

Characterization of Sheep Farming in Agroecosystems of Indigenous Communities in Campeche, Mexico

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RESUMEN

Objetivo: Caracterizar la ovinocultura en los agroecosistemas de productores indígenas que recibieron financiamiento por la Comisión Nacional para el Desarrollo de los Pueblos Indígenas (CDI), en Campeche, México.

Diseño/metodología/aproximación: Se diseñó un cuestionario con características socioeconómicas y técnicas y se aplicó a 199 productores agrupados en 27 unidades de producción ovina, distribuidos en siete municipios de Campeche.

Resultados: La ovinocultura de las comunidades evaluadas se caracteriza por el pastoreo extensivo, bajo nivel tecnológico, carencia de infraestructura, y alta participación de la mujer en edad productiva que tienen disponibilidad para aprender e implementar innovaciones y tecnologías. El sistema de producción es tradicional enfocado a repoblar los rebaños, son medio de ahorro, autoconsumo, sin registros productivos y reproductivos. Los productores están dispuestos a implementar estrategias que contribuyan a mejorar sus unidades productivas.

Limitaciones/implicaciones: Las políticas de apoyo, así como esquemas de capacitación deben ser diferenciadas entre la ovinocultura indígena y la tradicional.

Hallazgos/conclusiones: Las unidades de producción ovina tienen infraestructura inadecuada para el manejo del rebaño, existe conocimiento limitado para un manejo adecuado, no hay registros de control y se clasifican como sistema de producción tradicional.

Palabras clave: Ovinos, razas, unidades indígenas de producción

ABSTRACT

Objective: To characterize sheep farming in agroecosystems of indigenous producers who received financing from the National Commission for the Development of Indigenous Peoples (Comisión Nacional para el Desarrollo de los Pueblos Indígenas, CDI) in Campeche, Mexico.

Design/Methodology/Approach: A questionnaire was designed with socioeconomic and technical characteristics and was applied to 199 producers grouped into 27 sheep farming units, distributed among seven municipalities of Campeche.

Results: Sheep farming in the evaluated communities is characterized by extensive grazing, a low technology level, lack of infrastructure, and high participation of women of productive age that are available to learn and implement innovations and technologies. The production system is traditional and focused on repopulating flocks, which are a means of savings and auto-consumption, without productive and reproductive records. Producers are willing to implement strategies that contribute to improving their farming units.

Study Limitations/Implications: Support policies, as well as capacity-building plans, should distinguish between indigenous and traditional sheep farming.

Findings/Conclusions: The sheep farming units have inadequate infrastructure for flock management, they demonstrate limited knowledge for their adequate management, there are no control records, and they are classified as a traditional farming system.

Key words: Sheep, breeds, indigenous production units.

temperatures (Nuñez-Domínguez et al., 2016), they are an option for food production for auto-consumption and commercialization. Currently, there is a lack of information regarding the state of sheep farming systems in Campeche that were supported by the National Commission for the Development of Indigenous Peoples (*Comisión Nacional para el Desarrollo de los Pueblos Indígenas*, CDI). Based on this, this study characterized sheep farming in the agroecosystems of indigenous communities supported by the CDI-PROIN program.

MATERIALS AND METHODS

The study was conducted from October to December 2015 with the participation of 199 producers grouped into 27 sheep farming units (SFU) and distributed in seven municipalities of the state of Campeche (Table 1). The municipalities are located between parallels 19° 14' and 20° 00' N, and 89° 50' and 90° 42' W, at 260 m altitude. The climate is sub-humid warm with summer rains (García, 1988), with temperatures between 26° and 30 °C and annual precipitation between 1200 and 2000 mm.

To characterize sheep farming, a questionnaire was designed and applied with semi-structured questions considering socioeconomic and technical characteristics. The first questions asked age, education, years active, importance of sheep farming, land tenure, type of sheep commercialization, number of animals sold per year, annual income from sale of sheep, current size of flock, land surface designated for sheep, breeds used, productive purpose, type of labor

INTRODUCTION

Sheep farming in the southeast of Mexico is a mostly mixed-system activity that combines agriculture with animal husbandry. The aim of these systems is to sell animals and artisanal craftwork, produce wool for elaborating indigenous garments, and recycle nutrients by using livestock manure to fertilize crops (Gómez-Castro et al., 2011). As such, sheep farming is important for the food security of isolated regions and marginalized populations (Pérezgrovas and Castro, 2000). In Mexico, 11.6% of indigenous women do not have economic income, 32% have income lower than the minimum wage, 28% earn from one to two minimum wages, and 16% earn more than two minimum wages (CONEVAL, 2011). These figures indicate that the indigenous population requires support and finance schemes that are easily accessible which would allow them to improve their productive processes in order to develop their economic activity. Starting in the 2014 fiscal year, the Program for Improving Indigenous Production and Productivity (*Mejoramiento de la Producción y Productividad Indígena*, PROIN) was created as a governmental strategy to increase income, training, and employment opportunities in indigenous communities, fostering the consolidation of productive and tourist projects as well as food security to benefit the indigenous population, organized in groups, societies or businesses, that resides in localities with 40% or more of indigenous population; and to improve their monetary and non-monetary incomes while creating conditions for equality between women and men (CDI, 2014).

In Campeche, Mexico, PROIN financed projects for sheep breeding among organized groups made up of 60% women and 40% men, with the objective to improve their economic income. Backing for sheep farming was given assuming that the agroecological conditions of the state are adequate for its production, and that there is presence of breeds like Pelibuey and Blackbelly. Because of their rusticity and prolificacy, resistance to internal and external parasites, and adaptation to environmental conditions in precipitation and high

Table 1. Municipalities granted financial support to raise sheep by the CDI-PROIN 2014-2015 program, in Campeche, Mexico.

Municipality	Number of towns	Households/Town		Farmers	
		Number	Percentage	Number	Percentage
Campeche	7	10	37.0	68	34.2
Hopelchén	2	2	7.4	17	8.5
Calkiní	1	1	3.7	8	4.0
Calakmul	3	3	11.1	21	10.6
Carmen	3	5	18.5	40	20.1
Candelaria	4	4	14.9	28	14.1
Champotón	1	2	7.4	17	8.5
Total	21	27	100	199	100

Source: Comisión Nacional para el Desarrollo de los Pueblos Indígenas (CDI), Campeche, 2015.

employed, infrastructure, and equipment. For technical characteristics, the questionnaire inquired about reproductive management, feeding, sanitation, technical assistance received, and water management. The information was obtained directly from the members of each group, and direct observation was also made on the management and available infrastructure of the sheep farming units. The data were analyzed with the Statistica software, version 7.1 (StatSoft, 2005).

RESULTS AND DISCUSSION

General Characteristics of Farmers

In the state of Campeche, 80% of sheep farmers that were supported by the CDI-PROIN Program consider sheep farming to be a secondary economic activity and as a "savings account" (Table 2), which agrees with that indicated by Gaspar *et al.* (2016). The other activities carried out by the farmers are domestic (75%), agricultural (18%), commercial (6%), and academic (1%). This is a similar situation to that of the farmers given support to purchase sheep through investment subsidies from the Program for Promoting Family Sheep Farming in the Estado de México (Martínez-González *et al.*, 2011). Despite this, these systems contribute more than 30% of total monetary income and auto-consumption among family sheep production units (Nahed-Toral, 2002), and the producers perform other activities to cover family expenses (Nuncio-Ochoa *et al.*, 2001). The producers have little experience in sheep farming: on average, 1.5 years; this is due to them having started in this activity because of the CDI financial support to acquire sheep.

The participation of women represented 78.4% of members in the production unit, and is the result of the CDI program's gender focus. Women's observed

participation is more than the 10-13% indicated by Vélez *et al.* (2016), and more than the 30% observed in Valle del Mezquital, Hidalgo (Vázquez-García, 2014). Because they are a small species, raising sheep requires less space compared to cattle, their management is easier, and the majority of small flocks are close to or on the backland of producers' houses. This favors greater participation of women in the care and management of the flock, as they divide their attention between livestock and domestic chores.

All farmers interviewed speak an original language, either Maya (67%), Chool (24%), Mam Ixil, Totonaca or Tzental (9%), which coincides with that reported by Perezgrovas and Castro (2000) among rural sheep farmers in the state of Chiapas; this confirms that the support provided by the CDI in Campeche has benefitted the target population, and that it is necessary to consider it in training activities and the design and implementation of new projects. In other words, this affirms that the backing has managed to reach the target groups; however, production and

Table 2. Socioeconomic characteristics of indigenous farmers granted financial support to raise sheep by the CDI-PROIN 2014-2015 program, in Campeche, Mexico.

Variable	Mean \pm S. D.
Age (years)	38.7 \pm 6.3
Education (years in school)	2.4 \pm 0.5
Experience raising sheep (years)	1.4 \pm 0.8
Total land owned (ha)	21.0 \pm 10.6
Land used for raising sheep (ha)	5.9 \pm 3.7
Heads owned (number)	92.8 \pm 52.2
Heads sold per year (number)	15.3 \pm 14.1
Net income from sheep sales (\$)	18 305 \pm 17 389

S.D. = Standard deviation.

capacity-building plans for indigenous farmers should be differentiated from conventional sheep farming because the socioeconomic, geographic, cultural, and technological conditions of these social groups are different. The importance of this study emerges from this, with the aim of contributing to this aim.

The average age of farmers was 38.7 years, and only 4% were older than 50, indicating a favorable age group for adopting technology and innovation (Borroto *et al.*, 2011), which could be advantageous for authorities in charge of following up on the backing granted. In education, 63% have primary school studies, 29% have secondary school studies, 7% have upper school studies, and 1% college studies, similar to that reported by Vélez *et al.* (2016). Because of the educational level and considering that the majority do not speak Spanish, access to sources of information (electronically) is limited, and therefore it is necessary to implement innovative strategies in training and technology transfer; for example, the use of illustrations with images for better comprehension, as well as written text in the local language.

The average number of sheep per farmer group was 49.4 heads with a range of 15 to 105, of which 78.3% are Pelibuey × Blackbelly crosses, and 21.7% are Pelibuey × Kathadin crosses. Sixty-eight percent (68%) of studs used are Pelibuey, 17.9% Dorper, 7.1% Kathadin, and 7.0% Blackbelly, which indicates a preference for Pelibuey animals due mainly to their prolificacy and rusticity (Nuñez-Dominguez *et al.*, 2016); 59.3% of the production units have the goal of producing females for breeding, due to the interest in increasing the size of flocks, while only 22.2% of the animals are occasionally traded, and 18.5% are used for auto-consumption. This is similar to that found by Vázquez-García (2014).

The total workforce used is family labor, with important participation from women in livestock activities, and caring for the animals is done by the majority of family members, similar to what sheep-raising families do in the states of Veracruz (Pérez-Hernández *et al.*, 2011) and Hidalgo (Vázquez-García, 2014). The producers sell their live animals at low prices (US\$1.6 to US\$2.1 kg of live weight). They trade ewes with one to two births, and year-old lambs, weighing approximately 38 to 40 kg; sales are made within the same production unit.

At the time of the study, all production units had management pens and food and water troughs, built

with local materials. They also had spaces to shelter the animals, although 90% of the production units did not have adequate pens for each productive stage of the flocks; they lacked equipment and only 30% possessed agricultural machinery and basic equipment.

This situation is similar to what predominates in farming systems in Tabasco (Nuncio-Ochoa *et al.*, 2001) and Campeche (Dzib-Can *et al.*, 2006), and in general, it is similar to all of south and southeastern Mexico, which departs notably from sheep farming on the high plateau and north of Mexico, characterized by technological components and adequate infrastructure that allows for maintaining a greater number of animals in less space.

Of the farmers, 74% have an extensive farming system and 70% feed their sheep with grass. Twenty-one percent (21%) provide crop residues as well, and just 9% use a commercial balanced feed (Galaviz-Rodríguez *et al.*, 2011). All sheep production units employ continuous breeding, similar to that reported in the state of Campeche (Dzib-Can *et al.*, 2006) and Veracruz (Pérez-Hernández *et al.*, 2011). The rate between the number of males for every female was 1:4, a proportion higher than the 1:25 that farmers with high technology levels implement, but similar to that of farms with medium to low technology levels (Dzib-Can *et al.*, 2006), and this indicates the possibility of improving their breeding management.

All of the farmers have trained in basic organization and administration by way of CDI community promoters, but only 22.2% have been instructed on sheep management, principally on feeding, breeding, and sanitation themes; and the same producers mention that they require technical assistance and specialized training in parasite control, prevention and treatment of disease, forage conservation, and the establishment of agrosilvopastoral systems using local resources. With respect to this, it is considered important to promote environmentally-friendly farming by establishing agrosilvopastoral systems based on local resources, and taking advantage of the empirical experience of producers and the knowledge they possess about plants and their fruits. This way, through participative research, the species with potential to be used can be identified, selected, and evaluated directly in the production units (Villa-Herrera *et al.*, 2009). Some plants that are locally available, and which farmers consider to be important to promote in order to complement the sheep's diet are West Indian elm (guácimo or pixoy, *Guacima ulmifolia* Lam.), breadnut

(ojite, *Brosimum alicastrum* Swartz.), and river tamarind (guaje, *Leucaena leucocephala* (Lam). de Wit).

Only 3% of the production units evaluated keep productive and reproductive records; the rest do not record information, but they are interested in learning its use in order to improve. This is similar to the situation in Yucatán (Góngora et al., 2010) and Veracruz (Pérez-Hernández et al., 2011). Seventy-five percent (75%) of water provided to the flocks arrives by haulage to the farming unit, 15% is obtained from a well, and only 10% from the local drinking water system, which is similar to that reported by Pérez-Hernández et al. (2011) for communities in Veracruz. The former suggests the need to plan infrastructure for rainwater capture in the production units.

CONCLUSIONS

The sheep production units characterized lack adequate infrastructure for flock management. The support policies, as well as training plans, should be differentiated between indigenous and traditional sheep farming. Women's participation in raising sheep is high, and they have great willingness to learn and implement innovations and technologies. They lack basic knowledge in managing flocks and as a consequence, the production system is traditional, without control records. The producers want to continue in the activity and are willing to implement strategies that contribute to improving the production units.

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