

Co-innovation of family farm systems: developing sustainable livestock production systems based on natural grasslands

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1 Introduction

In Uruguay, during the last decades the number of farms has decreased significantly being the family farms the most affected ones. Between 2000 and 2011, 21% of the farms disappeared. However, Uruguay has 26.480 livestock farms in 11.7 million of hectares, most of them family farming systems based on natural grasslands. In those systems, the level of technology applied is low, which in turn, determines low productive efficiency and high output variability across time. Although several technological alternatives have been generated by research, farmers didn't use them, so significant improvement in sustainability of livestock farmers was not obtained. The technology transfer approach was not successful to promote learning and changes leading to innovation. We proposed that at the farm level there are opportunities to improve the productive and economic results through an adequate selection and orientation of the productive activities and applying the adequate technologies, but in a modality in which researchers and farmers are closely involved in that co-design process. A co-innovation approach implemented in the horticulture systems in Uruguay successfully contributed to improve their sustainability. Proposals for improvement were discussed between farms and scientists considering farmer's objectives and resources (Dogliotti *et al.*, 2014). At the regional level there are opportunities to coordinate activities to enhance family's quality of life. The objective of the project was to evaluate the impact of strategic changes (re-design) in the sustainability of farming systems and to scale up the results to a regional level, using the "co-innovation" approach in the east region of Uruguay.

2 Materials and Methods

The research was conducted in Rocha-Uruguay, between 2012 and 2015. We applied a participative learning and action research approach known as co-innovation (Rossing *et al.*, 2010). The work was carried out at two scales, the farm and the regional level, with interconnected activities at specific instances, where results were exchanged and discussed. At the farm level the project involved 7 livestock family farms based on natural grasslands that were monthly visited, following three steps (Dogliotti *et al.*, 2014): (i) characterization and diagnosis, (ii) re-design and (iii) implementation, monitoring and evaluation. At the regional level the project has emphasized the strengthening of an inter-institutional network with regular workshops involving the participation of farmers, researchers, technicians and other local actors. In order to evaluate the processes, we used an Indicator-based Framework for Evaluating the Sustainability of Natural Resource Management Systems (Masera *et al.*, 2000) at the farm level, and the framework for planning, monitoring and evaluation called Participatory Impact Pathways Analysis (Alvarez *et al.*, 2010) served at the regional level.

3 Results – Discussion

Results from the initial situation are presented in Table 1. We found that the weakest point of the farms was associated with low physical and economic productivity and with natural resources degradation. The main point to be addressed to improve farm sustainability was an imbalance between animal requirements and nutrient offer. Historically farmers managed their farms with high stocking rate and high sheep to cattle ratio, resulting in other problems such as low reproductive efficiency, low cattle sale weights and low productivity of natural grasslands.

The main strategy of the redesign process was working with more grass. The first step was the adjustment (reduce) in stocking rate and sheep to cattle ratio, and pasture allocation according biomass height and animal category; which was complemented by low cost breeding practices.

The proposals elaborated with farmers have two years of implementation and have led to significant improvements in farm sustainability (Table 1). Compared to the initial situation, meat production increased by 24% and net income increased by 40%, explained by an increase in gross income while maintaining the same costs. . The amount of standing spring biomass of natural grassland increased in 60%. All farmers mentioned a better organization of labor with "less workload and task simplification". They learnt and started to use adequate techniques. Also they started to plan in the medium and long term which has enabled them "to make better decisions, visualize and anticipate future problems".

At the regional level the implementation of six workshops allowed the development of an inter-institutional network related to the project that also addressed issues linked to rural development. It included an extension institute, local government, Ministry of Agriculture, Livestock and Fisheries, University of the Republic, national and local farmers' organizations, farmers involved in the project, researchers and other new actors that were invited as the project

advanced. During the first workshop the impact pathways of the project were identified and summarized in the following idea: “There is a considerable improvement in the sustainability of the farms and in the region with the application of adequate technologies, which have resulted in higher incomes, conservation of natural resources and improvement at the social level”. Based on that, the actors proposed a set of activities to achieve the vision. In the next workshops, participants reflected on the results and progresses achieved so far using participatory methods and suggested changes for better results and impact. The project’s strategies and activities had been changed to some extent, based on the lessons learnt.

Considering the impact pathways, members of the network elaborated an annual communication plan to effectively disseminate the knowledge generated along the project, based on the work at the farm level and taking into account the aims of the different groups (farmers, technicians and institutions). During the last two years several activities, took place, according to the designed plan. Farm’s meeting and field days were organized supported by the inter-institutional network. In November 2014, a field day was done in a farm with the objective of showing main results of the project. Almost 160 people had the possibility to listen about the changes implemented by a farmer in the field, the reasons for doing that and the results obtained. The evaluation showed that participants gained new ideas for their farms.

Table 1: After two years of implementation of redesign proposed, results at farm level.

ATTRIBUTE	DIAGNOSTIC CRITERIA	CRITICAL POINT	INDICATOR	UNIT / SCALE	Initial situation (av. 7 farms)	Intermediate situation (av. 7 farms)
Productivity	Productive efficiency	Low or upgradable production yields	Equivalent meat production (i.e. meat + wool)	kg ha ⁻¹	99	123
	Economic efficiency	Low or upgradable economic income	Net income	US\$ ha ⁻¹	70	98
Stability	Quality of life	High level of satisfaction with quality of life	Family satisfaction with quality of life	5 to 1 (* ¹)	4,6	4,6
		Inadequate labor organization	N° of families that mention an improvement in labor organization during interviews/ 7 farms involved in the project (* ²)	%	—	100
	Productive stability	Low use of adequate production techniques	% implementation of an adequate technology set proposed (* ³)	%	39	98
Reliability/ Adaptability/ Resiliency	Natural Resources conservation	Degraded natural grassland	Spring biomass of natural grassland	kg DMha ⁻¹	1183	1868
		Good level of biodiversity	Richness and diversity of birds	N° (Shannon index)	129 (3,71)	132 (3,86)
Self-reliance	System fragility	Availability of family labor	Proportion of labor input provided by family	%	93	93
	Diversification	Diversification of income sources	Number of income sources	N° (* ⁴)	2.7	2.6
Self-reliance	Financial dependence	Low level of debt	Relation debt / patrimony	5 to 1 (* ⁵)	5	5
	Decision-making	Lack of medium and long term planification	Family worth and use of medium and long term planification	5 to 1 (* ⁶)	2.1	3.9

(*¹) 5: very satisfied, 4: moderately satisfied, 3: satisfied, 2: little satisfied, 1: not satisfied (*²) Emerged as critical point during monitoring interviews. Farmers mention less workload and task simplification (*³) Adequate technology set proposed: adjustment in stocking rate and sheep to cattle ratio, pasture allocation according biomass height and animal category; adjustment of the mating season, management according to body condition, ovarian activity diagnosis, pregnancy diagnosis, control of breastfeeding, fall weaning, preferential handling of the rearing, mate of heifers at 2 years and use of records. (*⁴) Sources: cattle, sheep, other animal productions, vegetable production, off-farm work (*⁵) 5: <0.05, 4: 0.05- 0.1, 3: 0.1-0.15, 2: 0.15-0.2, 1: >0.2 (*⁶) 5: worth planification and use long-term plans, 4: worth planification and use medium-term plans, 3: worth planification and some areas planned, 2: worths planification and don’t use plans, 1: not worth and don’t use plans.

4 Conclusions

The methodological approach is being effective in improving sustainability at farm level and contributing to regional development, where farmers, local institutions and researchers jointly define activities based on the results of the project.

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References

Alvarez, S., Douthwaite, B., Thiele, G., Mackay, R., Córdoba, D. & Tehele, K. (2010). Participatory Impact Pathways Analysis: a practical method for project planning and evaluation. *Development in Practice*, Volume 20, Number 8, pp. 946-958.

Dogliotti, S.; García, M.C.; Peluffó, S.; Dieste, J.P.; Pedemonte, A.J.; Bacigalupe, G.F.; Scarlato, M.; Alliaume, F.; Alvarez, J.; Chiappe, M. & Rossing, W.A.H. (2014). Co-innovation of family farm systems: A systems approach to sustainable agriculture. *Agricultural Systems*, **126**, 76-86.

Masera, O., Astier, M. & López-Ridaura, S. (2000). Sustentabilidad y manejo de recursos naturales; el marco de evaluación MESMIS. GIRA, México.

Rossing, W.A.H.; Dogliotti, S.; Bacigalupe, G.F.; Cittadini, E.; Mundet, C.; Mariscal Aguayo, V.; Douthwaite, B. & Alvarez, S. 2010. Project design and management based on a co-innovation framework. In: *Building Sustainable Rural Futures: The Added Value of Systems Approaches in Times of Change and Uncertainty – IFSA 2010*, Vienna, Austria, pp. 402- 412.