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by

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INTRODUCTION OF FOURWING SALTBUSH (ATRIPLEX CANESCENS) INTO DEGRADED RANGELANDS IN UPLAND BALUCHISTAN

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SUMMARY

The rangelands of upland Baluchistan have an arid to semi-arid continental-Mediterranean climate. Production of sheep and goats is the main agricultural activity. Range stocking densities have increased six-fold in 30 years. Feed deficits are becoming more serious as ranges retrogress. Range forage is deficient in both quantity and quality during critical periods in the production cycles of small ruminants.

To help mitigate range degradation and increase forage production the Arid Zone Research Institute is testing plants and planting methods to introduce new grasses and shrubs into these ecosystems. Fourwing saltbush (Atriplex canescens) has the drought resistance, salinity tolerance, soil adaptability, evergreen habit, forage productivity, and high nutritive value needed. Present studies show that fourwing saltbush transplants can survive on dry, windy sites with one at-planting irrigation, can be transplanted into established grass stands, and can produce at least 8,000 kg (DM)/ha of forage under optimum soil moisture conditions.

INTRODUCTION

The grassland and shrubland range types in upland Baluchistan have a climate which is continental, arid to semi-arid, and Mediterranean in character. Winter precipitation predominates but significant summer monsoonal rainfall occurs in the grassland areas. The latitudinal zone is from 28° to 32°N.

Dominant species in the shrubland type are Artemisia maritima and Haloxylon griffithii, where the annual precipitation is 200mm, with 80% occurring during winter. Dominant species in the grassland type are Cymbopogon jawarancusa and Chrysopogon aucheri, where annual precipitation is 300mm, with 40% occurring in summer.

Range stocking densities, mostly from sheep and goats, have increased six-fold in the past 30 years. To mitigate range retrogression the Arid Zone Research Institute is testing plants and planting methods which could be useful for introduction of new grasses and shrubs into these rangeland ecosystems.

Improvement of livestock production is a key objective of these efforts. The present range forage is deficient in both quantity and quality during some seasons even in higher rainfall years. This problem is especially serious when

forage deficits coincide with critical stages in the animals' production cycles, e.g. during the breeding season, late gestation, or early lactation.

METHODS

Fourwing saltbush (Atriplex canescens) was selected to improve range areas and to establish forage reserve plantations on sub-marginal croplands. Its merits include drought resistance, salinity tolerance, soil adaptability, evergreen habit, forage productivity, palatability, and high nutritive value. Leaves, stems and fruits of fourwing saltbush are eaten by all classes of livestock, the forage is rich in crude protein, calcium and phosphorous yearlong, and the plants provide cover and feed for wildlife (Springfield, 1970).

A study is underway to evaluate establishment of fourwing saltbush within stands of perennial grasses. The heavily grazed grassland site has a total plant cover of 20%, of which total Cymbopogon jawarancusa, a relatively unpalatable species, contributes almost 75%, and Chrysopogon aucheri, a highly palatable species, contributes 25%. The sparse plant cover in this degraded grassland appears to offer an opportunity for introduction of new forage plants. However, arid and semi-arid grasslands and shrublands typically exhibit large areas of seemingly "open" ground. Below these bare spaces root competition for soil moisture

poses serious problems for introducing new plants. Despite the ecological realities of such interventions this rather unconventional fourwing saltbush introduction study has been attempted.

In July 1987, 240 three-month old fourwing saltbush seedlings were transplanted into 0.5 sq m to 1.0 sq m openings in the Cymbopogon-Chrysopogon grassland. Each transplant got four liters of water at planting time and another four liters two months later. During that period the study site received only 27mm of rainfall and during the next 10 months received only an additional 147mm. Livestock grazing was excluded from the site, but rabbits severely grazed many of the young transplants.

Fourwing saltbush establishment trials are also located on clean-tilled sites to estimate the irrigation required to achieve acceptable survival and growth of transplants. Studies in both major range types have compared three levels of irrigation. Seedlings were planted in three blocks, with up to 100 plants per block. All transplants received 15 liters of water at planting. One block received a second irrigation one month later, and the third block received a final irrigation two months after planting. Study sites are on upland alluvial fan or terrace deposits, with no sub-irrigation, and are exposed to fairly constant winds.

Fourwing saltbush seedlings were also planted on a site adjacent to an ephemeral stream to evaluate forage production where soil moisture was not a limiting factor. It was assumed that the shrub roots would grow to depths where plants would receive natural and constant sub-irrigation. Seedlings were planted in a grid pattern at 1.5-meter spacings and surface-irrigated initially to assure good establishment and growth. The site affords ideal conditions for production of fourwing saltbush and serves as a test and demonstration of a high-producing forage reserve located within a semi-arid rangeland ecosystem.

Precipitation from September 1987 through August 1988 varied from 51mm at one of the shrubland sites to 167mm at the grassland site. Probabilities of these locations receiving annual rainfall amounts this low ranged from 10 to 25%.

RESULTS and DISCUSSION

Fifty percent of the fourwing saltbush seedlings planted into the established grassland community survived the first year. At least 25% were showing vigorous growth, and the 20 largest plants averaged 27cm in height and 19cm in diameter. Many of the young transplants severely grazed by rabbits early in the experiment had resprouted, offering further evidence of the survival capacity of fourwing saltbush.

Results indicate that fourwing saltbush transplants into open stands of grazing-stressed perennial grasses can compete with the existing vegetation if there is adequate soil moisture for the first month or two. The latter conditions might be met by careful timing of planting with favorable precipitation periods, possibly combined with use of micro water catchments at the planting holes. Survival and growth of fourwing saltbush seedlings transplanted into established grassland in western Texas was reported to be significantly better in 46cm- and 91cm-wide tilled strips than in 10cm-wide ripped strips, in direct relationship to the reduction of competing vegetation (Petersen et al, 1986).

Irrigation of transplants would be economically prohibitive in most cases. However, the productive and perennial characteristics of fourwing saltbush, coupled with the critical need for yearlong nutritious forage, encourage testing of almost any ecologically feasible ways to introduce this plant.

Transplanting of fourwing saltbush seedlings to upland rangelands in Iran increased forage production 300% (Nemati, 1976). During the winter season, which coincides with late gestation needs of sheep, the forage value of grasses is usually low. In early spring, when lactation

places an even higher nutritional demand on dams, warm-season grass forage is lacking, resulting in a range forage supply which is deficient in quantity, if not quality. In both cases the availability of high quality browse from forage shrubs offers opportunities for yearlong grazing where otherwise it would not be feasible (Goodin and McKell, 1971).

The dryland trials of fourwing saltbush, without plant competition, indicate that only one at-planting irrigation is needed to achieve essentially 100% survival and establishment of transplants.

Fourwing saltbush planted under optimum soil moisture conditions in the sub-irrigated demonstration forage reserve blocks grew to 1.5m in height and 1.5m in diameter in less than six months, with a standing crop yield of 8,000 kg (DM) per ha. Annual yields based on multiple harvesting and regrowth cycles would be higher.

Studies conducted under drought conditions on dryland sites and the demonstration of optimum forage production potentials serve to encourage further development of techniques and applications for introduction of fourwing saltbush into the range forage resources of Baluchistan.

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