

from 0.5 to 2 ha). The second group (B, 34%) was defined as livestock farmers raising either pigs in a very integrated MFS, with use of by-products from crops or cattle raising (combined or not with the SR and optimizing the use of natural resources). The 3rd group (C, 54%) was composed of SR breeders (as the main activity), divided according to grazing pasture area: the small unit using less than 15 ha; the large unit using more than 40ha and the ones using the public natural areas (67 to 402 ha). The proportion of species cultivated as food are higher in A than in C: 73 vs. 55%. While the proportion of feeds that are forage species are 30, 36 and 42%, respectively. The different links between activities (crop and livestock) are explained in relation to the farm conditions but also according to the natural environment. The index of sustainability appeared to be better for the groups exploiting crops as in the A group or the MFS "pig" ones (with the use of by-products for feeding animals and herbs for health control).

Conclusion

In the fields of SR production, improving the reproductive performances of the SR, increasing the use of silvopastoral resources, and organising the milk and meat sectors are recommended. The importance of MFS for the future, the interest of local resources and non conventional practices of feeding and health control of the animals are highlighted for reaching sustainable production. This Cuban experience of SAP in the case of SR production could be shared with other farmers of the Caribbean.

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Small ruminant feeding systems in semi-arid land of Punjab, Pakistan: status and prospectus for improvement

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Introduction

Small ruminants (SR) are an integral part of mixed-farming systems in Pakistan. More than 85 million heads of both goats and sheep (GOP, 2009) belonging to 62 different breeds are available in the country (Hasnain, 1985). The majority of the SR flock owners are either landless or have a small piece of land (<5 acres). In Pakistan, a mix of different feeding and management systems are in practice in different areas. The scarce information available on the production systems indicate that despite the different problems, the sustainable SR production is contributing a lot to the well being of small farmers. The aim of the study was to characterize and evaluate the existing feeding systems to determine the status and thus to identify areas for future developments.

Material and methods

The present study was conducted in the adjoining villages of Rawalpindi and Islamabad (commonly called twin cities), in the Punjab province of Pakistan. The twin cities are located (Latitude 33°N and Longitude 73°E) in the Potohar Plateau in the northwest of the country. The mean monthly (Jan-09 to Dec-09) minimum and maximum temperature varies between 2.6–24.3°C and 17.7–38.7°C, respectively (PMD, 2010). The monthly mean total rainfall varies between 17.8–309.9 mm (PMD, 2010). Small ruminant farmers ($n = 50$, flock size >5 animals) having a history of keeping flocks for more than 18 months were randomly chosen and interviewed from each village that falls in the specified radius of 50 Km. A maximum number of farmers from each village were interviewed to gather detailed information. However, the famers having common feeding and management systems and residing in a same village were pooled to make a single unit. The data of only ≤ 5 farmers from each village were used for statistical analysis. A structured questionnaire was used to collect information to assess the demographic factors, production parameters, feeds and feeding systems. The T-test was used to compare the live weight difference among kids and lambs.

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Results

Three types of feeding systems namely grazing (GS; 86%), partial grazing (PG; 10%) and stall feeding (SF; 4%) were identified in the study area. The farmers who opted for GS also feed their animals with other types of feeds depending on the environment and availability of pasture/range vegetations in the grazing areas. Animals were fed crop residues, non-conventional feed sources (kitchen waste, fruit & vegetable leftovers etc.) and green fodder/forage (cut and carry) during severe hot and cold weather and periods of fodder/forage scarcity (May, June, Dec., & Jan.). Small and large ruminant mixed flock grazing was significantly ($P < 0.01$) higher (52.94%) in the area. Supplemental feeding was significantly ($P < 0.001$) higher in female animals. Weight gain was significantly ($P < 0.01$) higher in lambs after 1 m of age and in kids between 1–2 m of age (Table 1).

Table 1 Weight gain of male kids/lambs in flocks reared under complete grazing system

Weight gain (kg/month)	0–1 month (Mean \pm SE)	1–2 month (Mean \pm SE)	2–3 month (Mean \pm SE)
Goat	3.2 ^b \pm 0.59	3.9 ^a \pm 0.61	3.0 ^b \pm 1.10
Sheep	2.9 ^b \pm 0.90	4.1 ^a \pm 1.01	4.2 ^a \pm 0.84

^{ab}Values with different superscripts in a row differ significantly.

Conclusions

The GS of SR production was common in the area. The little supplemental feeding with grazing resulting in appreciable kid/lamb growth suggests that proper feeding management would enhance the productivity of SR.

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Advances in integrated tree crops-ruminants systems for productivity enhancement and environmental sustainability in Southeast Asia

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Among the prevailing ruminant production systems, the integration of ruminants with tree crops such as coconuts, palm oil and rubber is generally neglected and most underestimated. This is associated with inadequate and inefficient use of the natural resources, which dictates improved land use systems, productivity enhancement, and environmental sustainability. Improved efficiency in natural resource management is justified by serious and inadequate animal protein production throughout Asia, where currently available supplies will need to be doubled to meet projected human requirements in 2050. In this context, integrated tree crops- ruminant production systems merit much more emphasis and expansion. Among the tree crops, palm oil is outstanding in Southeast Asia, with Malaysia and Indonesia together accounting for about 79% of the total world planted area of about 8.3 million hectares, and producing about 87% of the total world production of palm oil. Integrated palm oil-based production systems are therefore important pathways in which ruminants (buffaloes, cattle, goats and sheep) can provide the entry point for development. The stratification of the systems, production options, use of forage legumes, and potential for enhanced productivity are indicated. Productivity enhancing technologies and intensification of production systems that can use the abundant availability of feeds to include herbage undergrowth, palm oil fronds (OPF), palm kernel cake (PKC), palm press fibre (PPF) and palm oil mill effluent (POME).have been shown to significantly enhance animal production being consistent with economic benefits and social

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