Script of Kotaro Baba's Powerpoint presentation, October 19, 2005

Slide 1
Good morning everyone. My MS thesis proposal is an evaluation of beef production systems in Tizimin, Yucatan. I went to Yucatan from the end of May until the end of July of this year. Although it was for two months, it might not be enough to get to know beef production in the region. However, it provided a good opportunity to talk with many cattle producers and see many ranches and cows. It was a very good experience.

Slide 2
This is a scene on a ranch in this region. Cowboys mount horses, herd cattle, and rope cows. It is like a scene from western movies.

Slide 3
As everyone knows this is Mexico, and it is close to the United States. I guess both countries are very close to one another, economically and culturally, too. Tens of millions of people, or possibly more, come and go to these two countries each year.

Slide 4
This is an enlarged map of Yucatan. Merida, where the UADY is located, is located here. I spent the summer in Tizimin, which has a population of about 50,000. The size of the town is similar to Ithaca. Of course, there are no Macdonald's, Starbucks coffee or Hong Kong restaurants, for now. Tizimin is a good town. Nice people, especially beef cattle producers.

Slide 5
Brief information about Tizimin. Tizimin is located 170 km from Merida and about the same distance from Cancun, which is one of the most famous tourist destinations in the world. Many people in the region go to the Cancun area for work, where payment is generally very good. For example, the salary for jobs such as a cowboy assistant in Tizimin is 7 US dollars per day. In Cancun, workers such as servers at restaurants earn tens of dollars, sometimes hundreds of dollars per day. Anyway, tourism might be a very good way to earn income. It also offers livestock production opportunities to provide beef to the tourist industry.

Next, there are no above ground rivers in this region. The Yucatan peninsula was originally under the ocean and the region's limestone foundation is fossilized coral beds and ocean floor. There are no above ground rivers in this area. All ground water seeps through the porous limestone and travels to the sea in underground rivers.

Next, climate information:
The annual mean temperature ----------24 C
The minimum temperature of the year ---12 C
The maximum temperature of the year-----40 C
The annual rainfall----------1000 mm
The humidity---------- 80%

In general, this region is hot and humid but it is cooler in winter.

Seasonal differences. There are three seasons: rainy season, cool season, and dry season. The period of the rains is June through September. The cool season, which is called "nortes", is when a north wind blows bringing lower temperatures from October to January. The dry season is generally from February to May.

Slide 6
This graph is about annual variation of temperature and precipitation in Yucatan. The black line is temperature, and the orange line is precipitation. You can see a climate change by month. Please take a look at the graph, especially the rainfall, which is the orange line. There is much precipitation during the rainy season. There is almost no rain in February, March and April. I arrived in Tizimin at the end of May of this year. Everyone—both local producers and professionals—told me there is usually no grass until the end of May. It means that the grasses grew up very rapidly in only two weeks. Although there was plenty of forage when I arrived, the cows were very thin because of the lack of forages during a long dry season.

Slide 7
Cows in Tizimin. Ranching is the main industry in the region. 450,000 hectares of land is for ranching. Although there are a few dairy and fattening cattle, the number of reproducing beef cows is most important in this region. Therefore, I decided to focus on the reproducing cows and how to improve their productivity.

There are many large ranches. Some have hundreds of cows, sometimes thousands. There are also many small farms in this region. 50 cows constitute a small herd.

Cows are mostly *Bos taurus* crossbreds such as Brown Swiss and Charolais, and *Bos indicus* such as Brahman and Nelore. Many producers prefer Brahman to Nelore. Producers told me the growth rate of Brahman is better in this region.

Slide 8
These are cows in the region. Most of the local producers told me that crossbreds are best. *Bos indicus* breeds are adaptable to the region with its hot and humid environment and diseases, ticks, and parasites. For growth rate and milk yield *Bos taurus* breeds often exceed *Bos indicus* performance with sufficient environmental opportunity. Therefore, crossbreds might combine the good characteristics of the two types of cattle.

Slide 9
Feeding. Producers mainly graze cattle on Guinea, *Brizantha*, Star, and Taiwan grasses. As for Taiwan grass, producers also cut and feed these four most frequently used grasses, according to a household survey of local beef producers. I ignored the area of cultivated grasses and only show the frequency of use. In addition, Jaragua, King grass, Mombasa, and Mulato are available. Producers rarely fertilize. Tree forages such as *Leucaena* and

Ramon are available. There are also many kinds of legumes, which David Parsons has explained in a previous seminar. Although some producers use tree forages, most large-scale producers do not because hired labor is required to cut and feed these forages, which is costly.

Slide 10
This is Taiwan grass, which is taller than star grass, in the early rainy season. They are very green. This is a happy season for cows and producers.

Slide11
This is a scene from the dry season (January to May). There is no grass. It is a very difficult time for cows and producers. I borrowed this picture from David Parsons because I have no picture taken in the dry season. I think we will see this scene, if not during the IARD class trip in January 2006 then in the An Sc 400 trip in March.

Slide 12
Supplements for cows. Some producers use supplements, like poultry manure, molasses, and commercial energy and protein concentrates such as Campi and ENGORDA GANADO. Engorda ganado is Spanish for "fatten cows". The commercial concentrate is made of grains, poultry manure, vegetable oil, vitamins, and minerals. Some producers feed 2 kg concentrate per day; some feed more and others less. I hypothesize that producers frequently do not use supplements appropriately to meet the nutritional requirements of their cows. Engorda ganado is a bit expensive, costing US 20 cents per kg. As an example, a 3 km bus trip costs US 20 cents in this region. Producers use these supplements especially for lactating cows and during the dry season.

Slide 14
This is an irrigation scene.

Slide15
Once again, this graph is about annual variation in precipitation in Yucatan. Most rain falls during the rainy season (June to September). There is little or no rain in February, March and April. Let's take a look at forage growth cycle on the next slide.

Slide 16
This is the annual forage growing cycle in Yucatan, the variability of the dry matter per kg per hectare of the whole plant.

nn1, which is the black line and nn2, pink line are Guinea grass without irrigation and with no nitrogen fertilization in Peto, which is south from Tizimin. nn3, which is the yellow line, is star grass with N fertilization and irrigation twice per week. nn4, which is the blue line, is star grass with daily irrigation and N fertilization in Merida. There are obvious seasonal differences in quantity of forage for all cases. There is also an

association between season and forage quanlity. The amount of forage in the dry season is about one-half of that in the rainy season.

Slide 17
Now to the problem statement. There is almost no rain and plant growth is low in the dry season when grasses disappear. Cows use their body tissue reserves and lose body weight. Calving intervals are prolonged and growth rate is slow during the dry season. Cattle performance is diminished.

Next, irrigation is expensive. Many producers cannot afford to irrigate. Something is needed to improve beef cattle management in this region.

Slide 18
How could we improve beef cattle management? There are ways to improve beef cow efficiency and to improve their competitiveness and profitability. First, increases in beef production have occurred due to nutrition concepts such as supplementation, type of forage as well as quality and quantity. Number 2, ranch management, for example, matching breeding and calving seasons with the availability of forage. Number 3, enhancements in the reproduction index, for example, calving frequency, age at first calving, and calving interval. Number 4, genetic selection such as bull selection and crossbreeding. My focus is on nutritional and ranch management and the reproduction index.

Slide 19
Nutrition and energy balance of cows. I'll briefly explain about energy balance of cows. When intake of energy is less than the amount of energy required, it indicates a negative energy balance. Energy reserves are used for lactation. When intake of energy required is greater than energy for milk production and maintenance, it indicates a positive balance. Energy intake above requirements is deposited as energy reserves. Energy balance is more negative when cows are in early lactation because higher requirements are mostly due to milk production.

Canfield's study indicates that energy balance status plays an important role in determining the postpartum return of cyclic ovarian activity.

Other researchers, such as Florence Nherera in Kenya and Bertha Rueda in Brazil, found that the energy for gain was always more limiting than protein. I also briefly simulated for a Yucatan case with the CNCPS model that energy was most limiting, especially BECAUSE of LOW quantity of forages and LOW QUALITY of mature forages containing HIGH NDF AND LIGNIN.

Slide 20
Objectives of the thesis. My MS thesis will be to evaluate monthly forage energy availability by matching of nutrient requirements of cows and breeding heifers. First, I will evaluate nutrient requirements of cows and breeding heifers. Second, I will evaluate forage supply and quality by month and how much energy comes from the forage. Third,

I will evaluate optimal or suboptimal calving seasons. I conceptualize that synchronizing calvings with the best times of forage energy availability should greatly improve nutritional status and beef productivity through shorter calving intervals and by encouraging more rapid growth.

Objective number 2. Develop supplements for beef cows calving each month of the year. Commercial supplemental diets are costly. Therefore, it is important to evaluate how well current supplements meet the requirements of cows during each phase of their reproductive cycle.

Slide 21
I will study these groups because forage quality and quantity differ by season. Cattle requirements also differ for each animal age group and physiological status.

Number 1. Seasons are the first half of the rainy season, which offers the best forage quality, the second half of the rainy season, the cool windy season, and the dry season with least forage availability and quality.

Number 2. Animal groups are weaning calves, breeding heifers, first and second calf cows, and older cows.

Number 3. Physiological status of breeding females are breeding heifers, early lactation, which is until 90 days postpartum, late lactation from 90 days to 240 days after calving, early and late dry periods, which includes the pre-partum period.

Slide 22
This graph illustrates the association between milk production and dry matter intake, cited from the study of Reynoso-Campos et al. for dual purpose cows in the Gulf Coast of Mexico. These are example reference curves for management groups of dual purpose cows producing 2500 kg milk in a 270-day lactation with a calving interval of 420 days. The milk production and dry matter intake are at peak after about 3 months postpartum.

Slide 23
Shown are energy required, energy supply, and energy balance. The energy balance is increasingly negative until the nadir about 3 months postpartum.

Slide 24
This illustrates the change in body condition score (dairy scale) and body weight. The nadir is around 90 to 100 days after calving. After weaning (around 240 days) cows increase BCS and weight for next calving. I will develop similar summaries for the Yucatan case.

Slide 25
The CVDS (Cornell Value Discovery System) is a research tool for addressing objective 1. It will be used to predict nutritional requirements and to simulate availability and quality of forage throughout the year relative to forage requirements for different cattle

types and to evaluate and improve energy balance throughout the annual production cycle.

Inputs needed for the CVDS are

1. Estimates of ME value of forage consumed each month. This will be predicted with the CNCPS version 6, using forage information in the tropical feed library that most closely matches those available for beef cows and calves in Yucatan and modified with actual chemical composition where available.

2. Description of cows that calve during each month of the year, body weights at calving and weaning, body condition score at calving and weaning, calf birth date, calf birth weight, age at calf weaning, calving interval and cow age at calving will be considered.

3. Input information, existing data and some assumptions will be used for inputs. Existing data to describe cows will be from UADY and expected chemical composition of forages will be from multiple sources.

Slide 26
The CVDS demonstrates the forage energy availability by month of calving and matching with nutrient requirements of cows and breeding heifers. This example was presented by Dr. Tedeschi at the NY beef cattle winter management meeting in January 2004

The figure indicates the forage energy content for each month. The white line is the mean forage energy. The black range is plus minus 1 standard deviation, and the grey range is plus minus 2 SD. In this case, the energy content decreased in October, November and December.

Slide 27
This figure shows energy balance—requirement minus supply. The white line is the mean energy balance, the black range is plus/minus 1 SD, and the grey range is plus and minus 2 SD. In this example, improved forage production, change in cattle type or numbers, or supplementation is needed during the months of July through December.

The CVDS can indicate the worst month(s) in which to avoid calving and lactation when requirements are greatest relative to forage energy supplies.

Slide 28
Objective 2: To develop supplements for beef cows calving in each month of the year. Commercial supplements are costly. Therefore, there is need to evaluate how best to meet the requirements of cows and to identify alternatives that will improve herd productivity.

Slide 29
Supplements for cows in this region include poultry manure, molasses, energy concentrates such as corn and sorghum, commercial energy and protein concentrates, commercial grass hay, urea, and legumes.

Slide 30
The CNCPS (Cornell Net Carbohydrate and Protein System) level 1 will be utilized for objective 2 to develop supplements for beef cows calving in each (any) month of the year. The CNCPS model (level 1) estimates nutritive values of forages for ME content, available ME and MP and animal requirements based on expected dietary intake and chemical composition of forages.

Required inputs are environmental information, descriptions of cow groups, and forage chemical component information. Input information comprises existing data from UADY and Cornell and assumptions.

Slide 31
The CNCPS is used to determine appropriate supplementation for these animal management groups.

> Number 1, seasons. First half of the rainy season which is the best forage quality. Second half of the rainy season, dry season which yields lowest forage, and cool windy season.
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> Number 2, groups of animals. Weaning calves, breeding heifers, first and second calf cows, older cows.
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> Number 3, physiological status for breeding females. Early lactation, which is until 90 days from calving, late lactation which is from the 90 days to 240 days after calving, and early dry and late dry which is prepartum.

Slide 32
Outputs.

1. To evaluate the forage energy availability by month of the year and matched to nutrient requirements of cows and breeding heifers. Expected impacts are that improved nutrition management will improve beef productivity through shorter calving intervals and faster rates of growth.

2. To develop supplements for beef cow whose nutritional requirements vary with month of calving, physiological status, and the supply and quality of forages throughout the year.