

## Supplementation Spent Grain from Waste Brewery in the Diet of Household Ovine System in the State of Mexico

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### Abstract

Industrial wastes poses a threat of environmental pollution worldwide, due to high biochemical oxygen demand for destruction. The beer industrial process, produces large amounts of semi-liquid waste as by-products, which can be reused in animal feed with beneficial results over performance in ruminant animals. In Mexico, the ovine household production system is based on forages in state of Mexico with low efficiency, principally during dry seasons in the year. The aim of this study was to use spent grain to supplement the ration of landrace hampshire sheep into a household system production. The study was conducted in the municipality of Cuautlalpan, State of Mexico. Nine sheep landrace (7 females and 2 males) with an initial weight between  $35 \pm 10$  kg were used and grouped into two treatments. The control group (T0) without supplementation, T1 supplementation with 10% of two spent grain and T2 with 10% of six spent grain, in a statistical model completely randomized. The one way analysis of variance (ANOVA) of weight gain was run in a general linear model procedure (GLM) of SAS, 2009. The results showed a positive effect of 10% supplementation with spent grain in the diet of crossbred sheep in on the daily weight gain ( $P \leq 0.05$ ), versus non untreated group. It is concluded that supplementation with spent grain from six malts in a 10% of dry basis ration, helps improve weight gain on landrace sheep in household system production.

**Keywords:** Hampshire; Livestock; Household; Aflatoxins; Forage

### Introduction

In Mexico, ovine production generates  $\geq 1.0\%$  of the livestock sector, almost imperceptible even though it has an inventory of 8.5 million heads cattle. Mexico State and Hidalgo are the most important producers, together participates with 27.3% of the total volume. However the most prevalent system production is household; feeding only with native forage [1], which is reduced during the winter season or during dry years. The lack of good pasture at least four months, requires producers to use food concentrates of high cost, not feasible for them, causing a low gain weight and animal finally price [2].

Industrial beverages produce large amounts of wastes [3] and great volumes during the year, that includes a threat of environmental pollution around the world, because these by-products are rich in organic matter and demand a high biochemical oxygen for destruction [4]. Beer is obtained from malted barley and other cereals, depending of the produced type of beer (light, brown), producing spent grain or malt bagasse as principal semi-solid waste (100 kg from processed barley are generated 130 kg wet bagasse or 20 kg bagasse by each hectolitre of beer produced [5]. The principal composition nutrition is protein, minerals and fiber, in different quantities, so it has been used successfully in animals as ruminants and aquatic [6-9].

The wet bagasse it is susceptible to microbial contamination as fungi [10], due to riche in organic matter and high moisture content. Thus, it is important to evaluate the aflatoxins presence, to avoid intoxications. The aim of this paper is to evaluate effect of supplementing bagasse brewery in 10% of dry base ration 90% forage, determining chemical composition and identifying the aflatoxin contamination and its impact on weight gain in crossbred ovine cattle.

### Materials and Methods

#### Description of the study area

The study was conducted at Cuautlalpan located at South of Texcoco, State of Mexico, the area is found at a distance of 100 km from Mexico City. Geographically  $19^{\circ} 25' 53''$  N and  $98^{\circ} 54' 05''$  O, and 2510 m above sea level. The weather is tempered semi-dry, with at minimum and maximum temperature of  $2^{\circ}\text{C}$  to  $31^{\circ}\text{C}$  respectively. There are

10,989 population (INEGI, 2010), 5,663 women and 5,326 man. This area receive 600 mm annual rainfall, which occurs in principally in June month.

#### Feed collection and preparation

Bagasse brewery (spent grain) was collected from Beer Factory located in Zumpango, State of Mexico. This factory makes different types of beer with two and six malts. The waste was sundried for 7 days, to eliminate most of its moisture. It was grounded thoroughly and mixed with other feed ingredients. Diets required for the experimental trial were stored in sacks.

#### Feeding and sampling procedure

All animals were fed with lucerne, oat straw and corn stover with 110 g protein/Kg d.w. and 2 Mcal perkg d.w. Bagasse brewery 10%, with two malts, with 113 g protein and 2.03 Mcal per kg, and bagasse brewery 10% with six malts, with 115 g protein and 2.5 Mcal, were offered two times per day in the morning and night, during 28 days.

#### Chemical analysis

Samples of two type of bagasse brewery were dried, ground and passed through a mesh 0.5 mm prior to chemical analysis. It was carried out in order to determine dry matter (DM), crude protein (CP), ashes, neutral detergent fiber (NDF), acid detergent fiber (ADF) by NIRS, in two samples of bagasse of two and six malts, and complete food.

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The aflatoxins content was determined by thin layer chromatography by UV light detection, in the toxicology laboratory at UAM-X [11].

### Animals and experimental design

The study was conducted on nine landrace sheep (seven females and two males) with an initial weight of 35 kg ± 10 kg, previously they were selected randomly and grouped into three groups. Control group fed with 100% of forages, T1, fed with 90% of forage and 10% of bagasse with 2 malts and T2, 90% of forage and 10% of bagasse with six malts. The experimental trial had a 28 days' duration. Animals were weighed every week.

### Statistical Analysis

The one way analysis of variance (ANOVA) of gained weight was ran in a general linear model procedure (GLM) of SAS, 2009. Differences between the treatments were tested using least significant difference test, where  $Y_{ij} = \mu + T_1 + B_j + E_{ij}$ .

### Results

#### Chemical composition and growth performance

The proximate composition in both bagasse brewery and growth performance are showed in Tables 1 and 2 respectively. In Table 1, we can see a variation in two samples, due to grains composition between samples, which similar to reported by Santos, et al. [6]; however our principal variation was in protein content. The aflatoxins analysis showed a lightly presence of Aflatoxin G, in small amounts, which doesn't present any health problem. In the growth performance we

Feed and food	FND (%)	FAD (%)	PC (%)	Ca	P	K
Spent grain/2 malts	43	17.55	26.62	0.2	0.79	0.39
Spent grain/6 malts	44.12	16.6	29.04	0.41	0.72	0.38
Complete food	57.53	25.22	21.84	0.61	0.5	0.29

Table 1: Chemical analysis in waste brewery and diet complete % in dry weight.

	Initial weight	1 week	2 week	3 week	4 week
Control	92.8	85.7	142.8	121.4	164.25
T2 (6malts)	190.1	256.1	228.5	190.43	252.33
T3 (2 malts)	104.7	128.5	142.8	152.33	219

Table 2: Growth performance week average in sheep feeding supplement with two and six malted cereal.

can see lightly differences between experimental groups, not so with the control group, where it was observed a lower weight gain (88.08 g and 54.75 g) respectively. In sheep landrace supplemented with 6 malts the weight gain was minor compared with the animals feeding whit six malts, (62.23 vs. 114.3 g), this result possibly by the initial weight used in the experimental group T2 or due too at maturity differences between groups, so this by product it can be used in animal food, as reported Aliyu and Bala [12].

### Conclusion

Results on the present study revealed that supplementation of brewer industry specifically with bagasse in 10% on a complete dry ration (90% forages), helps to improve light weight gain on landrace hampshire sheep [13].

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