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UNIVERSITY OF WYOMING.

Agricultural College Department.

WYOMING EXPERIMENT STATION,
LARAMIE, WYOMING.

BULLETIN NO. 63.

AUGUST, 1904.

Native and Introduced Saltbushes
Three Seasons' Trials.

By ELIAS NELSON.

Bulletins will be sent free upon request. Address: Director
Experiment Station, Laramie, Wyo.

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SUMMARY.

1. This bulletin is a report on various experiments with saltbushes at the Experiment Farm, three years' tests of Australian and native species and observations made in the field.

2. These investigations have been carried on in co-operation with the U. S. Department of Agriculture. Professor Scribner, the former Chief of the Division of Agrostology, and Professor Spillman, the present Chief, have extended financial aid and furnished seed for the prosecution of this work.

3. The investigations have included field tests of native and introduced saltbushes on cultivated land, seeding on the range, and experiments designed to determine the best time and best method of seeding the saltbushes.

4. The Australian Saltbush is a valuable forage plant in its native home and in parts of California and the Southwest. It makes a rank growth, is used for pasturage or cut and stacked for hay, and is an acceptable and nutritious feed for stock.

5. In Wyoming the Australian Saltbush winterkills and does not grow sufficiently rank during our short season to be of value for this region.

6. Stockmen and farmers should not be misled by the glowing accounts in seed catalogues of the marvelous growth of the Australian Saltbush.

7. The saltbushes are grayish, scurfy, annual or perennial, herbaceous or shrubby plants of a dense and usually bushy habit of growth.

8. Seven indigenous or native species are of importance in our State. Two of these are shrubby; three are herbaceous perennials, and three are annuals.

9. Our native saltbushes, especially Nuttall's and Nelson's, occur in great abundance in many localities and in the Red Desert are of vast importance as winter forage for sheep.

10. The shrubby species are unsuitable for cultivation.

11. Nuttall's and Nelson's Saltbush may be grown for pasturage. They make a good stand under favorable conditions, but grow slowly and require several seasons to attain full size.

12. The annual species are easy to start, make rapid growth and produce a large amount of forage on moist alkali land. They grow sufficiently rank to be cut for hay.

13. A moist soil and a certain amount of weathering of the seed is necessary for good germination.

14. The best stand was obtained where the seeds were covered half an inch deep, but nearly as good results were secured where they were left on the surface of the soil.

15. The best time to sow the saltbushes is in the fall or very early in spring.

16. Profitable crops are produced only where the soil is loose and friable and tolerably moist.

17. The saltbushes are recommended for cultivation on moist alkali land unsuitable for other crops.

18. Alkali lands used for pasturage may be materially improved by simply scattering seed over them, but some cultural treatment of the land is recommended wherever practicable.

19. Sheep soon become accustomed to them, eat them readily and remain in good condition when subsisting on saltbush forage.

Native and Introduced Saltbushes

THREE SEASONS' TRIALS.

BY ELIAS NELSON.

INTRODUCTION.

The forage value of saltbushes was early recognized by sheepmen both in the Western United States and in Australia. As soon as their tolerance of alkali and general adaptability to arid conditions became well known, far-seeing men interested themselves in their domestication. The cultivation of our native species has not been seriously considered until very recently. An Australian saltbush has been very successfully and profitably grown in California for more than ten years. Its extraordinary rankness of growth in that State has reached the ears of stockmen and farmers in Wyoming. Seedmen have given glowing descriptions of its wonderful productiveness, and many of our stockmen have speculated on realizing large gains by cultivating this plant, and not a few have lost money and experienced failures in attempts to grow it. The possibilities of our native species under cultivation have in the minds of many been unduly magnified, and some have even talked of seeding down whole sections of range land to the Russian Thistle. It is time for this station to publish some facts in regard to saltbushes, and to disabuse the public mind of erroneous ideas concerning the value of the Australian Saltbush for our State. It is our purpose in this bulletin to report the results of tests made on the Experiment Farm and observations made in the field, and to indicate the probable value of saltbushes for cultivation in this State.

CHARACTERISTICS.

The saltbushes or *Atriplexes* are succulent alkali plants, usually scurfy and grayish in color and with herbaceous or somewhat shrubby stems. They are nearly all diffuse in growth, and the seed of some species resembles that of spinach. Some are annuals; others perennial. Those with herbaceous stems are the most valuable ones for cultivation. They belong to the Goosefoot Family, as does also the cultivated beet, the lambs-quarter and the garden spinach. The common Greasewood and Winter Fat are also classified in this family.



SEEDS OF PERENNIAL SALTBUSES.

1. Nuttall's.

2 and 3. Nelson's

4. Shadscale.

OCCURRENCE.

In dry, interior regions, where there is little rainfall and more or less alkali in the soil, the more valuable forage plants, or the true grasses, are very largely replaced by other herbage. Saltbushes and their allies occur in such regions and are often the predominant class of vegetation. They often furnish more than half of the pasturage.

Many large and rank growing species, both annual and perennial, occur in Australia, and sheep have for many years been pastured very extensively on the natural growths of saltbushes in the deserts of that continent. More than thirty different saltbushes are indigenous to the Western United States, and most of those possess some forage value.

THE AUSTRALIAN SALTBUUSH.

Australian saltbushes were introduced into California as early as 1881, but it was not until in 1888 that the most valuable one, *Atriplex semibaccata*, now known throughout this country as the "Australian Saltbush," was tried in that State. Its rankness of growth, great drought-resisting qualities and tolerance of alkali soon became known and its cultivation has as a result increased until today it is grown quite extensively in California and parts of Arizona and New Mexico. In the warm, arid districts of California it is a very prolific grower, forming dense mats a foot or more in depth, and individual plants are often a few to even six feet in diameter. Not only will all classes of stock in the majority of cases eat it readily, either green or cured, but are said to thrive on it. In California it is cut for hay, as well as used for pasturage. It may be mowed as many as three times in a season, and a yield of twenty tons of green feed or five tons of hay per acre is not at all unusual. Seed of this saltbush has been widely distributed by the California Experiment Station and by the U. S. Department of Agriculture. It has been tested in all the

Western States and other parts of the United States. The seed is now offered for sale by all leading seedsmen in the East, as well as in the West, at a price of from one dollar to one dollar and fifty cents per pound. What seedsmen claim for this forage plant applies only to its cultivation in the warm districts of California and similar regions in the Southwest. Our experiments have shown that it is entirely unsuited to our conditions.

CULTIVATION OF AMERICAN SALTBUSHES.

The success of Australian species in California naturally led to an inquiry into the practicability of cultivating certain ones of our native species. The National Department has done much along this line, and through its field agents has secured seed of most of our Western species. This seed has been sent to the Experiment Stations in the West, where many of our natives have been tested. The Wyoming Station has co-operated with the U. S. Department of Agriculture in these investigations, and has for three years carried on experiments with saltbushes on the farm.

THE SALTBUSHES OF WYOMING.

In our State it is chiefly in Sweetwater, Carbon and Natrona Counties that the saltbushes are sufficiently abundant to figure very largely as a forage for stock. Wherever the saltbushes occur they are browsed upon and when accustomed to them stock eat them readily. We have observed that fully developed plants occur as a rule only inside enclosures, or where stock has not had free range. Being salty to the taste, grazing animals eat of them along with other herbage, and where they occur in pastures and on the range there is no need of providing salt for the stock. In parts of Sweetwater and Carbon Counties the saltbushes are the predominant herbage and often constitute from one-half to nearly all of the forage. On these ranges there is usually no water during summer



TYPICAL SALT BUSH LAND NEAR POINT OF ROCKS, IN THE RED DESERT OF WYOMING.

and what may be found in springs or sluggish creeks is generally too strongly impregnated with salt for use. These lands cannot for that reason be pastured in summer, but in winter when snowdrifts are found along bluffs and in gulleys sheep are driven in and the saltbushes and other plants which have grown undisturbed during the summer and cured in the fall furnish winter feed for these flocks. Sheep not only are able to subsist on this kind of forage, but thrive on it and remain in good condition.

These winter ranges do not deteriorate, as the plants are allowed to mature and reseed themselves during the growing season. The pasturage actually improves, for the plants become more matted as a result of the cropping and the droppings of the sheep add to the fertility of the soil.

Three of the seven more common species occurring in Wyoming are annuals, and two of the perennial ones are shrubby.

The Spiny Saltbush (*Artemisia confertifolia*) is a much branched, somewhat spiny, grayish shrub, one to several feet high. It has broad leaves and flattish seeds. The leaf-like bracts which enclose the seed proper are thick and scurfy, and have broad, rounded, free terminal portions. It is not uncommon on clayey alkaline flats. In autumn the leaves and seeds fall to the ground and are swept by the wind into small depressions in the ground. These accumulations are gathered up by sheep in the winter.

Shadscale (*Artemisia canescens*) is a grayish, scurfy shrub, one to several feet high, with narrow leaves and large, succulent, four-winged seeds. It occurs on clayey hillsides and bluffs in many localities in Wyoming, being rather conspicuous toward the close of the season when heavily loaded with seeds. Its succulent young shoots and large seeds, which are produced in great abundance, furnish considerable browsing for stock.

Nuttall's Saltbush (*Atriplex Nuttallii*) is the most important of the native saltbushes of this State. It is a deep-rooted perennial of a spreading and bushy growth, the leafy stems usually a foot or less in length. The plant is generally grayish in color and has thickish, succulent leaves, which are narrowly oblong and entire. By September the fertile plants have become heavily loaded with seeds, which are somewhat flattened, toothed at the summit and more or less covered on the sides with tubercle-like points.

This saltbush occurs on dry, gravelly plains and gumbo flats, in soil which is not too strongly alkaline. It is readily eaten by stock and endures close grazing. Where it is cropped continuously it becomes matted and sends up numerous leafy



NUTTALL'S SALTBUH
(*Atriplex Nuttallii*)



Nuttall's Saltbush spreading on hard, gravelly ground in a dooryard.
The large plant to the left is the parent of the smaller plants about it.

shoots. It is very common in many parts of Wyoming and in the Red Desert furnishes at least half of the winter forage. It readily reseeds and maintains itself where once established. Occasionally it spreads into fallow fields and here makes a thrifty growth. It often takes possession of dooryards, completely covering the ground.

Nelson's Saltbush (*Atriplex pabularis*). This saltbush was discovered in the Red Desert in 1897 by Professor Aven Nelson. It is very similar to Nuttall's Saltbush, but is whiter in color and of a more upright habit of growth. It is abundant only in the Red Desert, where it flourishes in the strongest alkali soils.

The Utah Saltbush (*Atriplex truncata*) is an annual species, somewhat pyramidal in form and with much-branched stems, greenish leaves and small seeds. It is common in waste places near towns, in dooryards and in loose soil generally, especially where there is some alkali. About Laramie we have observed that it is kept well browsed down by the town cows. It spreads rapidly on railroad embankments, and, though often appearing in cultivated fields, it is not a troublesome weed. In good soil it often grows to be two feet high and several feet in diameter.



UTAH SALT BUSH
(*Atriplex truncata*)



SILVERY OR TUMBLING SALTBUUSH
(*Atriplex argentea*)

Silvery Saltbush (*Atriplex argentea*). An annual saltbush of a rounded form, grayish white color and with seeds which are more or less tubercled and winged. Its growth is very dense, and under favorable conditions it attains a great size, often being a foot and a half high and several feet in diameter. It occurs on alkali flats and attains its greatest size where the soil is loose and contains considerable alkali. In the fall the tap roots usually break off and the plants, driven about by the winds, often pile up against wire fences and other obstructions in their way.

Spreading Saltbush (*Atriplex philonitra*). This is another annual species growing naturally where the soil is quite strongly alkaline. It is quite white in color, dense and spreading as to its habit of growth and has slender stems and small, broad leaves. It is not as large nor as coarse as the other annuals. It comes very readily from seed and is easy of cultivation.



SPREADING SALTBUH
(*Atriplex philonitra*)

THE CULTIVATION OF SALTBUSHES ON THE EXPERIMENT FARM.

The Australian Saltbush was tested at this station as early as in 1897. It was again sown in 1901. Though a thin stand was secured, it made very little growth. Being a perennial, it should live from year to year, but with us it has winterkilled. It is too tender for this region and does not grow rank enough, at least at Laramie, to be of any value. We would, therefore, advise ranchmen and farmers not to plant it, as it is quite evidently unsuited to our climatic conditions. Five other Australian saltbushes have been tried on the Experiment Farm, and, while some made considerable growth, they are all too tender for this State and do not attain as large a size as some of our natives.

The cultivation of the native saltbushes of the Western United States by farmers and at the Experiment Stations has generally been unsuccessful. As a rule they have failed to make a stand. This had been the experience on our Experiment Farm when our station in 1901 took up grass and forage plant investigations in co-operation with the U. S. Department of Agriculture. Experiments with saltbushes formed an important part of these investigations. The National Department furnished us with seeds of certain native species each year, and a further supply of seed for the experiments has been gathered in Wyoming by the writer.

The experiments carried on during the three years have included* (1) tests on broken, cultivated land containing small amount of alkali, (2) tests on range lands, (3) late fall seeding versus spring seeding, and (4) planting to determine best method of sowing the seed.

*For a more complete account of the experiments and the results obtained see the 13th and 14th Annual Reports of the Wyoming Experiment Station.

FIELD TESTS ON CULTIVATED LAND.

The land used contained alkali in amounts just large enough to render it unsuited for the cultivation of alfalfa. It was in a good condition of tilth. The seed was sown broadcast by hand after a seed bed had been prepared. On June 8, in 1901, six native species were sown on half an acre, the seeds being raked in by hand. As dry weather had already set in, there was a lack of moisture and the seeds did not germinate well. The Utah Saltbush, however, made a fairly good stand, the plants maturing fully and attaining a height of a foot and a half. Only a few plants of the Silvery Saltbush appeared. These were eight to fifteen inches high and one to two feet in diameter. A few seedlings of Nuttall's and Nelson's Saltbushes were observed, but these made very little growth that season. Shadscale and the Spiny Saltbush did not come up.

In 1902 all of the Wyoming species were planted in the same manner as in the preceding season, except that the seed was covered by means of a spike-toothed harrow. The perennial ones were sown on May 3. A very sparse stand was secured of most of these, but they did not make a great deal of growth and the stems thrown out were few and not over a foot in length at the end of the season. The annual species were planted May 23. As dry weather prevailed during May and June, the seeds did not germinate, but as a result of the rain which fell in July all came up and made a good stand. Though the seedlings were not discernible until in August, considerable growth was made before the close of the season. The Silvery Saltbush attained a height of a foot; the Spreading Saltbush fifteen inches, and the Utah Saltbush a foot. A severe freeze on September 11 injured the Utah Saltbush in the tops, while the other two were more or less completely killed.

Nine western saltbushes were sown on May 15, in 1903. While a fairly good stand was secured of nearly all of them,

very little growth was made, the plants being only a few inches high at the close of the season. The Silvery Saltbush and the Utah Saltbush, however, did quite well and made a ranker growth than in 1902.

RANGE SEEDING.

Four of our native species were sown on a tract of range land on May 3, in 1902. The land was scarified by means of a spike-toothed harrow before the seed was sown and again harrowed after the planting to cover the seed. None of the saltbushes came up, as the season was very dry.

On October 25 of the same year an adjacent piece of land was disc-harrowed and three of our native saltbushes sown and the seed harrowed in. Nuttall's Saltbush and the Utah Saltbush came up well the following spring, but the Silvery Saltbush did not make a stand. These species made scarcely any growth, not being over an inch or two high in September. Observations made this spring show that Nuttall's Saltbush has not persisted.

In these range experiments the saltbushes were sown in hard, gravelly, upland soil, where they do not grow naturally. We are confident that with the same treatment good results can be secured on lowlands which are somewhat moist.

FALL SEEDING VERSUS SPRING SEEDING.

Seeds of Nuttall's Saltbush, Utah Saltbush and Silvery Saltbush planted on October 21, 22 and 23, in 1901, and covered half an inch deep made a fairly good stand the following spring. The same species planted in the same manner on May 10, in 1902, failed to come up. The experiment was repeated in the fall of 1902 (October 2) and in the following spring (April 21). Equally good stands were obtained, both where the seed was covered half an inch deep and where left on the surface of the ground. Good results may thus be secured both from spring and fall seeding if the planting in the spring be early,

but a good germination of the seed is more certain when they are sown in the fall.

METHODS OF PLANTING.

The different methods tried were, (1) planting one inch deep, (2) half an inch deep and (3) leaving the seeds on the surface of the ground. The plantings were made in the fall of 1901 (October 21, 22 and 23), in the spring of 1902 (May 10), and the autumn of 1902 (October 27), and in the spring of 1903 (April 21). The four plantings were made in identically the same manner. The saltbushes used were Nuttall's, the Silvery and the Utah.

The best results from the autumn planting of 1901 were secured where the seed was covered half an inch deep, while the seed covered one inch deep gave only a slightly better stand than those left on the surface. The stand of the annual species was somewhat better than that of Nuttall's Saltbush. The seed planted in the spring of 1902 did not come up, as the season was very dry.

The results of the plantings in the fall of 1902 were very similar to those of the plantings the following spring. Good stands were obtained both where the seed was covered one inch deep and where half an inch deep. The seed planted half an inch deep, however, gave the best stand. On the plats where the seed had been left on the surface a fairly good stand was obtained.

A light covering for the seed thus gave the best results, while nearly as good stands were secured where the seed was left on the surface and where planted an inch deep. The presence of sufficient moisture in the soil, however, appears to be of more importance than the method of seeding. The husk in which the seed kernel is enclosed is hard and tough, and germination is not possible until it has been subjected for considerable time to the softening action of moisture. To ensure sufficient weathering of the seed, the sowing should be in the

autumn or early enough in spring to receive full benefit from late snows and the April showers.

GENERAL NOTES.

The Australian Saltbush and other saltbushes of that island continent, while of great value for cultivation in their native home and in parts of California and the Southwest, are unsuited to our State. They are too tender and do not grow rank enough in our short season to make their cultivation profitable.

Our native species, it is well known, are of great importance where they occur in abundance, and many sheep growers depend upon the natural growths of saltbushes as winter forage for their flocks. Observations made in the field and tests made at the Experiment Farm seem to indicate that their cultivation will prove profitable only to a limited extent.

Only the herbaceous species or those not woody are suitable for cultivation. Such are Nuttall's Saltbush, Nelson's Saltbush and the three annual species. Their cultivation would not be profitable on land where it is possible to grow forage plants which make a ranker growth and are more acceptable as feed for stock. Only on alkali lands unsuitable for other crops is it advisable to plant the saltbushes, and good yields will not be realized except on lands which are tolerably moist and which have been put in a good condition of tilth.

Nuttall's Saltbush does not grow sufficiently rank to be cut for hay, and its habit is such as not to adapt it for mowing. The same may be said of Nelson's Saltbush, though it grows more upright and is somewhat taller. The annuals, on the other hand, grow quite rank and yield a large amount of forage. It would be quite practicable to cut them for hay. They are, however, much coarser than the Australian Saltbush, which has very slender stems and is cut and stacked for hay in California. It is perhaps chiefly for pasturage that they

may be grown. There is much alkali land naturally quite moist on ranches in Wyoming which, if planted to saltbushes, the annuals especially, could be made to yield large crops of forage.

A moist soil is necessary if a good stand is to be secured, and a certain amount of weathering of the seed to soften the hard husks enclosing it favors germination. The seed, therefore, should be sown very early in spring or in the fall. The best germination in our experience was obtained from seeds which were covered half an inch deep, but almost as good results were secured when the seed was left on the surface of the soil.

The perennials are of slow growth at best and it requires a few seasons for the individual plants to reach full size. The annuals, however, are easy to start, and make quick and large growths under favorable conditions.

While a better stand and a quicker growth is obtained when a seed bed is prepared, it is, however, quite possible to materially improve the pasturage of alkali land by simply broadcasting the seed. The annual saltbushes are valuable for this purpose. They reseed themselves from year to year on alkali flats, in fallow fields, on railroad embankments and in dooryards. Nuttall's and Nelson's Saltbushes may be sown in the same way on suitable land. It is not advisable to sow the saltbushes on dry, upland pastures, as the annuals make very little growth here and the perennials are too difficult to establish.

We have no data bearing directly on the digestibility and nutritive value of our native saltbushes. We do not believe that they equal in palatability or nutritive value our native grasses or the common forage crops grown in the State. It is well known that they furnish a vast amount of acceptable forage for sheep in winter, and that stock browse upon these plants more or less and remain in good condition when subsisting very largely on saltbushes.

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