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Waste disposal in livestock farms located in municipalities of Rio Grande do Sul, Brazil. Destino dos resíduos pecuários oriundos de propriedades rurais nos municípios do Rio Grande do Sul.

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Abstract

The present study had as objective to evaluate the main forms of disposal of livestock residues from farms in the municipalities of the state of Rio Grande do Sul. The collection of information occurred through the application of questionnaires, answered by farmers, seeking information about the most commonly used livestock waste disposal practices. 102 farmers were interviewed from fifty municipalities in the state. In more than 80% of the rural properties investigated, the inorganic residues originated by services rendered to animal health have an incorrect destination. More than 80% of farmers reported inadequate disposal of inorganic residues of medical or animal health products. With these results, we believe that the implementation of reverse logistics for veterinary waste management is essential, for environmental and, mainly, public health reasons.
Keywords: Reverse logistic. Farming. Health. Environmental impact.

Resumo

O presente trabalho teve como objetivo avaliar as principais formas de descarte de resíduos pecuários oriundos de propriedades rurais nos municípios do estado do Rio Grande do Sul. A coleta de informações ocorreu mediante aplicação de questionários, respondidos por agropecuaristas, procurando-se obter informações sobre as práticas de descarte de resíduos agropecuários mais comumente utilizadas. Foram entrevistados 102 agropecuaristas oriundos de 50 municípios do estado. Em mais de 80% das propriedades rurais investigadas, os resíduos inorgânicos originados por serviços prestados à saúde animal têm destinação incorreta. Com estes resultados acreditamos que a implantação da logística reversa para resíduos de uso veterinário torna-se essencial, por razões ambientais e, principalmente, de saúde pública.
Palavras-chave: Logística reversa. Agropecuária. Saúde. Impacto ambiental.

Introduction

The generation of solid waste in livestock farms is one of the great problems faced by the farmers, being that, the inadequate disposal causes serious environmental problems such as contamination of soil, water and animals (NOGUEIRA et al., 2015, p. 95). Therefore, when thinking about sustainable agriculture, it is important to highlight several points, such as the correct disposal of empty containers of agrotoxics, veterinary products, animal waste and carcasses.

Studies show that the planet generates 30 billion tons of solid waste per year, 39% of which comes from livestock (WALDMAN, 2011). Considering that the Brazilian herd is composed of 218 million bovine heads (IBGE, 2016) , and with the frequent sanitary management carried out, it is possible to be said that only preventive vaccination against foot and mouth disease generates around 7.8 million empty bottles.

Currently, reverse logistics for veterinary products is not yet implanted in the country, therefore, toxic and / or biological infectious waste remains with the end user, and for decades they have been disposed of inappropriately in the environment. However, the change in consumption habits and the popularization of the theme bring up the need to discuss the sustainability of agricultural activity (HLAWNSKY, 2018).

Despite the importance of this theme, the studies referring to the destination of health care waste of veterinary origin are still scarce in Brazil, and being for many times, the livestock farmers the main actors who are uninformed and susceptible to giving an incorrect destination to the wastes produced by the herd (NOGUEIRA et al., 2015, p 95). Thus, the objective of this study is to investigate the destination of livestock residues from farms in municipalities in the state of Rio Grande do Sul.

Materials and Methods

The study was carried out in municipalities of the state of Rio Grande do Sul, Brazil, during the period from August 2018 to January 2019. The collection of information occurred through the application of questionnaires for agriculturalists, seeking to obtain information on the most commonly used agricultural waste disposal practices. One hundred and two (n = 102) farmers were interviewed, encompassing fifty municipalities of the state, distributed throughout all mesoregions. These were selected through free adhesion when there was demand for veterinary care at the Ruminantes Clinic of the Federal University of Santa Maria (UFSM), at agricultural fairs and technical meetings.

The questionnaire was elaborated with fifteen objective questions of multiple choice (Figure 1). The questions aimed to collect information about the types of residues generated in the properties, focusing on the solid waste of veterinary health services and their final destination. Property information was also verified through a set of six questions to investigate if the level of schooling, type and quality of breeding, production system, area of ownership and number of animals may be associated with the form of waste disposal. After the application of the questionnaire, information was exchanged, through a conversation, to verify the opinion of the interviewees about the subject and what their expectations about public actions related to the topic.

Finally, guidance was provided aiming at the environmental awareness of the participants on the correct destination of the tailings.

Questionnaire on the destination of livestock waste for rural producers in the municipalities of Rio Grande do Sul

Name:_____
Profession:_____
Municipality: _____

1. Regarding the level of education of the producer:
( ) Without study
( ) Incomplete elementary school
( ) Complete elementary school
( ) Incomplete high school
( ) Complete high school
( ) Incomplete undergraduate
( ) Complete undergraduate
( ) Incomplete post-graduation
( ) Complete post-graduation

2. Regarding the type of creation of the property:
( ) Cattle
( ) Sheep
( ) Goats
( ) Buffalo

3. Regarding the purpose of production:
( ) Cut
( ) Milk
( ) Wool
( ) Genetics

4. Regarding the production system:
( ) Extensive
( ) Semi-extensive
( ) Intensive

5. In relation to the property area:
( ) < 88 ha
( ) from 88 to 330 ha
( ) > 330 ha

6. Regarding the number of animals raised on the property:
( ) < 25
( ) 25-50
( ) 50-100
( ) 100-300
( ) > 300

7. Where are the medicines/agricultural products of the property placed?
( ) Specific place (pharmacy)
( ) Does not have a specific place only for medicines/agricultural products

8. Regarding the destination of agricultural packaging:
( ) Do not use this type of product
( ) Return to where they were purchased
( ) Burn the packaging
( ) Bury the packaging
( ) Dispose of with household waste
( ) Reuse
( ) Deposit in the environment

9. Regarding the destination of packages of veterinary medicinal products:
( ) Do not use this type of product
( ) Return to where they were purchased
( ) Burn the packaging
( ) Bury the packaging
( ) Dispose of with household waste
( ) Reuse
( ) Deposit in the environment

10. Regarding the disposal of needles and syringes:
( ) Do not use this type of product
( ) Burn
( ) Bury
( ) Dispose of with household waste
( ) Deposit in the environment
( ) Ecopoint/Health Unit
( ) Reuse

11. How is the carcass disposal done?
( ) Burn the carcasses
( ) Bury the carcasses
( ) Leave the carcasses in the environment
( ) Use compost

12. In relation to domestic dry garbage generated on the property:
( ) Burn the trash
( ) Bury the trash
( ) Leave in the environment
( ) Recycle
( ) Take this waste generated on the property to the city dump

13. Do you use an immersion/aspersion bathroom?
( ) Yes
( ) No

14. For those who use a immersion/aspersion bathroom, how do you dispose of the dirty water?
( ) In the environment
( ) Other destination

15. What is the destination of animal waste?
( ) Compost
( ) Pond of decanting
( ) Fertilizer

Figure 1. Questionnaire on the destination of livestock residues for rural producers in the municipalities of the state of Rio Grande do Sul.

The collected data were compiled, evaluated and converted into percentage (%), which was represented in graphical and tabular form. The variables of interest for the analysis were categorized and analyzed using multilevel logistic regression models, using the municipality as a random factor. The models were adjusted using the lme4 package (BATES et al., 2015) in program R (R Core Team, 2018). The variables answers used were categorized in a dichotomized way: a) Education: 1 = undergraduate and post-graduate, 0 = other levels of education; b) Type of breeding: 1 = cattle, 0 = other species or creation of multiple species in the same unit; c) Purpose of creation: 1 = beef, 0 = other; d) Production/creation system: 1 = extensive, 0 = other; e) Property area: 1 = less than 88 ha, 0 = 88 or more ha; f) Number of animals in each unit: 1 = units with 100 or more animals, 0 = units with less than 100 animals.

Separate models were constructed for each of the explanatory variables, testing all response variables. The explanatory variables used were: a) Destination of agricultural packaging, b) Destination of packaging of veterinary drugs, c) Disposal of syringes and needles, d) Form of disposal of the carcases, e) Destination of domestic dry garbage. The association between the response and explanatory variables was considered significant using p value <0.05. The results were expressed as odds ratio.

Results and discussion

Of the 102 agriculturalists interviewed, 78 (76.5%) were male and 24 (23.5%) were female. Most of the interviewees had completed undergraduate (28%), or incomplete (22%), and postgraduate (13%) or in progress (5%). Regarding the type of animal creation, 43% of the interviewees created only cattle and 39% raised cattle along with sheep, the main purpose being meat production (66%), and animals predominantly raised in an extensive (45%) or semi-extensive (44%).

In relation to the area of properties, 56% had less than 88 ha. There was a discrepancy in the total number of animals raised, 25% of which had 25 to 50 animals and 24% had more than 300 animals. In 83% of the properties the interviewed answered that there is a specific place to pack the medicines and agricultural products before use. After use, 43% stated that they return the agricultural packaging to the place where they were purchased (reverse logistics), but 18% still discard it with household waste.

The concern with the inappropriate disposal of pesticide packaging led the Federal Government to create Law no. 9.974/2000, laying down rules for the collection of packaging. The process begins in the purchase of the defensive, when the producer is informed about the nearest collection point and the return period of the packaging (DURAZZINI; PARADELO, 2010, p. 61). Brazilian legislation requires the farmer to return the empty containers of agrochemicals to the receiving unit, which may result in a fine, if he does not prepare them properly (triple washing), in addition to being included in the Environmental Crimes Law. This fact is extremely important because in the year 2017 alone, the agricultural sector estimated around 44.5 thousand tons of empty containers, of which 91% were recycled and only 9% incinerated (HLAWNSKY, 2018).

As regards the destination of packaging of veterinary medicinal products, 38% of the interviewed dispose of household waste, 20% burn packaging, 19% deposit in the environment or reuse, 15% return to the place where they were purchased and 8% buried. Regarding the dispose of

needles and syringes, 37% of the interviewed affirmed to dispose with household waste, 28% deposited in the environment, buried or reused, 16% burned and only 19% returned in ecopoints or basic health units.

Residues resulting from animal health services, such as syringes, needles, ampoules, vaccine bottles and parasiticide packagings, among other products for veterinary use, are called Health Care Waste (HCW). Such waste is classified as hazardous and requires special care from its generation to it final disposal (ABNT, 2004). Therefore, the disposal of vials of veterinary products in the collection of common waste is an inadequate practice, given the occupational and environmental risk due to the characteristics of the product principles (TAKAYANAGUI, 2005; GÜINTHER, 2010).

Practices such as burying, burning, discarding in empty rivers or in the environment the empty bottles, or still containing remnants of products, pollute the environment (GONÇALVES et al., 2015, p. 3), once the residues of veterinary medicinal products can reach the soil, and to superficial and deep water sources, often persisting, undergoing changes, or being assimilated by organisms that may be adversely affected by these products (BOXALL, 2004). BUENO & TREVISANE (2008, p. 13) have described that HCWs are potential sources of disease spread and present an additional risk to workers who handle them and the general population when inadequately managed. In our study, inorganic waste from animal health services has an incorrect destination in more than 80% of the rural properties investigated, 85% of which are related to the disposal of veterinary products and 81% to the disposal of needles and syringes

Nowadays, the reality for the environment is worrisome, since most of the veterinary packagings are still deposited in dumps next to the household waste, generating a continuous risk to the public health (HLAWNSKY, 2018). CHAICOUSKI et al. (2010, p.212) verified in their study that Paraná cattle ranchers also face environmental problems with the lack of a program of solid waste collection from health services, and the treatment and final destination are still summarized in the adoption of immediate solutions, almost always based on simple disposal, predominating open pit deposits that contribute to environmental degradation. Most producers take HCWs to the city dump or keep them on hold, some still dispose with organic human waste.

NOGUEIRA et al. (2015, p. 97) reported that the cattle ranchers interviewed, also in the state of Paraná, were discarding the waste produced by the veterinary health services without following the specific procedures for this type of material. With 52% of respondents reporting that they bury or burn waste, 28% store in sheds on the property, and 20% discard along with common solid or organic waste.

Brazilian legislation establishes that all waste generated from services related to human or animal health needs different processes in their management, in addition to an environmentally adequate final disposal (BRASIL, 2018), instituting the responsibility of managing the HCW, from its generation to the final disposal, to its generators. This is in line with Law 12.305/2010, which establishes the National Solid Waste Policy (NSWP), establishing shared responsibility for the product life cycle, forcing manufacturers, importers, distributors and traders to return the packaging of the products after use by the consumer (BRASIL, 2010). It also institutes reverse logistics systems as a tool to minimize the generation of solid waste, based on the return to the business sector, seeking reuse. An example of success to be followed is the packaging of agrochemicals, since veterinary products offer risks as much as agricultural pesticides (HLAWNSKY, 2018).

When interviewees were questioned about how the disposal of the carcasses was done on the property, 50% responded that they buried, 33% left in the environment, 13% burn the carcasses and

only 4% used the compost. Farmers with extensive production systems reported more frequently (odd ratio: 7; confidence interval: 2.7 to 18.5, p <0.05) to leave the carcasses exposed in the environment rather than bury them. Agriculturalists with area properties of less than 88 ha reported more frequently (odds ratio: 10.4; confidence interval: 3.5 to 30.7, p <0.05) to bury the carcasses instead of leaving them exposed in the environment. The results of the logistic regressions are presented in Table 1. The destination of carcasses from animals that die from routine or catastrophic causes is a problem that still affects most rural properties. The concern is due, especially, to the lack of specific regulations for disposal and disposal that address health, environmental and economic aspects (PEREIRA, 2017).

Table 1. Associations between producer education, characteristics of production units, and frequency distribution of agropecuarian responses (n = 102) related to waste disposal in production units in 50 municipalities in the state of Rio Grande do Sul.

Variable response	Explanatory variable	Categories explanatory variable	Observations [a]	Chance ratio	IC 95% [b]	P value	ICC % [c]
Education: undergraduate and postgraduate	Dry waste destination	Burn	21	-	-	-	21,2
		City dump	63	6,4	1,4 – 29,6	< 0,05	
		Other	18	5,4	0,9 – 32,1	0,061	
Production system: extensive	Disposal of carcase	Bury	51	-	-	-	0
		Leaves exposed	34	7,0	2,7 – 18,5	< 0,01	
		Other	17	3,3	1,04 – 10,3	< 0,05	
Production system: extensive	Dry waste destination	City dump	63	-	-	-	0
		Burn	21	2,8	1,02 – 7,8	< 0,05	
		Other	18	2,2	0,7 – 6,3	0,15	
Number of animals:> 101	Disposal of carcase	Bury	51	-	-	-	29,0
		Leaves exposed	34	7,9	2,3 – 26,7	< 0,01	
		Other	17	4,4	1,1 – 17,9	< 0,05	
Property area: <88 ha	Disposal of carcase	Leaves exposed	34	-	-	-	8,5
		Bury	51	10,4	3,5 – 30,7	< 0,01	
		Other	17	4,6	1,2 – 17,2	< 0,05	

a Number of responses for each category of the response variable.

b IC = confidence interval (95%) of the odds ratio.

c ICC = Intraclass Correlation Coefficient corresponding to the percentage of variation in the response variable that is associated to the random factor (Municipality).

Composting is a solution for the fate of carcases and other biological wastes such as ferns and wraps, which is economically and environmentally viable. This method emerged as an alternative to the most common practices such as burial, deposition in pits or valves, burning and even abandonment in the open air, which can cause serious problems such as contamination of soil and groundwater, and still transmit diseases (OTENIO et al., 2010). The environmentally correct destination of animal carcasses and other livestock residues is a growing trend, which represents a practical, cheap and safe alternative from the biosecurity point of view, as well as preserving the environment and contributing to the reduction of final production costs (OTENIO et al., 2010).

Regarding the dry garbage generated on the properties, 62% take the waste generated to the city's dump, 20% burn and 18% leave in the environment, bury or recycle. Agriculturists with undergraduate and postgraduate education reported more frequently (odds ratio: 6.4, confidence interval: 1.4 to 29.6, $p < 0.05$) to take the dry garbage to cities rather than burning it. According to data from the National Solid Waste Plan (BRASIL, 2011), approximately 70% of rural households burn, burial or dispose of waste in wastelands, rivers, lakes and weirs. The difficulty of solving the environmental impacts caused by garbage is also due to the lack of services of collection and segregation of waste by most municipalities.

Most of the producers interviewed (70%) do not have a immersion or aspersion bathroom on their property. And among those who own, 80% discard the dirty water in the environment, causing soil contamination and generating a significant environmental impact (SCREMIN & KEMERICH, 2010, p. 142).

Regarding the destination of animal waste, 87% of the interviewed answered that these residues are dispersed in pastures, 12% use compost and 1% use decantation pond. The balance of solid waste estimated for the livestock sector a total generation of 1.7 billion tons/year of manure, considering cattle breeding, swine farming and poultry farming. Most of these wastes are generated by beef cattle, which occurs mostly in the extensive rearing model, leaving residues dispersed in the pastures, with no viability to take advantage of biodigestion systems (IPEA, 2012). More than 70% of this amount is thrown directly into the environment, causing consequences such as environmental impact and waste of raw material.

Waste from the agroforestry sector can be used positively in the environment, as in cases where such waste is used as an organic fertilizer or a source of renewable energy. However, if they are not well managed, treated and disposed of, they have a high potential for generating negative effects, causing contamination of soil, water and air, generating risks to human health, ecosystems, besides public health costs (IPEA, 2012).

Given the environmental problems caused by the incorrect disposal of livestock residues, the results found in this study demonstrate that farmers are aware of the lack of legislation to adapt the correct destination to these wastes, and most interviewees believe that reverse logistics would be the best option to the question. Rural producers are aware of the risks inherent in using an inadequate form of final destination, however, they do not know the correct destination of the waste.

Brazil's agricultural vocation is indisputable, being fundamental the adoption of preventive measures to avoid environmental degradation by the activity, due to the significant number of animals in the national herd, and consequently the enormous volume of flasks generated in the health care of these animals. The search for alternatives involving composting, recycling and reuse of solid waste produced in the rural environment, as well as the proposed reverse logistics brought by shared responsibility, established by law, represent valuable tools in the management of solid waste and in the protection and preservation of the environment (ROVERSI, 2013).

Conclusion

The inorganic waste originated by animal health services has incorrectly destination in more than 80% of the rural properties investigated. In addition, there was a lack of guidance to producers on the final destination of these wastes considered to be hazardous.

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