Use of mulberry foliage for pigs in the integrated tropical systems

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An intense work of research was carried out in different areas of the tropics between 1993 and 2003. The investigation was about the use of shrub-like and arboreous foliage of mulberry (Morus alba) as a source of protein for feeding pigs. The mulberry can be used in the tropic as a permanent crop integrated to systems of animal production, mainly of swines. According to the existing information about the use of mulberry foliage for feeding growing/fattening pigs, the conclusion was that between 20 and 25 % of the total ration could be constituted by mulberry foliage. The age of cut and the management of the planting fertilization are among the factors that can influence on the response of the herd. Further researches should be required but, over all things, the implementation of the available results for increasing the efficiency of the systems of swine production through the integration of the tree component as an essential subsystem because there are already enough data that benefit the use of mulberry foliage for feeding pigs.

Key words: pigs, mulberry, Morus alba, integrates systems, tropics

From ancient times, human beings have used trees for feeding animals. However, sometimes the shrub and arboreous foliage is thought to be an exclusive food for ruminants, like cows and lambs, or for herviborous like rabbits and horses (Sánchez 1999). This is not completely true and the clearest example is the silkworm, which eats mulberry leaves only. For instance, in China, the humans learned, many centuries ago, to go from collecting wild mulberry leaves to cultivate them, improve them and harvest them systematically, like any other plant of feeding purposes (Tingzing et al. 1988).

Development

Advantages and disadvantages of forage trees for feeding pigs. The use of trees as a source of forage enriched with protein is always a really good option for feeding pigs because these tropical trees are locally available and there is no need of planting them more than one time after each harvest, and several have a high yield of green biomass (Ly 2004). Which are the disadvantages? Leguminous trees like leucaena (Leucaena leucocephala) or guazuma (Guazuma ulmifolia) do not supply very digestible forages for pigs due to the presence of very active antinutritional factors (Carvajal 2010), or they are less palatable like tithonia (Tithonia diversifolia) or glicria (Glicridia sepium), which reduces considerably the acceptability and intake. Another disadvantage is that they can contain a lot of fiber, sometimes of difficult digestion for pigs, mainly when they are young. However, it is not a big problem for them, specially with mulbery, during the fattening stage (Ósorio 2003, González et al. 2004, Araque et al 2005, Tepper 2006, Contino et al. 2008 and Phiny 2012), or for the breeding sows, mainly the pregnant ones (Muñoz 2003 and Contino et al. 2006).

Trees for cultivation. The tropical trees with the best results in pigs feeding have been, until this moment, the non leguminous trees, like mulberry (Morus alba) and the trichantera or nacedero (Trichanthera gigantea) according to tests performed with animals, and the moringa (Moringa oleifera) according to laboratory tests. In the case of the mulberry foliage, its content of nutrients is between 15 and 25 % of crude protein (N x 6.25), and between 15 and 20 % of crude fiber, in a biomass that, in a humid base, can contain between 25 and 35 % of dry material. The nutrient content of mulberry foliage can vary according to different factors, like, mainly, the age of the cut and the level of fertilization. According to studies carried out in Cambodia, the most used mulberry foliage for feeding pigs was the one of periodic cuts, every 90 days, in plantations fertilized with effluents from digestors filled with pig excretions (Phiny et al. 2009). A second variant also researched was the association of non legume trees with other leguminous, with the objective of having, mainly, consumables of N addition to soil, provided by the legume trees (Khieu 2005). Table 1 shows some characteristics of the chemical composition of the type of mulberry foliage evaluated in Cambodia.

In the arboreous production for feeding pigs, the system used is the cut and transportation of green biomass. For the treatment of mulberry it is recommended to separate the leaves with their petioles and the tips of the branches, of the stems or the rachis. This strategy decreases the yield but elevates considerably the digestive usage. On the other hand, the stems could be used for feeding herviborous animals. This feeding strategy is supported by data from Pok et al. (2005), who demonstrated that the nutritional value of mulberry foliage was clearly superior when using young leaves, apicals, instead of basals, still in buds of 90 d (table 2).
Table 1. Some characteristics of the content of nutrients in mulberry foliage (dry base)

<table>
<thead>
<tr>
<th>Item</th>
<th>Range, %</th>
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<tbody>
<tr>
<td>Mineral matter</td>
<td>15-20</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>15-20</td>
</tr>
<tr>
<td>Crude protein</td>
<td>15-25</td>
</tr>
</tbody>
</table>

Ly (2005, unpublished data)

Animal response. It is always advisable to serve grinded foliage when it is a green fresh material. It is also possible to produce meal through the drying of biomass in the sun for two or three days during dry seasons. Besides, the silage technique can be used to freshly preserve great volumes of harvested biomass. The use of molasses at 50%, in the proportion of five partes per 95 of green foliage, can be a good recipe.

The Mexican researchers from Conkal and those from Aragua, Venezuela have possibly been who have evaluated more systematically the zootechniques of feeding pigs with mulberry foliage. Table 3 shows information about features of the behavior and the carcass of pigs fattened with variable levels of mulberry foliage meal.

Table 3. Features of the behavior and the carcass of fed pigs (20-90 kg) with variable levels of mulberry foliage meal

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Meal of mulberry foliage, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Intake, kg DM/day</td>
<td>1.89</td>
</tr>
<tr>
<td>Weight gain, kg/day</td>
<td>0.715</td>
</tr>
<tr>
<td>Conversion of DM, kg/kg</td>
<td>2.64</td>
</tr>
<tr>
<td>Carcass yield, %</td>
<td>77.66</td>
</tr>
<tr>
<td>Dorsal fat, mm</td>
<td>23.5</td>
</tr>
</tbody>
</table>

mulberry foliage offered ad libitum to pregnant sows.

Nutritional value. The studies of digestibility in pigs, from the first ones carried out in Cambodia (Ly et al. 2001 and Chiev Phiny et al. 2003) to the most recent performed in Cuba and in Cambodia (Caro and Ly 2012 and Phiny 2012), have demonstrated that the precaecal usage of nutrients, the N among them, is relatively high in the mulberry foliage, probably because of the low tenor of antinutritional factors. Young apical leaves of mulberry with branches of no more than 90 days, are very digestible for pigs (Pok Samkol et al. 2005).

Conclusions

Mulberry is a non legume that can be used in the tropical areas as a permanent crop integrated to systems of animal production, mainly of pigs. According to the existing information about the use of mulberry foliage for feeding growing/fattening pigs and pregnant sows, between 20 and 25 % of the ration can be constituted by mulberry foliage. The age of cut and the handling of plant fertilization are among the factors that can influence on the response of the pig herd.

Further studies are required, as well as the implementation of the results in order to increase the efficiency of the systems of pig production through the integration of the arboreal component, as an indispensable subsystem. Meanwhile, there are already enough data that benefit the use of mulberry foliage for feeding pigs.

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