Integration of Livestock in the Sugarcane Industry in Cuba

Rena Perez

Dpto. Producciones Agropecuarias No-caneras, Calle 23 y O, Vedado
Ministerio del Azucar, La Habana, Cuba

Abstract

The Cuban sugarcane industry comprises a total of 1.8 million hectares dedicated to sugarcane for sucrose, produced in 156 sugarmills on the island. An additional 188 thousand hectares, is used to produce agricultural produce, milk, meat, poultry and eggs in order to help feed part of the half-million size workforce. For this, 94 thousand hectares are dedicated to food crops and animal feeds, while a similar amount of land is used for pastures and forests. The economic recession of the early nineties has stimulated the development of sustainable agricultural policies for producing livestock in the sugarcane-sector.

All of the sugarcane ground in the mills is produced in two types of cooperatives: 1) 1300 Basic Units of Cooperative Production (BUCP), newly-formed in 1993 from the previous state-run and sugarmill-administered cane plantations, and 2) 400 Agricultural Production Cooperatives (APC), originally formed by private landowners into a cooperative organisation 20 years ago. Presently, 80% of all sugarcane entering the mills is produced by the 1300 BUCPs and 20% by the APCs and other private owners. In addition to the production of livestock in the 1300 newly-formed cane cooperatives, approximately 200 state-run farms, administered directly by the sugarmills and other sugarcane service industries, such as transport, construction and maintenance, also maintain livestock. Presently, in both areas, the cane coops and state farms, new emphasis is being placed on the use of sugarcane and its derivatives, soybeans, forage trees and multinutritional blocks for feeding livestock.

In December 1995, there were 72 thousand pigs, 188 thousand sheep, 4 thousand goats, 16 thousand rabbits, 6 thousand ducks, 21 thousand horses and 122 thousand head of cattle, including oxen. That same year a total of 8.7 thousand tons liveweight was produced, in addition to 1.6 thousand tons of fish and 20 thousand tons of milk.

KEY WORDS: Livestock, sugarcane, integration, Cuba

Introduction

The Cuban sugar industry, until the economic recession of the early 1990's, produced during 6 months of each year, from December to May, approximately 10% of the world annual production of crude sugar. For this, 70 million tons of sugarcane, harvested from 1.8 million hectares, were processed in 156 sugar mills into approximately 8 million tons of crude sugar and 2 to 2.5 million tons of final molasses. The basic division of all agriculture on the island is "cane" and "non-cane" and, in 1983, the government encouraged the "cane" sector, which employs 450 thousand workers or 12% of the entire active workforce, to set up crop and animal production systems to help feed the workers, and eventually their families. Ever since the introduction of this crop in the island, food for cane workers was mostly imported. By 1985, reproductive and productive livestock herds had been organized in all 156 sugar mills and other major service industries, to include: swine, rabbits, poultry, sheep, goats and cows (Table 1).

Until 1990, in addition to 450 sugarmill farms that produced crops and livestock, the sugar industry produced for the "non-cane" sector a total of 4.5 million tons of animal feeds, in 11 different products and when mostly needed, during the 6-month-long dry season. These included: 500.000 MT of 3% molasses-urea; 200.000 MT molasses-urea-bagasse; 325.000 MT hydrolysed bagasse pith; 400.000 MT each of B molasses and protein molasses, mostly for pigs, and 80.000 MT of Torula yeast. However, by 1995, due to a drastic nation-wide economic cutback, reflected in the lack of urea and caustic soda for hydrolysing and processing bagasse, and problems in transporting such highly fibrous feedstuffs to the feedlots, the production of most animal feeds was curtailed.

Table 1. Integration of livestock in the Cuban sugar industry

	1985		1990		1995	
	reprod.	total	reprod.	total	reprod.	total
Swine	9365	63646	12387	108231	10994	72244
Sheep	38731	87015	105050	228294	86058	187562
Goats	1593	3552	1702	3879	1507	3667
Rabbits	-	-	10167	41628	4046	16473
Ducks	-	-	-	2961	3028	5900
Horses	4017	34587	3817	30332	5547	20713
Cattle	2059	23069	14990	56655	30533	122641*

* includes a total of 79 thousand oxen: 29,267 working pairs; 5879 pairs in full training and 6399 pairs beginning training (requirement: 33 thousand pairs)

Land Tenure, Livestock and Food Production

Land Tenure

Due also to the economic recession, land tenure was drastically affected and most of the previously state-run agricultural enterprises, including the sugarcane plantations, were reorganized into cooperatives, called Basic Production Cooperatives (BPC). Formerly, 82% of all land in agriculture, including sugarcane, had been managed by the state, however, after the readjustment, this figure had dropped to 33 percent. Moreover, while the average size of the state-run sugarcane plantations had been between 12 and 13 thousand hectares, the 1300 newly-formed coops were assigned, each, slightly more than one thousand hectares (ONE 1994). Presently, 80% of all sugarcane entering the mills is produced by the BPCs and 20% by Agricultural Production Cooperatives (APCs) and other private owners. Livestock production is now in the in the hands of the newly-formed cane coops and in approximately 200 remaining farms which are managed directly by the sugar mills and other service industries, such as transport, construction, maintenance and the research institutes (Tables 2 & 3).

Table 2. Food program* of the Cuban sugar industry

Crops	Amount		Animal products	Amount	
	g/d	kg/yr		g/d	kg/yr
Rice**	115	36	Meat (w bone)	145	30
Beans **	58	18	Fish (cleaned)	150	8
Tubercles ***	500	156	Eggs	2/wk	104/yr
Fresh vegetables	170	35	Fat	20	6
Fresh fruits	230	48	Milk	1/4 l.	78

* breakfast and/or lunch while at work; ** uncooked; *** unpeeled

Livestock and Food Production

Two factors, which occurred almost simultaneously, caused a revamping of conventional agricultural livestock policies, towards the promotion of alternative or sustainable agricultural policies in the sugar industry. The first was: in order to develop livestock in the newly-formed cane coops, the government decided that most of the animals belonging to the former state cane plantations should be handed over to the coops. The new coops had little other than cane, consequently, they were receptive to new ideas related to using cane for feeding their livestock.

The second factor was that, when the sugarcane plantations were broken up, besides the sugarmill farms losing all of their cane and most of their animals to the coops, they no longer had sufficient sugarcane for their remaining livestock, and had to replant. And that is what they are presently doing, planting sugarcane. These farms might have relied more on molasses to feed their animals, but the economic recession meant less fertilizer and insecticides, therefore much less cane, resulting finally in the need to restrict molasses for use mostly in multi-nutrient blocks.

Table 3. Food production in the Cuban sugar industry (1990-95)*

	1990	1991	1992	1993	1994	1995
Crops, 000 MT	129	145	156	119	142	166
Livestock, MT	6671	6421	6173	5697	5803	6518
Fish, MT	-	268	457	849	1127	1600
Milk, MT	9830	12394	14846	15054	17704	19494

* in addition, 450-500 t/yr. of cheese

At present, in order to reduce basic food importation and feed better the workers, the coops need to produce more livestock. For that, they must use more cane for their animals, more efficiently. They need additional cane grinders and choppers. The remaining 200 sugarmill farms, that have more access to machinery, are re-planting sugarcane specifically as animal feed. A reconsideration of conventional agricultural policies towards alternative or sustainable agriculture is definitely the order of the day (Perez and Rabago 1996) and new emphasis is being placed on the use of sugarcane, soybean forage, protein trees and multinutritional blocks for feeding livestock in a technological package arrangement referred to as a "sugarcane village" for 300 workers (Table 4).

Table 4. Livestock objectives in a "sugarcane village" for 300 workers

Concept	Amount per capita	Reproductive herd	No.animals/day
Milk	1/4 litre/d	20 cows & progeny	30
Eggs	2/week	300 laying hens	300
Poultry	1 per 3 mo.	start 350 every 3 mo.	350
Rabbits	1 per 3 mo.	50 does and 6 bucks	125-150
Mutton	1/4 carcass/yr.	150 ewes and 6 rams	375-400
Pork	1/3 carcass/yr.	20 sows and 2 boars	200
Fish	2 kg per 3 mo.	5000 fingerlings/ha-yr.	-

Towards a Sustainable Agriculture Policy for Livestock in the Sugar Industry

Since the current economic cutback, the number one problem related to livestock production in the sugar industry has been to provide animals a sufficient daily amount of energy and protein. Prior to the recession, the country imported annually, 1.9 million tons of cereals and protein supplements, and naturally some of these feeds eventually trickled down to livestock in the sugar industry. However, all that disappeared, feedstuff importations remain 30% of the pre-recessional period, and justly prioritized for livestock production in the "non-cane" sector of the country. Therefore, the new emphasis for feeding livestock in the sugar industry is with sugarcane, a crop that although it requires 16 months from planting to reach maturity, is a perennial crop that this country definitely knows, and, if "fractionated", could provide up to 80% of the daily energy needs of most livestock. As protein sources, the emphasis is now on soybean forage, sunflowers (mainly for oil) and protein trees. Multi-nutrient blocks (MNBs) are finally being promoted as a source of non-protein nitrogen for ruminants. The following is a brief description of the state of this program as it relates to a new chapter in the history of the Cuban sugar industry: livestock for half a million workers!

Sugarcane

The proposed "fractionation" of sugar cane for feed and fuel, first proposed in 1986 during an FAO Expert Consultation in the Dominican Republic (Preston 1988), has since then been promoted almost exclusively for animal production, where it has been shown that free-choice sugarcane juice and a restricted amount of a protein supplement can be used for pigs (Sarria *et al.*, 1990) and ducks (Men and Su 1992). However, in order for sugarcane to constitute an economically viable livestock production system, the cane tops, 15%, and the pressed cane stalks, 40% of air-dry weight, need also to be used for animal production. For that, the "sugarcane fractionation system" requires little other than protein forage and free-choice MNBs. In support of the "cane fractionation system", is the following recent and fascinating farm study done in Colombia (Molina *et al.*, 1995).

The farm study used as an example, an average amount of 28 kg of whole sugarcane, which was chopped and used solely as ruminant feed, or pressed to extract the juice for pigs before the stalks and tops were fed to a group of heifers. The pigs received a daily average of 0.5 kg of soybean meal and 10 kg of fresh cane juice. The heifers on the "leftover fibre diet", received a daily average of 12 kg of pressed stalks, 6 kg of cane tops, 9 kg of protein tree forage (*Gliricidia sepium*), 0.6 kg rice bran and 0.4 kg of poultry litter. They also consumed 0.7 kg of MNBs. The control (whole cane) diet, also fed to heifers, consisted of 28 kg of chopped, whole sugarcane, in addition to the same ingredients fed to the heifers on the experimental ration.

The same 28 kg of whole cane, "fractionated", produced a total of 1100 g liveweight gain, 500 g with cattle and 600 g with pigs, almost double the 765 g liveweight gain produced on the whole cane heifer ration. This general concept, or strategy, is gaining momentum within the livestock program of the Cuban sugar industry. What has added a certain momentum, or strength, to the overall program, is the fact that farmers can now produce their own "protein", in the form of soybean forage.

Soya Bean Forage

In 1989-90, the Cuban sugar industry initiated a program to plant soybeans in rotation with cane, 5 thousand hectares for seed. It was a failure, due to many reasons: an incorrect planting schedule, lack of inoculants, herbicides and insecticides, and insufficient combines for harvesting, but perhaps more importantly, a lack of basic, farmer-friendly, grass-roots soybean technology. Several months later, and perhaps in part because the soybean program had failed, in a sugarmill in the eastern part of the island, pigs fed diluted B molasses, were offered as a source of protein, fresh soybean plants (PEREZ 1995). They began to grow faster and it was decided to plant soybeans periodically adjacent to the pig barn for this purpose. The idea quickly took hold amongst the other sugar mills of the province and freshly-harvested soybean forage is now being used in more than 150 sugarmill farms and cane coops throughout the entire island for pigs, ducks, rabbits and chickens, and to a limited extent for ruminants,

particularly for milk production, until the protein trees are in production.

The technique consists in planting a 7-row plot of soybeans, weekly (Perez and Ochoa 1996). The length of the rows in the plots corresponds to the number of animals to be fed. The distance between rows is 35 cm, half the distance recommended for the production of soybeans for seed. The seeds should be inoculated and each plot requires weekly irrigation. After 8 or 9 plots have been sown, the first plot is ready for harvest. Harvesting must be carried out while the forage is still in the early milk-stage, otherwise, the anti-trypsin factor present in the formed seed, described as a defence mechanism against insects and birds, could affect non-ruminant performance. A recently-performed, in vitro, digestibility trial of nitrogen in the whole soybean plant was 67% (IIP 1995), which compares favourably to that of soybean meal of 75%, and to forages in general of between 35 and 40 percent. Perhaps, this is a clue to one of the reasons for its success.

Protein Trees

At last, trees are beginning to be recognized as "protein trees" and farmers in both the cane coops and the sugar mills are beginning to refer to them as protein banks. Until recently, these trees, mostly *Erythrina* and *Gliricidia*, were used only for fencing and cut back once yearly, in the early spring. As earlier stated, traditionally, cane farmers were never livestock farmers. Having to produce one's basic needs was, and still is, an entirely new concept, since up until 10 years ago, most food for the cane sector was imported. And because "protein" for animals has been something one normally had to "plant" in the soil, the idea that tree leaves can contain up to 25% protein and be used for cattle is new and difficult to grasp (Perez 1996).

The "non-cane" sector continues to promote the use of *Leucaena* in the form of a swath at 5-metre intervals in pastures, while the "cane" sector, in addition to *Trichantera gigantea*, is promoting *Gliricidia* planted in a double-row arrangement, 0.5 x 0.5m, with a one metre wide band between double rows to facilitate hand cutting (Molina 1993). At present, in more than 70 different sites, this is occurring. Finally, the information that a Vietnamese student, studying in Colombia, fed oxen,

in addition to their daily diet of bagasse, *Gliricidia* and MNBs, and got them to move more quickly (Thu *et al*., 1993), was widely disseminated here in a recent island-wide meeting on oxen in the sugar plantation. This information has begun to have wide-sweeping consequences on the use and propagation of protein trees and on the local manufacture of MNBs, and more importantly perhaps, for use in up to 80 thousand oxen in the coming 1996-97 cane harvest.

Multinutritional Blocks

Surely, because the cattle industry in Cuba used so much molasses/urea and other animal feeds, prepared in the sugar mills, MNBs were, for a long period, not promoted. The recession changed all that; in 1995, the production of cane-based, animal feeds was approximately 10% of that of previous years. One outstanding incident changed the outlook on MNBs. In January of 1993, in the middle of the dry season, and a drastic 70% cutback on the importation of animal feeds, a 200-head dairy reported 101 animals in anestrus. The diet had been reduced to dry-season pasture, supplemented by sugarcane, nothing else. Multi-nutrient blocks were provided. Three months later, still in the dry season, only 8 cows remained in anestrus and the manager of the dairy reported that the animals were consuming more cane.

At present, in about 60 cane coops and sugarmill farms, MNBs are being made by hand, while in the "non-cane" sector, the interest is to perfect machinery for their centralized preparation and distribution. Although the most common formula refers to the use of molasses, one interesting development, particularly in the sugar mills, has been to use limited molasses, up to 50 or 60% fresh filter-press mud, 10% each of urea, minerals and calcium oxide or hydroxide, and no additional fibre.

Perhaps, one of the more eloquent examples of, firstly, the effect of MNBs, and secondly, the effect of MNBs, together with more locally-available feedstuffs, is the information presented in Table 5, obtained over a period of 16 months from a small sugarmill-owned dairy herd of approximately 15 milking cows. At the end of June, 1995, the herd was first exposed to MNBs and, in November, 1995, besides the MNBs, to a mixture of pressed cane stalks, chopped cassava stems, king

grass and soybean forage. Milk production has practically doubled, and milking cows, expressed as a percentage of the total herd, has already increased from 57 to 70 percent.

Table 5. Average daily milk production during 16 months (litres/ day)

	J	F	M	A	M	J	J	A	S	O	N	D
1995	-	-	-	4.8	4.6	4.8	6.4	6.2	6.6	6.6	6.5	7.5
1996	7.5	7.9	8.1	8.3	8.1	8.4	8.9	-	-	-	-	-

Guideline to Livestock Feeding Systems

It is impossible to monitor 1300 cane coops and 200 sugarmill farms, all with crops and livestock, and accurately report the results of the recent introduction of alternative and/or more sustainable forms of agriculture. It will be a long process; perhaps, more precise information will be ready for FAO's Third Electronic Conference on Tropical Feeds! Meanwhile, the following is a brief guideline of the different production systems and diets being promoted according to the general livestock objectives set out in Table 4.

Pigs

The reproductive herd is managed at the coop or farm level. Each family receives two weaner pigs/year, one every 6 months, to be fattened mostly on table scraps and other local resources. The cane co-op, or the sugarmill farm, produces the weaners for the families and the pork, and lard, consumed in the collective dining area (Table 2). Energy sources can vary from fresh cassava, sweet potatoes, ripe bananas, cane juice or just plain ground cane, depending upon the time of year and/or available machinery. Protein sources are generally fish or fish silage, torula yeast, some saccharomyces yeast in cream form from the distilleries, but increasingly, whole plant soybean forage, about one metre freshly-cut forage per pig, per day.

Ducks
Surprisingly, ducks will eat the whole soybean plant and only leave the thicker part of the stem which then can be gathered and fed to pigs or sheep. Ducklings are started on one kilogram of dry feed, then switched over to soybean forage, one metre for every 5 ducks, the same amount for rabbits, approximately. As energy, the ducks are fed diluted molasses, cane juice or boiled tubercles.

Rabbits
They are kept in cages. Previously, macro-pellets (a type of MNB, without urea), made preferably with B molasses and a protein supplement, were widely used. However, the soybean forage feeding system is now overtaking the molasses blocks. In one farm, a trial was set up to compare: sweet potato vines, a mixture of sweet potato vines and soybean forage, or only soybean forage. It was impossible to obtain precise information for this report, however, the farm manager reported best results with soybean forage.

Chickens
Fresh cassava roots and soybean plants, ground finely together in a ratio of 50:50 are beginning to give promising results.

Sheep
The sheep are left to graze mostly in the cane fields to mid-morning, and return in the cool of the afternoon. At night, they are kept in paddocks near the other animals. The farmers are beginning to use MNBs, and as soon as conditions permit, meaning the acquisition of more and simple machinery to chop and crush the cane, and the production of sufficient protein tree forage, hope to keep the productive herd inside in the dry season and feed them a mixture of 80% cane or tops with 20% protein forage, and MNBs. Inbreeding has now been largely controlled by binding tightly the testicles with a piece of rubber tubing at 5 days of age, within several days, they drop off.

Cows

With the creation of the cane coops, and a general movement of workers and their families from a sugarmill-oriented to a coop-style life pattern, there has been an increasing need to produce milk locally. Most of the larger dairies have been broken up into mini-dairies of up to 20-30 cows; at the same time, the government has promoted the sale of both heifers and cows to the newly-formed cane coops. Wire fencing is imported, therefore mostly unavailable to the cane sector; this has meant that the traditional pasture system has been increasingly pressured to use a dry-lot system, particularly in the dry season. Moreover, the interesting work carried out in one sugarmill dairy (Table 5), the fact that cows can produce 9 l/day of milk without imported concentrates and with only locally-available feed resources, is now being replicated in other sugarmill dairies in the remaining 13 provinces. All this has stimulated new interest in MNBs, and in protein trees. In fact, one immediate problem in need of solution is: can *Gliricidia*, which basically does not produce viable seed in Cuba, be started by stake, year round?

Conclusion: Concerns and Problems

In Cuba, because food for the entire sugar industry was mostly always imported, cane farmers for 400 years have only been cane farmers, not cane and livestock farmers. The overall problems that affect a better integration of livestock in the sugar industry in the context of the current Cuban situation, recently affected by a drastic economic recession, are:

1. The fact that, as most Caribbean nations, Cuba imported "temperate belt animal genetics" and did not develop a national feed resource base consistent with the nutritional demands of this type of livestock;
2. The fact that, the entire university agricultural training program must be revamped: a) to produce graduates in sustainable farming systems, and b) to learn to effectively extend positive experimental results to grass-roots level; 3. the fact that, neither the island, nor the sugarcane industry on the island, produces the required quantity nor quality of seeds, nor inoculant, nor sufficient fingerings required to optimize and/or accelerate this unusual and interesting activity. For this, the cane sector must necessarily develop specialized farms at either the

provincial or sugarmill level for producing seeds and inoculant, and centres for producing fingerlings (cane sector has 4 000 ha of water); and 4. the fact that, there is insufficient simple machinery, such as, cane grinders and choppers, planters and harvesters, to face the immediate challenge of effectively and rapidly integrating livestock production in the 1300 newly-formed cane coops.

Finally, so as not to end on a pessimistic note, cane farmers, in 1995, received for the first time, a new Cuban sugar-industry-promoted magazine, "Canaveral", devoted to technical information for cane producers, including the production of livestock!

References

IIP (Instituto de Investigaciones Porcinas) 1995 Internal Report

Men B X and Su V V 1992 Sugar Cane Products in Diets of Ducks. Livest Rev Rur Dev 4(3):10-14

Molina C 1993 Granja "El Hatico". En Memorias Seminario Internacional: Estrategia de alimentacion en verano para ganaderias tropicales. Medellin Colombia Junio 2-4 1993

Molina C, CH, Molina D, CH, MolinaD, EJ and Molina D, JP 1995 Produccion de carne bovina y porcina con base en la utilizacion de la cana de azucar. Informe interna CIPAV Cali, Colombia

ONE (Oficina Nacional de Estadistica) 1994 Characteristicas de las UBPC (Informe interno) Ministerio Economia & Planificacion

Perez R 1995 La cana de azucar como base de un sistema alimenticio pecuario. Proceedings: II Encuentro Nacional de Agriculltura Organica 17-19 de mayo de 1995 La Habana Cuba p 77-84

Perez R 1996 Ventajas del pinon florido. Canaveral 2(2):38-41

Perez R and Rabago R 1996 El camino hacia una agricultura sostenible en las cooperativas caneras. Canaveral 2(1):40-46

Preston T R 1988 Fractionation of Sugarcane for Feed and Fuel. In: Sugarcane as feed. FAO Animal Production and Health Paper No 72 FAO Rome p 310-319

Sarria P, Solano A Y Preston TR 1990 Utilizacion de jugo de cana y cachaza panelera en la alimentacion de cerdos. Livest Rev Rur Dev 2(2):92-100

Thu N, Dong N, Hon N, Quac V 1993. Effect of molasses-urea cake on performance of growing and working local buffaloes and cattle. Livestock Research for Rural Development 5 (1):23-27