

Wheat as Food.

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Commencement Thesis

by

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The discovery of wheat was attributed to the goddess Isis by the ancient Egyptians. The Roman and Greek mythologies attribute it to Ceres, or, as she is known among the Greeks, Demeter. Her canonization is said to have been a reward for the service she rendered mankind by transforming *aegilops* into wheat. However this cereal first came into use, it has certainly been in use by man since the earliest dawn of civilization.

Its native place is doubtful, for it is found nowhere in a wild state, but what meager information we possess points to Persia and parts of India as the places of its first production.

The cultivation of wheat in Egypt in early times is pictured on some of the ancient tombs at Thebes, and grains of it have been found in the sarcophagi of these and other Egyptian tombs.

These grains, known to be at least thirty-five hundred years old have been so perfectly preserved that they still possess vitality. Plants grown from them were wonderfully productive, being the seven-eared kind seen by Pharaoh in his dream.

It is now a generally accepted theory that wheat is a higher development of *aegilops*. To prove this, M. Fabre, a French gardener,

made a series of experiments, covering a period of twelve years, beginning with *aegilops* and by careful cultivation and selection securing perfect wheat in the end.

But whatever the history of wheat in the ages of which we have so little record, this we know, that its cultivation by any people is a mark of their civilization, probably because it requires more intelligent and thoughtful husbandry than any other grain. It is, with the exception of rice, more extensively used as food than any other grain, forming a very important part of the diet of all civilized peoples.

It is, then, of interest to us to know what materials it affords for the nourishment of the body, and in what proportions they are present—in short, we need to test the strength of our "staff of life."

The composition of the grain is, of course, what is of importance to us. The following table represents the average composition, as given by Klippart and others.

Nitrogenous matter	Water	14.0%	Gum	1.7%
	Gluten	12.8%	Fat	1.2%
	Albumen	1.8%	Fiber	1.7%
	Starch	59.7%	Minerals	1.6%
	Sugar	5.5%		

As to the relative value of these constituents in 729
the flour: gluten comes first because of its use to
the body as a muscle-making food, and because
of its physical properties of toughness and
elasticity, which enable us to make wheat flour
into bread which is light, palatable, and digestible.

The quality of the gluten is relatively of more im-
portance than the quantity. Starch, forming a
large proportion of the grain is, with the other carbo-
hydrates present — the sugars and fats — a heat and
fat producing food. The sugar, included among
these, should be chiefly cane sugar: maltose, if
present, is an evidence of fermentation. The
proportion of soluble albumenoids (given in
the table as albumen) should be small. Pot-
assium phosphate is the principal mineral
constituent and is of value as a brain and
nerve food. The fiber is useless to the body. The
water serves the same purpose as any other water
taken into the body. Its presence in wheat is
desirable in the least possible quantity.

The conditions which may produce an
appreciable variation in the composition of
the wheat grain are (1) the variety of wheat, (2)
the soil, and (3) the climate. These we will
consider in the order given.

Wheats are divided into the two general

classes, soft and hard. There are associated characters of color and the nature of the seed coat but these do not concern us. The soft wheats contain a high percent of water and are poor in gluten. The gluten is apt also to be of an inferior quality. The hard wheats are richer in gluten, which is also of better quality, and do not contain a high percent of water. The hard wheats are characteristic of warm climates, the soft, of temperate regions; though the hard wheats are much grown in our northern states. To keep a variety of wheat up to a high standard of excellence great care must be used in the selection of seed year after year, for if the poorer part of the crop is used as seed wheat, deterioration is inevitable. The soils best adapted to wheat raising are calcareous soils or clay soils. A light sandy soil is not desirable, but if a shallow light soil be underlaid by a subsoil which is calcareous or clayey, it proves very satisfactory. The soil must not, on the other hand, be too heavy, and must be well cultivated and perfectly drained. The nitrogenous ingredients of the soil are usually first exhausted, hence old wheat lands are improved by the application of nitrogenous manures.

The climate has a great effect on the character

of a wheat. Varieties having the most desirable qualities may be so modified upon transporting them to Regions where the climatic conditions are different, that they are of very little value. The best wheats for a given region can only be determined by several years experience. New varieties must be tested as to whether they will hold to their desirable characteristics. The variation of the seasons in a locality may have considerable effect upon the quality of a wheat crop. The conditions most favorable to the production of a high grade of wheat are, a hot summer and a sunny climate. To these conditions, probably, the superior quality of the southern European wheats is due. In southern Russia a wheat is grown which, from fourteen analyses gave an average of 21.56% nitrogenous substances.

Having all our conditions favorable to the production of a good wheat, the quality of its final products must depend, to a large extent, upon the miller, for wheat flour of some sort is the basis of nearly all the wheat foods we eat. "The art of the miller consists not less in properly mixing the kinds of grain to produce the best flour, than in well grinding and preparing it for food, and offers scope for intelligence and knowledge," says R. C. Tiedje.

The wise miller no more thinks of combining different wheats into one flour, until he has studied their characters and can foresee a good result, than the farmer would think of planting mixed seed. The best results, it is claimed are gained by a judicious selection and combination of different wheats; though the objection is raised to this that no two flours give the best results in baking under exactly the same conditions, and that in the flour there are the two distinct components, each with its individual peculiarities. It is known, however, that the baker can secure the best results by using the flours from different wheats in the same bread. But the proper use of these, Mr. Jago explains is to make the addition of the different flours at different stages of the fermentation. To do this the baker must be acquainted with the principles which govern the proper blending, and on this point many bakers are ignorant, or else they do not like the trouble it makes, so the flours mixed in the grinding are more commonly used. In home baking, on as small a scale as it is usually done, this would be impracticable, so it is probable that the flours mixed in the grinding will continue to be used until we are more

highly educated in this direction.

Milling methods have been greatly improved in the last twenty five years, both as to the cleaning of the grain, preparatory to the grinding of it, and in the manner of grinding the wheat and separating flour from bran. The roller process has almost entirely succeeded the old way of grinding between stones. The improvement originated, as most improvements do, from necessity. When the hard wheats were ground, the crushing force sufficient to reduce the wheat also crushed the bran into such fine particles that it could not be separated from the flour. The process now used is one of "gradual reduction". Both the quantity and quality of the flour have been affected favorably by the new methods. The germ is entirely removed by the roller process. While this part of the grain is rich in food material, it is undesirable in the flour because it contains so much fatty substance that the keeping quality of the flour is impaired by it—there is a tendency to become rancid. The flour made by the gradual reduction process is separated into different grades. Upon first examination the lower grades appear to be the best because the percentage of albuminoids is high, but further investigation shows the

percentage of gluten to be very low. The physical characteristics of a good flour are, a white color with just a tinge of yellow, no trace of bran, a sweet odour, and a sufficient amount of adhesiveness to retain for some time any shape impressed upon it by squeezing.

After the work of the miller, which we have found to be the selection and preparation in ^{the flour} of that part of the grain of wheat that can be of use to the body, there yet remains the work of submitting his product to some sort of a cooking process so that it shall be attractive, appetizing and easily digestible. Making the flour into a dough by mixing it with water, distending the dough by charging it with a gas, then baking it, is generally admitted to be the best way of accomplishing the desired end. The method of fermentation by yeast is most commonly used for charging the dough with gas. This process of fermentation is also important from a chemical standpoint, since it partially digests the flour. The sugar undergoes alcoholic fermentation, the albuminoids are partially peptonized, and the starch undergoes a limited diastasis by the albuminoids so changed.

If the fermentation be allowed to proceed too far, the gluten loses, in part, its elasticity, and

the bread is not good. The other processes used, to a lesser extent, to charge the dough with gas do not accomplish the chemical transformations produced by fermentation.

Bread made of whole wheat flour is more nutritious than the fine white loaf which is the housewife's pride, but where a mixed diet is used there is no great advantage gained by using the whole wheat. The presence of bran hastens the peristaltic action of the stomach and so prevents the proper digestion and absorption of the food, according to Jago. Very little of the bran is digested, so it does not add much in nutriment. The phosphates are the chief loss, if we discard the bran, but these are replaced in the other foodstuffs of an ordinary mixed diet. There is a difficulty, too, in making a well-raised loaf of the whole wheat flour. If the fermentation method is used, the sponge must be made of fine flour, then the other added in the dough stage. Gluten bread, used for diabetic patients, is made by mixing a stiff dough, simply of flour and water, and after this has stood for a time, kneading it in water to wash out all the starch. It is then baked in small puffs, the gluten expanding greatly if the temperature of the oven be right. The gluten puffs that can be

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produced from a flour indicate the quality of the gluten of the flour.

Wheat is used, to a limited extent, in other ways than in bread. Macaroni is made from a flour paste. The superior nutritive value of Italian macaroni is attributed to the better wheat produced there. There are a number of preparations of wheat made simply to be used in porridges—the grain crushed into flakes, germ meal, the grain roasted and ground, and probably others. Hafers and biscuit said to be made of the whole wheat are also on the market.

Since wheat so nearly meets the requirements for a perfect food, it will doubtless hold its place for ages to come as in ages past, as the staple element of man's diet.

No other grain contains the elements in so nearly the required proportions for man's needs, as does wheat. Greatly as its value has been increased by improved methods of preparation, there is yet room for advance. That the productiveness of the plant may be increased by careful selection and cultivation, that the nutritive value of the grain can be increased by the use of fertilizers, we can not doubt.

And as the culture of this grain has marked the progress of man's civilization

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we may hope to see no limit to the improvement of the one until the other shall have reached perfection.

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