



Development of a Fourwing Saltbush Release for the Northern Great Plains

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ABSTRACT

Fourwing saltbush [*Atriplex canescens* (Pursh) Nutt.] is a perennial small shrubby species tolerant of a wide variety of soil and climatic conditions of North America. It has potential for rangeland restoration and soil conservation in the Northern Great Plains. The reason for the study was to develop a fourwing saltbush cultivar or prevarietal release adapted to the Northern Great Plains. Seed was collected from several plants at one site in Jackson County in western South Dakota. Seeds were propagated and planted to a field plot at the USDA Natural Resources Conservation Service Plant Materials Center (PMC) in Bismarck, North Dakota, for evaluation and seed production. The plants were found to be highly adapted and good seed producers. After 13 years of observation and seed production, the study was discontinued in 2014 because of seed harvesting requirements. No mechanical means of harvest is known that is feasible for commercial seed production. There are approximately 100 bulk pounds of cleaned seed stored in a seed cooler at the Bismarck Plant Materials Center. The seed is available to researchers.

INTRODUCTION

Fourwing saltbush is a long lived shrub with an extensive root system and deep taproot. It has an assortment of growth forms depending on site conditions and ecotype. Height can range from 1 to 6 feet. Plants are normally dioecious, female and male flowers on separate plants. Some can be monoecious and some are found to have male and female parts on the same flower. It can also change gender from one season to the next depending on environmental conditions (Winslow 2012). The four large wings on the fruit help identify this particular *Atriplex* species.

The native range for fourwing saltbush extends from western North Dakota, south to Texas and Mexico, and west to Washington (USDA NRCS 2005). In the Northern Great Plains, it is most commonly found in the western half and scattered in association with mixed prairie vegetation in badlands on upland clay to sandy soils and on lowland alkali to saline soils (Johnson and Larson 1999). It has C4 photosynthesis. It is salt, cold and drought resistant. In nature, it can intercross with other *Atriplex* species (Stutz and Carlson 1985).

It is widely used in rangeland and riparian improvement and reclamation projects. It is a highly palatable browse for most livestock and big game. It is grazed by all classes of livestock except horses (USDA NRCS 2005).

Ecotypes differ in growth rate, winter deciduousness, drought and cold hardiness and palatability. Known cultivar releases include 'Marana', 'Rincon', 'Santa Rita', Snake River Plains Germplasm and 'Wytana'. Marana is a California desert selection, Rincon originated in North Central New Mexico, Santa Rita is from Arizona, Snake River Plains Germplasm was

collected in southern Idaho, and Wytana is a natural cross of *Atriplex canescens* and *Atriplex nuttallii* from Montana.

The various attributes of fourwing saltbush make it a desirable plant for conservation, livestock, and wildlife. As various ecotypes do best in close proximity to their origin, it was decided that a fourwing saltbush with origins in the Northern Great Plains would be the most suitable for the region. Therefore, the objective of this study was to develop a fourwing saltbush cultivar or prevarietal release for the Northern Great Plains.

MATERIALS AND METHODS

Seed was collected from several plants at the South Dakota State University Cottonwood Range and Livestock Research Center in Jackson County, South Dakota by Ron Haigh in 1999. The collection site was in Major Land Resource Area 060A Pierre Shale Plains and Badlands. The location is SE1/4 SW1/4 sec. 16, T. 1 S., R. 19 E., lat. 43°56'57" N. and long. 101°51'30" W. The seed was collected in an enclosure area set up in the rangeland that kept out cattle and wildlife. The adjacent plants were grazed each year by livestock and appear to have abundant regrowth each spring according to Ron Haigh. Scot Kronberg, USDA, Agricultural Research Service, Mandan, North Dakota brought the small envelope of seed collected by Haigh to the Plant Materials Center. The seed was given the accession (identification number) 9082680.

Seed was propagated in the greenhouse in a soilless potting mix. Seed germinated with no pretreatment. Seedlings were vigorous. Approximately 25 seedlings were hand planted at the USDA, NRCS PMC in Bismarck, ND in May of 2001 and an additional 50-75 plants in 2003. Spacing between plants was 2 feet and spacing between rows was 7 feet. The plot was maintained by hoeing, mowing, and spot spraying of glyphosate between the rows. Generally, residue was hand clipped and removed every other year in November after seed harvest. Sometimes residue was not clipped for 2 to 3 years. Seed was hand harvested from 2002-2013. Seed was cleaned using a debearder and fanning mill. In 2002, samples were collected for nutrient and fiber analysis when plants and seed were mature. The samples were taken on November 6, 2002. The tips and tops of side branches were clipped from random plants within the planting. The length of the samples averaged 12-15 inches. The samples were partitioned into two lengths. The top 6 inches, including stem and leaf, were cut and bulked and designated as TIP. Leaves were stripped from the lower remaining 6-9 inches of the original sample and tested as LF. Samples were analyzed for percent acid detergent fiber (ADF), neutral detergent fiber (NDF), and percent N content. Crude protein was estimated by multiplying percent N x 6.25. Forage quality estimates were performed by the Oscar Olson Biochemistry Laboratories at South Dakota State University.

A small trial to compare performance of different sources was planted in June 2003. Seedlings of 9082680, Natrona, and Wytana were grown in the greenhouse and each accession transplanted into separate single 20 foot rows at the PMC in May 2003. Natrona is not an official cultivar release but rather a fourwing saltbush source originating in Wyoming from the Wind River Seed Company. Height and width was recorded for each of the sources in 2003 and 2004. The trial was removed in 2009.

Seed of 9082680 and Natrona were distributed in 2008 for an NRCS field trial in western North Dakota (Golden Valley County). Seed was planted as part of a mix.

RESULTS AND DISCUSSION

In the initial plot at the PMC, the plants were vigorous most years. Seed production amounts varied from year to year. Seed production ranged from 0.5 pounds to 32 pounds of clean seed/year from 2002-2013. The plants became extremely woody and regrowth was very slow the year after cutting off plants that had not been cut for three years. Thus, seed production was reduced considerably the year after residue removal. Clipping residue every year or every other year produced the most seed. In 2006, some of the plants producing seed were flagged as female. The next year some of these plants set no seed. It is not known if this was due to gender change or just lack of seed set that year. Seed was more difficult to harvest the years that previous years residue was not removed due to many lateral branches. Perhaps clipping of actively growing vegetation at a particular growth stage would still allow seed production but would keep the plant less woody. This was not studied. Gophers became a problem in the field and destroyed the roots of several plants. Plants did not remain evergreen over winter. Reduced rainfall received some years did not appear to hinder plant growth or seed production. By 2013, several plants were dead. Gophers, herbicide drift and continual removal of residue may have contributed to their mortality. The remaining plants were vigorous. Samples of leaf material (LF) collected in 2002 had a crude protein (dry matter basis) of 22%, ADF of 15%, and NDF of 27%. The tip material (TIP) had a crude protein (dry matter basis) of 18%, ADF of 26% and NDF of 40%.

In the source comparison trial, differences in growth between the three accessions were found. Overall, plants of Natrona were upright and had less lateral spread and branching than the other two sources. The South Dakota accession (9082680) was very upright, had closer spaced branching, slightly larger, and appeared more vigorous some years. Wytana stayed much shorter and growth of plants were slower than the other two accessions. In 2004, the average height was 33.8 inches for accession 9082680, 25.4 inches for Natrona and 13 inches for Wytana. Average widths in 2004 were 48.2 inches for accession 9082680, 47.8 inches for Natrona, and 26.5 inches for Wytana.

In the field planting in Golden Valley County, ND, the two accessions were planted in separate plots within the field. They were planted as 20% of a range mix. Unfortunately, no record was made by the field office indicating which accession was planted at a particular plot. The two sources showed little difference in stand establishment. In 2012, vigor was rated high for established plants for both sources. One accession was slightly more robust, branched, and taller.

CONCLUSION

The fourwing saltbush accession 9082680 collected in western South Dakota was vigorous and produced seed at Bismarck. It was also vigorous in western North Dakota. Preliminary data taken indicates a high crude protein and digestibility in early autumn. The variety Wytana also appears adapted to the area, though it was much smaller in size and growth. The local source, Natrona, from Wyoming was also adapted and vigorous, but may not be consistently available. Mechanical seed harvest appears to be a big challenge for seed producers and seed availability of

Atriplex canescens. It is likely that seed sources from the Northern Great Plains would be adapted and meet the current fourwing saltbush seed demands. Although the height and amount of biomass produced is less for Wytana, it can be mechanically harvested.

NRCS APPLICATION

Wytana is currently an accepted cultivar for NRCS practices in ND and SD. Observations from this study support the adaptability of fourwing saltbush and the cultivar Wytana.

LITERATURE CITED

- Howard, J. 2003. *Atriplex canescens*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2016, October 19].
- Johnson, J. and G. Larson. 1999. Grassland Plants of South Dakota and the Northern Great Plains. South Dakota State University, College of Agriculture & Biological Sciences, South Dakota Agricultural Experiment Station B 566 (rev.) Brookings, SD, p 248.
- Stutz, H. and J. Carlson. 1985. Genetic Improvement of Saltbush *Atriplex* and other Chenopods. In: J. Carlson and E. McArthur (chairmen), Proceedings of Symposium on Range Plant Improvement in Western North America; 14 February 1985, Annual Meeting of the Society for Range Management, Salt Lake City, Utah. p. 89-92.
- USDA NRCS. 2005 (edited). Plant Guide for fourwing saltbush (*Atriplex canescens*). <http://plants.usda.gov/plantguide/pdf/pg-acta2.pdf> (accessed October 24, 2016).
- Winslow, S. 2012. Fourwing saltbush *Atriplex canescens*: A Native Shrub for Conservation Use in Montana and Wyoming. USDA-NRCS-Montana Technical Note-Plant Materials MT 83.

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PDF | On the Ground • Four-wing saltbush is an important browse species for wildlife and domestic livestock and has been reported to provide as much as | Find, read and cite all the research you need on ResearchGate. native to western North America, extends from Canada to Mexico and from the Great Plains to the Pacific Coast. 1. Four-wing saltbush seedling consumption by the various rodents at the site. Four-wing saltbush seedlings were grown. Fourwing saltbush is one of the most widely distributed and important forage shrubs on western ranges. Springfield (1970) re Deep, extensive. Canada to Mexico, Great Plains to Pacific Coast Ranges. Sea level to 2440 m. Dry slopes, flats, washes valley bottoms. Fourwing saltbush required the least amount of water per gram of total shoot and root produced of the four shrubs studied. The highest production for shrub and grass species occurred at the field capacity. Cultivar development for saltbush has also emphasized ecotypic adaptation. The 3 released cultivars of fourwing saltbush were developed for warm winter (Marana™), intermountain cold desert (Rincon™), and northwestern Great Plains (Wytana™) planting applications (Carlson 1984). Wytana™ was developed from a fourwing saltbush × Gardner saltbush hybrid entity known as *Atriplex aptera* A. Nels. Fourwing saltbush is a nondescript shrubby member of the goosefoot family (Chenopodiaceae) that ranges across much of the southern Great Plains, Great Basin, and desert southwest. It is characterized by grayish, linear to spoon-shaped leaf blades, yellowish twigs, and small, yellowish, or brown wind-pollinated flowers clustered in slender inflorescences and lacking showy petals. Mature fruits can be eye-catching because of their relatively large size (1/2 to 1 inches long and broad) and four membranous wings (thus, the name "fourwing"). Fourwing saltbush is often abundant, especially in sandy areas, and easy to ignore. When it comes to reproduction, fourwing saltbush is anything but ordinary.