

# Bulletin No. 8.

## Agricultural Experiment Station.

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# Stock Feeding.

— BY —

F. A. GULLEY.

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## FORAGE PLANTS.

With some assistance from the Agricultural Department of Washington, the Experiment Station has been making tests of grasses and forage plants with and without irrigation. The tests so far do not promise much with no irrigation, though it may be the work would have been more successful had not the rainfall for the past two years been much below the average.

With irrigation we find nearly all the grasses and forage plants of the country grow luxuriantly, and the question of importance is to learn which are most profitable to produce. We want to determine the best two or three kinds, and aside from experimental work, plant but them until we get something better.

In the Central, Eastern and Northern States, notwithstanding all that has been written and claimed for a number of grasses and plants for hay, the farmers continue to sow timothy and clover practically to the exclusion of all others.

## ALFALFA.

On irrigated lands in Arizona, alfalfa makes such luxuriant growth and possesses so many good qualities, in hardiness, permanency, feeding value, etc., that we may easily select it as one and perhaps the best of any that we know.

Alfalfa is recognized as a most excellent food as hay, or to feed off by grazing for cattle, and for growing and working horses, but like red clover is objected to by the owners of driving horses.

For driving horses a sufficient hay supply is derived from the small grains cut before maturity and cured as hay. This, however, is a too expensive food for cattle feeding, and fed alone no better than alfalfa, if equal to it.

The question that presented itself was to find something that

may be fed with alfalfa that will be better than alfalfa alone. Corn would fill the bill, but corn is too expensive to be used for cattle-food.

## SORGHUM.

Of the plants we have tested, the sorghums promise most of value, and we have begun investigating their habits of growth, food value and adaptability to irrigated land. Quite a number of varieties of sorghum of both the sweet and non-saccharine kinds were planted at the Phoenix Station last spring and summer for the purpose of comparing growth, but as on the different plots a considerable quantity of forage was produced, we concluded to make a feeding test in a crude way, to learn how to handle the rather wild range steers of the territory preliminary to attempting more thorough work.

As we are receiving frequent inquiries in regard to the feeding value of sorghum, we have thought it best to publish the result of this test at the present time rather than to wait until we have given the question more complete investigation.

### FEEDING TEST.

A stock scale and weighing pen was put in and through the kindness of Messrs. Hurley Bros., of Phoenix, 21 steers were provided for the test. The steers were cut out from a lot of 50 or more very ordinary range steers and were selected with reference to dividing the 21 head into three as uniform lots as possible. The cattle were not such as we would select for putting up to feed, to secure best results, in fattening for market.

Three small fields were fenced off, all communicating with the scales, and seven head put in each, numbered A, B and C. The intention was to feed one lot alfalfa, another sorghum, and the third alfalfa and sorghum mixed for 60 days, then finish up on the feed that gave best results to that time, but this was varied from, as we did not have sufficient sorghum to complete the feeding.

The steers were fed twice a day, morning and night, the feed given weighed and what was left uneaten weighed out, the quantity being increased and decreased to supply what the cattle would eat nearly clean.

The cattle were fed in low mangers, one in each field, the lot eating together. The waste includes what they left and pulled on to the ground and represents about the loss that would occur in ordinary careful feeding in mangers.

The test commenced November 18th. The weights given for that date are the average of three daily weighings, and the last weight, February 28th, is the average of weights for two days.

An attempt was made to weigh the steers separately at the start, but this was found impracticable with our facilities owing to the wildness of the steers, they having no regard for a five wire barbed-wire fence around the field and a corral of poles six feet high around the scale when they became excited.

## WEIGHTS AND GAINS OF EACH LOT.

WEIGHT.	Nov. 18, lbs. ....	Dec. 12, lbs. ....	Dec. 30, lbs. ....	Jan. 21, lbs. ....	Feb. 17, lbs. ....	Feb. 28 & Mar. 1, lbs	Total gain, lbs. ....	Average Gain per head, lbs. ....
Weight of Lot A. . . . (7 steers.)	6996*	7242	7238	7204	7506	7545†	549	78.4
Weight of Lot B. . . . (7 steers.)	7612*	7716	8090	8160	8454	8407†	795	113.4
Weight of Lot C. . . . (7 steers.)	7543*	7684	7980	8218	8216	8440†	897	128.1

Lot A was fed sorghum 71 days, then alfalfa 31 days.

Lot B was fed alfalfa the entire time.

Lot C was fed alfalfa and sorghum 71 days, then alfalfa 31 days.

January 21, six days before ceasing to feed sorghum:

Lot A had gained in weight 208 lbs, 29.7 lbs per head.

Lot B had gained in weight 548 lbs, 78.2 lbs per head.

Lot C had gained in weight 675 lbs, 96.4 lbs per head, showing a decided advantage in the alfalfa and sorghum over alfalfa alone, while sorghum gave the least gain of the three rations.

From January 21st to February 28th the gains were as follows:

Lot A, 341 lbs, or 48.2 per head.

Lot B, 247 lbs, or 35.2 per head.

Lot C, 222 lbs, or 31.7 per head.

Single weights of animals are not to be relied on as showing actual gain or loss, as the steer may eat or drink varying quantities the day of weighing.

To learn something of the individual variation, the steers, with considerable difficulty, and no doubt interference with gain in weight, were weighed separately five times during the feeding, commencing December 12, when they were not quite so wild as at first.

\*Average of weights for three days.

†Average of weights for two days.

## LOT "A."

Steers.....	Age—Years.....	Average gain, Nov. 18 to Dec. 12, lbs....	December 12, lbs....	December 30, lbs....	January 21, lbs.....	February 17, lbs....	February 28, lbs....	Gain per head, 78 days, lbs.....
No. 1	4	35	1198	1164	1170	1200	1208	10
2	4	35	1268	1266	1276	1340	1338	70
3	3	35	1156	1166	1130	1150	1158	2
4	2	35	898	892	900	944	922	24
5	3	35	814	824	834	876	854	40
6	2	35	990	992	998	1026	1032	43
7	2	35	918	934	896	970	976	58

## LOT "B."

No. 1	5	29	1410	1442	1450	1496	1512	102
2	5	29	1192	1262	1270	1284	1302	110
3	3	29	1050	1052	1058	1106	1104	54
4	4	29	1048	1134	1178	1228	1202	154
5	3	29	1168	1248	1254	1302	1328	160
6	2	29	884	934	926	966	1016	132
7	3	29	964	1018	1024	1072	1048	84

## LOT "C."

No. 1	6	20	1476	1598	1648	1642	1662	186
2	5	20	1354	1396	1446	1370	1420	166
3	3	20	1034	1068	1102	1158	1186	152
4	3	20	1060	1090	1124	1174	1206	146
5	4	20	1030	1050	1040	1060	1066	36
6	3	20	840	862	906	842	868	28
7	2	20	890	916	950	970	974	84

Without exception the wildest steers in each lot made least gain, and even at the close of the experiment the different lots had not quieted down sufficiently to be moved from field to scales except with men on horses.

## FOOD CONSUMED.

Lot A, seven steers, for 71 days consumed an average of 38.8 lbs of sorghum\* per head per day of which they rejected and wasted 2.5 lbs each.

In the last 31 days they consumed 34.4 lbs alfalfa each per day, of which 2.5 lbs were rejected and wasted.

Lot B, seven steers, consumed an average of 33.6 lbs alfalfa per head per day for the entire period of 103 days, of which they rejected and wasted 1.2 lbs.

Lot C, seven steers, for 71 days, consumed an average of—

{ 18.1 lbs alfalfa per head per day rejecting and wasting 1. lbs.

{ 20.5 lbs sorghum per head per day rejecting and wasting 1.4 lbs.

In the last 31 days they consumed 30 lbs alfalfa per head per day, rejecting and wasting 1.4 lbs.

It will be noticed that sorghum gives nearly equal results with alfalfa pound for pound when the two are fed together.

From the single weights it will be seen that compared with other steers of the same lot there were two quite inferior steers in Lot A, two in Lot B, and three in Lot C.

Rejecting these very inferior steers, five head in Lot B and four head in Lot C made very fair gains for cattle receiving no grain, an average of 159 lbs, for Lot B and 182 lbs for Lot C.

The gain of Lot A from December 12th to February 28th, is low, two steers making no gain during the entire period, and the lot as a whole showing no increase from December 12th, until after January 21st, when the feed was changed from sorghum to alfalfa, after which they showed the greatest increase in weight of any of the lots. They also made the largest increase from the beginning to December 12th. These results may be partly due to weighing heavy, i. e. full of feed or water, on December 12th.

## ALFALFA vs. SORGHUM.

In this experiment, alfalfa alone, gives a much better result than sorghum alone, but the combination of the two is superior to either fed singly, and this is what might be expected, judging the two feed-stuffs from their chemical composition.

Sorghum, stalks leaves and seed, is rich in carbonaceous, but deficient in nitrogenous matter for a complete food.

In considerable experience in feeding cattle with sorghum, it has always given good results, but we have always fed it with grain of some kind, or cotton seed and its products.

Alfalfa may be classed with the nitrogenous foods, being deficient in carbonaceous material to make a well balanced fattening food.

Not desiring to discuss the chemical composition and digesti-

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\*The sorghum used in the experiment included a number of varieties of the sweet and non-saccharine kinds. It was cut as the seed were ripening and shocked in the field, and hauled to the feeding pens as needed and fed without cutting up.

bility of feed-stuffs at this time, we will simply state that the experiments made in this country and in Europe indicate that a food that contains one part of digestible protein (nitrogenous compounds) to from five to eight parts of carbo-hydrates gives best result in feeding. This is termed the nutritive ratio of the food.

The nutritive ratio of sorghum is one, to fourteen to eighteen, while the nutritive ratio of alfalfa is about one to four,—the first too wide, the latter rather narrow,—and a combination of the two should give better results than either fed alone.

Grain-hay, or corn, with alfalfa should give better results than alfalfa alone, while cotton seed meal, which has a narrow ratio, ought to make a good combination with sorghum, and experience in feeding shows that the two make a good ration.

Sorghum and alfalfa fed without grain are open to the objection that the animal does not get his food in condensed form, as in grain feeding, hence the animal cannot eat and digest a sufficient amount to make as rapid gain as when grain is fed.

From two to two and a half pounds gain per day for one hundred days is a good gain for average 1,000 pound steers, fed on hay and corn in the central states and we are confident that this increase may be nearly made with selected range steers fed on sorghum and alfalfa, if they can be "broken" to eat and to feed quietly after placing in the feed yards.

#### GAINS FROM OTHER FEED-STUFFS.

While in Texas\*, we made two feeding experiments in 1889 and 1890, the first with 48 steers divided into lots of six head each, average weight of steers 772 lbs., The average gain of each of the eight lots of steers in 83 days feeding varied from 148 lbs. to 202 lbs. per head.

It was a test of different feed-stuffs, hay, corn, cotton-seed products, and corn and sorghum silage.

The second test in 1890 was with 71 steers, a better class of steers than in the first experiment, divided into fourteen lots. Eleven of the fourteen lots made average gain per lot from 161 lbs. to 251 lbs. per head in 90 days feeding, average gain for the entire lot 205 lbs. per head; and three lots of seven head each made average gain per lot from 222 lbs. to 279 lbs. in 79 days, average for the entire lot 244 lbs.

After feeding eleven of the pens 90 days and making average gain of 205 lbs., and three pens 79 days and making average gain of 244 lbs., the steers in the eleven pens were turned together, feed changed, fed 20 days longer, when they made average gain of 41 lbs. more, or average gain on 50 head in 110 days of 241 lbs., while the other three pens gained 42 lbs. each or 286 lbs. per head in 100 days.

This was an exceptional gain in weights in experimental feeding with steers weighed singly every ten days, for any disturbance or excitement of a fattening animal stops gain in weight for the time.

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\*Texas Agricultural Experiment Station bulletins No. 6, 1889, and No. 10, 1890.

The large gain was due to two causes, first, rich condensed food, and second, the steers were "broken" and kept quiet during the test.

The "breaking" was done by

### DEHORNING

the steers just before they were put into the pens to feed.

The first winter all the steers were dehorned except in one pen, and steers with horns left on made the least gain of a year. If the horns of a wild steer are sawed off close to the head, he becomes quiet at once, and a drove may be put into a pen and they will feed as quietly as hogs or sheep.

For a moment the operation is painful, but no serious after-results occur when the work is properly done. We have frequently had steers step from the dehorning chute to the manger and go to eating as quietly as if nothing unusual had happened, and in dehorning cows in full milk no shrinkage in yield or quality has taken place, showing that it is not a serious shock to the system. From a humanitarian standpoint it is to be commended where steers are shut up together to feed as it stops all fighting. Castration is a much more serious operation so far as it injures the animal. Dehorning is not desirable except with cattle that are to be shut up to feed. It should not be practiced on cattle that are to run on the range, nor should the horns be cut off when flies are troublesome.

### SORGHUM.

In beginning our study of the feeding question, we have started with sorghum, because at present it is the only cultivated plant we know of except alfalfa that on irrigated lands in Arizona will supply cattle food at a cost that will permit its use. Sorghum and alfalfa supplement each other, each supplying what the other lacks to make a good cattle food.

### VARIETIES.

There are a great number of varieties, some of which are sweet, others not, and some of the latter kind produce more seed or grain than the sweet varieties.

We have grown and fed a large number of both the sweet and non-sweet varieties, and while some of the latter, Jerusalem corn in particular, are highly recommended by Kansas stock feeders, we prefer the large sweet varieties for cattle feeding.

We found this winter, and it agrees with our experience in Texas and in Mississippi, that the cattle would eat the stalks of the sweet varieties nearly clean, while of the non-sweet kinds they would eat the heads, some of the leaves, and reject most of the stalks. Feeding the two kinds together they take the sweet first.

It does not follow that the best varieties of sorghum for the dry regions of the west central part of the Mississippi Valley are most desirable for us. They require a plant that will live through long droughts, while we want a plant that will produce a large yield of

food material with irrigation, otherwise it will be too costly for our purpose. Corn does not ear up well in this very dry atmosphere, while sorghum grows to perfection and is equal if not superior in feeding value to a good corn crop; compared in acreage, or in cost of producing food that may be turned into a given number of pounds of beef.

### CULTIVATION OF SORGHUM.

Sorghum may be sown broadcast like grain and harvested with a machine, but grown in this way it makes a very much smaller yield and of inferior quality as compared with planting in drills and giving the crop one or two workings.

We prefer to plant in drills three to three and a half feet apart, on ridges and irrigate between the rows,—can plant any time from April to middle of July. The crop should be harvested about the time the seed are hardening. It may be cut close to the ground and thrown together in loose shocks where it will keep without spoiling through our winters. The outside of the shock will become quite dry, but the cattle do not reject the dry stalks of the sweet varieties.

It will save some waste if the shocks are made large and upright and bound with one or two wires.

With sufficient irrigation and stirring the ground between the rows after each watering, the yield will vary according to variety from eight to fifteen tons of partially cured forage per acre which will include from five to fourteen hundred weight of seed equal in feeding value to about the same quantity of corn. We made a very fair crop last year, planting in July after wheat, with two very light irrigations. We prefer planting earlier, but nothing is gained in planting before the ground is well warmed up in the spring—this applies to irrigated land, and not where crops are dependent on spring rains.

### FEEDING ALFALFA ON THE GROUND.

While living in Mississippi the writer had occasion to clear up considerable new ground, and for three years from ten to fifteen acres of this new land was partially plowed and sowed broadcast, twenty to thirty pounds orange sorghum seed to the acre in June. When the cane began to ripen the latter part of September, steers were turned in, at first but an hour or two at a time, but after a few days allowed free access with range over a clover field. We have never had cattle fatten more rapidly than by this method and never lost any steers from bloat in feeding in this way, but some losses have occurred where steers have had access to the young second growth of sorghum after a crop of forage has been taken off.

### VARIETIES.

Orange, Honduras and Coleman are large and late sweet varieties. Early Amber is a small early sweet variety, good horse or

mule feed, but too light in yield to be used profitably for cattle feeding.

Jerusalem corn, Kaffir White and Yellow Dhoura, sometimes known as Millo Maize, are non-sweet varieties grown largely in Texas and Kansas. Another plant much like the non-sweet sorghums in growth, and one that has been highly commended by Southern writers is Teosinte. I have grown it for several years, and fed, or tried to feed it, and notwithstanding all that has been said in its favor, I think it bears about the same ratio to the sweet sorghums in feeding value that sage brush does to alfalfa.

### SORGHUM SEED

May be procured from any of the seed stores or through Kansas Commission houses. We have recently ordered a sack from Sterling, Kas., that cost three cents per pound there.

We will forward prepaid Coleman Sorghum seed and Jerusalem corn, in one-fourth pound packages, if applicants will send us four cents in stamps as long as the supply lasts, or larger quantities of mixed sweet sorghum, our own growing, on receipt of stamps to cover postage, to those who wish to plant experimental patches.

Coleman is rated as one of the best varieties for sugar and molasses, as well as for forage, and will be used for our principal crop the coming season.

### CATTLE FEEDING IN ARIZONA.

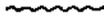
For several years the writer was engaged in winter cattle feeding in Michigan where the staple foods were corn and hay,—after that time for seven years in Mississippi in handling a large dairy herd and fattening beeves, where a series of experiments were made to determine the food value of cotton seed. These experiments were continued in Texas in 1889 and 1890. During these years the work of the distillery and other feeders in the northern states, and the extensive work of the cotton seed hull and meal feeders in the South was frequently inspected. With this general knowledge of the facilities for feeding cattle over a considerable part of the country, it would seem to me that we have in Arizona certain favorable conditions for feeding cattle that will enable us to compete successfully with cattle-men of other states. First, we have warm and dry winters, no shelter is required; second, in alfalfa and sorghum, we have two crops that supply a nutritious cattle food for the growth of which our climate is specially adapted, and they may be grown at a cost that will enable us to produce beef at the minimum expense compared with other sections of the country. It must be borne in mind, however, that in

### FEEDING CATTLE

certain requirements are necessary, the most important of which is that the cattle must be MADE COMFORTABLE AND KEPT QUIET. No matter what the feed may be, a steer that is frequently worried or ex-

cited will not gain in weight. Second, the steer must have palatable food, and some variety and occasional variation if possible. Third, plenty of clean water to drink.

Our winter climate provides for the comfort of the animal, de-horning will tame the wildest steer, but the noisy, irritable man and the dog must not be allowed in the feeding lots. In experimental feeding with frequent weighing and with small lots of cattle, it is difficult to secure a fair gain in weight with wild steers, and at best is much less than that made with larger numbers when the cattle are weighed only before and after feeding, and where a considerable number are kept together.



Correspondence pertaining to the agricultural industries of Arizona is solicited by the members of the Experimental Station Staff.