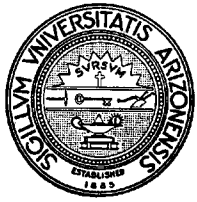
Bulletin No. 170 March, 1940



University of Arizona
COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

RATIONS FOR FATTENING CATTLE IN ARIZONA

By

E. B. Stanley and A. H. Walker

PUBLISHED BY
University of Arizona
TUCSON, ARIZONA

ORGANIZATION

ALFRED ATKINSON, Sc.D. — President of the University

EXPERIMENT STATION STAFF

P. S. BURGESS, Ph.D. — Dean and Director
RALPH S. HAWKINS, Ph.D. — Vice-Dean and Vice-Director

AGRICULTURAL CHEMISTRY AND SOILS DEPARTMENT

WILLIAM T. McGEORGE, M.S. — Agricultural Chemist
JAMES F. BREAZEALE, B.S. — Biochemist
THEOPHIL F. BUEHRER, Ph.D. — Physical Chemist
HOWARD V. SMITH, M.S. — Associate Agricultural Chemist
WILLIAM P. MARTIN, Ph.D. — Assistant Soil Microbiologist
RAYMOND H. KELLNER, B.S. — Assistant Agricultural Chemist
GEORGE E. DRAPER, M.S. — Assistant Agricultural Chemist (Phoenix)

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY DEPARTMENT

GEORGE W. BARR, Ed.D. — Agricultural Economist
ELZER D. TETREAU, Ph.D. — Rural Sociologist
NED O. THOMPSON, M.S. — Assistant Agricultural Economist

AGRICULTURAL ENGINEERING DEPARTMENT (IRRIGATION)

GEORGE E. P. SMITH, C.E., D.Eng. — Agricultural Engineer
HAROLD C. SCHWALEN, B.S. in M.E., M.S. in C.E., Assoc. Agricultural Engineer
LAWRENCE G. BOOHER, B.S. in C.E. — Asst. Agricultural Engineer

AGRONOMY DEPARTMENT

R. S. HAWKINS, Ph.D. — Agronomist
IAN A. BRIGGS, M.S. — Associate Agronomist
LLOYD V. SHERWOOD, Ph.D. — Assistant Agronomist
CHARLES HOMER DAVIS, Ph.D. — Assistant Agronomist
*ARTHUR T. BARTEL, M.S. — Assistant Agronomist

ANIMAL HUSBANDRY DEPARTMENT

ERNEST B. STANLEY, M.S. — Animal Husbandman
ARTHUR H. WALKER, Ph.D. — Assistant Animal Husbandman
C. L. BELL, M.S. — Assistant Animal Husbandman

VETERINARY SCIENCE DEPARTMENT

WILLIAM J. PISTOR, B.S., D.V.M. — Veterinarian
EDMUNDO FELIX, B.S. — Laboratory Technician

BOTANY AND RANGE ECOLOGY DEPARTMENT

D. M. CROOKS, Ph.D. — Botanist
JOHN J. THORNBER, M.A. — Taxonomist
R. C. CHANDLER, Ph.D. — Assistant Botanist
LYMAN BENSON, M.S. — Assistant Botanist
ROBERT A. DARROW, Ph.D. — Assistant Range Ecologist
JOSEPH F. ARNOLD, M.S. — Research Assistant in Range Ecology
W. THOMAS LIGHTLE, M.S. — Field Assistant

DAIRY HUSBANDRY DEPARTMENT

W. H. RIDDELL, Ph.D. — Dairy Husbandman
†WALTER S. CUNNINGHAM, M.S. — Dairy Husbandman
RICHARD N. DAVIS, M.S. — Associate Dairy Husbandman

ENTOMOLOGY AND ECONOMIC ZOOLOGY DEPARTMENT

CHARLES T. VORHIES, Ph.D. — Economic Zoologist
†ELMER D. BALL, Ph.D. — Entomologist
H. G. JOHNSON, Ph.D. — Associate Entomologist
LAWRENCE P. WEHRLE, Ph.D. — Assistant Entomologist

HORTICULTURE DEPARTMENT

*ALTON H. FINCH, Ph.D. — Horticulturist
W. A. FRAZIER, Ph.D. — Associate Horticulturist (Phoenix)
WILLIAM E. MARTIN, Ph.D. — Assistant Horticulturist
ROBERT H. HILGEMAN, B.S.A. — Assistant Horticulturist (Tempe)
C. W. VAN HORN, B.S. — Assistant Horticulturist (Yuma)
JUSTIN G. SMITH, B.S. — Assistant Horticulturist (Tempe)
‡KARL HARRIS, M.S. — Assistant Irrigation Engineer (Phoenix)

HUMAN NUTRITION DEPARTMENT

MARGARET CAMMACK SMITH, Ph.D. — Nutrition Chemist
LOUISE OTIS, Ph.D. — Associate Nutrition Chemist

PLANT BREEDING DEPARTMENT

WALKER E. BRYAN, M.S. — Plant Breeder
ELIAS H. PRESSLEY, M.S. — Associate Plant Breeder

PLANT PATHOLOGY DEPARTMENT

JAMES G BROWN, Ph.D. — Plant Pathologist
RUBERT B. STREETS, Ph.D. — Associate Plant Pathologist
†KARL D. BUTLER, M.S. — Assistant Plant Pathologist
MANFRED GOTTLIEB, B.S. — Assistant Plant Pathologist (Phoenix)

POULTRY HUSBANDRY DEPARTMENT

HARRY EMBLETON, B.S. — Poultry Husbandman
HUBERT B. HINDS, M.S. — Associate Poultry Husbandman

---

* In co-operation with United States Department of Agriculture, Bureau of Plant Industry.
† On leave.
‡ In co-operation with United States Department of Agriculture, Bureau of Agricultural Engineering.

TABLE OF CONTENTS

PAGE

INTRODUCTION 137

EXPERIMENTAL PROCEDURE 139

FEEDS USED 139

Chemical Analysis 140

Average Prices 140

EXPERIMENTAL RESULTS 140

Relative Value of No. 1, 2, and 3 Federal Grades of Alfalfa Hay 140

The Value of Hegari Fodder and Cottonseed Hulls as Compared with Hegari Silage 142

The Value of Whole Cottonseed 143

The Value of Hegari Silage when Fed with Alfalfa Hay, Rolled Barley, and Cottonseed Meal 145

The Value of Ground Barley when Replacing Part of the Cottonseed Meal Supplement in a Basal Ration of Alfalfa Hay and Hegari Silage 147

The Value of Alfalfa Hay when Added to a Ration of Hegari Silage and Cottonseed Meal 148

SUPPLEMENTARY STUDIES 149

Calves vs. Yearlings 149

Alfalfa Hay, Ground, vs. Baled Alfalfa Hay, Unground 150

Comparison of Meat Meal, Fish Meal, and Cottonseed Meal 151

ADDITIONAL FEEDING TESTS NOT COMPLETED 151

Addition of Cottonseed Meal to an Alfalfa Hay and Barley Ration 151

The Value of Barley Added to a Basal Ration of Cottonseed Hulls and Cottonseed Meal 153

The Value of Barley-Alfalfa Hay 153

Effect of Limiting the Silage Allowance 153

SUMMARY 155

RATIONS FOR FATTENING CATTLE IN ARIZONA

By E. B. Stanley and A. H. Walker*

INTRODUCTION

The results of the several experiments reported in this bulletin are intended to aid the commercial feeder in the selection of economical rations for fattening cattle. Various combinations of locally produced feeds have been fed to determine their relative values singly and in the aggregate as complete rations. An understanding of comparative feed values will serve as a guide to cattle feeders in planning their cropping systems and also in the proper selection of purchased feeds.

Within recent years the production of finished beef has become an established farm enterprise of major significance, particularly in the Salt River and upper and lower Gila valleys of the state. This industry has provided an outlet for farm crops that gives to this section a mobility of farming practices that will permit adjustments in line with economic conditions. Maintenance of soil fertility sufficient to meet the requirements of the varied and intensive type of agriculture of this area is of paramount importance. In the event conditions should especially favor the production of certain cash crops, lands in alfalfa can be readily converted into whatever specialty crop seems economically feasible to grow. This flexibility of farming practices, made possible by a moderate climate, can be maintained only with the support of livestock feeding enterprises.

Cattle fattening operations are largely in the hands of feeders who have made the business their principal occupation in conjunction with general farming. They produce no less than 500 and upwards of several thousand head of cattle in the course of a feeding season. Unfortunately, this large scale system of cattle feeding does not make for a wide distribution of feed-lot fertilizer throughout the farming area. It is believed that cattle feeding can and should be included in the agriculture system of the moderate sized farm capable of handling at least a hundred feeder cattle. Large volume production and cheap electrical power have contributed to the general use of feed grinding and mixing mills, some of which are capable of taking 4 to 6 tons of hay per hour through a ¾ inch screen. Low processing costs, complete utilization of second grade alfalfa hay and of barley hay, besides the convenience and desirability of feeding mixed feeds are advantages which cattle feeders in this section claim are enough to warrant the use of grinding and mixing mills.

* The authors wish to thank Dr. E. L. Scott for his assistance in the planning and conducting of the experiments reported herein during the time he was a member of the Arizona Agricultural Experiment Station staff.

Rations of different combinations are prepared from the following feeds: alfalfa hay, barley hay, hegari silage, cottonseed hulls, cottonseed meal, and barley and hegari grain. Hegari silage is very widely used by cattle feeders. The 15 to 18 tons of silage or 2 tons of grain which this crop will yield on improved farm lands accounts for the popular use of this feed. It should be understood that the cattle fattening enterprise is dependent not only upon the feeding operation but also to a large extent upon the efficiency of feed crop production.

The double cropping system made possible by a yearlong growing season and the high productive value of land enriched with feed-lot manure combine to provide for a maximum of beef-producing feeds per acre of farming land. Yields of 6 tons of alfalfa per acre are not uncommon, nor 2 tons of barley. Cottonseed meal and hulls are readily available and locally produced. Barley and hegari grains have proved satisfactory substitutes for corn. Heavy feeding of these grains is not required in the Arizona fattening ration. Instead of feeding for several months on a heavy grain ration, the fattening process has been stepped up to the point of finishing a beef in about 120 days, following a preliminary period on irrigated alfalfa-barley or Bermuda grass pasture.

Prior to 1930, owing to the comparatively high cost of grains, the experimental rations included a large amount of alfalfa hay and cottonseed meal—a high protein content. The addition of grain was attended by considerable financial hazard. Cottonseed meal, because of its more favorable price relation to grain, was fed both as a concentrate and a supplement. In the readjustment of cropping practices during the past few years, grain prices have fallen below those for cottonseed meal making it possible to add rather substantial allowances of barley or hegari to the cattle fattening ration. Feeds are inexpensive only in terms of replacement feeds or in relation to the gains they will produce and the value of the meat sold from them. In the feeding experiments reported herein, grain in the ration has paid for itself when added sparingly to "sweeten" the ration and increased in accordance with the feeders adage to "keep the feed a little better than the cattle."

This bulletin reports the results of cattle feeding tests conducted at the Salt River Valley Experiment Farm, Mesa, from 1930 to 1936.

Yearling steers were used exclusively excepting three lots of calves in the 1932-33 test. The cattle were fed for 120 days except in the 1933-34 test which ran 135 days.

A total of five feeding tests is included in this study. The first four were devoted chiefly to a study of roughage feeds. Some of the comparisons were not carried through the entire series, and others were terminated following 1 year's work where results indicated that further study was not warranted.

EXPERIMENTAL PROCEDURE

Good quality range-raised yearling steers of predominantly Hereford breeding were purchased for October or November delivery. Three lots of range calves were used in the 1932-33 test.

The cattle were divided into lots of ten steers each as evenly as possible according to their individual weight, condition, type, and feeder grade.

Each animal was indentified with a brass number on a neck strap. The steers were weighed individually on the first and second days and by lot on the third day. An average of the three weights was taken for the initial weight, and the experiment proper was started on the second day. Final experimental weights were taken in the same manner while intervening weights were taken by lots at 30 day intervals.

The feed lots were unsheltered, woven-wire enclosures 48 feet by 60 feet. Each lot was equipped with automatic drinking cup, a box for block salt, and a feed trough 3 feet by 36 feet above which was a rack for hay.

A preliminary period of 1 to 2 weeks was allowed the cattle to become accustomed to their feed and quarters. All lots were hand fed. The method of feeding varied with different rations. Water and plain block salt were available at all times.

FEEDS USED

Baled alfalfa hay grown on the Station farm was used in all the tests. The federal grades of alfalfa hay were designated by E. H. Phillips, Federal Hay Grader, and I. A. Briggs, of the Agronomy Department, University of Arizona. The ground hay was from baled hay of the same grade.

Hegari silage produced on the Station farm was fed in all lots in which silage was used. This crop averaged 16 tons per acre with a grain yield of about 4,500 pounds.

Barley was grown locally and purchased from local mills. In the first two and last tests the barley was rolled, and in the other two it was ground.

Whole cottonseed grown locally was purchased from local gins.

Cottonseed hulls were produced by local mills.

Fifty per cent protein dry-rendered meat scraps were purchased from a local mill.

Sixty per cent protein dry-rendered sardine meal was purchased from a local mill.

Hegari fodder was harvested on the experimental farm with a binder, then shocked, and later stacked in such a way as to protect the heads from birds and to insure maximum drying. Ground hegari fodder of high moisture content heats quickly and should be ground in quantities only as needed. Unless hogs follow the cattle, the fodder should be ground fine enough to insure cracking most of the grain. A Papec hammer mill was used for this purpose.

CHEMICAL ANALYSIS

Samples of the different feeds used in the various trials were taken at intervals and analyzed by the Agricultural Chemistry Department. A table of the average analysis of the various feeds is shown in Table 17.

AVERAGE PRICES

An average price for each of the different feeds used over the entire period of these studies was used in order to make the feed cost of gains comparable in the separate tests.

TABLE 1.—AVERAGE PRICES OF FEEDS USED.

Feed	Price per ton	Price per pound
Cottonseed meal	$27.00	0.0135
Barley	30.00	0.015
Silage	3.50	0.00175
No. 1 alfalfa	12.00	0.006
No. 2 alfalfa	11.00	0.0055
No. 3 alfalfa	10.00	0.005
Ungraded alfalfa hay	10.00	0.005
Ground hegari fodder	10.00	0.005
Meat meal	50.00	0.025
Fish meal	50.00	0.025
Cottonseed hulls	7.00	0.0035
Whole cottonseed	20.00	0.01

EXPERIMENTAL RESULTS

RELATIVE VALUE OF NO. 1, 2, AND 3 FEDERAL GRADES OF ALFALFA HAY

A series of six tests was conducted in this particular study. Two of the tests were with yearling steers and one with steer calves fed a ration of baled alfalfa hay, hegari silage, ground barley, and cottonseed meal. This ration without the barley was fed to yearling steers in two tests, and in another test the same ration was fed with the alfalfa hay ground.

A summary of the results of these three latter tests comparing No. 1, No. 2, and No. 3 federal grades of alfalfa hay fed with hegari silage and cottonseed meal is shown in Table 2. It was found that the steers fed No. 2 hay required less feed per pound of gain than either of the No. 1 and No. 3 hay lots, although the advantage over the No. 1 hay lot in this respect was not marked. The No. 2 alfalfa more than paid the $1 per ton difference in price over the No. 3 grade, but the No. 1 grade would have had to be priced below the No. 2 hay to pay out and could not pay the $2 per ton difference over the No. 3 hay. The rate of gain varied in the same order as the differences in the feed required per lot.

In Table 3 is shown a summary of the two tests comparing No. 1, No. 2, and No. 3 alfalfa hay fed with hegari silage and cottonseed meal and ground barley added. The one test made with calves

TABLE 2.—THE COMPARISON OF FEDERAL GRADES OF ALFALFA HAY NUMBERS 1, 2, AND 3 FED WITH HEGARI SILAGE AND COTTONSEED MEAL.

	Number 1	Number 2	Number 3
Number of steers finishing	30	30	30
Average initial weight (lbs.)	610.0	609.9	609.2
Average final weight (lbs.)	840.9	845.2	834.0
Average daily gain (lbs.)	1.85	1.88	1.80
Average daily feed (lbs.)			
Alfalfa hay	6.30	6.34	6.57
Hegari silage	22.87	22.92	22.89
Cottonseed meal	4.44	4.44	4.44
Pounds feed per 100 pounds gain			
Alfalfa hay	341.0	337.0	365.2
Hegari silage	1,238.3	1,217.6	1,272.9
Cottonseed meal	240.2	235.7	246.6
Cost per 100 pounds gain	$7.46	$7.16	$7.39

TABLE 3.—THE COMPARISON OF FEDERAL GRADES OF ALFALFA HAY NUMBERS 1, 2, AND 3 FED WITH HEGARI SILAGE, GROUND BARLEY, AND COTTONSEED MEAL.

	Number 1	Number 2	Number 3
Number of steers finishing	20	19	19
Average initial weight (lbs.)	573.1	574.5	573.6
Average final weight (lbs.)	838.5	835.4	793.7
Average daily gain (lbs.)	2.08	2.08	2.07
Average daily ration (lbs.)			
Alfalfa hay	7.40	7.46	7.82
Hegari silage	21.80	21.77	21.80
Ground barley	3.02	3.01	3.01
Cottonseed meal	1.54	1.54	1.54
Pounds feed per 100 pounds gain			
Alfalfa hay	355.5	358.6	377.4
Hegari silage	1,047.1	1,046.1	1,054.9
Ground barley	145.3	144.9	145.4
Cottonseed meal	73.9	74.1	74.3
Cost per 100 pounds gain	$7.14	$6.97	$6.92

on this same ration is not included in this table. In this ration too a similar difference was found between the three grades of hay as in the preceding ration of hay, silage, and meal. The increased hay requirement of the lots fed the No. 3 grade cannot be attributed to the refused stemmy hay, since it was an insignificant amount.

To obtain a value for the different grades of hay the five series of comparisons discussed above were summarized with the one series with calves. This complete summary gives a value of $11.97 per ton for No. 2 alfalfa and $11.44 for No. 3 alfalfa when No. 1 alfalfa is priced at $12. From these figures it was found

that the better grades of hay will not pay the difference of $1 per ton over the lower grades.

THE VALUE OF HEGARI FODDER AND COTTONSEED HULLS AS COMPARED WITH HEGARI SILAGE

Each of these roughages supplemented only with cottonseed meal was fed as separate rations to study their relative feeding values. In the 1930-31 test a small amount of alfalfa hay was fed in both the silage and cottonseed-hull lots to get the steers started on feed.

A summary of the results is shown in Table 4. It includes three tests with hegari fodder and two tests each with hegari silage and cottonseed hulls. Hegari fodder was productive of more rapid gains. The steers receiving this feed made an average daily gain of 2.11 pounds; the silage-fed steers, 1.92 pounds; and the hull-fed steers, 1.81 pounds.

TABLE 4.—COMPARISON OF HEGARI SILAGE, HEGARI FODDER, AND COTTONSEED HULLS.

	Hegari silage	Hegari fodder	Cottonseed hulls
Number of steers finishing	20	30	19
Average initial weight (lbs.)	601.2	587.7	574.8
Average final weight (lbs.)	831.3	851.7	790.1
Average daily gain (lbs.)	1.92	2.11	1.81
Average daily ration (lbs.)			
Cottonseed meal	4.46	4.52	4.55
Hegari silage	37.56	.....	.....
Hegari fodder	.....	16.25	.....
Cottonseed hulls	.....	.....	18.62
Alfalfa hay	0.25	.....	0.35
Pounds feed per 100 pounds gain			
Cottonseed meal	232.7	214.0	251.6
Hegari silage	1,958.7	.....	.....
Hegari fodder	.....	769.4	.....
Cottonseed hulls	.....	.....	1,028.8
Alfalfa hay	13.3	.....	19.3
Cost per 100 pounds gain	$6.64	$6.74	$7.10
Value per ton			
With silage at $3.50	$3.50	$9.75	$6.10
With fodder at $10	$3.60	$10.00	$6.30

With hegari silage priced at $3.50 per ton, it was found that hegari fodder was worth $9.75 a ton and cottonseed hulls $6.10 per ton. If hegari fodder is priced at $10 per ton, hegari silage is worth $3.60 and cottonseed hulls $6.30 per ton according to the results of these tests.

In one test conducted in 1930-31 a comparison was made of cottonseed hulls, hegari silage, and alfalfa hay when supplemented with cottonseed meal and one of the other two roughage feeds.

The results are shown in Table 5. In this comparison the hulls are not quite as efficient as they were in the previous test. Compared with hegari silage the cottonseed hulls were worth only $4.98 per ton with silage at $3.50 per ton. This is $1.12 less than the value given above. An average of the three comparisons shows the hulls to be worth $5.73 or 163.7 per cent of the value of silage at $3.50. In the one comparison in which cottonseed hulls replaced alfalfa hay, the hulls were worth $6.25 per ton with the hay priced at $10. A higher value than that shown by these results would be expected for the hulls when compared with alfalfa hay, since good quality hegari silage is worth at least 50 per cent of the value of alfalfa hay (Table 7). A higher value for hulls resulted in their use as replacing part of both the silage and hay allowance. When used in this way, hulls were worth $7.18 per ton compared with alfalfa hay at $10 as shown in Lot VI, Table 5.

TABLE 5.—VALUE OF COTTONSEED HULLS.

	Lot I	Lot IV	Lot V	Lot VI
Number of steers finishing	10	10	10	10
Average initial weight (lbs.)	563.8	585.7	580.3	578.2
Average final weight (lbs.)	799.2	800.0	802.8	812.0
Average daily gain (lbs.)	1.96	1.79	1.85	1.95
Average daily ration (lbs.)				
Alfalfa hay	6.50	6.29	0.44	4.91
Hegari silage	23.20	.....	15.58	15.00
Cottonseed hulls	.....	11.98	11.63	5.97
Cottonseed meal	4.46	4.46	4.46	4.46
Pounds feed per 100 pounds gain				
Alfalfa hay	331.6	352.3	23.8	252.0
Hegari silage	1,183.2	.....	840.4	769.7
Cottonseed hulls	.....	670.7	627.1	306.4
Cottonseed meal	227.4	249.7	240.5	228.8
Cost per 100 pounds gain	$6.80	$7.48	$7.03	$6.77
Value of hulls compared with silage at $3.50	.....	$4.98	.....	.....
Value of hulls compared with hay at $10	.....	.....	$6.25	.....
Value of hulls replacing part of both hay and silage	.....	.....	.....	$7.18

THE VALUE OF WHOLE COTTONSEED

All rations in which whole cottonseed was used gave very good results, both as to the rate and efficiency of gains. In 1932-33 and 1933-34 a ration of No. 1 alfalfa, ground barley, and cottonseed meal was compared with a similar ration in which cottonseed was fed in place of cottonseed meal. The steers on the cottonseed meal ration were bothered considerably by bloat, especially in the 1932-33 test, and made an average daily gain of only 1.54

pounds. Consequently the value for cottonseed found in this comparison is probably higher than it should be due to the poor showing of the cottonseed meal lot. Another factor which may contribute to the high value is that in 1 year about twice as much alfalfa hay was fed in the cottonseed meal ration as was fed in the cottonseed ration, but this is probably balanced by the high level of cottonseed fed the same year. In 1935-36 another comparison was made with the same rations except that the alfalfa hay was ungraded and the barley was rolled. In this comparison the nutritive ratios of the two rations were about the same. The results of the three comparisons are averaged and shown in Table 6. The steers gained faster and showed more finish on the cottonseed ration; their feed requirement per 100 pounds gain was lower, consequently the cottonseed was worth more than the cottonseed meal fed. In these comparisons where no silage was fed, the cottonseed was worth $27.65 when cottonseed meal was worth $27 or 102.4 per cent of the value of cottonseed meal. This figure may be slightly high, but, an average of seven trials (one with silage) by the Texas Agricultural Experiment Station,[1] gave a value of 120 per cent, and in only one test was a value found below 100 per cent when the same feed prices were used as in this series of experiments.

TABLE 6.—COMPARISON OF COTTONSEED AND COTTONSEED MEAL IN RATIONS WITH AND WITHOUT HEGARI SILAGE.

	CSM	Cotton-seed	CSM	Cotton-seed
Number of steers finishing	29	30	10	10
Average initial weight (lbs.)	577.9	577.8	585.0	583.0
Average final weight (lbs.)	801.7	845.9	857.5	874.0
Average daily gain (lbs.)	1.76	2.14	2.01	2.16
Average daily ration (lbs.)				
Alfalfa hay (No. 1)	14.10	10.13	7.10	7.31
Ground barley	4.07	4.17	2.92	2.86
Cottonseed meal	1.18	.....	1.46	.....
Cottonseed	.....	4.79	.....	4.30
Hegari silage	.....	.....	24.09	14.78
Pounds feed per 100 pounds gain				
Alfalfa hay (No. 1)	800.9	472.3	351.9	339.4
Ground barley	231.4	194.4	144.8	132.9
Cottonseed meal	67.0	.....	72.4	.....
Cottonseed	.....	223.5	.....	199.5
Hegari silage	.....	.....	1,193.2	685.4
Cost* per 100 pounds gain	$8.37	$7.52	$7.00	$6.89
Value of cottonseed with cotton-seed meal at $27	.....	$27.65	.....	$21.15
Percentage of cottonseed meal	.....	102.4	.....	78.3

Average value for all trials $26.02 per ton, 96.4 per cent of cottonseed meal.

* Alfalfa hay priced at $10 per ton.

[1] Mimeographed reports, Texas Agricultural Experiment Station.

In 1933-34 there was a similar comparison with hegari silage included in both rations. Since this is only one test, the results are indicative rather than conclusive. In this trial the nutritive ratio of the two rations was identical (1:5.7), although slightly more protein was furnished by the cottonseed than by the cottonseed meal. The results are shown in Table 6. The average daily gain was slightly higher in the cottonseed ration, 2.16 pounds as compared with 2.01 pounds for the cottonseed meal ration.

In this comparison cottonseed was worth $21.15 per ton when cottonseed meal was worth $27 or 78.3 per cent of the value of cottonseed meal.

There is some indication that the high oil content of the cottonseed had some beneficial effect in rations not containing silage for succulence.

From the results of these trials cottonseed is worth 75 to 80 per cent as much as cottonseed meal in a silage ration and is fully equal to cottonseed meal in a dry ration. These values would hold only where cottonseed meal is fed in excess of the protein requirement and used as a source of energy as it is in most feed lots of the Southwest. Morrison[2] gives a value of 71.4 per cent which is too low from the results obtained in these tests and at the Texas Station. The Arizona Station recommends that not over 5 to 6 pounds of cottonseed be fed per day for fattening yearling steers.

THE VALUE OF HEGARI SILAGE WHEN FED WITH ALFALFA HAY, ROLLED BARLEY, AND COTTONSEED MEAL

Morrison states that the value of sorghum silage is about 35 per cent that of alfalfa hay in good rations for fattening cattle. A somewhat higher relative value than this was found in experiments conducted at this Station. Two rations, one composed of alfalfa hay, cottonseed meal, and rolled barley and another composed of these same feeds with silage added, were used in this test. In balancing these two rations (nutritive ratio 1:4) the addition of silage effected a reduction of about one half of the daily allowance of alfalfa hay and a threefold increase in the cottonseed meal in comparison with the ration of alfalfa hay fed as the sole roughage. Table 7 presents data compiled from an average of two tests in which these rations were fed. The steers receiving the alfalfa hay-hegari silage ration made an average daily gain of 2.11 pounds per head in comparison with 1.90 pounds made by the hay-fed steers. The silage-fed ration was productive of 100 pounds of gain in live weight at a feed cost of $6.67 as compared with $7.92 for the ration of alfalfa hay, barley, and cottonseed meal. Fed in this way the silage had a value of $6.02 per ton, or more than half the value of alfalfa hay priced at $10 per ton. It is believed that the excellent quality of the hegari silage grown on the Experiment Station farm accounts for the some-

[2] F. B. Morrison, *Feeds and Feeding*, 20th ed.

TABLE 7.—THE VALUE OF HEGARI SILAGE IN AN ALFALFA HAY, BARLEY, AND COTTONSEED MEAL RATION.

	Silage & hay	Hay
Number of steers finishing	19	20
Average initial weight (lbs.)	575.5	574.3
Average final weight (lbs.)	833.3	802.2
Average daily gain (lbs.)	2.11	1.90
Average daily ration (lbs.)		
Alfalfa hay	6.86	13.03
Hegari silage	20.93	.....
Rolled barley	1.78	4.72
Cottonseed meal	3.03	1.06
Pounds feed per 100 pounds gain		
Alfalfa hay	325.5	686.0
Hegari silage	993.7	.....
Rolled barley	84.6	248.5
Cottonseed meal	143.8	56.0
Cost per 100 pounds gain	$6.67	$7.92
Value of silage $6.02 per ton		

what higher relative value obtained in these tests than those secured at other experiment stations for silage.

A further study was made of the value of silage in which the rations were very similar to those in the preceding test with the exception that No. 1 alfalfa hay was fed and ground barley used in place of rolled barley.

The results of these two tests are presented in Table 8. Several steers in the lot fed alfalfa hay, barley, and cottonseed meal developed cases of chronic bloating resulting in an average daily gain per head of only 1.64 pounds in comparison with the silage-fed lot's daily gain of 2.08 pounds per steer. The results of this test give the silage a value of $7.49 per ton in comparison with No. 1 alfalfa at $10, which admittedly is too high due to the low average daily gain of the steers in the lot receiving no silage, probably because of the bloating trouble.

Considerable difficulty was encountered in feeding the ration of alfalfa hay, barley, and cottonseed meal. From two to four steers in each lot fed this ration would frequently bloat. No trouble of this nature occurred among the steers fed this ration with silage included. It is believed that the bloating was due to the method of feeding. The hay was fed separately from the concentrates in a rack, making it possible for the more greedy steers to overeat the limited allowance of barley and cottonseed meal. Chopping or grinding the hay and feeding it mixed with the concentrates would probably eliminate serious danger of bloat on this ration.

In 1930-31 silage at the rate of 15 pounds per steer was included in a ration of alfalfa hay, cottonseed hulls, and cottonseed meal,

replacing 6 pounds of hulls and 1.4 pounds of hay. This gives a value of $5.35 per ton for silage and, while this was only a single trial, in view of the other values shown it indicates that hegari silage is worth at least 50 per cent as much as alfalfa hay.

TABLE 8.—SILAGE VERSUS NO SILAGE.

	No. 1 alfalfa hay & silage	No. 1 alfalfa hay
Number of steers finishing	20	19
Average initial weight (lbs.)	573.1	578.2
Average final weight (lbs.)	838.5	793.7
Average daily gain (lbs.)	2.08	1.64
Average daily ration (lbs.)		
No. 1 alfalfa hay	7.40	15.36
Hegari silage	21.80	.....
Ground barley	3.02	3.60
Cottonseed meal	1.54	1.14
Pounds feed per 100 pounds gain		
No. 1 alfalfa hay	355.5	933.8
Hegari silage	1,047.1	.....
Ground barley	145.3	218.9
Cottonseed meal	73.9	69.2
Cost* per 100 pounds gain	$6.79	$8.88
Value of silage $7.49 per ton		

* Alfalfa hay priced at $10 per ton in this test.

THE VALUE OF GROUND BARLEY WHEN REPLACING PART OF THE COTTONSEED MEAL SUPPLEMENT IN A BASAL RATION OF ALFALFA HAY AND HEGARI SILAGE

In the 1933-34 test three comparisons of a hay-silage-meal ration were made with the same ration and barley added. These comparisons were with No. 1, No. 2, and No. 3 alfalfa hay, respectively, and while the results are not as reliable as if conducted in separate years, they are fairly conclusive because of the uniformity of gain made by the steers in the separate lots.

The hay and silage were fed at the same level in both lots, and the barley was fed in the proportion of two parts barley to one of cottonseed meal, but the concentrate level was held the same in both rations. The results are shown in Table 9.

The average daily gain was practically equal on the two rations with a slight advantage in favor of the barley lot which decreased the feed required per 100 pound gain but was not sufficient to pay the difference in price between $30 per ton for barley as compared with cottonseed meal at $27.

The results of these tests gave a value of $28.75 for barley with cottonseed meal priced at $27 per ton.

In one test in 1930-31 in which barley was added at the rate of about 2 pounds per steer for the last 30 days, the rate of gain

was increased slightly, but unless a premium were paid for finish, the barley was not worth as much as cottonseed meal.

TABLE 9.—THE VALUE OF BARLEY ADDED TO AN ALFALFA, SILAGE, AND COTTONSEED MEAL RATION.

	No barley	Ground barley
Number of steers	30	30
Average initial weight (lbs.)	582.7	585.0
Average final weight (lbs.)	854.7	862.2
Average daily gain (lbs.)	2.01	2.05
Average daily ration (lbs.)		
Alfalfa hay	7.10	7.10
Hegari silage	24.09	24.09
Cottonseed meal	4.39	1.46
Ground barley	.....	2.93
Pounds feed per 100 pounds gain		
Alfalfa hay	352.6	346.0
Hegari silage	1,195.4	1,173.1
Cottonseed meal	217.7	71.3
Ground barley	.....	142.5
Cost per 100 pounds gain	$6.79	$6.88

Value of barley, $28.75 per ton, with cottonseed meal at $27.

THE VALUE OF ALFALFA HAY WHEN ADDED TO A RATION OF HEGARI SILAGE AND COTTONSEED MEAL

The results obtained from feeding a ration composed exclusively of hegari silage and cottonseed meal in two tests were compared with a ration of alfalfa hay, hegari silage, and cottonseed meal fed in seven tests to determine the value of alfalfa hay when added to a silage-cottonseed meal ration. Uniform gains were secured in the seven lots fed the alfalfa hay ration, while in the two lots fed silage and cottonseed meal the average daily gains per head were 2.14 and 1.69 pounds, respectively. The average daily allowance of cottonseed meal was the same in all lots. A small amount of hay was fed in one of the two silage-cottonseed meal lots to get the steers started on feed. The results of this study are shown in Table 10. While only two lots were fed on the silage-meal ration, it would appear that a figure of $8.10 per ton for alfalfa hay fed in this manner would be a fair value compared with silage at $3.50 per ton.

In 1930-31 alfalfa hay was added to a ration of cottonseed hulls, hegari silage, and cottonseed meal reducing the hulls to one half the former level. When fed in this manner the alfalfa hay was worth $12.06 per ton, but this is to be expected since it was compared with cottonseed hulls which are not worth the $7 charged. Also, this is a single trial so it can be taken as an indication only.

TABLE 10.—VALUE OF HAY IN A SILAGE-COTTONSEED MEAL RATION.

	Silage-meal	Hay-silage-meal
Number of steers finishing	20	70
Average initial weight (lbs.)	601.2	597.6
Average final weight (lbs.)	831.3	839.8
Average daily gain (lbs.)	1.92	1.92
Average daily ration (lbs.)		
Alfalfa hay	0.25	6.63
Hegari silage	37.56	23.21
Cottonseed meal	4.46	4.43
Pounds feed per 100 pounds gain		
Alfalfa hay	13.3	345.8
Hegari silage	1,958.7	1,211.3
Cottonseed meal	232.7	231.1
Cost per 100 pounds gain	$6.64	$6.97

Value of alfalfa hay $8.10 per ton

SUPPLEMENTARY STUDIES

CALVES VS. YEARLINGS

In the 1932-33 test three lots of calves were compared directly with three lots of yearlings fed similiar rations. The three lots of each age class were fed No. 1, No. 2, and No. 3 alfalfa hay, respectively. Since one lot of calves and one lot of yearlings were fed one of the three grades of hay, the three lots of each class were averaged for this comparison. The results of this test are shown in Table 11. The allowance of concentrates was limited to the same amount for each group. The yearlings consumed 1.9

TABLE 11.—THE EFFICIENCY OF FATTENING CALVES AS COMPARED WITH YEARLINGS.

	Calves	Yearlings
Number of steers finished	29	28
Average initial weight (lbs.)	440.3	562.5
Average final weight (lbs.)	683.1	809.0
Average daily gain (lbs.)	2.06	2.11
Average daily ration (lbs.)		
Alfalfa hay	6.19	8.09
Hegari silage	14.37	19.12
Ground barley	3.13	3.12
Cottonseed meal	1.63	1.93
Pounds feed per 100 pounds gain		
Alfalfa hay	301.7	383.9
Hegari silage	699.7	907.6
Ground barley	152.2	148.1
Cottonseed meal	79.2	77.4
Cost per 100 pounds gain	$6.08	$6.77

pounds of alfalfa hay and 4.75 pounds of silage more in their average daily ration than did the calves.

The yearlings made a slightly greater average daily gain of 2.11 pounds per steer as compared with a gain of 2.06 pounds made by the calves. This advantage of the yearlings in rate of gain was not sufficient to affect their greater feed requirement per unit of gain. The feed cost per 100 pounds of gain was $6.77 for the older cattle and $6.08 for the calves. This difference will be greater if roughage is higher and concentrates lower than the prices used and vice versa.

ALFALFA HAY, GROUND, VS. BALED ALFALFA HAY, UNGROUND

A test was conducted in 1932-33 to study the relative feeding value of ground alfalfa hay with baled alfalfa hay, unground, when fed in a cattle fattening ration with hegari silage and cottonseed meal. Three grades of alfalfa hay—U.S. No. 1. No. 2, and No. 3—were compared with the same grades of ground hay. The results of the three comparisons, while not to be taken as conclusive evidence, compare favorably with those secured by other experiment stations. An average of the results obtained from the three comparisons of the different grades of alfalfa hay fed ground and unground, respectively, are presented in Table 12. The advisability of grinding alfalfa hay for cattle fattening rations was not the sole objective of this particular study. Grinding costs were not reckoned nor was any other consideration taken of possible benefits that might accrue due to this operation aside from the factor of feeding value. No appreciable differences developed in the results comparing the ground hay and unground hay of each grade. The steers fed ground hay made practically as rapid gains and at about the same feed cost per 100 pounds of gain as the steers fed unground alfalfa hay.

TABLE 12.—THE VALUE OF GRINDING HAY FOR FATTENING STEERS.

	Baled	Ground
Number of steers finishing	30	30
Average initial weight (lbs.)	623.9	622.6
Average final weight (lbs.)	838.5	826.9
Average daily gain (lbs.)	1.79	1.70
Average daily ration (lbs.)		
Alfalfa hay	6.13	5.89
Hegari silage	22.22	22.24
Cottonseed meal	4.46	4.46
Pounds feed per 100 pounds gain		
Alfalfa hay	342.5	346.0
Hegari silage	1,241.8	1,305.8
Cottonseed meal	249.5	262.2
Cost per 100 pounds gain	$7.25	$7.56

THE VALUE OF MEAT MEAL AND FISH MEAL WHEN COMPARED WITH COTTONSEED MEAL AS PROTEIN SUPPLEMENTS FOR FATTENING CATTLE

A series of comparisons was made in the 1935-36 test in which the ration consisted of alfalfa hay, hegari silage, and rolled barley plus one of the protein supplements. The cottonseed meal was fed mixed with the rolled barley in the proportion of two parts of barley to one of cottonseed meal. The meat meal containing approximately 50 per cent protein was fed at 88 per cent, the level of cottonseed meal, to equalize the amount of protein fed from the two sources. The fish meal containing approximately 60 per cent protein was fed at 70 per cent, the level of cottonseed meal.

The results are shown in Table 13. Since only one trial is reported, the results are indicative and are not to be regarded as conclusive.

The steers in Lot I on the cottonseed meal ration made slightly more rapid gains at a lower feed requirement per 100 pounds gain than Lot II or III on meat meal and fish meal, respectively. This would indicate that cottonseed meal is worth more pound for pound than meat meal or fish meal when fed on an equivalent protein basis. The meat meal and fish meal were practically equal in feeding value. Since both of these feeds cost considerably more than the cottonseed meal, $50 as compared with $27, they are not practical protein supplements for cattle fattening rations in Arizona at this price ratio.

In another series of the same test the use of meat meal and fish meal in a basal ration of alfalfa hay, cottonseed meal, and rolled barley, exclusive of silage, was studied. Cottonseed meal in Lot V was fed mixed with rolled barley in the proportion of one to four. In Lots VII and VIII the meat meal and fish meal, respectively, were fed in the same proportion as in Lots II and III and were not comparable with Lot V because an excess of protein was fed in these lots as compared with the cottonseed meal lot. Disregarding the feed costs of the protein supplements in this study, cottonseed meal was at least equal to either of the other protein supplements.

ADDITIONAL FEEDING TESTS NOT COMPLETED

A few ration comparisons in addition to those previously reported were discontinued following a single test, and the results herewith presented are not to be accepted as conclusive.

ADDITION OF COTTONSEED MEAL TO AN ALFALFA HAY AND BARLEY RATION

In Table 14 are shown the results of one test to study the addition of cottonseed meal to a rolled barley-alfalfa hay ration. In this test the addition of 1¼ pounds of cottonseed meal to the daily ration increased both the rate and efficiency of gain resulting in a slight reduction of the cost of gain.

TABLE 13.—SUMMARY OF RESULTS OF STEER FEEDING EXPERIMENT, OCTOBER 16, 1935, TO FEBRUARY 13, 1936, 120 DAYS.

	Ration					
	CSM	Meat meal	Fish meal	CSM	Meat meal	Fish meal
Lot and number of steers	I (9)	II (10)	III (10)	V (10)	VII (10)	VIII (10)
Av. initial weight (lbs.)	577.7	575.7	575.7	577.3	573.0	575.0
Av. final weight (lbs.)	853.3	827.0	823.5	817.0	811.0	802.5
Av. daily gain (lbs.)	2.20	2.10	2.07	2.00	1.98	1.90
Average daily ration (lbs.)						
Alfalfa hay	7.46	7.34	7.36	11.52	11.32	11.59
Hegari silage	18.32	17.83	17.82	.....	.....	.....
Rolled barley	3.13	3.17	3.18	5.04	4.87	4.88
Cottonseed meal	1.56	.....	0.15	1.26	.....	0.24
Meat meal	.....	1.27	.....	.....	1.95	.....
Fish meal	.....	.....	1.02	.....	.....	1.57
Pounds feed per 100 pounds gain						
Alfalfa hay	339.3	350.4	356.5	576.9	570.6	611.2
Hegari silage	832.9	851.6	863.2	.....	.....	.....
Rolled barley	142.2	151.4	154.1	252.4	245.6	257.2
Cottonseed meal	71.1	.....	7.2	63.1	.....	12.8
Meat meal	.....	60.5	.....	.....	98.2	.....
Fish meal	.....	.....	49.2	.....	.....	82.6
Feed cost per 100 pounds gain						
Alfalfa hay	$1.70	$1.75	$1.78	$2.88	$2.85	$3.06
Hegari silage	1.46	1.49	1.51	.....	.....	.....
Rolled barley	2.13	2.27	2.31	3.79	3.68	3.86
Cottonseed meal	0.96	.....	0.10	0.85	.....	0.17
Meat meal	.....	1.51	.....	.....	2.46	.....
Fish meal	.....	.....	1.23	.....	.....	2.06
Total cost per 100 pounds gain	$6.25	$7.02	$6.93	$7.52	$8.99	$9.15

TABLE 14.—ADDITION OF COTTONSEED MEAL TO AN ALFALFA-BARLEY RATION. ADDITION OF BARLEY TO A COTTONSEED MEAL-HULLS RATION.

	Ration			
	Alfalfa barley	Alfalfa barley meal	Hulls meal	Hulls barley meal
Number of steers finishing	10	10	10	10
Average initial weight (lbs.)	579.5	577.3	574.5	578.7
Average final weight (lbs.)	802.0	817.0	815.5	823.5
Average daily gain (lbs.)	1.85	2.00	2.01	2.04
Average daily ration (lbs.)				
Alfalfa hay	11.62	11.52	.....	.....
Rolled barley	5.92	5.04	.....	3.20
Cottonseed meal	.....	1.26	4.67	3.20
Cottonseed hulls	.....	.....	19.44	17.66
Pounds feed per 100 pounds gain				
Alfalfa hay	627.0	576.9	.....	.....
Rolled barley	319.0	252.4	.....	156.7
Cottonseed meal	.....	63.1	232.7	156.7
Cottonseed hulls	.....	.....	968.0	865.8
Cost per 100 pounds gain	$7.92	$7.52	$6.53	$7.50

THE VALUE OF BARLEY ADDED TO A BASAL RATION OF COTTONSEED HULLS AND COTTONSEED MEAL

Table 14 also shows a comparison of equal parts of rolled barley-cottonseed meal with cottonseed meal when fed with cottonseed hulls as the only roughage. The gains were practically equal, but the cost was considerably greater for the barley-cottonseed meal ration due largely to the fact that barley is priced higher than cottonseed meal.

THE VALUE OF BARLEY-ALFALFA HAY

In another of these tests barley hay fed in the proportion of three parts No. 2 alfalfa hay to one part barley hay, and three parts barley hay to one part No. 2 alfalfa hay, respectively, was compared with alfalfa hay when fed with a basal ration of hegari silage and cottonseed meal. The results of this test, which are shown in Table 15, indicate that the three to one alfalfa-barley hay mixture is practically equal to alfalfa hay on the basis of the rate and efficiency of gain. However, in this one trial the three to one barley-alfalfa hay mixture did not give as rapid and efficient gains as either of the other two rations. It is probable that this can be attributed to the inferior quality of the barley hay and, further, to the fact that it was not ground.

EFFECT OF LIMITING THE SILAGE ALLOWANCE

The effect of limiting the allowance of silage to the same amount of alfalfa hay fed was studied in one test, and the results

TABLE 15.—USE OF BARLEY HAY IN STEER FATTENING RATIONS.

	No. 2 alfalfa	3 to 1 No. 2 alfalfa-barley	3 to 1 barley-No. 2 alfalfa
Number of steers finishing	10	10	10
Average initial weight (lbs.)	623.3	623.5	623.3
Average final weight (lbs.)	843.3	839.2	820.8
Average daily gain (lbs.)	1.83	1.80	1.62
Average daily ration (lbs.)			
Hay	5.91	5.91	5.84
Hegari silage	22.26	22.25	22.25
Cottonseed meal	4.46	4.46	5.08
Pounds feed per 100 pounds gain			
Hay	323	329	360
Hegari silage	1,214	1,238	1,373
Cottonseed meal	244	248	314
Cost* per 100 pounds gain	$7.03	$7.16	$8.44

*All hay priced at $10 per ton.

are shown in Table 16. In this test No. 1 alfalfa hay was used and was priced at $10 per ton because this probably more nearly represents the value of the hay for steer feeding.

The hay intake was increased by one half, but the concentrates were held at the same level although the proportion of barley to cottonseed meal was increased somewhat to help balance the increased alfalfa consumption.

In this one test limiting the silage to the level of the hay intake was not warranted.

TABLE 16.—EFFECT OF LIMITING SILAGE TO LEVEL OF HAY CONSUMPTION.

	Full fed silage	Limited silage
Number of steers finishing	10	10
Average initial weight (lbs.)	561.2	563.2
Average final weight (lbs.)	819.5	805.0
Average daily gain (lbs.)	2.15	2.02
Average daily feed (lbs.)		
No. 1 alfalfa	7.73	12.16
Hegari silage	19.22	12.19
Ground barley	3.14	3.35
Cottonseed meal	1.62	1.41
Pounds feed per 100 pounds gain		
No. 1 alfalfa	359	602
Hegari silage	893	605
Ground barley	146	166
Cottonseed meal	75	70
Cost* per 100 pounds gain	$6.56	$7.50

* Alfalfa hay priced at $10 per ton.

SUMMARY

1. No. 2 alfalfa hay was found to be practically equal to No. 1 alfalfa in feeding value and worth slightly more than No. 3 alfalfa for fattening steers. However, the difference was not great enough to pay the $1 difference in price.

2. With hegari silage priced at $3.50 per ton, hegari fodder was worth $9.75 and cottonseed hulls $5.73 per ton when supplemented with cottonseed meal for fattening yearling steers. The value of the hulls was somewhat higher when fed with both alfalfa hay and silage.

3. In these tests whole cottonseed was worth as much as cottonseed meal when fed in a ration without silage. The one test in which silage was fed indicates a somewhat lower value.

4. When fed with alfalfa hay, rolled barley, and cottonseed meal, hegari silage was worth fully 50 per cent the value of alfalfa hay. This is somewhat higher than the value quoted by Morrison.

5. Ground barley was worth as much as cottonseed meal when replacing part of the cottonseed meal in an alfalfa hay-hegari silage ration.

6. Alfalfa hay added to a silage-cottonseed meal ration is worth about $8 per ton, which is slightly higher than one would expect from the value of silage found above (4).

7. Calves make more efficient gain than yearlings, but the yearlings utilize a larger percentage of roughage than do the calves. Consequently if concentrates are higher priced in comparison to roughages, yearlings may make more economical gains.

8. Ground alfalfa hay was found no more valuable than baled hay of the same grade when fed separate from the concentrates as it was in this test.

9. Results indicate that cottonseed meal is equal in value to meat or fish meal when fed at the same protein level in a ration of alfalfa hay, hegari silage, and rolled barley.

TABLE 17.—FEED ANALYSIS.

	Dry matter	Crude protein	Ether extract	Crude fiber	N-free extract	Ash
Cottonseed meal....	94.12	39.94	8.95	9.56	28.85	6.82
Whole cottonseed..	93.77	19.72	19.57	23.64	27.03	3.82
Barley (ground, rolled)	92.45	9.97	2.26	5.51	71.56	3.15
Meat meal.....	94.31	51.23	9.98	1.71	1.63	29.76
Fish meal.....	94.06	58.82	7.77	0.28	9.40	17.79
Cottonseed hulls....	92.64	4.13	0.94	43.35	41.87	2.35
Ground hegari fodder.....	90.72	5.04	1.63	21.14	52.50	10.40
Hegari silage.....	29.00	1.42	0.27	6.79	17.13	3.38
Alfalfa hay.....	93.20	13.90	1.57	28.98	40.33	8.43
Alfalfa hay No. 1	93.07	16.58	1.32	22.10	43.97	9.10
Alfalfa hay No. 2	90.49	16.58	1.15	24.45	40.22	8.09
Alfalfa hay No. 3	93.80	12.95	0.74	29.50	40.60	10.01
Barley hay.....	93.96	8.19	1.45	25.90	49.82	8.60