and facilities were improved to permit a more comprehensive and detailed program of livestock management and nutrition research, and to increase the program of meadow improvement and management research.

Research Facilities and Physical Plant

Section 5, containing 661 acres, had two fenced fields when the Experiment Station acquired the land. No other improvements had been made on the land in 1941. Section 5 now (1969) contains 12 fenced fields, varying in size from about 10 acres to more than 100 acres. These fields include one 60-acre field recently developed for drainage and controlled irrigation experimental work. The rest of the land at Section 5 is in native meadow.

The fields are enclosed with more than 11 miles of fence, with all but two miles of the fence built or rebuilt since the station acquired the land. There are now 28 buildings, including 3 residences, a modern well-equipped laboratory, a cattle feeding and feed storage barn with a capacity of 64 head of animals on individual feeding experiments, and numerous storage and utility buildings. The buildings also include 8 sheds over feed bunks which provide shelter in 16 of the 25 lots in the cattle feeding and handling complex. The facilities include a domestic well, two livestock water wells, and one irrigation well. Electrically heated water is piped to all but one of the fields and provides fresh water automatically for all the cattle during the winter.

The land, real property improvements, equipment, livestock, and supplies of the Squaw Butte Experiment Station have a value in excess of one-half million dollars. Of this amount, the value of the livestock runs as high as $100,000 in the summer before any cattle are marketed. The station owns 300 head of breedings cows and markets young stock as yearlings.

Meadow Improvement Research

The staff of the Squaw Butte Experiment Station decided that of first importance was research work directed toward improving the quantity and quality of native meadow hay with the meadows still in their natural or native state. This approach was taken with the view that it would be many years before much of the native meadow area would be diverted to improve crop production.

With this as a guiding concept, important research accomplishments added to the economy of the livestock industry in the service area of the station.

Improved Quality by Changing Haying Practices

It was found that the harvested hay yield decreased by 40 percent as a result of changing the cutting height from 2 inches to 4 inches. When the cutting height was raised to 6 inches, only 21 percent as much hay was harvested as when cut at 2 inches. This emphasized the importance of slower moving speed and cutting as close to the ground as possible.

Research at Squaw Butte indicated that native meadow hay lost about 1 percent protein per week beginning the last of June. The amount of digestible protein dropped from more than 5 percent the latter part of June to about 1½ percent by the first of August. During this same period there was a drop of about 10 percent in the digestibility of gross energy in the hay.

These findings have resulted in a marked change in the haying practices of this area. The changed practices add up to many thousands of dollars in the feeding value of the hay harvested. Twenty years ago, hay harvest in Harney County began about July 1 and often was not completed until October. Now very little hay is cut after August 1.

Hay yields increased with commercial fertilizer. Research at Squaw Butte has indicated nearly all native meadows in southeastern Oregon in which some grasses are present (not straight rush or sedge) will respond to nitrogen fertilizer. In general, about $10 worth of fertilizer applied in the fall or early spring will produce about one ton additional hay worth at least $20 per ton. The station recommends that the least expensive source of nitrate (presently urea) be applied at the rate of 60 to 90 pounds per acre.

The application of phosphorus fertilizer to native meadows has increased yields and hay quality where clovers are present. Work at Squaw Butte has shown that the minor elements (zinc, sulfur, maganese, iron, boron, and copper) are in adequate supply for maximum production of native meadow hay.

Prior to 1950, no commercial fertilizers were applied to native meadows in southeastern Oregon. Now many ranchers are using fertilizers and many more will do so as the need for additional hay arises.

Tillage or renovation studies were started in the fall of 1942. The work on the meadows at Squaw Butte has shown that native meadows cannot be improved by cultivation and that the introduction of tame species without first improving water management is difficult. These findings were important and resulted in removing the practices from the docket of the ASCS program.

Storage of meadow hay does not reduce value. Hay palatability and livestock performance were not reduced as a result of feeding of hay that is two or more years old. The meadow hay must be well stacked or otherwise protected from weather. The vitamin A content of the hay decreases, but 4-year-old hay still contained enough carotene to meet the vitamin A requirements of beef cattle on the winter feed ground. Carrying a reserve supply of hay to aid in grazing management is not detrimental to winter livestock performance. This is a recommended and needed practice.

LIVESTOCK PROGRAM

Those responsible for the very early plans and policies of the Squaw Butte Experiment Station wisely decided that owning the livestock was in the interest of the objectives of the program. This permitted complete control as compared to limited control if rancher cooperators were providing the stock. Ownership of the livestock by the State of Oregon made possible the use of the money obtained from the sale of stock to supplement appropriated funds in the research and operation of the station.

Early plans for livestock studies at Squaw Butte were directed toward a typical eastern Oregon beef cattle operation. Hereford cattle were used and livestock production records kept. Some work was done on winter supplementation, mineral supplements, and management. As a result of this early work, the station has accumulated continuous production data on every dam in the herd from 1937 to date. This proved to be of immense value for studies of production factors of range cattle in later years.

History of Cattle Herd at Squaw Butte

Stocking of the station began with the purchase of 137 head of females in the fall of 1936 (70 came from Wyoming as part of the drouth relief purchase program, 50 aged cows were purchased from the U. S. Experiment Station at

Miles City, Montana, 4 head came from the Chandler Hereford Ranch at Baker, Oregon, 3 came from Oregon State University at Corvallis, and 10 from Eastern Oregon Livestock Company, Frenchglen, Oregon). In 1938, 59 head were purchased (41 from the Eastern Oregon Livestock Company, 11 from the Stearns Cattle Company at Prineville, Oregon, and 7 from the Hayes Hereford Ranch, Corvallis). This brought the total to 196 head. After 1938, no females were introduced into the herd from outside sources. In general, bulls used from 1937 through 1946 were of the Domino line from the Chandler Hereford Ranch of Baker, Oregon.

Five bull calves of the Prince line were purchased from the Crowe Hereford Ranch of Millville, California, in the fall of 1944 after the Domino bulls were disposed of. No other bloodline was used on the herd until 1967.

In 1961, bull calves were saved from the top producing cows of the Squaw Butte herd. These calves were fed and tested, and the top four to six were saved to go into service on the station.

The Prince line of cattle was of good quality and had an excellent disposition (a desirable characteristic for research animals). About 20 years of breeding to the one line produced very uniform genetic material for experimental work. The good disposition plus uniformity was thought to outweigh the possible problems brought about by inbreeding. The breeding program, using station-produced bulls, rapidly increased the coefficient of inbreeding, and by 1965, problems were developing at an accelerating rate. The closed herd breeding program began to be phased out with the use of a Lionheart bull on a selected group of the station cows in the spring of 1965.

Bulls produced from the Lionheart sire went into service in 1967. The last calves from the station cows saved as breeding bulls were from the 1967 calf crop. From then to date, bulls have been obtained from a synthetic line being developed at Oregon State based on combining lines 1, 2, and 3 of the OSU lines, and 1, 4, and 10 of the U. S. Range livestock station lines.

Two cross-breeding studies were conducted on a limited scale. One was a test of a Brahma X Hereford cross, the other a Charolais X Hereford cross. No Brahma X Hereford females were retained, and this study was terminated after two years. Charolais X Hereford females from the first cross were retained in small numbers. The major objectives of this study were completed in three years.

The present type of beef cattle research program began in 1948. Improved financing permitted construction of fences for more pastures, buildings, and the purchase of needed equipment. The first man trained to work in the field of livestock nutrition was employed in April 1950. Work prior to this clearly indicated that improved nutrition was of primary importance in improving the production of beef cattle in southeastern Oregon.

It was pointed out in the range section of this report that in 1935 a 50 to 55 percent calf crop and a 500-pound long yearling (about 16 months of age) was normal. Today an 85 percent calf crop and a 700-pound yearling at market time are commonplace. Improved nutrition, management, and breeding of beef cattle along with range and meadow improvement have made this increase possible. Beef cattle sales in southeastern Oregon have increased from about 270,000 head in 1940 to about 400,000 head in 1969. These figures include 118,500 cattle equivalent (sheep ÷ 5) of sheep in 1940 and 27,000 cattle equivalent of sheep in 1969. This calculation was made, using U.S. Department of Agriculture census figures, to allow for the conversion of sheep operations to cattle, a move that has been taking place in southeastern Oregon since the late 1930s. The increase in the number of livestock marketed, plus added market weight, has resulted in an estimated increase in beef production from about 110 million pounds in 1940 to about 240 million pounds in 1969 in the 10 southeastern Oregon counties.

The following are only a few areas of beef cattle research that have contributed substantially to the production increase:

Winter feeding of range cows improved. A study completed in 1950 indicated that station cows wintered on less than one ton of hay per head produced only a 69 percent calf crop and weaned calves at under 200 pounds, whereas, cows wintered on a full feed of hay consuming under two ton per head, during the winter, produced a calf crop of 84 percent with a weaning weight of the calves at 250 pounds. The addition of one pound of cottonseed meal and one pound of rolled barley per head per day increased the hay consumption to approximately two tons for the winter, increased the calf crop to 88 percent, and the weaning weight to nearly 300 pounds. The weaning weights were obtained at a mean age of about six months. During this study, the cows were summered on poor condition range, and they often lost nearly all of their spring and early summer gain during the fall grazing period. This early study on wintering breeding cows had a significant influence in bringing about gradual improvement in wintering practices in southeastern Oregon. Similar rations today, when coupled with range improvement and other beef cattle nutrition management improvements, produce a calf crop of about 90 percent with a 400-pound calf weight at six months of age.

Improved wintering of weaner calves. The station found that calves weaned in the fall and wintered on native meadow hay alone made some skeletal growth but gained almost no weight. Calves fed one-half pound of cottonseed meal and three pounds of barley per head per day gained about 1½ pounds per day. Gains up to 1.6 pounds per head per day during the winter did not seriously suppress the summer gain during the next summer. As winter gains went above 1.6 pounds, there was a depressing effect on summer gains on the Squaw Butte Range, sufficient to tend to reduce the economic return from the winter feeding. The feed cost per pound of gain was highest when animals were wintered on hay alone and was lowest when they were fed to gain about 1½ pounds per day.

Early weaning of range calves most profitable. The common practice in southeastern Oregon has been to wean calves in late October or during November. The station found that calves left on their dams on sagebrush-bunchgrass range made little or no gain after the first of September. Weaning calves early in September, however, and placing them in weaning lots or small fields on a good supplemental ration and good quality hay proved to be beneficial. The calves returned nearly $4 per head more above feed cost when sold as yearlings the following summer, than did a similar group of calves weaned 30 days later. Another advantage of early weaning is obtained from better weight gains and range utilization on the cows after the calves are taken off. This practice increased the return from marketing the calves and increased the lenght of time that the cows could be left on range, thereby saving on wintering cost of the cows.

Supplemental vitamin A feeding of range beef cattle not needed. It has been generally recommended that the beef cattle producer in southeastern Oregon should provide supplemental vitamin A to his beef herd to insure against vitamin A deficiency diseases and problems. About 18 years of work on vitamin A nutrition in beef cattle on the station has failed to show a need for vitamin A supplementation to cows, calves, or yearlings under good or normal feed and management practices. This work indicates that no return can be expected from feeding vitamin A supplements to range beef cattle in southeastern Oregon.

Nonprotein nitrogen substituted for cottonseed meal. The vegetable sources of protein such as cottonseed and soybean meal have been steadily increasing in price over the last several years. This trend may be expected to continue, thereby increasing the need for finding an effective substitute. Work on the station has shown that urea can be substituted for part or all the cottonseed meal, providing the energy portion of the ration is adequate. This substitution results in a feed cost saving of one to three cents per pound of gain in wintering weaner calves. Work presently in progress indicates that biuret, a urea-like compound, is less toxic and more palatable than urea and may be more safely used.

Slaughter-grade beef produced on improved native range for less cost. Through improved nutrition, management, and production techniques, the station finished yearling steers to a slaughter grade of "high-good" and "low-choice" at a supplemental feed cost of about 10 cents per pound of gain as compared with about 20 cents per pound in the commercial feedlot. This was done with steers on crested wheatgrass range which were fed supplements to adequately balance the nutrients available from the grass.

Such a reduction in the cost of converting feed to meat will aid the beef grower to better compete with non-red meats in the marketplace. The opportunity to produce low-cost slaughter-beef of high quality exists on many thousands of acres of crested wheatgrass range or on improved native range in southeastern Oregon.

SUMMARY AND ECONOMIC EVALUATION OF ACCOMPLISHMENTS

It would be impossible to accurately measure the financial benefits of the research program of the Squaw Butte Experiment Station from 1935 to 1969. It is clear, however, that the information obtained from research has contributed to every advance in the livestock business in southeastern Oregon in the last 30 years.

Range and meadow improvement methods and practices that are now in common use were developed at Squaw Butte. Of equal importance are the methods of increasing beef production per cow and per acre of land through improved cattle management and nutrition.

Without increasing the land area, the station increased its beef sales from 48,000 pounds in 1944 to an average of 150,000 pounds per year from 1964 through 1968. This is an increase of more than 300 percent. Beef production in the 10 southeastern Oregon counties has more than doubled in the same period. The work of the Squaw Butte Experiment Station contributed immeasurably to this increase.

PUBLICATIONS

The following list of publications issued by the Squaw Butte Experiment Station from 1948 to June 30, 1969, indicates the scope, complexity, and accomplishments of station research. A few publications are repeated under Range, Native Meadow or Livestock because they contributed directly to more than one area of the ranching operation.

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