AN ABSTRACT OF THE THESIS OF

HEIDI RENATA BUEHNER for the degree of
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TITLE: WINTER SUPPLEMENTATION AND DELAYED WEANING OF AN AUTUMN CALVING REEF HERD UNDER WESTERN OREGON CONDITIONS.

Abstract Approved: ____________________________
Dale W. Weber

Two management systems were evaluated in terms of the effects on cow condition score and body weight changes and calf growth rates. The management systems evaluated were winter supplementation of energy, winter creep feeding and delayed weaning. The calves used in this study were born in September and October of 1981. The 48 cows and their calves were brought to a feedlot situation in December and allotted to four groups to allow controlled feeding of an energy or a non-energy supplement to the cows and a creep feed to the allotted calves. The cows receiving 3.64 kg rolled barley/head/day were not different in either body weight or condition score (1 to 5 condition score scale) from the cows fed a protein (non-energy) supplement which was fed at a level to provide the equivalent protein intake for all the cows. That is, there was no effect of the additional energy present in the rolled barley on the performance of the cows or their nursing calves. Creep
feeding had a significant effect on calf end weight (\(P=.001\)) and calf rate of gain (\(P=.001\)). The creep fed calves were on the average 12.95 kg heavier at the end of the trial and gained an average of 9.34 kg more than the calves not creep fed. Creep feeding, though, in today’s marketplace may not be a cost effective alternative for the commercial beef producer.

Delayed weaning (DW) significantly increased the ADG of calves between the ages of 196 to 266 days of age (\(P=.001\)). Steers gained significantly faster than the heifers during this period (\(P=.001\)). DW calves did not have a significantly higher ADG than the control (C) calves during the postweaning period (to yearling age), but the DW ADG from 196 days of age to yearling age was still significantly greater than the C calves (\(P=.001\)). Postruminal digestion of milk during the experimental period may be the reason for the additional gains by the DW calves.

Delayed weaning of fall born calves appears to be a sound management alternative under western Oregon conditions. Winter supplementation of cows and/or calves during the winter months did not realize significant changes in body weight and condition or the profitability of the sale of beef calves.
WINTER SUPPLEMENTATION AND DELAYED WEANING OF AN AUTUMN CALVING BEEF HERD UNDER WESTERN OREGON CONDITIONS

by

HEIDI RENATA BUEHNER

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Redacted for Privacy

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Redacted for Privacy

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Dean of Graduate School

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# TABLE OF CONTENTS

## CHAPTER I
**EFFECT OF WINTER SUPPLEMENTATION OF COWS AND CREEP FEEDING OF AUTUMN BORN BEEF CALVES**

<table>
<thead>
<tr>
<th>Summary</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Methods and Materials</td>
<td>11</td>
</tr>
<tr>
<td>Results</td>
<td>15</td>
</tr>
<tr>
<td>Discussion</td>
<td>19</td>
</tr>
</tbody>
</table>

## CHAPTER II
**EFFECT OF DELAY WEANING ON GROWTH RATE OF AUTUMN BORN BEEF CALVES**

<table>
<thead>
<tr>
<th>Summary</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>25</td>
</tr>
<tr>
<td>Methods and Materials</td>
<td>28</td>
</tr>
<tr>
<td>Results</td>
<td>30</td>
</tr>
<tr>
<td>Discussion</td>
<td>37</td>
</tr>
</tbody>
</table>

**LITERATURE CITED**

| 41 |

**APPENDIX**

**APPENDIX A - Condition Scoring**

**APPENDIX B - Forage Growth Curve for Western Oregon**

| Dryland Hill Pastures | 51 |
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Chapter I: Effect of Winter Supplementation of Cows and Creep Feeding Autumn born beef calves</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Adjusted Means for Condition Scores of Energy Supplemented Cows (Treatment) and the Non-Energy Supplemented (Control) Groups</td>
</tr>
<tr>
<td>1.2</td>
<td>Adjusted Means for Body Weight Changes of 1. Energy Supplemented Cow (Treatment) and Non-Energy Supplemented Cows (Control) and; 2. Creep Fed Calves (Treatment) and Non-Creep Fed Calves (Control) (kg)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table</th>
<th>Chapter II: Effect of Delay Weaning of Growth Rate of Autumn Born Beef Calves</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Characteristics of Treatment Groups on April 27</td>
</tr>
<tr>
<td>2.2</td>
<td>Adjusted Means of Average Daily Gain (kg) for Period 1 (April 27 to July 6)</td>
</tr>
<tr>
<td>2.3</td>
<td>Adjusted Means of Average Daily Gain (kg) for Period 2 (July 6 to October 9 - yearling age)</td>
</tr>
<tr>
<td>2.4</td>
<td>Adjusted Means of Average Daily Gain (kg) for the Overall Period (April 27 to October 9)</td>
</tr>
<tr>
<td>2.5</td>
<td>Adjusted Means for Cow Condition Score Change and Body Weight Gain in Relation to Delayed Weaning</td>
</tr>
</tbody>
</table>
EFFECT OF WINTER SUPPLEMENTATION OF COWS
AND CREEP FEEDING OF AUTUMN BORN CALVES

CHAPTER I

Summary

The effect of supplementing autumn or fall calving beef cows during the winter months with an energy supplement was evaluated. The energy supplement was rolled barley fed at 3.64 kg/head/day to the treatment group of cows. The feeding level was set to simulate what the commercial beef producer might use above and beyond the base ration of silage and/or hay. A low energy supplement was developed and fed at a level to equalize the protein intake of both groups of cows. The calves were also allotted into two groups to evaluate the effect of creep feeding. The 2x2 factorial of the feeding trial was a Completely Randomized Design with two types of treatments, the energy supplementation of the cows and the calf supplementation with respect to calf growth. The 48 cow-calf pairs were allocated to the four groups by balancing according to breed of dam, age of dam, age of calf and sex of calf. The objective of the study was to evaluate the condition score and body weight changes of the cows and the growth rate of the calves.

No significant differences were found in dam condition scores or body weight changes. Both groups of cows lost approximately 0.25 of a condition score unit (condition score based on a 1 to 5 scale). In addition, the cows gained 24.4 kg and 23.78 kg for the energy and non-energy supplemented groups, respectively. The percent Holstein and age of dam were consistent covariates in the analysis for condition score.
The nutritional level of the dam did not have an influence on calf performance. Creep feeding did significantly (P<.001) increase both rate of gain and final end weight of the calves. The creep fed calves were on average 12.95 kg heavier at the end of the trial than the calves not receiving the creep feed. This represented an increase of 8.2% in weight. The amount of gain during the experimental period for the creep fed calves was 72.65 kg and only 63.31 kg for the non-creep calves. This difference is an increase of 14.7% due to creep feeding.

The level of supplementation did not affect the performance of the cows or the calves during the winter months. The silage and hay were fed at levels that were adequate in energy to maintain the cows in lactation in western Oregon. Even though creep feeding significantly increased calf growth, the added cost of creep feeding in today’s market would most likely not be profitable.
Introduction

Maximizing efficiency is and always has been a goal of the beef cattle producer. In western Oregon, most dryland or irrigated pastures are a combination of tall fescue (*Festuca arundinaceae*), perennial ryegrass (*Lolium perenne*), and subterranean clover (*Trifolium subterraneum*). With the unique growth structure of these pastures in western Oregon (Appendix B), fall calving beef herds may be one means to maximize the efficiency of conversion of forage to kilograms meat produced per hectare. The annual forage production by these grasses and clovers in the Willamette Valley hill pastures range from 5000 to 9000 kilograms dry matter per hectare (Bedell, 1981). The production comes mainly from the end of April to mid June. Very little forage production occurs during the summer period from July to September. The spring growth is of very high quality considering percent crude protein, energy content, and digestibility. The crude protein levels of subterranean clover in April and May may range from 17 - 22% while the grasses may have 7-11%. These levels decrease to approximately 10% and 4-6% respectively by the end of June. *In vitro* digestibility of these forages also drops by the end of June to 30-45% from an April level of 54% to 61% (Sanders, 1965). The goal to receive maximum beef production would be to effectively utilize these high quality forages either by grazing or by preserving the spring forages by ensiling or hay making techniques.

Different management systems have been explored. Yearling beef cattle stocked at 6-7.5 head per hectare from mid-March to late June made higher weight gains per unit area as compared to spring cows with
calves or to ewes with lambs. In terms of production of meat per hectare in western Oregon, yearling cattle on ryegrass-subclover or tall fescue-clover pastures gained 560 kg/ha and 730 kg/ha, respectively (Bedell, 1981). Other work that included fall calves indicated that spring yearlings were less efficient than six month old calves in the utilization of spring forage (Gomm, 1979). After June, the quality of the forage drops below what is necessary for optimum gains of yearlings, lactating cows, and calves (Bedell, 1979). The crude protein levels are adequate for growth in all months except July, August, and September (Bedell, 1977).

The author conducted a survey (unpublished data) of the county extension agents of western Oregon as to the percentage of fall calving beef herds in each of their respective counties. The results showed that the percentage of beef herds fall calving ranged from 6% to greater than 90%. The southwestern Oregon counties were those areas having the highest level of fall calving beef units. Since Oregon beef producers fall calve, research has been proposed at Oregon State University to ascertain alternative management systems to maximize efficiency. The objective of this research was to examine these alternatives. Rosecrans (1981) studied one management alternative and found that twin fostering of calves did not affect reproductive performance of the fall calving cows, but the system required large amounts of supplemental feed inputs to maintain cow condition. The research reported here is the third year of a five-year research project to examine fall calving in western Oregon. Two projects were conducted: 1) Winter supplementation of cows
and/or calves; 2) Delayed weaning of calves greater than 200 days versus controlled normal weaning at 200 days of age.

Literature Review

With late August to October calving, cows are in their peak lactation during the winter when forage growth in western Oregon is minimal.

Cow Intake. The maintenance requirement of a lactating cow can be defined in terms of digestible energy where digestible energy is a function of body weight. One such equation is \( DE = 74.5 \cdot BW^{0.75} \) where \( BW \) = body weight of the cow (Maddox, 1965). Different energy and protein feeding levels during the winter have been explored at both above or below N.R.C. maintenance requirements (NRC, 1976). Feeding cows below the recommended level for maintenance has been shown to increase days to first estrus and decrease conception rates (Johnson et al., 1952; Wiltbank et al., 1962; McGinty and Frerichs, 1971; Deutscher and Whiteman, 1971; Whitmore et al., 1974; Holloway et al., 1975b; Cantrell et al., 1982; Wetteman et al., 1982; Ellis et al., 1983; Kropp et al., 1983; Rakestraw et al., 1984). Several studies have indicated that if lactating cows are at levels below maintenance they will lose body weight and condition at the expense of maintaining milk production (Anthony et al., 1961; Vaccaro and Dillard, 1966; Wilson et al., 1969; Deutscher and Whiteman, 1971; Kropp et al., 1973; Wyatt et al., 1977a; Lowman et al., 1978a; Lowman et al., 1979; Turner and Raleigh, 1981; Cantrell et al., 1982; Kropp et al., 1983; Somerville et al., 1983; Hancock, 1984). Beef cattle show a great deal of flexibility in their response to feed levels (Knapp and Black, 1941). According to Pinney
et al. (1972), "Beef cows can maintain a high level of reproductive performance even though deficient in energy as indicated by winter body weight loss." Rate of body live weight loss prior to and during the breeding season had more effect on fertility than absolute live weight (Somerville et al., 1979).

Energy deficient beef cows will attempt to maintain milk production at the expense of body reserves (Somerville, 1983). The body reserves that are lost are mainly composed of fat tissue (Wright and Russel, 1984). The fat is translocated to the udder for the formation of milk fat. Autumn calving cows can be fed below their energy requirements for maintenance and milk production with very little effect on milk yield, milk composition or calf performance (Stewart et al., 1972). Increasing or decreasing the plane of nutrition had little effect on milk yield and no effect on milk composition (Anthony et al., 1961). Lactating beef cows, by mobilizing body reserves, are able to supply a significant proportion of the energy requirements for milk production (Lowman, 1979). Feeding cows below their maintenance and lactation requirements does not always decrease total milk production as was once thought. In contrast, milk production of beef cows was little affected by difference in level of feeding (Anthony, 1961). By early spring when the fall calving cows are turned out on the spring pastures, they will have a compensatory increase in total daily production with the normal decline over the lactation period (Anthony et al., 1961; Furr and Nelson, 1964; Pinney et al., 1972; Wyatt et al., 1977a; Chesnutt, 1982).

Milk yield is significant to calf performance. In a study with Hereford cows and calves, milk yield outweighed all other environmental
and animal factors studied (age of dam, sex of calf, etc.) as the major determinant of growth rate (Jeffery et al., 1971). Calf gains and milk yield were highly correlated over the first four months of lactation and the correlation declined with each monthly period thereafter (Howes et al., 1958). Neville (1962) found the correlation greatest during the first sixty days of lactation. In both the short term and the long term, an increase in milk yield resulted in higher calf weights (Gleddie and Berg, 1968; Lowman et al., 1978a). Each additional pound of average daily milk production in Santa Gertrudis cattle resulted in a 14 pound increase in calf weight at 205 days of age (Wistrand and Riggs, 1968). Also a high correlation (0.78) exists between milk production and duration of lactation (Abadia and Brinks, 1972). Variations in milk composition have a relatively small effect on rate of growth when compared to total milk yield (Klett et al., 1965; Rutledge et al., 1971). Quantity not quality is the determinant in suckling calf performance.

**Genetics.** Since the cattle breeds at the Berry Creek Ranch Research facility included Holstein crossbreds, a discussion of the influence of dairy genetics in a beef herd is appropriate. Many researchers have looked at ways to increase total milk production since it is correlated with calf growth (Knapp and Black, 1941; Gifford, 1953; Howes et al., 1958; Drewry et al., 1959; Pope et al., 1963; Furr and Nelson, 1964; Totusek and Arnett, 1965; Klett et al., 1965; Melton et al., 1967a; Melton et al., 1967b; Gleddie and Berg, 1968; Pahnish et al., 1969; Todd and Fitzhugh, 1969; Drennan, 1971; Meiske et al., 1973; Wyatt et al., 1977a). Studies have examined such breeds as the Holstein, Brown Swiss,
Jersey and Simmental in either a straight bred situation or cross breeding with various established beef cattle breeds. When the milk production of Angus X Holstein cows was compared with British beef cows, the dairy X beef cows produced approximately 75% more milk than the straight bred British beef cows (Wilson et al., 1969). This dairy influence also increases the frame size of the dam and the ultimate weaning weights of the progeny (Pahnish et al., 1969; Cundiff, 1970; Deutscher and Whiteman, 1971; Wyatt et al., 1977a). For every 100 kilograms increase in cow weight, an additional 9.78 kilograms was recorded in calf weaning weight (Ewing et al., 1967). As the percent of Holstein breeding increased, the level of milk intake increased resulting in higher calf weaning weights (Wyatt et al., 1977b).

Regarding frame size of the progeny, one study reported a 7 pound increase in weaning weight per 100 pound increase of body weight of the dam (Neville, 1962). This increase in frame size and thus the body weight also increases the maintenance requirements of these cows. The high milk production also increases the quantity of nutrients required by the dairy and the dairy X beef cows (Schake and Riggs, 1972). If fed at the same levels as straight bred beef cows, dairy crossbreds will lose more weight and condition due to their larger body size and higher milk production. Holsteins lost significantly (P<0.01) more weight during the winter period in Oklahoma than did Herefords in the same herd (Kropp et al., 1973). More total feed is required for dairy crossbreds to maintain body condition especially during lactation (Kropp et al., 1973; Kronberg et al., 1983).
An examination of condition scores of dairy cross cows showed that they had a lower condition score as compared to beef breeds (Wyatt et al., 1977b). The failure of higher milking cows to maintain weight post partum may result in poorer subsequent performance (Johnson et al., 1952) since reproductive performance and milk production are closely associated with nutritional status (Bond and Wiltbank, 1970; Holloway et al., 1975a). In condition scores estimated by weight:height ratios, it appeared that the scores were related to pregnancy rate with non-pregnant cows being in poorer condition (Ellis et al., 1983).

Holstein X Angus cows in comparison with straight bred Angus produced more milk and heavier calves at adjusted 205 day weights, but these crossbred cows lost more weight and condition during their lactation and required a higher level of nutrition to rebreed and maintain body weight (Deutscher and Whiteman, 1971). The conclusion from the study was that dairy cross cows when managed under beef conditions resulted in poor reproductive efficiency (McGinty and Frerichs, 1971).

This poor reproductive efficiency was the result of Holsteins exhibiting a longer postpartum interval than beef breeds (Deutscher and Whiteman, 1971; Holloway et al., 1975a). The increase in postpartum interval to first estrus is longer with high milk yield and the conception rate is lower with the first estrus than at subsequent estrus periods (Whitmore et al, 1974). High milk yield results in lengthening the interval to first estrus (Johnson et al., 1952; Turman et al., 1965; Kropp et al., 1973; Rakestraw et al., 1984). In order to counteract this weight loss to avoid delay in estrus postpartum, additional forage is needed to be consumed by the dam. A study with Holstein, Holstein X
Hereford, and Herefords showed the crossbreds consumed 7 – 14% more forage and the Holsteins consumed 33 – 42% more forage than the straightbred Herefords (Holloway et al., 1975a). A study with Brown Swiss X Hereford and Herefords had similar results (McGinty, 1972). A 30 day flushing period at 125% of the NRC recommendations just prior to the start of the breeding season increased conception rate but did not affect the postpartum estrus interval (Loyacano et al., 1971). Supplemental feeding may not alleviate the long postpartum anestral period. But one must remember that there exists a negative correlation between cow efficiency and feed consumption (Davis et al., 1983b). Overconditioned cows are less efficient over their lifetime than cows of moderate body condition (Pinney et al., 1972; Davis et al., 1983a; Davis et al., 1983b). Since the goal of the beef producer is to produce kilograms of meat per hectare as efficiently as possible, cows with increased mature body size or excess body condition may not fit that goal of efficiency. Large frame cows with high milk production potential have an increased feed maintenance cost in order to produce calves and to rebreed during the desired time period. Therefore, dairy genetics in the beef herd may not be the answer to increased meat production to the beef producer.
Methods and Materials

The winter supplementation trial utilized 48 fall calving cow-calf pairs. One cow died from hardware disease (traumatic reticulopericarditis) and her calf was removed from the study. The cow-calf pair was replaced but the data from the new animals was not included in the analysis since the death of the cow occurred three weeks into the winter trial period. The dams were of five major breed types: Holstein X Angus, Holstein X Hereford, straightbred Hereford and Limousin X Hereford or Angus. The calves were sired by Hereford or Hereford X Angus bulls. The average age of the calves at the start of the trial was 65 ± 18 days. The groups are defined as follows:

Group 1: Cows-Energy, Calves-No Creep
Group 2: Cows-No Energy, Calves-No Creep
Group 3: Cows-No Energy, Calves-Creep
Group 4: Cows-Energy, Calves-Creep

The four groups of cow-calf pairs were created in which the pairs were balanced according to breed of dam, age of dam, age of calf, and sex of calf.

Ration Supplements. The energy supplement was chosen to simulate what the commercial producer in western Oregon would use to supplement fall calving beef cows being fed hay or silage. A Pacific coast rolled barley was selected due to its availability and cost. This rolled barley was fed at 3.64 kilograms per head per day to the cows in the energy groups. A low energy supplement was developed to supplement protein but not energy significantly. Since the rolled barley contained a low level of protein, a protein supplement was developed and fed to
the cows in the low energy groups so that the rations would be isonitrogenous. This pelleted protein supplement was composed of 159 kg feathermeal, 273 kg wheat, and 23 kg molasses and was fed at 0.9 kg per head per day. The crude protein levels were $8.8 \pm 0.35\%$ and $34 \pm 1.41\%$ for the rolled barley and the low energy protein supplement respectively. By feeding at the levels described above, the treatment difference was the amount of energy consumed by the cows on the rolled barley supplement. The bulk of the diet of all the cows was made up of a clover/grass silage and grass hay. The silage was fed at approximately 182 kg per day and 73 kg grass hay per day was fed to each group of twelve cows. Exact weights of the feed presented could not be obtained at the facility. Wastage of silage was estimated at 6% and hay at 33%.

To evaluate the performance of calves on a creep feed, a ration of 355 kg of ground barley, 77 kg soybean meal and 23 kg molasses was mixed and fed at the level of 0.9 kg per head per day to two of the four groups of calves. The trial was initiated on December 19, 1981 and continued to March 5, 1982 for a total of 75 days. All cows were synchronized with prostaglandin and bred by artificial insemination before the trial started. All calves received selenium and vitamin E injection\(^1\) at birth and the bull calves were implanted with zeranol\(^2\) at around one month of age and not reimplanted during the trial. All cows and calves were weighed and the cows were also condition scored

\[^{1}\text{Burns-Biotec Laboratories, Inc., Omaha, NE 68103.}\]
\[^{2}\text{IMC Chemical Group, Inc., Terra Haute, IN 47808.}\]
approximately every two weeks for a total of six measurements to monitor weight and condition changes. The condition score method utilized was developed by Kilkenny (1976) and is based on a 1 to 5 scale (Appendix A). The Kilkenny method was modified at this facility to an expanded system. This expansion added a "+" or a "-" sign with each number on the 1 to 5 scale. The scale was made to be a 1 to 15 scale to better evaluate the condition of various body types of cattle present in the study. The example below illustrates the number system.

<p>| | |</p>
<table>
<thead>
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</thead>
<tbody>
<tr>
<td>2-</td>
<td>1.66</td>
</tr>
<tr>
<td>2</td>
<td>2.00</td>
</tr>
<tr>
<td>2+</td>
<td>2.33</td>
</tr>
</tbody>
</table>

At each weighing, the four groups of cows and calves were rotated to a new pen in order to eliminate environmental effects of the feeding structures. Weights and condition scores at the beginning and end of the trial were done on two consecutive days and the data averaged to avoid weight differences due to rumen fill.

The objective of this study was to evaluate the effect of supplemental energy fed to postpartum fall calving beef cows in relation to condition score and body weight and to also study the effect of creep feeding fall born calves. An analysis of covariance was used to detect differences in body weight and condition score of the dams throughout the time period of the experiment. Calf weight gain was analyzed with regard to the dam nutritional level as well as the creep feeding. The covariates in the model included: percent Holstein, cow age, calf age,
cow beginning weight and calf beginning weight. The analysis of covariance procedure from the Number Cruncher Statistical System (NCSS) package (1984) was used for these analyses.
Results

The adjusted means of the six condition scores, average condition score and the change in condition score are listed in Table 1.1. No significant differences were found between either treatment group throughout the trial period. Both groups of cows had condition scores of less than a 3.00, indicating that the cows had less than an ideal (Condition score of 3.00) body condition score. The difference in the amount of body condition between the cows fed energy and those cows not fed energy was about the same at each measurement throughout the trial. Also, both groups lost condition through the trial period. All cows lost approximately one quarter of a condition score unit. The cows fed the energy supplement lost 0.28 units of condition while those cows not fed the energy supplement lost 0.30 units of condition.

The significant covariates for the cow condition score are as follows: percent Holstein in all condition scores, the average condition score and the change in condition score; cow age for condition scores of January 10 through March 5, the average condition score and the change in condition score; and the beginning score for the change in condition score.

The means for body weight and changes in body weight of both the cows and the calves are listed in Table 1.2. No significant differences were noted in the cow end weight and cow weight gain. Cows gained weight of 23.4 kg and 23.78 kg for the energy supplement group and the non-energy supplement group, respectively. The significant covariate for cow end weight was the age of cow and for the cow weight gain the covariates were cow beginning weight and calf age.
The adjusted means for calf end weight and calf weight gain are also listed in Table 1.2. Significant differences were seen in both calf end weight (P=.01) and calf weight gain (P=.001) due to the treatment effect of creep feeding. The calves receiving the creep feed were 12.95 kg heavier on average than the calves not receiving the creep, which is an increase of 8.2% in weight. The creep fed calves gained 72.65 kg while those calves without creep gained only 63.31 kg during the experiment. The difference in gain amounted to 9.34 kg or an increase of 14.7% with creep feeding.

The nutritional level of the dam did not influence calf performance. The energy supplement apparently was not fed at a level to affect the amount of milk produced by the dams.
TABLE 1.1

Winter Supplementation Trial.
The Adjusted Means of the Condition Scores of Energy Supplemented Cows (Treatment) and the Non-Energy Supplemented Cows (Control).

<table>
<thead>
<tr>
<th>Date of Condition Score Measurements</th>
<th>Treatment</th>
<th>SE</th>
<th>Control</th>
<th>SE</th>
<th>Significant Covariate</th>
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</thead>
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<tr>
<td>December 21, 1981</td>
<td>3.05</td>
<td>0.18</td>
<td>2.76</td>
<td>0.19</td>
<td>% Holstein</td>
</tr>
<tr>
<td>January 10, 1982</td>
<td>2.99</td>
<td>0.16</td>
<td>2.70</td>
<td>0.16</td>
<td>% Holstein Cow age</td>
</tr>
<tr>
<td>January 22, 1982</td>
<td>2.69</td>
<td>0.14</td>
<td>2.45</td>
<td>0.14</td>
<td>% Holstein Cow age</td>
</tr>
<tr>
<td>February 5, 1982</td>
<td>2.69</td>
<td>0.19</td>
<td>2.45</td>
<td>0.19</td>
<td>% Holstein Cow age</td>
</tr>
<tr>
<td>February 19, 1982</td>
<td>2.85</td>
<td>0.21</td>
<td>2.60</td>
<td>0.21</td>
<td>% Holstein Cow age</td>
</tr>
<tr>
<td>March 5, 1982</td>
<td>2.72</td>
<td>0.19</td>
<td>2.50</td>
<td>0.19</td>
<td>% Holstein Cow age</td>
</tr>
</tbody>
</table>

Condition Score Group Average

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th>SE</th>
<th>Control</th>
<th>SE</th>
<th>Significant Covariate</th>
</tr>
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<tbody>
<tr>
<td>Condition Score</td>
<td>2.77</td>
<td>0.16</td>
<td>2.58</td>
<td>0.17</td>
<td>% Holstein Cow age</td>
</tr>
<tr>
<td>Change in Condition</td>
<td>-0.28</td>
<td>0.14</td>
<td>-0.30</td>
<td>0.14</td>
<td>First Condition Score</td>
</tr>
<tr>
<td>Score Over Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>% Holstein</td>
</tr>
</tbody>
</table>

* No significant differences (Treatment vs. Control) were noted for the individual time period condition scores, the averages or the overall change in condition scores.
### TABLE 1.2

**Winter Supplementation Trial**

Adjusted Means for Body Weight Changes of:
1. Supplemented Cows (Treatment) and Non-Energy Supplemented Cows (Control) and;
2. Creep Fed Calves (Treatment) and Non-Creep Fed Calves (Control)

(in kg)

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th>SE</th>
<th>Control</th>
<th>SE</th>
<th>Significant Covariate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow end weight</td>
<td>534.9</td>
<td>3.6</td>
<td>519.4</td>
<td>3.7</td>
<td>Age of Cow</td>
</tr>
<tr>
<td>Cow weight gain</td>
<td>23.4</td>
<td>3.8</td>
<td>23.8</td>
<td>3.8</td>
<td>Cow Beginning Weight</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Calf age</td>
</tr>
<tr>
<td>Calf end weight</td>
<td>169.6a</td>
<td>1.3</td>
<td>156.6b</td>
<td>1.3</td>
<td>% Holstein Cow age</td>
</tr>
<tr>
<td>Calf weight gain</td>
<td>72.6c</td>
<td>1.3</td>
<td>63.3d</td>
<td>1.3</td>
<td>Calf Age</td>
</tr>
</tbody>
</table>

*ab* (adjusted means differ significantly at P=.01)

*cd* (adjusted means differ significantly at P=.001)
Discussion

Many feeding trials have been performed for evaluating the postpartum requirements of fall calving cows. Some have been designed to limit protein and others to achieve a certain body weight loss. The current study was to evaluate supplementing energy in relation to dam condition score and body weight change and calf performance.

The nutritional plane during lactation has been shown to have a significant effect on both condition score change and rate of body weight loss (Lowman et al., 1979). As the level of feeding increases, the winter weight losses and condition decrease (Wilson et al., 1969; Raleigh et al., 1970; Wyatt et al., 1977b; Hancock et al., 1983). A study using 2 kg per day of rolled barley as supplemental feed demonstrated a decreased liveweight loss and an increase in milk yield in both the short term and the long term (Lowman et al., 1978a). Cantrell et al. (1982) looked at three levels of winter feeding (low, moderate and high) and achieved a drop of one condition score in the low group with only a 3.8% loss in body weight. By weaning time, no differences in body condition were noted in the three groups.

In the current study, the effect of feeding supplemental energy had no significant effect in body weight loss or condition. Apparently, the level of silage and hay in the study was adequate to maintain the body weight and condition. According to Furr and Nelson (1959), large quantities of supplemental winter feed would be required to obtain differences in body weight. In a study using a protein or a protein plus energy supplement, the cows on the supplements weighed 6.8 - 10 kg lighter than those cows on hay alone (Turner and Raleigh, 1981).
Breed variation was a significant covariate for condition score. The Holstein genetics tended to lower the condition scores. This is in agreement with Wyatt et al. (1977b), where Holsteins had the lowest and Herefords the highest condition scores. Additionally, Holsteins have been reported to lose significantly more weight during the winter months than Herefords (Kropp et al., 1973).

In terms of body weight and condition, supplemental feeding in Western Oregon may not be necessary. With cows on a ryegrass/fescue/subclover silage or hay, the supplemental feeding did not affect the body weight loss or condition loss by the dams. Postpartum interval to estrus or conception rate was not examined by the author. Both groups of cows had acceptable condition scores at the end of the winter trial.

Davis et al. (1983a) reported that dams receiving low energy diets generally had lifetime efficiencies equal to or superior to those fed high energy diets. Dams on the high energy diets had greater salvage value but did not wean calves of sufficient additional size to offset their own increased ME intake.

The influence of the dam's nutritional level on the growth rate of the calf was not significant when extra energy was fed to the treatment cows. Other researchers have found similar results. Dunn et al. (1965) stated that the post calving DE level fed to cows did not affect the weight gains of the calves. A high energy winter diet of fall calving cows did not improve calf gains during the winter or eventual weaning weights, did not improve conception rates, calving interval, or prolapse incidence (Turner and Raleigh, 1981). Yet other workers have shown
there is an influence of the dam's nutritional level on calf performance. Calves born to heifers fed a low energy diet weighed less than calves from heifers fed a higher energy diet, even after creep feeding was considered (Bond and Wiltbank, 1970). In contrast, the percent calf crop born and weaned favored those cows receiving a low winter feed level over their lifetime (Pinney et al., 1972). Another report demonstrated that cows fed low energy diets produced 11.36 kg more calf per cow than those cows on high energy diets taking into consideration conception rates, calving intervals, calf losses and adjusted weaning weights (Turner and Raleigh, 1981). Much of the variation in the data above may be due to the environmental conditions, breed types and the types of forage and/or concentrate fed and the levels at which these feedstuffs were fed.

The last part of the study involved the effect of creep feeding on calf growth rate. Creep feeding had a significant effect on the rate of gain and the final weight of the calves. In a similar experiment by Furr and Nelson (1959), creep feeding fall born calves increased weaning weights by 23 to 39.5 kg. They concluded that neither creep feeding or high levels of winter supplementation to the cows was profitable. Turner and Raleigh (1981) had similar thoughts in stating that additional feed to fall calving cows during the winter was not beneficial and creep feeding would pay only in years of high calf prices. Since these fall calves are presented in the spring with abundant spring forage that is high in digestible protein, it would be logical to avoid the cost of creep feed and to take advantage of the
spring pastures for rapid calf growth. With current cattle prices today, efficiency of production is a necessity and the cost of creep feeding cannot usually be justified by the commercial beef producer.
Summary

The effect of calf age at weaning on growth rate of autumn or fall born beef calves was evaluated. By changing the date of weaning calves from late April to late June or early July, it may be possible to increase the ADG of fall calves while making more efficient utilization of the western Oregon forage growth that occurs during the spring months.

Forty-six fall born calves sired by Hereford or Hereford X Angus bulls with an average calving date of October 10, 1981 were used. Calves were allotted to two groups by balancing for sex of calf, cow age, calf age, cow breed type and previous feeding treatment. The control (C) group was weaned at a mean age of 196 days and the delay wean (DW) calves were weaned 70 days later. Sex of calf was also evaluated with respect to calf performance. The effect of delay weaning significantly increased the rate of gain during the 70 day period (P<.001). The delay wean calves had an adjusted mean ADG of 1.26 kg while the control group had an adjusted mean ADG of 0.89 kg. The steers gained significantly faster than the heifers (P<.001). No significant differences were noted in ADG from the delay wean date (266 days) to the yearling date (364 days) between the two groups. As an overall effect from 196 days of age to yearling age, delayed weaning still resulted in significantly greater rates of gain (P<.001) with the steers out gaining the heifers (P<.001).
The comparison of the growth rates in this study demonstrated the growth advantage of delayed weaning. This may possibly be due to postruminal digestion of milk increasing the total metabolizable energy and metabolizable protein intake of the calves grazing subclover/ryegrass/tall fescue pastures.

No effect of delayed weaning was observed on either body weight or condition score of the dams. Both cows with calves and without calves at their sides gained body weight and condition during the spring forage production season. All cows had acceptable body condition and weight prior to calving. Delayed weaning of fall born beef calves appears to increase the efficiency goals of the beef herd and therefore may be a viable management alternative for fall calving beef units of western Oregon.
Introduction

The traditional weaning date for most calves is around 200 days of age. For fall born calves, they would be weaned in early spring before the rapid growth of western Oregon improved pastures. A survey by Rosecrans in 1980 (unpublished data) revealed that all the managers interviewed weaned their fall born calves at no less than nine months of age. The time of weaning was based on forage quality and quantity instead of calf age. These managers believed that weaning at approximately nine months of age resulted in heavier calves at weaning and did not adversely affect the ability of the dams to rebreed in the subsequent season. Bedell (1977) also interviewed western Oregon cattle ranchers who fall calved, and these producers also weaned their calves at approximately nine months of age without reproductive difficulty in their dams.

The objective of this study was to evaluate the effects of weaning fall born calves at 270 to 300 days of age. The date of delay weaning was determined by forage growth, quality and availability. The first two years of the study concentrated on the growth of the calves during the spring forage season, the growth after weaning and on the final yearling weight. The third year of the study will continue to follow these guidelines and will also evaluate the effect of delayed weaning on dam weight and condition score.

Typical clover-grass pastures in western Oregon have rapid spring growth rates, but by early summer the growth rate declines dramatically (Sanders, 1965). Fall born calves are approximately 200 days of age before this rapid growth occurs. By this age, the rumen is fully
functional in herbage digestion and conversion to microbial cell protein and volatile fatty acids (Swanson and Harris, 1958). Fall calves are able to utilize this forage since few differences exist between the six-month-old calf and the adult rumen on hay/grain/silage diets (Lengeman and Allen, 1955). This increase in forage availability will also increase the milk production of a cow in late lactation even when the cow has been on a diet restricted in energy and protein (Le Du et al., 1976a). The increase in milk production plus the herbage quality may potentiate greater growth rates by calves left with their dams during the spring than those calves grazing alone. Calves on milk supplemented diets will restrict voluntary forage intake (Neville et al., 1952; Baker and Barker, 1972; Baker et al., 1976), but by the time calves reach approximately two hundred days of age, this forage intake depression by milk consumption is minimal (Wyatt et al., 1977a). Therefore, the total metabolizable energy and nitrogen intake is increased when a calf is suckling and grazing verses just grazing alone (Le Du and Baker, 1979).

Many techniques have been employed to decrease rumen degradation of ingested protein: heat and chemical treatment, encapsulation, amino acid analogues, selective manipulation of balances of rumen metabolic pathways and the esophageal groove (Chalupa, 1975). Of interest here is the esophageal groove which functions during suckling by closing down and directing milk from the esophagus past the rumen through the omasum to the abomasum (Schalk and Amadon, 1928). Milk is a highly digestible food which is high in energy and protein (National Research Council, 1976). Digestion of milk in the abomasum and absorption of nutrients
in the lower gut would provide the calf with high quality metabolizable protein (MP) and metabolizable energy (ME) to complement protein and energy derived from ruminal digestion of forage (Rosecrans, 1981) especially in regards to sulfur containing amino acids (Burroughs et al., 1975). By feeding a liquid suspension protein supplement as a suckle, or in the dry form, total nitrogen (N) retention can be increased by as much as 30% by suckling (Orskov and Fraser, 1969; Orskov et al., 1970). Casein infusion into the abomasum of steers also results in a similar increase in N retention (Johnson et al., 1978). Daily gains of lambs were approximately 2 times as great in lambs receiving abomasal infusions vs. those with per os pellets (Black and Tribe, 1973). Young ruminants of a given weight when growing rapidly near genetic potential cannot obtain enough MP solely from microbial N derived from rumen fermentation to meet the requirements to sustain high growth rate (Orskov, 1980; Burrough et al., 1973). Delayed weaning of fall born calves probably would allow the postruminal digestion of milk to complement synergistically the high quality forage of spring clover-grass pastures. The forage availability should also allow the dam to regain weight and condition lost in early lactation during the winter months.
Methods and Materials

The mean age of the 46 fall born calves sired by Hereford or Hereford X Angus bulls at the start of the trial (April 27, 1982) was 196 days. The mean calving date was October 10, 1981. Dams were of five major breed types: Holstein X Angus, Holstein X Hereford, straightbred Hereford and Limousin X Hereford or Angus. The winter feeding trial ended March 5 so the cows and calves had been grazing grass-clover pastures for 54 days as a single group. Weight of the calves were measured on April 26th and 27th and averaged. Calves were balanced into the two groups according to sex of calf, cow age, calf age, and cow breed type. The calves designated to be control weaned were removed from their dams on the 27th of April. Characteristics of the resultant treatment groups are listed in Table 2.1. Bull calves were castrated 2 weeks before the start of the trial.

Mean calf age at the start of the trial was 196 days which closely resembles the traditional 205 day weaning age. The DW date occurred on July 6, 1982, or 70 days after the C date. At the start of the trial, the intended DW date was to be 75 days after the C calves were weaned. However, since the DW date was to be determined by forage growth and availability, the decision was made to move the DW date earlier due to dry environmental conditions. The DW date should also take into consideration the dam weight and condition and the ADG of the DW calves relative to the ADG of the C calves. To monitor calf growth, cow weight and condition score (modified Kilkenny method, 1976), all the calves and cows were weighed and the cows condition scored at 14 day intervals.
The C and DW calves both grazed similar forages (ryegrass/tall fescue/subterranean clover pastures) throughout the trial. Pasture rotation was regulated by forage growth and availability. After the DW date, all the calves were combined to graze hay aftermath or pasture until yearling age. During this time period (95 days), all the calves were supplemented with 1 kg rolled Pacific coast barley/head/day.

An analysis of covariance was used to detect differences in ADG due to the treatment (DW vs. C) and sex of calf. The potential covariates included percent Holstein, cow age, age of calf, beginning calf weight, and previous treatment with creep feeding in the winter feeding trial.

The second part of the analysis was to evaluate cow weight and condition with respect to the effect of delay weaning. Cow weights and condition scores were analyzed during the following time periods: 1) delay wean period, 2) post delay wean period, and 3) overall time period. Cow weight and condition scores were averaged from April 26th and 27th data, July 6th and 7th data, and from August 24th and 25th data. The August date was chosen because the 1982 calving season was about to begin.

The objective was to evaluate change in weight and change in condition score of cows relative to the main effect of delayed weaning. One-way analysis of covariance was used to detect differences in the changes in the weights and condition scores due to the treatment (DW vs. C). The covariates in the analysis were percent Holstein, cow age, age of calf, and sex of calf.
Results

Table 2.1 illustrates the characteristics of the delay and control weaned groups. The adjusted means of ADG from April 27th to July 6th are listed in Table 2.2. A significant difference in ADG exists between the DW and C wean calves (P<.001) and between the steers and the heifers (P<.001). Delayed weaning increased ADG of calves by 42%. Steers grew 17% faster than heifers during this period. The treatment by sex interaction effect on ADG was not significant in this period (P=0.54). None of the covariates in the model were found to be significant.

The adjusted means of ADG of the post DW period (July 6th to October 9th) illustrated that DW calves did not grow at a rate significantly different than the C calves (P=.29) (Table 2.3). Sex of calf was also not significant in relation to ADG (P=.06). No treatment by sex interaction effect on ADG was seen (P=.20). None of the covariates in the model were significant.

The adjusted means of the ADG for the overall period from April 27th to October 9th are presented in Table 2.4. A significant difference still exists between DW and C ADG adjusted means and the steer vs. heifer ADG adjusted means. The DW calves grew 28% faster than C calves. Steers grew 19% faster than the heifers. The effect of DW was more pronounced in steers than heifers with increases in ADG of 31% and 23% respectively. The delayed weaning by calf sex interaction effect on ADG overall was not considered significant (P=.15). No covariate of significance in the total period was seen.

Cow condition score and weight changes during the delay wean period (April 27th to July 6th) were evaluated. No treatment effect of delayed
weaning was measured in either condition score change (P=.28) or body weight change (P=.19). Similar results were obtained for period 2 (July 6th to October 9th) with significance levels for condition score change and body weight change at P=.59 and P=.52 respectively. Overall, no significant differences were noted with condition score change (P=.25) and body weight change (P=.57) of the cows due to delayed weaning. It was evident that the period with the largest condition and body weight changes was period 1. The cows gained both condition and body weight during the spring months. Period 2 showed little condition score and body weight changes. In the model, the covariates included percent Holstein, cow age, calf age, calf sex, and cow beginning weight for each appropriate time period. Interestingly, only the percent Holstein had a significant effect on condition score change and body weight change. The raw data illustrated that the animals with Holstein blood had lower body condition scores than those animals with more beef breeding. With condition score change in period 1., percent Holstein was only slightly significant (P=.03) as a covariate. The result for period 2 at (P=.52) shows percent Holstein as not a significant covariate. With body weight change, percent Holstein was not significant as a covariate within the first period (P=.09) or the second period (P=.25), but percent Holstein was significant as a covariate in the overall period (P=.01) for body weight change.
### TABLE 2.1
Characteristics of Treatment Groups on April 27

<table>
<thead>
<tr>
<th>Item</th>
<th>Delay Wean</th>
<th>Control Wean</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Heifers</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Steers</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Winter feed treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creep</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>No Creep</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Age, days</td>
<td>196 ± 3.8</td>
<td>196 ± 3.3</td>
</tr>
<tr>
<td>Mean weight of calves, kg</td>
<td>190.2</td>
<td>191.2</td>
</tr>
<tr>
<td>Mean age of dam, years</td>
<td>4.2 ± 1.6</td>
<td>4.2 ± 2.2</td>
</tr>
</tbody>
</table>
TABLE 2.2

Adjusted Means of Average Daily Gain (kg) for Period 1 (April 27th to July 6th)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Steers</th>
<th>SE</th>
<th>Heifers</th>
<th>SE</th>
<th>Treatment Means</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay wean</td>
<td>1.36</td>
<td>.03</td>
<td>1.17</td>
<td>.03</td>
<td>1.26&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.02</td>
</tr>
<tr>
<td>Control wean</td>
<td>0.96</td>
<td>.03</td>
<td>0.82</td>
<td>.03</td>
<td>0.89&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.02</td>
</tr>
<tr>
<td>Treatment Means</td>
<td>1.16&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.03</td>
<td>0.99&lt;sup&gt;d&lt;/sup&gt;</td>
<td>.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>ab</sup> (means differ significantly at P<.001)
<sup>cd</sup> (means differ significantly at P<.001)
## TABLE 2.3

Adjusted Means of Average Daily Gain (kg) for Period 2 (July 6th to October 9th - yearling age)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Steers</th>
<th>SE</th>
<th>Heifers</th>
<th>SE</th>
<th>Treatment Means</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay wean</td>
<td>0.35</td>
<td>.03</td>
<td>0.25</td>
<td>.03</td>
<td>0.30</td>
<td>.02</td>
</tr>
<tr>
<td>Control wean</td>
<td>0.35</td>
<td>.03</td>
<td>0.32</td>
<td>.03</td>
<td>0.33</td>
<td>.02</td>
</tr>
<tr>
<td>Treatment Means</td>
<td>0.35</td>
<td>.02</td>
<td>0.28</td>
<td>.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*all non-significant differences between treatment means and interaction means*
TABLE 2.4

Adjusted Means of Average Daily Gain (kg) for the overall period (April 27th to October 9th)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Steers</th>
<th>SE</th>
<th>Heifers</th>
<th>SE</th>
<th>Treatment Means</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay wean</td>
<td>0.80</td>
<td>.02</td>
<td>0.65</td>
<td>.02</td>
<td>0.73^c</td>
<td>.01</td>
</tr>
<tr>
<td>Control wean</td>
<td>0.61</td>
<td>.02</td>
<td>0.53</td>
<td>.02</td>
<td>0.57^d</td>
<td>.02</td>
</tr>
<tr>
<td>Treatment</td>
<td>0.70^a</td>
<td>.02</td>
<td>0.59^b</td>
<td>.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^ab (means differ significantly at P<.001)
^cd (means differ significantly at P<.001)
TABLE 2.5

Adjusted Means of Cow Condition Score Change and Body Weight Gain in Relation to Delayed Weaning

<table>
<thead>
<tr>
<th>Condition Score Change</th>
<th>SE</th>
<th>Body Weight Change (kg)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Period 1 (April 27th to July 6th)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay Wean</td>
<td>0.75</td>
<td>0.13</td>
<td>113.5</td>
</tr>
<tr>
<td>Control Wean</td>
<td>0.95</td>
<td>0.13</td>
<td>122.6</td>
</tr>
</tbody>
</table>

| **Period 2 (July 6th to October 9th)** |     |                         |     |
| Delay Wean             | 0.17| 0.09                    | 14.3 | 3.3 |
| Control Wean           | 0.22| 0.09                    | 11.9 | 3.0 |

| **Period 3 (April 27th to October 9th)** |     |                         |     |
| Delay Wean             | 0.95| 0.13                    | 131.2| 5.2 |
| Control Wean           | 1.17| 0.12                    | 134.4| 4.8 |

* No significant differences were noted with respect to either condition score change or body weight gain.
Discussion

Delayed weaning of fall born calves under western Oregon range conditions increased the ADG of calves between the age of 196 to 266 days ($P<.001$) versus weaning at 200 days of age. Steers gained at a higher rate than heifers ($P<.001$) during this period. Work by Rosecrans (1981) at the same research facility resulted in similar data in which delayed weaning of calves from 200 to 291 days of age significantly increased the ADG from 0.85 to 1.23 kg ($P<.001$). In addition, steers gained at a greater rate than heifers in both treatments ($P=.02$).

An increase in ADG was not reported by Powell (1975) with delayed weaning of fall born calves. However, studies in Oklahoma with fall calving cows showed calves weaned at 285 days weighed 30 kg more than calves weaned at 210 days. The following year, these delayed wean calves were 29 kg heavier than their counterparts. Further work indicated that by weaning and selling calves at 9-10 months of age rather than at 7 months, an additional 90.45 kg of selling weight resulted. The economic difference at 1984 market prices was an additional $42.24 for calves weaned at 285 days of age versus calves weaned and run as stockers for 75 days (Hancock et al., 1984). When grazing cornstalks, delayed weaning still increased ADG from 0.26 to 0.59 kg (Volyles et al., 1983). Cows, however, lost 15 kg when their calves remained at their sides in comparison to the weaned cows which gained 15 kg during the same time period (Volyles et al., 1983). Another study examined delayed weaning and found an added 0.45 kg per day gain with the resultant increase in revenue of $47/calf (Kropp et al., 1983). Lowman et al. (1978b) also found an increase in ADG by
delayed weaning of calves. Calves weaned in late April gained 0.8 kg per day over the 150 day period compared to 0.95 kg per day when calves were left with their dams and weaned 100 days later. Another report with Angus X Holstein calves that were weaned in July demonstrated that these calves gained 28.9 kg more than those weaned in March. This increase in calf weight with delayed weaning resulted in reduced cow weights in August and September of 22.3 kg (Chesnutt, 1982). Perk and Turner (1979) also experienced more condition loss with delayed weaning. In Oklahoma work with the weaning of calves at 285 days of age produced dams that were lighter in weight and thinner in condition at 285 days postpartum than cows that weaned calves at 210 days. These researchers noted that the delayed weaned cows had body weight and condition that were still acceptable (Hancock et al., 1984). Data presented in this paper did not indicate a drop in either body condition or weight with delayed weaning and no significant differences were seen in body weight or condition score between the delay weaned and the control cows in any of the time periods. Both groups had acceptable body condition and weight prior to calving. These results are in agreement with Kropp et al. (1983) with calves weaned at 285 days of age. Associated with warm season grass growth during the spring months, the cows were able to regain weight and condition lost during the previous winter months. The cows with the lower condition score tended to regain more body condition than the cows already carrying adequate condition. The greater the winter loss of weight, the greater the summer weight gains (Kropp et al., 1973). Cantrell et al. (1972) stated that delayed weaning fall calves until 9-10 months of age to utilize
summer forage appears to be an advantage regardless of the postpartum nutrition of the cow.

The grass growth peak in western Oregon is well utilized by fall born calves. By 4-5 months of age, grazing and traveling activities of calves are similar to their dams (Dwyer, 1961). These calves do not exhibit a depression of growth rate while grazing in competition with their dams until 10 months of age (Bailey and Bishop, 1972). By 10 months of age, the fall calves are weaned from their dam in western Oregon due to the decrease in forage growth.

The increase in calf growth rate is well documented but the levels of the increase differ with each report. One must consider the different environmental and management conditions as well as the dam breed composition in relation to the expected lactation length and total yield. One must also consider the growth potential of the calf in its own ability to utilize the nutrients for growth. Because of these factors, the amount of increase in growth rate is difficult to predict.

The forage production in certain years may limit potential growth of calves, but by delayed weaning the drop in ADG may be held to a minimum.

Delayed weaning allows milk to bypass the reticulo-rumen via the esophageal groove (Riek, 1954). Milk intake has been demonstrated to increase total ME intake of grazing calves (LeDu and Baker, 1979). Postrumininal digestion of milk with increased ME and MP intake was thought by Rosecrans (1981) to be the factor involved in the growth response with delayed weaning. Larger and fatter calves at weaning are worth more and have been shown to be better capable of continuous
skeletal growth on a low plane of nutrition due to available body fat for growth (Holloway and Butts, 1983). Christian et al. (1965) reported that ADG in postweaning feeding period was found to increase significantly with weaning weight. Delayed weaning calves allows for heavier weaning weights for better performance in the post weaning period.

The spring weaned fall calves, once in the feedlot, would probably exhibit compensatory growth. Compensatory growth in cattle does require additional time to reach slaughter weight but is more efficient in protein and energy conversion during the entire feeding period (Fox et al., 1972).

Delayed weaning fall born calves under western Oregon conditions is a management tool that nutritionally improves the growth rate of calves without long-term detrimental effects to the dam in terms of body weight or condition. The utilization of spring forage is also increased with the result that delayed weaning allows for better efficiency in beef production for fall born calves in western Oregon.


Sanders, K.D. 1965. The Seasonal Yield, Quality and Utilization of Trifolium Subterraneum in Mixture with Festuca arundinacea and Lolium perenne in Western Oregon. MS Thesis. Oregon State University, Corvallis, Oregon.


APPENDIX
CONDITION SCORING

BODY CONDITION IS SCORED FROM 1 (VERY THIN) TO 5 (VERY FAT).

1 - SPINE PROMINENT AND THE TRANSVERSE PROCESSES FEEL SHARP TO THE TOUCH WITH NO DETECTABLE FAT COVER.

2 - THE TRANSVERSE PROCESSES CAN STILL BE FELT WITH THE THUMB BUT THEY ARE ROUNDED WITH A THIN COVERING OF FAT.

3 - INDIVIDUAL TRANSVERSE PROCESSES CAN NOW ONLY BE FELT WITH FIRM PRESSURE FROM THE THUMB.

4 - THE TRANSVERSE PROCESSES CANNOT NOW BE FELT EVEN WITH FIRM PRESSURE.

5 - TRANSVERSE PROCESSES CANNOT BE FELT AND ARE OBVIOUSLY COVERED WITH A VERY THICK LAYER OF FAT.
Fig. 1. Condition scoring method

- fat cover
- hide
- eye muscle
- transverse process
- back bone
Figure 1. Forage growth curve for western Oregon dryland hill pastures.