



## There is Beef in Sweetpotato

Dr. Irene M. Adion (veterinarian), Dr. Ma. Teresa S.J. Valdez (animal nutritionist), and Prof. Clarita J. Aguilar (socioeconomist) – project team for the UPWARD-DA-CLIARLD-TCA<sup>1</sup> Collaborative project on *Improving Local Feed System for Smallhold Beef Production Through Farmer Field School* – found that sweetpotato residues can be recycled into cattle feed, through a learning process that involved farmers right from the start. The article below describes how scientists and farmers worked together to show that ...

Three ladies and some cattle-raisers came together in Paniqui, Tarlac, Philippines – no, not for a barn dance – but to study opportunities for improving the local feed system for smallhold cattle production using a farmer field school (FFS) approach. A collaborative project between an all-women research team and a group of male farmers showed that: (1) the FFS approach can be adapted to facilitate learning towards an improved feed system for cattle; (2) the use of sweetpotato residues and other locally-available feed resources for cattle can have a positive impact on local livelihoods; and (3) a sweetpotato-based feed system can be an avenue for farm waste disposal.

### **The sweetpotato-cattle system**

During initial group discussions, researchers and farmers realized that the focus on sweetpotato-cattle system in Paniqui, Tarlac was not only logical; it was also practical. In the sweetpotato-growing regions of Central Luzon, Philippines, cattle is one of the permanent backyard commodities, with most farming households raising at least one head of cattle. These are usually raised on locally available feedstuff, particularly non-marketable sweetpotato roots, leaves and vines of sweetpotato – generally considered as farm residues. This feeding system is homegrown, so its suitability to both livelihood and production conditions is not an issue. Still, results of earlier participatory diagnosis revealed opportunities for optimizing benefits from traditional feeding practices.

Cattle raising farmers use an average of 500 kg of sweetpotato residues, equivalent to eight cartloads of sweetpotato vines or 199 kg sweetpotato chips, to raise one head of cattle over a period of two months. The team noted that feeding proportions may not meet the animals'

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nutrient requirements. We explained to them that we used a tool with the aid of a computer to predict how much gain in weight their individual cattle would have if they are given the ration specially formulated using the resources they have during the particular duration of the fattening trial. The new is new to them; it is the first time they hear of it, and it rings well! The farmers welcomed the prediction and took our assurance of a positive weight gain for their animals.

Now, how did three women researchers (i.e., a veterinarian, an animal nutritionist and a socio-economicist) convince the male-dominated farming-cum-cattle-raising clique to come to a farmer field school to study the problem and work with them to improve the system?

### **The class needed a lesson plan: the learning curriculum**

The idea of a farmer field school (FFS) was not entirely new to the team. In fact, other local success stories of FFS facilitating learning about complex concepts like integrated pest management encouraged the team to test it as a vehicle for studying and improving the local feed system for smallhold beef production in Paniqui, Tarlac. This is perhaps easier said than done. What should the farmers learn or what kind of learning process would be appropriate for a subject such as cattle feed?

Several institutions collaborated in the preparation of the learning curriculum for FFS on beef cattle feed system: the Offices of the Municipal Agriculturist and the Provincial Agriculturist, the Department of Agriculture's Regional Office for Central Luzon, Tarlac College of Agriculture, and CIP-UPWARD. But before any topic could be listed, problem/needs analysis and agroecosystem analysis had to be conducted to ensure relevance. Thus, the involvement of farming households was crucial in all phases of the curriculum design process.

The curriculum underwent three transformations after brainstorming sessions and a series of farmer consultations. A curriculum of 32 topics drafted earlier by the project team was whittled down to 22 topics which all of the prospective participants certified as relevant, acceptable, and appropriate (Table 1). With topics arranged according to the normal life stages of beef cattle, session discussions were focused on the utilization of sweetpotato as feed for beef cattle. Areas of concern that contribute to the general effectiveness and efficiency of sweetpotato-based rations such as health management, breeds, housing and general management were also included. During the conduct of the FFS, a session on *urea-molasses-mineral block (UMMB) making* was added as requested by the participants. In addition, all the information that led to the design of the curriculum was used by subject matter experts to prepare field and technical guides for FFS facilitators.

### **Piloting the farmer field school for sweetpotato-based cattle feed**

Twenty-four sweetpotato farmers who were raising at least one head of beef cattle participated. These farmers came from four villages: Patalan, Rang-ayan, Cayanga, and Barang. The institutions that helped develop the curriculum also threw in their support to the pilot FFS, along with the support of the local farmers' cooperatives (Table 2).

Feeding trials and forage gardens served as aids to learning, as participants learned skills for a successful beef cattle production. Each FFS participant performed a 70-day feeding trial using specific feed resources in the community. The intention here was for farmers to prove that fattening can be done in a short period, contrary to the popular belief that it takes at least a year. They were made to choose the feed resources to use, and applied the

animal management skills they learned from the on-going FFS. Farmers kept feeding records and monitored the weight of stocks by liveweight estimation using body measurements. Farmers used to think that 300 grams is the maximum ADG possible. The highest ADG obtained was 1.571 kg, while the mean of the ADGs was 1.05 kg. Valuation by traders on the fattened cattle were the highest that the farmers ever experienced.

**Table 1. The FFS Curriculum**

MODULE	TOPIC	TITLE
A.		<i>Introduction to Farmer Field School</i>
Session 1	A.1	Principles and Concepts of FFS
B.		<i>Beef and Sweetpotato Production as Economic Enterprises</i>
Session 2	B.1	Status and Prospects of Beef & Sweetpotato Production in the Philippines
	B.2	Technical, Socio-Economic, Environmental Constraints to Beef and Sweetpotato Production
C.		<i>Components of a Successful Beef Production System</i>
Session 3	C.1	The Stock: Breed and health condition
	C.2	Housing requirements
	C.3	Health program
	C.4	Nutritional requirements
	C.5	Waste management
	C.6	General administration
D.		<i>Development and Utilization of Sweetpotato-Based Feed System</i>
Session 4	D.1	Beef cattle as ruminant
	D.2	The role of forages and sweetpotato in ruminant ration
Session 5	D.3	Special session on fecalysis ( <i>Practicum</i> )
Session 6	D.4	Characteristics of forages and sweetpotato residues
Session 7	D.5	Availability and utilization of farm by-products and sweetpotato residues (fresh roots, dried chips, vines)
Session 8	D.6	Silage making and fermentation of sweetpotato residues
Session 9	D.7	Deworming / vitamin administration ( <i>Practicum</i> )
Session 10	D.8	Constraints in using sweetpotato residues
Session 11	D.9	Forage production & management practices (including sweetpotato) and pasture development
	D.10	Special session on forage gardening ( <i>Practicum</i> )
E.		<i>Health Management of Cattle Fed with Sweetpotato-Based Feed</i>
Session 12	E.1	Common diseases of beef cattle, their prevention & control
Session 13	E.2	Parasites and their control
	E.3	Drug administration
Session 14	E.4	Urea-molasses-mineral block (UMMB) making
F.		<i>Waste Management</i>
Session 15	F.1	Waste treatment and recycling technology, composting
Session 16	F.2	Biogas technology
G.		<i>Marketability of Sweetpotato-Based Fed Beef Cattle</i>
Session 17	G.1	Marketing of beef cattle - liveweight and dressed weight estimation, pricing, markets
	G.2	Carcass quality evaluation
Session 18	G.3	Tapa and Corned Beef Making
Session 19	G.4	Cost and return analysis of sweetpotato-based beef production
Session 20	G.5	Field day
	G.6	Operational Plan for sweetpotato-based beef production management

**Table 2. Institutional counterparts for the conduct of the FFS**

Institution	Counterpart	Quantity	Amount/Value (Php)*
1. CIP-UPWARD	Molasses	2 drums	3,000
	Feed	20 bags	10,000
	Animal Stock	1head	17,000
	Food	-	-
2. Department of Agriculture	Animal Stock	1 head	18,000
	Technical Assistance	-	-
	Facilities/Vehicles	-	-
3. Local Government Unit of Paniqui	Animal Stock	7 heads	150,000
	Technical Assistance	-	-
4. Barang PMP Cooperative	Animal Stock	6 heads	183, 650
	Food	-	5, 000
5. Patalan PMP Cooperative	Animal Stock	3 heads	45, 800
6. Cayanga PMP Cooperative	Animal Stock	3 heads	48, 500
7. Rang-ayan Farmers	Animal Stock	3 heads	29, 000
8. Office of the Provincial Veterinarian	Technical Assistance	-	-
	Biologicals	-	-
9. Tarlac College of Agriculture	Technical Assistance	-	-
	Facilities/Vehicles	-	-
	Forage Planting Stocks	-	-

\* Approximately, US\$1 = Philippine pesos (Php) 55

Aside from sweetpotato, a mixture of common weeds, native and improved species of grasses are part of the daily ration of cattle in the area. With pastures providing these cheap sources of feed, knowledge and skills in pasture management are also important in successful – and profitable – feedlot fattening. Opportunity to apply learning in pasture management was available through 108-m<sup>2</sup> forage gardens that each farmer maintained. Farmers also evaluated plant spacing and number of nodes on planting materials of forage species planted in the forage gardens.

Field trips enhanced learning through exposure to on-the-ground alternative cattle management practices. Also, when farmers also asked for copies of each of the topic contents, farmer's hand-outs were developed.

FFS sessions were held either weekly or bimonthly (Box 1) – depending on the nature of the topic – over a period of seven months. After field observations and data gathering, the facilitators encouraged group discussions among participants to bring up issues, concerns and clarifications.

#### Box 1. Cattle-FFS session time allocation

<i>Time</i>	<i>Activity</i>
8:30 – 9:00	Arrival/Registration
9:01 – 10:00	Field observation/Ocular observation/Data gathering
10:01 – 10:10	Coffee break
10:11 – 10:30	Group interaction
10:31 – 12:00	Pre-test/Session 1/Group dynamics/Post-test
12:01 – 1:00	Lunch break
1:01 – 2:30	Pre-test/Session 2/ Group dynamics/ Post test
2:31 – 3:00	Wrap-up/ Process evaluation
3:01 – 3:30	Tasking/ Planning for the next meeting

## Indicators of effectiveness

M&E results indicated effectiveness of the pilot FFS. First, there was sustained interest and participation by FFS participants. Seventy-six percent (76%) of the FFS cooperators attended at least 15 of the 28 sessions. Interestingly, the trend in attendance was increasing as the FFS progressed to its concluding session (Figure 1).

Second, improvement in participants' knowledge on sweetpotato-based cattle feed system was noted. In the pre-test, only 54% got passing scores (50% or better). This increased to 77% in the post-test. Perhaps more importantly, the FFS cooperators have begun to practice 12 of the 19 skills introduced during the FFS. These skills include stock judging, housing, deworming, liveweight and dressed weight estimation, forage identification, forage gardening, sweetpotato chipping, silage making, record keeping, cost and return analysis, and action planning.

Third, the FFS earned active support of the different collaborating institutions and farmers from the preparation to the conduct of the FFS. Veterinary services were made available to the participants at least twice a month, technical assistance was provided weekly, while assistance to avail of credit and marketing were provided when necessary. The farmers' cooperatives regained the trust of the municipal mayor, such that the municipal government once again extended financial assistance to their cattle fattening projects.

Fourth, the rapport established between researchers, farmers and collaborating organizations built trust that laid the foundation for transparency. This is a particularly crucial issue since experimenting with cattle is viewed as a high-risk adventure. Technical assistance was provided in terms of selecting the right combination of feed materials to be used and the optimum amount of each feed material to be given on a daily basis. This was made possible by the use of LIFE-SIM 2003<sup>2</sup>, a simulation model that help researchers predict responses to changes in livestock feed strategies.

Finally, the field school curriculum was developed with farmers, ensuring that topics address knowledge gaps that they, themselves, have identified. The intervention itself – sweetpotato as cattle feed – built on local resources (Box 2) and the livelihood system. This goes to show that farmers' participation and building on what they have are critical factors in developing the learning content of FFS.

### Box 2. Sweetpotato residue as feed

Sweetpotato residue is a collective term for vines and non-marketable roots. The nutrient content varies with the type of residue and in some instances, processing methods employed. Sweetpotato vines have better feeding values as compared to rice straw and corn stover that have low feeding values.

Availability of sweetpotato as fodder in Central Luzon (BAS, 1998 as cited by PCARRD 2001)

- non-marketable tubers: 1.8-5.8 tons/ha
- tops: 13.0 – 31.2 tons/ha
- vines: 14.09 tons, at 2 tons DM/ha

The energy production of sweetpotato (152 MJ/ha/day) is almost similar with corn (159 MJ/ha/day) while dry matter production was estimated to be higher for sweetpotato than with corn. Wherever sweetpotato is produced in developing countries, it is almost always used in some form as animal feed. FAO estimated that 40% of the total output in the largest sweetpotato producing countries is devoted to this purpose.

<sup>2</sup> See report on workshop attended by Dr. Maria Teresa S.J. Valdez, to train on the application of the LIFE-SIM 2003 simulation model in CIP Annual Report 2003. The models are also freely available and can be downloaded from the CIP website [www.cipotato.org](http://www.cipotato.org).

## **What's in store? – implications for further work**

Recycling farm waste. The local feed system also provides an alternative for managing farm wastes or crop residues, which, if left unused, would only serve as pollutants. It efficiently converts weeds and crop residues into high value and nutritious meat product - beef. An average of 13.22 kg sweetpotato vines were fed to the cattle daily. For fresh sweetpotato roots, the average use as feed per day was 8.33 kg. Five farmers used dried sweetpotato chips at an average of 3.52 kg/day. Rice straw was scarcely utilized, while majority used cattle fattening concentrate and molasses. These various combinations of feed resources were made possible through a simulation model for designing feeding strategies (Box 3), taking into consideration the variability of local feeding practices and feed resources.

Livelihood. The pilot FFS demonstrated how introduced feeding practices could increase household income - from beef cattle fattening as well as from the efficient use of farm resources, including family labor and farm residues. The improved feed system increased net profits from cattle fattening (which was considered a secondary source of income) from ₱1,113 per fattening cycle of 12 months to as much as ₱4,000.00 per cycle. This is over and above the added value of ₱500.00 per fattening cycle – the value of the sweetpotato residues which would have gone to waste if they had not been fed to the cattle. These sweetpotato residues consist of very small, tubers that traders refuse to buy, and those with mechanical injury or pest infestation. Under the traditional feeding practice, when costs of family labor, sweetpotato vines and roots from the farm, and vaccination and vitamins provided free by agencies involved are included in the cost-benefit calculations, farmers could stand to lose up to ₱1,172 per fattening cycle. This calls attention to the need to control for quality in the practice of the different component technologies to enable farmers to maximize the potential benefits. Indeed, the bottomline of all these efforts is the farmers' bottom line – profits.

Scaling up the FFS. The FFS did not only get the attention of the farmer cooperators or of the cattle traders. Because of its potential contribution to livelihood improvement, local government units have expressed interest to support. At the municipal level, the mayor has expressed renewed interest in supporting livestock dispersal efforts, which has

A strength also of the SP for cattle feed FFS is that results of interventions are easily determined and seen because effects in terms of animal growth are immediately observed, so farmers' responses are also immediate. Then, conversely, when results are not positive, it can also be very challenging for the facilitating team.

As mentioned earlier, the success of a FFS-type activity draws on several factors: broad-based institutional support, stakeholder participation in needs and situation analysis towards a curriculum design, and rapport between and among the researchers/FFS facilitators, farmer-participants and other collaborating organizations. These also led project participants to a clear identification of challenges that need to be met to move things forward. These include:

1. Sharing lessons with more farmers;
2. Post-FFS support to farmer graduates and local extension staff;
3. Enlisting support for more FFS activities on sweetpotato as cattle feed; and
4. Capacity development for facilitators of similar livestock-based FFS activities.

According to Julian Gonsalves, UPWARD Senior Adviser, achievements in the livestock area for rural livelihoods could have significant bearing on the ultimate goal of addressing poverty. In recent years, there is a general upward trend in per capita consumption of beef, which is the most expensive source of protein in the Philippines. This was attributed in part

to the emergence of cattle feedlot operations that is more profitable than breeding and ranching due to the lower production cycles. Backyard farms now account for an average of 91% of the total national cattle population (Bureau of Agricultural Statistics, 2003). ■■■

**Box 3. Notes on the application of the SLP LIFE-SIM 2003 Beef Simulation Model to design feeding strategies for the FFS on cattle fattening in Paniqui, Tarlac, Philippines.**

When we offered 24 cattle feeding options to farmers to experiment on, we had to explain that we used a tool with the aid of a computer to predict how much weight their cattle will gain if they are given the ration specially formulated for their individual animal. This is the first time they hear of it, and it rings well! The farmers welcomed the prediction and took our assurance of a positive weight gain for their animals.

**Findings on the local feed system used as basis in designing feeding strategies:**

- The feed resources in the Beef Cattle FFS sites are quite variable.
- Barang village: rice straw and mixed weeds and grasses
- Rang-ayan village: corn stover and sugarcane tops
- Patalan and Cayanga: sugarcane tops and weeds
- One farmer uses Napier grass (*Pennisetum purpureum*), which he maintains around his fishpond.
- Sweetpotato (roots and vines) and yambean (tubers) are abundant cattle feed during the summer
- Common grasses are scarce in the summer
- Sweetpotato vines and roots and yambean are fed to cattle because they are abundantly available and will if not utilized as feed
- Local feeding system does not meet the animal's nutritional requirement
- Farmers believe that weeds and common grasses can meet the animals' nutrient requirements better.

**Design considerations:**

- resources farmer have during the duration of the fattening trial
- local feeding practice
- published feeding value of feed resources
- cattle body weight

**Steps:**

1. For each animal, formulate a nutritionally-balanced feeding ration.
2. Input formulation into the model and simulate for predicted outcomes.
3. Choose those that predict positive weight gains.

**Output:** 24 scenarios offered to farmers for experimentation

**Notes:**

1. The simulation tool helped design feeding options that will yield acceptable results to farmers. In the process, it helped in convincing farmers about the possibility of fattening cattle in 70 days.
2. For a researcher, the tool is very helpful and easy to use in making feed formulation adjustments.
3. The model generally gave lower predicted values for weight gain than expected.
4. In future FFS projects, the model will be very useful. However, there is a need to do sample collection and nutrient analysis for some of the feed resources to reduce dependence on published values which may not be applicable sometimes.
5. The model really works very well for controlled conditions. Hopefully the model can integrate some of the "farmer factor" – a farmer's specific management style.

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**References**

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