Pakistan Vet. J., 2009, 29(3): 133-137.

FEED INTAKE, WEIGHT GAIN AND HAEMATOLOGY IN NILI-RAVI BUFFALO HEIFERS FED ON MOTT GRASS AND BERSEEM FODDER SUBSTITUTED WITH SALTBUSH (*ATRIPLEX AMNICOLA*)

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ABSTRACT

A feeding management experiment was conducted to determine the effect of Mott grass and berseem fodder substituted with saltbush on the performance of Nili-Ravi buffalo heifers. Fifteen buffalo heifers of 8 months age and 120 kg average initial body weight were divided into five equal groups and fed on T1, T2, T3, T4 and T5 having Mott (*Pennisetum purpurium*), Berseem (*Trifolium alexandrinum*), Mott+Saltbush, Berseem+Saltbush and Mott+Berseem+Saltbush, respectively. The experiment was completed in five phases of five weeks each. Higher ($P<0.05$) mean DM contents were observed in saltbush substituted diets (T3, T4 and T5) than T2 and T1. Crude protein contents were higher ($P<0.01$) in Berseem+Saltbush and Berseem alone. Ash contents were significantly ($P<0.01$) higher in saltbush containing diets as compared to Mott and Berseem alone. Mean daily DMI was higher ($P<0.01$) on T2, followed by T4, T1, T5 and T3. Daily water intake was significantly higher ($P<0.01$) in heifers on saltbush substituted diets. Highest daily weight gain was observed on Berseem alone and on saltbush combination diets. RBCs count was higher ($P<0.05$) on T1 and T3, and lowest on T4 (berseem+saltbush). WBCs count ($P<0.05$) were 9.19 ± 0.75, 9.63 ± 0.75, 9.34 ± 0.75, 8.85 ± 0.75 and $8.96 \pm 0.75 \times 10^3$ μl^{-1} on T1, T2, T3, T4 and T5, respectively. Haemoglobin contents were higher ($P<0.01$) in heifers on saltbush containing diets and Berseem alone. PCV varied significantly ($P<0.01$) among treatments and was higher on saltbush substituted diets. Buffalo heifers performed better on Berseem and saltbush diets. It is concluded that saltbush can be incorporated in the conventional diets of Nili-Ravi buffalo heifers up to 50% as an alternate forage source when conventional fodders are short and their nutrient contents are low during severe winter and summer seasons.

Key words: *Atriplex amnicola*, buffalo heifers, weight gain, DMI.

INTRODUCTION

Buffalo is the major dairy animal in Pakistan, contributing approximately 67% of total milk produced in the country (Afzal *et al*., 2007). The present population of approximately 27.3 million heads of buffaloes place Pakistan at second position in the world after India and before China (Khan *et al*., 2007). The Nili-Ravi is the most popular dairy buffalo breed and is mainly reared in Punjab. Pakistan is recognized as the 5th largest milk producing country in the world but per head milk yield is still much less as compared to production level of animals being maintained in the developed countries (Economic Survey, 2006).

Forages are an important source of cheaper feed and their role may be assessed from the fact that their feeding alone constitutes nearly 70% of the total cost of livestock production. Berseem and oats are grown during Rabi season to meet fodder needs in winter and cultivation of mott, sorghum and maize is practiced to fulfil the summer requirements. These fodder crops are not sufficient to meet the requirements under traditional productional specifically in the salinity affected areas. The farmers in these areas face fodder shortage during both seasons.

The area under fodder production is only 14% of the total cultivated land in the country, which produces 58 million tonnes of fodder, being highly inadequate to meet the requirements of our livestock. Mostly, the farmers have to rely on cereal straws, crop residues, farm wastes and some times on expensive feed supplements to fill the feed gap. In terms of roughages, our animals are getting about 40% less green fodder including the pastures and roughage's situation shows a deficiency of about 19% (Sial and Alam, 1988).

Saltbushes are the major salt tolerant fodder species for productive use of saltland, having medium to high concentrations of protein, low concentration of metabolisable energy and relatively low to high concentrations of salt (Barrett-Lennard *et al.*, 2003). If grown on saline soils in Pakistan, saltbush can help to meet the feed deficits. Realizing the importance of this sector, there is need to improve the animal production practices through better feeding management at all stages of animals life especially the growing buffalo heifers which are ignored by the farmers because they are paying more attention to lactating and market

buffaloes. Therefore, the present study was conducted to evaluate the saltbush as a substitute in the diets of large ruminants for improved growth performance.

MATERIALS AND METHODS

A feeding experiment was conducted to determine the effect of saltbush (*Atriplex amnicola*) substitution in mott grass (*Pennisetum purpurium*) and Berseem (*Trifolium alexandrinum*) on the performance of Nili-Ravi buffalo heifers. Fifteen buffalo heifers of 8 months age and 120 kg average initial body weight were divided into five equal and housed individually in the conventional tail to tail system. The experiment was conducted for a period of 25 weeks having five phases of five weeks each. The buffalo heifers were provided one week adjustment period and fed on Mott, Berseem, Mott+Saltbush (50:50), Berseem+Saltbush (50:50) and Mott+Berseem+Saltbush (33.3:33.3:33.4) diets designated as T1, T2, T3, T4 and T5, respectively (Table 1). The data on daily dry matter intake, water intake and weekly weight gain were recorded.

Two representative samples were taken from bulk of fresh fodder used for feeding to heifers on different treatments during each period. The samples were analyzed for dry matter, crude protein and ash contents (AOAC, 1990).

The Blood samples were taken in 10cc disposable syringes having added EDTA from each heifer belonging to different treatments three times each during the five phases. The samples were analyzed for RBCs (Schalm *et al*., 1975), WBCs (Coles, 1974), haemoglobin concentration (Benjamin, 1985) and packed cell volume (Bush, 1975).

The data thus collected were averaged on weekly basis and analyzed using Mixed Model Least Squares and Maximum Likelihood computer programme (Harvey, 1990) to perform analysis of variance. Means were compared by Duncan Multiple Range test, where necessary (Duncan, 1955).

Table 1: Composition of treatment diets (Mott grass and Berseem fodder substituted with Saltbush) fed to Nili-Ravi buffalo heifers

Treatments	DM	CP	Ash
T1	$19.10 \pm .626^{b}$	08.20 ± 0.23^{e}	09.60 ± 0.07^{c}
T2	$18.40 \pm .626^{b}$	16.80 ± 0.23^{a}	09.50 ± 0.07^{c}
T3	$22.50 \pm .626^{a}$	08.60 ± 0.23^{d}	13.20 ± 0.07^{a}
T4	$22.40 \pm .626^{a}$	13.80 ± 0.23^{b}	13.20 ± 0.07^{a}
T5	$21.40 \pm .626^{a}$	11.50 ± 0.23^{c}	11.75 ± 0.07^{b}

Values with different superscripts within a column differ significantly (P<0.05).

RESULTS AND DISCUSSION

Feed composition

Mean dry matter (DM) contents were highest in T3, followed by T4, T5, T1 and T2 (Table 1). DM contents were higher in the saltbush containing diets (T3, T4 and T5) compared to diets containing Mott or Berseem alone (Table 1). High DM as observed in the study were comfirmed by the Pichard *et al.* (1988), who reported high (35-55%) dry matter content of green leaves of 13 species of trees and shrubs.

Crude protein (CP) contents of T1, T2, T3, T4 and T5 diets were 8.20 ± 0.23, 16.80 ± 0.23, 8.60 ± 0.23, 13.80 ± 0.23 and 11.50 ± 0.23%, respectively. Significant (P<0.01) difference was observed between treatments (Table 1). The CP content of whole dried plants ranged from 6.6% in *A. Amnicola* to 9.2% in *A. Vesicaria* grown in Western Australia (Malcolm *et al.*, 1988). Diets with shrub pasture containd more CP than those with grass pastures and *A. canescens* (10% CP) was recommended for rangeland improvement by Otsyina and Mckell (1986). Bhattacharya (1989) reported that *A. Halimus* cuttings contained 18% CP on DM basis.

Ash contents were significantly (P<0.01) higher in saltbush containing diets as compared to Mott (T1) and Berseem alone (T2), as shown in Table 1. The present study indicated higher ash contents in the saltbush containing diets as compared to conventional fodder diets especially Mott. Gihad (1993) found high ash content of saltbush (20 to 38 %) and up to 10% NaCl in saltbush. Guevara *et al*. (2005) compared saltbush and alfalfa hay and reported mean values of ash as 25.3 and CP 13.6%, respectively.

Dry matter intake

The highest DMI was observed for T2 having Berseem fodder alone, followed by T4 (Berseem+Saltbush), T1 (Mott grass alone), T5 (combination of three fodders) and the lowest on T3 having Mott+Saltbush (Table 2). Analysis of variance showed a significant (P<0.01) difference between treatments (Table 2). Gupta *et al*. (1983) reported higher dry matter intake in lactating Murrah buffaloes when given choice to have more than one feeds.

Present results clearly indicate significant effect of type of fodder and combination of forages on DMI. Combination of forages up to fifty fifty (50:50) basis seems desireable as far as DMI was concerned. Abu-Zanat (2005) suggested inclusion of *Atriplex nummularia* in the diet up to 50% with no adverse effect on DMI.

In buffalo heifers, daily DMI was comparatively less on saltbush substituted diets than on Berseem and Mott alone, which may be due to higher salt contents in the saltbush. Riaz *et al.* (1994) reported significant decrease in feed intake with the increase in the level of *Atriplex amnicola*, feeding alone or in combination with the conventional forage (Sudex) in Teddy goats. Depressed feed intake was also found at high salt intakes by grazing ruminants (Masters *et al.*, 2006). High intakes of salt led to decreased feed intake by about 20 to 30% (Gihad, 1993).

Table 2: DMI, water intake, weight gain and haematology in buffalo heifers fed on Mott grass and Berseem fodder substituted with Saltbush

Variables	Treatments				
	T1	T2	T3	T4	T5
DMI/day (kg)	3.03 ± 0.12^{b}	3.23 ± 0.12^{a}	2.65 ± 0.12^{d}	3.08 ± 0.12^{b}	2.76 ± 0.12^{c}
Daily WI (lit)	6.85 ± 0.26^{d}	6.71 ± 0.26^{d}	11.52 ± 0.26^{a}	11.28 ± 0.26^{b}	9.65 ± 0.26^{c}
Daily weight gain (kg)	0.22 ± 0.01^{c}	0.43 ± 0.01^{a}	0.20 ± 0.01^{bc}	0.24 ± 0.01^{b}	0.30 ± 0.01^{b}
RBCs (10^{6} µl^{-1})	5.32 ± 0.05^{a}	5.14 ± 0.05^{b}	5.28 ± 0.05^{a}	4.97 ± 0.05^{c}	5.21 ± 0.05^{b}
WBCs (10^{3} µl^{-1})	9.19 ± 0.75^{b}	9.63 ± 0.75^{a}	9.34 ± 0.75^{ab}	8.85 ± 0.75^{c}	8.96 ± 0.75^{c}
Haemoglobin (g^{-dl})	8.49 ± 0.05^{d}	8.87 ± 0.05^{b}	8.69 ± 0.05^{c}	8.64 ± 0.05^{c}	9.01 ± 0.05^{a}
PCV (%)	29.67 ± 0.75^{b}	26.93 ± 0.75^{e}	28.47 ± 0.75^{d}	28.6 ± 0.75^{c}	30.07 ± 0.75^{a}

Values with different superscripts within a row differ significantly (P<0.05).
DMI = Dry matter intake; WI = Water intake; RBCs = Red blood cells; WBCs = White blood cells; PCV = Packed cell volume

Water intake

The highest water intake (WI) was observed on T3 (Mott+Saltbush), followed by T4 having Berseem+ Saltbush, T5 containing Mott+Berseem+Saltbush, T1 (Mott alone), and T2 having Berseem alone (Table 2). Daily WI was higher in heifers on saltbush substituted diets and lower on Mott and Berseem alone. Highly significant (P<0.01) difference was observed in WI between treatments (Table 2).

The results indicate higher daily intake of water in heifers fed on saltbush substituted diets compared to conventional fodder alone. These findings are supported by Garg and Nangia (1993), who reported increased voluntary water intake in saltfed (200 g/d) buffaloes. Riaz *et al*. (1994) also observed significant (P<0.01) difference in WI on *Atriplex amnicola* alone and in combination with the Sudex in Teddy goats. Similar findings in sheep having high concentration of salt in saltbush diets were reported by Grice and Muir (1988).

Daily weight gain

The highest (0.43 ± 0.01 kg) daily weight gain (DWG) was observed in heifers fed on Berseem alone (T2), followed by Mott+Berseem+Saltbush (T5), Berseem+Saltbush (T4), Mott alone (T1) and Mott+Saltbush (T3). Comparatively higher DWG was observed on Berseem alone and Berseem in combination with saltbush and lower on Mott alone and Mott+saltbush. The heifers on Mott+Berseem+saltbush (T5) diet also performed better than T1, T3 and T4 (Table 2).

Abu-Zanat (2005) observed findings similar to those of the present study wherein 50% saltbush substitution was made in the conventional forages. He reported significant (P<0.01) effect of forage type on growth rate of Awassi lambs. Lambs fed alfalfa hay diet showed higher growth rate compared to those given the diets containing different proportions (25, 50 and 75 %) of *Atriplex nummularia* or *Atriplex halimus* mixed with alfalfa hay. Treatments had significant (P<0.05) effect on live weight changes of lambs. The results of this study regarding lower weight gain in heifers on saltbush substituted diets are partially in line with those reported by Parthasarathy *et al*. (1983).

Some workers reported contrary findings, which may be due to high concentration of salt in the saltbush diets and observed loss of live weight at high concentration of salt in saltbush (*A. vesicaria)* diets (Grice and Muir, 1988). Significant (P<0.01) decrease in weight gain was reported with the increase in level of Atriplex in Teddy goats offered 100% *Atriplex amnicola* diets (Riaz *et al*., 1994). Masters *et al.* (2005) also observed significantly decreased live weight gain in weaner wethers with increasing sodium in the diet either as a direct effect or through an interaction with potassium.

Haematology

Red blood cells (RBCs) count in heifers was higher on T1 (Mott) and T3 (Mott+saltbush) diets. Significantly (P<0.05) lower RBCs count was observed on T4 (Berseem+saltbush), T2 (Berseem alone) and T5 as compared to other treatments (Table 2). White blood cells (WBCs) counts in heifers given corresponding treatments were 9.19 ± 0.75, 9.63 ± 0.75, 9.34 ± 0.75, 8.85 ± 0.75 and 8.96 ± 0.75 × 10^{3} µl^{-1}. Haemoglobin contents in heifers were highest on T5, followed by T2, T3, T4 and T1 (Table 2). Packed cell volume (PCV) in heifers fed on T1, T2, T3, T4 and T5 was 29.67 ± 0.75, 26.93 ± 0.75, 28.47 ± 0.75, 28.60 ± 0.75 and 30.07 ± 0.75%, respectively. Significant differences in RBCs (P<0.05), WBCs (P<0.05), haemoglobin (P<0.01) and PCV (P<0.01) were observed between treatments (Table 2).

These findings are in line with the results reported by Pradhan and Sastry (1989), who found significant differences in buffaloes in haematocrit/PCV, haemoglobin betwen crops and climatic periods. Ezequiel *et al*. (1989) observed significantly low erythrocyte count with 80% maize silage and blood haematocrit was significantly higher than with 40%

Napier hay for Holsteins. The findings of Gill *et al.* (1994) were contrary to those of the present study. They reported that mean values for haemoglobin, erythrocyte count and PCV were non significantly different among five different feeding regimes of Sudex and Atriplex alone and with different proportions. Contrasting results were also reported by Matras *et al*. (1992), who found that diet had no influence on haematocrit and haemoglobin in ewes.

Conclusions

The Nili-Ravi buffalo heifers showed comparable intake and gain on diets having conventional fodders substituted with saltbush, especially the performance of heifers was comparatively better on berseem and saltbush combination diets (berseem+saltbush and berseem+mott+saltbush). Saltbush can be incorporated in the conventional diets of heifers to maintain daily intake and growth performance during feed scarcity periods when conventional fodders are short and their nutrient contents are low.

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