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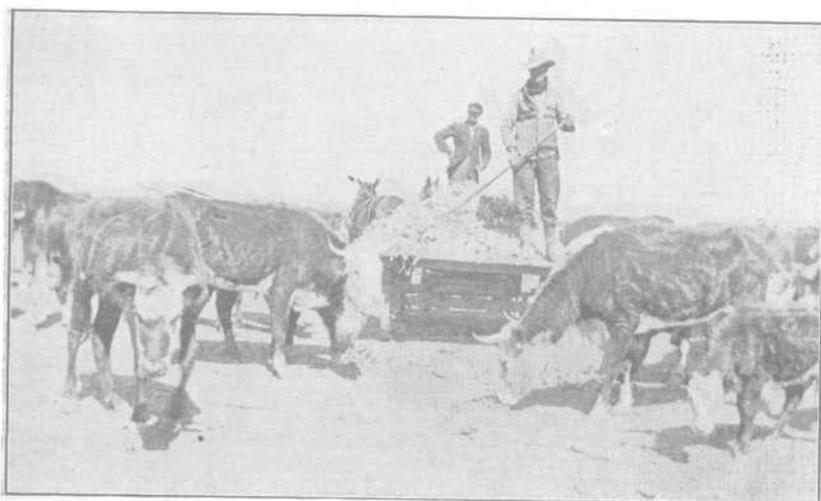
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University of Arizona, College of Agriculture

FEEDING YUCCA TO STARVING CATTLE

By R. H. WILLIAMS, ANIMAL HUSBANDMAN



Chopped Yucca has kept these cows alive.
(Method of feeding Yucca)

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FEEDING YUCCA TO STARVING CATTLE

By R. H. WILLIAMS, ANIMAL HUSBANDMAN

Yucca has been fed to ten thousand cattle in the State of Arizona during the past year, to keep them from starving. Stockmen estimate that fully 75 percent of these animals would have died if feed other than range had not been furnished them. The timely use of yucca will save 95 percent of the cows and sheep from starvation during periods of drought. A correspondent who has been feeding yucca states that he would have 700 more cows now had he begun to use this emergency feed three months earlier.

The first report of the use of yucca for feeding cattle was in 1910, when Mr. E. J. Moyer of Willcox fed 40 starving cows over a period of three months. In November, 1913, Mr. J. H. Lawhon of Bowie began feeding yucca. At the outset 20 cows and calves were fed to test the results of feeding yucca. The animals consumed the feed and did well, and the number of cattle given yucca that year was increased to 200. Mr. Lawhon has fed yucca every year since 1913 except during the winter of 1914-15, and is now feeding 500 cattle on chopped yucca alone and reports good results from it.

PREPARING YUCCA

Previous to the winter of 1917-18 yucca was prepared for feeding by chopping down the stems, burning off the dry leaves and chopping the pulp finely with hand axes. This was a tedious method, requiring one man for every 40 cows fed. Last year some of the large outfits used mechanical contrivances for cutting the yucca. Cook & Johnson of Willcox cut the stems into lengths of 12 to 14 inches and split them so that they would pass through a 12-inch silage cutter driven with a 4-horsepower engine. Powers & McCord of San Simon used a big knife attached to a lever to slice the stalks; and the J. H. Ranch, north of Willcox, arranged a vertical pump jack with a stroke plunger which cut the stems into short pieces.

SPECIAL YUCCA CHOPPERS

Early in 1918 there were several specially designed machines made for reducing the yucca stems to pieces sufficiently small to be eaten by cattle. Stockmen who have used these chopping machines claim that the "Ideal," sold by Peterson of Deming, New Mexico, the "Crackerjack," sold by Krakauer, Zork & Moye of El Paso, Texas, or the small machine made by Davies of Deming, New Mexico, will chop from one and a half to two tons of yucca per hour.

These small machines should be speeded up to 500 revolutions per minute and driven with a 6 to 10-horsepower engine. They are sufficiently large to chop feed for 500 cattle.

The yucca chopped with these power machines is much better for feeding cattle than that cut by hand or with homemade devices. The machine shreds the coarse fibrous yucca and makes it sufficiently fine so that cattle will not choke in swallowing it, and there is less danger of loss from impaction. One man with a machine can cut more yucca in an hour and do it better than five men with axes can in a day. There is no need of cutting the yucca into such fine, short pieces as corn is cut for a silo. If the pieces are too large, however, there is danger of the animals choking in swallowing them, or impaction may result owing to the difficulty cows have in regurgitating and chewing the large fibrous pieces. For best results the knives should be sharp so they will cut the pulp rather than shred it.



The yucca pile ready for chopping

FEEDING YUCCA

The large yucca plants are cut down, the branching green leaves trimmed off, and the stems hauled to the chopper. The plants, one at a time, are then chopped and the pulp loaded on a low wagon with a flat rack. The load of feed is taken directly to the feed lot and scattered on the ground. A good plan is to begin scattering the feed close to the gate and to drive the wagon in a wide circuit, continuing to spread the yucca as much as possible. The tame

cows will gather at the spreading of the first forkful and begin to eat and follow along slowly after the wagon. The wild cows will begin to eat on the outer part of the circuit and will receive a reasonable share of the food. Feed bunks are not generally used but in each lot where weak cows or calves are fed, troughs should be available for holding cotton seed meal or cake.

Mr. J. C. Hood of Douglas, Arizona, feeds as follows: "We cut a swath through a yucca patch and throw the stems into convenient piles or windrows. The yucca chopper and engine are mounted on a large platform placed on a wagon. This outfit is driven along the windrows and one man throws the yucca on the wagon while the other runs it through the cutter and the chopped feed drops directly to the ground. The moving wagon scatters the feed and the cattle follow along and eat it. This method can only be used where yucca grows close to water, and in such a place there will be no difficulty in having the cows remain with the outfit and clean up the feed as cut."

Labor required: The amount of labor required to feed yucca to cows varies according to the distance the stems must be hauled, the organization of the crew, and the quantity fed to the animals. Five men are sufficient to feed 500 to 700 cattle and do considerable other work, such as lifting up weak cows, repairing fences, and grinding knives. These men should be grouped so that they may work to



Chopping yucca with a small machine. This machine is run by a 6 H. P. gasoline engine and will chop $1\frac{1}{2}$ to 2 tons per hour.

advantage, viz.: Two cutting down and trimming the yucca, one hauling to the chopper, and two chopping and feeding.

Selecting the animals to be fed. Only the animals that are threatened with starvation are fed. In order to discover these animals and bring them to the feed lot it is necessary that one man ride continuously among the cows on the range. It is a mistake to allow the cows to become so weak that they cannot stand before beginning to feed them. In some districts cattlemen cooperate and gather weak cows belonging to neighboring herds which chance to be in their vicinity. This avoids the necessity of driving weak cows past one outfit to the headquarters of their owners for feed.

Use four feed lots. Animals should be classified into suitable groups in the feed lots. To avoid abuse and injury of weak animals by the stronger ones it is best to have the stronger cows and bulls placed in one lot. Another lot should be used for weaning calves and weak cows. Cows that are newly placed on feed should be given a lot by themselves; and a fourth lot should be available for cows with young calves, and those that cannot get up by themselves. The lots containing the bulls and strong cows and the weaning calves should be large so that the animals may have freedom and can gather some of their feed from the range. Fenced pastures should be reserved for this purpose. These pastures may be arranged so that they extend close to headquarters where abundance of water is available. The cattle on these areas will consume considerable dry grass but will come up at feeding time if given yucca at regular hours.

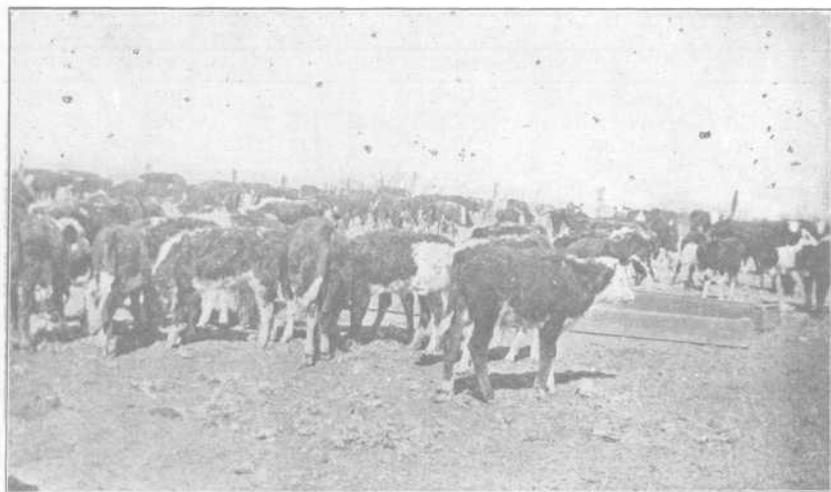
Getting cows to eat yucca. . . Almost all hungry cows in the Southwest have learned to eat the green yucca leaves. They are not accustomed to the pulp as a feed and pick it over the first few hours, but soon learn to eat the chopped feed. Only a few of the most timid animals refuse to eat the yucca after the first day. To avoid bloating and scouring, which frequently occur when cows begin to eat yucca, it is best to give the animals only five to ten pounds each for the first day. The quantity may be increased one to three pounds daily until the animals are given all they will eat in half an hour. It is interesting to note that wild range cows will eat yucca more readily than they will alfalfa hay or cotton seed cake.

Amount of yucca to feed: Fifteen to eighteen pounds of yucca daily will keep a dry cow alive, but for best results thirty pounds should be given each animal. This amount will maintain stock in good vigorous condition and they will feed their calves well and continue to breed. A cow will consume from forty to fifty pounds

of chopped yucca daily, and a calf will consume half this amount, if given all they will eat. A good plan is to vary the amount of yucca fed according to the amount of feed the cows can gather upon the range. Ten pounds per head daily is considered sufficient where an abundance of dry grass is available; twenty pounds where browse and grass are meagre; and thirty pounds where little or no other feed is available.

Feeding cows "on the lift:" After cows have become so weak that they cannot get up by themselves special attention must be given them or they will die. Some of these cows will begin eating greedily while they are down and make a rapid recovery, while others are so weak and worn out that recovery is slow. Cows that are within three months of calving and those that have had calves inside of ten days are especially weak and helpless. These weak cows should be separated from the rest of the herd and fed liberally on chopped yucca and about one pound of cotton seed meal once or twice a day. The highly concentrated cotton seed meal will assist in improving the digestive system and stimulating recovery. Yucca fed alone has a tendency to cause impaction and scouring in weak cows and on this account it is best to begin feeding the cows before they become so weak that they cannot rise. A little patience and care given the weak animals will be abundantly repaid by the number that will recover. Even with the best of care the mortality will be at least 25 percent, but under average conditions fully half should recover.

Feeding calves on yucca: Calves may be taken from their dams



Weaning calves on chopped yucca and one pound of cotton seed meal per day.

when three weeks old and raised on yucca and cotton seed meal. They should be given all the chopped yucca they will eat, with the addition of one to two pounds of cotton seed meal daily. The tender parts of the yucca, near the top of the plant, are the most palatable and nutritious. Young calves should be given a small quantity of milk along with the other feeds, if it is available.

Calves from five to eight months old may be weaned to advantage on chopped yucca and cotton seed meal. This suggests that calves may be separated from their mothers at the spring and fall roundups and placed in a pasture near a good supply of yucca. If the feed in the inclosure is insufficient the calves should be given daily all the chopped yucca they will eat, together with one pound of cotton seed meal, until they have been weaned. This method will be of value in reducing the mortality among the cows and increasing the calf crop.

YUCCA AS A FEED

There are various ways of estimating the value of a feed for live stock. The chemical composition of a feed, when considered along with other characteristics, such as palatability and amount of crude fiber, may serve as an index of its value. The amount of water varies greatly in different feeds and it is necessary that the percentage composition of feeds be calculated on a water free basis, in order to eliminate the variation in the results due to water, and to facilitate comparison.

CHEMICAL COMPOSITION OF DRY MATTER IN EMERGENCY FEEDS

Feed	Protein	Ash	Fat	Fiber	N. F. E.
¹ Yucca, young stems.....	7.50	5.55	1.54	16.13	69.28
¹ Yucca, old stems.....	3.07	9.15	.93	19.59	67.26
² Yucca, stems.....	4.30	6.85	1.09	23.97	63.77
² Yucca, head and leaves....	6.30	6.00	1.60	30.88	55.22
² Yucca silage.....	6.55	6.19	2.98	37.38	46.93
² Sotol head.....	5.44	4.14	1.93	30.73	57.73
² Sotol dry leaves.....	2.33	3.09	4.45	44.30	45.79
² Sotol and blossom heads...	11.47	6.85	2.15	24.76	50.98
² Sotol green leaves.....	4.59	4.53	2.43	39.58	48.85
² Bear grass.....	3.73	2.89	1.53	46.63	45.21
² Prickly pear.....	4.85	20.60	1.82	13.94	58.79
² Prairie grass.....	6.83	8.59	3.08	37.55	43.94
² Barley straw.....	4.08	6.64	1.75	41.96	45.57
² Corn stover.....	6.51	6.40	1.77	33.89	51.44
² Corn silage.....	7.99	6.46	3.04	23.95	58.56
² Alfalfa hay.....	16.30	9.41	2.52	30.96	40.81
² Cold pressed cotton seed cake.....	28.34	4.56	8.36	26.06	32.69

1—From Arizona Agr. Exp. Station "Timely Hint" 135. 2—New Mexico "Press Bul. 301." 3—Henry & Morrison "Feeds and Feeding."

The following table gives the chemical composition of dry matter in yucca and other plants sometimes used for range cattle.

Protein: The above table indicates that the dry matter in yucca contains about 6% of protein; that in alfalfa hay over twice this amount; and that in cotton seed cake five times as much. Sotol, prickly pear, barley straw, and bear grass each contains less protein than does yucca. The dry matter in yucca is very similar to that in corn silage and corn stover, in the amount of protein it contains. Each of these feeds is considered to be extremely deficient in protein.

Ash: Ash is not considered an especially important constituent for range cattle as the animals undoubtedly secure a sufficient supply of it in their ordinary feeds. Prickly pear is extremely rich in ash, containing three times as much of it as does yucca. On the other hand, sotol, bear grass, and cotton seed meal contain less ash than does yucca.

Fats: No doubt a considerable portion of the constituent in yucca known as fat is composed of gums and rosins. These are extracted by ether in making the fat separation. The dry matter in yucca contains only 1.50% of fat. Compared with other feeds yucca is extremely deficient in fat, containing less than does bear grass, prickly pear, corn stover or barley straw. Such feeds as alfalfa hay, corn silage, prairie hay, and cotton seed meal have two or three times as much fat as has yucca. Fortunately the yucca plant is rich in carbohydrates, and these to a great extent may replace the function of fat in the animal organism.

Crude fiber: Prickly pear is the only feed in the above list with less crude fiber than has yucca. It is interesting to note that the entire yucca plant has no more crude fiber than has corn silage or cotton seed cake. Bear grass, barley straw, prairie grass, and sotol contain more fiber than does yucca. No doubt a large percentage of the crude fiber contained in yucca is digestible since the feces voided by animals fed on yucca is of fine texture and apparently scanty in quantity. This suggests that the dry leaves could be left on the plant when chopped, to add filler to the ration for cattle fed on yucca.

Nitrogen free extract or carbohydrates: The average yucca plant contains about 63 percent of carbohydrates. It is richer in this constituent than is any other feed in the list. Altho sotol has only 80 percent as much carbohydrates as yucca, yet the sotol plant exceeds cotton seed meal, alfalfa hay, barley straw, corn stover, and

prairie grass in this constituent. This indicates that yucca should be fattening when fed in liberal amounts.

Yucca compared with other feeds: Yucca compares favorably with prairie grass, corn stover, or corn silage as a feed. It is distinctly better than barley straw, bear grass, prickly pear, or sotol in the amount of nutrients contained in the dry matter. Yucca has less crude fiber and more carbohydrates than has sotol, bear grass, barley straw, or corn stover, and should be a better feed than any of these. The chopped yucca more nearly approaches corn silage than does any other feed in the list. Its greatest deficiency is in protein, but in this respect it is superior to sotol, prickly pear, barley straw, or bear grass. Where reasonable amounts of protein are fed as a supplement it is probable that in the cattle feeding business chopped yucca can replace corn silage pound for pound, altho it is not as palatable.

Do not burn dry leaves: In feeding yucca it is best to leave the dry, fibrous leaves instead of burning them. Cows will greedily consume the pulpy stems and are less subject to bloat and scouring than they are if the dry leaves are burned. No doubt in food value these dry leaves are inferior to the stems but they furnish considerable bulk and dry matter and should be left on the plant when chopped. The dry leaves do not interfere much with chopping if the plants are placed in the hoppers head first.

Feeding quality of the different parts: Some stockmen trim off the branching green leaves at the top to facilitate chopping and handling. These leaves are to some extent eaten by cattle, but they are coarse and fibrous and make an inferior food. In some places range cattle eat the leaves that are left behind after trimming.

Undoubtedly the growing portion of the stalk located beneath the green leaves is especially rich in protein, water, and digestible nutrients. As the plant becomes older it is more fibrous and richer in ash but inferior in protein, fat, and carbohydrates. It is claimed that the root is also palatable and especially nutritious.

Digestible nutrients in yucca compared with other feeds: In order to ascertain the value of any feed it is necessary to study its effect on the animal. The best summing up of the value of a feed is to give the digestible nutrients in 100 pounds. The following table gives a comparison of the digestible nutrients in yucca as compared with other emergency feeds:

According to the table below yucca contains 30% of dry matter, while prickly pear has about half this amount. Corn silage contains 26.3% of dry matter and is therefore very similar to yucca in

DIGESTIBLE NUTRIENTS IN SOME EMERGENCY FEEDS

Digestible nutrients in 100 pounds of feed					
Feed	Crude protein	Carbohydrates	Fat	Total	Nutritive ratio
	Pounds	Pounds	Pounds	Pounds	1:
¹ Yucca head, leaves and stem	1.08	22.3	.35	24.2	20.0
² Prickly pear .....	.40	8.9	.20	9.7	23.2
¹ Sotol head and leaves..	.90	18.2	.46	20.1	21.0
¹ Bear grass	1.73	42.0	.50	44.9	25.0
¹ Prairie hay	4.00	41.4	1.10	47.9	11.0
² Corn stover	2.20	47.8	1.00	52.2	22.7
² Corn silage	1.10	15.0	.70	17.7	15.1
² Barley straw .....	.90	40.2	.60	42.5	46.2
² Alfalfa hay	10.60	39.0	.90	51.6	3.9
² Wheat bran and shorts	12.90	45.1	4.00	67.0	4.2
² Cold pressed cotton seed cake	21.10	33.2	7.40	70.9	2.4

¹—New Mexico Agricultural Experiment Station "Press Bul. 301." ²—Henry & Morrison "Feeds and Feeding."

this respect. Yucca has about the same amount of protein as has silage, but only half as much fat. On the other hand yucca is distinctly richer in carbohydrates, containing about 50% more than does silage. This emphasizes the importance of adding more protein to yucca in order to make it a better balanced feed. Prairie hay, which contains less digestible carbohydrates and more protein, is a considerably better balanced feed than is either corn silage or yucca. Alfalfa hay, wheat bran, and cotton seed meal are each considered to be over rich in protein and make a splendid supplement to yucca. Unless these supplements are added yucca cannot be considered a balanced ration although it will undoubtedly assist in keeping animals alive.

Yucca can be used to advantage in reducing the mortality among range cows during periods of drought. As long as the supply lasts the yucca should be used in districts where it grows if the cattle are dying. Yucca may also be used to good advantage in feeding sheep. Already bands of sheep have been fed on chopped yucca with good success. The sheep remain strong and do well when given daily three pounds of chopped yucca per head and what range they can gather.

SUMMARY

1. Yucca is found in large quantities in the central and southeastern parts of Arizona.
2. An average plant weighs 50 pounds. From 25 to 40 years are required to grow such a plant.

3. In 1910 yucca was fed to starving range cattle, but it was not until 1917 and 1918 that this plant was used extensively.

4. In the early part of 1918 special yucca choppers were placed on the market. These machines are recommended for reducing the yucca to pieces of suitable size for cattle.

5. Only the thinnest animals and weaning calves are fed yucca.

6. Feeding is done by scattering the chopped yucca on the ground or placing in feed bunks. It is best to group the animals into three or four lots and feed them separately. The stronger animals should be allowed the freedom of a large pasture where they can gather dry grass and browse.

7. Hungry cows and sheep readily learn to eat yucca.

8. Some cows bloat when first fed yucca, but later become accustomed to it and suffer no injurious effects from eating it.

9. Probably 75% of the cows that have been fed on yucca would have died if some kind of feed had not been supplied them.

10. From ten to forty pounds of chopped yucca should be given each animal; the amount may vary between these limits according to the amount of dry grass and browse the animals can gather.

11. Some animals have died from impaction and bloating when hand chopped yucca was given them.

12. The total cost of feeding yucca need not exceed \$1.00 per head per month.

13. As a feed, yucca is deficient in protein but otherwise makes a good ration. It is similar to corn silage in its feeding quality.

14. Yucca should be supplemented by a small quantity of wheat, bran, cotton seed meal, or other feed rich in protein.

15. The coarse, pulpy yucca seems to be highly digestible and cattle will gain strength and take on fat if given liberal quantities of it.

16. Do not burn the lower dry leaves.

17. The present supply of yucca will soon become exhausted but stockmen are recommended to use it until they grow crops on overflow areas.

18. A reserve of feed is necessary during periods of drought when cattle are starving.