

Management of Equine production and its environmental impact: the case of settlements in Buenos Aires (Argentina).

Manejo de la producción equina e impacto ambiental: el caso de establecimientos en Buenos Aires (Argentina).

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ABSTRACT

Equine production in Buenos Aires (Argentina) is 512847 heads. The equine production management is an important factor for the minimization of environmental effects. This management includes the implementation of good practices.

The aim of this paper is to characterize the equine production paddocks in Buenos Aires in terms of their management, and to evaluate the possible environmental impact they may generate. Sixteen paddocks have been characterized according to the sources of water supply, quantity and depth of the wells, breed, productive system, type and management of beds, type of feed, feeding practices, supplementation, other ration components and management. These are the first studies on environmental effects of equine production in Argentina.

Key Words: environment, equine production, management

RESUMEN

La producción equina en Buenos Aires (Argentina) es de 512847 cabezas. El manejo de la producción equina es un factor importante para la minimización de los efectos ambientales. Este manejo incluye la implementación de buenas prácticas. El objetivo de este trabajo es caracterizar los establecimientos de producción equina en Buenos Aires en cuanto a su manejo y evaluar el posible impacto ambiental que pueden generar. Se han caracterizado 16 establecimientos según las fuentes de abastecimiento de agua, cantidad y profundidad de los pozos, raza, sistema productivo, tipo y gestión de camas, tipo de alimentación, prácticas veterinarias,

suplementos dietarios utilizados, y manejo de la alimentación. Este trabajo es el primer estudio sobre los efectos ambientales de la producción equina en Argentina.

Palabras clave: ambiente, producción equina, manejo.

INTRODUCTION

Equine production is widely distributed throughout Argentina with a total of 2,442,130 heads (SENASA 2015). Argentina is internationally acknowledged as an equine producer par excellence, being among the top ten countries in the world. Production is distributed throughout 172,145 paddocks, being 16% pure-bred animals (MINAGRI 2014). Buenos Aires province concentrates 21.69% of the production.

The global studies on equine production management and its environmental effects is very scarce (Bott & Greene 2013). As it is observed in other types of animal production, the production management is an important factor for the minimization of the environmental effects (Bott & Greene 2013; Auer et al. 2013).

The productive management includes the implementation of good practices regarding the quality of the water suitable for animal consumption, the kind of nutrition and supplementation, the management of effluents, and the sanitary monitoring of the animals, among other variables (Fernández Cirelli et al., 2013). The water quality used for animal consumption is crucial since both the animals' health and nutrition depend on it (Fernández Cirelli et al., 2013).

The overfeeding of the equine and the excessive supplementation could be one of the main causes of environmental pollution. The phosphorus present in most of the nutritional supplements for sport equines, sent back to the environment in the manure, has the potential of a negative impact on it (Topliff 2002; Hainze et al. 2004; Westendorf et al., 2013; NRC 2007).

Poor management practices of dung could lead to an increase in the movement of sediments, nutrients and xenobiotics toward surface or groundwater, thus altering the resource quality.

The management of dung and beds has been the object of several investigations for the potential effect they can produce on the environment, mainly in the United States (Swinker et al 1995; Westendorf et al 2010a, b; Westendorf 2012; Prokopy 2013;).

This research had sport horses as the target population in the province of Buenos Aires, as this is the region with the largest number of heads in the country. It has to be pointed out that this is the first study of this kind in our country. The aim of this paper is to characterize the equine production facilities in Buenos Aires in terms of their management, and to evaluate the possible environmental impact they may generate.

MATERIALS AND METHODS

Study area: Establishments are located in the province of Buenos Aires (Figure 1) in a rural/urban interface area. A peripheral perimeter was established around the city of Buenos Aires starting in Escobar District, then Pilar, Exaltación de la Cruz, San Antonio de Areco, General Rodríguez, Lujan, Mercedes and General Las Heras districts.

Survey: It was carried out in 16 paddocks with similar characteristics, mainly, training places for jumping horses, where the stable work routines, training, and health plan were homogenous. The floor of the boxes is earthen.

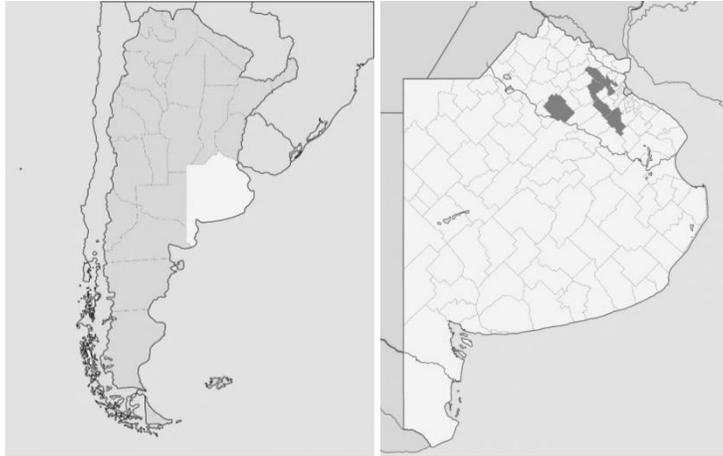


Figure 1: Study area of settlements in Buenos Aires (Argentina).

Through specific surveys, establishments have been characterized according to the sources of water supply (groundwater and surface water), quantity and depth of wells, breed (alfalfa, bundles, pellets, balanced feed), productive system, type of management of beds, type of feed, feeding practices, supplementation and management.

All the paddocks were visited, handed over the questionnaire to the person in charge and taken samples from the animals' feed, beds and drinking water. Questions about the different management practices connected with the sport-equine-production were asked:

- Drinking water source: ground or surface?
- Who do you receive counsel for the nutritional management of your animals from?
- Do you use feeders, bunks or mangers in order to minimize the food's contact with the ground, and thus, from rainwater?
- What kind of food do you feed your animals with?
- Do you use supplementation?
- How many hours a day do your animals spend in the box?
- What type of bed do you use? How do you manage the manure generated in the establishment?
- Nearby bodies of water: river - lagoon - stream? How far are they? At what depth is the water table?
- Under what kind of sanitary management is the paddock?

Samples: Water, feed and bed samples from the paddocks were recollected to evaluate the importance of these components in the quality of the dung in order to consider these sources both in the sanitary management of the equines and in the environmental risk the potential environmental risk of dung. The water samples (N=16) 500ml vol. approx. in polyethylene containers previously rinsed with distilled

water, sealed without air chamber, taken to the laboratory refrigerated. They were acidified to preserve the analytes in HNO₃ solution with 0.2% v/v at the time of collection. Once in the laboratory, they were filtered using 0.45 µm nitrocellulose disposable filters if suspended solids were present.

The feed samples of alfalfa used as food were recollected in polyethylene bags (ca. 500g approx. weight) and sealed.

The bed samples were recollected from the storage and were conditioned in plastic bags (ca. 500g) and sealed.

Determinations: Quantification of As, Pb, Cd, Cr, was performed by ICP-OES (inductively coupled plasma - optical emission spectroscopy) using a Perkin Elmer Optima 2000 DV. These elements were selected since their presence in large quantities in the water may be harmful to the animals' health (Fernández Cirelli et al., 2010; Asano et al. 2002); besides, in Argentina, arsenic is a toxic natural element very often found in ground and surface water (Smedley & Kinniburgh 2002). This element comes from the pampean loess and it is present in large quantities in the ground and surface water of the *Pampas* plains (Farías et al. 2003). The Cr, Cd and Pb are of anthropogenic origin.

For the equipment calibration, reference materials from the National Water Research Institute of Canada (NWRI) with certified content of all minor elements were used for calibration, verification and validation of the analytical method.

Feed and bed: Samples (0.1 g) were digested with conc. HNO₃ (20 ml) and 15 N H₂SO₄ (10 ml). After complete oxidation, the samples were cooled and diluted to 50 ml with deionized water.

RESULTS AND DISCUSSION

As regards the productive management, 88% of the analyzed paddocks were under the supervision of a veterinarian, while the other 12% were directly managed by the producer. The water sources come from groundwater in most cases – between 60 and 70 meters deep in most of the paddocks. This is consistent with the agricultural use of the water for animal production in Argentina since most of the water comes from groundwater (Farías et al. 2003).

As to feed management, most of the paddocks employ mangers to feed the animals (88%); and 12% also use bunks. These methods allow for a proper feed management which guarantees the feed's safety and minimizes its lost and waste due to falls or trampling by animals.

The beds used in every facility are made of chips. Moreover, 25% of the facilities employ straw. All the establishments receive counsel from Veterinarians in order to balance the diet.

The feed used is predominantly alfalfa provided in bundle or pellets. Supplementation is used in all the paddocks; Concentrates are used in 100% of the paddocks, while 50% of paddocks employ oils, being the supply of electrolytes (62.5%) and vitamins (68.8%) lower. In addition, the use of balanced rations and growth promoters was recorded in only one paddock. The kind of supplementation given to the animals in these paddocks is similar to the one given in other parts of the world; however, in Argentina, the use of alfalfa equines feeding is traditional, unlike other parts of the world.

For the beds, 25% of the studied establishments also incorporate straw. Most of them use feeders (87.5%), while 12.5% use bunks.

Regarding the training and daily working routines, the equines exercise each morning and are kept within stables, in 4 x 4 boxes, with food and drinking water inside.

It was observed, as a shared characteristic, that the discarded bed and manure were placed in open shaving storages, whose general clearance was carried out, on average, once every 45 days, leaving them exposed to the open air and rain during that period; and with the consequent and potential lixiviation of organic matter and pollutants.

The equines remain in the boxes from 10 to 18 hours. In the 30% of the paddocks, the animals are kept in the boxes for 14 hours. The time the animals stand in the box allows the observer to notice the abundant feces the equines produce on those beds that later are discarded in the external storages

The beds used in every facility are made of chips. Moreover, 25% of the facilities employ straw. The floor of the boxes is earthen, which allows for all the liquids filtered from the bed and droppings to go into the ground. Only 25% of the farms are close to a water body of water: lagoon (6.25%); river (6.25 %) and stream (12.5%).

Regarding the distance between the place and the water bodies: most of them (75%) are 1 km away, while one of them is only 100 m away from a lagoon. The depth of the water table was: 80 m (6.25%); 70 m (37.5%); 60 m (31.25%); 50 m (12.5%); 40 m (6.25%); 30 m (6.25%). The health plan of every establishment consisted –as a basis- of a Coggins test every 2 months, vaccination against influenza every 3 months, vaccination against encephalomyelitis every 12 months, tetanus once a year, equine adenitis once a year. The deworming is carried out every 2 months with benzimidazoles-organophosphates, ivermectin-praziquantel and Equestpramox rotations, keeping this alternate order.

In the water samples, only As could be detected in the establishments 3 (25 µg/L), 11 (25µg/L), and 15 (62µg/L), and Pb in establishments 3 (26µg/L), 10 (24µg/L), and 14 (14µg/L). Nevertheless, concentrations determined are below the limits admitted for animal drinking in the argentine legislation (Ley 24051 Decreto 831/93). All other analyzed elements were below the detection limit (DL). As is of natural origin in groundwater in large areas of Argentina (Smedley and Kinniburgh 2002), while Pb is of anthropogenic origin, as well as Cr and Cd. These elements were analyzed since the equine farms studied are in a rural/urban interface area.

Bundle and bed were also analyzed and the results are shown in Table 1 and Table 2, respectively. As was only detected in samples of bundle from farms 2, 5, 10, 15 and 16 (Table 1). The high content in farm 5 is noteworthy and it will be further explored. Cd was found in 25% of establishments, while Cr was determined in 60% of establishments (Table 1). The concentrations found may be toxic for the animals, even though these elements are not still contaminating water tables. Pb was detected in 70% samples. The given values of As, Cd and Pb are lower than the recommended by the 2002/32/CE Regulation issued by the European Parliament and Council (2002), which deals with undesirable substances in animal feed, except for one case of As in paddock 5.

Table 1. Trace element analysis of bundle. Concentrations are expressed in µg/g. LG: Limits admitted for animal bundle in the European legislation (European Union 2002). Detection limit (DL).

BUNDLE				
	As	Cd	Cr	Pb
DL	< 0.40	< 0.16	<0.28	< 0.49
LG	4	1		5
1	< DL	< DL	0.81	<DL
2	1.35	0.46	0.72	< DL
3	< DL	< DL	4.88	0.51
4	< DL	< DL	1.75	< DL
5	9.47	0.39	4.45	0.99
6	< DL	< DL	< DL	<DL
7	0.64	< DL	< DL	< DL
8	0.51	0.32	< DL	< DL
9	< DL	< DL	0.68	< DL
10	1.10	< DL	2.22	3.92
11	< DL	< DL	0.93	0.85
12	< DL	< DL	0.85	1.43
13	< DL	<DL	1.93	0.56
14	0.63	0.70	< DL	< DL
15	2.54	< DL	< DL	< DL
16	1.46	0.52	< DL	<DL

The results of bed (Table 2) show Pb, Cr and Cd in all the establishments except 7 and 8. Its presence in manure may be related to its presence in feed. The accumulation in bed and leaving them on the floor could cause the contaminants reach the water table. As was not detected.

Table 2. Trace element analysis of bed. Concentrations are expressed in µg/g.

BED				
	As	Cd	Cr	Pb
DL	< 0.40	< 0.16	< 0.28	< 0.49
1	< DL	0.46	< DL	0.52
2	< DL	0.63	< DL	1.01
3	< DL	0.68	0.33	1.77
4	< DL	0.65	0.47	0.99
5	< DL	0.55	0.87	0.61
6	< DL	0.74	0.85	0.62
7	< DL	0.66	< DL	< DL
8	< DL	< DL	< DL	< DL
9	< DL	0.28	0.43	0.61
10	< DL	0.43	< DL	0.78
11	< DL	0.75	< DL	0.89
12	< DL	0.53	0.91	0.67
13	< DL	0.35	0.41	0.88
14	0.57	0.45	< DL	< DL
15	2.30	< DL	< DL	< DL
16	2.30	< DL	< DL	< DL

CONCLUSIONS

Analysis of the results show that bundles administered may be controlled since they may represent a risk for animal health, although until now there is no direct impact on the quality of groundwater. The fact that these establishments are 100% advised by veterinarians ensures early detection of possible symptoms of disease.

The deposit of waste bed outside the stables should be reviewed because it can leach residues of found materials and reach the water table or pollute surface water by runoff (Farías et al. 2003). The selection of feed ingredients could be a viable option to prevent possible contamination and protect the environment (Farías et al. 2003). This survey has proven to be a good opportunity to assess some of the management practices, which may allow the improvement of management operations in equine production to preserve its sustainability.

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