

Torula yeast (*Candida utilis*) on distiller's vinasse in growing pig diets

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Twenty-four Yorkshire-Landrace x Yorkshire growing pigs, of 98 d of age and 25.5 kg of liveweight were used to evaluate the substitution of imported soybean meal by torula yeast (*Candida utilis*), produced at national scale on distiller's vinasse. The animals were allocated individually, according to completely randomized design. They were distributed into three treatments (0, 34 %, and 66 % of protein substitution), with eight repetitions each. There was not significant effect of the yeast level on the daily weight gain, the final liveweight and the feed conversion. The results suggested that up to 66 % of the protein from soybean can be substituted in this swine category. Studies are recommended to permit higher level of inclusion, as well as economic and environmental evaluations.

Key words: *yeasts, pigs, vinasse.*

The application of torula yeast, developed on final molasses, in the feeding of non-ruminant animals has been widely studied. It has been proved that it can substitute totally the traditional protein sources, not affecting the productive and reproductive indicators in pigs (Lezcano 1976, Mora 1979, Barrios *et al.* 1987, Lan *et al.* 1989, Mederos *et al.* 1989 and Figueroa and Ly 1990).

At present, there is great demand for final molasses, due to the fact that it can be used in animal feeding, alcohol production for the pharmaceutical industry, as well as for drinks and spirits. In Cuba, sugar production decreased in recent years, as a consequence from the low prices of sugar. Thus, it also decreased the production of yeast from molasses on final molasses. Its high production cost, due to the drying required by the fuel utilization, reached very high levels since the 80's. In this period, the ton of yeast was more expensive than that of soybean (Lezcano 2005).

Works developed by the Cuban Institute of Research on Sugarcane Derivatives (ICIDCA) permitted using the distiller's vinasse as substrate to obtain the torula yeast (Almazán *et al.* 1982). According to Saura *et al.* (2008), in a typical Cuban distillery, which produces 50 000 L of alcohol per day, around 25 t of yeast can be produced for the animal feeding, and from 50 to 60 % of the vinasse contamination can be reduced. In these conditions, it is necessary to assess this protein source of great economic and environmental value.

The objective of this study was to evaluate in growing pig performance the partial substitution of protein from the soybean meal by the torula yeast, grown on distiller's vinasse.

Materials and Methods

The torula yeast, elaborated on distiller's vinasse, was obtained from the yeast plant "Esteban Hernández", located in the Aguada municipality, in the Cienfuegos

province. The substrate came from a nearby distillery. From 57 to 60 t of vinasse were used to obtain one ton of yeast.

Treatment and design. A completely randomized design was applied, with three experimental treatments and eight repetitions each. The treatments were: A) control diet of soybean and corn, B) substitution of soybean protein by protein of the yeast from vinasse at 34 % and C) at 66 %.

Animals and housing. Twenty-four pigs were used at 8 per treatment. They were allocated individually, with initial weight of 25.5 kg and with 98 d of age. The animals were of a commercial Yorkshire, Landrace x Yorkshire crossbreeding. The distribution was of 50 % of barrows and 50 % of sows per treatment. Nipple drinkers and feeding troughs were used. The feed was provided in only one ration, at 8:30 a.m. The diets were formulated according to the recommendations of NRC (1998) for this category.

In order to know the chemical and amino acid composition of the yeast from vinasse, the criteria of Saura *et al.* (2008) were followed, and for the mineral composition, the indications of Rodríguez *et al.* (2011). The composition of the diets and the calculated supply of nutrients are shown in table 1.

Results and Discussion

There were not differences between the treatments for initial weight, final weight, daily weight gain, feed intake, feed conversion and viability (table 2), with acceptable values for the growth period under evaluation. These results agreed with those of Lezcano and Mora (2008) in production conditions, when substituting up to 75 % of the soybean protein by the yeast grown on vinasse. The liveweight gains and the feed conversion were higher, maybe due to the best housing and individual feeding conditions.

It has been proved that the yeast grown on final

Table 1. Composition of the diets, humid basis (%)

Ingredients	Substitution of the soybean protein by the yeast from vinasse %		
	0	34	66
Soybean meal	22.90	15.10	7.50
Torula yeast		8.40	16.50
Corn meal	74.03	73.07	73.20
Calcium carbonate	1.02	1.02	1.02
Dicalcium phosphate	0.08	0.08	0.08
Premixture of vitamins and minerals	0.03	0.03	0.03
Common salt	0.05	0.05	0.05
Total	100.00	100.00	100.00
Calculated bromatological composition			
Dry matter, %	88.75	89.01	89.26
Crude protein, %	15.60	15.85	16.09
Digestible energy, MJ/kg	13.91	13.84	13.88
Calcium, %	0.77	0.80	0.85
Phosphorus, %	0.58	0.60	0.69

Table 2. Productive performance of the pigs

Indicators	Substitution of the soybean protein by the yeast, %			SE±
	0	33	66	
Initial weight, kg	25.63	25.69	25.63	0.26
Final weight, kg	46.07	46.06	44.88	1.14
Weight gain, g/d	754.00	727.00	687.00	36.00
Intake, kg/pig/d	1.81	1.81	1.81	—
Feed-weight gain, kg/kg	2.44	2.49	2.63	0.11
Viability, %	100.00	100.00	100.00	—

molasses of sugarcane can be used as only source of protein in the diets of fattening pigs and sows (Mora 1979, Maylin *et al.* 1988, Lan *et al.* 1989 and Figueroa and Ly 1990). The results of this work suggest that 66 % of the protein supplied by the soybean can be substituted by the yeast grown on distiller's vinasse, in a diet using corn as energy source.

According to Piloto and Macías (2005), the *in vitro* digestibility of nitrogen from torula yeast grown on distiller's vinasse is inferior to that elaborated on final molasses. This may indicate that the substrates on which yeast are grown can affect the nutritional value of this protein source and, thus, the behavior of the pigs.

Saura *et al.* (2008) used the same yeast species with substrate variation, which is the most important variation factor (Vananuvat and Kinsella 1975). There were not differences for the lysine concentration between both yeasts, but in respect to that provided by the soybean meal, which was 40 % lower, as it is habitual in these protein sources, whereas the methionine plus cystine values are quite similar in both protein sources.

It is known that yeasts are rich in vitamins of the B complex, thus, the vitamin supply of the torula yeast

should be considered, by having characteristics similar to that of the final molasses from sugarcane.

According to the criteria of Rodríguez *et al.* (2011), all the minerals analyzed in the yeast sample were within the non-toxicity limits for the pig, when considering the concentration in the feed and its level of inclusion in the diet.

The production cost is another aspect that should be considered when working with this protein source, because when comparing its price with that of the soybean cake, it is more expensive by the drying and by the utilization of 4 to 4.5 t of final molasses per ton of dried yeast produced (Lezcano 2005). However, the distiller's vinasse diminished the cost of molasses, which is equivalent to 80 to 100 USD/t of dried yeast. This, together with higher industrial efficiency, would make it more competitive as to the price.

The decrease in environmental contamination is another of the advantages in the use of vinasse. According to Saura *et al.* (2008), in the production process of this yeast, there is direct removal of more than 60 % of the chemical demand of oxygen (CDO) which produces the distiller's wastes. Therefore, the environmental benefit

should be considered, mainly when alcohol production rise is expected.

It is concluded that in the conditions of this study it is possible to substitute 66 % of the protein from soybean by torula yeast grown on distiller's vinasse, with diets of corn as basic cereal. This subject should be further studied and higher inclusion levels should be assessed.

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