Replacement Management

Characteristics of Young Stock Feeding Programs

- Calves
  - 75% of losses during 1st 3 months
  - High quality diet a must
  - Prone to health problems
  - Labor intensive
  - Reinforcement for good or poor job

- Heifers 3 months to breeding age
  - Control of rate of gain is critical
  - Lower nutrient concentration in diet
  - Concentrate still a major component

- Bred heifers
  - Tolerate variation in nutrition
  - Goal is adequate calving weight and condition
  - Maximize forages

The Calf

The First 12 Weeks

Birth

- Difficult birth costs $40 – 75
  - Cow and calf mortality
  - Reduced milk production
  - Rebreading problems
  - Labor for assisting delivery
- Cows and heifers should deliver 1 – 2 (4 – 8) hours after calf enters pelvic area

Calving Assistance

- When should you assist?
  - People most often assist too soon or too late
  - If the cow has not made progress for 30 minutes
  - Be sterile
  - Don’t use a tractor!
- Resuscitation
  - Insert straw into nostrils, blow into mouth, massage chest, artificial respiration
After Calving

- Dip navel in 2% iodine solution
- ID Calf
- Remove calf immediately

Difficult Birth and Calf Mortality

<table>
<thead>
<tr>
<th>Category</th>
<th>Hefers</th>
<th>Cows</th>
<th>Hefers</th>
<th>Cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unassisted</td>
<td>45</td>
<td>79</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Easy Pull</td>
<td>30</td>
<td>15</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Hard Pull</td>
<td>14</td>
<td>3</td>
<td>35</td>
<td>24</td>
</tr>
<tr>
<td>Jack</td>
<td>7</td>
<td>1</td>
<td>55</td>
<td>66</td>
</tr>
<tr>
<td>Vet</td>
<td>4</td>
<td>1</td>
<td>48</td>
<td>65</td>
</tr>
</tbody>
</table>

The First 3 Months

- Period of maximum risk and maximum cost
- Goals

<table>
<thead>
<tr>
<th>BW (lb)</th>
<th>Hol/BS</th>
<th>Ary/Guer</th>
<th>Jer</th>
</tr>
</thead>
<tbody>
<tr>
<td>200-250</td>
<td>150-200</td>
<td>130-160</td>
<td></td>
</tr>
</tbody>
</table>
- Mortality < 5% loss during 1st 3 months
- Low cost = Low mortality, Early weaning, Economical feeds

Three Phases of Development

- Liquid-feeding Phase (2 wks)
  - Nutrient requirements meet by liquid feed
- Transition Phase (6 wks)
  - Nutrient requirements meet by liquid feed and starter
- Ruminant Phase
  - Nutrients derived from solid feeds

Components for Success

- Dry cow nutrition and management
- Calving environment
- Colostrum management
- Feeding and management of the pre-weaned calf
- Transition management
- Housing

Colostrum Management

- Timing
  - 1st hr of life
  - 12 hr later
- Quality
  - Age of dam
  - 1st milking
  - Vaccination of dam
- Quantity
  - 2 quarts per feeding
- High Antibody
  - Older cows
  - 1st milking
  - Vaccination
  - Low 1st milk yield
- Low Antibody
  - 1st lactation
  - Later milkings
  - No vaccination
  - High 1st milk yield
Feeding Colostrum (When?)
- Ig absorption highest at birth and declines to near zero by 24 hours of age
- At birth the gut is sterile - no bacteria
- The intestine has the ability to absorb large molecules for the 1st 3-24 hours of life
- Feed as soon as possible (1-2 hours after birth and 12 hours later)

Feeding Colostrum (How?)
- Let the calf nurse the dam or bottle feed (or esophageal feeder) the calf?
- 25-40% of calves don’t consume adequate colostrum
- Bottom line – calves left to nurse the dam are at greater risk of consuming insufficient colostrum and consuming that colostrum later compared to hand feeding

Feeding Colostrum (How Much?)
- Traditional – feed 2 quarts as soon as possible and 2 quarts 12 hours later
- Depends on several factors
  - Antibody (Ig) concentration in colostrum
    - 50 g IgG/L
    - >18 lb 1st milking lower concentration of IgG
  - Weight and age of calf

Milk Composition

<table>
<thead>
<tr>
<th>Item</th>
<th>Milking 1</th>
<th>Milking 2</th>
<th>Milking 3</th>
<th>Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td>1.056</td>
<td>1.040</td>
<td>1.035</td>
<td>1.032</td>
</tr>
<tr>
<td>Solids %</td>
<td>23.9</td>
<td>17.9</td>
<td>14.1</td>
<td>12.9</td>
</tr>
<tr>
<td>Protein %</td>
<td>14.0</td>
<td>8.4</td>
<td>5.1</td>
<td>3.1</td>
</tr>
<tr>
<td>IgG, g/L</td>
<td>48.0</td>
<td>25.0</td>
<td>15.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Fat %</td>
<td>6.7</td>
<td>5.4</td>
<td>3.9</td>
<td>3.7</td>
</tr>
<tr>
<td>Lactose %</td>
<td>2.7</td>
<td>3.9</td>
<td>4.4</td>
<td>5.0</td>
</tr>
</tbody>
</table>

IgG Concentration and Yield

<table>
<thead>
<tr>
<th>1st Milking Yield (lb)</th>
<th>% &gt;35 g IgG/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;35</td>
<td>80</td>
</tr>
<tr>
<td>27 to 35</td>
<td>60</td>
</tr>
<tr>
<td>19 to 26</td>
<td>40</td>
</tr>
<tr>
<td>11 to 18</td>
<td>20</td>
</tr>
<tr>
<td>&lt;11</td>
<td>0</td>
</tr>
</tbody>
</table>

Colostrometer
- Measures the specific gravity of milk
- Greater specific gravity is better
- Greater specific gravity means more solids = more Ig
- $r^2$ 0.53-0.69 between IgG and specific gravity
- Doesn’t work well with Jersey milk
**Frozen Colostrum**

- Freeze from older cows - good quality, not bloody, not pre-milked, no mastitis
- Freeze in gallon bags
  - thaw in warm water, not boiling water
  - microwave - medium to low power or defrost

**Pre-Weaned Calf**

- High quality liquid and dry feeds
- Clean, dry housing
- Goals
  - alive and healthy (low mortality and morbidity)
  - growing moderately
  - wean early (4-5 weeks)

**Liquid Feeding (Surplus Colostrum)**

- Surplus Colostrum
  - Cheap
  - High protein and low lactose
- Storage
  - Frig
  - Small bulk tank
- Dilute 3:1 & feed at 10% of BW
- Feed undiluted at 8% of BW

**Liquid Feeding (Unsalable Milk)**

- Antibiotic and/or mastitic milk
- 51% Strep, 50% Enterobacter, 41% Strep, 32% E. coli (CA researchers)
- Composition of mastitic milk
- Pasteurization
- It’s your call
- Feed at 10% of BW

**Liquid Feeding (Whole Milk)**

- Mother natures best
- Can be expensive
  - $12/cwt = $0.92/lb powder basis
  - $15/cwt = $1.15/lb powder basis
- Coccidiosis?
- 10-20% more expensive

**Liquid Feeding (Milk Replacer)**

- Cheaper
- Convenience
- Medicated – Antibiotics/Ionophores
- Protein – 20 to 24%
- Fat – 10 to 20%
  - 3.5% milk fat = 25% fat on equivalent replacer basis
  - Higher fat = lower intake from dry feeds and slower weaning
Extra Milk Needed with Cold Stress

<table>
<thead>
<tr>
<th>°F</th>
<th>°C</th>
<th>Birth to 3 wk</th>
<th>&gt;3 wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE_M</td>
<td>Milk, lb</td>
<td>NE_M</td>
<td>Milk, lb</td>
</tr>
<tr>
<td>68</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>59</td>
<td>15</td>
<td>13</td>
<td>0.70</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
<td>27</td>
<td>1.41</td>
</tr>
<tr>
<td>41</td>
<td>5</td>
<td>40</td>
<td>2.11</td>
</tr>
<tr>
<td>32</td>
<td>0</td>
<td>54</td>
<td>2.82</td>
</tr>
<tr>
<td>23</td>
<td>-5</td>
<td>67</td>
<td>3.52</td>
</tr>
<tr>
<td>14</td>
<td>-10</td>
<td>81</td>
<td>4.23</td>
</tr>
</tbody>
</table>

Whole Milk vs. Milk Replacer

- Whole milk
  - Nature’s best (+)
  - Lower mortality? (+)
  - Nutrient content and quality (+)
  - Expensive - 10 to 20% higher cost

- Milk replacer
  - Cheaper (+)
  - Medicated (+)
  - Convenience (+)
  - Nutrient content and quality (-)

Milk Replacer Protein

<table>
<thead>
<tr>
<th>High Quality</th>
<th>Low Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dried skim</td>
<td>Meat solubles</td>
</tr>
<tr>
<td>Dried whey</td>
<td>Fish protein concentrate</td>
</tr>
<tr>
<td>Dried whey product - (delactosed whey)</td>
<td>Wheat flour</td>
</tr>
<tr>
<td>Dried whey protein concentrate</td>
<td>Soy flour</td>
</tr>
<tr>
<td>Soy protein isolate</td>
<td></td>
</tr>
<tr>
<td>Protein modified soy flour</td>
<td></td>
</tr>
<tr>
<td>Soy protein concentrate</td>
<td></td>
</tr>
<tr>
<td>Animal plasma</td>
<td></td>
</tr>
</tbody>
</table>

Milk Replacers

- Immune reaction from non-milk replacers
  - Soybean protein
- Ability to stay in suspension
- Energy
  - Lactose only carbohydrate - whey and skim
  - Fat - tallow, lard, hydrogenated vegetable
  - 10% - 20% fat?

Additives

- Oxytetracycline, Chlortetracycline, Neomycin
  - claims for improved gains and lower respiratory disease
- Coccidiostats/cides are a must
  - rumensin, bovatec, decox
- Acids - propionic, acetic, benzoic, citric

Feeding Management

- Nipple bottle or bucket
- Open pail
- Group - ad-lib feeding w/computer or gang feeder
  - acid preserved, high quality
  - sanitation
New Calf Feeding Program

- Accelerated or Intensive
- Normal Biological Growth vs Restricted Growth

<table>
<thead>
<tr>
<th>Species</th>
<th>Feed Conversion</th>
<th>lb Feed/lb Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf Programs</td>
<td>0.35-0.45</td>
<td>2.22-2.85</td>
</tr>
<tr>
<td>Lambs</td>
<td>0.69-0.73</td>
<td>1.37-1.44</td>
</tr>
<tr>
<td>Pigs</td>
<td>0.66-0.73</td>
<td>1.37-1.51</td>
</tr>
</tbody>
</table>

New Calf Feeding Program

<table>
<thead>
<tr>
<th></th>
<th>New</th>
<th>Current</th>
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</thead>
<tbody>
<tr>
<td>Milk, lbs DM</td>
<td>2.5</td>
<td>1.25</td>
</tr>
<tr>
<td>% Milk Protein</td>
<td>28</td>
<td>22</td>
</tr>
<tr>
<td>% Starter Protein</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>lbs Gain, 1-7 wk</td>
<td>74</td>
<td>40</td>
</tr>
<tr>
<td>lbs Powder, 1-7 wk</td>
<td>108</td>
<td>51</td>
</tr>
<tr>
<td>lbs Starter, 1-7 wk</td>
<td>28</td>
<td>48</td>
</tr>
<tr>
<td>Cost, 1-7 wk</td>
<td>124</td>
<td>54</td>
</tr>
</tbody>
</table>

Dry Feed Management

- High quality to encourage early weaning
- Why early weaning
  - Cheaper
  - Less labor
- Characteristics of high quality
  - Ingredients
  - Minimum dustiness
  - Taste good

Gain of Calves Fed Milk Only

Calf Starters

Recommended Nutrient Content (As-Fed)

- Crude Protein: 16 – 20%
- Crude Fiber: 10%
- TDN: 72 – 75%
- Ca: 0.4 – 0.7%
- P: 0.3 – 0.7%
- Vit A: 2000 IU/lb
- Vit D: 500 IU/lb

Coarse, bulky, minimum of dust
- Crimped oats, rolled barley, corn, SBM
- Molasses - 5 - 10%, Animal fat - 2%
- Antibiotics
- Coccidiostats
- Feeding - “Art”
  - Provide fresh by week one
  - Keep fresh and ad-lib
  - Fresh water
### Starter Intake

![Graph showing starter intake over the weeks]

### Dry Feed Management
- Hay for pre-weaned calves?
- Necessary for rumen development?
- Waste most of it?
- If you insist
- All in one starters - added fiber component

### Weaning – How and When?
- **How**
  - Feed a fixed amount of liquids from birth – approx 9 to 10% of BW
  - More fat in cooler weather
  - Plenty of fresh, clean, water
  - Quality starter, early, fresh
- **When**
  - When they are ready
  - Eating 1.5 -2.0 lb. of starter/day for 3 days

### The Transition Calf
- One stress at a time
- Weaning
  - Two weeks in same, individual housing
  - Adjust to no milk or abrupt cessation?
- Introduce forage
  - When calves are consuming 5 to 6 lb grain/day
  - Dairy quality alfalfa or excellent quality grass hay
  - Move to transition housing

### Housing – Calf Hutches
- Inexpensive compared to calf barn
- All in – All out
- Natural ventilation
- Less respiratory disease
- Spread of disease less – no calf to calf contact
- Disinfection
- Must have good base

### Housing – Calf Barn
- Individuals or Group pens
- Spread of disease can be a problem
- Difficult to disinfect
- Ventilation can be a problem
Health

- Diarrhea (scours) single largest health difficulty encountered
  - E. coli, rotovirus, coronavirus, salmonella, coccidia, cryptosporida
- Dehydration
  - Electrolytes replace milk (max 24 to 48 hrs)
- Vaccinations
  - If dam was properly vaccinated colostrum should contain Ig for diseases

Vaccinations

- IBR (Infectious Bovine Rhinotracheitis), BVD (Bovine Viral Diarrhea), PI3 (Parainfluenza Virus), BRSV (Bovine Respiratory Syncytial Virus)
- Respiratory disease
  - bacteria and viruses are causes
  - Poor ventilation, over-crowding, damp/cool weather, and toxic gases are predisposing factors

Coccidia

- Protozoa
- Clinical – diarrhea
  - Coccidiocide - deccox
- Subclinical – depressed growth
  - Coccidiostat – bovatec/rumensin

Cost of Raising Calves

- Labor
- Feed
- Variable
- Fixed

Success in Calf Rearing

- Dry Cow
- Calving Environment
- Colostrum Management
- Pre-weaned Calf Nutrition
- Early Weaning
- Transition Calf
Managing Heifers from Weaning to Calving

Patrick French

Post-Weaning Feeding

- Critical period for calves
  - Coccidiosis - bovatec, rumensin, deccox, amprolium (Corrid) in starter?
  - Stresses – diet and behavior
- Calf starter to 5 - 6 lb./day
  - Then supplement with good hay
- Shift to cheaper concentrate after 3 - 4 months
  - Balance to meet needs based on forages

Calf starter to 5 - 6 lb./day
- Then supplement with good hay
- Shift to cheaper concentrate after 3 - 4 months
- Balance to meet needs based on forages

Coccidiosis - bovatec, rumensin, deccox, amprolium (Corrid) in starter?
- Stresses – diet and behavior

Feeding the Heifer - 3 to 13 mo

- Rate of gain critical - Mammary development, age at breeding
  - Regulate rate of gain by controlling energy concentration - fiber concentration
  - Ad-lib forages?
  - Holstein - 1.5 - 2.0 lb. of gain/day
  - Jersey - 1 - 1.3 lb. of gain/day
  - Protein:Energy

Van Amburgh (1998)

- Three treatments - 1.3 / 1.75 / 2.0 lb. ADG
- Bred at 750 lb.

<table>
<thead>
<tr>
<th></th>
<th>1.25</th>
<th>1.75</th>
<th>2.00</th>
</tr>
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<tbody>
<tr>
<td>Prepubertal Gain</td>
<td>1.6</td>
<td>1.8</td>
<td>2.1</td>
</tr>
<tr>
<td>Age at Calving</td>
<td>24.2</td>
<td>22</td>
<td>21.0</td>
</tr>
<tr>
<td>Calving BW</td>
<td>1185</td>
<td>1161</td>
<td>1126</td>
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<table>
<thead>
<tr>
<th></th>
<th>Slow</th>
<th>Mod</th>
<th>Rapid</th>
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<tbody>
<tr>
<td>Calving BW</td>
<td>1210</td>
<td>1164</td>
<td>1144</td>
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<tr>
<td>BW Loss</td>
<td>117</td>
<td>121</td>
<td>134</td>
</tr>
<tr>
<td>BCS Nadir</td>
<td>2.5</td>
<td>2.3</td>
<td>2.6</td>
</tr>
<tr>
<td>305 FCM</td>
<td>19818</td>
<td>19382</td>
<td>18282</td>
</tr>
<tr>
<td>Days Open</td>
<td>152</td>
<td>154</td>
<td>147</td>
</tr>
</tbody>
</table>

Lammers et al. (1999)

- Two rates of gain (1.54 & 2.2 lb/day)
- Estrogen implants (Compudose)

<table>
<thead>
<tr>
<th></th>
<th>No Implant</th>
<th>Implant</th>
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<tr>
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<td>2.2</td>
</tr>
<tr>
<td>Calving BW, lb</td>
<td>1393</td>
<td>1366</td>
</tr>
<tr>
<td>Age at Calv, mo</td>
<td>22.9</td>
<td>22.8</td>
</tr>
<tr>
<td>Puberty, d</td>
<td>334</td>
<td>311</td>
</tr>
<tr>
<td>Puberty, wt</td>
<td>648</td>
<td>674</td>
</tr>
<tr>
<td>Milk Yield, lb</td>
<td>18602</td>
<td>17742</td>
</tr>
</tbody>
</table>
How Fast Should Heifers Grow?

- Target pregnant weight
  - 1,400 lb mature wt × 0.55 = 770 lb
- Target first calving age = 687 d (22.5 mo)
- Target age at first pregnancy
  - 687 – 280 = 407 d
- Target ADG before conception
  - \( \frac{(770 \text{ lb} - 90 \text{ lb})}{407 \text{ d}} = 1.7 \text{ lb/d} \)
- Target ADG after conception
  - \( \frac{(1,400 \text{ lb} \times 0.82 - 770 \text{ lb})}{280 \text{ d}} = 1.4 \text{ lb/d} \)

Heifer Groups and Feeding

- No. of groups depends on herd size and facilities.
- 5 groups suggested
  - Group 1 Postweaning
    - Starter and hay ----- Grower and hay
  - Groups 2 and 3 - grower and hay
    - Corn silage or hay, concentrate based on needs
    - Pre - breeding groups

Heifer Groups and Feeding

- Group 4 - Breeding age groups
  - silage, hay, grain
  - watch for heats
- Group 5 - Bred Heifers
  - Body condition and supplement
  - Poorest quality forage
  - Group springers with close-up dry cows.
  - More groups = better nutrition but more labor

Virginia Tech

500 lb. heifer / 1.8 lb. ADG

- Feed lb.
- Corn silage 15
- Grass hay 5
- Corn grain 3.5
- Soybean meal 1.0

- 13.6 lb. DMI
- 11.96% CP - 34%RUP
- 1.11 Mcal ME/lb.
- 41% NDF
- $0.63/day
- ME allowed gain - 2.0
- MP allowed gain - 2.4
- AA allowed gain - 2.0

Texas

500 lb. heifer / 1.8 lb. / day

- Feed lb.
- Cotton gin trash 1.6
- Rolled corn 2.8
- Distillers 1.0
- Cotton sweepings 0.8
- Alfalfa hay 2.2
- Wheat midds 3.6
- Cottonseed meal 0.8
- Sorghum Sil 2.8
- Milk products 4.0

- 12.85 lb. DMI
- 17.2% CP - 29.5% RUP
- 1.18 Mcal ME/lb.
- 35.9% NDF
- $0.635/day
- ME allowed gain - 2.0
- MP allowed gain - 2.4
- AA allowed gain - 2.0

Colorado

500 lb. heifer / 1.8 lb. / day

- Feed lb.
- Wheat Straw 3.2
- Wet Brewers 6.4
- Carrots 4.0
- Beet pulp 4.0
- Corn Screenings 2.4
- Alfalfa Silage 8.0

- 13.22 lb. DMI
- 11.2% CP - 45.4%RUP
- 1.03 Mcal ME/lb.
- 46.2% NDF
- $0.44/day
- ME allowed gain - 1.5
- MP allowed gain - 2.6
- AA allowed gain - 2.4
Forages for Heifers
- Allocate quality where it will be used the best
  - Highest quality for younger heifers
  - Older heifers must receive poorer quality!
    - Lowest nutritional priority?
    - 1st cut hays
    - Silage and byproduct feeds
- Formulate rations for heifers to adequately supplement forages used

Complete rations for heifers
- Every bite is a balance ration
- All ingredients in desired proportions
- Desire ad-lib intake
  - Limit intake through fiber levels
  - Max. intake at 21%ADF or 32 - 35% NDF
    - Do we want max. intake?
  - Fiber sources to limit intake
    - Poorer quality silage
    - Ground hay
    - Corn cobs, cottonseed hulls

Advantages of TMR’s for heifers
- Minimize feed competition
- Small meals
- Use by-product feeds
- Feeding labor?
- Feed waste?
Concerns
- Need mix wagon
- Heifer groups large enough to justify use of mix wagon

Summarize Management of Older Heifers
- Influence of environment on growth
  - Health
  - Mud
  - Housing type - Confinement vs. Open housing
    - 12 - 24% increase in feed efficiency - why?
    - DMI is higher
    - Housing transition - confinement to open housing
      - Lose body weight 1st 30 - 60 days.

Growth charts
- Need to routinely monitor growth?
  - Need facilities to do this
  - Gains 1.1 - 2.0 lb./day.
- Most variation between growth rates attributed to environment rather than feeding program
- Must adjust feeding according to growth
- http://www.das.psu.edu/dcn/calfmgmt/growth/docs/contents.html

Heifer Raising Costs

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Forages for Heifers

---

Complete rations for heifers

---

Advantages of TMR’s for heifers

---

Summarize Management of Older Heifers

---

Growth charts

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Heifer Raising Costs
<table>
<thead>
<tr>
<th>Health</th>
<th>Heifer summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccinations</td>
<td></td>
</tr>
<tr>
<td>Brucellosis</td>
<td>Wean at an early age - Goal of 6 weeks.</td>
</tr>
<tr>
<td>IBR (Infectious Bovine Rhinotracheitis)</td>
<td>Transition - Liquid/individual to dry/group</td>
</tr>
<tr>
<td>BVD (Bovine Viral Diarrhea)</td>
<td>Allocate forages use of low cost ingredients</td>
</tr>
<tr>
<td>PI3 (Parainfluenza Virus)</td>
<td>Goals to breed by 14 mo.</td>
</tr>
<tr>
<td>BRSV (Bovine Respiratory Syncytial Virus)</td>
<td>Calve at 24 mo. with good body condition.</td>
</tr>
<tr>
<td>Lepto</td>
<td></td>
</tr>
</tbody>
</table>