FARMER FIELD SCHOOL

ON SWEETPOTATO-BASED

CATTLE FATTENING

Technical and Field Guides

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Table of contents

Field guides

Overview

Background/justification

Beef cattle fattening in Tarlac province, Central Luzon region of the Philippines, serves as a security measure for farmers who invest on rice production during wet season despite the uncertainty of good harvest. Beef cattle fattening is closely linked with rice and sweetpotato (SP) farming being able to convert residues and by-products into cash. However, farmers have fattened their cattle traditionally by tethering where nutritionally insufficient grasses are available and with no supplements. Because of this, cattle are being fattened for extended periods up to two years before selling them. Aside from their existing production practices, farmers have expressed that they also have a problem in marketing their animals for the prices are dictated by the buyers or "*viajeros*" coming to their areas.

To address their concerns and issues, a season-long training employing participatory approach was piloted in 2004. Sweetpotato-fattening cattle FFS was conducted in Paniqui, Tarlac, with 24 farmer-participants. Outcomes of this FFS included the development of a curriculum and the technical and field guides used in implementing the FFS. Hand-outs for participants were also developed and provided to the participants. Improved management system through the FFS increased the average daily gain of fattened cattle by 100%, thus shortening their fattening period to four months and their cattle called for better prices.

Another FFS was implemented in 2005 due to farmers' requests and local leaders who have learned about the improvement in cattle fattening from previous farmer-participants. Twenty-eight farmer-participants came from 7 villages of Paniqui and 23 from two villages of Moncada, totaling 51 participants. This was also done to validate earlier findings and further refine the curriculum and learning tools. Methods used were redefined and improved to suit participants' needs. Project team tasking was adjusted to fit participants' availability. Schedules of topic presentation were rearranged according to farm situations. Participatory methods used in the facilitation of the learning process proved very useful to attain project goals.

Purpose/objectives of the publication

This manual is meant to serve as guide in the conduct of the sweetpotato-based cattle fattening FFS. The facilitating team and farmer-participants discussed and finalized the topics involved in the

two FFS curricula. The topics covered by the manual were selected from the two curricula.

The technical guide is designed to serve as technical background for facilititators and resource persons assigned for a specific topic. The field guide is to be used during the conduct of the sessions of FFS. It includes objectives of the session, materials needed, steps and guide questions. Details should include the facilitating team.

Target readers and uses

1. Local government staff involved in the conduct of the livestock-based FFS.
2. Resource persons who need reference materials for implementation of the courses.
3. Participatory research and development professionals expanding their work on improving livestock production through enhanced participation of local people and other stakeholders.

Outline of the publication development process/steps

1. Identification of topics to be included from the curricula developed from the two SP-cattle FFS.
2. Gathering of necessary pictures and illustrations for the guides.
3. Initial editing of draft technical and field guides authored by resource persons and used during the conduct of the two FFS.
4. Lay-outing of manual.
5. Submission of first lay-out to UPWARD, Drs. Irene Adion and Tess Valdez for review and comments.
6. Revision, lay-outing, cover designing and initial printing of manuals.
7. Final revisions and printing.
8. Distribution of manuals to list of recipients and key partners.

Core team

- Irene M. Adion, Department of Agriculture – Regional Field Unit III (DA-RFU III)
- Maria Teresa SJ. Valdez, Tarlac College of Agriculture (TCA)
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Introduction to farmer field school on beef cattle production

Clarita J. Aguilar

Introduction

Beef cattle fattening production is a good source of livelihood among farmers in the countryside. Farmers can derive substantial income from cattle fattening as well as maximize the use of farm resources given adequate capital to purchase stocks, ample knowledge in selecting stocks for fattening, and efficient feeding management using local and available resources.

Moreover, the existence of meat outlets and livestock markets offering attractive prices and good marketing arrangements makes it attractive for farmers to invest in cattle fattening. Livestock raisers can maximize benefits from cattle production provided they are equipped with information and know-how on the use of available resources to minimize production costs.

So what can farmers do? How can farmers/livestock raisers develop knowledge and skills to improve and develop capacities on cattle fattening enterprise? In this exercise, the farmers will analyze the relative importance of beef cattle fattening and its constraints within a given agronomic condition. Feeding options using locally available resources, especially that of sweetpotato either as basal or supplement in the ration will be integrated in this season-long learning activity - the farmer field school (FFS).

What is farmer field school?

Farmer field school is a training or learning process of experienced farmers (adult learning). In FFS, adults learn best through hands-on experience especially when the subject matter is related to their experience. It allows them to explore and discover new ideas for themselves. It is believed that learning in this way could be best internalized by the adult learner.

What is the focus of FFS in cattle fattening?

The focus of FFS on cattle fattening are health and feeding technologies and the economics of cattle enterprise. This season-long learning activity will equip the cattle growers with information and skills related to beef cattle production. Appreciation of cattle fattening for a short period could

be experienced, thereby generating and maximizing benefits over a shorter period.

What are the activities for the FFS cattle fattening?

The activities in FFS cattle fattening include the following:

- Animal observation
- Charting the development (in terms of weight gain) of animal stock
- Agro-ecosystem analysis
- Presentation of results and analysis
- Economic analysis
- Group dynamics exercise

What are the preparations for FFS cattle fattening?

Preliminary meetings – introduction of FFS concept, discussion what the project is all about, what is its purpose and who should be involved

a. Preparation meeting - courtesy call to local leaders
b. Preparation of base map – understanding local conditions
c. Mapping of the locality – discussing problems, their causes, and perceived solutions
d. Division of labor – roles and responsibilities (counterparts)
e. Learning content or plan for the field school – agreement on the content of the curriculum based on identified problems
    - Selection of participants
    - Preparation of manpower and material requirement for the FFS
    - Conduct of pretest and post test
    - Assignment to work groups
    - Experimentation with the animal stock through feeding options
    - Evaluation of results – economics
    - Evaluation of process
    - Evaluation of impact

What differs FFS from other training activities?

a. FFS is intended for the participants to be the main actors in the experimentation, observations, and other activities, thereby, see the immediate results of what they are doing.

b. FFS is a season-long learning experience, thereby, requiring farmers' commitment to participate from a period of six months or more.
c. FFS is participatory, drawing information from participants first, before injecting relevant information on what they do not know yet by allowing them to perform the actual activities, thereby, see the results at once and be able to get answers to their queries.
d. FFS is facilitative in nature, not a lecture type learning activity.
e. FFS does not confine participants from learning inside the four walls of a classroom but rather allows them to learn outside it.

Status and prospects of beef cattle and sweetpotato production in the Philippines

Irene M. Adion

Introduction

The Philippine beef cattle industry is predominantly of the smallhold or backyard type and traditionally led by the private sector. Commercial feedlot fattening operation emerged and proliferated on account of the increasing demand for beef and beef products. Three things that accounted for this great demand are the ever-increasing human population, changing eating habits of the Filipinos, and import liberalization. The supply of beef comes from the commercial ranches, the smallholder cattle raisers and feedlot operators.

The number of commercial ranches engaged in cattle production is steadily decreasing. This is largely due to a combination of factors such as weak peace and order situation in production areas, implementation of comprehensive agrarian reform law, land use conversion, lack of domestic source of quality stock, changing policies on pasture lease, increasing input costs, poor herd and pasture management among others. Given this environment, the country's cow-calf operation declined both in number and production performance. This has resulted in the lack of good quality stock for fattening.

Cattle fattening is heavily dependent on the importation of feeder stocks coming mostly from Australia. From 1990-1999, feeder cattle importation totaled to 1,290,633 heads as against breeder cattle importation of only 54,560 heads.

Nevertheless, current trends in the livestock industry show that the beef cattle sector has the biggest room for growth. The volume of production has been increasing from 232.34 thousand tons in 1996 to 271.24 thousand tons in 1999. The total output in 1999 was valued at PhP 5.3 billion.

Beef cattle production

Population inventory

From 1990 to 1995, the cattle population grew by 4.5% annually

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Components of a successful beef cattle production system

Maria Teresa SJ. Valdez

Introduction

Beef cattle are an important link in the food chain converting roughage and farm by-products into highly digestible protein, energy, minerals, and vitamins.

Cattle fattening has gained prominence as an important business project of the livestock industry in the Philippines. It gives the farmer year-round work and provides him with extra income. He can lower his input costs by making use of cheap and plentiful farm by-products such as corn stovers, rice straw, sugarcane tops, sweetpotato vines and leaves which ordinarily go to waste. Most importantly, cattle fattening lasts only six months providing a fast turnover of capital.

What is feedlot fattening?

Feedlot fattening involves the provision of an artificial environment wherein cattle are placed in a confined area to consume a predetermined diet. Profit comes from the growth of the animals, efficiency of liveweight gain, and improved carcass value relative to the cost of feed and other inputs.

Feedlot siting and planning

A good location for a feedlot is a well-drained area. Feedlot must be as dry as possible. Water running into the feedlot from outside should be minimal and if necessary, provision for removal of manure build-up or wet areas within the yard should be considered.

As a guideline for floor space or stocking rate, an average of 5 sq. m./head is considered satisfactory. Feeding space should be 0.75 m per animal.

Purchase feeder stock from reliable breeders or select good quality stock from the livestock market. To ensure profit and produce good quality meat, the following points should be considered:

Age. Young animals (up to 3 years old) need less feed for every unit of weight gain because they digest feed more efficiently and consume

more feed in proportion to body weight. Further, young animals cost less because of lower weight, but they require longer period of feeding and higher feed quality to reach the desired finish. Older feeder stock (4 years and above) require shorter period in the feedlot and will eat a wider variety of feed and roughage than young stock. If nutritious feed is abundant and cheap, younger cattle are generally more economical to fatten. If coarse roughage and plant by-products are available, older stocks are preferable. Likewise, the available capital will determine the age of animal for fattening since older and heavier cattle cost more than young cattle.

Sex. Steers or castrated males are preferred over heifers because they are readily available and easier to manage. Steers also grow faster than heifers. Although bulls grow faster than steers, their carcass quality is lower than steers and heifers.

Breed. Improved breeds and crossbreeds gain weight faster than native animals. Tropical breeds are more adaptable to local climatic conditions and feed quality than temperate breeds. Generally, feeder stock with blood of any improved tropical breeds is preferred. Also, grades or those born of native cows and purebred bulls perform well in the feedlot. Some of the recommended tropical breeds are:

1. Brahman – silver gray or red. This breed is resistant to diseases and can withstand heat better.
2. Ongole or Nellore – white. The bulls may have dark gray head, neck and hump. Knees may be black.
3. Indu-Brazil – light to silver gray and brownish dark gray to red.
4. Batangas cattle – this is not really a distinct breed of cattle in the Philippines, but rather are generally grades coming from Mindoro, Masbate and other provinces. The term 'Batangas beef' has become popular because of the good quality cattle produced by the "*supak*" or force feeding method of Batangas province.

Disposition. An active yet mild, quiet, and easily handled cattle usually grows faster and fatten well. Restless, nervous, and erratic cattle waste too much energy when they panic even at the slightest provocation.

Constitution and vigor. These are determined by the size and quality of the vital organs. A large feeding capacity, strong appetite, a large heart girth, well-sprung ribs, a wide depth, and full chest show good constitution and vigor.

Cattle nutrition

Feed is key to profitable cattle raising. Cattle need nutrients for maintenance, growth and production. The animal raiser must formulate feeds based on his animal's sex, age, desired weight gain, and moisture content of available feeds.

The ration should be adjusted to the requirements for fattening cattle based on the availability of feed materials in the locality. Cattle can be fattened on all roughage or on roughage-concentrate diet. Give good quality grass-legume mixture in the form of pasture herbage. It is best to restrict animal movement at all times, so that it uses less energy and gains weight quickly.

The moisture content of feed is important. There is a maximum dry matter intake if the ration has only about 34% moisture content. Cattle become fatter during summer by eating dry grass than during the rainy season when the animals are allowed to eat large amounts of young fresh grasses. Cattle consume feed at a rate of up to 3% of its body weight depending on the age of the animal. The animals need the following nutrients:

a. Dry matter that satisfies the animal's appetite and promotes good digestion;
b. Protein in amounts based on age, sex, body weight and desired productivity;
c. Energy from carbohydrates, fats and excess protein;
d. Essential minerals such as salt, calcium and phosphorus. Salt intake increases the water intake of the animals. The daily intake should be 0.045 kg per 45 kg body weight;
e. Vitamins, A, D, and E; and
f. Water which is the most important nutrient. Intake of water by cattle depends on the temperature, humidity, moisture content of the roughage, dry or wet feeding, and salt content of the diet.

Disease prevention

1. Never buy sick cattle. Make sure the animals are not stressed. Good sanitation should also be provided.
2. Proper nutrition helps ensure the health of cattle and increase their resistance to diseases. Salt in the diet helps prevent foot rot.
3. Do not mix newly arrived animals with cattle already on feed. New arrivals should receive good quality roughage as a starter ration and then given water 3-4 hours later.

4. Bathe the animals at least once a week to clean them and to improve their feed intake.
5. Be alert for signs of illnesses. Once identified, isolate sick animals right away.
6. Spray the animals with insecticide to eliminate parasites like ticks and blood sucking fleas.
7. In coordination with the Bureau of Animal Industry (BAI) or the Office of the Provincial Veterinarian, vaccinate against *Hemorrhagic septicemia* and other common diseases.
8. Conduct fecal examination to determine proper drugs for deworming.

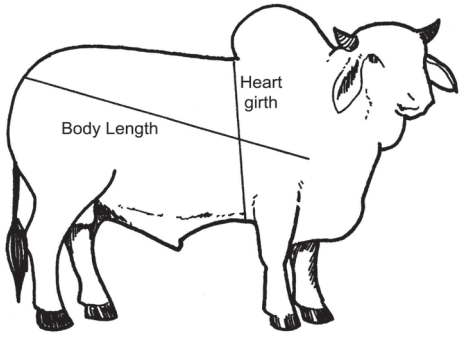
Waste management

The positive environmental impacts of backyard cattle fattening relate to the production of valuable solid cattle wastes which will serve as organic manure for cropland fertilization. Cattle consume large quantities of previously unused crop by-products in the form of straw and corn stover, which are otherwise burned on the fields, creating substantial air pollution.

The potentially negative impacts on the environment relate to liquid cattle wastes run-offs from feedlots if left untreated or uncollected. These wastes may enter and contaminate groundwater tables. Safety measures should be taken to ensure that feedlots incorporate cemented floors with runoffs into collection basins. Cattle should be housed in sheds and feedlots of accepted designs to prevent waste runoff.

Livestock on feedlot are frequently kept on concrete floors, dry areas, or unpaved area. The large volume of wastes can cause soil, water and air pollution if not properly managed. Pollution is caused by emission of gases from manure in the form of ammonia and excretion of phosphorus and other elements. Emissions come from manure in the stables during storage, after application on soils or when manure is simply disposed of. Losses depend on the housing system and manure management. Generally, in ruminant feedlot meat production systems, the manure is left to dry in the yard and urine is not collected. This results in losses of nitrogen through evaporation and leakage. The following matrix indicates the most common environmental risks associated with cattle feedlotting:

marketing or buying animal. In the absence of a weighing scale, the liveweight of cattle can be estimated by correlating the body weight to its heart girth and body length. The heart girth is the circumference of the body which passes over the withers and just behind the elbows. The tape measure is wrapped around the heart girth just tight enough to lay the hair down. The body length is measured from the point of shoulder to the pin bone. The tape measure should follow the contour of the body during measurement of the body length. With this information, the approximate weight of an animal can be determined using the equation recommended by PCARRD, below:



$$\text{Approximate LW} = \frac{(\text{HG})^2 \times \text{BL}}{10{,}840}$$

where: LW = liveweight, kg
BL = body length, cm
HG = heart girth, cm

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Beef cattle as ruminant

Maria Teresa SJ. Valdez

Introduction

Ruminants such as the carabao, cattle, sheep and goats possess peculiar stomach arrangements and anatomical features that make the digestive processes of their feed radically different from those of the horse or swine. The unique digestive processes of ruminants enable them to utilize coarse roughage such as hay, stovers, husks, cobs, hulls, stalks, pulp, and other fibrous by-products.

Beef cattle as a ruminant

A ruminant animal is any even-toed, hoofed mammal that is a cud-chewing quadruped. Ruminant animals include the domestic cattle. They have a compound stomach with four compartments which allows them to utilize fibrous feeds like grasses and hay which humans cannot. They are able to digest and convert these unusable grasses and other products as source of nutrients. They swallow feed in large pieces into the first stomach compartment, bring the food back into the mouth and chew it again. This is called "chewing the cud". The food is again swallowed and moves thru the four stomach compartments. A cattle spends 6 hours eating and 8 hours chewing its cud each day, hence an average cattle has more than 40,000 jaw movements per day.

Features of the ruminant stomach

Ruminants differ from other mammals in having a greatly enlarged forestomach with three additional stomach compartments (Figure 1). Of these, the rumen (paunch) and reticulum (honeycomb) have more than 50% of the total capacity of the digestive tract. The rumen has a capacity of 47.5 kg, while the reticulum, the smallest of the compartments, has a capacity of 3.86 kg. This large capacity is essential to allow the feed to reside in the rumen longer so that microorganisms can break down fiber, non-protein nitrogen (NPN) and other complex carbohydrates which mammalian enzymes cannot digest. The omasum (manifold/many plies) and abomasum (true stomach) each represents 6 to 8% of the capacity of the digestive tract. The omasum has a capacity of 5.25 kg while the abomasum has a capacity of 5.66 kg, totaling the capacity of the four compartment to 62.27 kg in adult cattle. Thus, the four compartments hold

60 to 65% of the total volume compared to 25% for the small intestines,10% in the large intestine, and less than 5% in the cecum.

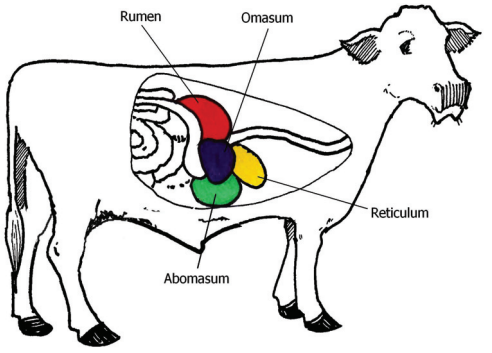

Figure 1. Four compartments of the ruminant stomach.

No digestive enzymes are produced in the first three compartments. Thus, these are considered as ante-chambers or dilations of the true stomach in which the feed is subjected to microbial fermentation. Enzymatic digestion takes place in the abomasum and the small intestines.

There are some unique features in ruminants that differentiate them from swine and poultry in terms of how they can get their required nutrients. In the ruminant stomach, particularly in the rumen and reticulum, there are billions of microorganisms which can digest and ferment cellulose in feedstuffs. In the process of fermentation, volatile fatty acids (VFA) namely acetic, propionic and butyric acids are produced which are then used by the ruminant animals as sources of energy.

Moreover, the bacteria and protozoa in the rumen digest feed protein and non-protein nitrogen like urea to produce ammonia. Ammonia is toxic to the animal when absorbed into the blood in large amount. However, the same microorganisms use part of the ammonia to build their body protein called bacterial or protozoal protein. These microbial proteins are highly digestible (70.90%) in the abomasum and intestine while the rest of the ammonia are absorbed across the rumen wall into the blood stream and detoxified in the liver into urea. The amino acids produced from the digestion of microbial proteins are absorbed and carried by the blood to form the body protein of the animal. Therefore, microorganisms in the rumen provide the ruminant animal both with energy in the form of VFA and protein from the microbial protein they synthesize. In addition, rumen microorganisms are capable of synthesizing water-soluble vitamins (B complex and C).

Rumination process

Rumination includes regurgitation, remastication, reinsalivation, and reswallowing of feed. From the rumen and the reticulum, the semisolid feed is regurgitated or returned back to the mouth by reverse peristalsis of the esophagus. The reticulum supplies fluid to the feed to facilitate its passage upward to the mouth at the speed of 1.4 meters per second. In the mouth, the feed is remasticated and mixed with the saliva. Grinding of the feed is thorough and lasts for more than 1 minute. The liquid portion of the regurgitated feed is swallowed first. Then the boluses are swallowed into the rumen while remastication is taking place. The rate of passage is about the same as regurgitation.

Rumination takes place on an average of 14 times in 24 hours. It may occur anytime of the day. The total period spent in rumination is 8 hours daily.

Digestion process

Earlier, it was mentioned that a cattle spends 6 hours eating and 8 hours chewing its cud each day, thus has more than 40,000 jaw movements per day.

After the feed is swallowed, it first enters the reticulum and then into the rumen. The upper part of the rumen is filled with gases. For proper functioning of the rumen, the feed is soaked with water and saliva. The feed then undergoes mixing and kneading by repeated contraction of the rumen wall. These processes take place all the time even while the animal is resting. Enzymes are secreted by the protozoa and bacteria for the digestion of carbohydrates, proteins, and fats. In particular, bacteria release cellulose and proteinases for the digestion of cellulose and proteins, respectively. Plant enzymes, called cytases, in the grains digest the hemicellulose. The feed is subjected to this fermentation process for 2 ½ days in the rumen. During digestion, heat is also evolved. The whole mass of feed is lightly acidic.

Nutrient requirements of cattle

Because of the unique anatomical and physiological features of the ruminant digestive system, provision of cattle with the nutrients found in appropriate/suitable materials such as roughages and concentrates comprises the major factor in carrying out a viable cattle project. The kind and amount of nutrients required by an animal are determined by its physiological activities. In the case of feedlot cattle, this includes maintenance and growth.

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Sweetpotato residues, forages and other feed resources for ruminant rations

Ronald M. Angat, Maria Teresa SJ. Valdez and Cielito A. Beltran

Feed resources

The feed resource base is made up of grasslands, cultivated pastures, weeds and crop residues from croplands, areas under tree plantation, and agro-industrial by-products. The backyard type of operation usually depends on a few hectares of pasture grasses, however, the bulk of feeds is supplied by weeds from croplands and crop residues such as rice straw, sweetpotato vines and leaves, non-marketable sweetpotato roots, yambean, corn stover, and sugarcane tops.

These feeds usually make up the roughage requirement of cattle. Roughage is a feed which is relatively high in fiber and low in total digestible nutrients or energy. On the other hand, concentrates are feeds which contain high digestible energy, low fiber, and either high or low protein. They include grains (corn), oil meals, root crops, and grain by-products (rice bran, wheat bran, corn bran, brewer's spent grain, corn gluten feed, corn gluten meal). Concentrates are usually included in cattle rations to increase energy intake.

The amount of concentrate to be incorporated in the ration depends on the availability and quality of the roughage, price of the concentrate, and production level of cattle to be fed. A high level of concentrate in the ration is recommended during summer months when grasses are scarce and crop residues are often utilized as feed. Similarly, concentrate supplement is needed by fast-growing animals. Fattening or finishing cattle require high amount of energy, thus, a combination of energy-rich concentrate supplement and roughage is necessary.

a. Selected feeds commonly available in Tarlac

- *Sweetpotato residue (SPR)* is the collective term that refers to as any part of the sweetpotato plant that is not marketed or used as planting materials or human food. They are referred to as rejects that do not pass trader's selection criteria which are usually based on root size, shape, skin texture and presence or absence of insect damage. Sweetpotato residues evolve at harvesting (vines and leaves) and after root sorting.

a. Kinds of sweetpotato residue

Based on farmers' concepts of sweetpotato residue, two major categories are identified: roots, vines or leaves. SPR roots are subcategorized into marketable and non-marketable roots. Marketable SPR roots include roots that are within the buyers' standards but are not marketed because of over production. Trimmings and peelings include all root parts cut-off before a root is cooked or sold. Non-marketable SPR roots include roots that fall short of the buyers' standard. These are damaged, infested, too large and too small roots. SPR vines are subcategorized into vines with tips and vines without tips.

b. Potential of sweetpotato residue as livestock feed

Wherever sweetpotato is produced in developing countries, it is almost always used in some form as animal feed. According to estimates made by the Food and Agricultural Organization (FAO), 40% of the total output is devoted to this purpose in the largest sweetpotato producing countries. The nutrient content of sweetpotato varies with the type of residue and in some instances, processing methods employed. Sweetpotato roots may be fed to animals either raw or cooked. In places where more sophisticated technology is available, roots are converted into chips before being fed to animals. The vines and leaves of sweetpotato are also used as animal feed.

Sweetpotato is generally considered a high-energy food since it contains a high amount of carbohydrates (starch in roots; fiber in vines and leaves). The energy production of sweetpotato is 152 MJ/ha/day, which is comparable with that of corn at 159 MJ/ha/day. Sweetpotato contains 89.7 - 94.0% carbohydrates on the dry weight basis, 66.8 - 78.5% of which is starch. It also contains vitamins and minerals. The roots contain carotene which is the precursor of vitamin A. Vitamin B-complex in the form of riboflavin, niacin, and thiamine are also present in the roots and leaves of sweetpotato. It provides good amount of vitamin C. While protein and fat contents are generally low, the major inorganic elements necessary for body processes such as calcium and iron are high in sweetpotato. Sweetpotato vine is a good source of protein, ash, sugars and vitamins but is relatively high in fiber and have very low dry matter content. They also have better feeding values than rice straw and corn stover. Dry matter production was estimated to be higher for sweetpotato than corn. The other nutrient components of SP are shown in Table 1.

Luzon was 14.09 (1,000 tons) at 2 tons DM/ha. Non-marketable sweetpotato tubers is 1.8-5.8 tons/ha, while tops is at 13.0-31.2 tons/ha (PCARRD, 2001). The amount of SPR roots left in the field ranges from 0.5 to 7.8 tons/ha, while that of SPR vines gathered range from 6 to 40.2 tons/ha. Hence, 10,530.96 tons of SPR roots and 50,462.50 tons of SPR vines were available in Paniqui, Tarlac in 1997 (Adion, *et al.*, 1998).

e. Constraints in using SPR

Livestock raising efficiently converts digestible, but inedible and non-marketable products in the farm into valuable animal products. Sweetpotato residues are available in small farms. They have better feeding values compared to rice straw and corn stover. A closer look at the sweetpotato industry will reveal that it is far from stable and viable because of many drawbacks in its physical, technological, and socioeconomic/marketing components. Moreover, the *Camote Kulot* disease, which was first observed in Tarlac in 1991 has gradually spread through the years, affecting sweetpotato grown in most of the municipalities in Central Luzon. This disease affects both the yield and quality of sweetpotato vines and roots.Many sweetpotato varieties that are grown in the region, including the "Super Bureau" that is planted in about 90% of the sweetpotato production areas, are susceptible to the disease. These problems have to be overcome if the industry has to sustain the small livestock raisers who are largely dependent on SPR as feed resources.

- *Urea.* Urea feeding is justifiable only if deficiency in feed protein exists. It is an economical replacement for a part of the protein in a ration. For efficient use of urea as non-protein nitrogen source, adequate amount of energy and sulfur should be made available to the animal. Urea is to be given in small amounts at the start, then increased gradually but should not exceed more than 3 % of the total ration. No more than 50 to 100 g. urea per head per day should be fed to feedlot cattle consuming a high concentrate ration. Excessive intake of urea causes death. Poisoning from urea is characterized by bloat, insalivation, abnormal respiration, and incoordination which are corrected by giving the animal an antidote. Vinegar or acetic acid is a helpful emergency treatment for urea poisoning if the animal is treated at once. In severe cases, puncturing the hunger hollow with a trocar is necessary.

During summer months when molasses are readily available, a water-urea-molasses mixture with a maximum of 10% urea may be used as a lick, with proper precaution. To regulate animal intake of water-urea-molasses mixture, a rotary licker is recommended. The suggested liquid-urea mixture is: 2.5 kg urea, 4.5 kg molasses, and 18 l water.

- *Rice straw and corn stovers.* These crop residues are abundant in small farms. Although of low feeding value, these provide a good source of roughage to maintain mature animals during the lean months. Several studies on rice straw utilization, either treated or untreated with chemicals, supplemented with concentrates or green forages, showed improvement in livestock performance. Generally, cattle production is most favorable when pastures are green and abundant. However, high levels of production cannot be maintained for long on feeds like rice straw or corn stover. To improve its feeding value, rice straw may be treated with urea. Urea-treated rice straw (UTRS) is done by making a solution of 100 kg water and 5 kg urea (fertilizer grade) and sprinkling or pouring over 100 kg of rice straw. This is then covered with a plastic cover to prevent flow of air for 10 days. The treated rice straw can be fed directly to ruminants.

- *Legume hay, empty pods, green corn.* These crop residues have good feeding values and are also available although in smaller quantities. In Batangas, some farmers deliberately use high seeding rates in sowing their corn crops. As the season progresses, farmers thin out the excess corn plants along with weeds and used it as feed for livestock.

- *Sugarcane tops.* Majority of the smallhold farmers in areas where sugarcane is the principal crop, the animals are fed with cane tops in fresh or dried form during the entire harvest season (November to May). Cattle are fed on cane top-based rations with urea-molasses and other concentrates. Furthermore, the digestibility of sugarcane tops can be highly improved by making it into good quality silage.

- *Weeds.* Weeds abound in small farms. These are found growing with crops, under orchards and plantation, on irrigation ditches, farm borders and fences, roadsides, and other unused areas. Although crops should not be intentionally kept weedy just to have a fodder for livestock, the opportunity to use the weeds should not be overlooked. Moreover, allowing unproductive native grasses to grow on borders and fences, along irrigation canals and roadsides is not as profitable as replacing them with higher yielding grasses and legumes.

should be allowed between successive plowings and harrowing. Final soil preparation is furrowing if needed.

- The ideal time of planting is at the start of the rainy season to take advantage of the moist condition of the soil and to obtain good germination and survival of new plants. However, if irrigation is feasible, planting can be done anytime of the year.

b. Planting materials

The upright growing grasses are propagated either by canes or tufts/rootstocks and the creeping grasses by stem cuttings. Below is the table on some of the vegetable propagules of selected feed sources.

Vegetative propagule		
Grasses	**Legumes**	**Fodder trees**
Canes (Napier)	Seeds	Seeds/cuttings
Rootstocks (Guinea)		
Stem cuttings (Paragrass, stargrass)		

c. Method of planting

1. Vegetative method – use of plant parts as planting material aside from seeds. Below is the recommended distance of planting grasses.

Grasses	Distance of planting
Napier	50 cm between furrows x 25 cm between hills
Guinea	75 cm between furrows x 50 cm between hills
Stargrass, paragrass	50 cm between furrows – cuttings or stolons are dropped on the furrows then partly covered with soil

Napier grass is quicker and easier to plant when stems/ canes are used as planting materials. These are cut into lengths each containing two nodes and merely pushed into the ground at 45° angle. Where planting materials are not a problem, lay whole stems along the furrows and lightly cover them with soil.

2. Sexual method – propagation by seed.

When seeds are to be sown, the soil should be worked up to a fine tilth. Most small seeded grasses and legumes are sown at the rate of 3-5 kg per hectare while large seeded ones are sown at 6-10 kg PLS/ha. Seeds maybe drilled along furrows

and covered with a thin layer of soil. They are broadcast by hand on loose seedbed.

d. Fertilizer and irrigation

- Manure/slurry from the cattle shed are applied to pastures to improve the soil nutrient content.
- To provide a boost in growth/regrowth/yield of the pastures, nitrogen, phosphate and potash fertilizers should be applied. Grasses have a high requirement for nitrogen, while phosphorus for legumes to improve its growth. Soil analysis must be taken into consideration to determine the nutrient deficiencies of the soil for proper fertilizer recommendation.
- Nitrogen fertilizer can be applied at the start and end of the rainy season or after each cutting or grazing in intensively managed grass pasture under irrigated condition.
- Irrigation during the dry months is essential to enhance the growth and yield of the pasture. The application of nitrogen fertilizer before irrigation will increase its effectiveness.

e. Grazing and cutting intervals

Napier and guinea grasses can be cut or grazed at approximately 45 days interval during the wet season and 60 days during dry season or before the onset of flowering of both grasses. These two grasses are sensitive to frequent and intense defoliation.

f. Weed control

Weed control can be minimized by:

1. Proper pasture establishment and management particularly in the early stages:
   a. Through land preparation
   b. Planting high quality seeds/vegetative materials of adapted plants
   c. Planting fast growing species
   d. Proper fertilization
   e. Using the right amount of seeds/vegetative materials and best planting method at proper time

to 3% of its body weight. Therefore, a 250-kg feeder cattle will require 7.5 kg dry matter from grass. On the other hand, the animal requires 30 kg (7.5 kg / 75% moisture) if given fresh grasses.

The following steps are important in estimating the daily feed requirement of animals (PCARRD, 1985):

1. Know/estimate the age of the animal and its body weight. The dry matter required is determined by established standards or by using the appropriate percentage of body weight.
2. Determine the dry matter content of the ration, on "air-dry" or moisture-free basis. The term "air-dry" refers to the feed or ration having approximately 12-14% moisture content under ordinary conditions. For example, 1 kg of hay, straw or concentrate has approximately the same dry matter content as 1 kg of "air-dry" feed.
3. Determine the desired ration or proportion between roughage and concentrate based on the realistic availability and process of these feeds.

Feeding management practices

1. Feed animals daily with 1-2 kg concentrate during fattening period. Give roughage daily at 3% of the body weight if given air-dry or 8.75% if given fresh.
2. Give clean water without limit or *ad libitum*. Provide 30-50 grams ordinary table salt per head per day.
3. Give the animals fresh and palatable feed. Reduction of feed intake by 5% will reduce weight gain by 10%. Do not overstock feeds in the feed bunk since the bottom portion will develop heat and make the feed stale.
4. Mix feed properly. Digestion will be more efficient if roughage is eaten together with concentrates.
5. Provide at least 15-20 % roughage to prevent bloating and other digestive disorders. Roughage consumption stimulates saliva secretion of up to 80-120 liters per day.
6. During rainy days, cattle will eat more at daytime. On the other hand, during summer, they will eat more at night and during the cooler hours. It is important to provide enough feeds during these periods.
7. Providing 0.75 m bunk space per head will allow cattle to eat slowly. This will help increase the rumen's efficiency thus facilitating digestion.

Health management of fattening cattle

Irene M. Adion and Maria Lorna S. Baculanta

Introduction

The importance of health in animal production cannot be ignored, and yet it is often overlooked. Apart from the general impression that good feeding will make a great difference in the growth performance, the efficiency of metabolism and its significance to the normal physiological functioning of the body systems should be given due attention.

Good animal health provides benefits to both producers and consumers. Specifically, producers gain better productivity while consumers get better quality and cheaper animal products. The more traditional approaches to animal health put emphasis on considering health problem as an isolated issue. In reality, however, animal health improvement involves improvements in breeds, feeds, environment and caring aspects, thus, should be considered as one part of a larger system - the agroecological suprasystem.

Health

Health is the absence of illness and has sound body functioning and normality in appearance. As such, health status is determined only after thorough clinical examination. It has three aspects: the animal, the history and environment.

Animals are unable to describe their symptoms and signs. In fact, they vary widely with their reactions to handling and examination. Knowledge about medicine is not enough to reach an accurate diagnosis of animal health because knowing animals' behavior by heart is more important to achieve reliable measure of health status.

Disease is defined as an abnormality in one or more body functions that is either manifested or not. A set of guide questions which may help determine health conditions are as follows:

Animal

1. What abnormality is observed on the animal? Since when?
2. How fast does it affect the animal's body?
3. What particular observable disease symptoms disturb the animal?

Abdomen - Variations in abdominal size are usually appreciated during the general inspection of the animal. An increase of the size may be due to the presence of excess food, fluid, feces, flatus or fat.

External genitalia - Gross enlargements of the sheath or scrotum is usually inflammatory in origin. Discharges of pus and blood from the genitalia indicate infection of the genitor-urinary tract.

Mammary glands - disproportionate size of the quarters of the udder suggests acute inflammation, atrophy or hypertrophy of a gland.

Limbs - posture and gait as earlier discussed suggest conditions.

A disease is the result of a continuing process of interaction between various elements of the ecosystem.

Types of diseases

1. Infectious diseases are caused by pathogenic microorganisms which can be transferred from one animal to another by direct or indirect mode of transmission.
2. Non-infectious diseases are caused by toxic substances, chemicals and other foreign bodies inducing abnormalities of bodily functions.

Determinants of infectious diseases

1. Agent - cause of the disease.
2. Host - animal affected by the agent.
3. Environment - setting where the host and agent are situated.

Interactions between these determinants make a disease a complex problem rather than a simple one to deal with.

Six principal stages in the cycle of an infectious disease

1. Exit route from an infected host (Where it came from).
2. Transfer methods between infected and susceptible host (How it is transferred).
3. Entry routes into a susceptible host (Where and how it entered another animal).
4. Establishment of the agent within the susceptible host (How it attacks the animal).

5. Pathogenesis of the disease (How it cause damages to the animals' body).
6. Multiplication of the agent and dissemination to exit routes or achievement of other final states.

Kinds of diseases according to cause

1. Viral - Foot & Mouth Disease (FMD), pink-eye, encephalomyelitis (Mad Cow), warts
2. Bacterial - Tuberculosis, hemorrhagic septicemia, colibacillosis, anthrax, black leg
3. Parasite – endoparasites like liver fluke, stomach worm, tape worm, lung worm, blood parasites i.e., anaplasmosis, babesiosis, toxoplasmosis and ectoparasites like sucking lice, mites, ticks
4. Fungal - ring worm, aspergillosis, coccidiosis
5. Nutritional – vitamin & mineral deficiency, i.e. muscular dystrophy, blindness, lameness

Common diseases

1. Viral diseases

a. Foot and Mouth Disease (FMD) – is a disease affecting all cloven-footed animals

Etiology: Picornaviridae with type O virus causing the epidemic in the country

Transmission:
- Direct contact with infected animals through the vesicular fluid, saliva, urine, milk and meat
- Indirect contact through contaminated human and objects which include vehicles, beddings, clothing, footwear, etc.
- Susceptible animals are pigs, sheep, goats, carabao, and cattle. People can be carriers of FMD virus.

Clinical signs:
- High fever in acute cases but maybe absent in mild ones
- Vesicles in the hooves, which may also appear in the udder, teeth, conjunctiva, nasal passages, perineum, and other thin-skinned areas.
- Salivation
- Loss of appetite with lameness resulting in weight loss

Recommendations:

- Snail control by chemicals, biological and physical means
- Refrain from grazing animals in infected swampy areas
- Treatment using flukecides or broad-spectrum antibiotic

Ectoparasites

d. Mange

Etiology - cause by *Demodex bovis, Psoroptes* spp.

Transmission:

- Transmission is direct
- Contact with contaminated materials such as feed troughs

Clinical signs:

- General hair loss and skin thickening
- Badly affected animals become emaciated and may die

Recommendation:

- Repeated dipping or spraying with acaricides should be carried out to prevent spread rather than cure existing lesions

e. Myiasis

Etiology - caused by screwworm fly and blowfly

Transmission:

- The disease can be spread either by migration of flies or by shipment of infested cattle or other livestock

Clinical Signs:

- Presence of screwworm larvae of fresh accidental or surgical wound by castration, docking and deworming
- Profuse brownish exudates with foul odor from wound
- Inappetence with restlessness

Recommendations:

- Topical dressing of affected wounds with larvicide antiseptic.

f. Trypanosomiasis – "Surra"

Etiology: caused by *Trypnosomia evansi*

Transmission:

- Mechanically transmitted by arthropod vectors like tsetse fly

2. Period where there is high and low demand for the product and availability of market outlets or buyers of the product. This means availability of buyers and outlets for direct consumption or processing of the product. Shortage of beef supply means high demand of the product, inversely, excess of the available beef product means low demand or less users for the product.
3. Availability, number and location of buyers as well as identification of the buyers, their roles and potential demand areas. Buyers could either be local or institutional. Exportation could be potential market for local produce.
4. Price trends and prevailing prices. Market prices are determined by a complex and dynamic interaction between demand and supply. Pricing is the mechanism by which products are allocated among different groups based on their ability to pay. Farmers are highly dependent on price information coming from shippers or local buyers. But there is no existing price information bulletin among local areas in Central Luzon.
5. Availability of price information schemes. Price information often limits farmers/growers of the prevailing market price, thus, deprived of the benefit that should accrue to them. Lack of price information puts farmers in a disadvantageous position during price negotiations.

Marketing system of beef cattle in the Philippines

Beef cattle marketing systems are now quite efficient especially in areas where livestock market is available. However, in many areas, marketing of cattle is still facilitated by village buyers/agents and middlemen. In Tarlac, for instance, the local markets of Camiling and Sta. Ignacia observe direct selling from the producer to butcher-retailers. This is advantageous to the farmers in getting fair price of their produce. However, it would be more advantageous if there are established livestock markets near areas of production to promote direct selling and reduce live animal transport.

Marketing arrangement between producers and buyers is often direct since cash payments or down payments are always required or demanded if facilitated by agents. Unlike in other crops, credit –marketing tie up is not a popular marketing arrangement because of the possible losses considering the cost of time and money for traditional cattle fattening requires longer period.

Prices of beef cattle

Prices of beef cattle vary from places and depend on the availability and volume of supply. In Central Luzon, the price of beef is higher by PhP 20-50/kg depending on the quality and type of cuts. Lean meat prices range from PhP 100-140/kg and PhP 60-100/kg for the other parts.

Demand and supply of beef cattle

The local beef cattle industry is considered one of the least developed in the country. Decline in cattle production for the decade was recorded at 1.68%/annum (PCARRD, 1993). This can be attributed by high slaughter rate at an average of 449,507 heads per annum. The local production is not enough to meet the demand of a rapidly increasing human population. The estimated per capita consumption for beef in 1992 was 1.57 kg. With a population of about 80 million, the country needs 133,600 tons of beef which is equivalent to 890,666 heads of cattle for slaughter assuming a carcass weight of 150 kg/head. With increasing demands for beef coupled with the declining trend in local cattle population, it is expected that the country will continue to be highly dependent on importation.

Constraints in beef cattle marketing

Several constraints were identified why there is a slow growth and development of cattle industry in the country today.

1. Low breeding base. The available breeding base is not enough to produce the required number of cattle for slaughter. The shortage is a result of the continuous and indiscriminate slaughter of breeders, young female cattle and even pregnant cows.
2. Poor herd management. This resulted in low productivity of cattle under local conditions which is caused by inefficient and ineffective culling and selection programs, natural weaning of young stock resulting in premature breeding and even inbreeding, incidence of numerous farm-related accidents and other seasonal factors.
3. Inefficient marketing system and structures. Ready market for beef and its by-products is observed but is constrained by the following:

Beef tapa and corned beef making

Marliza D. Viloria

Meat processing in the Philippines is one of the most popular sectors of the meat food industry. It is also considered as the most promising venture when it comes to income-generating business because of its high product demand and high production. In fact, Filipino housewives prefer to make home-made foods. Moreover, processing meat at home may provide meat enthusiasts the proper skills that may eventually lead to income generating project of the family.

Why process meat?

Meat needs to be processed to:

- Prolong its shelf life
- Enable the use of waste by-products into delicious food
- Increase the variety of preparations
- Improve the quality
- Add value to meat

Selection of good quality meat for processing

Factors that need to be considered:

- Has firm fat
- Has bright and fine-textured lean
- Must be tender, juicy and has a full-characteristic flavor when cooked
- Should not contain pathogenic and spoilage causing microorganisms as well as toxic residues
- Contain high amount of nutrients in the right proportion and readily available form

Other factors to be considered:

- Water binding capacity
- Soluble proteins present
- Emulsifying capacity

Introduction to farmer field school on beef cattle production

Clarita J. Aguilar

Introduction

Beef cattle fattening production is a good source of livelihood among farmers in the countryside. Farmers can derive substantial income from cattle fattening as well as maximize the use of farm resources given adequate capital to purchase stocks, ample knowledge in selecting stocks for fattening, and efficient feeding management using local and available resources.

Moreover, the existence of meat outlets and livestock markets offering attractive prices and good marketing arrangements makes it attractive for farmers to invest in cattle fattening. Livestock raisers can maximize benefits from cattle production provided they are equipped with information and know-how on the use of available resources to minimize production costs.

So what can farmers do? How can farmers/livestock raisers develop knowledge and skills to improve and develop capacities on cattle fattening enterprise? In this exercise, the farmers will analyze the relative importance of beef cattle fattening and its constraints within a given agronomic condition. Feeding options using locally available resources, especially that of sweetpotato either as basal or supplement in the ration will be integrated in this season-long learning activity - the farmer field school (FFS).

Objectives

At the end of this session, the participants should be able to:

1. identify the importance and constraints of beef cattle fattening enterprise;
2. explain the objectives of beef cattle fattening project; and
3. discuss the need for a season-long training on beef cattle fattening.

Materials

Metacards
Permanent markers (pentel pen)
Colored markers
Fruit seeds

- Waste management
- Marketability of sweetpotato-based feed and beef

3. Process evaluation will be done before the end of session.

Pretest and Post Test

Introduction to farmer field school on beef cattle fattening

Instructions. Read the statement carefully and encircle the right answer.

1. A farmer field school is considered as
   a. a season long training
   b. a school for crops and livestock
   c. a classroom activity
   d. none of the above

2. The first step in developing a field school is through
   a. action research
   b. information campaign
   c. diagnostic study
   d. experiment

3. Is farmer field school applicable to all crops?
   a. Yes b. No c. Do not know

4. Farmer field school consists of the following:
   a. production
   b. marketing
   c. processing
   d. all relevant aspects of cattle fattening enterprise from production up to marketing

5. The farmer field school model is a farmer training approach and is based on the principle of:
   a. adult education
   b. research and extension education
   c. out of school youth
   d. government education

Pretest and Post Test

Beef cattle as ruminant and feed resources for ruminant rations

1. The cattle, buffalo, goat, pig, chicken and horse have similar digestive system.

   a. True
   b. False

2. A cattle has the capacity to digest grasses and fibrous farm by-products like rice straw, corn stover and others because it has

   a. long stomach
   b. big mouth
   c. sharp teeth
   d. four stomach compartments

3. What can be found at the largest compartment of a ruminant stomach that aids in digesting feeds to obtain its nutrients?

   a. microorganisms
   b. acid
   c. saliva

4. Which of the following is not considered a ruminant?

   a. cattle
   b. horse
   c. goat
   d. buffalo

5. Because sweetpotato leaves and vines given to cattle is high in fiber, it is considered as

   a. roughage
   b. concentrate feed

6. Sweetpotato is rich in

   a. protein
   b. energy

Silage making and fermentation of sweetpotato residues

Ronald M. Angat

Introduction

The topic presents an option for the use of sweetpotato residues through ensiling. The conservation process offers a solution to the problem of erratic year-round feed supply. During the session, the advantages of sweetpotato silage are highlighted and the step-by-step process of ensiling is introduced.

Objectives

At the end of the session, the participants should be able to:

1. discuss the advantages and disadvantages of ensiling; and
2. make a silage.

Materials

3 pieces manila paper
2 pentel pens
1 roll masking tape
2-3 sacks sweetpotato residues
3 cleavers or knives
1 plastic container or can with cover
Molasses (if available)

Methodology

1. Prepare the following guide questions:
   a. Have they ever heard of or tried using silage as feed?
   b. What is silage?
   c. What are the possible benefits from using silage as feed?
   d. How is ensiling done?
   e. In your own opinion, what are the disadvantages of ensiling?
2. For question No. 1a, ask participants one by one. On a manila paper, tally their positive and negative answers. When all participants have answered, define and describe silage to answer question No. 1b.

Some estimates on costs and pricing of tapa

Expected weight of packaged product	=	5.25 kg
Cost per kilo product	=	P 149.052
Suggested retail price with 10% gain	=	P 163.95 or P 164.00
Suggested price per ½ kilo pack	=	P 82.00

Corned beef making

What is corned beef?

Corned beef is meat preserved by salting with or without some spices and other ingredients. It is commonly known as "*Karne Norte*" in the Philippines.

Materials

Lean meat/lean trimmings – beef, carabeef, horsemeat or chevon
Knives and curing containers
Kettle/pressure cooker and stove
Ingredient scale, measuring cups and spoons
Ingredients and spices

Procedures

1. Wash meat thoroughly. Chill if possible.
2. Cut about 1 inch cube. Place on a tray and tilt tray to drain.
3. Determine weight of meat. Using Table 1, determine the amount of ingredients used. The required amount of ingredients should be measured using either an ingredient scale or measuring gadgets, whichever is available.
4. Dissolve salt, sugar and Prague powder into the water. Water required is 200 ml per kilo meat. Filter solution using a cheesecloth.
5. Submerge cubed meat in the solution. Place meat in a chiller for 2 to 3 days at 35-40°F or overnight at room temperature.
6. Without washing, transfer the meat to a kettle.
7. Weigh spices (shown in Table 2). Wrap in cheesecloth and place it inside the kettle. Cover the kettle and boil over very low flame. Keep on boiling until meat becomes tender. If desired, a small amount of gelatin may be added to act as binder for the meat upon cooling.