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Characterization of two goat production systems in the Highlands of Mexico

P. Nagel^{a,}, M. Wurzinger^a, L. Iñiguez^b, F. G. Echavarría Chairez^c, M. de J. Flores Nájera^c, J. M. Pinos Rodríguez^d, W. J. Gómez Ruiz^d, W. Zollitsch^a*

^aBOKU-University of Natural Resources and Applied Life Sciences Vienna, Department of Sustainable Agricultural Systems, Gregor Mendel Straße 33, A-1180 Vienna, Austria

^bInternational Center for Agricultural Research in the Dry Areas, P.O Box 5466, Aleppo, Syrian Arab Republic

^cNational Institute of Forestry, Agricultural and Animal Research, CEZAC, Apartado Postal 18, km 24.5 Carr. Zacatecas-Fresnillo, 98500, Calera V.R., ZAC, Mexico

^dUniversidad Autónoma de San Luis Potosí, Instituto de Investigación de Zonas Desérticas, Apartado Postal 504, Calle Altair 200, Fracc. del Llano, 78377, San Luis Potosí, S.L.P., Mexico

Abstract

In interviews and participatory workshops farmers gave valuable information about their production systems and the socioeconomic circumstances they live in. Body measurements from 100 female goats per region were taken. In both regions the animals had nearly the same weight, height at withers, chest girth and body length with the age of two years. Afterwards the goats in Zacatecas (ZAC) stop growing and at the age of 4 years goats in San Luis Potosí (SLP) are approximately 13 kg heavier; also, all their body measurements are between 7 and 9 centimeters greater. Chemical analysis of 43 fodder plants from semiarid rangeland collected during the dry season showed mostly poor nutrient contents. However some legumes and composites showed reasonable feeding values, although potentially suitable fodder plants sometimes possess defense mechanisms preventing them from being eaten by goats or other animals. It can be concluded that the two systems are different: farmers in Zacatecas rely on very traditional farming methods, while farmers in San Luis Potosí constantly look for new options of farming. Therefore, the money lately invested in the San Luis Potosí site, could result in a more modern system which could act as a model for other regions in Mexico.

1. Background and Aim of the Study

Arid and semiarid regions cover a great part of the Mexican territory especially in the Mexican highlands. 128 millions of hectares can be defined as arid or semiarid environments and around half of Mexico's population lives there. Furthermore most of the inhabitants of these rural areas depend on agriculture and animal husbandry (Echavarría et al., 2006 p. 3). Mayén (1989 p. 11) states that 40.9 millions of hectares of the Mexican territory are, due to topography, temperature and precipitation, not adequate for cattle and sheep husbandry. The ability of goats to survive in very scarce environments is one reason for its importance in these tropical regions. Above all smallholders depend on goats and their products to sustain their families.

Characterizing the goat-production systems in two states of Mexico with a focus on socioeconomic aspects, characterization of the Criollo goats and recollection and analysis of fodder plants is the purpose of the present investigation.

2. Study areas

The Mexican highlands are situated between the mountain ranges of the Sierra Madre Oriental and Occidental. The province Zacatecas (ZAC) is located entirely in the centre of the highlands between latitudes 25°09'N and 21°04'N and longitudes 100°49'W and 104°19'W. The neighboring province San Luis Potosí (SLP) lies east of Zacatecas between latitudes 24°29'N and 21°10' and longitudes 98°20'W and 102°18'W (INEGI, 2002).

Deserts and semi-deserts cover 73% of the Zacatecan territory where 65% of the people live. In San Luis Potosí 69% of the land is defined as arid or semi-arid inhabited by 60% of the population. A low level of formation, poor alimentation and a high infant mortality are consequences of the poverty. Combined with bad housing conditions, low purchasing power and the absence of well paid jobs makes the people of Zacatecas and San Luis Potosí willing to migrate into other Mexican provinces or into the USA (Estrada et al., 1999 p. 179ff and 235ff).

3. Methods

The data collection for the present paper took place in spring 2005. From February to April data from Zacatecas was collected and from April to June the same data collection plus chemical analysis were carried out in San Luis Potosí.

Plant collection and chemical analysis

The farmers in Zacatecas were accompanied on their daily tours to collect the most important fodder plants of the region in this season. A biologist helped with the determination of the plants found. In San Luis Potosí the same procedure for the plant collection was used. Just as in Zacatecas the collected plants were either described as good fodder plants by the farmers or chosen after the directly observed consumption of this plant by various goats.

Phenotypic description of the Criollo Goats

The animals selected for the characterization of the Criollo Goats in the two sites were between two and four years old. Only female goats which represented the main phenotypic types of the herd were measured. The farmers determined the age of the animals. All measurements were taken by one person at the same day and in the morning (the animals still being sober) with a tape. The weighing was performed with a simple spring balance.

Interviews and participatory workshops

The farmers were accompanied on their daily herding tours during 4 to 6 hours. The emphasis of the questionnaire guide in Zacatecas was on socio-economic aspects of the farmers and therefore the reliance of the farmer was crucial to get personal information. Additionally INIFAP provided data from a survey which was carried out in 2004. In the participatory workshop in Pánuco (ZAC) 14 farmers and one housewife participated. The workshop was basically orientated on strengths and weaknesses of goat and plant production system and of the village in general.

In San Luis Potosí a questionnaire was elaborated to get the same information as in Zacatecas. The participatory workshop in Matehuala was orientated on a SWOT-Analysis (strength-weakness-opportunities-threats). Three farmers from the region (two of them also working as intermediaries) and one restaurant owner were among the 19 participants.

4. Results and discussion

4.1. Goat production in Pánuco (ZAC) and San José de la Peña (SLP)

In Zacatecas the farmers kept 40 animals more than farmers in San Luis Potosí where the herds consisted of 61 animals on average ($p = 0,09$). The production in San Luis Potosí focused on kid goats and milk products which were consumed in the own family or sold in the own or the surrounding villages. In Zacatecas the production concentrated on adult animals for local markets. As well as in San Luis Potosí the intermediary is finally determining the price paid per kilo.

The two regions again show quite big differences whereas the milk in San Luis Potosí plays a more important role. The farmers there stated that they milk their goats 2 to 9 months getting daily milk of about 0.5 to 1.5 liters from one goat. Products achieve higher prices during the dry season where less milk is available. The farmers in Zacatecas mentioned that their goats can only be milked during rain season and only for three months giving 0.5 to 1 liter each goat.

Concerning the agricultural used farmland no differences were observed. In both regions every family has about 10 hectares of land to cultivate mainly maize and beans.

Hernández (2000) gives a short summary of the main characteristics of a typical goat production system in Mexico. The objective of the smallholder's goat keeping is the production of meat mostly for family use. There are no official ways of commercializing the products and thus they have to be sold to intermediaries at low prices. Grazing and browsing native vegetation and roadsides with very scarce supplementary feeding for the goats occasionally reduced to maize crop residues and chopped *Agave sp.*, is very common in these regions.

Hernández (2000) also states that the farmers get no technical assistance and have no access to credits because of their solvency. Furthermore the initiatives of forming groups or co-operations between goat keepers are often confronted with insuperable difficulties and therefore inhibit the implementation of programs to develop more paying goat production systems.

4.2. Phenotypic description of the Criollo goats in Pánuco (ZAC) and San José de la Peña (SLP)

In Table 1 the results of the body measurements are presented. An interaction between region and age can be observed for all body measurements. At the age of 2 years goats in both regions do not differ significantly in any body measurement. In San Luis Potosí the goats keep growing whereas in Zacatecas

no further growth could be observed. This leads to significant differences between the 3 and 4 year old goats in San Luis Potosí to those in Zacatecas concerning all measurements taken.

Table 1: Body measurements of the Criollo goats

	n	body weight (kg)	height at withers (cm)	chest girth (cm)	body length (cm)
region*age					
SLP*2 years	8	33 ^a	70 ^a	77 ^a	73 ^a
SLP*3 years	62	41 ^a	75 ^a	82 ^a	77 ^a
SLP*4 years	36	46 ^a	76 ^a	86 ^a	80 ^a
ZAC*2 years	58	32 ^a	67 ^a	75 ^a	71 ^a
ZAC*3 years	28	33 ^b	68 ^b	76 ^b	72 ^b
ZAC*4 years	7	33 ^b	67 ^b	76 ^b	72 ^b
R²		0,49	0,43	0,53	0,39
s_e		5,7	4,3	4,0	4,4

a,b: significant difference (p<0,1); SLP: San Luis Potosi; ZAC: Zacatecas; superscripts for interaction: different superscripts give significant differences for animals of the same age class in different regions.

One explanation for the difference in growth could be related to different management practices. The most striking fact of all is that in Zacatecas bucks stay with the herd throughout the year and mate even very young goats. López (1983 p.80) observed that with this type of management goats are mated the first time at the age of 7 to 9 months which leads to disturbances of growth. Gall (2001 p.98) points out that early gestation leads to problems if it is combined with malnutrition, as it is often the case in extensive grazing systems in the tropics and subtropics. This influences not only the reproduction performance of the goats but also the growth of the animals which could actually be the explanation for the developmental stop of the Zacatecan animals.

As expected no uniform breed characteristics in the phenotypic description of the goats could be found. Mayén (1989 p.28) states that the Criollo goats do not show specific phenotypic markings but can be generally described as a very robust race with a great adaptation for the difficult circumstances in most Mexican regions.

Except from the farmers in San José de la Peña (SLP) who get purebred bucks from the project they are participating in, the farmers in Mexico depend on their Criollo bucks. Sometimes the government (as subsidies) or other organizations (for experiments) give purebred bucks to farmers who use them in their Criollo herds with more or less success. As there is no breeding concept and these gifts are rare and random the breeding progress is little. In the interviews the farmers of San José de la Peña (SLP) strengthened that exotic purebred bucks or cross-bred bucks with a high proportion of exotic genes often reacted more sensitive on the adverse circumstances on the rangelands. Above all on the spiny vegetation affected the health and welfare of the animals leading to declining production or even death. This should be kept in mind for further breeding programs because it could prevent the farmers from losing part of their production or even valuable animals.

4.3. Fodder plants and nutritional value

Table 2: Results from the chemical analyzes of fodder plants

botanic name	family	CP	NDF	ADF	Ash
		g/kg DM	g/kg DM	g/kg DM	g/kg DM
<i>Schinus molle</i> L.	Anacardiaceae	247	583	261	80
<i>Salsola tragus</i> L.	Chenopodiaceae	187	625	149	285
<i>Bidens odorata</i> Cav.	Compositae	275	680	161	124
<i>Euphorbia stictospora</i> Engelm.	Euphorbiaceae	133	348	309	47
<i>Erodium cicutarium</i> (L.) L' Her. ex Aiton	Geraniaceae	257	582	179	149
<i>Avena sativa</i> L.	Gramineae	136	586	319	158
<i>Chloris virgata</i> Sw.	Gramineae	55	835	529	226
<i>Zea mays</i> L.	Gramineae	45	688	354	71
<i>Prosopis laevigata</i> (Willd.) M.C. Johnst. (fruits)	Leguminosae	298	621	245	66
<i>Prosopis laevigata</i> (Willd.) M.C. Johnst. (leaves)	Leguminosae	170	720	376	49
<i>Reseda luteola</i>	Resedaceae	211	257	152	88

In the personal interviews farmers explained that some of the collected plants like *Schinus molle*, *Reseda luteola*, *Prosopis laevigata*, etc. ought to contain substances which inhibit the consumption of big

amounts. Most of these plants have high CP contents and low fibre contents which would make them exceptional fodder plants. Other collected plants (*Salsola tragus*, *Bidens odorata*, *Erodium cicutarium*, etc. are very scarce on the mostly deteriorated rangelands and therefore again do not support a relevant amount of CP to the daily ration. Plants like *Calliandra eriophylla*, *Acacia schaffneri*, *Senna wislizeni*, etc. protect their leaves and fruits with spines so the animals have again problems of consuming bigger amounts.

Besides from leading their herds to good feeding grounds the farmers also help their animals getting fodder plants which are protected with spines or out of reach (*Agavaceae sp.* and *Cactaceae sp.*). The species of fodder plants found in Zacatecas differed from those collected in San Luis Potosí. Although some plants existed in both areas it can be presumed that generally two different vegetation types were observed.

Since the dry season demand a lot from the goats, farmers in both regions join actively in the search of fodder for their animals. In Zacatecas the farmers cut of the spines of *Opuntia stenopetala* which provided extra nutrients and water for the goats. In San Luis Potosí this habit of the farmers is even more pronounced. They cut of the leaves, blooms or fruits from *Agave salmiana*, help the goats to pick the fruits from *Echinocactus platyacanthus* and furthermore provide leaves and blooms from *Yucca filifera* on the daily tours.

5. Conclusions

Most good fodder plants are very scarce, contain substances which inhibit consumption in big amounts or possess other defence mechanisms. This results makes clear that the fodder situation on the pastures, especially during the dry season, is more than difficult and the animals are confronted with extreme conditions. Sustainable solutions for animals, farmers and environment have to be found to make this way of animal husbandry more yielding and the ecosystem more stable again.

New ideas like oat cultivation in the dry season, etc. could be helpful in preventing the soil losses and also help the farmers to get their animals through this difficult time of the year. Changes can only be made with the financial support of the government or other organisations and the help of professional consultants.

Measuring approximately 100 Criollo goats per region showed great variation in the phenotypic appearance although in San Luis Potosí the herds were more similar compared to those in Zacatecas.

Concerning the purpose of the goat production system differences are noticed. In San Luis Potosí the farmers produce kid goat (for meat) and also goat milk for cheese and production of candies. In Zacatecas the milk production plays a minor role also because adult animals (for meat production) are sold and thus not much milk is produced.

It can be concluded that the two systems are different: farmers in Zacatecas rely on very traditional farming methods, while farmers in San Luis Potosí constantly look for new options of farming, such as the use of specific feeds, technologies, etc. Therefore, the money which was invested lately in the San Luis Potosí site, could result in a more modern system which could act as a model for other regions in Mexico.

6. References

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