

**FEEDING *MUCUNA* BEANS TO SMALL RUMINANTS OF  
MAYAN FARMERS IN THE YUCATAN PENINSULA, MEXICO**

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**SUMMARY**

*Mucuna* bean (*Mucuna pruriens*) (MB) has been proposed as a green manure and cover crop in smallholder agricultural systems in the southeastern Mexican state of Yucatan. Its increased adoption could also benefit smallholder farmers through provision of food or feed for their animals. In this on-farm, farmer-managed study, MB was offered as a supplement to small ruminants (sheep and goats) grazing secondary vegetation as their basal diet. The study took place in the homegardens of seven Mayan farmers in Hocaba and Sahcaba, Yucatan. Control diet included grazing secondary vegetation. To improve the adoption of MB by farmers, additional objectives included the solicitation of smallholder perspectives on the MB technology. MB generally improved animal performance in comparison to the control. Weight changes during the study period for growing lambs, kidding goats, double kids pre-suckling, and single kids pre-suckling were 63 (control) vs. 95 (with MB), -1.40 vs. -0.85, 86 vs. 130, and 110 vs. 214 g a<sup>-1</sup> d<sup>-1</sup>, respectively. For post-suckling kids and non-pregnant goats, no differences in live weight (LW) were observed between control and MB treatments. Farmers generally commented favorably on the MB supplementation, saying that it was useful, helped during dry season, increased animal weight and milk production, and animals consumed MB well. Most farmers found no disadvantages, but two farmers mentioned the same disadvantage: soaked MB tend to become infested with grubs, and animals do not consume them. All farmers said supplementation was easy and positive changes in animals were evident (such as decreased consumption of pasture, weight increase, and the possibility of feeding them in the corral). There were no major problems in integrating MB in these systems and farmers were able to solve small problems involved in its utilization.

**Key words:** *Mucuna* bean, feed-small ruminants, Mayan farmers, adoption.

**INTRODUCTION**

The ruminant performance in the tropics is affected by seasonal variation in the availability and quality of pastures (Whitman, 1980). In the state of Yucatan, Mexico, 74% of the ruminant production systems depend on rain-fed pastures (Segura, 1980). The dry season reduces the productive capacity of animals, affecting mainly the herds of small farmers. Supplementation of animals in these systems is constrained by the high price of imported supplements.

Crop production in the Yucatan region is based on the pre-Hispanic slash-and-burn system, *milpa*, where two-to-three year cultivation periods alternate with fallows, allowing for natural regeneration of soil fertility (Pérez-Toro, 1981). Of late, sisal (*Agave fourcroydes*) mono-crops and extensive cattle raising have brought higher pressure on land, resulting in decreased soil fertility, increased weeds pressure and reduced crop yields (Mariaca, 1992). Food availability, and particularly the availability of protein-rich foods, varies by season and between years. Visible effects of malnutrition are evident in the children in the Mayan communities who have high levels (63 %) of chronic malnourishment (Balam, 1996). A potential solution is increased production of animal protein by the region's farmers. Small ruminants are particularly promising due to their relatively low cost and ability to turn fibrous compounds into foods of high nutritional value.

A study assessing green manure/cover crops in southeastern Mexico concluded that, although MB has been promoted to the region's farmers for soil fertility improvement, broadening of its utilization beyond soil fertility management is needed (Arteaga *et al.*, 1997). In addition, in the recent decade, a number of practitioners and researchers have emphasized the need to include farmer criteria in the development and selection of innovations (Ashby, 1993; Gleifus, 1997). A pool of methodologies has been designed to develop technologies suitable to the biophysical, socio-

economic and cultural needs of farm households (Radulovich and Karremans, 1993; Blanco, 1997).

The objective of this research was to study the performance of goats and sheep with MB (*Mucuna spp.*) and to get feedback from the collaborating farmers on the potential of MB to improve the production of their small ruminants.

## METHODOLOGY

### Location

The feeding trials on goats and sheep were carried out in the homegardens of seven farmers in Hocaba and Sahcaba, Yucatan. These communities are part of the Hocaba municipality in Yucatan located at 20° 47' N and 89° 09' W, bordering to the south with the community of Sahcaba, to the north with Tahmek, to the east with Xocchel and to the west with Seye. The climate type, AW<sub>0</sub>, is characterized as warm and subhumid with summer rainfall. The annual average rainfall is 1021 mm and the annual average temperature is 26.6°C. The rainfall season is from May to October, and the dry season from November to April (Duch, 1988).

### Study process with the farmers

The promotion of velvet bean as green manure and cover crop in the communities of Sacaba and Hocaba started in 1993 by a research team from the FMVZ-UADY (PROTROPICO, 1997). The present study was conducted in collaboration with two farmer groups, "Ya'ax Col Cooperative Society" and "Ka'ax Taman" from the Hocaba municipality, who use velvet beans as a green manure but who also raise small ruminants.

During the research process, a number of participatory techniques were used, including focus group discussions, interviews, participant observation, brain storming, and a field trip to experimental station trials (Selener, 1997). Information received was simultaneously systematized using sheets and cards. The procedure consisted of the following steps:

- Creation of a handbook on the process to follow during the work.
- Presentation and explanation of objectives to the farmers' groups. The commitments of the researchers and farmers were agreed upon to avoid misunderstandings.

- Display of farmer answers in paper sheets to generate discussion on diverse points of view.
- Discussion and planning of future work: The discussions revealed inconsistencies in farmer experiences and it was established that the response of goats and sheep to MB feed was not known to the farmers. Consequently, the trials were planned together with the farmers but taking into account the previous results obtained under controlled conditions (Castillo-Caamal *et al.*, this volume).
- Initiation of feeding trials and a simultaneous study on the benefits and constraints of MB supplementation as a result of the discussion and planning.
- Interviews of farmers were conducted before the feeding trials were concluded.

### Selection of animals and design of trial

Based on meetings and visits to the farms of all interested farmers, the animals intended for the feeding trial were selected, taking into account their age, reproductive and physiological stage and physical characteristics. The flocks of seven farmers, four with goats and three with sheep, were included in the trial. The animals were separated into two groups, those supplemented with MB in addition to grazing secondary vegetation, and those that were only grazing secondary vegetation (Table 1). Prior to feeding, MB were ground with a feed mill with 9 mm sieve. For growing sheep and goats, 400 g a<sup>-1</sup> d<sup>-1</sup> were offered, while 500 g a<sup>-1</sup> d<sup>-1</sup> were offered to adult goats. The animals were housed in small corrals. Note that supplementation was given also on those days when animals were not taken out to graze.

The animals were given a 15-day adaptation period and they were weighed every two weeks during the 70-day trial period. The general management was performed by the participating farmers and included preparation of corrals to control MB consumption, MB grinding, feeding, management of grazing, and deparasitization with febendazol at the beginning of the trial. Monitoring of animal weights was carried out by students of veterinary medicine together with farmers. Animals were not fed for 14 h before every weighing. Regressions of time vs. weight were utilized to analyze the data.

Table 1. Characteristics of the animals included in the trial.

Farmer	Species	No.	Physiological Stage	Treatment	
				With MB	Without MB
Doña Feliciana	Goats	2	Kidding with single kiddies	1	1
Doña Arcadia	Goats	2	Kidding with double kiddies	1	1
Doña Ramona	Goats	2	Not pregnant	1	1
Don Ramon	Goats	6	Not pregnant (4) and growing kid post-suckling (2)	3	3
Don Lázaro	Sheep	4	Growing-male	2	2
Don Ismael	Sheep	4	Growing-male	2	2
Don Severiano	Sheep	4	Growing-male	2	2

## RESULTS

The trials were farmer-managed, which caused differences in the management of animals, including in grazing time, grazing sites, and timing of feeding. No significant differences were therefore detected. However, on average, animal performance with MB was good.

On average the growing lambs supplemented with MB had a daily weight gain of 95 grams as compared with the 63 grams for the sheep which fed only on secondary vegetation (Table 2). As the trial started during the dry season, the control group first experienced a slight weight loss. In contrast, the animals supplemented with MB maintained a continuous growth. The supplementation induced a better weight gain response than grazing alone, a finding similar to that obtained under controlled

conditions (Castillo *et al.*, this volume). Data on two animals were excluded due problems in farmer management. The weight of the kidding goats fluctuated during the trial, but at the end, their average weight was reduced as compared to their initial weight. This phenomenon is normal due to the high intake of milk by their kids. On average, the weight loss was more severe in animals depending exclusively on grazing (Table 2).

In contrast, the kids had a continuous growth, both with and without supplementation; however, those supplemented with MB had a higher average weight gain (Table 2). Goats with both double and single birth deliveries gained more weight when fed with MB than those depending exclusively on grazing (Table 2). Likewise, it was observed that the kids consumed the MB offered to their mothers, which added to their nutritional supply.

Table 2. Performance of sheep and goats with *Mucuna* bean (MB) supplementation in on-farm conditions in Sahcaba and Hocaba, Yucatan, Mexico.

Stage	No. of animals	With MB	Without MB	R <sup>2</sup>
<i>Kidding Goats</i>				
LW change (kg)	4	-0.85	-1.40	No estimate <sup>a</sup>
<i>Kids post-suckling</i>				
DWG (g a <sup>-1</sup> d <sup>-1</sup> )	2	100	100	0.79 <sup>b</sup> , 0.74 <sup>c</sup>
<i>Kids pre-suckling</i>				
DWG (g a <sup>-1</sup> d <sup>-1</sup> )				
Double	4	130	86	0.97 <sup>b</sup> , 0.99 <sup>c</sup>
Single	2	214	110	0.89 <sup>b</sup> , 0.65 <sup>c</sup>
<i>Growing lambs</i>				
DGW (g a <sup>-1</sup> d <sup>-1</sup> )	12	95	63	0.88 <sup>b</sup> , 0.80 <sup>c</sup>
<i>Non-pregnant goats</i>				
LW change (kg)	6	2	2	No estimate <sup>a</sup>

Note: a). No estimate because values through the period of trial had great variation. b) and c) correspond to R<sup>2</sup>, in animals with and without MB consumption, respectively. Values R<sup>2</sup> were obtained from regressions on time vs. weight gain.

There were no differences between treatments among the growing post-suckling goats and non-pregnant adult goats. This may indicate the need for supplementation only at certain physiological stages of the animals in this trial. In this trial, the best response was obtained on growing sheep and in lactating goats as evidenced by their own weight increases and the growth of their kids.

Additional work on the subject was conducted in controlled conditions which verified that commercial supplement can be entirely substituted with MB for growing sheep (Castillo-Caamal *et al.*, this volume), and that the response of goats supplemented with MB was comparable to the use of ramon foliage (*Brosimum alicastrum*), which is considered of high fodder value in Yucatan (Mendoza-Castillo *et al.*, this volume). Additionally, no negative behaviour was observed with free intake of MB by growing lambs (Castillo-Caamal *et al.*, this volume).

In the interviews with the seven participating farmers at the end of the trial, following issues emerged:

- Five farmers mentioned that they did not face any problems during the trials, but two considered that the researchers' visits should have been more frequent and they should have gotten more technical support of veterinarians.
- All the farmers considered that MB supplementation is useful, as the animals consume it well, it helps during dry season, and it increases animal weight and milk production.
- Five of the farmers found no disadvantage in using MB, but two mentioned the same disadvantage: soaked MB tend to become infested with grubs, and animals do not consume them.
- Three farmers thought that MB supplementation did not change the general management of the herd, two of them mentioned that there was a slight change but it did not affect the general management of the animals, and two farmers did not answer the question.
- All farmers agreed that inclusion of MB in the diet of the animals was not difficult.
- Two farmers did not observe any changes in their animals, while five of them pointed out such changes as decreased consumption, increased weight, and the possibility of feeding them in the corral.

- All farmers affirmed that they would continue supplementation with MB to decrease production costs and to improve the growth of their animals.

## CONCLUSIONS

In spite of the variations caused by the differences in management, the animal performance had favorable trends in on-farm conditions. This was affirmed by the results obtained under controlled conditions and reported in this volume (Ayala-Burgos *et al.*; Castillo-Caamal *et al.*; Mendoza-Castillo *et al.*). These results are promising. In Yucatan, the harvest of MB coincides with the beginning of the dry season, when availability and quality of fodder diminish, producing an increased demand for, and consequently prices of, supplementary feed. Therefore MB has potential to decrease some of the adverse effects of the dry season in these production systems. This work also helped understand the ways in which farmers start managing and integrating the MB into their system, which could help future dissemination efforts. The on-farm trials together with farmers allowed the researchers to understand some of the factors involved in the adoption of MB. Seemingly, there are no major problems in integrating *Mucuna* bean in these farming systems.

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