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This article reports some of the results of experiments tried with wheat in the season 1890–91, with reference also to like experiments of previous years.

These experiments are reported:

- No. 65. Quantity of seed.
- No. 66. Time of sowing.
- No. 67. Depth of sowing.
- Nos. 62 and 69. Effect of fertilizers.
- No. 116. Test of varieties.

The season of 1890–91 was more than usually favorable for wheat over most of Illinois, and the crop of the State was one of the best for many years. The experiments reported, except No. 69, were made on the fertile dark colored prairie soil of the Station grounds at Champaign. Experiments with fertilizers were made at Flora, Odin, Nashville, and near Belleville.

Trials for three years indicate that variations in quantity of seed between one and two bushels per acre have less effect on yield than other conditions. In 1891 the largest yield was from six pecks per acre; in 1890, from four and from eight pecks; in 1889, from five pecks.
In 1891 sowing small kernels gave a larger yield than was obtained from the same weight of larger kernels, but less than from the same number of larger kernels. The kernels in the crop from the small seed were approximately as large as those from the larger seed.

In two trials no injury resulted from rolling drilled wheat soon after sowing.

The yields of five plats, sown at intervals of ten or twelve days from Sept. 2d to Oct. 14th, were all good. It is not certain that they were affected by the date of sowing. If the last sown plats be excepted, there was no appreciable difference in time of ripening, and very little including it. The quantity of straw and the number of stalks per square foot decreased from the earliest to the latest sowing. The average length of heads and weight of kernels increased from the first to the last, except in the case of the second sowing, which was better than the third. In view of danger from the Hessian fly and of undue growth of straw, very early sowing is not advisable; and the danger to late sown wheat from repeated freezing in winter or early spring makes it unsafe in this latitude to sow in October.

Covering wheat one inch deep gave better results than covering three inches, and much better than covering five inches.

Trials with various commercial fertilizers on wheat indicate that on the soil of the Station grounds such use is not profitable. Barn-yard manure invariably produces a noticeable effect. Trials at Flora, Odin and Nashville show a marked increase in yield from use of barn-yard manure; those at Odin and Nashville, some increase from the use of superphosphate of lime, but, in general, not enough to make its use profitable. At Belleville neither barn-yard manure nor superphosphate produced any considerable percentage of increase in yield. At Flora the plats with superphosphate yielded less than those without any fertilizer. In view of the results in former years, trials on a small scale of superphosphate of lime and cattle tankage are recommended for wheat on the light colored soils of southern Illinois. The value of barn-yard manure for these soils can hardly be overestimated.

Trials of 12 varieties of English cross-bred wheat and of two varieties from France indicate possible value from some, with, however, a probability that all will mature too late to be very desirable in Illinois. A trial of a promising new variety of spring wheat from Canada, as was to have been expected, did not give promising results here.

Experiment No. 65. Wheat, Quantity of Seed.

This experiment has been tried for three years. The season of 1890-91 the same land was used as the preceding season. It was divided into seven plats each 2 x 4 rods. The land was plowed about Sept. 10th. It was harrowed twice and rolled Sept. 20th; and Sept. 22d the plats were sown with a drill at rates varying as closely as practicable from three to eight pecks per acre. The number of pounds of seed sown on
each plat is stated in the table. Plat No. 5 was sown with small kernels, averaging 45 kernels per gram. The others were sown with well cleaned wheat of the same variety, averaging 27 kernels per gram. The attempt was made to sow the same number of kernels on plats 5 and 6, so that a comparison might be made of the effect of large and small seed. Plat No. 7 was rolled September 24th. The wheat was cut June 27, 1891, stacked July 8th, and threshed July 23d. The wheat was cut rather closer to the ground than in ordinary harvesting. July 1st, on each of the seven plats, the number of stubs was counted on two squares two feet on a side.

The table following gives the results:

**Amount of Seed; Yield of Wheat and Straw; Number of Stubs per sq. ft.**

<table>
<thead>
<tr>
<th>Plat.</th>
<th>Seed sown.</th>
<th>Yield per acre.</th>
<th>Weight 100 kernels, grams.</th>
<th>Stubs per sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lb. per plat.</td>
<td>Pecks per acre.</td>
<td>Grain, bu.</td>
<td>Straw, lb.</td>
</tr>
<tr>
<td>1</td>
<td>2.5</td>
<td>3</td>
<td>22</td>
<td>4.140</td>
</tr>
<tr>
<td>2</td>
<td>3.25</td>
<td>4</td>
<td>21.31</td>
<td>3.760</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
<td>22.18</td>
<td>4.080</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>8</td>
<td>26.53</td>
<td>5.100</td>
</tr>
<tr>
<td>5</td>
<td>2.75</td>
<td>4</td>
<td>26</td>
<td>5.040</td>
</tr>
<tr>
<td>6</td>
<td>4.75</td>
<td>6</td>
<td>29</td>
<td>5.400</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>6</td>
<td>27.66</td>
<td>4.560</td>
</tr>
</tbody>
</table>

The following table from bulletin No. 11, p. 348, gives the results of the trials in two preceding years:

**Amount of Seed, and Yield of Wheat and Straw.**

<table>
<thead>
<tr>
<th>Number of pecks sown per acre.</th>
<th>Yield per acre. 1888–9.</th>
<th>Yield per acre. 1889–90.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>36.2</td>
<td>4.560</td>
</tr>
<tr>
<td>4</td>
<td>38.3</td>
<td>4.700</td>
</tr>
<tr>
<td>5</td>
<td>36.3</td>
<td>4.750</td>
</tr>
<tr>
<td>6*</td>
<td>35.4</td>
<td>4.540</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*In 1889, a plat adjacent to this was drilled at the same rate and afterwards rolled. This plat yielded at the rate 26.5 bushels per acre.

In 1891 the two largest yields were from sowing at the rate of six pecks per acre; the next from sowing eight pecks; with nearly as much from sowing four pecks of smaller seed. The yields from sowings of three, four and five pecks per acre of good seed were less than when six or eight pecks were sown. In 1890 the largest yields were from sowings at rate of eight and four pecks; with best yield from sowing six pecks. In 1889 the largest yield was from sowing five pecks, with yields almost the same from sowings of four and six pecks.
In the fall of 1889 a plat was rolled after being sown and yielded a little more than the adjoining plat not rolled.

In 1890 a plat was rolled which yielded a little less than the adjoining plat unrolled, but under like conditions otherwise.

There was comparatively little difference in the weight of lots of 100 kernels from each of the plats. Those from the plats sown with small kernels were slightly heavier than those from any other plat, with one exception. The number of stalks per square foot was largest when six pecks per acre had been sown.

Experiment No. 66. Wheat, Time of Sowing.

In the trial for 1890-91 a tract of land was used which had been in oats in 1890, preceded by three crops of corn, and these by clover. The land was plowed at different dates from August 2d to 29th, but each plat sown had received like treatment as to plowing. The plowing was six inches deep, the land being rolled soon after plowing. The tract was divided into five plats two rods wide and a little over 51 rods long, containing .64 of an acre each.

The wheat was drilled at the rate of one and one-half bushels per acre, as nearly as practicable, each plat being disked twice, harrowed twice and rolled the day it was sown or the day previous. The rainfall had been light and the ground was rather dry. After the last plat was prepared for seeding there was a rainfall of .51 inch, and the wheat was sown on it the next day. The dates of sowing were September 2, 12 and 22, and October 2 and 14.

The growth in the autumn was not strong. The two plats first sown made the largest growth, but did not appear to have so uniform a stand as the third and fourth sowings. The latest sowing went into the winter with a small and feeble growth. The Hessian fly made its appearance on the earlier seeding, but did no appreciable injury. The winter was exceptionally mild and the spring unusually favorable for the wheat. The earlier sowings made a very good growth. The first sowing was tallest and had rather shorter heads than the later sown plats. Much of the wheat was five feet high. That last sown headed some days later than the others, but matured within a day or two of same date. There was no perceptible difference in the time of maturing of the other plats. There was 10 per cent or more of blasted or smutted heads. Aside from this, the plats attracted much favorable comment. Intelligent visitors could see no difference between the first four sowings. Large numbers of English sparrows did considerable damage before and after cutting; apparently most on the first sown plat, the injury decreasing in order of sowing.

The wheat was harvested June 29th and threshed July 7th. A little rain fell the night before threshing, making the wheat "tough" in threshing, and a little was left in the straw. The number of stalks on areas of 4 sq. ft. was counted in six places in each of the five plats. The
aggregates for the 24 sq. ft. in each plat were: 1299, 1218, 991, 953 and 860, showing a steady decrease from earliest to latest sowing. In one place in the fourth sowing the number of stalks was less than half the average of the others in that plat; but for this the fourth plat would have shown more stalks than the third. The largest number per sq. ft. was 63. In only six of the 24 areas counted was the number per sq. ft. less than 35. These numbers do not indicate the number of heads. The number of stubs was also counted in a distance of 65 inches in two rows of each of the five plats. The averages of the two rows, from first to last sowings, were: 1067, 1018, 927, 897 and 840, showing a constant decrease in number.

The following table gives the results:

<table>
<thead>
<tr>
<th>Plat.</th>
<th>Date of sowing</th>
<th>Yield, lb.</th>
<th>Yield per acre, bu.</th>
<th>Stubs per sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept. 2</td>
<td>1,186</td>
<td>30.88</td>
<td>54</td>
</tr>
<tr>
<td>2</td>
<td>Sept. 12</td>
<td>1,386</td>
<td>36.08</td>
<td>59</td>
</tr>
<tr>
<td>3</td>
<td>Sept. 22</td>
<td>1,324</td>
<td>34.46</td>
<td>41</td>
</tr>
<tr>
<td>4</td>
<td>Oct. 2</td>
<td>1,398</td>
<td>36.40</td>
<td>39</td>
</tr>
<tr>
<td>5</td>
<td>Oct. 14</td>
<td>1,310</td>
<td>34.11</td>
<td>36</td>
</tr>
</tbody>
</table>

All the yields were large for this region, the average being 34.6 bu. per acre. Especially with the uncertainty caused by injury by the birds, it is not safe to say that the yield was affected by the time of sowing. As reported in Bulletin No. 11 of this Station, the yields in 1889 from sowings at different dates were: September 22d, 38.2 bu.; September 29th, 40.4 bu.; October 8th, 36.1 bu. In 1890 the yields were: September 12th, 32.4 bushels; September 23d, 29.1 bu.; October 4th, 20.8 bu.; October 15th, 12.1 bu. In March, 1890, there were severe freezings which injured the later sown wheat more than the earlier sown. In each of the three years there was a decrease in the yield of straw from the earliest to the latest sowing.

An attempt was made to select the largest heads from each plat. Of these 50 from each plat were compared. It was found that the earliest sowing had slightly the shortest and lightest heads, with least number of kernels; the latest sowing made the best showing in these particulars. The average number of kernels per head was 43.

The table shows results from each plat.

**Comparison of Fifty Heads from Each Plat.**

<table>
<thead>
<tr>
<th>Plat.</th>
<th>Average length, in.</th>
<th>Number of kernels.</th>
<th>Weight of kernels, grams.</th>
<th>Weight of heads, grams.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.67</td>
<td>2,023</td>
<td>64.2</td>
<td>85.9</td>
</tr>
<tr>
<td>2</td>
<td>3.72</td>
<td>2,182</td>
<td>67.2</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>3.69</td>
<td>2,141</td>
<td>65.2</td>
<td>87.6</td>
</tr>
<tr>
<td>4</td>
<td>3.78</td>
<td>2,189</td>
<td>65.7</td>
<td>88.5</td>
</tr>
<tr>
<td>5</td>
<td>3.96</td>
<td>2,304</td>
<td>73.6</td>
<td>99.8</td>
</tr>
</tbody>
</table>
Experiment No. 67. Wheat, Depth of Sowing.

September 27, 1890, in each of nine rows one rod long and one foot apart, 198 kernels of selected seed wheat were planted. This is one kernel for each inch. The wheat in rows 1, 2, 3 was covered one inch deep; that in rows 4, 5, and 6, three inches; that in rows 7, 8, and 9, five inches. An extra row was planted on each side.

June 30, 1891, the wheat was harvested. The stand was best on rows 1 to 3, good on rows 4 to 6, and poor on rows 7 to 9. The wheat was about four feet high. The yield is not reported, as the English sparrows had done some injury. There was, as in all the wheat on the Station grounds, a very perceptible percentage of smutted heads. The facts as to each row are given in the table.

<table>
<thead>
<tr>
<th>Row</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total stalks</td>
<td>648</td>
<td>648</td>
<td>710</td>
<td>541</td>
<td>615</td>
<td>623</td>
<td>417</td>
<td>475</td>
<td>169</td>
</tr>
<tr>
<td>With good heads</td>
<td>608</td>
<td>603</td>
<td>662</td>
<td>498</td>
<td>588</td>
<td>580</td>
<td>410</td>
<td>444</td>
<td>155</td>
</tr>
<tr>
<td>Without heads</td>
<td>16</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>10</td>
<td>0</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Showing smut</td>
<td>24</td>
<td>42</td>
<td>44</td>
<td>31</td>
<td>33</td>
<td>7</td>
<td>29</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

The indications were that in this favorable season shallow covering was decidedly better than deep.

Experiment No. 62. Wheat, Effect of Fertilizers.

The trials made in 1889 and 1890 with commercial fertilizers of different kinds for wheat on the Station grounds did not indicate, with certainty, any appreciable effect from their use. In the fall of 1890 a trial was made to see if any effect would be produced upon wheat from fertilizers which had been applied in unusually large quantities in the spring of 1889. (Two crops of corn had been grown on the land without appreciable influence by the fertilizers.) Seven plats were used each 2 x 4 rods. The land was disked and harrowed twice, September 20, 1890, and the wheat drilled at the rate of about one and one-half bushels per acre, 34 lb. being sown on 56 square rods. The corn had been cut September 16th, and removed from the plats.

The table gives results.

Yields of Wheat in 1891 from Plats upon which had been put Commercial Fertilizers in Large Amounts in 1889.
It will be noticed that the smallest yield of both grain and straw was from the plat to which sulphate of potash had been applied; the largest from one of the unfertilized plats. The average yield of the unfertilized plats was a little more than that of those on which the fertilizers had been applied. No sufficient reason appears for the small yield of plat No. 5, unless the fertilizer produced an unfavorable effect. The yields were noticeably smaller than those of the plats adjacent in which effect of time of sowing was tested. There was little difference in weight of the kernels.

The results of all the trials here with commercial fertilizers on wheat, as also on corn, do not show that it is generally profitable to apply these on the black prairie soils of central Illinois.

On the University farms the effect of a liberal application of stable manure made in 1888 was plainly seen in wheat of 1890-91 in a more vigorous growth of straw.

Experiment No. 69. Wheat, Effect of Fertilizers.

For three years past experiments with commercial fertilizers on wheat have been tried at points further south than the Station grounds. For 1890-91 the trials were made on the farms of W. W. Bowler, Flora; A. M. Woodward & Co., Odin; Chas. Stephani, Nashville, and Fred Helms, Wilderman, near Belleville. These are all not far from latitude 38° 30', and, except the last named, on the level light colored soils, characteristic of that region. Mr. Helms's soil is darker colored and naturally very fertile.

The land at Mr. Bowler's had been in grass from 1883 to 1888. In 1889 it produced about 40 bushels of corn per acre. In 1890 it was sown to oats, but the crop failed. The land at Odin had been thrown out of cultivation for several years until 1889, when it produced a fair crop of corn. In 1890 it was sown to oats, which failed to produce a crop. The land at Nashville had been in cultivation about 40 years—in corn in 1883 and 1884; oats in 1885; wheat in 1886; oats in 1887; wheat in 1888 and 1889; and in oats in 1890. Mr. Helms's land has been cultivated by him 22 years without manure. It was in wheat on clover sod in 1889-90, and yielded about 30 bushels per acre.

In each case, except at Flora, nine plats 2 x 20 rods, containing one-fourth acre each, were used. To plat 1 in each case five wagon loads of barn-yard manure were applied, and 100 lbs. of glue factory superphosphate to plats 3, 4, 6, 7, and 9. On the farm of Mr. Bowler, near Flora, 9 additional plats of the same size were used, 50 lb. of superphosphate being applied to plats 10, 12, 13, 15 and 16. The barn-yard manure and superphosphate were applied before sowing.

In each case the land had the treatment usual in the region in preparing for wheat. The wheat was sown with a drill about September 20, 1890. The winter was favorable for the crop. When visited at the last of April, as well as at harvest time, the effect of the barn-yard
manure in stimulating growth was very apparent; that of the superphosphate, less so. The wheat was carefully harvested, and threshed from the shock, except at Flora, where Mr. Bowler was compelled to put it in stack and thresh August 20th. Mr. Helms estimates that his crop was damaged one-fifth or more by plant lice. The wheat at Nashville was measured; at the other places, weighed. It was all of good quality.

The results are given in the table:

**Effect of Fertilizers upon Wheat, 1890-91.**

<table>
<thead>
<tr>
<th>No. of plat</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>7</th>
<th>9</th>
<th>Average</th>
<th>2</th>
<th>5</th>
<th>8</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 loads manure</td>
<td>400 lbs. superphosphate per acre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yield per acre, bushels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flora</td>
<td>25.47</td>
<td>18.2</td>
<td>20.2</td>
<td>15.2</td>
<td>19</td>
<td>16.53</td>
<td>17.83</td>
<td>20.07</td>
<td>20.93</td>
<td>18.13</td>
<td>19.71</td>
</tr>
<tr>
<td>Odin</td>
<td>25.47</td>
<td>17.93</td>
<td>19.2</td>
<td>20.66</td>
<td>20.06</td>
<td>21</td>
<td>19.85</td>
<td>19.33</td>
<td>20.06</td>
<td>19.53</td>
<td>19.64</td>
</tr>
<tr>
<td>Nashville</td>
<td>28</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>15</td>
<td>17</td>
<td>16</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Belleville</td>
<td>40.7</td>
<td>40.23</td>
<td>40.01</td>
<td>39.05</td>
<td>39.8</td>
<td>39.16</td>
<td>39.85</td>
<td>35.25</td>
<td>36.9</td>
<td>37.8</td>
<td>36.65</td>
</tr>
<tr>
<td>Average</td>
<td>29.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>23.38</td>
<td>35.25</td>
<td>36.9</td>
<td>37.8</td>
<td>36.65</td>
</tr>
</tbody>
</table>

The average yields were good; that at Belleville especially so, notwithstanding the injury by plant lice. Compared with the unmanured plats, those to which superphosphate of lime was applied at the rate of 400 lbs. per acre show an increase of 1 1/2 bushels per acre. The average increase at Nashville was six bushels; at Belleville over three bushels. At Odin there was only a very slight increase, while at Flora the unmanured plats gave a somewhat larger yield than those receiving superphosphate.

Compared with the unmanured plats, the plats receiving barn-yard manure at the rate of 20 ordinary two-horse wagon loads per acre showed an average increase of over 8 3/8 bushels per acre. At Nashville the increase was 18 bushels—from 10 to 28 bushels; at Flora and Odin nearly 6 bushels, and at Belleville 4 bushels per acre.

The cost of the application of the superphosphate at Nashville was about repaid by the increased yield; at neither of the other places was this the case, while at Flora the yield was slightly lessened on the plats receiving this fertilizer.

The five plats at Flora each receiving superphosphate of lime at the rate of 200 lb. per acre gave yields at rate of 17.33, 16.8, 18.46, 14.60 and 17.33 bu., an average of 16.9 bu. per acre. The unfertilized plats gave yields at rate of 19.26, 16.86, 16.73 and 16.5 bu., an average of 17.33 bu. per acre. It cannot be said with confidence that this lighter application did either good or harm.

The results of all these trials are not encouraging as to the profitable
use of superphosphate of lime, or dissolved bone, for wheat on the light colored soils of southern Illinois. In view of the results in previous years, however, trials on a small scale are recommended, as also of cattle or hog tankage, at the rate of about 400 lbs. per acre. The very great value of barn-yard manure for these soils is well illustrated by these experiments, most noticeably at Nashville.

Experiment No. 116. Wheat, Test of Varieties.

Trials were made of very small quantities of 12 varieties of cross-bred wheats received from Carter's, of London, England. These wheats were exhibited at the Show of the Royal Agricultural Society of England at Windsor, in 1889, the parent stocks also being shown. They very favorably impressed the writer. The samples received were of fine appearance. They were sown September 27, 1890, in rows one foot apart. The results were not conclusive. It is probable that most, if not all, the varieties will mature too late to be very desirable here. Two or three may be considered promising. They will be tested further.

The U. S. Department of Agriculture sent the Station packages of two varieties of wheat labeled "Hybride Lamed" and "Hybride Dattel." The kernels were remarkably plump and attractive in appearance. Through a mistake of the postal authorities these wheats were not received until October 4th. They were sown October 8th, and made a fair growth and gave fair yields. They were a week or more later in maturing than the ordinary varieties. Positive judgment as to their value for this region is suspended until further trial.

A small package of Campbell's white chaff, described as a new spring variety originating in Simcoe Co., Ontario, was received from Canada and sown in rows in the spring. The quantity received was small. The English sparrow injured the ripened grain somewhat so that only general impressions can be reported. These were not favorable; but spring wheat growing has not been found generally profitable for this region, and perhaps, can not be fairly tested here.


Daily Variation in the Milk and Butter Production of Cows.

The quantity of milk produced by a cow and the quality of the milk are influenced directly by the individuality, and indirectly by the breed of the animal. Each breed is only a group of individuals of the same kind. The breeds differ from each other by certain characteristics which are preserved so long as conditions are not sufficiently strong to change them. To the distinct characteristics belong the disposition to produce a large quantity of milk, or milk possessing a specific peculiarity, such as high content of butter fat and casein.
Numerous observations show that with nearly all cows the milk production follows the general course of decreasing in quantity of milk and butter, and increasing in percentage of butter fat as the period of lactation progresses.

By weighing and testing the milk of cows every day, I have observed that lines representing the daily production of milk and of butter fat do not take the course of a straight line down an inclined plane, but are broken, zigzag lines. The results of these observations are given here in plates on pp. 12–15.

The days from May 1st to July 5th are represented by the perpendicular lines in the plates, every fifth day being numbered at the top.

The figures on the left of the plates represent:

First, per cents of butter fat in the milk produced each day, the horizontal lines representing successively an increase of .2 or 1.5 of one per cent.

Second, pounds of milk produced each day, each horizontal line showing successively an increase of .2 or 1.5 of one pound.

Third, the pounds of butter fat produced each day, calculated by multiplying the pounds of milk by the per cent of butter fat found in the milk for that day. Except for cow No. 5, the horizontal lines represent successively an increase of .04 or 1.25 of one pound of butter fat; for No. 5, they represent .02 of 1.50 of a pound.

The intersections of the broken and perpendicular lines show the point where the figures in the left hand margin are to be sought.

The dotted line on plate 1 represents the night milk, and the solid broken line on the same plate, the morning milk of cow No. 2.

There still remains a considerable amount of this material which cannot be printed for lack of space. The milk from each of five cows has been weighed and tested every day since May 27th. A diagram of the production of a cow during the whole period of lactation would be very instructive. So far as is known, this is the first time the suggestion has been made. We shall continue the diagrams.

The plates given here are an illustration only of the idea, and it is hoped that by these diagrams the reader is given an opportunity to see more at a glance than could be readily obtained from the mass of figures which they represent.

The history of these cows is given on page 511, bulletin No. 16, of this Station.

Cow No. 2 is a very nervous and somewhat vicious animal, while cow No. 5 is a mild-eyed, "mulley cow."

The broken lines of the diagram show the production of the cows from day to day, and are evidence to illustrate, First, that the variation in the quantity and quality of the milk of one cow at each milking is greater than the variation in the same cow’s milk each day: compare plate 1 with plate 2.
Second, that under exactly the same conditions the daily milk of one cow varies more than that of another: compare plates 2 and 3.

Third, that the mixed milk of three cows is more uniform in amount and richness from one day to another than the milk of one cow.

The record of each milking of cow No. 2 (plate 1) shows the general tendency to equalize the milk production by going to both extremes. May 19th she gave 12.75 lb. milk in the morning and 7 lb. at night. The morning milk contained 6.5 per cent of butter fat, the night milk only 2 per cent. The average per milking of this cow for three months has been 9.35 lb. milk and 3.92 per cent of fat. For instance: in general, it can be seen that in this record when one milking was above the average in quantity and quality, the next milking went below, and vice versa.

During the 66 days represented in plate 2, the daily quantity of milk (from both milkings) varied from 23 to 17 lb.; the per cent of butter fat in the daily milk from 3 to 6.1, and the pounds of butter fat in the daily milk from 0.56 to 1.29.

The daily record of cow No. 5 for the 66 days shows a very uniform per cent of butter fat, varying only from 2.8 to 3.4. The same regularity is seen in the total daily production of butter fat, 0.65 to 0.42 lb.; and plate 3 shows that the course of the line representing the pounds of butter fat gradually declines from May 1st to July 5th. A decrease in the pounds of milk from day to day is also shown in the record of this cow.

Cow No. 2 is a striking example of occasional extreme variations in milk production, and, contrary to the general statement, the variation in quantity and quality coincide. That is, when she gave a small mess of milk it had a per cent of butter fat below her average, and the largest milkings were of her richest milk. This does not hold true in the average per cow calculated from the daily records of three cows, for the reason that the milk of cow No. 1 (not given here for lack of space) showed just the opposite tendency from cow No. 2. Nearly every time when the milk of cow No. 1 increased in quantity it decreased in percentage of butter fat; and as the pounds of milk per day decreased, the per cent of fat in the milk increased.

The record of cow No. 5 on this point shows a very uniform percentage of butter fat from day to day regardless of the quantity of milk produced.

These individual characteristics may be more concisely stated thus—

Cow No. 1. The richest milk is given when the quantity is small. The quantity decreased somewhat.

Cow No. 2. The richest milk is given when the quantity is large. The quantity did not permanently decrease.

Cow No. 5. The richness of her milk was very uniform and changed but slightly. The quantity decreased permanently.
Beginning June 18th, cow No. 2 was given 5 lb. of wheat bran daily; one week later this was increased to 7 lb. per day. The other two cows got nothing but pasture feed, which gradually grew very short in July on account of the severe drought.

By comparing plates 2 and 4 it can be seen that the upper three broken lines across plate 4 are not so irregular as the three lines across plate 2. This makes it very probable that the greater the number of cows in a dairy is the more uniform will be the production from day to day.

During the time of this record, May 1st, to July 5th, these cows have been exposed to uniformly dry weather. The rainfall for the month of May was .89 in.; June, 2.18 in.; total, 3.07 inches. The average of 10 years for these two months is 9.5 inches.

It is also of some interest to compare the line representing the daily pounds of milk shown in plate 4 with one showing the mean daily temperature.

Although there are exceptions, this comparison shows that as a rule the number of pounds of milk was low when the mean daily temperature was high, and the number was high when the temperature was low. In other words, these two lines give something of the appearance of an irregular picket fence with each picket sharpened at both ends.

The following table shows the highest, lowest, and average daily yield of milk, per cent of butter fat and pounds of butter fat produced by each of six cows from May 1 to August 1, 1891.

Also the average daily record per cow calculated from the total daily production of the whole herd.

| Yield of Milk; Per cent. of Butter Fat; Yield of Butter. |
|---|---|---|---|---|---|---|---|---|---|
| No. of cow and period of milking after May 1st. | Pounds of milk. | Per cent. of butter fat. | Pounds of butter fat. |
| | Highest | Lowest | Average | Highest | Lowest | Average | Highest | Lowest | Average |
| No. 1, to July 27, | 13 | 5.5 | 10.3 | 8 | 4.25 | 5.28 | .666 | .312 | .539 |
| No. 2, to August 1, | 23 | 15 | 18.7 | 16 | 3 | 4.7 | 1.297 | .574 | .885 |
| No. 3, to July 1, | 11 | 4 | 7.9 | 8 | 2.9 | 3.56 | .369 | .16 | .28 |
| No. 4, to August 1, | 45 | 22.5 | 38.2 | 3.95 | 1.7 | 2.99 | 1.71 | .603 | 1.141 |
| No. 5, to August 1, | 20.5 | 10 | 15.9 | 3.6 | 2.8 | 3.14 | .653 | .33 | .498 |
| No. 6, July 6 to Aug. 1 | 26.5 | 20.5 | 24 | 4.4 | 2.7 | 3.31 | 1.166 | .623 | .792 |
| Average for the herd | 22 | 16.6 | 19.44 | 4.58 | 3.26 | 3.02 | .858 | .483 | .707 |

This table as well as the diagrams show that the test of a cow’s milk for one day only may give a decidedly wrong impression of the cow’s capacity for a week, month, or year.

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UNIVERSITY OF ILLINOIS,

Agricultural Experiment Station.

PRESS BULLETIN, No. 5.

Bulletin No. 18 of the Illinois Agricultural Experiment Station is devoted to Dairying Experiments.

The tests of dairy cows at the Illinois State Fair and at the American Dairy Show, Chicago, 1891, were made by the chemist of the Station and the bulletin contains a report upon the tests, and upon the working dairy maintained at the Dairy Show.

Continuing the investigation of milk tests, the Babcock test is found to be of great value in testing both the skim-milk and the butter milk, thus furnishing a check upon the processes of butter making. The results obtained emphasize the necessity of proper attention to both the temperature and acidity of the cream when churned.

A device for measuring the acid used with the Babcock test is explained and an illustration of the device is given. Also a method of marking test bottles is given.

Further investigation has been made of the method of testing milk by "composite" samples in which no preservative has been used—the sample, though sour, being put into good condition for the test by the use of concentrated lye. The practical results have been very satisfactory.

In trials of different methods of cream separation, the best results with Cooley cans in which the milk was set 10 inches deep were obtained when the milk stood 48 hours. But the most complete separation by setting the milk was obtained when the milk was set three inches deep in pans for 24 hours.

The results from the work on cream raising by dilution, show [1] that with rich milk and with that from a new milch cow, the cream rose as completely when the new milk was quickly cooled to 70°F. without the addition of water as it did when diluted with an equal quantity of water. [2] The rising of the cream was more complete in a given time, and was hastened by diluting the milk from cows that were not fresh or that gave a considerable quantity of average milk.

If you use the above concerning our bulletin, which will be out in a few days, we shall be glad to have the paragraph below follow.

W. L. Pillsbury, Secretary of Station.

This bulletin will be sent free of charge to any person engaged in farming in the state of Illinois who will send his address to

Agricultural Experiment Station,
Champaign, Ill.