African Journal of Biotechnology Vol. 10(32), pp. 6062-6071, 4 July, 2011
Available online at http://www.academicjournals.org/AJB
DOI: 10.5897/AJB10.1154
ISSN 1684–5315 © 2011 Academic Journals

Full Length Research Paper

Farmers preferences and use of local fodder flora in Tank District, Pakistan

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Accepted 8 April, 2011

Regional fodder trees, shrubs and herbs play an important role in the forage production and receive increased research attention. Fruitful information from farmers and herdsmen about the species they use is lacking in the area. The objective of the study was to find out herdsmen and farmers preference of local fodder species, their criteria for assessing fodder species and the best fodder in the area. The study was carried out in the semi arid region of Tank District. Information was gathered through a semi structured open questionnaire by interviewing 375 respondents of different age groups in different villages of Tank District during 2008 to 2009. A total of 38 different local fodder species were used by farmers and herdsmen. The three most preferred species were *Acacia nilotica, Zizyphus mauritiana* and *Con vol vulus arvensis.* The most frequently mentioned criteria were palatability, ability of the fodder to satisfy hunger and resistance to drought (ever green nature)..

Key words: Rangelands, herbivory, palatability, animal preferences.

INTRODUCTION

Tank has a boundary with South Waziristan agency hence it is called Tank (Tukk). The town of Tank was ruled by Nawab Shah Nawaz Khan, the late Nawab of Tank. It was made tehsil of District D. I. Khan in 1878 and upgraded to the level of District in 1992. Tank District lies from 31°-15' to 30°-31' north latitudes and 70°- 22' east longitudes. It has an area of 409191 acres (1679 square km^2). It is bounded by FR Jandula on the North West, District D.I. Khan on the north and on the west by South Waziristan agency and by District Lakki Marwat on the east. To the extreme of its east lie the ranges of Sheikh Baden and Kohe Suliman on the west. The altitude varies from 260 to 300 m above the sea level. The population mostly depends on agriculture. However, a small portion of the inhabitants are engaged in services, business and other small scale trades.

Grazing is the most economical way of utilizing rangeland vegetation. Palatability is a plant characteristic that refers to the relish with which plants or its parts or feed is consumed as stimulated by the sensory impulses of grazing animal (Hussain and Durrani, 2009) while, preference refers to selection of a plant species by the animals as feed. Animal factors are differential preference for forage species, age, stage of pregnancy, general health and hunger of animal; and plant factors include seasonal availability, degree of maturity, growth stage, phenology, morphological and chemical nature, relative abundance of associated species, accessibility to plants/sites and climate affect palatability (Wahid, 1990; Kababia et al*.,* 1992; Grunwaldt et al., 1994; Nyamangara and Ndlovu, 1995). It has been frequently observed that sheep and cows generally prefer grasses and forage more than shrubs; while goats and camels prefer shrubs (Wilson et al., 1995; Huston, 1978; Grunwaldt et al., 1994; Khan, 1996). Gillen and Sims (2004) reported that the degree of dietary overlap between sheep and goats is greater in dry season because of limited forage availability. Hussain and Mustafa (1995) reported that 58% of the total species were used as forage by goats and sheep in Nasirabad valley (Hunza). Many studies concluded that over grazing reduces palatable cover and species diversity (Hickman et al., 1996; Batanouny, 1996; Makulbekova, 1996; Hussain and Durrani, 2007, 2008). Rasool et al. (2005) stated that the grazing system in Balochistan consists of 74% nomadic, 21% transruminant and 5% sedentary type. Omer et al. (2006) stated that forage production was high during spring in dry temperate rangeland in Northern areas of Pakistan. The

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Table 1. Level of knowledge of the respondents (%) in different age and education groups.

Parameter	Number of plants known to inhabitant				
	Up to 3	4- 6	7 - 8	9 -10	Total
Age group					
Up to 20	3	-	-	-	3
21 - 40	-	15	11	-	26
41 - 60	-	-	14	16	30
61 - 80	-	-	11	30	41
81+	-	0	0		0
Total	3	15	36	46	100
Education					
Illiterate		10	22	21	53
Primary	3		10	9	22
Middle	5	5	-	-	10
Matric	5	-	-	-	5
FA/ FSc	3	-	3	-	6
BA /BSc	-	2	-	-	2
MA/MSc	2	-	-	-	2
Total	18	17	35	30	100

review indicates that no work on the ethnobotany of forage plants of Pakistan in general and Tank rangeland especially is available. Keeping in view, the lack of information and importance of fodder, this study was conducted to assess various fodder plants, best and preferable forage and criteria of their priority. The findings will help rangeland ecologists to suggest ways and means to improve this and similar other rangelands in Pakistan.

MATERIALS AND METHODS

Tank lies from 31°-15' to 30°-31' north latitudes and 70°- 22' east longitudes. It has an area of 409191 acres (1679 square km^2). The altitude varies from 260 to 300 m above the sea level. After a general survey and preliminary discussion with the farmers and herdsmen, 15 villages were selected. In each village, interview and personal observation were conducted with about 25 randomly selected persons during 2008 to 2009.

An open ended questionnaire was used for collecting information. Each respondent was asked to list the fodder plant they and their cattle use in the area, rank the fodder in order of merit according to their preferences and likeness by animals by giving the criteria. They were further asked to classify the palatable species by animal preferences (goats, cows and sheep). The plants were initially identified through farmers and herdsmen. Taxonomic identification of plants was confirmed in the PUH Department of Botany University of Peshawar and National Herbarium, Islamabad. The plant nomenclature used followed that of Flora of Pakistan (Nasir and Ali, 1971, 1996; Ali and Qaiser, 1996, 2007; Hussaain et al., 2006). The information reported here is purely based on local farmer and herdsman opinion.

RESULTS

Majority of the respondents were in the age group of 61 to 80 years (41%) followed by 41 to 60 years (30%). Many of them were either illiterate (53%) or had got their primary education only (22%) (Table 1). The respondents of age group 60 and above were more knowledgeable, they knew up to 10 fodder plants. Most of the respondent (46%) listed up to 9 plants, while 35% of them listed up to 8 plants (Table 1)

Listing of fodder forage plants

There were 38 plants used as fodder forage in the Tank District (Table 2). Out of which the respondent listed only 12 fodder species during free listing. *Acacia nilotica and Zizyphus nummularia* were listed, respectively, by 100 and 90% of the respondents. The local listed both species at first three positions during free listing. *Convululus arvensis, Trifolium alexandrianum* and *Suaeda fruticosa* were the second frequently listed species, respectively by 85, 80 and 60% of the interviewee. *Salsola foetida* and *Brassica compestris* were also popular fodder as they were mentioned by 60 and 45% of the respondent, respectively. *Tribulus terristris* and *Zea mays* were recommended by less than 50% of the respondents. The remaining species shown were listed by either 30% or less than 30% of the respondents (Table 3).

Ranking the best fodder species

The respondents were asked to rank the three best species in the area (Table 4). *Acacia nilotica, Zizyphus*

Table 2. List of plant fodder forage species in the study area.

S/N	Botanical name	Local name	Family	Economic use
1.	*Avena sativa*	Karyanrha	Poaceae	Fodder
2.	*Aerva jvanica*	Sperai	Amaranthaceae	Fodder
3.	*Anagalis arvensis*	Gul boti	Primulaceae	Fodder
4.	*Acacia nilotica*	Kikar	Mimosaceae	Fodder
5.	*Chenopodium album*	Sarmay	Chenopodiaceae	Fodder
6.	*Chenopodium murale*	Tora sarmay	Chenopodiaceae	Fodder
7.	*Convolvulus arvensis*	Mal parwati	Convulvulaceae	Fodder
8.	*Cymbopogon jwarancusa*	Sargharay	Poaceae	Fodder
9.	*Capparis decidua*	Kreta/ kirrha	Caparidiaceae	Fodder
10.	*Cynodon dactylon*	Am washa	Poaceace	Fodder
11.	*Centaurea iberica*	Azghai	Asteraceae	Fodder
12.	*Cicer arietenum*	Chznrha	Papilionaceae	Fodder
13.	*Calotropis procera*	Splmaka	Aeclipiadaceae	Fodder
14.	*Desmostachia bipinata*	Drab	Poaceae	Fodder
15.	*Delbergia sissoo*	Shawa	Papilionaceae	Fodder
16.	*Erythreae ramosassima*	Sur gulay	Gentianaceae	Fodder
17.	*Fagonia cretica*	Spelaghzay/ dhaman	Zygophyllaceae	Fodder
18.	*Heliotropium eichwaldii*	Waghi	Boraginaceae	Fodder
19.	*Lathyru apheca*	Marter jungle	Papilionaceae	Fodder
20.	*Lathyrus sativus*	Matri gul	Papilionaceae	Fodder
21.	*Melilotus parviflora*	Shinji	Papilionaceae	Fodder
22.	*Morus alba*	Spin tot	Moraceae	Fodder
23.	*Medicago denticolata*	Shpathlary	Amaarnthaceae	Fodder
24.	*Malva parviflora*	Pachkay	Malvaceae	Fodder
25.	*Malva neglecta*	Tiklay	Malvaceae	Fodder
26.	*Oxalis carniculata*	Tarwekaai	Oxaladaceae	Fodder
27.	*Oryza sativa*	Sholay	Poaceace	Fodder
28.	*Rumex dentatus*	Jungle sag/lablabo	Polygonaceae	Fodder
29.	*Sonchus asper*	Kandiari	Asteraceae	Fodder
30.	*Salsola foetida*	Lanrhay	Chenopodiaceae	Fodder
31.	*Syssimbrium irrio*	Jungle usson	Brassicaceae	Fodder
32.	*Suaeda fruticosa*	Toor lanrhay	Chenopodiaceae	Fodder
33.	*Tribulus terristris*	Maklinday	Zygophylaceae	Fodder
34.	*Tamarix aphylla*	Ghaz	Tamaricaceae	Fodder
35.	*Torilis japonica*	Spin gulay	Apiaceae	Fodder
36.	*Triticum aestivum*	Kanrak	Poaceae	Fodder
37.	*Trifolium alexandrianum*	Shaftal/ riska	Papilionaceae	Fodder
38.	*Zizyphus mauritiana*	Bera	Rhmnaceae	Fodder

mauritiana and *Convolvulus arvensis* were ranked as the three best fodder plants by 100, 90 and 85% of the respondents, respectively

Criteria for ranking the best fodder species

Acacia nilotica ss. nilotica

The main reason (by 30%) for considering it as the best was its highly energetic and nutritious value (satisfy hunger), enhancing fat production in cattle (31%) followed by its easy availability (25%). The other reason included were its ever green nature (drought resistant) (25%), palatability (15%) and sweetness (10%), respectively (Table 5).

Zizyphus mauritiana

Z. mauritiana was the second best fodder species. The criteria for its consideration were highly preference by all

Table 3. Ranking of fodder plants (%) commonly used by farmer as fodder in Tank.

S/N	Species	Total	1	2	3	4	5	6	7	8	9	10
1	*Acacia nilotica ssp. nilotica*	100	59	30	11	-	-	-	-	-	-	-
2	*Zizyphus mauritiana*	90	49	41		10	-	-	-	-	-	-
3	*Convol vulus arvensis*	85	34		30	21	-	-	-	-	-	-
4	*Trifolium alexandrianum*	80	40	40	-	-	-	-	-	-	-	-
5	*Suaeda fruticosa*	60	-	-	-	25	-	30	-	5	-	-
6	*Salsola foetida*	60	-	-	30	-	15	-	-	10	-	5
7	*Brassica compestris*	50	-	15	10	-	-	25	-	-	-	-
8	*Tribulus terristris*	45	-	27	-	-	-	-	15	-	3	
9	*Zea mays*	40	-	-	-	-	13	-	-	20	-	7
10	*Triticum aestivum*	30	18	-	-	-	12	-	-	-	-	-
11	*Prosopis farcta*	30	-	-	-	-	-	6	-	22	-	-
12	*Tamarix aphylla*	10	-	-	-	-	-	-	5	-	-	5

Table 4. Ranking the three most valuable fodder species by respondents (%)

Species	Total	Age group				
		Up to 20	21 - 40	41 - 60	61 - 80	81+
Acacia nilotica ss. nilotica	100	20	25	46	9	0
Zizyphus mauritiana	90	5	30	35	30	0
Convolvulus arvensis	85	5	28	34	18	0

Table 5. Criteria used by the respondents (%) for considering fodder as the best in Tank

Criterion	Species		
	A. nilotica ss. nilotica	***Z. mauritiana***	***C. arvensis***
Nutritious (satisfy hunger)	30	06	15
Enhances fertility	-	31	-
Ever green nature (drought resistance)	20	23	-
Mixed with wheat straw to increase milk	-	-	35
Easy availability	25	-	-
Can be stored	-	-	30
Palatability	15	40	-
Acceptable taste	10	-	20

sort of cattle (40%), enhancement of fertility (31%) and ever greenness of the plant (23%). Very few people considered it as a nutritious plant (6%) (Table 5).

Convolvulus arvensis

An increase in milk production (by 35%), storage capability for dry season (30%) sweet in taste (20%) and nutritious fodder (by 15%) were the main criteria for ranking the *C. arvensis* as the third best fodder in the area (Table 5).

Animal preferences

According to the local respondents, *A. nilotica* was preferred most by goats (60%) and camels (25%), respectively while cows and sheep liked it rarely (5 and 10%, respectively) due to its spiny nature (Table 6). Similarly, *Z. mauritiana* was also frequently used by goats and camel (50 and 30%, respectively) according to the local respondents. Sheep also feed on it when no alternative was available (20%), but non of the respondent showed its preference by cows. Unlike the *A. nilotica* and *Z. mauritiana a*, the *C. arvensis* was mostly

Table 6. Animal preferences of various fodders (%) in the area stated by the local respondents.

Type animal	Species		
	A. nilotica ss. nilotica	***Z. mauritiana***	***C. arvensis***
Goats	60	50	15
Cows	05	-	45
Camels	25	30	05
Sheep	10	20	35

liked by cows (45% respondents) and sheep (35% respondents). Goats and camels rarely utilize and prefer this fodder (Table 6).

DISCUSSION

Fodder forage for ruminant feeding are generally defined as the plant materials, primarily leave and stems, wild or grown for either direct consumption by ruminant or preserved for feeding of such animals (Heady, 1975). Hence the amount of forage available and consumable per unit area of land will support a certain number of livestock. Willims et al. (2009) (reference missing and incorrect) suggested that for improving forage production, it is important to chose those plant/fodders which have high net primary productivity to support large number of live stock for better animal products.

Of the 40 recorded species, only 12 species viz: *A. nilotica, Z. nummularia, C. arvensis, T. alexandrianum, S. foetida, S. fruticosa, B. compestris, T. terristris, Z. mays, T. aestivum, Prosopis cineraria and Tamarix aphylla* were considered as the best fodder plants in the area. However, *A. nilotica, Z. mauritiana* and *C. arvensis,* were the most preferred species in the area.

The criteria for ranking the best fodder included the ever green nature, easy availability, storage capability, property to induce milking and nutritious values. It was interesting to note that *A. nilotica* and *Z. mauritiana* were not only considered as the best fodder plants but also declared as the best fuel and timber wood species in the area. This definitely means a lot of human and grazing pressure on them. The findings agree with that of Hussain and Durani (2009) who also reported that species with high nutritive values are preferred by others in Harboi range lands, Kalat, Pakistan. Similarly, Samant et al. (2007) listed 150 species of fodder representing trees, shrubs and herbs used as fodder for livestock in the Indian Himalayan Region. Some of the species are similar with that of our findings and they also ranked plants on the basis of criteria similar to ours. It is generally, the farmers and herdsmen who harvest/cut fodder in this very range lands of Pakistan and transport it as head load to their houses and the fodder is used both in fresh and dried form. This agrees with the findings of Gali et al. (2006) who stated that some species were used as fresh and dried fodder in Argentina. Barkatullah et al. (2009) also reported that some plants are liked most by animals than others in the Malakand division, Pakistan. Likewise Mazancourt and Loreau (2000) stated that grazing optimization occurs when herbivory increases primary production at low grazing intensities. This threshold changes with plant community composition and herbivore preference and is, therefore, strongly affected by plant species replacement.

There is great pressure on the vegetation due to heavy grazing as the nomadic move their cattle to higher elevation in summer and return back on the arrival of winter to this semiarid region. Therefore, both regenerating seasons (spring and autumn) are under severe grazing and browsing stress as their mobility is on either direction. Boone et al. (2007) also stated that in semi-arid tropical sites in USA, water and forage shortages in the dry season causes pastoral livestock to move to water or key resource areas. In temperate summers, livestock may be moved to higher-elevation snow-free meadows. In winters, animals may be moved lower to warmer sites, or to mountain valleys protected from steppe winds. Some 300 species of grasses, other herbaceous plants, trees and shrubs were found in the mid-altitude rangelands of Uttarakhand, India, which were used as fodder both in fresh and dried condition (Singh et al., 2008).

It was observed that some plants like *A. nilotica, Z. mauritiana* and *T. aphylla* served as fodder for all the seasons when no alternative is available and therefore it is under severe grazing stress and is much adapted. Similarly, Gherbin et al. (2007) observed that warm-season grasses and legumes have the potential to provide forage throughout the Mediterranean summer when there were high temperatures and low rainfall and when cool-season grasses become less productive (Figure 1).

On the whole, there is always shortage of the fodder in the range land of Tank District. This is due to abundance cattle, and open and unmanaged grazing system in the area. Plants are heavily grazed round the year and most of the palatable specie have assumed bushy or cushion like habit (Figure 2). The regeneration capacity has declined as the plants are grazed even before flowering and fruiting stage. Furthermore, the camels were abundantly

Figure 1. Less productive autumn view of the grazing pasture in Tank District.

Figure 2. *T. aphylla* response to heavy grazing in Tank District.

present and had access to all sorts of plants and this made the whole vegetation bushy and stunted. The grazable plants also serve as medicinal, fuel and timberwood species. This multidirectional pressure hardly

Figure 3a. Effect of browsing on *Z. mauritiana* (tree) making cushion structure.

Figure 3b. Effect of browsing on *A. nilotica* (tree) making cushion structure.

provides any chance to this plant to regrow after they had been grazed or lopped (Figure 3a and b).

Similar study (Gallacher and Hill, 2008) conducted in Dubai, showed that heavy grazing reduced species richness and diversity without significantly reducing seedling density. Both annual and perennial species were

Figure 4. Number of local breed of livestock.

Figure 5. Camel browsing views changed the physiognomy of vegetation.

impacted, though the reduction in richness of annual species was less pronounced than the natural variation among locations. Since the local depends on livestock for their livelihood, they therefore cannot avoid such an act. There is need to improve the range lands by having some rotational system, providing better fodder forage plants suitable to semidry zone and to improve the livestock breed. A poor quantity breed of livestock will consume more and return less. Therefore, the locals kept large amount of livestock (Figures 4, 5 and 6).

The pressure in range lands can be reduced if high yielding breeds are provided which might fulfill the demands of the locals and this will also reduce the number of livestock in the area.

Figure 6. Local breeds of goat in the grazing field in the study area.

ACKNOWLEDGEMENTS

The grant of University of Peshawar to Lal Badshah Ph.D scholar is gratefully acknowledged. This paper is a part of Ph.D research work sponsored by University of Peshawar Pakistan.

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