WINTERING COWS ON GROUND MESQUITE

by

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IN

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CHAPTER I

INTRODUCTION

For many years the control of mesquite (Prosopis juliflora) has been a big problem on many farms and ranches throughout the southwestern United States. The infestation of mesquite has been brought about by heavy grazing and drought. Mesquite infests about 70 million acres of grassland in the United States (Marion, et al., 1952). Feeding mesquite to cows during drought and times when the price of other roughage is too high, the rancher might save enough money to pay for having it cut out and cleared off the land.

There is general agreement today among persons concerned with food production that unless world supplies can be very substantially increased to keep pace with the rapid rise in population, a hunger crisis is inevitable. With only 8 percent of the world's land surface well suited to arable agriculture, the problems facing the massive extension of conventional farming are immense. As population and demand for food products grows we need to look to new sources of supply for livestock feeds. Wood and wood products are in broad supply, thus, there is an available energy potential for livestock if the wood can be digested.

CHAPTER II

REVIEW OF LITERATURE

Recent attention has been given to the feeding of poultry litter to ruminants. The primary purpose of this practice is to provide a nitrogen source from the feces and urine in the litter. Thus, the litter functions as a protein supplement. Poultry litter has been successfully used as the protein supplement for ewes (Noland et al., 1955) and fattening steers (Fontenot et al., 1963). Bhattacharya and Fontenot (1965) showed that the nitrogen in broiler litter was used efficiently by sheep fed semi-purified rations with 25 or 50 percent of the total dietary nitrogen supplied by litter. Bhattacharya and Fontenot (1966) ran digestion and metabolism studies comparing wood shavings and peanut hull poultry litter fed to wethers at 25 and 50 percent levels. There was no difference in digestibility between the two types of litter. When the percent of litter was increased the digestibility of non-protein components declined.

Wood pulp has been used in rations as a roughage substitute. American workers (Titus, 1926; Mead and Cross, 1935; Byers et al., 1957; Ellis and Pfander, 1958; Matrone et al., 1957; Smith et al., 1957; Williams et al., 1958) have previously used wood pulp as a substitute for roughage in the development of purified diets for

ruminants. These diets have been used for studying requirements of various trace minerals found in abundance in roughages. Wood pulp was fed extensively as a substitute farm feeding stuff in Norway during the war years (Edin et al. 1941; Hvidsten, 1946). Rook and Campling (1959) ran an experiment in which they looked at palatability and general effects, effect on rumen functions, metabolism, and microflora, and digestibility of rations containing molasses soaked wood pulp as a substitute for farm roughages. In certain of the diets a complete replacement of farm roughages by wood pulp was achieved. This appears to be the first recorded instance of milking cows having been maintained satisfactorily on rations containing wood pulp as the sole source of roughage. The bacteria count was a little lower than on the usual farm ration. There was a threefold to fourfold increase in cellulolytic activity. The digestibility of crude fiber in all instances was very high in wood pulp rations. The only abnormal effect noted from using high proportions of wood pulp in the ration was a decrease in the time spent by an animal in rumination. It was hypothesized that this resulted from the complete lack of "fibrousness" of the material.

Kelser et al. (1967) fed a dry molasses product using waste paper as an absorbent base. The paper absorbed approximately three times its weight of molasses, and upon drying made a stable and friable product that was palatable and acceptable in the diet of lactating cows.

Smith (1961) fed wood shavings to very young cattle to test the effect on rumen development. The calves fed the wood shavings had a much larger increase in volume of rumen fluid after a few weeks than those receiving only milk. This was thought to be due mainly to an increase in saliva production. There was no great advantage as to the total tissue weight or development of the papillae. Smith (1961) in another experiment found that the ingestion of wood shavings by milk fed calves interfered in some way with magnesium and calcium utilization.

Marion et al. (1957) fed steers a ration containing 7.20 pounds of ground mesquite wood. The steers gained 2.20 pounds per head daily in a 140 day feeding trial. Similar steers fed cottonseed hulls instead of the mesquite meal gained 2.29 pounds per head daily. The steers fed the mesquite meal made a higher net return based on a price of $10 per ton for ground wood and $18 per ton for cottonseed hulls. This experiment was followed by a trial feeding yearling steers a ration containing 12.23 pounds ground mesquite wood per head daily in a 112 day trial. They made an average daily gain of 2.54 pounds compared to 2.71 pounds for steers fed a silage ration. The mesquite fed steers had a 32¢ per head marketing advantage over the silage group. A chemical analysis showed that the mesquite meal had a highter protein, fiber, and calcium content. Carotene was also found, which is either not present or present in a very small quantity in many dry roughages.

A man named Doolin (anonymous, 1956) reportedly fed mesquite wood to his cattle. However, examination of his trials indicates that 45 percent of the ration was molasses, grain, and meal. Since cattle can be maintained on eight to ten pounds of concentrate, it is possible that he was really maintaining the cattle on the concentrate.

CHAPTER III

MATERIALS AND METHODS

The mesquite was collected from a field with six years regrowth. The regrowth trees were cut with a hand axe. The material was dried, and then run through a grinder consisting of knives and hammers and a 3/8 inch screen.

This experiment was conducted as a pilot study to observe trends and possibilities for further experimentation. There was no control group. The only control was death.

Five pregnant crossbred cows were selected from a herd on pasture. They were put in a lot and gradually adjusted to the mesquite ration. The beginning ration consisted of nine pounds of concentrate (dry rolled milo with a vitamin-mineral supplement), one pound of mesquite, and one pound of black strap molasses per head per day. The one pound of molasses was diluted with approximately ten parts of water to thoroughly moisten the material, reduce the dust and increase palatability. The animals were fed twice daily. The mesquite was increased one pound daily until the animals were consuming a daily ration of one and one half pounds of concentrate (1/3 milo, 1/3 cottonseed meal, 1/3 vitamin-mineral premix), one pound of molasses plus ten parts of water, and all the mesquite they would clean up. The daily consumption of mesquite was usually between

14 and 16 pounds per head per day. The supplement was fortified to provide the minimum daily requirement for vitamins and minerals. The workers at Spur (Marion et al. 1957) found that vitamin A deficiency did not occur on rations including mesquite, but did occur on rations using cottonseed hulls. This indicates that there is available vitamin A in the wood.

Ellis (1966) hypothesized that cellulose digestion would be greatly increased if it would be possible to transfer microorganisms from the hindgut or proctodaeum of the termite to the bovine rumen. If the organisms survived this would further facilitate the feasibility of feeding wood or wood products. Wood is the primary component of the termite diet. The organisms (mostly protozoa) which break down the wood inside the termite represent the most efficient cellulose utilization in nature. Durham (1966) further hypothesized that microorganisms from deer rumina might increase the digestibility of the wood. Deer apparently can utilize some wood as evidenced by the damage they do to trees and fence posts.

Termites could not be procured at the time because it was the dormant season. Three weeks prior to the start of this experiment, material from the rumina of white-tailed deer was placed into the rumina of two fistulated steers which were on the mesquite ration. When the cows were well on feed, boluses from the steer rumina were collected and deposited into the rumina of the cows. Durham et al. (1966) presented results which showed some advantages in the use of this technique.

Two of the cows died early in the trial. The three remaining experimental animals were fed the mesquite in the lots from December 20th to May 1st. Cow number 512 was left on until May 10 so that a fifty day weight could be taken of her calf. They were weighed approximately every 30 days. Shortly after calving, the cows began losing weight rapidly. It was apparent that they were not on a high enough nutritional plane to support milk production. The concentrate allowance was then raised to five pounds per head per day. Birth-weights and subsequent periodic weights were taken on the calves up to 50 days of age in the lot. (The cows and calves were then put back with the herd, which was fed silage for the next 30 days). The herd was then transfered to a dryland pasture consisting of range grasses and weeds. During the next three months grazing was alternated between this pasture and a dryland forage sorghum pasture. Cow and calf weights were taken throughout the summer.

On August 21st, after four months off mesquite the three cows were returned to the lot and again placed on mesquite and supplement. The animals were not inoculated. Initial weight loss was severe. They showed some phosphorous deficiency symptoms. It was therefore decided to add 12 percent more "polyphos" to the concentrate portion of the ration. Vitamin A_{30} was also increased to 16 percent. The total test period on mesquite this time was 116 days after which they were put back with the herd on wheat pasture. They received a little silage from time to time when the ground was snow covered and once

when they wandered down to an old abandoned silage pit. Weights were taken on the wheat pasture up to 96 days.

CHAPTER IV

RESULTS AND DISCUSSION

The first cow to calve became ill disposed and went off feed shortly before calving. She had a healthy calf, but soon became very weak and died six days following parturition. Post mortem examination revealed adhesions of omentum to the lateral abdominal wall. The reticulum was adhered to the diaphragm. The rumen was nearly empty and the abomasum was packed with ingested mesquite. It is not known if this was a result of the ration. The examining veterinarian suggested that it could have been caused by a displaced abomasum. Another cow became ill disposed and went off feed shortly before she was supposed to calve. She died shortly after the dead calf was removed with an episiotomy and traction. The death did not appear to be related to the ration.

The data show that cows 512 and 641 gained 26 and one pound, respectively, prior to parturition. Cow number 581 lost 20 pounds prior to parturition. Although the cows essentially maintained the original gross weight, they were actually losing some of their own body weight during the latter stages of gestation when the developing fetii were growing rapidly. Such weight loss is recognized as normal for cows being wintered on the range. As seen in table 1, cow number 512 lost 194 pounds from start to termination of the period on mesquite. Cow number 641 lost 252 pounds. Cow number 581 lost 251

pounds. This includes parturition loss. It became evident after parturition that the cows were not receiving enough nutritional value from the ration to support both maintenance and milk production. They became severely emaciated. A decision was therefore made to increase the daily concentrate allowance to five pounds per head.

TABLE 1

COW PERFORMANCE

Trial 1

Cow Number	Av. Gain Up To Parturition (lbs.)	Total Loss On Mesquite (lbs.)	Av. Daily Gain On Grass (lbs.)
512	26	194	1.58
641	1	252	2.14
581	-20	251	1.85

Trial 2

Cow Number	Total Loss For Mesquite Period (lbs.)	Av. Daily Gain On Wheat Pasture (lbs.)
512	181	3.64
641	134	3.37
581	184	3.89

The cows averaged 192.66 pounds gained during the summer period on grass (see table 1). Number 512 was kept in the lot ten days longer than the other two so that a 50 day weight could be taken on her calf. She was in a very depleted condition when placed with the herd and gained the least amount of recovery weight. However, during the last half of the summer grazing period, she outgained the other two cows.

The performance of her calf paralleled her own. It made most of its weight gaining during the last half of the period.

Calf number 867 gained 50 pounds during the fifty days in the lot. Number 825 gained 97 pounds. Number 836 gained 29 pounds. It might be pointed out that number 836's mother, 641, had the least amount of dairy breeding, and was understandably the poorest milker. It is surprising that calf number 825, a heifer, outperformed the two bulls both in the lot and on grass.

TABLE 2

CALF PERFORMANCE

Calf No.	Mother's No.	Birthweight (lbs.)	Av. Daily Gain For 50 Days (lbs.)	Av. Daily Gain On Grass (lbs.)
867(B)	512	85	1.0	2.12
836(B)	641	89	.6	2.62
825(H)	581	58	1.94	4.10

There was some further weight loss in the cows even after the increased concentrate allowance after parturition. The data indicate that the ration containing mesquite was reasonably adequate for maintenance. The sharp weight loss post parturition suggests that the wood was inadequate as a major component of the ration for suckling cows. This is a good illustration of how much more the nutritional requirements are for lactation than for gestation.

The reasoning behind the second trial was that since the trial

would be carried on during the dry period, the severe weight loss could be avoided. It did not, however, turn out that way. The cattle began losing weight rapidly. There was an immediate response to the added phosphorous. They gained as much as two pounds a day for awhile, then began to taper off and started losing weight again. Total weight losses for the 116 days were: number 581, 184 pounds; number 512, 181 pounds; and number 641, 134 pounds (see table 1). The animals were not inoculated before trial 2. This could help explain the drastic differences between trial 1 and trial 2. The consumption was essentially the same in both trials. The recovery gains were much greater for trial 2 than trial 1. The average gain was 349.00 pounds compared to 192.66 in the first trial. A good portion of this difference naturally was due to the growing feti.

Chemical analysis of the mesquite (see table 3) yielded a higher percent protein and ash then reported by Marion et al. (1957). The difference probably is affected by the time of year when the mesquite was cut. Consumption tended to decline somewhat toward spring as the trees began to leaf out. This could be due to some unpalatable component in the leaf or sap.

If a rancher wanted to feed this ration to his cows, 90 to 120 days would be recommended as a maximum time. Anything over 120 days could lead to severe nutritional complications. The mesquite can be shredded in the field with a special machine for $2.50 per acre. Assuming a yield of six tons of wood per acre it would cost $.417 per

ton of mesquite. Marion et al. (1957) reported yields of six to ten tons per acre at Spur, Texas, in dense thickets of second-growth brush. The total cost of the ration for ninety days figuring the concentrate at $.03 per pound, the molasses at $.02 per pound, the cost of grinding at $4 per ton, and the labor at $.40 per 100 pounds fed, and including the cost of shredding, would be $13.33 per head. Assuming a 200 head cow herd, the cost would be $2,666.00.

TABLE 3

MESQUITE ANALYSIS

Date	% Protein	% Ash	Gross Energy (cal/gm.)	% P	% Ca	% DM
12/15/67	10.85	5.3	4,240.5	.15	.12	95.1
3/12/68	7.28	5.0	4,184.0	.12	.11	89.4

It is not believed that the ration interfered with the reproduction process as all the calves were born healthy except for one that had to be removed by the episiotomy. This brings to mind a possibility of buying a load of bred cows, putting them on the mesquite ration until they calve, then selling them as pairs or selling the calves and then fattening the cows and selling them.

To compare the ninety day cost of mesquite ration for 200 cows to that of a comparable projected period using the conventional method on an average ranch during the winter or periods of sparse grazing forage, the price of cottonseed cake was figured at $80.00 per ton,

mineral blocks at $74.00 per ton, grazing rights at $3.00 per head per month, and labor at $2.50 per day. The labor figure was acquired by assuming two men working one hour a day at $1.25 per hour. The cottonseed cake was assumed to be fed at the rate of 1-1/2 pounds per day. The total cost was $3,114.00 or $15.57 per head compared to $2,666.00 or $13.33 per head for the mesquite, a difference of $448.00, or a little over $2.00 a head.

Another aspect to think about which was not considered in the cost figures is that the shredding of the mesquite increased the availability and total production of edible forage. Also, the ninety day period in which the cows are in the lot could give the pasture a chance to rest and recuperate. A rancher could be able to increase his carrying capacity approximately 25 percent. Two important steps would take place. The first is mesquite control of which some method would have to be employed in any case. The second would be the acquiring of a cheap feed. This is of course assuming that this whole process is feasible.

CHAPTER V

SUMMARY AND CONCLUSIONS

Five pregnant crossbred cows, were put in a lot and fed for approximately 125 days on a ration consisting of 1-1/2 pounds of concentrate (1/3 milo, 1/3 cottonseed meal, and 1/3 vitamin-mineral premix), 1 pound of molasses, and from 14 to 16 pounds of ground mesquite wood per head per day. The cows were calved out in dry lot. One cow died six days after having a healthy calf. Her abomasum was heavily impacted. The probable cause of death was starvation due to failure of passage of nutrients. Another cow died shortly after her calf had to be removed by an episiotomy and traction. The three remaining cows were fed on the mesquite until their calves were 50 days old. They maintained their weight sufficiently during pregnancy. After calving they began losing weight rapidly. The concentrate allowance was raised to 5 pounds per head per day. The average loss from start to term was 219 pounds including parturition loss. There was rapid recovery weight during the summer months on grass. The average gain was 189.33 pounds. The average birthweight of the calves was 77.33 pounds. The average gain in the lot to 50 days was 59 pounds. The average gain on grass for the calves for 88 days through the summer was 218 pounds.

The three cows were put back on the mesquite ration for 116 days

of their next dry period. They began losing weight rapidly. They showed signs of phosphorous deficiency. Extra phosphorous was added and they responded by gaining weight for a short time. They averaged losing 117 pounds for the 116 days. The cows were then put on wheat pasture where they gained an average of 349 pounds in 96 days. The cows in the first trial were inoculated with rumen material from fistulated steers which had been on the mesquite ration and had previously been inoculated themselves with rumen material from white-tail deer. In the second trial there were no inoculations.

It is concluded that mesquite as the principle component is unsatisfactory for any kind of a production ration. It does seem to show some possibilities for maintenance. There did not seem to be any permanent damage done as a result of the period of restricted nutrition. The cows regained nearly all the weight they had lost. The calves made good gains, even though they had been considered somewhat stunted while their mothers were subsisting on the drylot ration of mesquite and supplement.

Because of the small numbers in these two trials, no definite conclusions can be drawn as to the feasibility of maintaining a large herd on mesquite. These experiments should lead the way for further experimentation. Further research needs to be done to determine the most desirable time for harvesting the mesquite in view of the possible effects on palatability and nutrient content. The possibility of ensiling the mesquite to improve digestibility should also be

studied. The economic savings of the proposition can be easily seen. The carrying capacity of the pasture can be increased by effective brush control and a period of rest and recuperation when the cows are in the lot. Plus a maintenance feed is being supplied which is cheaper than anything available. Much more experimentation must be done dealing with feeding mesquite on a seasonal basis.

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APPENDIX A

APPENDIX A

Weight of Cows Alternately on Mesquite and Hay and Dry Grass (pounds)

	Cow Number		
Dates weighed	512	641	581
Dec. 20	902	957	1,062
Jan. 3	974	972	1,078
Jan. 17	930	945	1,065
Feb. 15	902	958	1,045
Mar. 19	928	768*	848*
April 22	748*	705	814
May 10	708	-	-
Removed from mesquite			
May 25	762	742	812
June 19	768	782	894
July 12	813	857	930
Aug. 7	890	900	1,010
Aug. 21**	899	930	976
Placed back on mesquite			
Oct. 22	758	798	850
Nov. 13	795	840	869
Dec. 16	718	796	792
Removed from mesquite			
Jan. 20	848	910	916
Mar. 22	1,068	1,120	1,165

*Parturition loss included.

**Removed from grass and placed back on mesquite.

A P P E N D I X B

APPENDIX B

Calf Data

Calf number	867B	836B	825H
Mother's number	512	641	581
Birthdate	3/22	2/27	2/20
Birth weight	85	89	58
50 day weight	135	119	155
Recovery Period			
May 25	144	150	180
June 19	188	209	248
July 12	239	261	313
Aug. 7	298	350	400
Aug. 21	331	381	416

A P P E N D I X C

APPENDIX C

Composition of Premix (lbs./ton)

Limestone	800	Vit. A_{30}	14.5
Cottonseed meal	729	Vit. E_{125}	1.4
Salt	360	$Aureofac_{50}$	5.5
Polyphos	80	Mineral Oil	10.0

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