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UNIVERSITY OF IDAHO
Agricultural Experiment Station

MOSCOW, IDAHO

Alaska Wheat Investigation

—:— By —:—

H. T. FRENCH, Director

J. SHIRLEY JONES, Chemist

Idaho Experiment Station

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Alaska Wheat Investigations.

H. T. FRENCH, Director.

J. S. JONES, CHEMIST

In view of the fact that so much interest has been aroused regarding the Alaska wheat which has been so widely advertised by the Adams-Hobe Seed company, of Juliaetta, Idaho, it has been deemed best for the Idaho Experiment Station to make a flour test of the wheat, and again publish such other data as we have at hand regarding the growing of this wheat.

Much misinformation has been published in various ways touching the matter and numerous inquiries have reached this Station as a result of this widespread notoriety. People in foreign countries and distant islands of the sea, have sent communications to us pertaining to this "wonder". Even New Zealand has received some of the published articles on this wheat, judging from the inquiries coming from that far-away country.

Information on this subject has been gathered by members of this Station, in an impartial and unprejudiced manner, even though some may have imagined to the contrary. The Experiment Station worker must enter the field of investigation without prejudice or bias, pro or con, regarding the subject under consideration. He should have as clear an understanding of the matter as possible, and may have conclusions already drawn in his mind based upon previous experience or knowledge gained in some similar line of work; but he should be able

to bring to bear on the subject, a training of mind and hand, just as complete as possible, and that ability must not be warped by any prejudice or bias in favor of man or matter.

Many thousands of dollars and thousands of people are interested in this wheat, and with a view of serving these interests fairly and impartially we publish this bulletin.

Numerous circular letters and a press Bulletin were sent out a few months ago to individuals who are interested in this subject. In these publications it was made clear to any fair minded person that this station was in no way responsible for the widespread notoriety which the wheat had gained through the advertising which it received.

The first sample of this wheat brought to us was analyzed by the Station Chemist, just as a sample of rock or soil would be analyzed for an individual who could show that the matter was of more than local or personal interest. Some comments were made upon the probable value of such an analysis, and upon properties of the wheat as shown by a physical examination.

This report was used in advertising the grain without proper explanation accompanying it, and many people were undoubtedly misled by this omission.

In the following report the chemist gives the results of his investigations regarding the milling qualities of the wheat. We also give here some data relating to the classification and yield of the wheat so far as is known at this time.

Classification

Some serious mistakes have been made in placing the wheat where it belongs. Some writers say it is Old Miracle, Seven-headed Wonder, or Egyptian wheat; while others place it among the poorer varieties of the Durum wheats. It has also been classified as an Emmer or Spelt; but there is little to warrant such a classification either in its habit of growth or in its physical properties.

The Emmers are not considered valuable for flour to any degree and are not milled for this purpose. Mr. Adams, the promoter of this wheat, maintains that the wheat is not the old Miracle or Seven-headed Wonder, but declines to state just what it is, and in the absence of such a statement we are inclined to think the Agronomist of this Station has

given the wheat its legitimate place in a statement published in press bulletin No. 15, from which we quote as follows: 'Triticum Sat. Turgidum, Variety Poulard, known as Miracle, Egyptian or Mummy wheat, and raised in Southern Europe for macaroni, and other pastes and flours desired by certain French markets.' It is our observation that the heads of Alaska bear a closer resemblance to those which were raised by the Colorado Station as Miracle wheat than they do to any other class of wheat we have seen. The heads of the Alaska, however, are larger and the kernels themselves seem to be somewhat larger and are lighter in color than are those of the above mentioned Miracle wheat that was sent here.

Claims Made for the Wheat.

It is claimed by its owners that this is a hard winter wheat when grown in the winter-wheat sections of the country. A great deal of winter wheat is raised in Northern Idaho, but outside of one or two varieties grown in certain localities, none of it should be regarded as hard wheat. The Alaska that we have seen grown here under field conditions, would not in our opinion pass as hard wheat when compared to the hard wheats of the North. It is claimed again that it may be grown with profit on the worn-out soils of the Eastern states if fertilizers are used; but that is something which can be determined only by actual trial. There is so far no record of such a trial. Further, it is claimed that Alaska wheat is naturally a dry land wheat, and will therefore flourish on dry land. Again there is no record to our knowledge upon this point. Northern Idaho, where thus far the wheat has, for the most part, been grown, would not be classed along with the dry regions of the country. The wheat, as grown in this section does not shatter badly, and, although the heads droop when mature, the grain does not lodge as badly as some other varieties grown quite extensively in this section.

That the kernels are easily broken by the thresher is true to a certain extent; but other varieties of wheat are damaged in the same way. The kernel has quite a deep suture or groove which causes it to break more readily than some others.

Yield.

The history of the yield of this wheat from which conclusions were drawn, that when placed under field conditions similar yields might be expected, is as follows:

Mr. Adams states that from one head of wheat sown in his garden in the fall of 1904 he secured seven pounds of wheat. This he sowed in the spring of 1906 with a garden drill upon about $\frac{1}{8}$ of an acre of his garden. From this amount he harvested 1545 lbs., which he planted during the fall of 1906; and harvested in 1907, 53,000 pounds, stating that a severe hail storm damaged this crop heavily. In 1908 the wheat was grown under field conditions, both as a spring and winter wheat, in the vicinity of Juliaetta, Idaho, and one field in the State of Washington but near Moscow, as a winter wheat.

The yields this season, 1908, have not been phenomenal in any way. In some cases the wheat was quite badly mixed with other varieties, such as Canadian Hybrid and Little Club. An estimate of the yield, verified in some cases by the threshing machine record is from 20 to 40 bushels per acre. This is about the same yield as that obtained from ordinary winter wheat this season. That it will exceed these yields when grown under field conditions, remains to be proven.

The wheat bears a large branching head which was found, by the Chemist and Agronomist, both of whom examined several specimens, to contain from 90 to 140 kernels, while a fair estimate for other varieties is from 30 to 60 kernels. Whether this will increase the yield per acre or not depends upon the number of such heads grown on an acre. From four heads of the winter wheat picked at random by the Chemist from a box containing them, the kernels were shelled out, counted and weighed in the Laboratory. 508 kernels were obtained, which weighed 21.667 grams, or an average per hundred kernels of 4.2 grams. An average of 3.86 grams per hundred kernels is stated on good authority for domestic wheats, and 4.07 grams for foreign. What will happen to the shape of the heads, the number and weight of the kernels each will produce when raised for a term of years under average field conditions, is something that can be learned only by trial.

Wheat Tests.

Through the co-operation of the department of Chemistry and

Agronomy, the Station has undertaken a thorough examination of the wheats in this State, with a view of improving the varieties already grown, and if possible to introduce some new varieties which shall be of greater value for milling purposes than some of those which are common to this section. For this purpose extensive field trials are being made by the Agronomist, and the Chemist is making such Chemical tests of both the wheat and the flour as are deemed necessary in determining their value for bread making. To assist in this work the Chemist has a complete flouring plant, a roller mill of 15 to 20 barrels capacity, which is used in getting flour samples. This we believe will be of very great assistance in studying the problem of wheat improvement. The chemical analysis is only an indication of the true value of the wheat, and must be supplemented by milling tests. The wheat under discussion has been subjected to such tests, and the report of the Chemist is published in this Bulletin as follows:

Director, H. T. French,

Dear Sir:

Having adopted your suggestion made early last summer that as soon as possible a milling test should be given the wheat known locally as "Alaska," and that the flour obtained in milling, should by actual baking tests be compared to flour milled from some standard variety of milling wheat grown in this section of the state, I desire to inform you that the work suggested has been done, and herewith beg to submit the following report upon it.

The investigation of any wheat in attempting to fix its relative value for milling purposes, usually begins with a chemical analysis of the wheat itself. Although the results of a chemical analysis should not be accepted as conclusive evidence in favor of or against a wheat for flour making purposes, never-the-less it is contrary to the general experience of chemists familiar with this line of investigation, that the results of a chemical analysis and of an actual milling test should be widely at variance. Since it is possible that there might be an exception to this, Alaska wheat has been given as thorough a trial perhaps as it is possible to give any new wheat before it is actually presented to millers and wheat buyers for acceptance or rejection.

The fact that it has been placed in a class with the bread wheats of Southern Europe is sufficient evidence that it ought to be given a fair trial before final judgement is passed upon its value for flour making purposes here. The Idaho Experiment Station is exceptionally fortunate in having as a part of the equipment of the Chemical Department, a small flouring mill of a capacity of 15 or 20 bbls. of flour per day, where wheats of many varieties are being tested out for their milling qualities. In this mill it is possible to come quite close to the results obtained by the larger commercial mills. Although somewhat larger samples are required for milling than would be the case with the smaller mills used at some experiment stations, yet it is believed that better and more reliable information concerning the milling qualities of any particular variety of wheat may be obtained from it than from the smaller mills.

On September 19, 1908, there was secured at the warehouse in Juliaetta from the Spring and Winter Alaska wheat stored there, enough to make when cleaned about five bushels of each. This was cleaned at the warehouse under our direction, and we saw that each lot was labeled correctly and delivered to the express agent at the Railroad Station, from which place the samples were forwarded to Moscow. These samples were stored in the Experiment Station flour mill several days before they were ground. In the meantime there were secured from a local commission company about five bushels of as good a grade of Little Club wheat as could be found in the company's house. This was from the 1908 crop and raised south of town. Each of these lots of wheat was tempered, preparatory to grinding, to what was considered about the right degree in order to secure the best results in each case. No difficulty was experienced in grinding any of the wheat so selected. There was noticed, however, a decided difference in the way the two varieties milled. The Alaska, both fall and spring, ground very much like those which pass for the hard wheats of this section, viz., Turkey Red and Bluestem. This statement must not be understood as equivalent to saying that the Alaska is a hard wheat. An examination of cross-sections of the kernels of the Alaska wheat shows that although they have very hard outside layers, the interior of the kernels are soft and powdery; a similar examination of the hard wheats reveals the fact

that the hardness is not confined to the outer layers but is characteristic of the whole kernel. The fact that Alaska grinds like a hard wheat, however, is in its favor, for a far better grade of middlings, for further reductions, was obtained than in the case of the Little Club, which is a soft wheat. None but straight flour was obtained in either case. Both varieties gave flour of a rich yellowish color. The Alaska was somewhat the more colored, but it would be difficult for the inexperienced to distinguish between them on that point. With respect to the touch, the Alaska wheat may be described as sharp and granular, that from the Club wheat soft and flat. We are not prepared to grind for yield, but no appreciable difference in the amount of flour secured from each lot of wheat was noticed.

This flour was then sent to the laboratory for future work. It was thought at the time the milling was done that even if the flour would not make light bread it might reveal some of its characteristics when used for making biscuits, muffins, cakes, etc. In the writer's own home, such tests were made. It would be hard to distinguish between any of the three lots of flour so obtained, for as good a quality of this kind of bread as one could desire, was obtained from each of the flours, although the flavor was perhaps slightly in favor of that baked from the Alaska wheat flours. It was decided then that further work upon each would be necessary.

But before beginning any other work upon the flours, the wheats themselves were analyzed; samples having been retained from the larger milling lots. The results of the proximate analyses are recorded below:

| Name of Wheat | Description of Sample | Moisture per cent | Ash per cent | Ether Extract | Crude Protein N X 6.25 | Crude Fiber | Carbohydrates |
|----------------|-----------------------|-------------------|--------------|---------------|------------------------|-------------|---------------|
| Little Club | Plump & Sound | 11.25 | 1.70 | 1.24 | 9.10 | 2.80 | 73.91 |
| *Alaska Spring | " " " | 10.60 | 1.81 | 1.40 | 10.72 | 2.91 | 72.56 |
| *Alaska Winter | " " " | 10.36 | 1.77 | 1.44 | 11.17 | 2.48 | 72.78 |

*Graded 60 pounds per bushel.

These figures do not reveal anything strikingly abnormal about the composition of Alaska wheat. The higher percentage of ether extract in the Alaska wheat may mean that it has a little more oil than the Little Club and this may be the reason the flour obtained from it is of a slightly more yellowish tinge.

The Chemical examination of the three lots of flour was then taken up, the examination being confined to those determinations usually made in work of this nature. The result of this work is tabulated below:

| Name of Wheat | Moisture per cent | Ash per cent | Total | Protein as | Gliaden Number | Gluten | |
|---------------|----------------------|--------------------|--------------------------------|----------------------------------|-------------------|--------|-----|
| | | | Protein N x 5.7 per cent | Gliaden G N X 5.7 per cent | | Wet | Dry |
| Little Club | 11.34 | .41 | 7.75 | 4.76 | 53.67 | 26.2 | 9.0 |
| Alaska-Spring | 11.78 | .65 | 8.04 | 4.45 | 55.30 | 25.0 | 8.8 |
| Alaska-Winter | 11.27 | .48 | 8.78 | 4.96 | 56.49 | 27.1 | 9.1 |

Here again no marked differences are shown. In total protein and protein in the form of gliaden, the Alaska wheat flour in both cases is somewhat higher than that from the Little Club. This of course gives higher gliaden numbers, the inference possible being that they ought to show up better than the flour from Little Club wheat on baking. The gluten in case of the Alaska spring wheat flour was rather hard to wash out, the tendency being for it to go to pieces, but when gotten together the gluten so obtained, to all physical appearances at least, seemed to be of practically the same quality as that obtained from either of the other flours; it was, however, somewhat less in amount.

In making the baking tests the first consideration was regarding the color which each flour would develop when made into a dough and baked. In passing upon that point we used what is called the straight dough; i. e. the dough was baked without any intermediate fermentation or expansion. The absorption of each flour was determined first, and found to be, on 340 grams of flour, Little Club 180cc, Alaska Spring, 182cc, Alaska Winter 182cc. That is, it required 180, 182, 182cc of water to make a dough out of 340 grams of flour of a proper consistency for baking. In making up the dough, in addition to the flour and water mentioned, there were used in each case nine grams of compressed yeast, twelve grams of sugar, and four grams of table salt. After beating and kneading the separate lots of dough in a patent kneader they were molded into loaves put into bread pans and allowed to rise just far enough to touch the guage laid across the pans. The time required for each to rise was respectively, 1 hour-25 minutes, 1 hour-30 minutes, and 1 hour-30 minutes. The amount of water baked out in each case (in the oven thirty minutes, the temperature of which was 360-390 degrees F) was practically the same viz: 30 grams. Of the three

flours, both Alaskas gave noticeable whiter bread than did the Little Club, although as noted before, the flours themselves were judged to be a shade or two deeper yellow in color. The reason for this is not known, but whenever baked, on straight dough or long expansion dough, in the laboratory or out, the same relative results were obtained, although all were darker in color than a loaf made from Turkey Red flour under the same conditions, but from a lot of wheat milled six months before. No difference in flavor was discernable; all were good in that respect.

In testing the quality of the gluten, the different flours were made into dough exactly as before, and each was allowed to rise as far as it would in an expansion jar set in a closed case with the temperature at 90-95 degrees F. Each rose to the same height on the gauge, viz: from 2 1-4 to 6 inches; but different lengths of time were required in each case, the time recorded being 1 1-4 hours, 2 hours, and 1 1-2 hours respectively, for the dough made from Little Club flour, Alaska Spring and Alaska Winter. Upon kneading down preparatory to a second rising, it was judged that the dough made from the Little Club flour was somewhat more "springy" i. e. possessed more "life" and would likely be more desirable on that account. The difference noted was small, however. All the doughs were short, i. e. they could not be stretched far in the hands without breaking apart. To some bread makers this would be a desirable characteristic, to others, undesirable. During the second rising each expanded from 2 1-4 to 6 inches again, but required less time in each case. The time required was 55 minutes, 1 hour, and 1 hour respectively. Upon baking, the dough made from the Little Club flour gave somewhat the larger sized loaf, but a decidedly darker bread than the dough made from the Alaska flour. The texture and flavor in each case was good. The conclusions reached here are that the gluten in the Little Club flour is somewhat stronger and quicker acting than that made from either of the Alaska flours. Not willing to pass judgment upon the baking qualities of these flours, altogether from laboratory figures and experience, the writer has had all three baked and tested thoroughly in his own home so that each might be given the best possible opportunity to do its best under the direction of experienced bread makers. The results uniformly bear out the laboratory experience, that there is very little difference in the baking qualities of flour obtained from the Little Club wheat and that obtained from the Alaska wheat. The Little Club is a soft wheat grown extensively in this part of the State, both as a spring and winter wheat; for milling

purposes it would probably be placed about half way between the best and the poorest milling wheats. We understand that it is considered a good mixer by commercial millers and doubtless much of it is milled accordingly. It should be remembered that all the work mentioned was done upon wheat of this year's crop. It is possible that if samples representing these same lots were taken and ground three months from now, and the flour so obtained be compared in the same way, more decided differences might be revealed.

Regarding a possible question that may arise concerning the purity of the wheat tested out as Alaska, we can only state that every precaution possible was taken to be sure that that which was being sold for seed as Alaska Spring and Alaska Winter wheat, and that which was milled, came from the same lots of wheat in the warehouse at Juliaetta. This fact naturally would mean that these samples were not absolutely free from other wheat, because they came from farms on which Little Club wheat had been raised previously, and all wheat raisers know that more or less seed is always left upon the ground at harvest time, some of which will grow and ripen with the succeeding crop if conditions are favorable. As to the amount of such other wheat present we are not prepared to say definitely. The owner of the farm upon which the Spring wheat was grown, states that there were some other varieties of wheat, (mostly Little Club) growing in his field, but that the total amount of such other wheats was small, and he would not regard the Alaska wheat so raised as a mixed lot of wheat in the sense at least that farmers use that expression. The owner of the farm upon which the winter wheat was raised declined to make a statement one way or another, saying that he did not wish to have anything to do with the matter. The man who cut that field of wheat, however, and another who said he was in charge while it was being threshed, both say there was very little of any other wheat in it. The writer saw the last mentioned field just after the Alaska wheat in it was headed out, and went over about one-half of it. He does not remember seeing many heads of any other kinds of wheat, although it is possible of course that they were not yet all headed out. The conclusions reached seem to justify the statement that as fair a sample of Alaska wheat was milled as would be the case with any other varieties of wheat, where the samples were taken from the farms raising them, or from a warehouse from which they were to be shipped.

LABORATORY OF AGRICULTURAL CHEMISTRY.

Oct. 15, 1908.