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DIVISION OF ANIMAL INDUSTRY

THE UTILIZATION OF YUCCA FOR THE MAINTENANCE OF CATTLE



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*In cooperation with the School of Veterinary Medicine, A. & M. College of Texas.

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THE UTILIZATION OF YUCCA FOR THE MAINTENANCE OF CATTLE

BY

J. M. JONES, CHIEF, DIVISION OF ANIMAL INDUSTRY
A. B. CONNER, CHIEF, DIVISION OF AGRONOMY

Ranchmen in certain areas of Southwestern Texas, Southern New Mexico and Arizona have perhaps in bygone years many times wished that their ranges were entirely devoid of the seemingly useless and worthless *Yuccas* which thrive in the greatest abundance on these semi-arid plains. Such members of the *Yucca* family as those commonly known as soapweed, Spanish dagger and bear grass, were for a long time considered useless to stockmen. Furthermore, the protection afforded the plant by nature offered other difficulties in its utilization as feed. The *Yucca* leaves are protected by hard, sharp points resembling the point of a needle; they are of varying degrees of thickness, rather erect, and sharp-edged, being adequately protected by nature against molestation or destruction by beasts or vermin, without the assistance of man. It is only under the most trying conditions that live stock attempt to feed upon the *Yuccas* in their natural condition and then only on plants that are dwarfed or stunted and, therefore, easily accessible.

The recent long continued drouth in West Texas, South Arizona and New Mexico came at a time immediately following the most favorable range conditions known to cattlemen in these southwestern areas in a long period of years. The cattlemen had been doing a flourishing business and the ranges were stocked to their maximum capacity. The drouth came as a thunderbolt from the sky and during each succeeding month conditions grew from bad to worse on a great many of the ranges, utter ruin absolutely staring many ranchmen in the face if relief of some kind was not forthcoming.

The cattleman is by nature resourceful—he must be to operate successfully—and hence he began to cast about for emergency feeds which might be utilized. Sotol, which, by the way, is a member of the *Yucca* family, has been used for a long time by the cattlemen as emergency feed. The low growing, narrow-leaved *Yuccas* (bear grass), have, perhaps, also been used to some extent. Hence, the cattlemen reasoned that possibly other similar plants not heretofore utilized might also provide emergency feed. The tall growing *Yuccas* (soap weed and Spanish dagger) with large stems, or trunks, seemed to offer quantities of feed if they could be put into suitable form for feeding. This would require either grinding or chopping of the stems into small pieces.

At the beginning of the drouth there was no machinery on the market that would cut or grind the tall growing *Yuccas*—(*Y. elata* and *Y. macrocarpa*)—into sufficiently small pieces for consumption by cattle.

Fortunately, a number of the ranchmen in the drouth stricken area had some very intimate friends who were machine manufacturers, and these people came to their aid and spent several thousand dollars in perfecting a machine of a design that would handle the coarse *Yuccas* at a fairly rapid rate without continual delay. The Krakauer, Zork, & Moye's Company, of El Paso, has designed a machine that has been in quite general use in the Southwest during the past winter, and at this time it is doubtful whether there is another cutter on the market that is so well adapted to this purpose. Great credit is due the aforementioned firm for its active interest in perfecting a machine, thus enabling the utilization of a large amount of *Yucca* that would otherwise not have been available for maintaining the thousands of head of cattle which were so successfully maintained upon it during the greater portion of the past winter.

Another type of machine which was lighter and less expensive than that of the El Paso firm was placed on the market about the same time. This machine, known as the "Ideal Yucca Chopper," is manufactured

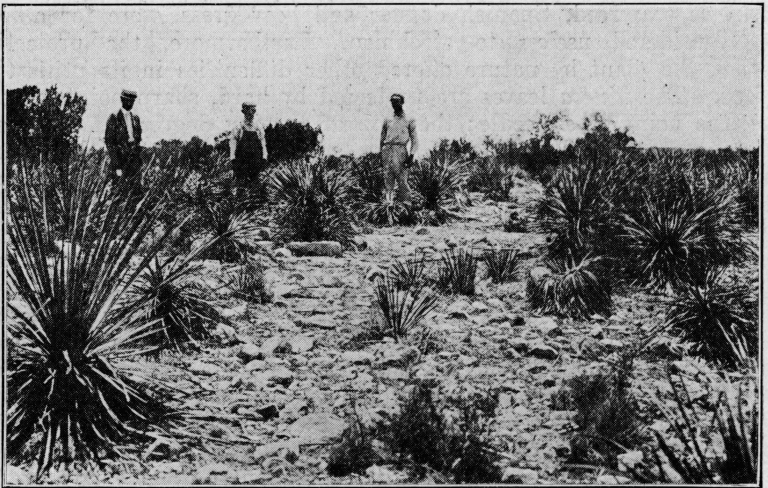


Fig. 1.—Sotol range in Val Verde County, Texas.

by the F. C. Peterson Company, Deming, New Mexico. A number of machines manufactured by this firm were disposed of among the New Mexico and Arizona stockmen during the past year.

BOTANICAL DESCRIPTION OF THE *YUCCAS*

Since several species of the *Yucca* are quite prevalent on large areas of Western and Southwestern Texas, it seems that this bulletin would be incomplete without a botanical description of these plants. The key and descriptive matter that follow are brief and concise and, it is hoped, will serve as an excellent means of aiding ranchmen in the identification of any of the *Yuccas* growing on their ranges. There is, in certain instances, great similarity between several species of *Yucca*, and ranchmen are sometimes led to believe that they are all of one kind, thinking that some of the plants have perhaps become dwarfed

under unfavorable conditions and that the long stemmed kinds attained a normal growth during more favorable growing periods. Botanical classification of the *Yuccas* shows that no less than a dozen species occur on the ranges of Western and Southwestern Texas. The different species are recognized by differences in height and size of the above-

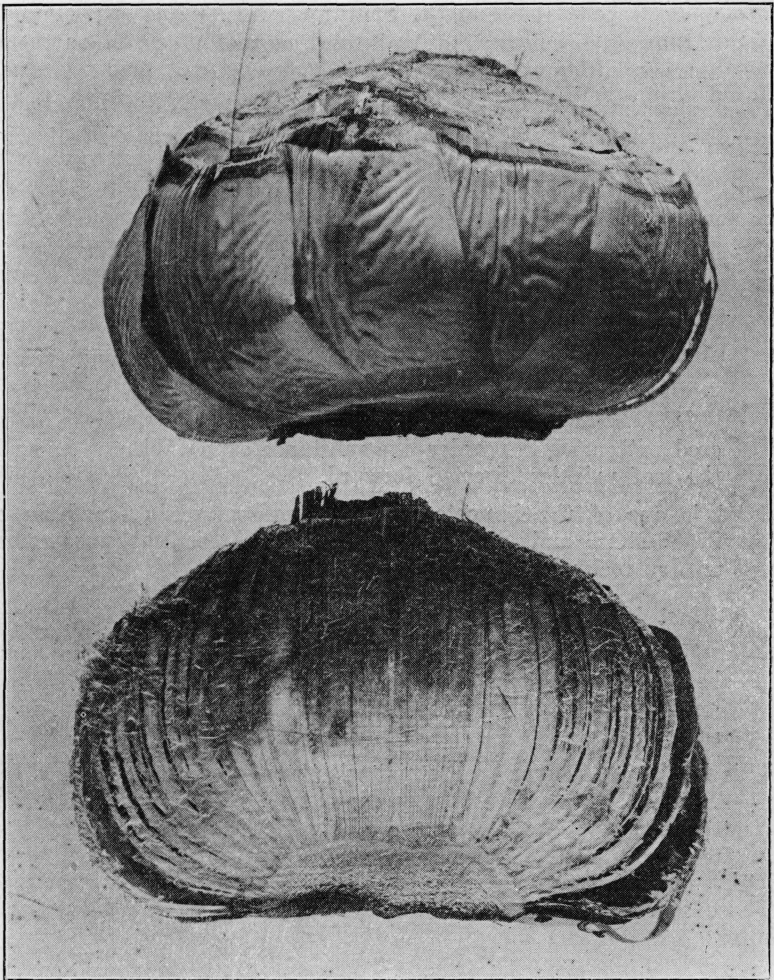


Fig. 2.—Sotol bulb with outer leaves removed. This bulb is the tender, succulent portion of the plant readily eaten by livestock when accessible.

ground stem; size, texture, and margin of the leaves; and the markings of the flower head, and seed.

DRACAENACEAE (*YUCCA* FAMILY).

Shrubby plants or trees with woody stems and roots; leaves abundant, narrow, parallel-veined, rigid; flowers greenish or white in elongated spikes or panicles borne on leafless stems; fruit leaves three, united;

seed vessel superior, one to three celled; styles united, sometimes very short; egglets two to several in each cell; fruit a capsule, or berry-like and not opening.

The *Yucca* family comprises three genera which may be distinguished from one another by the following botanical differences:

I. *Dasylyrion*, Zucc. (Sotol)

Flowers dioecious; i. e., unisexual, or with the male and female parts in different individuals.

Thick short-stemmed perennials with unisexual flowers—leaves numerous, strap-shaped, spiny-margined, and with numerous small white flowers borne in narrow panicles. The basal parts of the leaves form a round head about the thick stem. This inner part of this head is very tender and succulent feed for live stock and is readily eaten when quartered with an axe, or when the protective, spiny leaves are burned off. In Mexico it has been used in the manufacture of a drink called "sotol," which contains forty to fifty per cent. alcohol.

Two species of sotol are found in Western Texas:

D. leiophyllum, Engelm., which has green leaves with prickles mostly recurved.

D. Wheeleri, S. Wats., with leaves somewhat glaucous or covered with a white powder-like substance called "bloom" and with the leaf prickles directed forward.

Sotol is one of the important natural reserve feeds found on the range in Western and Southwestern Texas. It is not uncommonly found on dry rocky hills.

II. *Nolina*, Michx. (Sacahuiste or bear grass)

Flowers polygamo-dioecious; i. e., with some individual plants bearing single sex flowers and others perfect or with both male and female parts, or both perfect and single sex flowers on the same plant.

This is a thick-stemmed perennial with numerous long, narrow, saw-toothed leaves and small polygamo-dioecious flowers, borne on solitary pedicels; flowering stem, stout, nearly naked, being compound racemose, many flowered panicle; fruit thin, not opening, seeds nearly globular in shape and light-colored.

Three species of *Nolina* are found in Western Texas, according to Coulter:

N. Lindheimerina (Shelle) Watson. With stout tall stem, sixteen to eighteen dm. high; leaves three to nine dm. long, flat, thin, strongly saw-toothed; panicles single or compound; fruit thin, broader than long on pedicels about eight mm. long. Commonly growing in stony places through Central and Western Texas.

N. Texana, Watson. Stems several, very short, three to six dm. high, including the panicle; leaves six to twelve dm. long, two to four mm. wide, concavo-convex below, triangular toward the ends, margins rough; panicle compound, pods (four to six mm. broad) on pedicels four to six mm. long; seeds globose, smooth,

four mm. diameter; found abundantly on foothills in Western Texas.

N. erumpens (Torr), Watson. Stems medium tall, six to fifteen dm. high, rough-scabrous; leaves thin, keeled, six to nine dm. long, twelve mm. wide, very strongly saw-toothed; panicle compound with large open bracts, panicles on pedicels four mm. long, or less. The ripe seeds bursting the cell. Found growing between the Pecos and the Rio Grande.

Sacahuiste or bear grass, may be utilized advantageously as reserve feed in winter and in periods of drouth.

III. *Yucca*, L. (soapweed, Spanish dagger, bear brass)

Flowers perfect; i. e., the flowers contain both male and female parts.

Perennials with thick woody stems, either very short and mostly underground or rising into a thick palm-like trunk; leaves sharp-pointed, mostly rigid. Flower head in large panicles or racemes, with white bell-shaped flowers; fruit a three-cell capsule, dry or sometimes berry-like, fleshy. Pollinated exclusively by the *Yucca* moth, whose young feed on the young developing seeds.

Several species of *Yucca* are common to Western Texas.

Yucca elata. Stems tall, three to four meters or higher; leaves ten mm. wide, or less, white-margined; inflorescence, a much branched panicle; pod cylindrical, ovate or obtuse; seeds large twelve mm. wide, narrowly wing-margined; found in dry gravel mesas of Western Texas.

This is the common narrow-leaved *Yucca* known as soapweed, or pamilla. The roots are often used as a substitute for soap. The plant has some decorative value, but because of the large roots it is difficult to transplant. Its chief value, however, lies in the stem, which, ground, makes a roughage very palatable to cattle.

Yucca macrocarpa. Stems one and one-half to five meters tall, branching at top, leaves long (seven to thirteen dm.); broad (fifteen to fifty mm.), straight, very rigid, rough, yellowish green; filaments coarse and grayish; fruit not opening, ten cm. long or less, and only slightly pulpy.

This is the common broad-leaved *Yucca*, or "dagger" of the mesas of the southern part of the State. It is frequently used for decorative purposes and is easily transplanted. Grows very tall under cultivation. The leaf is used by the Indians for basketry, as it is suitable for forming designs, the outer part of it being greenish yellow and the inner white. The stems of this plant may be used as feed by cutting or chopping, as in *Yucca elata*.

Yucca baccata. A low-growing form (twenty cm. high, or less) with broad leaves (fifteen to fifty mm.), which are coarsely filamentose on the margins and very thick, rigid, channeled or concave, rough, especially on the back, tipped with a very stout brown spine; panicle pedunculate; fruit large, pulpy, oval or cylindrical (twelve to fifteen cm. long), dark purple, often long beaked; seeds eight to ten mm. broad.

The root of this species is used for "amole" by the Mexicans. It is not an important species as reserve feed for live stock.

Yucca glauca. A low-growing form with straight, narrow leaves (six mm. or less), which are thick and pointed; leaves smooth, sparsely fliferous; flowers small (four to seven mm. long, or less); flowers greenish white, or tinged with brown; seed ten to twelve mm. broad. Commonly grown in sandy hills and plains of Western Texas.

This is the common *Yucca* of the South Plains and the region to the south and west, where it is often very abundant. The leaves are sometimes used in the manufacture of stable brooms. The fruit sometimes has been cooked and eaten by the Indians. This is one of the most important of all the *Yuccas* as an emergency feed, on account of its wide distribution. It may be utilized by cutting the plants off under the ground with a mattock and feeding them whole to cattle, or by chopping them into pieces with an axe or with a feed cutter.

Several other species of *Yucca* resembling those described are found in this State, but they are relatively unimportant in an economic sense either on account of their limited range of adaptability or their structure.

YUCCA AS AN EMERGENCY MAINTENANCE FEED.

It would seem from the information and facts available that the Grazing Branch of the Forest Service, United States Department of Agriculture, cooperating with C. T. Turney, was among the first, if not the first, to recognize the possibilities of soapweed, Spanish dagger and bear grass as emergency feeds during periods of drouth on the southwestern ranges. In 1915, about one hundred fifty tons of soapweed (*Y. elata*) were cut and placed in a silo on the Jornada Range Reserve.* A portion of this feed was used in 1916, some was supplied to the cattle in 1917, and the remainder was utilized in 1918, with good results.

The emergency feeding investigations on the Jornada Range Reserve were conducted under the supervision of C. L. Forsling, Grazing Examiner in Charge, and to him grateful acknowledgment is hereby made for the valuable information he has so kindly placed at the disposal of the authors of this bulletin.

Professor Luther Foster, Animal Husbandman, New Mexico Agricultural Experiment Station, was also a pioneer in this field and has contributed valuable information as reported in Press Bulletin No. 308, which is quoted in part in this bulletin.

Certain Arizona ranchmen report that soapweed was utilized as an emergency roughage as early as 1915 with satisfactory results.

THE COMPOSITION OF YUCCA.

Before feeding a new roughage or concentrate to live stock, it is always desirable that an analysis be made in order that a definite idea may be had relative to its feeding value. Accordingly, several specimens of the *Yucca* have been analyzed by the Division of Chemistry of the New Mexico Experiment Station, the Federal Bureau of Chem-

*Bulletin No. 588, U. S. D. A. "Increased Cattle Production on Southwestern Ranges," Jardine, James T., Hurtt, L. C., page 26.

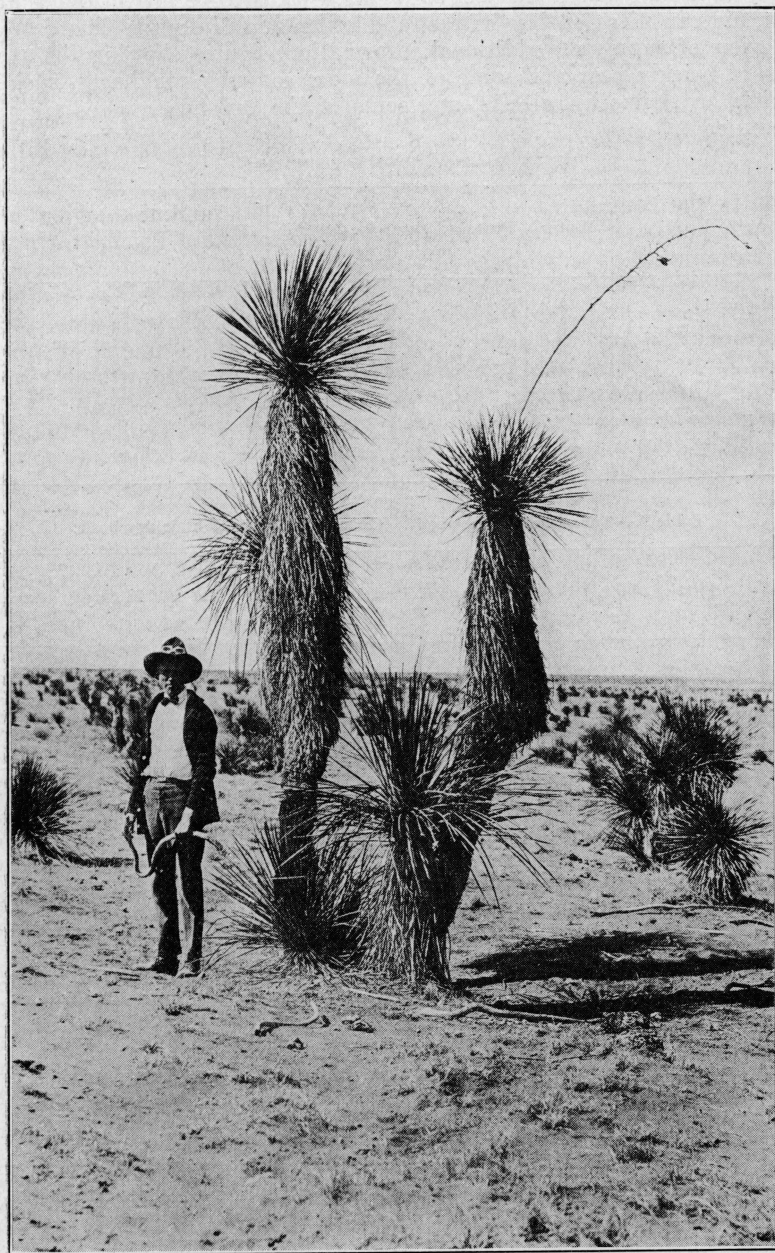


Fig. 3.—Soapweed (*Y. elata*) on the Jornada Range Reserve near Las Cruces, N. M. The large stems when cut into small pieces are utilized as maintenance feed for livestock.

istry, and the Division of Chemistry of the Texas Agricultural Experiment Station. These analyses show the *Yuccas* to be low in crude protein, high in nitrogen-free extract and rather high in crude fiber. With the view of supplying additional information, figures showing the analyses of prickly pear and some of the more common roughages, such as prairie hay, timothy, alfalfa, and some of the common grasses are also presented.

Table 1.—Chemical composition.*

	Water	Protein	Ash	Fat	Fibre	Nitrogen-free extract	Number of analyses
Alfalfa hay.....	9.61	14.42	8.41	1.97	29.98	35.81	34
Timothy hay.....	13.2	5.9	4.4	2.5	29.0	45.0	68
Prairie hay (S. Tex.)..	8.93	4.04	8.05	2.10	29.74	47.18	2
Oat straw.....	9.2	4.0	5.1	2.3	37.0	42.4	12
Rice straw.....	6.57	4.11	14.85	1.54	31.56	41.37	6
Cotton seed hulls.....	9.51	4.11	2.56	1.46	45.27	37.09	24
Prickly pear.....	84.26	0.73	3.06	0.34	2.41	9.04
Johnson grass (green)	78.78	2.99	1.92	1.16	5.60	8.12	7
Corn silage.....	74.4	2.2	1.5	1.1	5.8	15.0	62
Sorghum silage.....	77.29	1.6	1.31	1.03	6.16	12.40	7

Table 2.—*Yucca elata* (soapweed). Chemical composition air dry basis.

Part of plant	Water	Protein	Ash	Fat	Fiber	Nitrogen-free extract
†Head and stem.....	6.45	4.37	6.72	1.47	32.75	49.24
†Stem.....	7.1	4.0	6.4	1.0	22.3	59.2
†Head, only.....	7.11	5.34	10.19	1.41	20.88	45.07
†Stem.....	7.86	6.31	7.86	1.37	42.48	23.87
†Stem (green).....	64.86	2.05	3.36	1.56	12.52	15.65

Table 3.—*Yucca macrocarpa* (Spanish dagger).

Part of plant	Water	Protein	Ash	Fat	Fiber	Nitrogen-free extract
†Stem.....	7.35	3.75	7.65	1.30	33.66	46.29
†Leaves.....	4.65	4.48	6.25	2.02	28.58	54.02

Table 4.—*Yucca glauca* (bear grass).

Part of plant	Water	Protein	Ash	Fat	Fiber	Nitrogen-free extract
†Stem and leaves.....	6.80	6.94	10.90	2.09	37.53	35.74
†Stem and leaves.....	8.57	9.03	5.08	1.45	36.89	38.98
†Stem and leaves (green).....	52.94	3.55	2.53	.81	21.54	18.63

*Analyses taken from Bulletin No. 170, Texas Agricultural Experiment Station.

†Division of Chemistry, New Mexico Agricultural Experiment Station.

‡Division of Chemistry, Texas Agricultural Experiment Station.

Table 5.—*Dasyliirion* (sotol).

Part of plant	Water	Protein	Ash	Fat	Fiber	Nitrogen-free extract
*Bulb.....	52.78	2.31	2.27	.64	11.63	30.37
*Bulb.....	57.06	3.45	1.84	.71	11.69	25.25
*Bulb.....	58.42	2.13	1.69	.68	12.85	24.23
*Leaves only.....	12.49	5.10	3.10	1.39	43.73	34.19

*Division of Chemistry, Texas Agricultural Experiment Station.

The cost of preparing soapweed (*Y. elata*) and Spanish dagger (*Y. macrocarpa*) is possibly greater than that of cutting or grinding of the *glauca* or other of the dwarfed *Yuccas*. The wood-like stem of the *elata* is utilized to great advantage in the feeding of cattle on the drouth-stricken ranges. The analyses presented in tables 2, 3 and 4 show that the stem of the *Yucca* is as valuable for feeding purposes as the leaves. Of course, it is necessary to run the stems through a suitable cutter in order that they may be reduced to portions small enough to be easily eaten by the live stock. Ordinarily the soapweed and Spanish dagger plants which have reached considerable height are of little value on the range except perhaps as shade and for purposes of reseed-



Fig. 4.—Soapweed (*Y. elata*) stems ready for the cutter.

ing. The younger plants of both soapweed and dagger, as well as many of the low-growing forms are accessible to live stock and hence the leaves and the blossoms may be fed upon to a considerable extent when the range is bare of other vegetation. The dead leaves are found drooping downward outside the stems or stalks of these plants, but since they contain so much fiber and such a small amount of actual food value, it has so far been found to be the most practical plan to burn them from the plant while standing in the field before cutting. By leaving these leaves attached to the plant which is later to be cut for feed, it has been found that the food value of the plant is somewhat reduced, while at the same time much greater difficulty is experienced

in the cutting operation on account of the dry leaves becoming entangled in the machinery.

The cost of feeding *Yucca elata* on the Jornada Range Reserve is estimated at from \$2.27 to \$3.00 per ton. This includes burning, cutting, running through the cutter, and hauling to the cattle. There is usually a considerable outlay of capital necessary for the purchase of a satisfactory engine and cutter. The accompanying picture shows one of the most successful cutters that is in use on the drouth-stricken ranges for this purpose. This cutter was designed especially for this purpose after considerable experimenting, and several improvements have been made from time to time, until it is now declared to be doing the work in a most satisfactory manner. When one stops to consider the size of the stalks (four to eight inches in diameter) of some of the *Yucca* plants that are run through the machine, he is made to realize that powerful machinery is necessary. These machines have, during the past winter, retailed at approximately \$500, not including the engine. A sixteen to twenty horsepower engine is required to run the large type of cutter with the best success. It is not advisable to use a low horsepower engine on one of these cutters, owing to the fact that a light engine is likely to stall when an especially coarse or heavy stalk is fed into the cutter. Due to the increased cost of all machinery, it is estimated that a suitable engine for running one of these large cutters will now cost \$500 or more.

When the low-growing varieties of *Yucca*, such as *glauca*, are fed to live stock, it is not so necessary to utilize such powerful and expensive machinery as must be employed when *Yucca elata* and *Y. macrocarpa* are supplied. A number of small ranchmen are reported to have been using the dwarfed varieties as a maintenance ration for their small herds, preparing it by the use of an axe and a mattock. It is best when feeding *Yucca* to be provided with a suitable cutter in order that the stalks, roots, and as many of the leaves as possible may be cut up in parts small enough to be utilized by the cattle, obviating danger of ill effects. When the stems are cut in large pieces, there is some danger of the animals choking.

The low-growing or small-stemmed *Yuccas* (bear grass) average only a small amount of feed per plant, but the plants are generally found in large numbers, and scattered over a wide area in this State, being found throughout the entire western part of Texas and in a part of the Plains country. Their use by the small ranchmen as emergency feed, therefore, is of greatest importance. The following table shows the amount of green material obtained from the low-growing *Yuccas* at three different points.

Table 6.—Yields of bear grass (*Yucca glauca*) at several points.

Place.	Number plants per acre.	Total weight of green plants per acre, pounds	Average weight per plant, pounds
Lubbock.....	1237	1,991.5	1.61
Spur.....	123	168.5	1.37*
Spur.....	337	694.2	2.06**
Chillicothe.....	306	300.5	.98

*Clay soil. **Sandy soil.

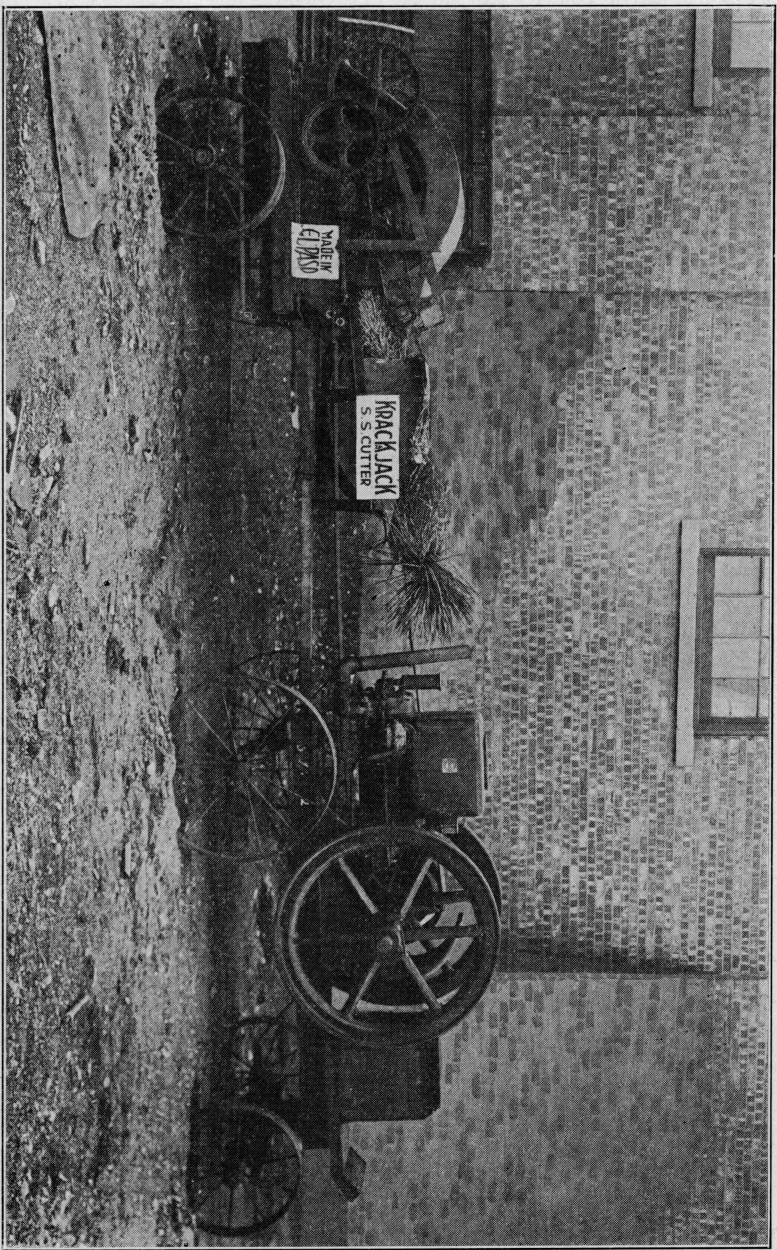


Fig. 5.—Substantial machinery is required to handle the large soapweed stems. (Courtesy of Krakauer, Zork & Mowbray, Inc., Denver, Colorado.)

From 1,000 to 2,000 pounds of green material per acre may be expected under average conditions of growth. This amount of available feed during emergency is a matter of great value to the small ranchman. Some ranchmen in the Odessa country fed a dwarfed variety, prob-

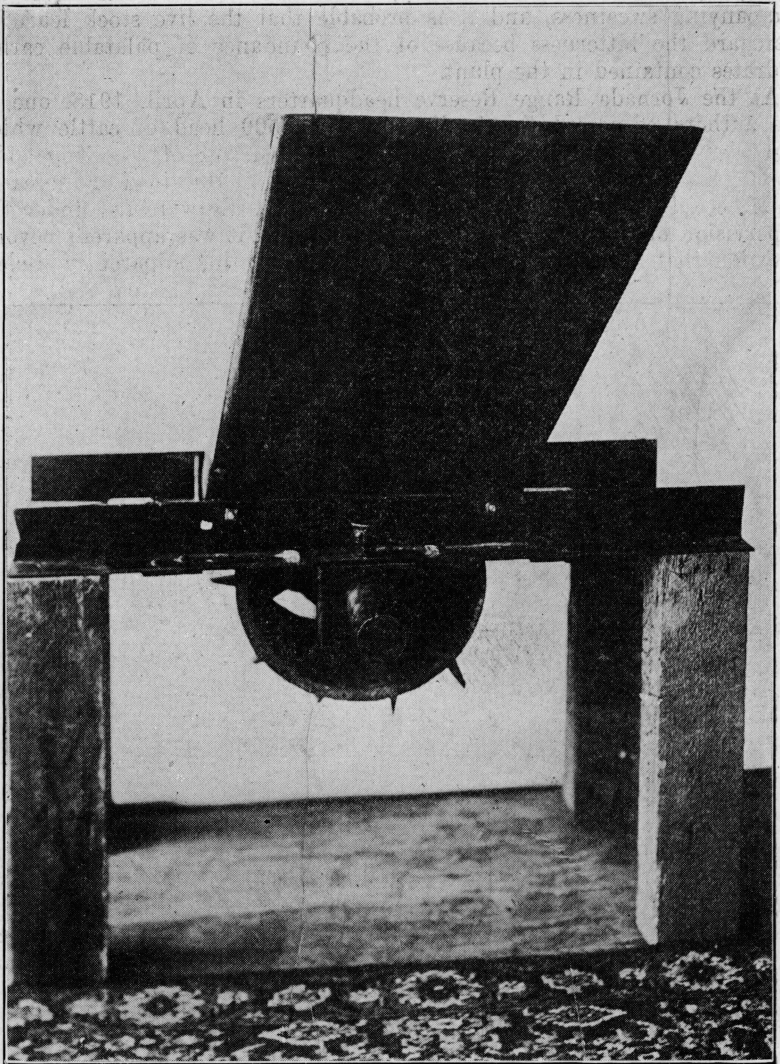


Fig. 6.—A small cutter can be used to prepare the dwarf *Yuccas* for feeding.
(Courtesy of F. C. Peterson & Co., Deming, N. M.)

ably the bear grass (*Yucca glauca*), to their herds, with apparently satisfactory results, and they did no more than to chop the plants off at the ground and haul them to the cattle at the feed lots. The calves seemed to relish this plant more than did the cows, as the former con-

sumed not only the leaves but the roots as well. The cows seemed to exercise some choice and some of them consumed a portion of the tops or leaves.

The flavor of the *Yucca* plant is rather sweet, indicating that there is sugar present. There at first appears to be a rather bitter flavor accompanying sweetness, and it is probable that the live stock learn to disregard the bitterness because of the abundance of palatable carbohydrates contained in the plant.

At the Jornada Range Reserve headquarters in April, 1918, one of the authors witnessed the feeding of some 500 head of cattle which had been brought in from the range for the purpose of receiving additional feed in order that their strength might be maintained or increased until better grazing became available. These cattle were fed under the supervision of a government grazing expert and it was apparent beyond question that the experimental stage of feeding this apparently useless

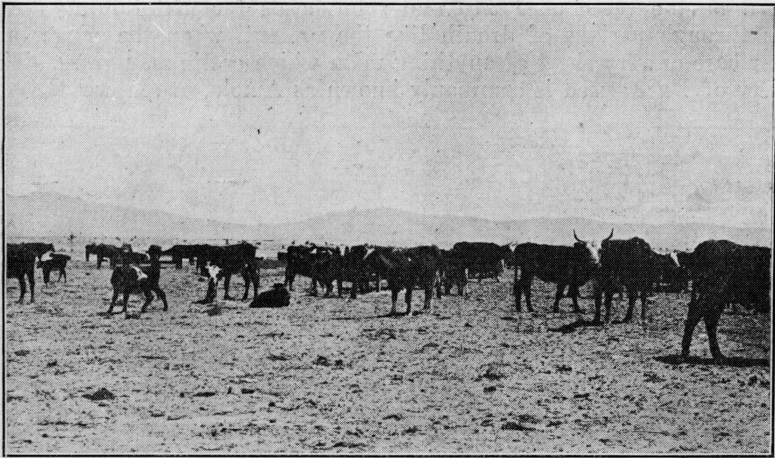


Fig. 7.—Thin cattle are not only maintained but will actually improve in condition on a ration of *Yucca* and cottonseed meal.

desert plant had passed, since it was self-evident that the soapweed (*Yucca elata*) which was being supplied with a small amount of cotton seed meal, was not only maintaining cattle, but that the animals were making good gains on this ration. C. L. Forsling, the grazing examiner in charge, explained the feeding operations in detail. He stated that out of a herd of some 3,000 head of cattle, the 500 head on feed represented the total number out of the entire herd that at any one time needed extra feed in order to maintain their strength. When a thin cow was first brought in from the range, she was placed in a lot with from 100 to 200 head of cows in a similar condition of flesh. These cattle received an approximate ration of thirty pounds of ground *Yucca* and three pounds of cottonseed meal per head daily for a period of twenty-five to thirty-five days. Usually during this period the cattle began to mend. Such individuals were then placed with others that had access to pasture and which received a reduced amount of ground *Yucca*, the approximate amount being twenty pounds. The cotton seed

meal supplied averaged about one and one-fourth pounds per head daily. After from thirty to forty days in this lot, the cattle in most instances continued to improve in condition and at the end of that period were in suitable condition again to be turned back on the range, receiving for a period of about thirty days one pound of cottonseed meal daily in addition to the available grass. Mr. Forsling states that over 1,200 cattle were fed on soapweed and cotton seed meal at various times during the spring until June 11, when feeding was discontinued.

EXPERIMENTAL FEEDING OF *YUCCA* IN NEW MEXICO.

The following are the results of a preliminary test in the feeding of *Yucca elata* and sotol by Professor Luther Foster, at the New Mexico College of Agriculture and Mechanic Arts, as reported in Press Bulletin No. 308:

“An experiment is in progress at the State Agricultural College to determine the value of *Yucca* and sotol heads for maintaining range cows through periods of drouth like the present, when the ranges are either bare or very short of anything upon which cattle may graze. The variety of *Yucca* used is commonly known as Amole, or soapweed.

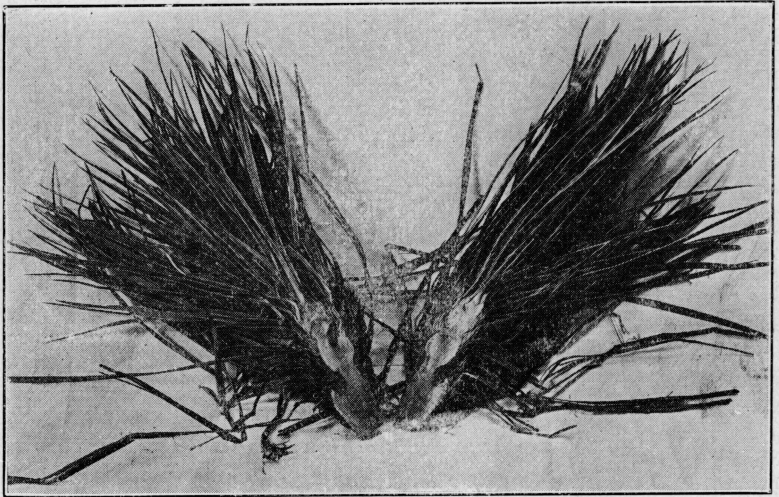


Fig. 8.—A split head of bear grass (*Y. glauca*) showing the above-ground growth of this dwarf *Yucca* commonly used as a feed.

“For this experiment twenty-five range cows in thin condition from two to four years old were selected. Five of them had young calves by their sides when the experiment began. The other twenty were divided into four equal lots, one of which was fed twenty-five pounds per head daily of sotol heads; another the same quantity of soapweed; the other two lots were fed exactly the same as the preceding two, but with the addition of two pounds of cotton seed meal per head daily. The five cows with calves were given twenty-five pounds of soapweed and two pounds of cotton seed meal per head daily. The calves were allowed the run of a separate lot, where they were given a small allow-

ance of soapweed and cotton seed meal, which was gradually increased until the cotton seed meal reached one-half pound per head, with all the soapweed they would eat. Both the sotol and the soapweed had been prepared for feeding by either running them through one of the cutters made for the purpose, or chopping them up with an axe and running them through an ensilage cutter. By either method they were cut up sufficiently fine for the cattle to eat them with little waste.

"In preparing the soapweed the dry leaves are burned off of the stem as it stands on the mesa. The stem is then cut off at the ground, furnishing the important part of the feed. The green leaves of the top are rejected by the cows unless cut up fairly fine. In feeding the cotton seed meal, it is sprinkled over the other feed after it is put in the trough. The cows have readily eaten both kinds of feed from the beginning.

"In addition to the feeds mentioned above, the cows have the run of about fifty acres of brush pasture, consisting almost wholly of shadscale brush, called chamiso in some localities and sagebrush in others. In the beginning, when the soapweed and the sotol had a tendency to physic them, they ate quite freely of the dry leaves and seeds of this brush, and while they still eat some of it, they do not seem to care for it as in the beginning.

"The cows were put on feed December 11, and at times during the first month all of them were fed sotol heads, but since January 12 the different lots have been fed as above indicated. The lot having sotol alone made slight gains, not counting the weight of a calf dropped February 8. Those having only soapweed also made a little gain, not counting the weight of three calves dropped during the month of January. As might be expected, the lots receiving cotton seed meal made much better gains, but two of those lots had no calves. The lot that had the calves at the beginning made an average gain of forty pounds per head, while the calves of that lot during the same time gained fifty-five pounds per head. The other lots gained as follows: Those on sotol alone, five pounds per head; soapweed alone, sixteen pounds per head; sotol and cotton seed meal, seventy-one pounds per head; soapweed and cotton seed meal, 101 pounds per head. The gain on these last two lots, in which none of the cows have calves, would no doubt be considerably less if they had had the same number of calves as the other two lots with which they are compared. Adding the weight of the calf to the sotol lot, it would make their gain twenty pounds per head, and adding the weight of the three calves to the soapweed lot would give those cows a gain of sixty-four pounds per head.

"Judging from results thus far, it is evident that cows may be maintained on either one of these plants without other fed, and if the cows had been put on the feed while they were still in good condition they would doubtless have remained practically in that condition, but with the thin cows that need improvement, like these we are feeding, it would be better to give them a small allowance of cotton seed meal. The calves are strong and healthy, and are making good growth.

"LUTHER FOSTER."

"March 16, 1918."

YUCCA FEEDING AT THE TURNEY RANCH UNDER THE SUPERVISION OF C. L. FORSLING, GRAZING EXAMINER OF THE FOREST SERVICE.

During the course of the winter and spring of 1918, it is estimated that 1200 head of cattle were at various times fed on a ration consisting of *Yucca elata* and cotton seed meal. At the outset, the original idea was to conduct an extensive experiment, but Mr. Forsling reports that the feeding of *Yucca* to cattle "soon became a part of the recognized work of conducting the ranch." Owing to the great success in feeding *Yucca elata* to cattle on the Jornada Range Reserve, Mr. Forsling issued a report covering the feeding operations during the winter. He says:

"Feeding soapweed to poor cows was started on the Jornada Range Reserve the latter part of January, 1918, and will be continued as long as necessary. More than 500 cattle are on feed at this time and some 400 more that were fed from forty to fifty days on soapweed and cotton seed meal are in condition to be maintained on one and one-half pounds of cotton seed meal daily and grass. The soapweed is being fed to those cattle at the rate of fifteen to eighteen pounds of the chopped feed mixed with one pound of cotton seed meal per day. Extra poor cattle are given twenty-five pounds of soapweed and two pounds of the cotton seed meal for twenty to thirty days, when they will have gained sufficiently to go on lighter feed.

"The most noticeable signs of improvement of poor cattle being fed on soapweed and cotton seed meal is that after being fed for eight to ten days they begin to lick themselves and have a generally satisfied appearance, calves begin to show signs of receiving more milk from their mothers, and cows on the feed for thirty or forty days are in condition to breed."

FEEDING SOAPWEED IN AN EXPERIMENT TO DETERMINE INJURIOUS EFFECTS.

Two steers were fed on a ration of soapweed (*Yucca elata*) and cotton seed meal at the Jornada Range Reserve in an experiment to determine whether or not injurious effects would follow prolonged feeding of the plant. These steers were supplied with all the soapweed they would consume with an additional three pounds of cotton seed meal per head daily. At the end of a sixty-five-day period one of these animals was slaughtered, after having made a gain of more than 200 pounds. The second steer was continued on feed for a period of eighty-seven days and made a proportionate gain in weight throughout the period. A veterinarian from the New Mexico College of Agriculture and Mechanic Arts made a careful examination of the digestive organs of both these steers at the time of slaughter and found them to be perfectly normal with no indication of injurious effects from feeding soapweed. The dressed carcasses displayed a good color and the meat in each instance was sweet and juicy. It was proved, therefore, that the feeding of soapweed was not only not injurious but that it would fatten the steers.

WHAT SOME PROMINENT RANCHMEN THINK ABOUT *YUCCA*.

C. T. Turney runs some 4,000 head of cattle on his ranch on the Jornada Range Reserve and has succeeded in carrying them through

the most severe drouth ever known in that section with a total loss of less than three per cent. Mr. Turney believes the feeding of soapweed (*Yucca elata*) entailed a saving of \$4,000 in the cost of feeding.

W. T. Webb, writing for Webb & Boyle, of Bonita, Arizona, says:

“Our method of feeding to begin with was to keep men riding continuously, picking out and driving to the feed yard all cattle that appeared to be dangerously poor and weak. We soon found, however, that this method was not at all satisfactory for the reason that in such cases appearances are often misleading, and a cow that looks fairly strong may be the first to die, and again, the less poor cattle are handled or driven in any way, the better it is for them, so we have now adopted the method of operating a cutting machine on the open range in the nearest patch of soapweed to each of our several watering places. This

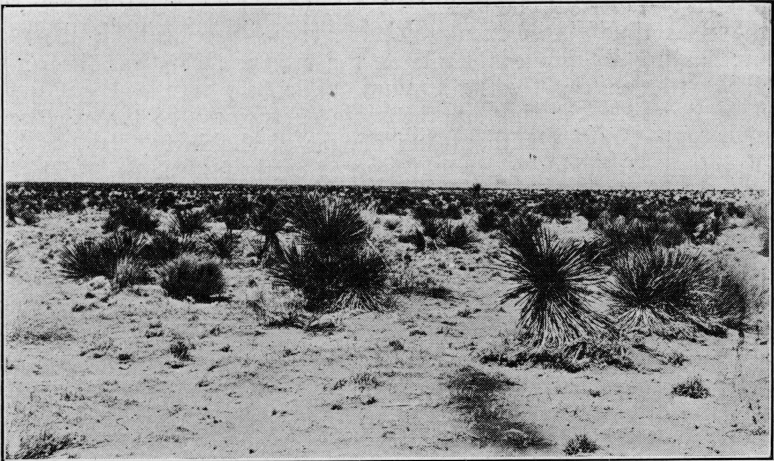


Fig. 9.—Young soapweed (*Y. elata*) growth on a cut-over range. The renewal of growth on cut-over ranges is a matter of great importance in the utilization of this plant.

method we have found entirely satisfactory, as we thus avoid handling the cattle, eliminate any long haul of the soapweed, and all cattle have access to the feed as well as an opportunity to pick around on any browse that the range may provide.

“We have fed several hundred head for from one to three months of each year since 1915, and in every instance our cattle have done well on the purely soapweed diet. There is positively no question but that cattle will gain in flesh if given plenty of this feed. At different times during the last three years we hauled to the ranch in a wagon not less than twenty head of cows that were down and too weak to get up alone, and with very few exceptions these cows have been saved on soapweed. At no time have we seen the slightest ill effects in the use of this feed. In every instance where we have fed it our cattle have done surprisingly well.”

A letter written by G. A. Gibson Brothers, Deming, New Mexico, is presented as follows:

“In regard to our experience in over one hundred forty days feeding

the soapweed, will say that we have fed eleven hundred forty head of cattle, all classes and from poor cows on the lift to fat bulls for beef, also to milch cows. We find that we have had greater success with this feed than any other we have ever fed. It keeps down diseases of all kinds in your herd, and soapweed with cotton seed meal is the finest milk producer I ever saw, but to put on fat soapweed with one pound of meal is better than any green feed I ever saw. It keeps the system in A-1 condition."

J. W. Dalton, ranching on nine sections in Lubbock county, fifteen miles east of Lubbock, makes the following statements relative to his experiences in feeding bear grass (*Yucca glauca*):

"Last year I had no grass and bear grass was used for roughness. It was obtained gratis for grubbing it out from an adjoining pasture which had not been grazed for several years and had lots of the *Yucca* in it. In gathering it one wagon was trailed and two loads were brought at the same time. Two men could gather the two loads in about two hours, hauling all they could pile on the wagon. This was thrown out to the cattle on the feeding ground. The best results I got out of feeding it was by cutting up the roots or tussocks so that the cattle could masticate them without any danger of choking. The two loads made a feed of roughness for 200 head of cattle for one day. They ate the leaves, leaving the crown and roots, which they could not eat until cut up for them. The next day the unconsumed portions of the roots were chopped into four or five pieces for that day's feed so that the cattle could get them in their mouths. The cutting was done with an axe on a bench which was moved about from place to place in the feeding area. The crown and roots are much better than the blades; however, they will eat the blades; it is good filler and just loosens their bowels and keeps them in good condition. At first I was only feeding one pound of cake every other day. On the first of March I increased it to two pounds. I started feeding bear grass about January 15 and fed it up until about April 1 last year or as long as they would eat it, but they will not do that every year. When the grass begins to get green they will not eat it. It depends upon the condition of the range and moisture as to how late they will eat it in the spring. The cattle stayed in fair condition and gave milk well when they had calves, while other cattle which did not receive enough roughness last year on account of no grass could not raise their calves. The cattle seemed to relish it and ate it so long as there was a piece of it."

Sayles Brothers, of Toyah, Texas, were at considerable expense during the past winter in feeding some 2,000 head of cattle on their ranch south of Toyah. Thomas Sayles made a special investigation into the merits of the soapweed as a maintenance roughage, and after a trip of inspection to some of the ranches that were already feeding this plant, decided to purchase a feed cutter in order that the cattle might be supplied with *Yucca* instead of the expensive concentrated feeds that were being fed. Mr. Sayles was highly pleased with the results obtained and the monthly feed bill which, during the winter months, averaged somewhere around \$4,500 per month had been materially reduced as a result of feeding the ground soapweed.

RANGE IMPROVEMENT PROBLEMS.

Ordinarily, at the first indication of a possible drouth provision is made by rangemen to remove all surplus stock to other ranges in order to obviate the danger of distressing conditions on the home range. The safest policy for the rangeman to pursue would be to stock his range with the optimum number of live stock at all seasons rather than to graze it to its maximum capacity during the most favorable seasons of abundance and plenty. The ranchman who is content to resort to the former practice may possibly have to be satisfied with smaller profits during the most favorable seasons, but such an operator would be placing himself in a position to hold onto the reins for a longer time and would naturally be better able to withstand periods of drouth, owing to the fact that his range would likely carry a supply of reserve grass. It is apparently human nature for everyone to want to make as many dollars as he possibly can and, this being true, it is a rather difficult matter to refrain from making every possible dollar out of the range each season. A large and fertile field of investigation lies open to students of live stock economics in the western ranching regions, and not until some of the important problems bearing on range live stock management in the various sections of the west are solved, will any great relief come to the ranchman. The Grazing Branch of the Forest Service, United States Department of Agriculture, is doing a most valuable work on the Jornada Range Reserve, near Las Cruces, New Mexico, in the matter of range improvement work and increased cattle production. This work is being conducted under the able direction of James T. Jardine, Inspector of Grazing, and already some valuable information is available in Bulletin No. 583, "Increased Cattle Production on Southwestern Ranges," United States Department of Agriculture.

When one stops to consider the saving entailed in feeding operations by the utilization of *Yucca* as a feed for the maintenance of live stock on drouth-stricken ranges, it is obvious that the *Yucca* plant can be utilized to splendid advantage, thus serving to dispense with the purchasing of dry roughages which have reached almost prohibitive prices, especially when delivered to ranges some distance from the railroad. The tests conducted by the New Mexico Experiment Station and the Grazing Service of the United States Department of Agriculture proved conclusively that cattle in normal condition could be maintained upon *Yucca* as a sole ration. These tests lead to the conclusion that it is advisable to supplement *Yucca* with a small amount of cotton seed meal.