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Wheat in Alabama

By

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WHEAT IN ALABAMA

BY

J. F. DUGGAR

AND

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SUMMARY.

The most productive varieties of wheat as tested at the Alabama Experiment Station during the past sixteen years, have been the following, in order of rank: Alabama Blue Stem or Purple Straw, Red Wonder, Golden Chaff, Currell, Fultz and Fulcaster. The different varieties have made average yields varying from 13.6 to 18.2 bushels per acre.

The earlier varieties are safer for Alabama, and the later varieties more liable to extreme injury from rust.

Wheat from most of these varieties was classed by experts in Chicago and Memphis as No. 1 Red Winter, the remaining varieties as No. 2 Red Winter. Their average percentage of protein was 12.87 per cent, or above the average of American wheat. The weight per bushels was 59 to 61 lbs. All these facts show that Alabama wheat of the crop of 1914 was of the highest quality.

The average date of sowing wheat at Auburn has been November 17th. A good place for wheat in the rotation is immediately after cowpeas or other summer legume, or after cotton. Wheat grown after plowing under velvet bean and cowpea stubble afforded an increase in yield of 216 per cent over wheat preceded by crab grass and weeds.

In experiments extending over five years equal amounts of nitrogen applied at planting time proved to be of practically equal value for wheat, whether the nitrogen was applied in the form of nitrate of soda, cotton seed meal or cotton seed; but nitrate of soda, when applied as a top dressing in March, proved much more effective than any other fertilizer.

Local experiments in a number of counties and extensive observations furnish evidence that there are considerable areas of land in the central, as well as in the northern, part of Alabama on which wheat may be grown at a profit, when prices are high and seasons not especially unfavorable.

Soils preferred for wheat are well drained clay or

stiff loam soils, with at least fair fertility, and well stocked with vegetable matter. Acid, poorly drained and very sandy soil should be avoided.

Stinking smut of wheat seems uncommon in Alabama; when present it reduces the yield and injures the quality of wheat. Where it is uncertain whether wheat is from a crop affected by stinking smut the seed wheat should be treated with formalin to prevent this disease; this treatment does not prevent either rust or the loose ("common" or "black") smut of wheat.

INTRODUCTORY.

The present is an opportune time to present the results of experiments with wheat that have been in progress almost continuously for sixteen years on the Experiment Station Farm at Auburn. These experiments have been made on upland soil, which in the earlier years was poor, and which in recent years may be rated as poor to medium in fertility; and most of them were made on a gravelly loam soil, designated by the Bureau of Soils as Cecil Gravelly Loam.

The recent interruption by the great European war in the demand for cotton, and the consequent disastrous decline in the price of this great staple to a point below the cost of production, justify diligent search to ascertain what other crops may be grown in 1915 as partial substitutes for cotton. Among such substitutes wheat deserves consideration for certain soils. While the yields obtained at Auburn and the general experience of farmers elsewhere in the State do not indicate that wheat is as profitable a crop as was cotton when the price was satisfactory, yet these experiments indicate that under some conditions yields of wheat may be obtained in Alabama that are above the average yields in the principal wheat growing States of the North.

If ever the farmers of Alabama are to grow wheat at a profit that time would seem to be in the year 1915. For the war in Europe has already caused the price of wheat to advance to the unusual price of about \$1.15 per bushel; in extensive areas of Europe the harvesting of the wheat crop of 1914 has been neglected by the drafting of farm laborers and horses for military purposes; and over the greater part of Europe there must necessarily be a great reduction in the 1915 acreage in wheat, because of the lack of men and horses. Hence with the continuation of the war for even a few

months longer it may reasonably be expected that the price of wheat will rise even above the present unusual figure.

Moreover, many Alabama farmers who may be near some local mill will wisely decide to grow wheat for home-consumption.

In the effort to reduce the cotton acreage in 1915 wheat should occupy an important, though a minor, position. It is estimated that a quarter of a million acres in Alabama now devoted to cotton, could under present conditions, be advantageously sown to wheat this fall. The conditions under which wheat may be most advantageously grown, and the methods of increasing the yields by proper selection of varieties, by judicious fertilization and by the prevention of certain diseases are treated in later pages of this bulletin.

In 1913 the area in wheat in Alabama was estimated at 32,000 acres and the average yield for the State at 11.7 bushels per acre.

TESTS OF VARIETIES OF WHEAT.

In each of 12 years variety tests of wheat have been made on upland soil at Auburn. In no case was stable manure used and seldom was the wheat immediately preceded by cowpeas. The commercial fertilizer employed differed somewhat from year to year.

The usual commercial fertilizer applied at the time of planting was one consisting chiefly of acid phosphate, with potash, and some nitrogen. This was supplemented after 1908 by a top dressing of nitrate of soda at the rate of 100 pounds per acre, applied in March. The total cost of these unnecessarily large amounts of fertilizer was about \$7.00 per acre.

It should be noted that in 7 out of the 12 years the average yield for all varieties exceeded 15 bushels per acre. The acclimatized varieties averaged much higher.

Table I shows in detail the yield of each variety in each year, and also the average yield for each variety that was included in four or more separate variety tests.

To get rid of the influence of varying seasonal and soil conditions, and to compare varieties in a more accurate way Table II has been constructed. In it the yields of all varieties each year are compared in percentages with the yield of the Fulcaster variety for the same year.

TABLE I. *Varieties of wheat; yield at Auburn in bushels per acre.*

YEARS	1899	1901	1902	1903	1906	1907	1909	1910	1911	1912	1913	1914	Av. yield of vars. tested 4 yrs. or more
VARIETY—													
Alaska							12.6	6.4					
Beardless Fulcaster (?)	6.5												
Blue Stem or Purple Straw—from Seedsmen	4.	11.3	15.7		21.1	1.7	24.8	17.6	15.6	9.1	10.4	34.9	15.1
Blue Stem or Purple Straw, Alabama Strain		18.3	16.5	7.8	23.2	7.0	24.3	19.9	19.2	14.4		31.5	18.2
Currell		16.6	13.7	6.8		3.7	23.5	19.8					14.0
Deitz or Deitz Mediterranean			16.8						15.1	8.5	14.0		13.6
Fultz	7.4	16.5	15.0	6.5	20.0	2.4	20.7	15.6			14.4	35.9	15.5
Fulcaster	5.8	17.0	18.1	6.1	17.0	4.6	23.2	15.6	14.1	9.8	13.1	29.5	14.5
Golden Chaff			15.5	6.8	20.0	4.6	21.6	22.2	17.1	6.5	12.4	34.0	16.0
Harvest King				4.6							12.9		
Lancaster											12.2	28.1	
Leap									18.0	6.7	11.0	25.6	15.3
Monarch			16.2	4.5									
Red May (or Early May)	5.4	17.0	12.0		19.1	2.2	22.7	21.9	15.4	7.5	11.4		13.6
Stoner												28.4	
Acme									14.5				
Klondyke									8.6	6.6			
Red Wonder									17.2	9.0	16.0	26.1	17.1
Average Yield Per Year	5.9	16.3	15.5	6.2	20.1	3.7	21.7	17.4	15.5	8.7	12.8	30.4	

TABLE II. Varieties of wheat; yields in comparison with Fulcaster, taking yield of Fulcaster as 100 per cent.

YEARS	1899	1901	1902	1903	1906	1907	1909	1910	1911	1912	1913	1914	Average per cent.
VARIETY													
Acme									103				
Beardless Fulcaster	112												
Alaska							54	41					48
Blue Stem or Purple Straw—from Seedsmen	69	66	89		124	37	107	113	111	93	79	118	91
Blue Stem (Alabama Strain)		108	91	128	132	152	105	128	136	147		107	123
Currell		98	76	111	126	80	101	127					103
Deitz or Mediterranean			93						107	87	107		99
Lancaster											93	95	94
Stoner												96	
Fultz	131	97	83	107	118	52	87	100			110	122	101
Fulcaster	100	100	100	100	100	100	100	100	100	100	100	100	100
Golden Chaff			86	111	118	100	93	142	121	66	95	115	105
Harvest King				75							98		87
Klondyke									61	67			64
Leap									128	68	84	87	92
Monarch			92	74									83
Red May or Early May	93	105	66		112	48	98	140	109	77	87		94
Red Wonder									122	92	122	88	106
Average Yield, All Varieties, Bushel Per Acre	5.9	16.3	15.5	6.2	20.1	3.7	21.7	17.4	15.5	8.7	12.8	30.4	

Most of the standard varieties average more than fifteen bushels per acre, even when there is included the very low yields of 1899, "the year of the great freeze." This is the only year of the last two decades in which cold has ever notably injured wheat at Auburn.

In the above table we note that Alabama Blue Stem (or Alabama Purple Straw) is the most productive variety, ranking 23 per cent. above Fulcaster.

The most productive varieties among those tested four or more years at Auburn are those mentioned below, with the following relative productiveness:

Alabama Blue Stem (Beardless)	123
Red Wonder (Bearded)	106
Golden Chaff (Beardless)	105
Currell (Beardless)	103
Fultz (Beardless)	101
Fulcaster (Bearded)	100

TABLE III. *Average yield by years of all varieties of wheat tested at Auburn.*

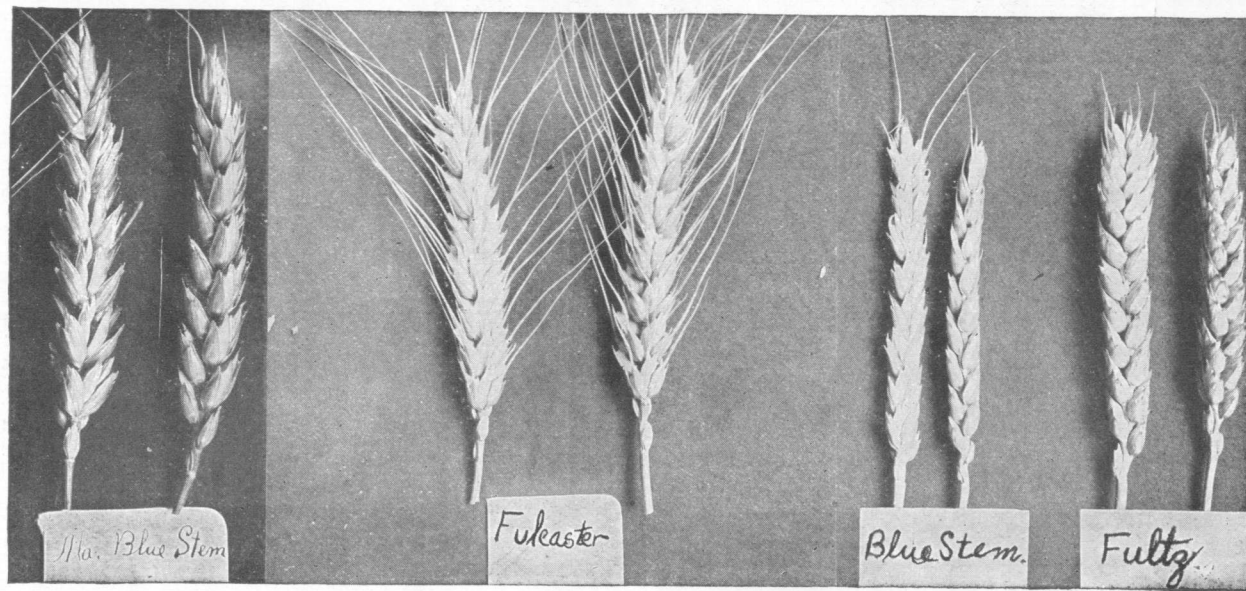
YEAR	Bushels Per Acre	PRINCIPAL CONDITIONS AFFECTING YIELDS
1899	5.9	No nitrate in spring and very little at planting; severe freeze in February.
1901	16.3	No nitrate in spring; usual nitrogen at planting.
1902	15.5	No nitrate in spring; dry May; usual nitrogen at planting.
1903	6.2	No nitrate in spring; usual nitrogen at planting.
1906	20.1	80 lbs. nitrate March 13.
1907	3.7	No nitrate in spring. Rust on wheat and on all small grain.
1909	21.7	100 lbs. nitrate in March.
1910	17.4	100 lbs. nitrate in March; poor stand.
1911	15.5	100 lbs. nitrate in March.
1912	8.7	100 lbs. nitrate in March; much rust.
1913	12.8	100 lbs. nitrate in March.
1914	30.4	100 lbs. nitrate in March; dry May.

QUALITY OF WHEAT FROM THE SEVERAL VARIETIES

The sample of wheat that weighs most per bushel commands the highest price, if it otherwise conforms to the local market demands.

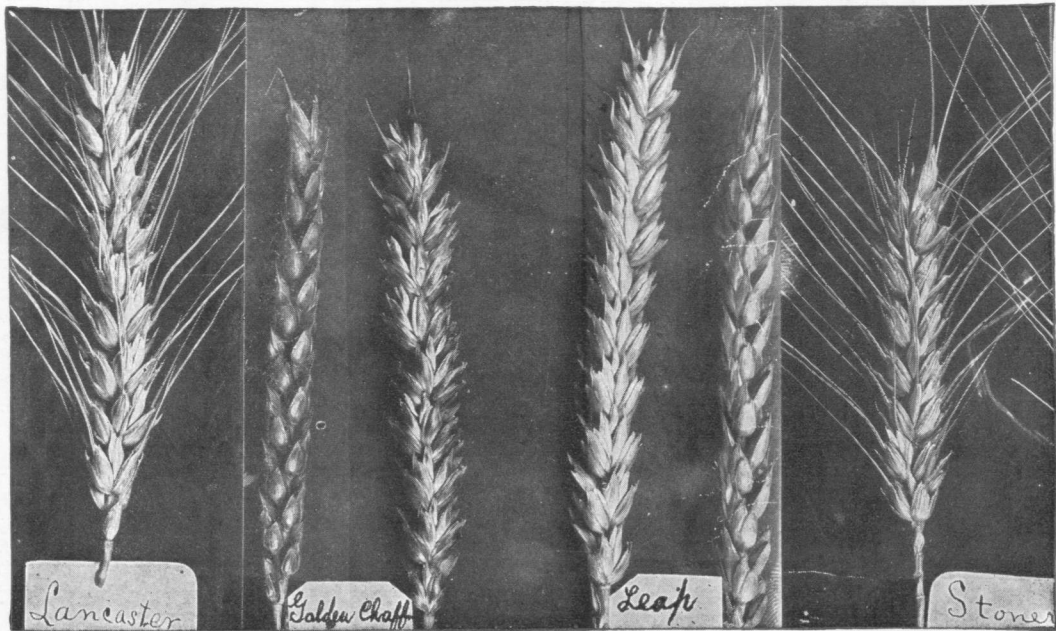
The following table shows the weight per bushel of each variety grown at Auburn in 1914—a year especially favorable to large yields and presumably to the production of wheat of especial plumpness and high weight per bushel.

PLATE I.



Varieties of Wheat Grown at Auburn in 1914.

PLATE II.



Varieties of Wheat Grown at Auburn in 1914.

Variety	Lbs. Per Bu.
Blue Stem or Purple Straw -----	61
Fulcaster -----	61
Golden Chaff -----	61
Red Wonder -----	61
Stoner -----	61
Leap -----	60
Fultz -----	59½
Alabama Blue Stem -----	59
Lancaster -----	59

The type or class of wheat desired by the markets within reach of Southern farmers is what is known as Soft Red No. 2. This includes Alabama Blue Stem, Blue Stem, Fultz, Fulcaster, Red May, and most of the other varieties tested at Auburn for four or more years.

Other considerations determining the quality and price of wheat are the following:

- (1) Percentage of protein.
- (2) Freedom from weed seeds, trash, etc., especially from wild onion and from cockle seed.
- (3) The natural color of the grain, unchanged by exposure to weather, by heating, etc.

Samples of all varieties grown in 1914 were submitted for classification to the Board of Trade of Chicago. Its experts reported that "all samples are of a superior quality, and all would grade No. 1 Red except Alabama Blue Stem, which would grade No. 2 Red."

"A state capable of producing wheat of the quality of this is to be congratulated," writes the Secretary of the Chicago Board of Trade.

Mr. E. R. Gardner, Chief Inspector of Memphis Merchants' Exchange, classes Stoner, Purple Straw, Fulcaster, Fultz, Golden Chaff and Red Wonder as "No. 1 Red Winter Wheat," and Leap, Alabama Blue Stem and Lancaster as No. 2 Red Winter Wheat.

It should be recalled, however, that this wheat crop of 1914 is unusually good in yield and quality.

The Atlanta Milling Company writes as follows: "The wheat from our Southern States, when properly matured, is as good as can be grown on the face of the earth; and so far as we know, there is only one obstacle in the way, that it has never been found a sure crop, owing to our climate."

Chemical analyses of wheat of the different varieties grown at Auburn in 1914 were made by Dr. J. T. Anderson. These results, recorded below, show that the average percentage of protein is 12.87, which is

considerably above the average composition of American wheat. Protein gives the "rising quality" to wheat flour, and is the constituent to which the popular name "muscle formers" is sometimes applied.

TABLE IV. *Analysis of wheat grown at Auburn.*

VARIETIES	AIR DRY	
	Per Cent Moisture	Per Cent Protein
Alabama Blue Stem -----	10.55	11.25
Red Wonder -----	9.88	13.31
Stoner -----	10.35	13.75
Lancaster -----	10.40	13.44
Purple Straw -----	10.12	13.13
Leap -----	10.55	12.13
Fultz -----	9.90	13.13
Fulcaster -----	10.65	13.53
Golden Chaff -----	10.47	12.19
Average, 9 Alabama varieties -----	10.32	12.87
Average, 310 American samples of wheat	10.50	11.70

The removal of most of the trash and of many weed seeds can be effected by recleaning the wheat in a fanning machine or wheat grader.

The desired color is retained by protecting the wheat against undue exposure to weather after harvest and by preventing the heating of the threshed grain when bulked. To avoid the latter in a damp climate like ours, several weeks are usually allowed to elapse after harvest before the wheat is threshed.

But the wheat should not be allowed to stand too long in the shock, nor even in stack or barn, before threshing, because the little grain-moths are more destructive to sheaf wheat than to the threshed grain.

QUALITIES DESIRED IN A VARIETY OF WHEAT.

Among the essential qualities of a satisfactory variety for the Cotton Belt are the following:

- (1) It must be of the type desired, that is, Soft Red.
- (2) It must be productive.
- (3) It must be early, as a means of minimizing the injury from rust.
- (4) It must afford plump grains, and at least a

moderately heavy weight per bushel, preferably 59 pounds or more.

Among the qualities that are usually desirable, but not strictly necessary are the following:

(1) It should be an acclimatized variety, or else the seed wheat should be from some locality within at least several hundred miles of the point where the crop is to be grown.

(2) A beardless variety has an advantage in that if rust threatens to become serious, the crop may be cut very early and utilized for hay. As a rule, however, experiments fail to show any constant difference in yield or hardness between bearded and beardless varieties.

DESCRIPTION OF VARIETIES.

The varieties of wheat may be divided into two great classes—bearded and beardless. The following among the varieties tested here are bearded: Acme, Fulcaster, Dietz Mediterranean, Alaska, and Red Wonder. The following are beardless: Blue Stem or Purple Straw, Alabama Blue Stem or Purple Straw, Fultz, Red May, Currell, Golden Chaff, and Klondyke.

Fultz is a typical beardless variety; medium early in maturity, chaff, light yellow; straw, light purplish at top. Many of its heads are slightly clubbed (that is, largest at the top) and have a few very short beards at the top.

This is probably the most widely grown variety in the Cotton Belt and gives general satisfaction.

Fulcaster is a typical bearded variety; chaff, light yellow; straw, light purplish at top; it has large open heads with very long stiff beards. It ripens a few days later than *Fultz*. This is a standard bearded variety, and probably the first choice of most Southern farmers who fancy a bearded kind.

Leap is beardless, with light yellow chaff and straw. It has long loose heads; its kernels are long and reddish. This variety ripens about the same time as *Fulcaster*.

Alabama Blue Stem (or *Alabama Purple Straw*) is a well established beardless variety. It has been grown in Lee and Chambers Counties, Alabama, at least as far back as 1859, and continuously on the Station Farm since 1901. Its straw is purplish at the top. Its heads are short, slender and compact. Its kernels are small, reddish and hard. This variety matures earlier by four to eight days than any other variety tested at Auburn. Its earliness gives it a decided advantage over other wheats for this latitude, as is shown by its larger average yield. The supply of seed is very limited.

Golden Chaff is a beardless variety with golden to brownish chaff, and compact medium-sized heads. It is a medium early variety. The leaves are large.

Purple Straw (or *Blue Stem*) is a beardless variety with short, slender, compact heads and light yellow chaff. The straw is light purple at the top. It is a medium early variety

and is one of the standard varieties for the South. In appearance this is similar to Alabama Purple Straw, but the latter is about a week earlier in maturing.

Lancaster is a bearded variety with light yellow chaff and yellow straw, and medium-early maturity. Its kernels are long, reddish, and hard.

Red May is a beardless variety, very much like Purple Straw. It has small heads, and small, red kernels. It is a standard Southern variety.

Klondyke is a beardless variety, too late for this latitude.

Alaska, or branched wheat, was extravagantly advertised a few years ago and sold at unreasonable prices. At Auburn it proved less productive than any other variety tested. Its peculiarity consists in having heads that seem large because the lower spikelets are branched and stand out from the central stem. It is not an early variety.

Stoner is a bearded variety with long loose heads and yellow chaff. It matures a little later than the Blue Stem or Purple Straw from seedsmen. Its grains are long and reddish. Some seedsmen have alluded to Stoner wheat as being the same as Miracle wheat, which latter, however, is an inferior variety and distinguished from all common wheats by the branching nature of the lower part of the wheat.

Red Wonder is a bearded variety similar to Fulcaster in appearance and maturity. It ranks second in yield among varieties tested at Auburn for four years or more.

PROPORTION OF GRAIN IN SHEAF WHEAT.

For the last five years, beginning in 1910, the percentage of grain in 100 lbs. of sheaf wheat has averaged for all varieties respectively, 41, 36, 24, 30, and 37 per cent. The average of these averages gives 34 per cent, as the usual percentage of grain in all varieties of wheat here tested.

The more favorable the year for a large yield of grain the higher has been the percentage of grain. We may roughly consider sheaf wheat as consisting by weight of two-thirds straw and one-third clean grain.

WHERE TO GET SEED.

Many of the leading produce dealers and grocery merchants of Alabama cities and towns have purchased supplies of seed wheat in the fall of 1914. Seed wheat can be obtained from practically all Southern seedsmen.

TIME TO SOW WHEAT.

Wheat is a plant making a large part of its growth during cool weather and is hardier toward cold than oats. The average date of sowing wheat in our experiments at Auburn during the past 16 years has been November 17th; and November sowings have generally given satisfaction in this latitude.

If wheat be sown very late (say, after December 1 in

Central Alabama) it does not have time to make the most vigorous root development nor time enough for the maximum utilization of the plant food in the soil, and its date of maturing may be so delayed as to increase the danger from rust.

On the other hand, by sowing wheat too early (say, before November 1 in Central Alabama) there is some danger that before the last freeze of the late winter the plant may reach the booting stage, in which it is more easily killed by cold. This too early development may be prevented by judicious grazing in January and February, but one is apt to overdo the grazing of wheat either by continuing it too late or by permitting livestock to run on the land when the ground is too wet.

In regions where the Hessian fly is present, (and this insect is believed to be now absent from all of this State except from limited areas in North Alabama), wheat sown before frost is likely to be injured by this insect. Hence where the Hessian fly is present it is recommended that the sowing of wheat be postponed until immediately after the first killing frost.

While the best date for sowing wheat has not been accurately determined by experimental methods for the several parts of Alabama, the following are suggestions as to the period during which the bulk of the crop should be sown, though departures of about two weeks may often be made on either side of these dates:

North Alabama, Oct. 10-Nov. 1.

Central Alabama, November 1-15.

South Alabama, November 15-30.

SOILS FOR WHEAT.

Wheat is not a crop for poor land; neither is it a very safe crop, in this climate, for extremely rich bottom land.

The soil chosen should be fertile or fairly fertile and should, preferably, be upland with good soil drainage and air drainage. That is, the best location from the standpoint of minimizing rust is a field with some slope, or where fogs do not settle.

Select soils that are loamy or even stiff, if well drained, and avoid, where possible, deep sandy soils.

Avoid also soils that are acid. When in doubt, the soil should be tested for acidity as follows:

Procure several small strips of blue litmus paper from a drug store and keep these carefully wrapped or bottled until used. While the land is damp insert these strips of blue litmus paper in gashes in the soil made by a knife. Press the damp soil tightly against both sides of the paper and leave the two in contact for several minutes. If the blue litmus paper becomes pinkish, sourness is indicated and wheat should ordinarily not be sown on such land, unless lime is used to overcome the acidity.

The best soil for wheat is a rather stiff soil well supplied with vegetable matter and nitrogen. Indeed, an abundance of vegetable matter may make even some of the lighter soils suitable for wheat.

PLACE OF WHEAT IN THE ROTATION.

Ordinarily wheat should either follow some summer legume or soil-improving plant such as cowpeas, soybeans, etc. Or else it should immediately follow a crop like cotton, which is thoroughly cultivated until late in the summer, provided that the cotton crop be removed in time for wheat to develop an ample root system before severe freezing weather. A common position for wheat in the rotation is immediately after corn. This order of cropping may be advisable where there is a vigorous growth of cowpeas between the corn rows, but it is usually not desirable where the corn field is foul with weeds and grasses; for these, when plowed under together with the corn stalks, leave the soil in a condition too loose and open for the best growth of wheat.

Positions in the rotation that should specially be

avoided for wheat are immediately after rye or oats, for the reason that these latter crops are apt to be followed by volunteer plants of rye or oats, which would thus be mixed with the wheat.

PREPARATION OF SOIL.

The preparation of soil for wheat should be much the same as for oats, but much more thorough in the matter of pulverizing clods and moderately compacting the plowed ground. If corn stalks are present, or if cotton stalks are large, they should be cut with a stalk cutter, or otherwise, and thoroughly plowed under. Plowing to a moderate depth is usually better for wheat than very deep or very shallow plowing. If time permits, it is preferable to plow for wheat at least several weeks before sowing the seed, so as to permit the settling of the soil by rainfall or by repeated use of the harrow, and if necessary by the repeated use of the plank drag or roller. The usual rule is to follow a roller with a light harrow or weeder or brush drag in order to leave a loose layer of soil to retain the moisture below.

Deep discing of mellow but unplowed soil is sometimes practiced as preparation for wheat, but it is believed that for the soil and climate of Alabama it pays to plow most soils in preparing for wheat.

SOWING WHEAT.

The best method of sowing wheat consists in using an ordinary grain drill with spouts 7 or 8 inches apart. As compared with broadcast sowing, drilling saves about one peck of seed per acre, insures more uniform germination and thus a more even stand and a more uniform ripening of all plants. Moreover, drilling economizes labor by distributing the fertilizers with the seed wheat. However, in experiments at Auburn it has been found unsafe to sow, in immediate contact with seed wheat, fertilizers containing any considerable amount of cotton-seed meal. Large amounts of meal, say, 100 pounds per acre, or more, when in immediate contact with the seed, have thinned the stand, by killing the germinating kernels. Still smaller amounts of cotton-seed meal may have this effect, if sown in immediate contact with the seed wheat.

This injury has not been noted with acid phosphate, ordinary guanos, or mixtures containing only small amounts of cotton seed meal.

Since wheat is quite hardy towards cold, it is believed to be unnecessary to sow it in deep open furrows, as is properly done with oats in the northern parts of Alabama. However, this method has probably no other disadvantage for wheat than its slowness.

When no grain-drill is available, wheat may be sown by hand broadcast on well prepared land. It should then be covered to a depth of about 2 inches, preferably by the use of a disc harrow or spring-tooth cultivator or other cultivating implement.

AMOUNT OF SEED.

The amount of wheat sown broadcast is usually 4 to 6 pecks per acre. The amount sown with the grain drill is 4 to 5 pecks.

At the present high prices of seed wheat, it is important to sow no more seed than is actually needed.

The more thorough the preparation of land and the earlier the date of sowing the smaller the amount of seed needed. Under favorable conditions, the amounts recommended are 4 pecks per acre for drilling and 5 pecks for broadcast sowing.

FERTILIZERS FOR WHEAT.

Effects of plowing under stubble or vines of cowpeas or velvet beans. In 1900 an experiment on this point was made at Auburn on very poor and very sandy upland, on a soil classed as Norfolk Sandy Loam.

On certain plots cowpeas and velvet beans were planted, while certain other plots were permitted to grow up in crab grass and rag weeds, all receiving the same fertilizer.

Cowpeas on one plot and velvet beans on one plot were cut for hay and the stubble plowed under. On other plots the entire growth of cowpeas, velvet beans and weeds was plowed under. Wheat, fertilized with acid phosphate and potash, was then sown on all plots. The following table gives the results:

TABLE V. *Increase in yield of wheat due to plowing under stubble or vines of cowpeas or velvet beans.*

PLOT	WHEAT AFTER	Bushels Grain Per Acre		Per Cent Increase from Legumes
		Yield	Increase Due to Legumes	
1.	Cow pea stubble	11.8	8.7	281
2.	Crab grass	3.0		
3.	Velvet bean vines.....	8.5	5.4	174
4.	Cow pea vines.....	9.0	5.9	
5.	Crab grass	3.3		
6.	Velvet bean stubble.....	7.8	4.7	190
	Av. 2 & 5. Crab grass.....	3.1		
	Av. 1 & 6. Stubble, cow peas and velvet beans.....	9.8	6.7	216
	Av. 3 & 4. Vines, cow peas and velvet beans	8.7	5.6	181

On this soil (which was extremely unfavorable for wheat) the increase in wheat from plowing under the stubble of either cowpeas or velvet beans averaged 6.7 bushels per acre. That is, the stubbles of these legumes afforded an increase of 216 per cent. in the yield of wheat and were worth as fertilizer, with wheat at \$1.00 per bushel, \$6.70 per acre.

The *entire vines* of these two legumes afforded likewise a large increase as compared with the weed plot. However, the entire plant in this case proved less valuable in its first-year effects than did the stubble of cowpeas and velvet beans. This was probably because the vines were rather poorly plowed under and left this sandy, loose soil in a condition too loose and open for the best growth of wheat. Doubtless if account had been kept of the fertilizing effects of vines and stubbles on the second year's crop, the vines would have been found to be the better fertilizer.

Several complete fertilizer experiments with wheat have been conducted by farmers in North Alabama with material furnished by this Station. In general these experiments, like others conducted elsewhere, indicate that nitrogen is first in importance for the wheat plant; that phosphorus is of secondary importance, but needed; and that potash, though often useful, is less important than the other two constituents.

TABLE VI. *Cotton seed, versus cotton seed meal, nitrate of soda, or manure for wheat.*

POUNDS. FERTILIZER PER ACRE		1901		1902		1903		1906		1907		Average increase five years	Average Increase '01 '02 '06
Nitrogenous Fertilizer	Other Fertilizer	Yield	Increase from nitrogen	Yield	Increase from nitrogen	Yield	Increase from nitrogen	Yield	Increase from nitrogen	Yield	Increase from nitrogen		
No nitrogen-----	{ 240 lbs. Acid Phosphate--- 40 lbs. Muriate of Potash	18.4	-----	4.7	-----	12.9	-----	8.5	-----	2.8	-----	-----	-----
434 lbs. (13 bus.) cotton seed-----	{ 240 lbs. Acid Phosphate--- 40 lbs. Muriate of Potash	20.9	2.5	5.7	1.0	10.5	-2.3	11.5	3.0	3.5	.7	1.0	3.7
200 lbs. cotton seed meal-----	{ 240 lbs. Acid Phosphate--- 40 lbs. Muriate of Potash	19.6	1.2	3.5	-1.2	11.0	1.8	11.9	3.4	4.0	1.2	1.3	2.7
100 lbs nitrate of soda at time of sowing--	{ 240 lbs. Acid Phosphate--- 40 lbs. Muriate of Potash	17.9	-.5	5.1	0.4	11.7	-1.1	14.0	5.5	5.1	3.3	1.5	3.4
100 lbs nitrate of soda as a top dress in M'ch	{ 240 lbs. Acid Phosphate--- 40 lbs. Muriate of Potash	21.0	2.6	13.0	8.3	12.7	-.1	17.3	8.8	4.0	1.2	4.2	6.6
2 tons horse manure before sowing---	{ None-----	18.3	-.1	6.7	2.0	10.7	-2.1	12.	3.5	4.3	1.5	1.0	3.4
4 tons horse manure before sowing---	{ None-----	22.2	3.8	4.8	0.1	-----	-----	-----	-----	-----	-----	-----	-----
No fertilizer-----		-----	-----	-----	-----	8.2	-----	7.8	-----	2.8	-----	-----	-----
Increase due to phosphate and muriate		-----	-----	-----	-----	4.6	-----	1.2	-----	.0	-----	[1.9]	-----

COTTON SEED VS. COTTON-SEED MEAL, NITRATE OF SODA, OR MANURE, AS FERTILIZER FOR WHEAT.

In 1907 wheat was a failure and hence all fertilizers were practically without effect; in 1903 also no fertilizer was notably effective. We may draw clearer inferences by studying the averages made up by excluding the years when fertilizers were ineffective. The 3-year averages permit the following interpretations, which are also borne out, but in a lesser degree, by the average figures for all five years:

(1) Nitrate of soda applied in March at the rate of 100 pounds per acre was the most effective and profitable fertilizer; its average increase for the three years mentioned was worth, with dollar wheat, \$6.60 per acre, or a profit from this fertilizer of at least \$3.60 per acre.

(2) That an equal amount of nitrate of soda applied at the time of sowing wheat was only about half as useful as in a top dressing, and of about equal value with amounts of cotton seed or cotton seed meal containing about the same weight of nitrogen as the nitrate of soda.

(3) That two tons per acre of the highest grade of fresh horse manure was about equal in its first-year effect to 434 pounds of cotton seed, or to 200 pounds of cotton-seed meal, or to 100 pounds of nitrate of soda applied in the fall; but only about half as effective as a top dressing of 100 pounds of nitrate of soda applied in March.

(4) That a mixture of acid phosphate and potash, without nitrogen, did not notably increase the yield of rather stiff, gravelly soil, above that of the unfertilized plots, which suggests that the amounts of these minerals used were larger than necessary.

REGIONS IN ALABAMA BEST SUITED TO WHEAT.

To determine the adaptability of wheat to a number of soils the Alabama Experiment Station has had conducted for the past three years a number of tests in various counties, which it was enabled to do by reason of a recent state appropriation for Local Experiments.

Some of the yields reported by the growers, or brief comments from these farmers, are here inserted.

1911. Bibb County, by J. M. Brown, Vick. "10 bushels from 2 pecks of Alabama Blue Stem seed."

1912. Elmore County, by Fifth District Agricultural

School, Wetumpka. 8 1-4 bushels per acre from Alabama Blue Stem, 9 1-4 bushels per acre from Red May.

1914. In this year an application of 100 pounds of nitrate of soda was applied in the spring.

Chilton County, by J. N. Dennis, Clanton. 23.4 bushels per acre from Alabama Blue Stem. 18.2 bushels per acre from Red May.

Clay County, by W. K. Hudson, Pyriton. 17 bushels per acre from Alabama Blue Stem. 7 bushels per acre from Fulcaster.

Butler County, by R. D. Gipson, McKenzie. 14.7 bushels per acre from Alabama Blue Stem. 7 bushels per acre from Fultz. Both varieties were injured by drought; Fultz was worse injured by rust than was Alabama Blue Stem.

Marengo County, by J. T. Scogin, Linden. "Both varieties, Red Wonder and Leap, made good wheat. No thresher available."

Lowndes County, by J. B. Mitchell, Jr., Letohatchie, on prairie upland of average fertility.

"The plants of both Alabama Blue Stem and Fultz grew breast high to a man and were very fine." He could not thresh the crop, but he and his neighbors estimated the yield at fully 25 bushels per acre.

The *Tennessee Valley region* is the part of the State in which the greater portion of Alabama's annual crop of about 350,000 bushels of wheat is grown*.

Many of the soils of that region are well suited to wheat, especially on farms where rotation has been practiced. Certainly in that region a fair share of the better grades of red land that have heretofore borne cotton may in 1915 be advantageously devoted to wheat as a sale crop.

The soils of many of the narrow valleys of the northeastern part of Alabama are likewise well suited for wheat. Indeed in every county throughout the northern half of Alabama may be found limited areas of soils adapted to this crop.

The *Central Prairie Region*, or Lime Belt, is a region which can advantageously substitute wheat in 1915 on some of its best land for a part of the usual acreage in cotton. Here practically no wheat has been grown in recent decades, but before, during, and for some years after the Civil War wheat was satisfactorily

* The year book, U. S. Dept. of Agriculture, estimates the yield of wheat in Alabama in 1913 at 374,000 bushels, grown on 32,000 acres, an average of about 11.7 bushels per acre.

grown. That wheat may again be made a rather important (though by no means certain) crop here is attested by the production in 1914 of 25 bushels per acre on the Canebrake Experiment Station on very dark gray soil at Uniontown, and by Mr. J. B. Mitchell's favorable results on upland prairie land at Letohatchie.

The soils of this region believed to be best suited to wheat are the more fertile upland tracts of dark gray and dark red lime soil, with the probability also of success on well drained black slough land.

The soils that are here least promising are believed to be the light-colored areas, those red lands that are notably poor, the thinnest grades of "buckshot" land (with angular loose pebbles), and undrained stiff bottoms.

In the eastern part of Alabama, especially north of the Western of Alabama Railway, wheat is not an untried crop. The Experiment Station at Auburn is located near the southern extremity of this region. In selecting soils for wheat in this part of East Alabama the preference is for the reddish soils designated as the Cecil Series, and including reddish gravelly loams, red clay soils, and the stiffer sandy lands that have red clay subsoils.

In that part of the *Coastal Plain south of the Central Prairie Region* and of the Western of Alabama Railway conditions of climate and soil become less favorable for wheat culture. Hence it seems the part of prudence for farmers living south of Linden, Greenville, Union Springs and Columbus, Georgia, to sow at first only small areas of wheat, strictly for home consumption, and to do this only when sure that they can get the grain ground in local mills.

Indeed before farmers in any part of the State not now growing wheat should undertake this crop they should ascertain that there are local mills that can grind the wheat, or else that freight rates on wheat are low enough to permit its shipment to the larger markets or export cities, such as Nashville, Chattanooga, Memphis or New Orleans.

PRINCIPAL DISEASES AND ENEMIES.

RUST.

The most destructive disease of wheat in Alabama is rust. This attacks the leaves and stems and results in small yields and shrivelled kernels, with consequent low weight per measured bushel and poor milling quality. There is no remedy for rust nor is any variety of wheat rust-proof. However, varieties differ somewhat in their liability to attack. Observation seems to indicate that in the South the earlier varieties are more apt to escape severe injury than the later varieties and that wheat grown on wet bottom land and where fogs settle is more liable to extreme damage from rust than is wheat grown on rolling upland. Continuous damp weather in the middle and late spring increases the injury from rust.

STINKING SMUT.

The kernels within the chaff become diseased and foul smelling. This disease reduces the yield and injures the quality of flour. However, stinking smut seems to be now uncommon in Alabama though liable to be introduced in seed wheat from other regions.

Fortunately this disease is easily prevented by treatment of the seed wheat. The method of treatment preferred is the use of formalin, which treatment is practically the same as that recommended for preventing smut in oats.

FORMALIN TREATMENT FOR STINKING SMUT.

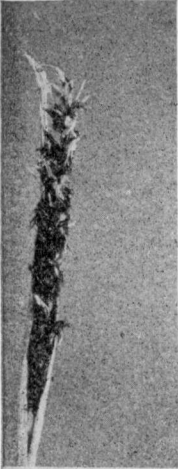
To every 3 gallons of water add 1 ounce of formalin, which is a 37 to 40 per cent solution of formaldehyde. Thoroughly wet the seed wheat with this solution of formalin, either by thoroughly sprinkling or dipping the seed. Cover the wet seed for a few hours with a clean cloth, so that the formalin vapors developed may thoroughly penetrate the mass. Then rapidly dry the wheat by spreading and stirring it.

The treated seed may be sown when convenient, but meantime it should not come in contact with any cloth bags, floors or "covering cloth" mentioned above unless all of these have previously been soaked with the formalin solution, which, for this purpose may be made of double the strength recommended above.

The old bluestone treatment for stinking smut of wheat consisted of soaking the seed, say, for 10 minutes in a solution of 1 pound of bluestone (copper sulphate)

for each 5 gallons of water. The strength of the solution and the duration of the treatment varied considerably. The result was frequently a decrease in the germinating power of the seed. The formalin treatment is recommended as better than either the blue-stone treatment or the Jenson hot water treatment.

LOOSE SMUT OF WHEAT.



*Loose Smut
of Wheat*

The diseased head of wheat (see figure) presents to the casual observer much the same appearance as does a smutted head of oats. However, the organism causing the loose smut of wheat is entirely different from those causing the smut of oats and the stinking smut of wheat. The treatment for loose smut of wheat, (a modification of the Jenson hot water treatment) is quite different from the treatment for the other two diseases, and requires such accuracy and usually injures so large a part of the seed that it is not to be generally advised. Its chief use is for treating small patches. If this treatment is attempted one must sow more than the usual amount of seed per acre.

The treatment consists in first soaking the grain for 4 hours in cold water and then in keeping small lots of this soaked wheat for 5 minutes in water maintained exactly at a temperature of 129 degrees Fahrenheit.

Practically the best way to avoid much injury from this disease is to secure seed from fields where little or no loose smut showed at the time of harvest.

WHEAT INSECTS.*

Doubtless owing largely to the limited culture of wheat in Alabama in recent years, practically no comments have been noted of insect injuries to this crop in this State. There are, however, many insects which may do some injury to wheat and some of these may

*This section was prepared by Dr. W. E. Hinds, Entomologist of this station.

prove to be important if wheat culture should become extensive.

Grasshoppers, the grass worm or other caterpillars, cut worms, Hessian fly, and occasionally other species, such as plant lice, may become important. The chinch bug, which is commonly serious in the North, has not been important in Alabama.

In the stored wheat the most serious damage may be expected from some of the small moths, particularly the Anguimoid grain moth and possibly other small moths which are now common enemies of stored corn. The black weevil so well known as a pest of stored corn in the South, may attack wheat to a more limited extent. Against these granary pests where they become abundant, we may apply fumigation with carbon disulphide or "high life" as is frequently done with corn. (For details regarding fumigation, room, and treatment, see Alabama bulletin No. 176, entitled, Reducing Insect Injury To Stored Corn.)

WORST WEEDS.

Cheat or *chess* is one of the worst weeds in fields of small grain. It is an annual grass growing about two feet high and maturing seed about the same time as wheat. Its seed are sometimes sold as a forage plant under the name of Arctic grass.

Cockle is a weed with large pink flowers and black seed, which latter are difficult to separate from the threshed wheat. This is a troublesome weed in wheat fields.

The best way to avoid these weeds is to use clean seed wheat and to reclean all seed wheat in a fanning machine, or to use wheat known to be free from weed seed. In that part of the field from which the seed is to be saved for seed purposes pull up by hand all plants of cheat and cockle about the time that wheat is in the dough milk stage.

Fields in which either of these weeds or wild onion (garlic) grows should not be sown in wheat.