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Bibliographic Review

Use of bovine digesta as organic fertilizer

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Abstract

The objective was to spread the use of bovine digesta as a source of organic matter for agriculture. Currently, there is a growing concern about the depletion of natural resources, of the uncontrolled disposal of waste on the environment. Initiatives that reduce the damage to the environment are important and necessary, and enhance products and improve the welfare and the environment. Agro-industrial residues may have a noble destiny, as they have organic characteristics that provide for its use as organic fertilizer when growing plants. The bovine digesta proves to be promising organic fertilizer for agriculture, which promotes the increase of dry matter improves plant growth and development, and provide environmental benefits.

Keywords: waste, organic matter, environment, minerals.

Introduction

The generation of residues of some agricultural activities, as the animal slaughter, may cause problems to the environment, especially organic residues deposited in water springs which cause the degradation of the existing biome, besides causing serious damage for the population which needs water of quality to survive.

In Brazil, the animal production for cutting is an economic activity of great relevance which is translated in the appearance of an increasing number of slaughterhouses, being either cattle, swine or bird (FERREIRA et al., 2002). The agricultural activities, mainly the product processing, has caused serious problems of soil pollution in superficial and underground waters due to the great volume of remains deposed without treatment in the environment (MATOS, 2005).

Currently the slaughterhouses are responsible for producing residues potentially pollutant to the environment. This kind of industry generates an amount of processed animal of 1.1 to 2.9 m^3 (ESPINOZA et al.,1998), value which should be multiplied by the amount of animals slaughtered per day in the Brazilian slaughterhouses, generating enough volume of organic matter to be used as fertilizer in agricultural crops. In Brazil, it was slaughter 29.665 million bovines in 2010 (IBGE, 2010).

The cattle digesta comprehends all the content present in the gastrointestinal tract of the slaughtered animal. The material *in natura* has green color and it is currently disposed in the environment, without treatment, causing pollution and ecological damages, becoming thus a problem for ruminant slaughterhouses, mainly the cattle ones, due to the great amount of solid residue generated in the slaughter of these animals (MORALES and LUCAS JUNIOR, 2008).

With the use of the digesta in agricultural crops it is possible to reduce the charge of pollutants which are released every day in water springs, contributing thus with the environment and with the agricultural production (EDVAN et al., 2010). Measures which aim to the exploitation of this solid residue are indispensible, mainly in big slaughterhouses (VASCONCELOS et al., 2010). In this context, the use of the cattle digesta as organic matter, besides promoting improvement in the agricultural production, would generate a sustainable use of the residues of the cattle slaughter.

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This review aims to discuss the use of the cattle digesta as organic fertilizer for the agriculture.

Organic fertilizer in semi-arid regions

The use of organic fertilizers is an alternative to reduce the cost with chemical fertilizers in the crop, leading to save natural resources, besides contributing to the environment. In this sense researches with corn (SANTOS, 2009), potato (SILVA et al., 2007) and pepper (ARAÚJO et al., 2007) indicated that the organic fertilizer provided reduction in the cost with the use of chemical fertilizers, besides improving the soil structure.

The Brazilian semi-arid region faces problems with soil fertility, fact which was observed by TIESSEN et al. (1994) who quantified the average time of residence of the organic matter in the soil, in soils of prairies in Canadá and one Latossolo[1] in Araripina, PE. In the prairies, the agricultural cultivation is economically viable for a period of 65 years after the removal of the native vegetation, while in the Latossolo of Araripina, after the removal of the caatinga, the agricultural cultivation is no longer economically viable after six years, showing the fragility of the ecosystem caatinga, and the necessity of organic matter reposition.

The soils of the semi-arid region are deficient in N and P (SAMPAIO et al., 2004) so, the obtaining of productivity without fertilization is very hard, mainly due to the limited purchasing power of the rural producers, the access to agricultural credit and the high variability in the rainfall. All these factors difficult the use of inorganic fertilizers, but on the other hand they make the organic fertilization a viable alternative.

SAMPAIO et al. (2004) evaluated for three years the residual effect of the application of N and P in a Neossolo Flúvico in Coxixola, PB, and observed that great part of the P, applied as superphosphate simple, remained unavailable for the plant in the soil in which it was incorporated at the end of 3 years of cultivation. Concerning N, these authors concluded that there was no residual effect of the application of ammonium nitrate and that, in this case, there was no economical return of the investment for this fertilizer.

The cattle and bird manure are organic fertilizers widely used in the semi-arid region (SANTOS et al., 2009), despite the great acceptance by the rural producers, their use may present some limitations. Their availability in rural properties is generally insufficient to supply the nutritional needs of the plants in the areas with agricultural crops. MENEZES and SAMPAIO (2002), in study with simulation model, estimated that the P contained in the manure which was accumulated in the corral in a typical property of the Curimataú from Paraiba would be enough to repose only 12% of the P removed from the soil by the agricultural crops, in the areas of hoeing. As a consequence, the other option would be the use of dejects of industry of swine breeding, which is rich in nutrients and could reduce the costs with the mineral fertilization, however attention must be paid in relation to the environmental contamination of waters by superficial drifting (RIGON et al., 2010).

However, there are small swine ranches in the Brazilian northeast, mainly due to the cost of acquisition of the ration, considering that the swine breeders go through difficulty during great part of the year, considering the oscillation in the offer of grains (corn and soybean), basic food in the diet of these animals, having as consequence significant interference in the costs of production and in the profitability of this important sector (ALBUQUERQUE, 2009). In this sense, the cattle digesta may be considered an option as organic fertilizer, mainly for small rural producers, considering that its use benefits the cultivation of plants and minimizes the environmental problems.

Dejects of slaughterhouses and the environment

The problems generated by the inappropriate management of the natural resources or simply by the carelessness with nature worsen the environmental situation. In this context, attitudes

[1] Brazilian soil classification

which contribute to minimize the prejudice caused to the environment are needed. It was observed that the population has been acquiring ecological awareness, being concerned with environment and with resources which are increasingly scarce for their survival (BEDARD, 2007). The dilapidation of resources and the generation of great part of residues is consequence of the socioeconomically development and of the change of habits and costumes which generate currently the excessive consumption, by part of the population, considering that the final destination of the residues generated in this process represent a great challenge/problem for the humanity.

According to NAGEL et al. (2010), the awareness of the harmful effects caused by the release of residues in the environment is linked to the implantation of more severe environmental laws which turns the environmental management a fundamental question for cold-storage buildings, tannery and other industries. The transparent and concrete action of the companies in the preservation and conservation of the environmental compounds must be materialized by the performance of activities which cause less environmental impact and which bring benefits for the environment.

Together with the growth of the industrial productivity, it also grows the number of problems which come from the deposition of dejects and by the international demands relative to the maintaining and promotion of the environmental quality, marked by its own management – the ISO 14.000 (GOMES and BASTOS, 2010). The increase in the production of dejects causes damages to the environment and this contamination according to MATOS (2005) may occur in a direct way, in which the greater impacts are caused by organic solid residues which come from the fermentation of the material, due to the formation of organic acids which generate bad odors and reduce the oxygen dissolved in superficial water. The production of foul smelling gases (methane and sulphide) causes discomfort to human beings and animals, besides being able to attract vectors of diseases, since the organic matter is, also, habitat for the proliferation of micro (bacteria, fungus, virus, protozoa etc.) and macrovectors (flies, mosquitoes, cockroaches and rats).

Agroindustry, since they process different products of animal and vegetal origin, generate varied residues, which can be submitted to the process of exploitation. The small cold-storage buildings and slaughterhouses are considered industries since they process products of animal origin, in whose residues it can be found visceras of slaughtered animals, slices of meat without commercial value, tallow, blood and other materials, all susceptible to biological treatment trough composting (COSTA et al., 2009).

Due to the enlargement of the slaughter of bovines in Brazil and consequent increase of solid residues (ruminal content), the slaughterhouses have aimed to be adapted to the demands of the Legislação Ambiental (Environmental Law) (MORALES and LUCAS JUNIOR, 2008). During the process of slaughter it is generated solid residues, as the ruminal content of bovines and liquid residues, as the water of carcass washing and of equipment's dirty with blood, which should receive specific treatments so that they can be disposed in the environment without risks of contamination (MOURALES et al., 1998). Appropriated processing and destination should be given to all the sub products and residues of the slaughter, in attendance to the current sanitary and environmental laws and norms (PACHECO, 2006).

Use of dejects of slaughterhouse as organic fertilizer

The search for alternatives for the use of dejects coming from slaughterhouses is relevant, since it would allow the use of the nutrients contained in the organic matter and enable the recycling of a product which would be discarded or which would pollute water sources (MATOS et al., 2005). These residues are composed/treated and used as soil fertilizers, since their nutrients after the mineralization may be absorbed by plants, in the same way as the chemical fertilizers (SANTOS, 1999). The recycling and the rational agronomic use of residues are presented as options for the solution of problems, however they imply in enlargement of knowledge over the residues and their respective forms of treatment (COSTA et al., 2009).

The main methods of treatment of the effluents of slaughterhouse would be put them together with the domestic sewage, due to their characteristics, but in areas in which these practices are not possible. The industries will have to have their own treatment stations (BRAILE, 1971). In the treatment of the cattle disgesta, it would be necessary a cemented area with light slope for the deposition of the residue in the industry out of doors, with the occurrence of lost of water by evaporation, remaining only

the solid residue. FERREIRA et al. (2002) reported that a lot of times the recovery of sub products of slaughterhouses is economically viable, contributing to reduce the negative impacts in the environment and enlighten the charge in the treatment system.

The raw material, after receiving appropriate treatment may be used as organic matter, mainly by rural producers. In the case of the digesta, this residue may be destined to the use in the agriculture, which constantly needs nutrients for the production of food. With the use of the digesta, it will be possible to reduce the charge of pollutants which are released every day in water springs, contributing thus with the environment and the agricultural production at the same time. Since currently this slaughterhouse residue is disposed in the environment with no treatment, it causes pollution and ecological damages (EDVAN et al., 2010).

Another way to use the organic dejects is through the process of composting. According to MORALES and LUCAS JUNIOR (2008), the use of composting is justified in the treatment and recycling of the solid residues generated in cattle slaughterhouse since it accelerated the decomposition of the organic material present in the ruminal content. In their experiment, the solid residues were appropriated to be submitted to the process of composting. The authors concluded that the produced compounds present good physical-chemical characteristics, indicating that they can be used as organic fertilizer and soil conditioner. However, in the case of the cattle digesta, there is no need to make the compound, since it can be applied directly in soil after the process of dehydration since it is the food pre-digested by the animal, eliminating thus a step in the use of this deject and reducing the cost with the treatment.

Use of the cattle digesta

In accordance with EDVAN et al. (2010), the solid residues found inside the gastrointestinal tract of the slaughtered animals are called digesta. The cattle digesta or ruminal content consist in the partially digested food, considering that each animal produces in average 25 kg of this residue (MOURALES et al., 2008).

NAGEL et al. (2010) report that the content of the rumen and solids of the green line (cattle digesta) may be daily lead to the industry of fertilizer, where it is placed in resting stalls for later processing.

The cattle digesta can be acquired in slaughterhouses *in natura* or dehydrated. The transport of the one *in natura* is expensive, since in this state it is doughy and hard to manage. However, the transport of the dehydrated digesta is very simple, since it is light and easy to manage. The process of dehydration may be done in the company itself in opened air, using sun light as dehydrating energy, becoming ready to use after the drying. Thus, the slaughterhouse would be benefited disposing the residue in the correct way, without harming the environment and the rural producer would be responsible for the transport of the digesta, since it will be acquiring a good quality organic fertilizer.

NAGEL et al. (2010), when studying the chemical composition of an organic fertilizer produced from residue of the slaughterhouse industry, obtained 80% of dry matter, 1.5% of nitrogen, 2.0 of phosphorus, 0.5% of potassium and 38% of organic matter. For cattle digestion, EDVAN et al. (2010) obtained 70% of dry matter, 2.0% of nitrogen, 2.0% of phosphorus, 1.0% of potassium and 38% of organic matter. In cattle manure, SEVERINO et al. (2006) found in their study values of 0.77% of nitrogen. However, GOMES and SILVA (2004) emphasize that the chemical composition of the organic fertilizer ranges according to the animal diet, and it was found dairy cattle manure with up to 51% of N (HENSLER et al., 1970). It may be said then that the bovine digesta also has its chemical composition changed according to the diet consumed by the animal.

EDVAN et al. (2010), using 6.5 and 13.0 Mg if bovine digesta per hectare, 5.5 and 11.0 Mg of cattle manure per hectare, aiming to apply 5.0 and 10.0 Mg of dry matter, respectively, for the doses of both fertilizers, observed that the use of 13 Mg per hectare of cattle digesta presented effect for the morphogenic and structural characteristics of

the buffel grass, result which is similar to the obtained when it was applied 11.0 Mg of cattle manure per hectare. In relation to the production per hectare in the same experiment it was obtained 1.8 Mg of forage dry matter in the higest doses of digesta and cattle manure. The cattle digesta presents characteristics which elevate the factors of production similar to the cattle manure.

Similar results were observed by VASCONCELOS et al. (2010), when evaluating different sources of fertilization (chemical, cattle manure and cattle digesta) in plants of Maniçoba and Pornunça, resulting in higher yield of dry matter with the bovine digesta. Still, according to these authors, the use of the cattle digesta as organic fertilizer increases the productivity of the studied species and becomes an option for the destination of this solid residue of slaughterhouses.

SOUTO FILHO et al. (2009), when evaluating different levels of nitrogen applied in forage plant cv. IPA-20 (*Opuntia fícus indica)*, trough the bovine digesta, concluded that they were not sufficient to have positive effect in relation to the production of fresh matter. However, the availability of nutrients in the soil was enough to achieve the nutritional demands of the palm.

In accordance with EDVAN et al. (2010), the ruminal digesta is a source of organic fertilizer which is optional in relation to the existents, increasing the production of forage dry matter and providing the growth and development of the buffel grass, mainly in relation of the tillage, besides being an ecologically right source of fertilizer. According to VASCONCELOS et al. (2010), the plants present an initial development which was improved by the fertilization, particularly the fertilization with the bovine digesta, considering mainly the values of accumulation of dry biomass.

Thus, it can be observed that the bovine digesta is a promising organic fertilizer, it provides improvement of dry matter in different crops besides improving the plant development, it brings benefits to the environment, since when it is used as fertilizer, it reduces its deposition in the environment.

Final considerations

The bovine digesta is a form of organic fertilization that when adequately utilized can be a great efficient to improve the vegetal development and production, besides it brings benefits to the environment.

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