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A Social Approach for the Assessment of Transition Farms: Taking Steps toward Whole-System Organic Certification in Mexico

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ABSTRACT This paper integrates a methodology for an assessment previous to organic certification of transition farms. The methodology was designed and applied to a farm in the municipality of Villaflores, Chiapas. Research consisted of grouping certification standards from different certification agencies into an integrated methodology for evaluating the farm prior to it being submitted to the certification process. The norms proposed by the International Federation of Organic Agriculture Movements and the Mexican certifier of ecological products were utilized—both of these accredited by the German certification program—as well as the Japanese Ministry of Agriculture's principles of organic agriculture. The methodology was based on a systemic approach and applied using agricultural anthropology. Field research was conducted from January-May 2012, through interviews, field observations and triangulation of information. Results indicated that within the agricultural sub-system of the farm, 77% of indicators meet the norms of organic certification and within the animal subsystem only 74%. This study permits the pre-assessment of farms and the progress quantification toward organic certification. Given the cost of taking on the certification process, this pre-assessment represents an important tool to help small farmers develop their capacity to identify farm components and interactions, keep records on all farm activities and plan organic transitions.

INTRODUCTION

The indiscriminate use of toxic substances in conventional agriculture across the planet has led to serious consequences for human, animal and environmental health. Efforts by farmers to produce healthy, chemical-free food have been validated and verified through the development of organic standards, certification and labelling (Rodriguez-Gomez 2013; Sage 2014).

Around the world, there are currently about 17 million hectares of land under organic cultivation. In Mexico, over 102,000 hectares are producing organic foods, with over 80,000 ha found in the states of Chiapas, Oaxaca, Michoacán, Chihuahua and Guerrero. Chiapas and Oaxaca alone include a combined 70% of the land surface dedicated to organic production. Organic coffee covers two-thirds of all land dedicated to organic production in the country, while corn covers 4.5% and sesame 4% of all organic farmland. Organic vegetable production covers only a tiny portion of total organic farmland, but is highly important in nutritional and economic terms (FAO 2001; Willer and Yuseefi 2007; Willer and Kilcher 2011; Lin 2011).

Organic certification standards are oriented to ensure that the final product of a productive process completes international norms. However, no norms exist to certify organic farms as whole-systems; instead, the standards have been designed for a final product, certifying the activities conducted in the process of production and commercialization (FAO 2001; IFOAM

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2008; Lamine et al. 2014). There is a gap in normative certification that leaves diversified and organic farms, as whole-systems, outside of certification opportunities. For this reason, the present study looked at developing a methodology to allow a systemic analysis of the subsystems of a diversified farm, in order to offer a tool for accompanying farmers during the organic transformation and certification, while following existing international norms.

Few interdisciplinary studies, especially in the social sciences, refer to organic farm certification (Watson et al. 2008; Lamine and Bellon 2009; Andrieu 2012). However, farm-level certification is important because organic farms do more than just produce food; they also offer important services such as improving landscape matrix quality, creating recreation spaces, protecting natural resources and preserving cultural heritage (Darnhofer 2009; Perfecto et al. 2010; Di Iacovo et al. 2014).

In this sense, several authors have discussed questions related to the necessity of addressing the different measuring units for organic farming and livestock raising, and despite the difficulties evaluation frameworks have emerged that are based on the evaluation of indicators at distinct spatial scales (plot, farm, landscape) taking into account the principles of organic agriculture and certification norms (Lund and Röcklingsberg 2001; Van Cauwenberg et al. 2007; Knickel 2008; Meul et al. 2008; Ferguson et al. 2013; Robertson 2013;). This paper represents an academic effort to: 1) construct a methodology for whole-system pre-assessment that complies with international norms and 2) apply it to a transition farm in order to carry out an assessment of its current status.

MATERIAL AND METHODS

Location

The present work was carried out in “La Montaña” farm, which lies along the highway between the state capital of Tuxtla Gutierrez and the town of Villaflores. The farm is located between the latitudes of 16° 00' 18" and 16° 20' 52" North and between the longitudes of 93° 24' 34" and 93° 19' 6" West. According to the Köppen classification as modified by Garcia (1998), the prevailing climate in Villaflores is hot-sub-humid AW_1 (w) (i) g with average temperature of 22 ºC and an average annual precipitation of 1,200 mm.

The documentary research was carried out at the Faculty of Agronomic Sciences of the Autonomous University of Chiapas and the field work was done at the farm and home of the farmer in Villacorzo, Chiapas, between January and May 2012. The farm was chosen due its orientation toward subsistence production and low scale trading. It was purchased in 2001 by an agronomist from a farm family and since then activities have been oriented toward organic production, meaning that the process of conversion has been taking place over 10 years.

Methodological Approach

Research consisted in obtaining quantitative and qualitative information about the processes of production and organic transition on the farm. Activities were ordered into three phrases: 1) planning—visits to the farm and the elaboration of a methodological framework for the application of an assessment system and the analysis of its results; 2) implementation of the methodology—tours of the farm, application of questionnaires, photography; 3) systematization of the compiled information—meaning its organization and analysis in the regional context.

The methodological perspective used in this study was the result of a systemic approach with agricultural anthropology methods used in previous studies in Chiapas and Oaxaca (Guevara 2007). The idea was a product of the gap in certification norms that are directed toward evaluating the production process of a product as a single entity rather than certifying farms as integrated systems.

As a starting point, proposed and accepted norms of the International Federation of Organic Agriculture Movements (IFOAM) and the Mexican certifier agency (CERTIMEX) were employed, because both are accredited by such national quality control agencies as DAKKS–Germany, USDA–USA, and MAFF–Japan. Dimensions, criteria and indicators were defined based on those standards. However, it was found that certification norms were established to evaluate finished products—through documents and field visits to establish that organic methods were used—rather than the farm as a whole system. It resulted more adequate in the context of a highly diversified farm to focus on another layer of analysis—the transition farm—in which several subsystems of production are integrated with the family unit where the farmer decides on, organizes, plans and implements production. As such, the construction of an evaluative tool that would permit the assessment of the whole farm's current status and perspectives for the organic certification of its products became the methodological focus.

According to the norms proposed by MAFF (2001), USDA (2003), DAKKS (2005), IFOAM (2008), and CERTIMEX (2009), it is necessary to conduct a study of the farm history in order to have a basis for the organic certification process. Looking at the integration of all subsystems into an indicator system, the principles of the agro-ecological transition (Gliessman 2004; Nahed-Toral et al. 2013a) were used to identify indicators that were not included in the certification standards and yet were considered to be important for the methodology and the beginning of a certification process.

Indicators were defined according to the completion of the norms of certification and the principles of agro-ecology. Measuring was carried out in function of the qualitative completion of each indicator, using the binomial form with options 1) yes, organic certification norms are being met, and 2) no, norms are not being met. Evidence was gathered through questionnaires, tours to farm facilities, background information searches and photography.

The number of indicators that were meeting certification standards was then converted into a percentage for the final whole-system assessment. The systematization of all information allows the simultaneous assessment of the different farm subsystems and their possible synergies, in addition to providing the necessary information for the farmer to decide whether to initiate the process of organic certification.

In Table 1, indicators are defined for the agricultural and animal production subsystems. Those marked with a double asterisk (**) are applied to both sub-systems.

- **Soil fertility: This indicator brings together information about soil management and, for example, synthetic fertilizer use or use of local nutrition sources such as animal manure and organic fertilizers (compost, bocashi, worm castings, green manures, etc.) and legume species for nitrogen fixation.
- **Soil conservation: this involves the use of agro-ecological and agronomic techniques such as crop rotation, mixed-cropping, tree grazing, living fences, mulch, contour rows, hedgerows, simple terracing, and other techniques to conserve soil and reduce erosion.
- **Pest presence and management: This indicator refers to the presence of pests such as herbivorous insects, and the mode of management used on the farm to avoid or reduce harm to crops or animals. Forms of management may include the use of chemical or botanical products, production and protection of natural enemies, spatial and temporal diversification, as well as ecological soil and pasture management.
- **Disease presence and management: This indicator refers to the presence of diseases such as those caused by fungal pathogens, and the mode of management used on the farm to avoid or reduce harm to crops or animals. Forms of management may include diversification, rotations, shifts in planting dates or cultural practices, etc.
- **Weed presence and management: This indicator refers to the presence of undesired plants such as invasive grasses, and the mode of management used on the farm to avoid or reduce harm to production. Forms of management may include the avoidance of competition through companion planting, crop rotation, as well as mechanical or chemical weeding practices.
- Seed and plant genetic material sources and management: This involves learning the origin of the seeds and the practice of *in situ* conservation of genetic resources.
- **Species composition: This indicator was used to learn the number of species and varieties within a given subsystem.
- **Species distribution: This refers to the arrangement of species in a given area.
- **Microclimate management practices: This refers the strategies for managing the farm microclimate and minimizing losses due excessive flow of solar radiation, air or water within the farm (selection of species and varieties, location of crops, planting dates, population density management, windbreaks, cover crops, mulch, drip irrigation, use of terraces, etc.).

Table 1: Criteria and indicators included in the evaluation proposal of the crop and animal sub-systems of transition farms and the results found in "La Montaña" farm, Villaflores, Chiapas

Criterion	*Area*	*Indicator*	*Tool*	*Compliance*
Crop Subsystem				
Environmental	Ecological soil management	Soil fertility	a, b, c	Yes
		Soil conservation	a, b, c	Yes
	System fragility	Pest presence and management	a, b	Yes
		Disease presence and management	a, b	Yes
		Weed presence and management	a, b	Yes
	Agro biodiversity	Origin and management of genetic material	a	Yes
		Species composition	a, b, d	Yes
	Microclimate management	Species distribution		
		Microclimate management practices	a, b, d	Yes
	Agro-astronomy	Use of lunar calendar	a, c	Yes
		Use of traditional climate prediction (*cabañuelas*)	a, c	No
	Water management	Use of irrigation (quantity, frequency and method)	a, b, d	Yes
		Surface water capture, retention and storage	a, b, d	Yes
		Ground water capture and extraction	a, b d	Yes
		Water quality analysis	a, b	No
Economic	Productivity	Land equivalency ratio	a, b	No
	Efficiency	Cost-benefit ratio	a, c	No
	Artisanal agro-industry	Added-value to products	a	No
	Publicity system	Diffusion mechanisms	a	Yes
	Self-sufficiency	Degree of dependence on external inputs	a	Yes
	Profitability	Labour demand	a	Yes
Social	Participation	Family involvement	a	Yes
		Gender equality	a	Yes
	Stability	Quality of life index	a	Yes
		Food self-sufficiency	a	Yes
	Capacity-building	Learning reinforcement through courses, workshops and congresses Capacity for change and innovation	a, c	No
Political	Economic supports	Credit	a	Yes
		Farmer alliance support	a	Yes
	Links to political parties	Support to political parties	a	Yes
Animal Subsystem				
Environmental	Ecological soil management	Pasture fertility	a, b	Yes
		Pasture conservation practices	a, b	Yes
	System fragility	Pest presence and management	a, b	Yes
		Disease presence and management	a, b	Yes
	Agro biodiversity	Origin and management of genetic material	a	Yes
		Species composition	a, b, d	Yes
		Species distribution	a, b, d	Yes
	Microclimate management	Microclimate management practices	a, b, d	Yes
	Alimentation	Feed type	a	No
		Animal grazing load	a, b	No
		Pasture rotation	a, b	No
		Feeding with forage species	a, b	Yes
	Agro-astronomy	Use of lunar calendar	a	Yes
Economic	Efficiency	Cost-benefit ratio	a, c	No
	Artisanal agro-industry	Added-value to products	a	No
	Publicity system	Diffusion mechanisms	a	Yes
	Self-sufficiency	Degree of dependence on external inputs	a	No
	Profitability	Labour demand	a	Yes
Social	Participation	Family involvement	a	Yes
		Gender equality	a	Yes
	Stability	Quality of life index	a	Yes
		Food self-sufficiency	a	Yes
	Capacity-building	Learning reinforcement through courses, workshops and congresses Capacity for change and innovation	a, c	Yes
Political	Economic supports	Credit	a	Yes
		Farmer alliance support	a	No
	Links to political parties	Support to political parties	a	Yes

(a) Survey, (b) Farm tour, (c) Background information, (d) Photography. Yes: meets organic certification standards, No: does not meet organic certification standards.

- Animal breeding and stock management: indicates the origin of animals found on the farm and their reproductive management.
- Feed type: this refers to the form of feeding used for farm animals, in intensive or extensive form.
- Animal grazing load: this indicator provides information on the management of grazing load in a determined area.
- Pasture rotation: this brings information on the use and rest periods of pastures to optimize their production.
- Forage species feed: this provides information on the quantity of forage species used in animal feeding.
- **Use of lunar calendar: this refers to the use of lunar phases to carry out activities such as planting, transplanting, harvesting, castration, births, cuttings, etc.
- Use of *cabañuelas*: this indicates whether traditional climate prediction methods are used to plan agricultural activities.
- Irrigation: refers to forms of water use (quantity, frequency, and method)
- Surface water capture, retention and storage: this indicator describes the gambit of techniques for surface water conservation, such as reforestation, contour planting, terraces, dikes, ponds, aqueducts, and infiltration edges (Table 1).
- Groundwater capture and extraction: this describes the techniques of capture and extraction of groundwater such as reforestation, soil structure management, manure management, wells, pumps among others.
- Analysis of water quality: this provides information on the state of the water used in subsystems of the farm, verifying if the farmer has made water quality studies.
- Land equivalency ratio: this indicator reflects the grade of efficiency of the diversification and if the interaction between species in beneficial (synergy) or negative (competition).
- **Cost-benefit relationship: this refers to the relation between costs and income, and the net benefit of each subsystem.
- ** Added value of product: this is an extra value given to a product, with the objective of obtaining a greater benefit.
- **Mechanisms of diffusion of the farm: this indicator provides information on the mechanisms that are used by a farmer to move products after harvest, as well as the costs that these activities generate.
- **Degree of dependence on external inputs: determines the degree of dependence on external inputs in each subsystem.
- **Workforce demand: provides information on the economic possibilities of the farmer to hire personnel to work on the farm as well as the costs of hired labour.
- **Family involvement: this indicator refers to the intervention of the family in the design, monitoring and implementation of the system.
- **Gender equality: indicates the distribution of costs, benefits, decision-making and the degree of democratization of the farm.
- **Quality of life indicators: this indicator permits measuring the quality of life of the people and the family well-being in relation to their integration in the farm.
- **Food self-sufficiency: Gives information on the satisfaction of nutritional needs of the family through the production on the farm.
- **Learning reinforcement through courses, workshops and congresses: capacity-building was considered, as well as knowledge-diffusion mechanisms and continued learning.
- **Capacity for innovation and change: this indicator refers to the kinds of changes and innovations that the farmer can carry out or already does within the farm or its subsystems.
- **Credits: this indicator provides information about the way that economic resources are obtained for farm use.
- **Alliance with Farmers (*Alianza para el Campo*): gives information about whether farm receives local, state, or federal resources under a subsidy scheme.
- **Political party supports: this indicator provides information about the political parties that may have provided support to the farmer (Table 1).

RESULTS AND DISCUSSION

History of "La Montaña" Farm

The land was purchased in 2001 by Mr Jesus Ovando and his family. Mr Ovando's origins are in the region; he grew up on a farm in the same municipality. However, he studied at the Faculty of Agronomic Sciences of the Autonomous University of Chiapas, whose campus is only about four kilometres from "La Montaña" farm, and graduated as an agronomist. After graduating, Mr Ovando worked for the National Geography and Statistics Institute (INEGI) before purchasing the two ha piece of land and beginning to work it. Initial activities focused on planting trees, since the parcel had been highly eroded pastureland. With time, a house was built and a well dug, which allowed irrigation and water use during the long dry season from November-May.

As the complexity of the farm increased, Mr Ovando noticed that birds and reptiles such as iguanas, formerly absent, began to use the land as a habitat and migration corridor. Tree planting deliberately focused on fruit trees, timber species and livestock forage species. Animals, starting with chickens and sheep, and then including pigs, rabbits, turkeys, ducks, and at one point a milk cow, were brought into the farm system to experiment with different production arrangements. A pond was formed for pigs to bathe in, and corrals with edible trees were built for forage. Crops such as corn, beans, yucca, peppers and tomatoes have all been produced, despite the erosion.

Since buying the site, the family has made an effort never to use agricultural chemicals, and has invested great energy in soil conservation measures such as living fences and contour planting. However, the family lives off-site and devotes most of its energy to a successful bakery business. Two full-time labourers are employed to carry out productive activities by day and watch the farm at night, since animal theft is not unknown in the region. Mr Ovando doesn't keep records of his costs and farm incomes, but said that he felt that in recent years the farm had been making a slowly-growing profit.

Crop Subsystem: Within the crop subsystem, production of corn, beans, vegetables, fruit and timber was considered. These productive components are organized within the farm in such a way as to feed back into the farm, as shown in Figure 1.

Within the ecological soil management systems area, the soil fertility indicator may be found. According to the results obtained in this study, "La Montaña" farm uses animal manure (from sheep, pigs, rabbits and birds), organic fertilizers (including compost, worm castings, and liquid fertilizers made from manure) and legume species (*Leucaena* sp, *Glyricida* sp, *Canavalia* sp and *Phaseoulus* sp) to increase the availability of nutrients in the soil. Since 2001, no synthetic fertilizers have been applied to the soil, meeting the standard for organic certification.

Soil fertility is a key concept for crop production, since abandoning soil fertility would mean a long descent of crop productivity and would effectively rule out organic agriculture. Metabolic function of plants requires that nutritional substances be found in equilibrium, while deficits or excessive quantities of one or another nutrient may lead to weakened plants that become more susceptible to damage pests and disease, and produce lower quality harvests (Vázquez 2005). However, the regular application of manure and compost can have positive effects on soil structure (Mccune et al. 2011), promote nitrogen mineralization and increase soil organic matter content, with positive outcomes on water retention and root growth (Pimentel et al. 2005; Richter et al. 2007).

In the area of agro-biodiversity, the species composition indicator was used to measure how the farm manages the complex species diversity found on site. This includes tree species as well as grains, legumes and ornamentals. With respect to this indicator, the farm was found to comply with the principles of organic agriculture.

In this sense, plant biodiversity, apart from all its benefits from a systemic perspective (soil protection, water balance, refuge for fauna, etc.) also functions in agricultural situations as a natural barrier to excessive pest population. Part of this function is carried out by the simple fact that there is no one plant population so large as to bring about a population explosion among herbivore insects. Other mechanisms include the secondary compounds emitted by plants that serve to make aromas of potential target plants only locally available in the immediate area surrounding the plant (Collins and Qualset 2008). Biodiversity also contributes to ecosystem services by increasing the stability and resilience of the larger landscape (Letourneau and Bothwell 2008; Norton et al. 2009; Mccune et al. 2012; Flores et al. 2014).

Within the area of efficiency, the cost-benefit ratio was used as an indicator. In the case of the crops in "La Montaña" farm, the owner

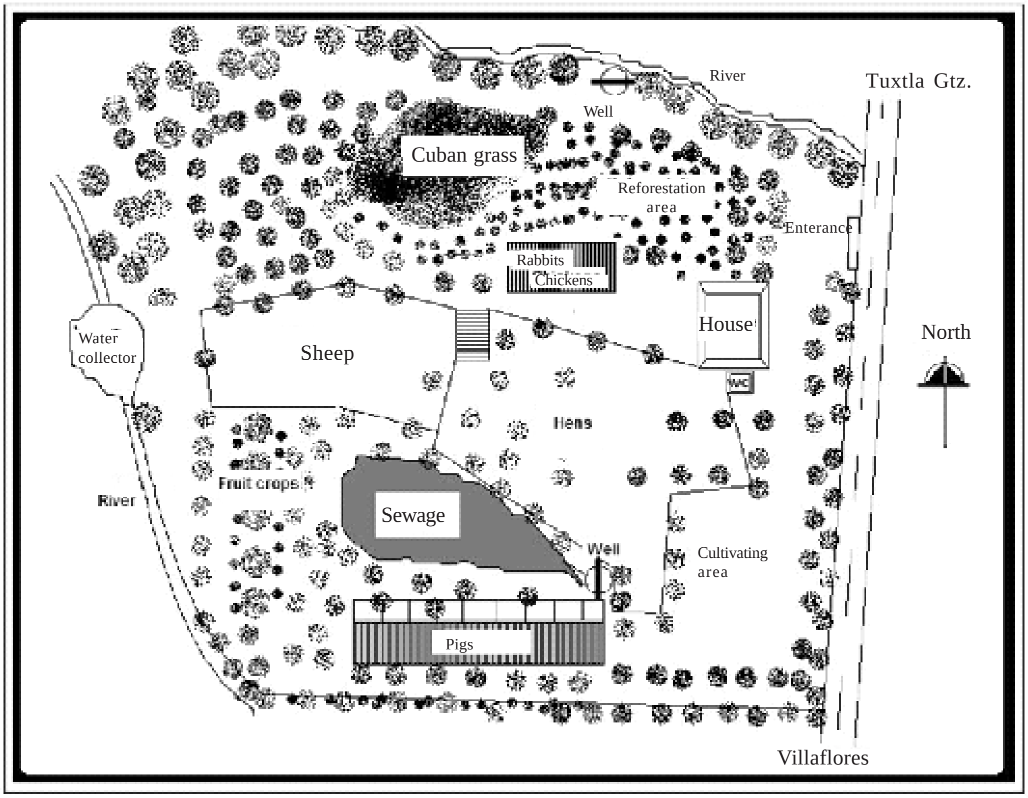

Fig. 1. Map of location and spatial organization of "La Montaña" farm
Source: **Original Work**

doesn't calculate the cost-benefit ratio, or even keep records of all inputs or activities carried out during the productive cycle. In this sense, the farm doesn't meet organic standards with regard to this indicator.

Nova (2003) and Sage (2014) mention the importance of knowing the cost-benefit ratio since any activity with a ratio calculated to be under 1:1 is considered to have more benefits than costs and, as such, a net benefit. In general terms, it can be said that processes of conventional agriculture have reduced the net benefit of agricultural production (farming) to a minimum, squeezed as it is between the costs of pricy inputs and farm prices paid for products. This has had the effect of forcing farmers to "get big or get out" since a small marginal profit forces large-scale production in order to have a decent farm income. On the other hand, small-scale organic agriculture relies on healthy products, reduced use of external inputs, and, often, specialty markets that offer a price that can cover elevated labour costs and make organic farming reasonably profitable even at small scales. However, access to technical assistance to build administrative and economic capacity of organic farmers is lacking, making it difficult to develop the case that small-scale organic farming has economic benefits (Mutersbaugh 2005; Lamine et al. 2014).

Within the area of stability, the quality of life index indicator showed improvements in the economic situation, food quality and availability, health and well-being, personal development and gender equality. As such, this indicator meets the standards for organic certification.

Quality of life in a concept that refers to the conditions of life desired by a person in relation to eight fundamental necessities: physical well-being, emotional well-being, material well-being, interpersonal relationships, personal development, self-determination, social inclusion and rights (Schalock et al. 2002). A happy person is thought to have several co-occurring elements: a favourable self-esteem, a feeling that she exercises reasonable control over her life, communicative and optimistic qualities, and a capacity to adapt to change and get through the daily challenges of life (Verdugo and Schalock 2001). Organic agriculture offers a great opportunity for farmers, because the combination of good diets, physical work and price premiums, along with the many community-building processes associated with organic foods, can improve the quality of life of many families in distinct contexts in the world (Armesto 2009; Rodriguez-Gomez 2013).

Within the area of economic supports the indicator -access to credit- appears. According to the findings of the survey, the farm has not been supported with governmental credits. According to the principles of organic agriculture, organic farms should strive for the greatest amount of autonomy possible. As such, we found that the farm meets the standards for organic certification with regard to this indicator.

Blanco (1999) and Guevara-Hernández et al. (2013) mention that credit is fundamental for economic progress, because farmers have investment needs that go beyond the capacity of available capital resources, especially in agriculture. It is argued that credit is a reasonable mechanism for providing economic resources in a timely manner. However, the principles of organic agriculture include self-sufficiency and closed systems (Altieri 1992; IFOAM 2005).

Finally and according to the certification norms and the principles of organic agriculture, 30 indicators were evaluated within the crop subsystem of “La Montaña” farm. Of these, 23 indicators (77%) met certification standards, while seven indicators (23%) did not (Table 1).

Animal Subsystem: Within the animal subsystem, production systems of animals such as pigs, chickens and turkeys, rabbits and sheep were considered.

Within the area of species diversity, the indicator –composition and distribution of species- was included. Results showed a great diversity of species present and a long-term effort to conserve native breeds of animals. Following the certification norms, this indicator meets the requirements for organic production.

Conservation of native or rustic breeds is an important effort, because these breeds have high likelihood of adaptive capacity and hardiness, long lifespan, good cross-breeding potential, and high reproductive efficiency. Well-adapted to tropical conditions, these animals can be raised with very low production costs (De Alba and Kennedy 1994). There is much less need for preventive measures against disease, since native and rustic breeds tend to have more inherent resistance to environmental stressors and pathogens. As such, these animals tend to have a high adaptive capacity (Gray and Hovi 2001; Garcia 2006; UE 2007).

Within the area of feeding and nutrition, the indicator –feed type- did not meet the norms of organic certification. The animal feed purchased is not organic and is based on the use of concentrations, manufactured in other places and using synthetic ingredients. Additionally, the grazing animal load indicator is not measured or formally considered in the farm. This indicates that the farmer makes no management decisions based on reducing or optimizing grazing load. According to the standards of certification, the farm doesn’t meet this criterion.

Organic crop and livestock systems should be closed systems. They shouldn’t depend on external inputs the origins of which are unknown. However, they may permit inputs that are certified as organic. Of course, in practice such purchased inputs may be highly expensive or inaccessible, for which it is recommended that farms produce the inputs for their productive subsystems, in order to guarantee the origin of the input and maintain low production costs (Altieri 1992; FAO 2003; Nahed-Toral 2013b).

However, there should be a diversified production in pastoral systems, favouring the association of legumes in pastures with grasses, as well as the addition of woody forage species such as *Guazuma ulmifolia*, *Leucaena sp*, *Gliricidia sepium* and *Erithryna sp* in practical spatial patterns (Aguilar 2008; Calderón 2008; Jiménez 2008). In such a manner, diversified pastures protect soil resources, biodiversity and ecological services, such as carbon capturing, among others (Nahed et al. 2009; Sepúlveda and Ibrahim 2009).

In the area of artisanal agro-industry, the added-value to products indicator was included in the evaluation. However, there are no activities in the farm to add value to animal products and, as such; this indicator was found not to comply with organic certification standards. To add value to something is by no means a simple task, not only for the economic and technical effort required, but also due to the human capacity-building and the change of mentality necessary for such an activity. Such a change in mentality requires people to think of a proactive relationship with their products. Added-value is a synonym of created-value. One way to convince is to focus on the economic benefits of adding value to farm products (Fred 2003; Nahed-Toral 2013b).

Budd (2002) Ponce-Palma et al. (2013) mention that farmers often don't add value to their products due to a lack of financial opportunity or funding, as well as a lack of information or market research on supply and demand strategies. As such, farmers should be given incentives to improve the quality of their products, which may include guaranteed fair prices or a stable year-long market. These kinds of incentives could stimulate farmers to continue or improve the elaboration of finalized products through sustainable production techniques and appropriate marketing (Nahed et al. 2008).

In the area of self-sufficiency, the degree of independence from external inputs was included as an indicator. Results showed that most productive subsystems on the farm depend on external inputs in the production process. This indicator was subsequently found not to comply with the standards of organic certification.

Organic products are accepted as such if they come from a production system with a rational management of natural resources and without the application of chemical products. In these systems, healthy food can be obtained while the soil fertility is maintained or improved over time and biodiversity is conserved. Consumers are able to identify such productive systems through the system of certification, which distinguishes these systems from non-organic systems by the methods they employ in production and processing (Gómez 2001; Rodriguez-Gomez 2013). Agricultural production should be understood as a service of the agro-ecosystem, and should be responsive to the internal needs of the system through a sustainable production model (IFOAM 2005; Ferguson et al. 2013; Flores et al. 2014).

In the area of participation, family involvement in the system was included as an indicator. Here the farm met certification standards, as well as with regard to the gender equality indicator. The opinion of the family is taken into account in the decisions of the farm, and all family members participate in farm activities, generally every Sunday and during school and work vacation periods.

Zarza (2006) mentions that gender equality is important in organic agriculture and livestock raising, because both women and men have the right to access with justice and equality the use, control, and benefit of productive goods and services. Additionally, organic agriculture should guarantee an equal role in decision-making in family and social life, as well as economic, political, and cultural activities. This coincides with IFOAM (2005) and Ponce-Palma et al. (2013) which mention that organic agriculture should be based in relationships that assure gender equality with respect to the environment and life opportunities.

In accordance with certification standards and the principles of organic agriculture, 27 indicators were evaluated in the animal subsystem. Of these, 20 indicators (74%) met organic certification standards while seven indicators (26%) did not.

CONCLUSION

The crop subsystem meets 77% of the indicators of organic farming, while the animal subsystem meets 74%; although the percentages are fairly high, there are still significant deficiencies in the farm. Chief among these is the disarticulation between productive systems. For example, not enough animal feed is produced on-site, and the farmer doesn't add value to farm products. As a finding of the research, organic certification is not an appropriate option for the farmer, until farm activities are duly recorded and greater integration between farm subsystems is achieved. Additionally, farm activities remain highly dependent on external inputs with unknown origins and manufacturing quality.

This analysis allowed the construction and application of a methodology that can be used to follow up with farms that are interested in organic certification—that is to say, not for one or another product, but rather for the farm as an entity. The methodology also lets farmers know in quantitative terms how far they are from meeting the standards for organic certification.

Monitoring and impact studies are highly important, because they allow us to perceive the accomplishment of change over time. Through this type of research, it is possible to apply several diverse approaches in order to generate scientific impacts beyond the traditional ones, thus offering more information and better integrated evidence for decision making. Such knowledge-guided decisions are oriented toward making necessary modifications in the dynamic contexts of transition farms.

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