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Emmer (Speltz) For Dairy Cows



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Emmer (Speltz) for Dairy Cows

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The term speltz is commonly used for both emmer and spelt by farmers and seedsmen in this country. However, according to the Agronomy Department of State College the crop grown in South Dakota and commonly called speltz is in reality emmer.

Emmer was probably introduced into this country forty or fifty years ago by German immigrants from southern Russia who settled in the Dakotas. It is still grown largely in the Northwest.

Farmers with whom the author has talked have been enthusiastic in their praises of emmer as a feed for all classes of livestock. It yields about the same as barley according to their observations, and is preferable to barley to handle and feed.

The desirability therefore of emmer as a crop to grow for dairy cows depends largely on its feeding value. Accordingly a project was outlined to determine the relative feeding value of emmer, barley and corn. These crops were chosen for comparison as the chemical analysis indicate that emmer has about the same composition as barley and corn and would naturally be used as a substitute for these feeds for the dairy cow.

Review of Literature

Very little work has been done on the feeding value of emmer to dairy cows. The stations which have reported on the crop have worked on cultural methods and yields mostly.

Idaho Exp. Sta. Bul. 104 reports yields averaging 13.3 bushels per acre. Oregon Exp. Sta. Bul. 150 reports a four-year average yield of spring emmer of 18 bushels per acre, winter emmer 15.6 bushels per acre.

The 1918 and 1919 annual reports from the Minnesota station and sub-stations show a yield of 30.9 to 54.4 bushels per acre.

Indiana Exp. Sta. Bul. 225 reported a yield of 23 bushels per acre for a five-year average as compared to a nine-year average of 52.6 bushels per acre for oats.

The Belle Fourche Experiment farm in South Dakota in its report for the year 1917 states, "Winter emmer and winter spelt have not proved sufficiently hardy for this locality". Later from the same station the report states, "Spring emmer did not equal the best varieties of oats and barley and is not resistant to extreme drought".

Farmers Bul. 270—"Emmer has not given as high average yield as oats, barley, or wheat". Department of Agriculture Bul. 1197; "Spring emmer should not be grown except possibly to some extent in North Dakota, eastern South Dakota and southern Minnesota for the purpose of increasing crop diversification. In all sections of these states it is out-yielded on the

average by the leading varieties of barley and oats. Even under conditions where rust and drought occur emmer does not compare favorably with barley and oats". Penn. Exp. Sta. Bul. 196—Barley and oats gave higher returns than spring emmer.

The only reference in which emmer was fed to dairy cows occurs in bulletin 81 by Wilson and Skinner from the South Dakota station. In this trial 17.5 pounds of emmer were required to produce one pound of butterfat, whereas 15.5 pounds each of corn and barley were required to produce one pound of butterfat.

This trial showed a greater gain in live weight during the emmer feeding than for either barley or corn. The total gain in weight by the five cows in each lot for the two periods was; 18 pounds for the emmer, 9 pounds for the barley and a loss of 16 pounds in body weight for corn.

The results from this trial indicate that emmer was not equal to corn or barley for milk production, but was superior to either in maintaining body weight.

Method of Procedure

Two trials have been completed on this project, in two successive years. The first trial was made during the fall and winter months of 1929-1930. In this trial seven cows were used divided into two lots as Lot I. and Lot II. Lot I. consisted of three cows, Lot II. consisted of four cows.

The trial was divided into three forty day feeding periods. The first ten days of each period was considered the transition period, and the data not used in interpreting the results. These trials were run by the alternate plan, that is during the first and third periods the cows were on emmer, during the second period they were on corn and barley—that is three cows in Lot II. on corn, and four cows in Lot I. on barley.

The ration consisted of local grown alfalfa hay, corn silage, emmer, oats, old process linseed oil meal, and wheat bran during the first and third periods. During the second period Lot I received barley and Lot II received yellow corn in place of emmer, otherwise the feeds were the same as in the first and third periods. The rations were balanced by varying the emmer, corn and barley. All other feeds were the same in amount throughout the three trials. It was thought that this method would afford better comparison of the three feeds which we wished to compare, than by varying all the feeds in the ration.

Heavy producing cows were chosen in as far as possible. Table 1 shows that many of the cows had recently freshened. It was felt that cows in the early stage of the lactation period would respond more readily to feed conditions than cows far along in their lactation.

The cows were milked twice a day with the milk machine. They were fed twice a day and water and salt were kept before them all the time. The stalls in which the cows were kept were roomy and comfortable. The cows were allowed outdoors whenever the weather was fit, during the warmest part of the day.

Ten day composite milk samples were taken during the experiment, and tested by the Babcock method.

The second trial was run during the fall and winter of 1930-1931. In this trial six cows were used. Three of the cows started on the emmer ration, and three on the barley ration. At the end of the forty day period, the order was reversed, so that the three cows which had been on the emmer ration, were on barley ration and vice versa.

Instead of balancing the grain ration for each cow, two concentrate mixtures were made, using the same proportion of emmer and barley in each. That is, the mixture consisted of two parts of barley or emmer and one part each of old process linseed oil meal, and wheat bran.

The concentrate mixture was higher in protein than required by the Morrison Feeding Standard, but because of the limited number of feeds used, and the relatively large amount of silage fed, it was felt that better results would be obtained on a high protein ration. Cows recently fresh and high producers were on the trial hence it was necessary to provide a liberal ration. With only three feeds in the mixture, it was necessary to have a high proportion of linseed oil meal and bran, otherwise there would have been difficulty in getting the cows to eat the required amount of concentrates.

The concentrates were fed according to milk production allowing one pound of the concentrate mixture to three and one-half pounds of milk for Holsteins, and one pound of the concentrate mixture to three pounds of milk for the Ayrshires. The alfalfa hay was fed at the rate of one and one-fourth pounds per hundred live weight. Silage was fed at the rate of three pounds per hundred live weight. Records were kept of the exact amount of concentrate, hay, and silage fed to each cow.

Aside from the ration fed, the cows were handled in the same manner as in the first trial.

During the first trial, cow 336, Holstein, refused to eat the concentrate ration, containing emmer, and after several days had to be taken off the trial because she lost greatly in milk and flesh. Cow number 49, Holstein, was substituted. Hence cow No. 49 did not receive the experiment rations during the transition period, or the ten day period preceeding the first 30 day period.

Cow 337, Holstein, was off feed due to veterinary service to bring her into heat. She dropped considerably in her milk and refused to eat for several days, hence it was necessary to take her off the experiment. The data from this cow was not used in compiling the results, therefore data from only six cows were used in the final interpretation of results in the first trial.

Discussion of Results

TABLE 1.—Record of Cows Used in First Trial

| Cow. No. | Breed | Age | Days Fresh | Days bred at end of trial |
|----------|---------------|--------------------|---------------|---------------------------|
| 49 | H. | 9 yr 9 mo. 27 da. | 11 mo. 29 da. | open |
| 41 | H. | 11 yr. 7 mo. 5 da. | 1 mo. 5 da. | open |
| 324 | H. | 6 yr. 9 mo. 27 da. | 2 mo. 11 da. | 2 mo. 1 da. |
| 4A | cross J. & H. | 3 yr. 9 mo. 21 da. | 3 mo. 4 da. | 4 mo. 16 da. |
| 5A | J. & H. | 2 yr. 7 mo. 11 da. | 2 mo. 15 da. | open |
| 205 | Ayr. | 11 yr. 3 mo. 8 da. | 4 mo. 24 da. | open |

Record of Cows Used in Second Trial

| Cow. No. | Breed | Age | Days Fresh | Days bred at end of trial |
|----------|---------------|--------------------|--------------|---------------------------|
| 218 | Ayr. | 5 yr. 1 mo. 20 da. | 1 mo. 8 da. | 1 mo. 10 da. |
| 352 | H. | 3 yr. 9 mo. 26 da. | 3 mo. 17 da. | 2 mo. 19 da. |
| 4A | cross J. & H. | 5 yr. 0 mo. 27 da. | 6 mo. 3 da. | 4 mo. 5 da. |
| 339 | H. | 6 yr. 4 mo. 14 da. | 1 mo. 0 da. | 4 da. |
| 222 | Ayr. | 7 yr. 4 mo. | 29 da. | open |
| 349 | H. | 4 yr. 6 mo. 14 da. | 3 mo. 16 da. | 1 mo. 9 da. |

The plan contemplated selecting heavy producing cows, and cows which had freshened recently. Obviously this plan was not carried out. The limited number of cows to choose from was a big factor, and then in one or two cases the cows which met the requirements of the plan, refused to eat the ration.

Weight

The cows were weighed at ten day periods.

TABLE 2.—Weight in lbs. of Cows by 30 Day Periods
FIRST TRIAL

| Cow No. | Barley | Corn | Emmer Av. of 1st and 3rd periods |
|--------------------------------|--------|--------|--|
| 49 | | 1500.0 | 1513.0 |
| 41 | 1417.0 | | 1434.0 |
| 324 | | 1182.0 | 1188.5 |
| 4A | 1233.0 | | 1239.5 |
| 5A | 1097.0 | | 1097.0 |
| 205 | | 1162.0 | 1163.0 |
| Av. | 1249.0 | 1281.3 | 1272.7 |
| Average Barley and Corn—1265.2 | | | |

Table two shows a gain in weight during the emmer feeding periods. The increase is not great but obtains in each case. In view of the fact that the cows were on emmer the first and third periods would favor this feed so far as the weight is concerned. The cows were in good condition at the beginning of the trial and many of the cows were far enough along in their lactation in the third period to put on fat.

TABLE 3.—Weight in lbs. of Cows by 30 Day Periods.
SECOND TRIAL

| Cow No. | Emmer Period Lbs. | Barley Period Lbs. |
|---------|----------------------|-----------------------|
| 218 | 1605 | 1633 |
| 352 | 1472 | 1495 |
| 4A | 1318 | 1352 |
| 339 | 1368 | 1393 |
| 222 | 1172 | 1170 |
| 349 | 1632 | 1607 |
| Total | 8567 | 8650 |
| Av. | 1427.8 | 1441.6 |

The second trial showed an increase in weight in favor of barley. In as much as all the cows were subjected to the same conditions it would seem a more accurate measure of the variation in weights than the first trial. However the gain or loss in weight does not seem sufficiently significant to state that either emmer or barley is superior in increasing body weight. The data presented as a result of the two trials indicate no significant difference in barley and emmer in maintaining body weight.

Milk Produced Per Unit of Grain

The test of feed for dairy cows is its effect on milk production. The practical feeder wants to know how one feed compares with another in producing milk. With this information it becomes an easy matter to determine the relative value of the various feeds in the concentrate part of the ration.

Table 4 contains the milk and butterfat produced during the three periods. A decrease of about 700 pounds in milk is noted in the second period. Most of this decrease was due to the rapid decline in milk production of cow number 41. This cow was milking heavy and when placed on the rather restricted ration and twice a day milking, decreased rapidly in milk flow.

In comparing the rate of decline in milk and fat in the first, second and third periods, it is observed that the decline is greater during the corn and barley feeding periods. In the case of three cows, numbers 205, 5A and 324, there was an increase in milk and butterfat in the third over the second period. The total production of the six cows in the first period showed an increase over the second period of 14.4 percent, while the third period showed an increase of 2.6 percent over the second period.

The total milk production during the first and third periods or emmer ration periods, amounted to 10,259.8 pounds of milk or an average for 30 days of 5129.9 pounds, as compared to 1913.2 pounds, and 1815.4 pounds for the corn and barley feeding periods respectively or a total of 4728.6 pounds of milk, for the 30 day period.

Similarly for butterfat, the emmer feeding periods showed a production of 211.42 pounds as against 202.66 pounds for corn and barley.

In the second period in which the decline in production due to the lactation was taken care of by the double reversible plan, the emmer periods show up better than the barley periods. The total production of milk and

fat for the two groups of cows on the emmer ration was 5879.1 pounds and 207.25 pounds respectively. On the barley ration the production was 5722.7 pounds of milk and 200.36 pounds of fat. This is an increase of 156.4 pounds of milk and 6.89 pounds of fat in favor of emmer.

The increase was not great but significant in view of the fact that the same conditions obtained with both feeds.

Tables 4 and 5 show the milk and fat production in both trials to be in favor of emmer. The total increase in the two trials was 557.7 pounds of milk or 5 per cent, and 15.71 pounds of butterfat or 3.7 per cent.

These data indicate that emmer is equal if not superior to either barley or corn as the chief source of carbohydrates in the concentrate portion of the ration in maintaining milk production.

TABLE 4.—Milk and Fat for 30 Day Periods
FIRST TRIAL.

| Cow No. | 1st 30 Day Period Emmer | | 2nd 30 Day Period Corn | | | | 3rd 30 Day Period Emmer | |
|---------|----------------------------|-------------|---------------------------|-------------|-----------|-------------|----------------------------|-------------|
| | Milk Lbs. | B. Fat Lbs. | Milk Lbs. | B. Fat Lbs. | Milk Lbs. | B. Fat Lbs. | Milk Lbs. | B. Fat Lbs. |
| 49 | 535.7 | 23.27 | 400.2 | 16.45 | | | 373.8 | 14.12 |
| 41 | 1742.8 | 57.66 | | | 1492.2 | 50.39 | 1390.0 | 43.57 |
| 324 | 1042.1 | 39.18 | 907.6 | 35.2 | | | 1067.4 | 38.40 |
| 4A | 932.5 | 47.20 | | | 880.3 | 44.87 | 854.6 | 41.29 |
| 5A | 505.2 | 27.49 | | | 442.9 | 26.63 | 503.5 | 28.67 |
| 205 | 650.7 | 31.15 | 605.4 | 29.12 | | | 661.5 | 30.83 |
| Total | 5409.0 | 225.95 | 1913.20 | 80.77 | 2815.4 | 121.89 | 4850.8 | 196.88 |

Av. 5129.9 pounds milk 211.42 pounds butterfat—emmer periods.

Av. 4728.6 pounds milk 202.66 pounds butterfat—barley and corn periods.

TABLE 5.—Milk and Fat for 30 Day Periods
SECOND TRIAL.

| Cow No. | 1st 30 Day Period Emmer | | 2nd 30 Day Period Barley | | 3rd 30 Day Period Barley | | 4th 30 Day Period Emmer | |
|---------|----------------------------|-------------|-----------------------------|-------------|-----------------------------|-------------|----------------------------|-------------|
| | Milk Lbs. | B. Fat Lbs. | Milk Lbs. | B. Fat Lbs. | Milk Lbs. | B. Fat Lbs. | Milk Lbs. | B. Fat Lbs. |
| 218 | 1301.1 | 45.97 | | | 1089.9 | 37.23 | | |
| 352 | 975.4 | 30.52 | | | 954.4 | 29.11 | | |
| 4A | 951.0 | 42.63 | | | 844.5 | 38.12 | | |
| 339 | | | 1154.7 | 37.31 | | | 1092.0 | 33.11 |
| 222 | | | 1081.9 | 39.66 | | | 991.1 | 36.66 |
| 349 | | | 598.1 | 18.93 | | | 568.5 | 18.36 |
| Total | 3227.50 | 119.12 | 2834.70 | 95.90 | 2888.8 | 104.46 | 2651.6 | 88.13 |

Total—5879.10 lbs. milk 207.25 lbs. butterfat during emmer period.

Total—5722.73 lbs. milk 200.36 lbs. butterfat during barley period.

TABLE 6.—Feed Consumed by 30 Day Periods
FIRST TRIAL

| Cow Number | Second Period | | | | | | | Average of First and Third Periods | | | | | | |
|------------|---------------|-------------|--------|--------|------------|----------|--------|------------------------------------|-------------|----------|--------|------------|--------|------|
| | Alfalfa | Corn Silage | Corn | Barley | Wheat Bran | Oil Meal | Oats | Alfalfa | Corn Silage | Oil Meal | Emmer | Wheat Bran | Oats | |
| | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 49 | 360 | 900 | 150 | | 15 | 15 | 60 | 360 | 900 | 15 | 150 | 15 | 60 | |
| 41 | 360 | 1050 | | 300 | 60 | 60 | 180 | 360 | 1050 | 60 | 300 | 60 | 180 | |
| 324 | 360 | 900 | 240 | | 30 | 30 | 120 | 360 | 900 | 30 | 240 | 30 | 120 | |
| 4A | 360 | 900 | | 240 | 30 | 30 | 180 | 360 | 900 | 30 | 240 | 30 | 180 | |
| 5A | 300 | 900 | | 150 | 15 | 15 | 90 | 300 | 900 | 15 | 150 | 15 | 90 | |
| 205 | 360 | 900 | 150 | | 15 | 15 | 60 | 360 | 900 | 15 | 150 | 15 | 60 | |
| Lbs. | 2100 | 5550 | 540 | 690 | 165 | 165 | 690 | 2100 | 5550 | 165 | 1230 | 165 | 690 | |
| TDN | 1083.6 | 932.4 | 441.18 | 547.86 | 98.49 | 129.19 | 485.76 | 1083.6 | 932.4 | 129.19 | 974.16 | 98.34 | 485.76 | |

*Total Digestible Nutrients (T.D.N.) in barley ration—2008.651 pounds.
 Total Digestible Nutrients (T.D.N.) in corn ration—1697.538 pounds.
 Total Digestible Nutrients (T.D.N.) in emmer ration—3703.450 pounds.

TABLE 7.—Feed Consumed by 30 Day Periods
SECOND TRIAL

| Cow Number | Alfalfa | Corn Silage | Emmer | Oil Meal | Wheat Bran | Conc. Ration | Alfalfa | Silage | Barley | Oil Meal | Wheat Bran | Conc. Ration |
|------------|---------|-------------|---------|----------|------------|--------------|----------|----------|---------|----------|------------|--------------|
| | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| 218 | 602 | 1444 | 225 | 112.5 | 112.5 | 450 | 612 | 1468 | 189 | 94.5 | 94.5 | 378 |
| 352 | 552 | 1324 | 144 | 72. | 72. | 288 | 560 | 1356 | 136 | 68 | 68 | 272 |
| 4A | 494 | 1189 | 163 | 81.5 | 81.5 | 326 | 508 | 1218 | 143 | 71.5 | 71.5 | 286 |
| 339 | 512 | 1232 | 155 | 77.5 | 77.5 | 310 | 522 | 1254 | 168.5 | 84.7 | 84.8 | 339 |
| 222 | 438 | 954 | 165 | 82.5 | 82.5 | 330 | 438 | 857 | 185 | 92.5 | 92.5 | 370 |
| 349 | 612 | 1468 | 82 | 41. | 41. | 164 | 604 | 1446 | 88 | 44. | 44. | 176 |
| Lbs. | 3210 | 7611 | 934 | 467 | 467 | 1868 | 3244 | 7599 | 909.5 | 455.2 | 455.3 | 1821 |
| TDN | 1637.42 | 1278.648 | 739.728 | 365.661 | 278.752 | | 1654.764 | 1276.632 | 722.143 | 356.422 | 271.768 | |

Total Digestible Nutrients (T.D.N.) in barley ration—4281.724 pounds.
 Total Digestible Nutrients (T.D.N.) in emmer ration—4300.210 pounds.
 *Analysis taken from Bul. 231.

Feed Consumption

Total milk and fat production in itself is not an absolute criterion of the value of a feed for dairy cows. One must also consider the consumption per unit of production.

The rations and feeds in the ration have been compared on two bases. First on the basis of total pounds of the feeds which are compared. Second on the total digestible nutrient basis of the entire ration.

In the first trial the ration consisted of alfalfa hay, corn silage, wheat bran, old process linseed oil meal, oats, corn, barley, or emmer. The only feeds which were varied in the ration were corn, barley, and emmer. That is, the rations were balanced for the individual cows by adjusting the amounts of these three feeds. It is realized that a comparison of feeds is more difficult in rations including several feeds, however when high producing cows are used it is necessary to include several feeds if the production is to be maintained.

The data in Table 6 indicate that it required 23.98 pounds of emmer, 28.22 pounds of corn and 24.51 pounds of barley to produce 100 pounds of milk, and 6.68 pounds of corn, 5.66 pounds of barley and 5.82 pounds of emmer to produce one pound of butterfat.

In comparing the result (Table 8) of the rations on the basis of total digestible nutrients in the entire ration we find that it required 88.72 pounds of T.D.N. in the corn period, 71.77 pounds of T.D.N. in the barley period and 72.19 pounds of T.D.N. in the emmer period to produce 100 pounds of milk.

TABLE 8.—T.D.N. Required to Produce Milk and Fat

| Feed | T.D.N. lbs. | Milk lbs. | Fat lbs. | T.D.N. Required to Produce | |
|---------------|-------------|-----------|----------|----------------------------|-----------|
| | | | | 100 lbs. Milk | 1 lb. Fat |
| Barley Ration | 2008.651 | 2815.40 | 121.89 | 71.775 | 16.479 |
| Corn Ration | 1697.538 | 1913.2 | 80.77 | 88.727 | 21.016 |
| Emmer Ration | 3703.450 | 5129.90 | 211.42 | 72.193 | 17.517 |

In the second trial in which the concentrate part of the ration was more restricted as to number of feeds included, and in which the total pounds of barley and emmer were used on the same proportion in the ration, the results favored emmer, but not markedly.

The second trial in which a grain mixture of two parts of emmer or barley and one part each of oilmeal and wheat bran were used the results were as shown in table 9.

TABLE 9.—T.D.N. Required to Produce Milk and Fat

| Feed | T.D.N. lbs. | Milk lbs. | Fat lbs. | T.D.N. Required to Produce | |
|---------------|-------------|-----------|----------|----------------------------|-----------|
| | | | | 100 lbs. Milk | 1 lb. Fat |
| Emmer Ration | 4300.210 | 5879.10 | 207.25 | 73.144 | 20.749 |
| Barley Ration | 4281.724 | 5722.70 | 200.36 | 74.819 | 21.366 |

The data in Table 9 agree closely with that in table 8, indicating no significant difference in T. D. N. in emmer and barley required in milk and fat production.

Physiological Effect

In the two trials in which fourteen cows were used, we had one cow No. 336 which refused the ration containing emmer. No satisfactory explanation can be given. In the case of all the other cows no differences could be noted in the palatability or physiological effects of emmer and barley.

It should perhaps be stated that the emmer used for both trials was locally grown, and relatively free from hulls. This no doubt influenced its feeding value and palatability materially. The emmer was, however, of the same quality as that received by the local elevators. In computing the T.D.N. the analysis of emmer without hulls was used.

Summary

1. South Dakota is one of the leading states in the production of emmer. Emmer has been grown in the state for a period of about 40 years.
2. The reports from the various experiment stations which have tested emmer from cultural and yield standpoints, indicate that emmer does not yield as well as barley or oats.
3. The two trials involving twelve high producing cows indicate that emmer is at least equal to barley in maintaining milk production.
4. The data in these two trials also indicate that there is no significant difference between barley and emmer in maintaining the body weight in dairy cows.
5. Emmer seems to be as palatable as barley for dairy cows.
6. No physiological differences were observed during the two trials in barley and emmer, excepting in the case of one cow which refused to eat emmer.
7. Emmer should of course be ground for dairy cows.
8. Emmer, with practically all the hulls removed was used in these trials and is much to be preferred for feeding dairy cows.
9. Emmer can be substituted pound for pound for barley without effecting the nutritional value of the ration.
10. Inasmuch as barley and emmer are about equal in feeding value for dairy cows, their relative cost in a ration can easily be determined, when the local prices are known.