

CHANGES IN ENVIRONMENTAL PERCEPTION AND KNOWLEDGE IN STAKEHOLDERS AFTER WASTE MANAGEMENT COURSES

Herrero M. A., Sardi G. M., Reuelto M., Gil S. B., Flores M. C.

Facultad de Ciencias Veterinarias, Universidad de Buenos Aires. Chorroarín 280 (1427), Ciudad Autónoma de Buenos Aires, Argentina. Tel +54 11 45248415.
aherrero@fvvet.uba.ar

1 INTRODUCTION

Livestock production systems are a current concern due to their adverse environmental effects. In Argentina, the lack of knowledge on waste management, manure reuse, and nutrient balance is one of the most conflicting issues concerning the environmental conservation. Therefore, conducting formal and informal environmental education at different education levels related to agricultural practices is required in order to develop attitudes towards the protection of the environment.

Training at different social levels including community members, farmers, agricultural-school teachers, stakeholders and decision makers is a key factor in the development of environmental education. The training provided for agricultural-school teachers and professionals will assist them in improving awareness, knowledge and practical skills in the matter of the protection of the environment to subjects whose future activities may have a significant impact on it (Tbilisi Declaration, 1977).

The present study was conducted in order to analyze changes in the environmental perception and knowledge of stakeholders involved in livestock management after a training course about livestock intensification and environmental management.

2 MATERIALS AND METHODS

A 40-h course was given within an environmental education program developed between the Ministerio de Educación (Buenos Aires) and the Facultad de Ciencias Veterinarias (UBA). The course was designed for a small number of students (10 – 20) as an interdisciplinary course; an agronomic engineer, a veterinary zootechnist, a veterinary pharmacology professor and an environment management professor gave lectures. Classes included a theoretical introduction, comprehensive reading of papers and a problem-solving group activity. Evaluation consisted on the description of a pilot project of a current local environmental problem selected by the group, and alternative solutions or changes, which could be carried out to protect the environment. Sixty-four professional trainers responsible of technological livestock management transfer to farmers and agricultural-oriented high school students took the course from August to December 2009. Five locations of Buenos Aires province were selected (Trenque Lauquen, La Plata, Pergamino, General Pueyrredon and Las Flores) as this is the most important province regarding livestock production and surface extension (307,571 km², 11.06 % of the total surface) in Argentina. The 64 subjects were both male and female educated adults, 20 (31.3%) agronomic engineers, 6 (9.4%) veterinarian, 31 (48.4%) livestock management technicians, 3 (4.7%) economist and 4 (6.3%) professionals in different subjects related to environmental management.

Stakeholder's perception of environmental issues and knowledge of different environmental aspects were assessed by the administration of an anonymous written questionnaire at the beginning of the course. In this questionnaire, the perception issues were focused on environmental problems related to effluents' discharges affecting surface and groundwater quality, soil contamination, flies, odours and diseases generated by concentrated animal feeding operations, greenhouse gases and presence of veterinary drugs in water bodies. The knowledge issues were related to farm nutrient nitrogen/phosphorus balances and nutrients in manure in livestock production systems. The questionnaire consisted on eleven questions with a five-point response scale for each one, anchored by "very important" to "not important". A "don't know" option was included in all questions (House, 1996). In each question two of the responses were correct, whereas the other two were incorrect. Correct/incorrect items were randomly distributed in all questions. Students were required to answer the same questionnaire at the end of the

course in order to identify differences in their environmental awareness in comparison with the pre-course questionnaire results.

Answers were categorised as correct/incorrect, don't know answers were considered incorrect. Homogeneity of the five locations distribution of correct and incorrect answers before the course was proved by the chi-square test for homogeneity. The exact Fisher test was used for comparing the distribution of the correct/incorrect answers of the pre-course (n=20) versus the post-course (n=33) questionnaire. The proportion of times that the "don't know" item was selected was calculated for each question of the pre-course questionnaire, and was contrasted to the hypothesis "the probability of obtaining more "don't know" answers to the item is >10%" using a normal approximation for the parameter success proportion of a variable with a binomial distribution.

3 RESULTS AND DISCUSSION

Fifty-three (83%) students answered both questionnaires.

Homogeneity of data proved that environmental perception and knowledge were similar for the five locations, showing that few respondents could give an appropriate response about impact of livestock productions on the environment before the training course. Significant differences ($p < 0.05$) were found in the distribution of the correct and incorrect answers for 3 questions of perception issues (Table 1) and 3 questions of knowledge issues (Table 2) when comparing the questionnaires before and after the training course. The "don't know" option was selected for all the 11 questions in the first questionnaire (>10%, test for one proportion, in all but 3 questions); however, it was never selected in the post-course questionnaire.

Perception is defined as the ability to perceive environmental problems in the real world, based on memory and influenced by prior experience (House, 1996). Significant differences in perception issues were found for potential environmental effects of livestock systems effluents in superficial water quality, in development of flies and bad odours, and in soil contamination. These issues are current visible environmental problems in the five different locations, mostly due to the increasing numbers of concentrated animal feeding operations in the last years. In a previous survey of perception, knowledge, awareness and attitude in regard to environmental problems in Indonesia, Sudarmadi *et al.* (2001) detected similar results when evaluating the perception of educated groups. Hughey *et al.* (2001) detected better values for environmental perception among New Zealand communities whom perceived the country as clean and green.

TABLE 1 **Perception of environmental issues related to effluents discharges at the beginning (n=20) and at the end (n=33) of a training course categorized as correct and incorrect answers, expressed in %.**

Environmental issue		Pre-course questionnaire	After-course questionnaire
Surface water quality*	Correct	65	100
	Incorrect	35	0
Development of flies and odours*	Correct	60	94
	Incorrect	40	6
Soil contamination*	Correct	55	97
	Incorrect	45	3
Greenhouse gases	Correct	60	61
	Incorrect	40	39
Farm worker's diseases	Correct	60	55
	Incorrect	40	45
Groundwater contamination	Correct	75	91
	Incorrect	25	9
Veterinary drugs in water bodies	Correct	30	9
	Incorrect	70	91

* Statistically significant ($p < 0.05$)

The high pre-course perception regarding the groundwater contamination may be due to the thorough information, mostly in local papers, about the potential contamination of human drinking water. In all five locations,

human drinking water is obtained from aquifers proved polluted by nitrates (Carbó *et al.*, 2009). Similar results were reported by Sudarmadi *et al.* (2001) with the perception of AIDS both in the educated and in the community group. The authors attribute these results to the extensive AIDS information program (newspapers, television, movies and radio) developed in Indonesia.

Knowledge is defined as a body of facts and principles concerning environmental issues that have been accumulated by mankind through study (Clarke, 1999). The results of the survey on the knowledge (Table 2) issues regarding the livestock waste management before the course showed that only half of the responders could give an appropriate answer. Similar results were reported by Sudarmadi *et al.* (2001) in Indonesia and by Pillot *et al.* (2006) in Vietnam.

The after-course questionnaire showed that this lack of knowledge had decreased significantly for almost all questions (3/4). The question of knowledge that did not show statistical changes after the course was the only one that the answer was a numerical value (Table 2). This result may be due to the less ability of the students to retain precise information.

TABLE 2 **Knowledge of different environmental issues related to livestock production system at the beginning (n=20) and at the end (n=33) of a training course categorized as correct and incorrect answers, expressed in %.**

Environmental issue		Pre-course questionnaire	After-course questionnaire
% Nitrogen excretion by livestock	Correct	45	58
	Incorrect	55	42
Nutrient restitution in grazing systems *	Correct	45	76
	Incorrect	55	24
Nutrient distribution due to permanence in pens *	Correct	30	75
	Incorrect	70	25
Incoming nutrients by corn supplementation *	Correct	55	90
	Incorrect	45	10

*Statistically significant (p<0.05)

4 CONCLUSIONS

The comparison of the issues regarding perceptions of potential environmental problems and knowledge of waste livestock management between the questionnaires administered at the beginning and after the course showed a significant improvement, less marked in the former than in the latter. It can be concluded that the waste management-training course provided elements to improve the perception of the risks and consequences of environmental pollution by livestock productions, and provided knowledge to improve the technological transfer of waste livestock management involving environmental protection. The stakeholder becomes a key factor in the multiplication of the knowledge to better define courses of action for good practice livestock management involving the protection of the environment.

REFERENCES

- Carbó L, Flores M, Herrero M A 2009. Well site conditions associated with nitrate contamination in a multilayer semiconfined aquifer of Buenos Aires, Argentina. *Environmental Geology* 57, 1489-1500.
- Clarke R 1999. Knowledge, <http://www.anu.edu.au/people/Roger.Clarke/SOS/Know.html> (Nov 2009)
- House M 1996. Public perception and water quality management. *Water Science and Technology* 34, 25-32.
- Hughey K, Kerr G, Cullen R, Cook A 2001. Perceptions of the state of New Zealand's environment. Lincoln University Report. Pp. 86
- Pillot D, Le Coq J F, Thi Hoa Ly N, Porphyre V 2006. Stakeholders' Perceptions of Pig Effluent Management in Thai Binh Province. In: *Pig Production Development, Animal Waste Management and Environmental Protection: a Case Study in Thai Binh Province, Northern Vietnam*. Porphyre V, Nguyen Que Coi (eds.), PRISE publications, France.

Sudarmadi C, Suzuki S, Kawadal T, Netti H, Soemantri S, Tugawati T 2001. A survey of perception, knowledge, awareness, and attitude in regard to environmental problems in a sample of two different social groups in Jakarta, Indonesia. *Environment, Development and Sustainability* 3, 169–183.

Tbilisi Declaration UNESCO-UNET 1977. Georgia, USSR, October. <http://www.gdrc.org/uem/ee/tbilisi.html> (Nov2009)