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INCREASING THE WHEAT YIELD OF KANSAS

by

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upon graduating from the

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The history of winter wheat in Kansas is one of the most interesting chapters in agricultural progress. Every Kansan refers with pride to the developement of the industry from the time farming was commenced a half century ago in the small river valleys of the eastern part of the state, when the state was considered to be more or less a desert, to the present time when Kansas has become one of the greatest wheat producing sections of the world.

At the time when wheat was first grown in this State, very little was known about the hard winter wheat for which Kansas has since become famous. Soft wheats were the only varieties grown and when the hard wheats were first introduced it was not thought that they would prove successful. It has scarce been forty years since the introduction of hard winter wheat by the Mennonite immigrants from the Russian Crimea. These hardy newcomers with remarkable foresight settled in the central part of the state and sowed small quantities of the seed-wheat which they had brought with them. This central group of counties has since developed into the principal wheat producing section of the state, and Kansas has come to occupy the foremost rank in the production of hard winter wheat.

Kansas raises more wheat than any other state in the Union, yet we must confess that this is due to the number of acres sown rather than to the large yield per acre. The average yield of wheat per acre in Kansas is nearly one-third bushels less than the average for all the states, many of which are less adapted to wheat growing than our own state. The average yield for the state for the last ten years has been 13.1 bushels per acre. Under more favorable cropping conditions, many of which are largely under the control of the intelligent, systematic farmer, the present yield of wheat for Kansas as a whole should be increased to more than double what it is at present. No wheat grower can afford to ignore this fact, and the sugject "How increase the wheat yield and maintain the fertility of the farm" becomes more and more important as land values rise.

The remarkable developement of wheat growing in Kansas has been due, largely to a very general use of the hard, red, winter wheat commonly known among the farmers as"Turkey wheat". For a number of years following the introduction of hard winter wheat, it was disparaged and rejected by many. It took a long period of years to reach its present place of importance, passing through a more trying stage than the durum wheats are undergoing at the present time. The house-wife was not acquainted with its bread-making qualities. The miller complained that it was so difficult to grind as to materially lessen its market value. The farmers, however, continued to grow the wheat and the millers put in machinery which would more economically and successfully produce hard wheat flour. The people began to learn and appreciate the value of this wheat and the world finally awakened to the fact that Kansas produced a bread-making wheat equal to the best produced anywhere: Thus the reputation of Kansas hard wheat has become firmly established.

The Seed.

The judicious selection of the variety to be grown is a matter of much importance and it is well to bear in mind when looking over a seedsman's list with the intention of trying a new variety that it is not always the variety which has given or is claimed to have given the largest yields,which will prove the best variety to grow in a given locality. Many other important factors should enter into the selection of the seed-wheat, such as adaptation to the climatic conditions existing at the place where the wheat is to be grown, hardiness, market value, etc. In all cases no attempt should be made to grow a new variety except in a small, experimental way, and it is the cheapest and safest plan to select new varieties from a list of those which have been tried by the State Experiment Station. It is a recognized province of the Experiment Stations to determine what varieties are best adapted to certain localities. Among the high yielding varieties of winter wheat which have given good satisfaction at the Kansas Experiment Station are the hard red bearded varieties: Turkey, Bearded Fife, Defiance, Malakoff, Kharkoff, Crimean, and Ghirka, a beardless wheat, and two soft red winter types; Fultz and Zimmerman.

After a variety has been tested by the Station for several years it is then usually safe to give it a trial on the farm. Yet it is not always essential to change seed wheat in order to effect improvement. Many farmers make it a practice to change seed every few years, claiming that the seed runs out. Under slip-shod methods of farming this may be true but where the grower takes especial care with his seed wheat, selecting only the best each year and breeding a small plot from hand selected heads, caring for it and storing it properly, he should have wheat equal to any his neighbors raise. In such a case nothing is gained by changing seed unless a better variety or better strain of the same variety is obtained.

An error made by most farmers is that of neglecting to keep their wheat pure. With the traveling thresher, so common in Kansas, it becomes a difficult proposition to keep grain free from foreign seed, as it is almost impossible to thoroughly clean the ordinary separator. Special machines are now being built for small threshing from which the seed and dirt may be blown out with compressed air and the separator thoroughly cleaned. The only practical way of removing foreign varieties after the seed has become mixed is by cutting them out in the field before harvest. Where the seed crop is not too large the sheaves may be opened and picked over by hand, but this is very tedious and rather expensive. Wheat does not cross readily , as corn and some other field crops, but any mixture of rye, foreign varieties of wheat, and weeds, injures the quality and may lower the yield.

Hard wheats are the product of high lands and a dry climate. If soft wheat is sown continuously on upland and in a semi-arid region it will become hard. In the same way hard wheats become soft when grown in low, moist regions. In many localities where hard winter wheat is grown, "yellow berry" causes a large annual loss. In Nebraska Bulletin #89 the following summary is given in regard to "yellow berry": "The chief cause of this condition is allowing wheat to become over-ripe, and failure to stack the sheaves". Yellow berried wheat is lighter in weight, has a lower gluten content, and produces an inferior grade of flour.

There is no one variety which may be called best for all parts of Kansas. In the eastern counties the soft red wheat; Fultz, seems to give the best satisfaction, while the Turkey variety has given the best results throughout thecentral and western parts of the state. The durum wheats which are rapidly coming into prominance will undoubtedly prove a valuable addition to the agriculture of the counties along the western border where they will insure a more regular crop and a higher yield than ordinary wheats. Nearly all the durum wheats are spring wheats, but successful winter varieties will undoubtedly be produced in the future.

The qualities which are usually desired in a hard winter wheat are resistance to drought, rust, and insects, high yield, heavy and plump grain, high gluten content of a superior quality, early maturity, stiffness of straw, and rank growth in fall for pasture.

It is not unusual for the same wheat to possess several different names in as many localities. Often a wheat grower will secure a strain of wheat producing a little better than his neighbor and give it a new name. Owing to this fact, comparisons between the different wheats are confusing. Herein lies the importance of wheat, corn and other crops.

The breeding and introducing of new varieties may be left to Experiment Stations and specialists but every wheat grower will profit by careful seed selection. Special care should be taken with part of the crop which is intended for seed for the next year. Occasionally a single hardy plant which has withstood a hard freeze, drought, rust, or storm when the plants surrounding it have been destroyed, may furnish the neculeus of a valuable wheat.

All shrunken and immature grains together with weed seed should be removed from the seed wheat, not only because the weeds and weak plants rob the more thrifty plants of soil moisture and plant food, but also to secure a regular and even seeding. In working for higher yields and on high priced land, no irregularities, skips, or waste strips can be permitted. It is a wise plan to test all seed before sowing. The operation is simple and inexpensive, and takes very little time. All new seed purchased from a breeder or seed house should be tested. This should be done early in the season in order that plenty of time may be had to secure good seed.

Culture.

It is of prime importance at seeding time to have a well-prepared seed bed. Improved methods of tillage will aid materially in increasing the yield of wheat. The ideal seed bed for wheat is a friable clay loam, finely pulverized and mellow at the surface, but firm and moist below the depth at which the seed is to be planted. The sufsurface should be firm in order that good capillary connection with the subsoil beneath may be secured. A mellow pulverized surface permits free circulation of air, the absorption of hear during the day, and acts as a blanket to retain the warmth during the night. This condition of the surface will also readily absorb and conserve moisture checking the calillary rise of moisture to the surface and preventing evaporation.

Early preparation of land for wheat is profitable. Early plowing followed at intervals by harrowing and subsurface packing puts the soil in good tilth, conserves moisture, prevents the growth of weeds, puts the seed bed in shape for the prompt germination of the seed and rapid growth of the young plants, giving larger yields of better grain. The results of all trials at various stations have shown this to be true. If the soil is properly tilled each season the expense and labor required to get the land into condition for seeding will be materially lessened.

The depth of plowing should be governed by the time at which the work is done, the condition and previous treatment of the soil, and the crop to be grown. If the field has been in a cultivated crop, disking and harrowing or harrowing only may be all that is necessary. As a rule no large yield of wheat may be expected when wheat follows a late maturing crop which leaves the ground dry and partially exhausted of plant food. When the ground is plowed deep it should be plowed early in the season so that a firm seed bed may be secured. For this reason and also that the available plant food which has accumulated near the surface may not be placed beyond the reach of the rootlets of the young plant, late plowing should be shallow. If the ground is not in good tilth and the lower strata of the seed bed is not compacted, percolation and evaporation both take place and rapidly dry the soil out.

Proper tillage and aeration of the soil is necessary to render the plant food available and assist in nitrification. For all plants, except legumes, nitrogem must be supplied in the form of a nitrate or nitrite in order that it may be available as plant food. Legumes have the power of using free nitrogen from the air when certain bacteria are present on the roots of these plants.

For many years nitrification was thought to be a chemical process only. Recent investigations have proven that it is the work of a nitric ferment or germ. These germs feed upon the organic matter or humus, producing the ammonia as a waste product. The ammonia is converted into a nitrous state by nitrous acid germs; nitre germs in turn act upon the nitrous acid, eliminating nitric acid as waste. This nitric acid displaces any bases which may be held in the soil in combination with carbonic or other weak acids, forming nitrate of lime, magnesia, potash, or soda, according to which element is present. Moisture and aeration is necessary to this process and since is one of the most essential elements of plant food and since tillage aerates the soil and assists also in rendering other plant food available as well as assisting materially in storing soil moisture, tillage becomes a very important subject in wheat culture. This brings up the question of summer fallowing.

Summer fallowing or summer culture is practiced for the purpose of storing soil moisture and to render a large amount of plant food available to the crop which is to follow. This method is usually satisfactory in regions of very light rainfall. Where the precipitation is heavy and where strong winds prevail, summer fallowing may exhaust the soil more than continuous systematic cropping, because of the washing and leaching of available plant food out of the soil or the blowing away of the finely pulverized surface soil. In most parts of the state, plowing immediately after harvest is best if the field is to be put to wheat the succeeding fall. If the plowing can not be done early disking the field is very profitable. This prevents the drying out of the soil and catches and holds in the soil, any summer rains which may occur. These summer showers usually fall very fast and the water may largely run off the surface where the ground is hard and dry.

In sowing wheat, as a rule, it is usually safe to sow at a date which is considered early in the locality in which it is sown. If the locality is afflicted with Hession Fly, it is better to wait until danger from the attack of these insects is over but not so late that there will be danger of the wheat winter-killing. If the soil has been put in proper condition and a fine seed bed secured, covering the seed to a depth of an inch will give as good results as deeper seeding, except in places of extreme drought and where there is danger of winter-killing. Or, if the wheat is to be pastured and liable to be injured by having the roots broken or the plant pulled out entirely, covering the seed to a depth of three inches is about the limit and not usually advisable. It is susual to drill wheat two to two and a half inches deep. Wheat should always be drilled in rows running east and west or around a slope, in order that the rows may catch the drifting soil, if any, and the snows of the winter will lodge in the small drill furrows, protecting the crown and roots of the plant from severe weather. An east and west direction of rows will also shade the ground more effectively when the wheat is maturing.

The ideal wheat drill is one which will make a small furrow, drop the seed uniformlly and compact the soil around the seed but not on top. Placing the seed thus in a small furrow, puts it in moist earth where it can sprout and grow at once and where it will suffer very little from a cold freeze. Winter willing of wheat is due to a low temperature but is usually accompanied by several other conditions. Dry, open winters are very hard on wheat. The heaving of the soil caused by alternate freezing and thawing, breaks the roots of the plants and cracks the soil, allowing the cold air to come in direct contact with the roots and also allows the warmth to escape. This heaving and cracking is diminished by a firm, moist seed bed.

A good seed bed will require less seed than one poorly prepared and the plants will tiller more in a moist fertile soil. The plant will adapt itself to its surrounding conditions, but some varieties tiller more than others. The time at which the seed is sown and the size and quality of the seed are important factors in determining the amount of seed to sow per acre. Three and six pecks are about the limits. The average between these is probably the best amount for the State as a whole.

The question of harrowing wheat has not been definitely settled. There are conditions when wheat may be injured by harrowing. It is not usually best to harrow wheat in the fall or early spring. When the wheat has made a start in the spring so that the harrow will not tear it out by the roots, the harrow will break the crust on a dry surface and conserve considerable moisture.

There is seldom a season in any part of Kansas when it is not advisable to cultivate the soil to conserve moisture. There is perhaps no time in the Western part of the state when it is not necessary to cultivate for this purpose. In the Western part of the state much mor than enough rain falls than would be necessary to mature a crop if it could all be used. Much of this surplus moisture can be stored and utilized under proper methods of tillage. The following is from an article from Mr. M. A. Carleton of the U. S. Dept. of Agriculture:

"Improvements in Wheat Culture"

"The normal yearly rainfall of the Great Plains at the 100 themeridean, where wheat growing is at present practically non-existent on account of the lack of drought existing varieties, is nearly three inches greater than that of the entire semi-arid Volga region, which is one of the principal wheat regions of Russia."

The soil fertility question is the most important subject of all. It is the factor which will require out attention more and more as the years go by. Only a small per cent of Kansas farmers have taken the question of soil fertility into account in the past. For nearly half a century we have been selling the fertiliy from the soil. With our prosperity and bountiful harvests we have almost forgotten that we are gradually but surely depleting the land. The question of maintaining soil fertility is the most important problem for the State Experiment Station to solve. If we are to adopt systems of soil improvement it must be done before the land becomes impoverished. Our systems of farming should be such that they will be permanent as well as profitable. We must understand the compesition and nature of the soil, we must know what elements are required and in what amounts these elements are being taken from the soil. Then we must see that these elements are being put back into the soil. The profits from the land in the future will come from the knowledge of how to do this in the most practical and economical way.

There are perhaps less than a dozen elements which are essential to the growth of plants and of these only four are liable to be deficient in soils and these become most important from an agricultural standpoint. These are nitrogen, phosphorous, potassium and calcium. If there is a deficiency of either one of these the crops begin to suffer. Carbon and oxygen are absorbed from the air and hydrogen from the water, but these three elements do not come into consideration since the crop can secure these freely where there is light, air, and water.

As usually considered, soil exhaustion is taken to mean a lack of plant food caused by continuous cropping without the return of any fertility to the soil. Soil exhaustion also includes a poor physical condition. It is for the improvement of the physical condition of the soil that crop rotation assisted by proper tillage is most valuable. The idea that crop rotation and tillage will alone maintain the fertility of the soil is erroneous. A crop rotation without manure robs the soil of plant food even more rapidly than a one-crop system. As a rule a one-crop system may deplete the soil more largely of one or two elements, while a crop rotation without the use of manure or fertilizers depletes the soil of the several elements. Yet a crop rotation is better than a one-crop system for several reasons.

Crop rotation from a physical standpoint secures ventilation of the soil in the case of deep rooted crops which send long roots into the soil and furnish passage ways for air and water after the roots have decayed. The decaying roots also add humus to the soil, improving the texture and water holding capacity. From the standpoint of plant food, legumes, which add nitrogen under favorable conditions, are the only crops yet discovered which add plant food to the soil. Rotation of crops alone will not work out the problem of soil improvement, nor will good tillage maintain the fertility. Everything available from the products of the farm should, so far as possible, be returned to the soil. Many farms in the Eastern States are now in a condition where they must be replenished by the addition of plant food from outside sources. For most of the clay-loam farms of Kansas, phosphorous is probably the only chemical fertilizer which will need to be purchased and this will not need to be used for a long time to come if a proper system of crop rotation and tillage is practiced and the manure and waste products are all carefully returned again to the land.

Very little data is at hand from the Kansas Station on trials with fertilizers or with fertilizers and manure compared. Work is being done along this line at present. In 1906, while in my Junior year at the College I conducted a small experiment with manure and fertilizers on small grains. As to definite results the experiment is of little value since it was begun late in the spring (April 30) and there was a dry period immediately following the application of the fertilizers.

The purpose of the experiment was to determine the effect of each fertilizer alone, the amount of which would give the best result, and to compare these results with the results secured by applying mixtures of the fertilizers and barnyard manure. All the fertilizers as well as the manure were well fined and applied by hand. The manure was well rotted horse and cow manure mixed, taken from the center and bottom of the usual manure pile in an alley back of a neighboring barn. The following fertilizers and amounts of each were used:

No.	Name of fertilizer.	Where from	Amount per acre, lbs.
1	Nitrate of soda	Armour	50 & 100
2	Potash	"	25 & 50
3	Bone meal	------	100 & 200
4	Superphosphate	Swift	150 & 300
5	Special grain fertilizer	-----	150 & 300
6	Dried blood	Armour	50 & 100
7	Sulphate of iron	-------	50 & 100
8	Mixtures	(1 Nitrate of soda 2-9) (2 Potash 1-9) (4 Superphosphate 6-9) (6 Dried blood 2-9)	225 & 450
9	Mixture	(4 Superphosphate 6-9) (2 Potash 1-9)	175 & 300
10	Well-rotted horse and cow manure		17600 & 35200
11	Untreated plot		------------

The ground was dry. The wheat was of the Kharkof variety (#573) which had stooled well and had a good color. The manure was not applied until May 9, nine days after the fertilizer was

No. of fertilizer.	No. of plot.	Name of fertilizer.	Lbs. of fer. applied per acre.	Yield, grain per acre, bu.	Length of straw in.	Texture of straw.	Remarks.
1 A	1	Nitrate of soda	50	29.2	36 to 38	Med.	Very uniform, very green and well filled.
1 B	2	"	100	32.976	36	C&S	Not as green as #1, but uniform
2 A	3	Potash	25	26.176	30 to 36	M:L	Uneven in ripening.
2 B	4	"	50	33.376	34 to 36	S&M:C	Heads medium to lrge, not even.
3 A	5	Bone Meal	100	31.84	28 to 33	Med.	Stands well, fairly uniform, med. heads.
3 B	6	"	200	27.2	28 to 34	F&M	Heads short to Med.
4 A	7	Super-Phos.	150	28.288	29 to 35	F:M	Heads Med. to large.
4 B	8	"	300	27.808	33 to 34	Med.	Heads Med to large, rripened even.
5 A	9	Special Grain	150	28.4	33 to 35	Med.	Heads Med. to large, ripened even.
5 B	10	"	300	31.488	32 to 34	M:F	Heads med. to large, ripened even.
6 A	11	Dried Blood	50	28.928	36 to 30	C:F	Fairly even in ripening.
6 B	12	"	100	28.8	35 to 30		Heads Med. Ripened uneaven.
7 A	13	Sulphate of Fe.	50	28.608	33	Fine	Heads Med. to long, ripened uniformally.
7 B	14	"	100	29.6	31 to 32	Fine	Heads Med. Fairly uniform in ripening.
8 A	15	(1 - 2-9) (2 - 1-9) (4 - 6-9)	225	34.128	32 to 35	Coarse	Short, Med. heads, fairly uniform in ripening.
8 B	16	(1 - 2-9) (2 - 1-9) (4 - 6-9)	450	35.448	32 to 34	Med.F.	Med. uneaven, fairly uniform in ripening.
9 A	17	(6 - 2-9) (4 - 6-9) (2-- 1-9)	175	34.24	34 to 36	Coarse	Med. to long. Fairly uniform in ripening.

Continued from last page.

9 B	18	(6 - 2-9)					
9 B	18 ---	(4 - 6-9)---	350	35.568	31 to 33	Fine	Uneven. Heads fairly uniform in ripening.
		(2 - 1-9)					
10 A	19	Well-rotted manure	17600	30.176	33 to 36	Fine	Med. to long. Fairly uniform in ripening.
10 B	20	Well-rotted manure	35200	32.256	30 to 34	Med.	Med. to long. Fairly uniform in ripening.
11 A	21	Untreated	------	29.600	34	Fine	Med. & Uniform. Riper than some others.
11 B	22	Untreated	------	28.400	28 to 31	Fine	Med. to short. Ripened early. appears poorest.

C&S = Coarse & still. M:L = Medium to long. S&M:C = Still & Med. to coarse.
F&M = Fine & Med. F:M = Fine to Med. C:F = Coarse of fine.

Note.---The general remarks are only for small plots and would vary considerably for a large area.

put on. The wheat was then eight to ten inches high; too late for practical application of manure. Two small showers fell between this time and harvest but the rain came too late to get good results from the fertilizer and manure. The wheat began to head out on June 1, at which time the plots treated with nitrate of soda, manure and the fertilizer mixtures (#8 & #9) showed up greener with a ranker growth than the others. On June 21 the wheat was harvested and placed in the shock. Owing to other duties the grain could not be threshed until August 4. The results were determined as follows:

(Insert table I.)

The average yield for the untreated plots was 29 bushels per acre while the yield of the other plots varied from the lowest yield of 26.2 bushels in plot 3 to the highest yield of 35.6 bushels in plot 18. I cannot account for the low yields of some of the fertilized plots unless the soil was poorer or that the fertilizers had a detrimental effect on the growing wheat. It will be noticed, however, that the plots treated with combinttions of fertilizers and with the manures gave very favorable results considering the time and conditions under which the experiment was made. These crops were doubtless able to use but a small per cent of the plant food in the fertilizers and especially in the manures. The manure acted partly as a mulch and thus perhaps made up, slightly, for the shorter length of time in which the plants might assimilate plant food from it. The data at hand was insufficient to determine the cost of applying the fertilizers and manure. However, if the work had been properly in due season, very satisfactory results should have been secured.

No nitrogen, perhaps, should ever be purchased for a Kansas farm but this element should be obtained by the use of legumes in the rotation. No waste material on the farm should ever be burned except when severely infested with insects. Everything should be returned to the soil whence it came, thereby saving a large amount of nitrogen, phosphoric acid and potash. All manure should be carefully saved and hauled out on the land before it has been permitted to leach away as is too often the case.

Phosphorous can be most economically obtained in the form of ground phosphate rock. It must be remembered, however, that the phosphate must come in contact with decaying organic matter before it will become available as plant food. The most satisfactory method is to sprinkle it through the manure which is to be applied to the land and then both spread on the field at the same time. About 200# per acre is a fair application of rock phosphote. A good grade will cost ten or eleven dollars per ton, in Kansas. "It is as rich as steamed bone meat, twice as rich as acid phosphate, and four times as rich in phosphorous as ordinary complete commercial fertilizers costing twenty dollars per ton.

It has been the common history of all old and thickly populated countries that the soil has become depleted and many areas have been abandoned. Soil depletion is taking place more rapidly in many parts of the United States than it has in any other country in the history of the earth. The time to begain maintaining soil fertility is now. Soils which have been run down for a century cannot be built up again without great labor and expense. A practical working rotation for the average Kansas farm should be governed by the following schedule which may be applied in varying proportions:

1. Grasses and alfalfa.
2. Pasture or meadow and manure before breaking.
3. Cultivated crops and annual legumes, such as cowpeas, soybeans, vetch, and field peas.
4. Grain crops.

In growing cover crops and in green manuring, care should be taken that the crop is not allowed to make a heavy growth before plowing under, especially if the ground is to be seeded soon after. When a large growth is plowed under in this manner the soil will become hard and dry. The capillary connection from below will be dut off, and unless an abundant amount of rain follows immediately, the decay will be slow and the plant food held from the crop to which the ground has been seeded.

Wheat pasture on a Kansas farm is an important item. If the total value received from this source were computed it would aggregate a very large sum. Close grazing late in the spring and tramping in wet weather are very detrimental to the yield of wheat, and also to the soil. With moderate grazing, however, it becomes a question of greatest need and how much will it pay to pasture. Where wheat mades a heavy growth in the fall it is usually advisable to pasture and in most cases a moderate loss in yield and quality will be repaid by the pasture received.

The loss from rust and especially from smut during some season is enormous. Thus far the only remedy found for rust is select-

-ing and breeding rust proof varieties. There are several treatments for smut on wheat. Perhaps the most effective remedy now used is the formaldehyde treatment for dipping the seed or springling it with a proportion of 1 lb. : 40 % of formalin in fifty gallons of water. The seed must become thoroughly wet with the mixture and should first be washed or passed through water to remove the loose spores. Bins, drills and sacks should be disinfected with the same substance also.

There will probably always be insect enemies of the wheat plant which will at times seriously injure the crop. The same insect does not remain for a long period of years as a rule. The Rocky Mountain Locust has come and gone; the Chinch Bug no longer does severe damage over a very large area. The Hessian Fly has for some time been about the only injurious insect having the field. There are local preventatives to keep these insects in check such as trapping them by an early growing or succulent crop around the wheat field for Chinch Bugs, late seeding for Hessian Fly, and burning stubble after harvest for both pests. But the only effective method of combating these insects is by a rotation of crops. The injurious insects thrive best on some one crop. When this crop is grown continuously for several years on the same field it favors the breeding of these insects. This is another argument for crop rotation.

In the past wheat has practically maintained itself, or in other words, our wheat today is the product of"the survival of the fittest." It has only been during the last decade that much attention or thought had been given to the improvement and breeding of wheat. Its close fertilization has been its salvation. As man'n necessity increases he will pay more attention and guard with greater care the small brown berry, the golden queen of the harvest.

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