IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 14, Issue 1 Ser. III (January 2021), PP 26-30
www.iosrjournals.org

Ruminant Feed Rations Based On AgroIndustrial ByProducts As An Alternative To Reduce Ecological Damage In Tropical Regions

A. Cabrera Núñez[*1], M.A.Lammoglia Villagómez, C.E. Martínez Sánchez, R. Rojas Ronquillo and R. Allende Molar.
Facultad de CienciasBiológicas y Agropecuarias,
Universidad Veracruzana,Tuxpan, Veracruz, México
*A. Cabrera Núñez[*1]*

Abstract: *This research was developed on a commercial ranch in the north of the state of Veracruz, Mexico. geographically located in the meridians: north latitude 20 ° 55 '19 ", west longitude 97 ° 41' 44". and average annual temperature from 19 to 38 ° C. Its objective was to carry out the preparation of food rations, based on by-products that are discarded in the juicers of Alamo, Veracruz such as the peel (T1) and orange bagasse (T2), as well as the orange halves (T3). Before preparing the food rations, the ingredients were analyzed under the Van Soest y Wine method. The results showed that the nutritional value and the nutritional recommendations indicated by the National Research Council (NRC, 2001) were fulfilled, showing values between 10 - 16% of Crude Protein (C) and 65% ofTotal Nutrients Digestibles (TND). With this work it was shown that the use of easily accessible, inexpensive, elaborated, transportable and highly palatable products, such as the case of orange peel by-products, is a viable alternative to reduce the damage ecological in the tropical regions of northern Veracruz, Mexico. In addition to being used in the supplementation in cattle.*

Key Words: *byproducts, orange, rations, ecological damage, tropical.*

Date of Submission: 13-01-2021 Date of Acceptance: 28-01-2021

I. Introducción

Industrial and agricultural by-products are a powerful source of food since their cost is low, since industries must find a destination for the by-products so that they do not pollute the environment. In recent years and due to society's environmental concern, agribusiness must be sensitive to environmental issues, seeking the growing development of a social conscience, which forces it not to produce at the expense of the planet, but in a sustainable way. Therefore, the nutritional characteristics of the agroindustrial by-products have been studied for the production of food rations in cattle (Elias, 1997).

The best strategy to achieve greater productivity is to establish a food supplementation program, using available material, human and financial resources. Given that the decision to supplement represents an additional cost to the producer, the use of those supplements that provide the maximum productive and economic response should be considered (Gutiérrez *et al*., 2003).

It is important to highlight that feeding from by-products, destined for cattle, is considered an alternative that producers can choose during the dry and winter season in order to increase weight gains, feed conversion and greater economic profitability (Martin,2014).Citrus by-products can be supplied in several ways, the most common being fresh bagasse, orange flake, and silage. In the first form, bagasse, due to its high water content and its potential contaminating the environment, generates a problem at the level of industrial plants, but at the same time offers an opportunity for supplementary feeding for ruminants, especially cattle (Dhanasekaran *et al*., 2011).Since there is a large production of orange, there are several industries in the periphery of the municipality dedicated to the extraction of juice, so exorbitant amounts of citrus residues are discarded, causing great damage to the environment. Therefore, this work focuses on considering the by-products obtained from citrus fruits, from whole fruit to bagasse, in order to be used by producers in the tropical region for supplementation of food rations in cattle.

Therefore, this research work aims to take into account that the growth in cultivated area and the local sales of the Valencia orange (*Citrus sinensis var. Valencia*), provide an increase in by-products obtained from this crop, such as whole fruit, pulp, juice, bagasse and peel; being raw material with high potential for its use in the supplementation of ruminants.

II. Material and Methods

This research was developed in a commercial ranch in the north of the state of Veracruz, in the Municipality of Alamo, Temapache, Veracruz; México.Geographically located in the meridians: north latitude 20 ° 55 '19 ", west longitude 97 ° 41' 44". The town is located at an altitude of 40 meters above sea level and an average annual temperature of 19 to 38 ° C.

To carry out the preparation of the food rations, it was collected in a juicer located in the Municipality of Alamo; Veracruz, those by-products that are discarded such as orange peel and orange bagasse. As well as the orange halves, which were used to be ensiled in a cake type silo.

Previousto the preparation of the food rations, the ingredients were analyzed in the Animal Bromatology Laboratory of the Faculty of Biological and Agricultural Sciences of the Veracruzana University, Tuxpan campus. Determining the following nutritional values: Crude Protein%, Ethereal Extract%, Ash%, Crude Fiber% (Van Soest and Wine, 1968). Also Nitrogen Free Extract%, Total Mcal Digestible Nutrients. and Net energy from production Mcal.

For the T1 and T2 food rations, it was necessary to collect by-products that were discarded as orange peel and bagasse in the juicers of Alamo, Veracruz. In relation to the T3 treatment, a cake-type silage was made, located on an elevated site with a slight slope, building a border around it to prevent the entry of water. The oranges were chopped into small 3-6 cm pieces; those that were accumulated in layers with 20 cm of thickness and were tamped with a tractor on top. Subsequently, it was covered with polyethylene plastic, and on this a uniform layer of 10-15 cm of soil, six meters wide and one meter high.To facilitate the mixing of the ingredients, each of the rations were added separately on spread canvases: T1: 50 kg. Orange bagasse; T2: 50 kg. Orange peel and T3: 50 kg. Orange silage. With this, the concentrate was made by adding broken corn (25kg), ground sorghum (20kg), vitamins and minerals (5kg). The ingredients were carefully mixed, achieving a homogeneous concentrated food in the different servings of citrus by-products (Table 1,2,3).

Table 1. Ingredients used for food rations based on orange bagasse and their protein percentage value

Ingredients	Kg	PC%	TotalPC%
Orange bagasse	50	10	5.10
Broken corn	25	12	2.75
Mincedsorghum	20	12	2.45
VitaminsandMinerals	5	----	----
Total	100		10.3

Kg, Kilograms

PC%, Porcent crude protein

Total PC% , Porcent total de crude protein

Table 2. Ingredients used for orange peel-based food rations and their protein percentage value

Ingredients	Kg	PC%	Total PC%
Orange peel	50	10	5.10
Broken corn	25	12	2.75
Mincedsorghum	20	12	2.45
VitaminsandMinerals	5	----	----
Total	100		10.3

Kg, Kilograms

PC%, Porcent crude protein

Total PC%, Porcent total de crude protein

Table 3. Ingredients used for food rations based on orange silage and their protein percentage value

Ingredients	Kg	PC%	Total PC%
Orange silo	50	10	5.10
Broken corn	25	12	2.75
Mincedsorghum	20	12	2.45
VitaminsandMinerals	5	----	----
Total	100		10.3

Kg, Kilograms
PC%, Porcent crude protein
Total PC%, Porcent total de crude protein

A statistical column was used, with the average of the values of the ingredients analyzed, followed by the maximum and minimum value of the number of samples analyzed, indicating in the columns, the variation of the nutrients.

III. Results and Discussion

One of the available resources are by-products and waste from industry and agriculture, since entrepreneurs do not see business in these products, the opportunity to use them to improve scarcity is being lost, as occurs during the dry months (Restrepo, 2014). In recent years, various investigations have been carried out regarding the use of various residues from agricultural and industrial crops, to determine its value as animal feed (Martin, 2009, Fernández, 2014).

Agroindustrial by-products are solid or semi-solid residues originating from agricultural activity. These are derived from the collection of a product or from some part of the manufacturing process. Generally, by-products management is difficult, since they are characterized by seasonal, localized and perishable production. The industries that process agricultural products must find a final destination for the by-products that meet two minimum requirements: that it is not polluting the environment and that the processing and transportation costs are covered by the sale price of the same and do not generate costs. additional to production. Due to their difficult handling and heterogeneity in terms of composition, they are a difficulty when commercializing them (Kucsevsa and Balbuena, 2012).

Among the different by-products there is a high variability in the available chemical composition, some can be very regular in their composition because the industrial processes that generate them are highly controlled. While others may present a significant variation, so it is necessary to know the nutritional contributions when formulating the rations. Once the contributions to be made through supplementation have been determined, it must be taken into account that many byproducts can simultaneously provide energy and protein; others, on the other hand, are lacking in some nutrient (Sánchez, 2006).

In relation to the nutritional value and the nutritional recommendations indicated by the National Research Council (NRC, 2001), the values between 10% - 18% of Crude Protein (CP) and 65% of Total Digestible Nutrients (TND), are considered desirable. Therefore, in this investigation, these parameters were met, intended for semi-grazing cattle with values of 10.0 - 16.0% CP provided in the rations.

Table 4. Nutritional value of orange by-products

Indicator	Orange bagasse	Orange peel	Orange silo
Crude protein %	10.0	10.0	16.0
Ethereal extract %	3.20	4.96	9.22
Ashes%	3.30	7.92	7.93
Raw fiber %	14.92	30.80	33.40
Nitrogen free extract %	64.51	67.18	77.58
Total, Digestible Nutrients (Mcal)	60.39	63.78	64.56
Net Production Energy (Mcal)	22.60	26.87	27.89

Animal Bromatology Laboratory / 2020

It is important to highlight that the orange pulp from the juicer presented a protein value of 10%-16%, these values of crude protein (CP) could be increased, by adding medium or high quality protein ingredients with a protein 20 to 45%.

In the juice extraction process, the pulp represents 60% of the fresh weight of the product to be squeezed, although the variability of the data is high (49% to 69%). The average dry matter content of the pulp is 20%. No significant differences are observed in the chemical composition correlated with the dry matter

content, although this is variable. The form of use of this by-product can be fresh, silage or dehydrated. The use of moist citrus pulp is almost exclusively for the ruminant, and is only justified in areas close to the production center due to the cost of transportation (Coppo, 2016).

The orange pulp from the Alamo juicer presented a protein value of 10% - 16%; These crude protein (CP) values could increase and improve daily weight gain, by adding medium-quality protein, such as urea, chicken manure, chicken manure or some surplus protein such as soybean paste, flour, cotton, among others (Gadberry, 2011).In food rations with citrus by-products for ruminants, (Ramirez, 2013) observed that the weight gain, carcass quality and the milk fat content increase, highlighting that, the animals that received only energy nutrients presented greater kilograms of weight gained to the addition of the orange by-product.

Regarding the quality of the orange silage, a good quality silage was obtained, due to its yellowish green and light brown color, a smell of ripe fruit, slightly acid and a firm texture without deforming when pressed with the fingers; which indicates that proper handling of the silage increased the nutritional and organoleptic properties of the ration.The results of the present work were similar to those reported by Gutierrez*et al*. (2003) who worked with by-products of valencia orange, appreciating a light brown and light mustard color in the silage throughout the fermentation times.

The silage produced in this study complies with the organoleptic characteristics associated with high quality silages, in this case an aromatic, sweet and pleasant fermented wine smell that characterizes lactic acid. This could be attributed to the fact that the orange peels, in addition to the natural fragrance of the essential oils, have acids that generate a pleasant smell that, accompanied by the increase in lactic acid bacteria in the fermentation process, gave the silage a slightly pleasant smell(Restrepo, 2014).

It is important to note that energy provides the body with the ability to perform work, in rations for fattening cattle, energy is required for activities such as growth and maintenance; so energy is a nutrient required by livestock in large quantities(Sánchez, 2006). The primary sources of energy in forages are cellulose and hemicellulose, and in grains it is starch. Fats and oils have a higher energy content, but are usually added in small amounts to cattlerations (Wadhwa y Bakshi, 2013).

The Valencia orange (*Citrus sinensis var. valencia*) is one of the most consumed products worldwide and a little more than 10% of the total production, approximately 6.5 million tons, is exported to other countries (Lopez, 2018). Oranges tend to be around the fifth position in the lists of agricultural products most produced or exported, surpassed only by bananas, apples, tomatoes and onions in terms of international trade. The orange is considered a 100% energetic nutrient according to what is established by the NRC (2001), it is the first tropical fruit of economic importance in the world, its production worldwide between 2016 - 2020 was 27,918 million tons of fruit fresh (Gómez et al., 2019). Mexico, for its part, is in 25th place, with 19,449 dollars and contributes 0.4% of total exports (Wadhwa and Bakshi, 2013).

Likewise, using the by-products of the predominant industry of the region in which the herd is located, leaves benefits for both the farmer, the industry and the environment, since by using these remaining from the industry as food that previously had destination in landfills contaminating the soil and the aqueducts around it, a cycle is closed in the reuse of these wastes.The range of agribusiness products is wide, in Colombia, Pachón *et al*. (2005) used the by-products of panelera cane as a nutritional supplement in cattle, thus avoiding contamination of the environment and the solution to the shortage of good quality food in dry times of that region (Fernández, 2014).

The Valencia orange (*Citrus sinensis var. valencia*) is one of the most consumed products worldwide and a little more than 10% of the total production, approximately 6.5 million tons, is exported to other countries (Sarah *et al*., 2018). Oranges tend to be around the fifth position in the lists of agricultural products most produced or exported, surpassed only by bananas, apples, tomatoes and onions in terms of international trade. The orange is considered a 100% energetic nutrient according to what is established by the NRC (2001), it is the first tropical fruit of economic importance in the world, its production worldwide between 2016 - 2019 was 27.918 million tons of fruit fresh (Kucsevsa y Balbuena,2012). Mexico, for its part, is in 25th place, with 19,449 dollars and contributes 0.4% of total exports (Wadhwa and Bakshi, 2013).

The integral residue of fresh orange is used in livestock feed, in addition, the dehydrated citrus pulp, although it is relatively high in fiber, is considered an energetic raw material(Acero, 2005). The fresh pulp is also pleasant to the palate of ruminants, it has a beneficial effect on the health and condition of the cattle, using between 20 and 25% of the ration. Orange pulp is high in carbohydrates, which allows the silage to be sustained for long periods of time without suffering any type of deterioration (Restrepo, 2014).

It should be noted that citrus by-products can be supplied in various ways, the most common being fresh bagasse, orange flake and silage. In the first form, bagasse, due to its high water content and its potential to pollute the environment, generates a problem at the level of industrial plants, but at the same time offers an opportunity for supplementary feeding for ruminants, especially cattle (Coppo, 2006; Dhanasekaran *et al*., 2011).The orange peel is the result of the extraction of the squeezed juice. The resulting pulp is made up of the skin (60%-65%), fruit segments (30%-35%) and seeds (0%-10%).

IV. Conclusión

It was very remarkable to observe through the nutritional analysis of the orange by-products, that the cake silage presented an adequate protein value of 16.0% and Net Energy of Production 27.89 Mcal, providing better energy and protein values that could be used both for production of milk as of bovine meat.

With this research work, it was shown that the use of products that are easily accessible, inexpensive, easy to manufacture, easy to transport and highly palatable, such as orange peel by-products, is attractive and a viable option, as a complement for ruminant cattle. in dry seasons (drought and winter), given the availability of citrus in tropical regions of Mexico. And in this way reduce the risks of contamination to the environment.

References

[1]. Acero Maldonado, E. 2005. Productos y subproductos alimenticios para los rumiantes en confinamiento. Primera Edición. Editorial Océano. México. D. F. p. 23-33.

[2]. Coppo JA, 2016, Bagazo de citrus como suplemento invernal en vacas de descarte, Sitio Argentino de Producción Animal, www.produccion-animal.com.ar.

[3]. Dhanasekaran, D., S. Lawanya, S. Saha, N. Thajuddin, y A. Panneerselvam. 2011. Production of single cell protein from pineapple waste using yeast. Innovat. Rom. Food Biotechnol. 8:26.

[4]. Elias, A. 1997. Avances y perspectivas en la transformación de residuales orgánicos en alimentos. Encuentro sobre animales monogástricos. Instituto de Ciencia Animal, La Habana. Cuba. p. 218.

[5]. Fernández, A. 2014. Transformación de subproductos y residuos de agroindustria de cultivos templados, subtropicales y tropicales en carne y leche bovina, 1a ed. – Bordenave, Buenos Aires: Ediciones INTA, 2014. 200 p.

[6]. Gadberry S. 2011. Part 1: Nutrition basics". Beef cattle nutrition series. University of Arkansas, USA. 24p.

[7]. Gutiérrez, F., A. Rojas, H. Dormond, M. Poore, and R. WingChing. 2003. Características nutricionales y fermentativas de mezclas ensiladas de desechos de piña y avícolas. Agron. Costarricense 27(1):79-89.

[8]. Kucsevsa, C; Balbuena, O. 2012. Suplementación de bovinos para carne: Aspectos prácticos. INTA (Instituto de Innovación y Transferencia de Tecnología Agropecuaria, ARG). 12pp.

[9]. López, M. 2018. Valoración nutricional de los rastrojos de piña (*Ananas comosus*) como alternativa forrajera de bajo costo para la alimentación del ganado. South Dakota State University, USA. 23p.

[10]. Martin, P.C.2014. Animal feed using agroindustrial residues in Cuba: past, present and future. Journal Advances in Agricultural Research,13(3):3-10 ISSN 0188789-0.

[11]. National Research Council (NRC). 2001. Nutrient requeriments of dairy cattle. 7 ed. National Academy Press, Washington DC., USA.

[12]. Ramírez, R., 2013, Formulación de raciones para carne y leche. desarrollo de un módulo práctico para técnicos y estudiantes de ganadería de Guanacaste, Costa Rica, Revista Intersedes. Vol. XIV. N°29. (128-153). 2013. ISSN. 2215-2458

[13]. Restrepo, R. 2014.Evaluación de ensilajes de subproductos agroindustriales (cáscaras de naranja) en la ganancia de peso de ganado bovino en la hacienda San Rafael, Pueblonuevo, Departamento de Córdoba. Agronomía. Costarricense 37(1):19-23.

[14]. Sánchez, J. 2006. Valor nutricional de los forrajes de Costa Rica. Boletín Centro de Investigación en Nutrición Animal. Universidad de Costa Rica. Costa Rica.

[15]. Van Soest, P., Wine. 1982. Nutritional ecology of the ruminant. Ruminant metabolism, nutritional strategies, the cellulolityc fermentation and the chemistry of forages and the chemistry of forages and plat fibers. O & B books. Inc. USA. 374 Pp.

[16]. Wadhwa, M.; Bakshi, M. P. S. 2013. Utilization of fruit and vegetable wastes as livestock feed and as substrates for generation of other value-added products. (H. Makkar, Ed.) (p. 68). Roma

A. Cabrera Núñez, et. al. "Ruminant Feed Rations Based On AgroIndustrial ByProducts As An Alternative To Reduce Ecological Damage In Tropical Regions." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 14(1), 2021, pp. 26-30.