

FOURWING SALTBUSH AS A WINTER MAINTENANCE FORAGE FOR SHEEP IN UPLAND BALOCHISTAN

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Summary

Sixteen Harnai lambs were used in a completely randomized design to study the nutritive value of fourwing saltbush as a winter maintenance browse in comparison to native range grazing with or without protein and energy supplementation at Tomagh Range Livestock Research Station, in Loralai District, Balochistan. The animals were divided into four groups of four lambs each. These four groups were assigned four treatments at random: fourwing saltbush grazing alone, range grazing plus lucerne hay (100 g/head/day), range grazing plus barley grain (100 g/head/day) and range grazing alone for ten weeks. The results indicate that the two range grazing plus supplementation treatments produced weight gains which were not significantly different from each other ($p < 0.05$). Both of these treatments yielded significantly higher weight gains ($p < 0.05$) than did range grazing alone except for the last week of the study. Fourwing saltbush grazing provided cumulative weight gains at 3, 4, 6, 7 and 8 weeks which were not significantly different from the range grazing plus lucerne hay treatment and gained an average of 6 percent in body weight over the 10 week period of study. The carrying capacity for sheep of a mature stand of fourwing saltbush was approximately 20 Sheep-kg-days (SKD) of grazing per cubic meter of foliage. Results of this study suggest that under fourwing saltbush grazing alone, lambs do not only maintain their body weights but can also gain weight in winter.

(Key Words: Fourwing Saltbush, Winter Forage, Sheep)

Introduction

The grassland and shrubland range types in upland Balochistan have a continental, arid to semi-arid Mediterranean climate. Ninety-three percent of Balochistan is classified as rangeland, and approximately 21 million ha or 60% is used for grazing. About 11.7 of the 21 million ha of rangeland is classified as poor for grazing providing only 30-50 kg/ha of dry matter (DM) per year and there are only 2.9 million ha of better quality rangeland providing 250-280 kg DM/ha per year, whereas the rest is of average type (FAO, 1983).

The livestock sector of Balochistan contributes 25 percent to the Gross Agricultural Product of the province (FAO, 1983). Sheep and goats are the major class of livestock and make up 48 percent and 42 percent, respectively of the livestock population of Balochistan. Sheep and goat pro-

ducts contribute directly or indirectly to the incomes of about 80 percent of the population of the province (Nagy et al., 1987).

Sheep and goats population has increased about six fold in the past 30 years from 1.9 million in 1955 to 18.4 million in 1986 in Balochistan (Masood et al., 1988), resulting in severe grazing pressure on the rangelands, which has caused a decrease in the quality and quantity of forage available to range livestock. This problem is especially serious when forage deficits coincide with the critical stages in the animal's production cycle such as breeding, late-gestation and early lactation. To reverse the trend of degradation of the natural vegetation it will be necessary to provide alternative forage sources so that certain range areas can be rested or rehabilitated.

Work on *Atriplex* spp. at the Arid Zone Research Institute, Quetta suggests that *Atriplex canescens* commonly known as fourwing saltbush is extremely useful for increasing forage productivity in the arid or semi-arid regions of Balochistan (Aro et al., 1988) because of its ability to establish, high productivity and persistency under arid conditions. The present study is a part of a continuing research program at the Arid Zone Research Institute focusing on the potential of

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fourwing saltbush (*Atriplex canescens*) as an improved and laternative winter feed suitable for all classes of range livestock in Balochistan.

Materials and Methods

Site

The study was conducted at Tomagh Range-Livestock Research Station, of AZRI, 15km west of Sanjawi in Loralai District at an elevation of 1,800m. The estimated average annual precipitation at Tomagh is 300 mm and approximately 60% of this falls in winter. The daily minimum and maximum air temperatures recorded during the study are shown in figure 1.

Treatment

The duration of the experiment was ten weeks, from November, 1988 to February, 1989. Sixteen Harnai lambs, six to seven months of age, were divided into four groups of four lambs each. Each of the four groups was randomly assigned to one of the following treatments.

- Treatment 1: Fourwing saltbush grazing alone
- Treatment 2: Range grazing + Lucerne hay

@ 100 grams/head/day

Treatment 3: Range grazing + Barley grain @ 100 grams/head/day

Treatment 4: Range grazing alone

Lambs under treatment 1 grazed in four 10 m x 17 m blocks of fourwing saltbush established in 1987 and shifted weekly from block to block while all the other lambs under treatments 2, 3, and 4 grazed native mixed grassland-shrubland range. Each animal had essentially equal access to the available range forage, which consists mainly of the two perennial grasses, *Cymbopogon jawarancusa* and *Chrysopogon aucherii*. The shrub and low tree component of the range vegetation includes *Prunus persica*, *Ebenus stellatus*, *Ephedra intermedia*, and *Olea cuspidata*. The grazing time for lambs under all the treatments was eight hour i.e., 0800 hours to 1600 hours. The lambs under treatments 2 and 3 were fed their supplementary ration individually in late afternoon when they returned from grazing. All animals had equal access to drinking water in the morning and evening.

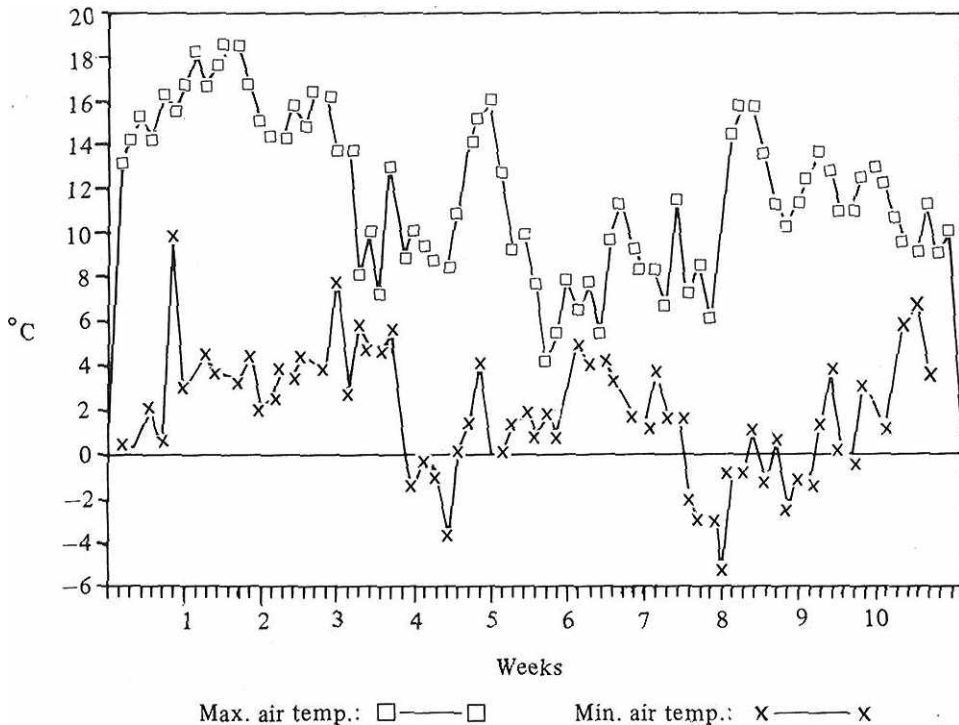


Figure 1. Daily temperature variations during the 10 weeks study period (Nov. 1988 to Feb. 1989) at Range-Livestock Research Station, Tomagh (Loralai District).

NUTRITIVE VALUE OF FOURWING SALTBUSSH

Data collection

The following measurements were made on the lambs in the study.

1. Initial body weight
2. Weekly body weight
3. Final body weight
4. Mortality

Fourwing saltbush forage production was estimated at the start of the study by the following method.

1. Crown diameters and heights were measured for every shrub in the four study blocks. Volume of shrub foliage was calculated at the start of the experiment by the following formula:

$$V = 4/3 \pi (d_1 + d_2/2)^2 (h/2)$$

where d_1 and d_2 are crown diameters, at right angles, and h is crown height.

This formula approximates the standard formula for computing the volume of a sphere, i.e.,

$$V = 4/3 \pi r^3$$

2. Total browsable forage was clipped from three representative fourwing saltbush plants, oven-dried at 68°C for 72 hours and then weighed. The resulting weights for dry forage were used to calculate the fourwing saltbush forage production. An estimate of 575 g/m³ of fourwing saltbush foliage was observed. The ratio of 575 g/m³ was

then used to estimate the total weight of browsable forage in the four study blocks, based on the foliage volume calculations from the 100% sampling, described above.

Results and discussion

The data on live weight changes, and cumulative metabolic weight changes are summarized in tables 1 and 2. The two range grazing plus supplementation treatments produced weight gains which were not significantly different during the 10-week study period. Except for the first three weeks of the study, both of these treatments yielded significantly higher weight gains ($p < 0.05$) than did range grazing with no supplementation.

Fourwing saltbush grazing provided cumulative weight gains at the end of the 1st, 3rd, 4th, 6th, 7th and 8th weeks which were not significantly different from the range grazing plus lucerne hay treatment. At the end of the 4th and 10th week, weight gains by lambs on fourwing saltbush treatment were similar to those on the range grazing plus barley grain treatment.

The fourwing saltbush treatment was significantly different from range grazing with no supplementation, only at the end of the fourth week when animals under the latter treatment experienced a sharp drop in average weight.

Lambs browsing fourwing saltbush as their sole

TABLE 1. WEEKLY LIVE WEIGHT RESPONSES TO DIFFERENT GRAZING AND FEEDING TREATMENT TOMAGH, LORALAI DISTRICT (KG)

Treatment	Weeks	0	1	2	3	4	5	6	7	8	9	10
Fourwing saltbush grazing alone		12.30	12.35	12.05	12.35	12.55	12.60	12.98	12.90	13.35	13.20	13.25
Range grazing + lucerne hay (100 g/head/day)		13.25	13.55	14.35	13.85	14.00	14.45	14.40	14.35	14.90	15.30	15.60
Range grazing + barley grain (100 g/head/day)		12.40	12.65	13.20	13.25	12.95	13.65	13.90	14.00	14.40	14.55	14.15
Range grazing alone		12.75	12.55	12.80	12.55	12.05	12.65	12.80	12.90	13.15	13.55	13.75
Standard error		0.23	0.26	0.32	0.24	0.27	0.27	0.27	0.27	0.32	0.31	0.37

TABLE 2. WEEKLY LIVE WEIGHT CHANGES IN LAMBS UNDER DIFFERENT GRAZING AND FEEDING TREATMENTS (KG W^{0.75})

Treatment	Weeks									
	1	2	3	4	5	6	7	8	9	10
Fourwing saltbush grazing alone	0.35 ^a	-1.45 ^c	0.38 ^b	1.55 ^a	1.85 ^b	3.92 ^{bc}	3.47 ^{bc}	6.25 ^{bc}	5.40 ^b	6.00 ^{bc}
Range grazing + lucerne hay (100 g/h/d)	1.92 ^a	6.33 ^a	3.50 ^{ab}	4.30 ^a	6.78 ^a	6.45 ^{ab}	5.17 ^{ab}	9.20 ^{ab}	11.42 ^a	12.92 ^a
Range grazing + barley grain (100 g/h/d)	1.20 ^a	4.63 ^{ab}	5.15 ^a	3.38 ^a	7.60 ^a	8.98 ^a	9.52 ^a	11.90 ^a	12.75 ^a	10.28 ^{ab}
Range grazing alone	-1.20 ^a	0.35 ^{bc}	-1.07 ^b	-4.12 ^b	-0.55 ^b	0.32 ^c	0.85 ^c	2.35 ^c	4.75 ^b	5.80 ^c
Standard error	0.78	1.05	0.93	1.08	1.12	1.07	1.06	1.18	1.10	1.01

Values in the same column with different superscripts differ significantly ($p < 0.05$).

feed source gained an average of 6 percent in body weight over the 10-week period of the study. This compares with weight gains of 5.8, 10.3, and 12.9 percent, respectively, for range grazing without supplementation, range grazing with barley grain, and range grazing with lucerne hay treatments.

After the initial two-week period of adaptation to the new feed, the lambs browsing only fourwing saltbush gained 40 percent as much as those grazing the native range and receiving lucerne hay or barley grain supplementation.

Toward the end of the study there was an apparent decrease in the average quality of the fourwing saltbush forage consumed due to decreased intake of the more leafy foliage. It was observed that the animals consumed the leaves of fourwing saltbush first, where and when available to them, but the sheep also readily browsed stems up to 3mm in diameter, especially during the last few weeks of the study when leafier material was less abundant. Changes in digestibility of available forage among the four separate plots, and over time, might have caused fluctuation in animal weights.

At the start of the experiment the fourwing saltbush forage blocks contained an estimated 222 m³ of browsable foliage weighing approximately 130 kg, on a dry-matter basis (DM). The aggregate weight of the four sheep used in the fourwing salt-

bush treatment group was 49 kg at the start of the study and 53 kg at the end.

Published nutrient requirements for sheep, based mainly on research data from the U.S.A., suggest a feed (DM) intake range of 3.0 percent to 4.5 percent of body weight for replacement ewe lambs (National Research Council, 1985). Research at AZRI has shown the intake of fourwing saltbush forage (DM) to be approximately 3.0 percent of body weight for Harnai ewe lambs similar to those used in the present study (Atiq-ur-Rehman, et al., 1988).

The present study suggest the following observations:

Firstly, the four ewe lambs under the fourwing saltbush treatment group consumed approximately 1.5 kg/day of forage (DM), equivalent to 375 g/animal/day for the 70 day period of the study, or a total of 105 kg DM. This feed intake level based on 3% of body weight, would have resulted in 80% utilization of the estimated 130 kg of fourwing saltbush forage available at the start of the experiment. Visual estimation of utilization in the blocks at the end of the 10 weeks tends to support the calculated value of 80%.

Secondly, the carrying capacity for sheep of a mature stand of fourwing saltbush is approxima-

tely 20 sheep-kg-days (SKD)* of grazing (or browsing) per cubic meter of foliage. This is based on the estimated value of 575 g/m³ of foliage and a feed intake of 30 g/day/kg for sheep, which means approximately 20 SKD/m³ of fourwing saltbush foliage. Thus, the fourwing saltbush blocks used in the present study had a calculated and observed carrying capacity of approximately 4400 SKD of which an approximately 3500 SKD were utilized.

The carrying capacity estimates for fourwing saltbush in the present study are in proportion to results reported for saltbush grazing trials in Australia where forage yields were somewhat less than one-half the production at Tomagh (Malcolm and Pol, 1986).

This study indicates that under fourwing saltbush grazing alone, lambs cannot only maintain their body weights but can also gain weight. These results agree with those reported by Joseph et al., (1987) and atiq-ur-Rehman et al., (1988) which suggests that fourwing saltbush provides sufficient nutrients to maintain the body weights of animals. This conclusion is also supported by the National Research Council standards (1981, 1984 and 1985) which show that the content of essential nutrients in fourwing saltbush leaves satisfies the minimum requirements of sheep and goats in all seasons. Khalil et al., (1986) reported that the crude protein content of the leaves of *Atriplex* species was higher than the requirements for sheep, which were stated by the National Research Council to range from 9 to 16%. In the present study no animal under test displayed any clinical signs of ill health or nutritional stress.

Future research

The carrying capacity of fourwing saltbush stands for goats has not been determined, but a follow-up study is underway to measure this. The remaining fourwing saltbush forage in the same block used for the present study will be grazed (browsed) by goats to a level of 100 percent utilization. Weekly weights of the goats will be recorded to help determine the trends in body

weights and the total animal weight gain produced from the fourwing saltbush with both kinds of livestock. It has been observed at Tomagh that goats will utilize more of the fourwing saltbush plants than sheep will, especially lambs. The tandem studies of sheep grazing followed by completion of full utilization by goats should provide a more accurate estimate of fourwing saltbush carrying capacity and better recommendations for its use by different kinds and age classes of animals.

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*The SKD is proposed as a standardized animal unit for calculating and reporting carrying capacities of range forage in terms of live weights of grazing animals for a given class of livestock. One SKD is equivalent to one kg of sheep sustained for one day.