Farm Science REPORTER

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JUST IN PASSING...

The Authors

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B. J. Firkins (he's "Bugs" Firkins to many Iowa people, especially those who have had any connection with Iowa State College as students or staff members) is professor of agronomy on the teaching staff of Iowa State College and research professor in soils of the Iowa Station. "Bugs" is a graduate of Iowa State College, but got his start on an Illinois farm.

C. A. Black for the past year has been spending all of his time with the Iowa Station on hemp investigation, so it is quite appropriate that he should discuss the results of those tests in this issue. Dr. Black (he's Charley to his friends and associates) was born on a farm near Iowa City, but spent most of his boyhood on a Colorado acreage where he and his family raised fruit, vegetables and chickens. He graduated from Colorado State College and has M.S. and Ph.D. degrees from Iowa State College in soils.

H. R. Meldrum (most folks call him Jerry) is mostly on the Extension Service agronomy staff, though he is still a part-time employee of the Experiment Station. Jerry is assigned to northeast Iowa. Although his early years were spent on a farm in South Dakota, he has lived in Iowa since 1916 and has been on the agronomy staff at Iowa State College about 18 years.

The remainder of the authors of this issue have been previous contributors to the FARM SCIENCE REPORTER. They include *C. R. Weber*, assistant agronomist of the USDA; *G. M. Browning*, project supervisor of research for the Soil Conservation Service; *J. B. Davidson*, head of agricultural engineering at Iowa State College; *C. H. Van Vlack*, extension specialist in agricultural engineering; *W. H. Pierre*, head of agronomy at Iowa State College; *C. P. Wilsie*, research associate professor of agronomy at Iowa State; *A. J. Englehorn*, research associate professor of agronomy at Iowa State; *Helen Virginia Johnson*, is physics instructor at Iowa State College.

An Agronomy Issue

This issue of the REPORTER is heavily "loaded" with crops and soils information — it's almost an agronomy issue. Even though the issue is a half larger than any previous one, we still did not cover all of the material that might have been.

So we are making an effort to send you before you get into the field with crop work the spring issue. Planned for this is an article on crop varieties, something about seed testing, the importance of soil conservation (experiments have shown how essential the top soil is to crop production) and various other articles.

As soon as we can be assured of the help to do so, the FARM SCIENCE REPORTER will come to you every other month rather than every 3 months. The committee of farmers who asked for and helped plan the REPORTER in its beginning wanted at that time to have a bi-monthly magazine and that is the definite plan for it. If that change is made, it will probably be issued in January, March, May, July, September and November instead of January, April, July and October as at present.

Revise Mailing List

If you have been on the mailing list of the FARM SCIENCE REPORTER at least a year, then you should fill out the card which is enclosed with this issue and return it to us at once providing you would like to be kept on the mailing list.

The government requires that all such mailing lists be revised once a year. If you want to be kept on the mailing list and have any doubt about whether you will be, we shall be glad to hear from you and will check to make sure your name is on the list.

We Are Now 4 Years Old

The REPORTER begins its fifth year with this issue. We have had many fine letters from readers during that time, suggesting items they should like to see discussed. We should be very glad to have your suggestions. Any criticisms — favorable or unfavorable — will be greatly appreciated.

Cooperative Breeding Work With Soybeans

In this issue we are telling you about Lincoln soybeans. This variety actually originated in Illinois, but the Iowa Station with some other experiment stations and the USDA have tested and increased the seed until it is now ready to "go to work" in aiding farmers *where it is adapted* to obtaining increased yields.

The Lincoln soybeans came from cooperative investigation between the U. S. Regional Soybean Laboratory, Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, and the Iowa Agricultural Experiment Station. Other and better beans for the same regions and others may eventually emerge from this cooperative work.

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More, Better SOYBEANS

BY C. R. WEBER

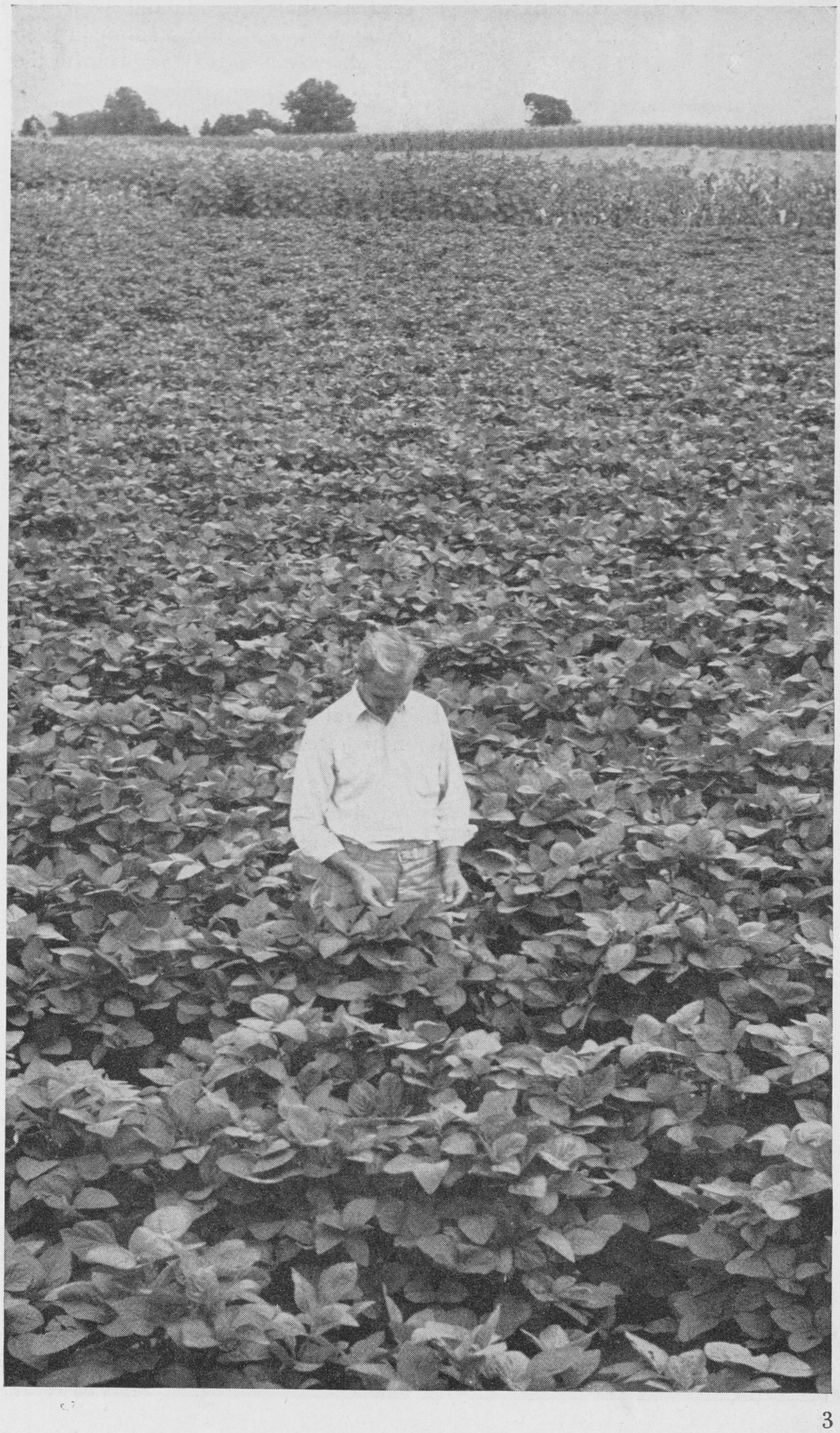
Lincoln, New Variety, To Be Grown by a Few Iowa Farmers in 1944[1]

A NEW SOYBEAN variety that has "showed its heels" in yielding ability to every other bean with which it has been compared in Iowa for the last 5 years will be grown by a few Iowa farmers in 1944 and it should be in the hands of many who want to give it a try in 1945 and 1946. It promises to be one more vital aid to our farmers in their "food battle" of this war period.

The new variety, Lincoln, has outyielded Richland, Mukden, B. H. (Black Hilum) Manchu, Dunfield and Illini in northern, central and southern Iowa tests that range from 3 to 5 years. The Lincoln has been ahead of every other variety in yield in all of these tests every year.

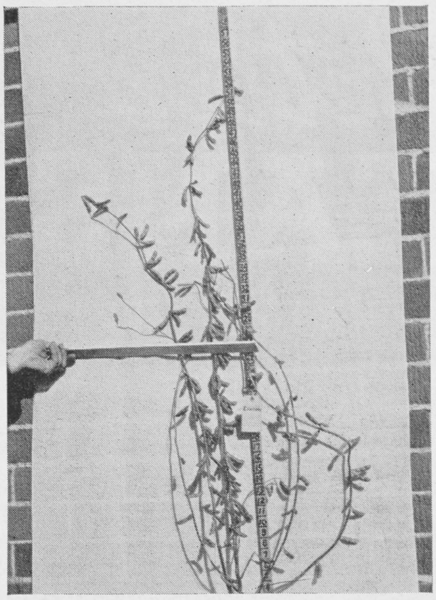
But that doesn't mean that it may be *just the soybean variety you want.* For instance, it doesn't stand up nearly as well as Richland, not quite as well as Mukden, but it is better than Dunfield and Illini. In none of the Iowa Station tests has it ever lodged badly enough to cause excessive loss in harvesting. Then, too, Lincoln is too late, our tests show, to be safely grown in the northern third of Iowa. We are therefore recommending that it be grown only in the counties from Woodbury, Webster, Black Hawk and Dubuque south and not in any counties north of these.

We do not need to lean entirely on the Iowa Station tests to measure the yielding ability of this new soybean variety, for it has had extensive tests in Ohio, Indiana, Illinois, Missouri and Nebraska also. As an average of 61 replicated trials in those five states and Iowa during the 5 years of 1938 to 1942, Lincoln has outyielded Illini and Dunfield by an average of 6.1 bushels to the acre, or 22 percent. It has averaged a day earlier than Illini, has lodged less than either Dunfield or Illini and has had superior seed quality. It has been superior to Dunfield in percentage of protein, percentage of oil and drying



Here's C. R. Weber, in the field at the right, examining Lincoln soybeans in an "increase field" at the Agronomy Farm, Ames, 1943. Lincoln has exceeded the yield of Mukden about 20 percent in central Iowa tests.

[1]Cooperative with U.S.D.A. (See page 2.)



Above is a single plant of Lincoln which measured 51 inches in height. When planted at normal rates of seeding, Lincoln does not branch as much as this one, seeded at a light rate.

quality of the oil. Dunfield has been considered the best variety in quality of oil.

And so — for the southern two-thirds of Iowa, as well as many areas of our surrounding states — Lincoln offers to step up yield of beans to the acre and, because of its higher oil content, it should be a real boon in this war period when fats and oils are so badly needed.

In order to insure the widest distribution and the most rapid increase of high quality seed of this new bean variety, local units of the different farm organizations in the southern two-thirds of Iowa were asked to recommend men in the different counties best qualified from the standpoint of previous experience, equipment and weed free soil, to receive the 1943 seed. The whole effort has been to place the seed in such a way as to insure its most rapid increase and ready availability to the largest number of farmers for planting in 1945. Arrangements have already been made for the distribution of the entire 1943 seed supply. Many should be able to obtain seed locally for planting in 1945 and almost anyone who wants it for the 1946 crop.

Not a "Hybrid"

Lincoln is not a "hybrid" bean — it came from a natural variety cross between a white flowered Mandarin and Manchu. The original hybrid between these two varieties was grown by C. M. Woodworth at the Illinois Agricultural Experiment Station in 1935. From individual plant selections made and tested by L. F. Williams of the United States Regional Soybean Laboratory, in short progeny rows, this new variety of Lincoln originated. It was first tested in yield trials in 1938.

In the search for superior adapted varieties of soybeans approximately 3000 plant introductions from the Orient have been tested cooperatively in Iowa by the United States Regional Soybean Laboratory and the Iowa Agricultural Experiment Station. Varieties now recommended, such as Mukden, Richland, Illini, Dunfield, Black Hilum Manchu and so forth, are the result of single plant selections from plant introductions into the United States. However, not all of these varieties were selected in Iowa. Nor was the Lincoln variety selected in Iowa. The greatest emphasis in soybean breeding work in Iowa is on the production of superior varieties for commercial utilization.

Soybeans, like oats, are naturally self-pollinated. To artificially make a hybrid, it is therefore necessary to apply pollen by hand from one variety to the newly opened flower of another variety. This cross pollination must be performed at a critical stage, and even with skilled workers only a few crossed seeds can be produced from many hours work.

The Iowa Station and other experiment stations are doing some hybridization in cooperation with the Regional Soybean Laboratory. For example, we are trying to "hook up" through hybridization the early maturity and ability which Richland has to stand up and not lodge along with the yielding ability and the good oil qualities of Lincoln.

Hybridization in soybeans is quite different from that in corn. With corn the plant breeder takes plants which normally are cross-pollinated and sees that they are self-pollinated — producing inbreds — finally getting them into purified lines. These inbred lines are then crossed to get the "push" which the crossing of inbreds brings.

Obviously when you have to open the tiny flower of the soybean at just the right stage (using good light and magnifying glasses in order to see what you are doing) and dust on it carefully the pollen from another variety in order to get one soybean pod, we can never hope to get much hybrid soybean seed. Sometimes these pollinations do not "take," and in that case you get no seed for the work. If the pollination is successful, you may get from one to three seeds — average one. The specific purpose of hybridization in soybeans is to bring together and re-combine the characters of two varieties so that in later generations you can select the one or ones that

These are side views of Lincoln seeded at the normal rate. The picture at the left was taken just before maturity and the one at the right was at combine stage. Lincoln lodges less than Dunfield, Illini, Chief, and Black Hilum Manchu, but more than Richland or Mukden varieties.

have the particular characters you want.

It was through a cross of varieties that Lincoln originated, but the cross happened to be one of the few natural crosses — not made by man.

Lincoln has a yellow seed with a black hilum (scar), white flowers, tawny (brown) pubescence (the hairiness of stems and leaves) and resembles Manchu in general habit of growth.

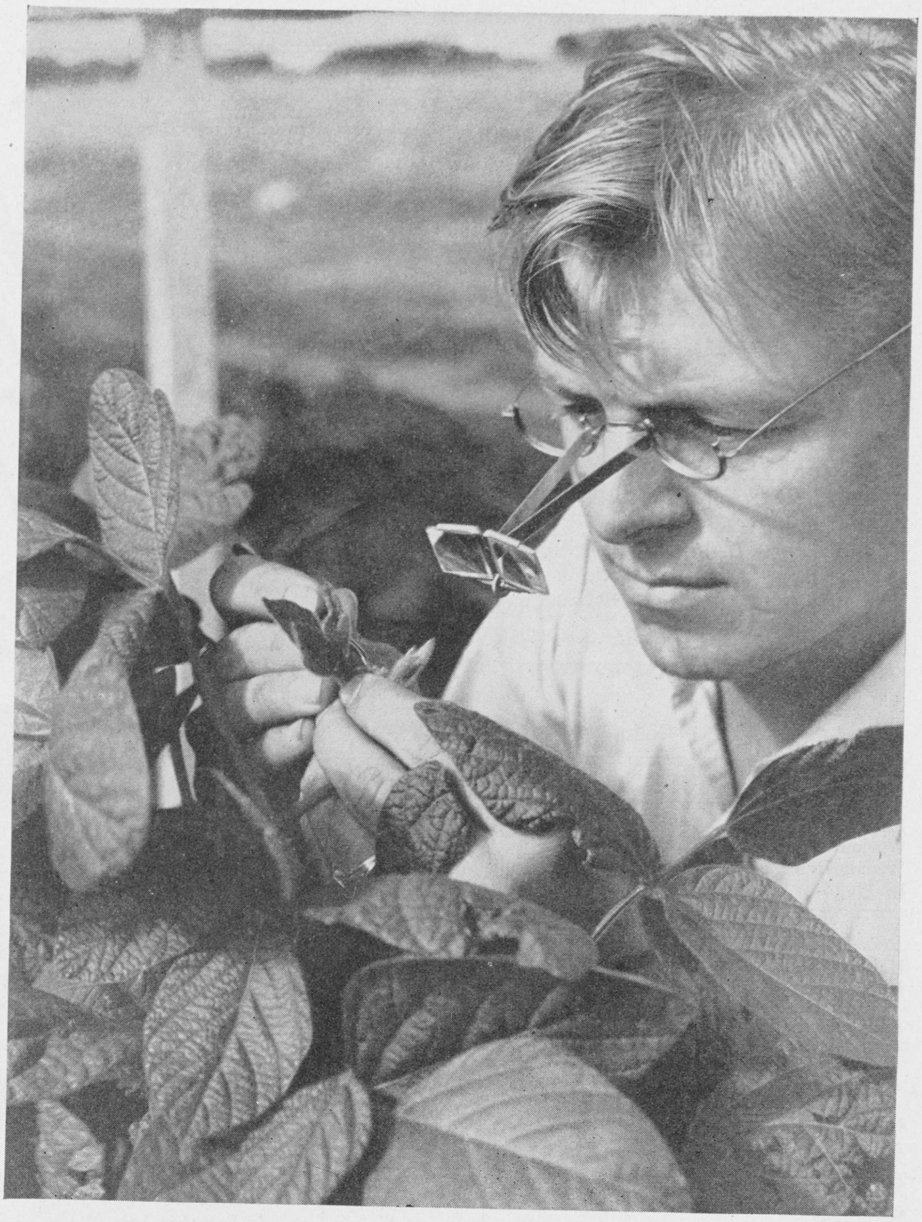
Lincoln is not the "last word" in soybeans and we hope that in the future other still better ones will come. In the meantime, until Lincoln seed becomes available for those in the areas to which it is adapted, what should we do to step up production? Iowa stands second in the United States in the number of bushels of soybeans produced, but third (Illinois and Ohio are ahead) in yield per acre. Iowa might well rank first in average yield per acre because she has more highly fertile soil than any other state. Iowa soybean yields can be expected to rise steadily as farmers gain experience with this crop, which is well adapted to Iowa soil and climate.

How to Increase Yields

Choosing the right variety is of first importance in yield and returns per acre. Richland is the best of those now available for general planting in northern Iowa because of its good yield, earliness and lodging resistance. It should be planted early — May 10 to 20 — on soils of good fertility.

On fertile soils when planting has been delayed, Habaro, which is 5 to 6 days earlier than Richland, may be expected to give satisfactory yields in extreme northern Iowa. Habaro is shorter than Richland and if planted on soils of low fertility, yields may be disappointing and harvesting unsatisfactory. Habaro should be harvested promptly when mature in order to avoid shattering.

The early Manchu strains — Wisconsin Manchu 606, Wisconsin Manchu 3 and Early Minnesota Manchu — are recommended in northern Iowa on the less fertile soils in preference to Richland or Habaro because these Manchu strains are taller. They range in maturity from 3 days earlier to the same as Richland. The early Manchu strains do not stand up well on fertile soils. Earlyana, a new soybean developed by the Purdue Agricultural Experiment Station and tested cooperatively by the Corn Belt experiment stations and the United States Regional Soybean Laboratory, is adapted to the less fertile northern Iowa soils. It is about 3 days earlier than Richland, grows 5 to 6 inches taller, and yields fully as well. However, Earlyana will not be generally available in Iowa for at least 2 more years.



The above picture shows the technique in hybridizing soybeans. Magnifying glasses and good light are essential. The tiny flower must be carefully opened and the pollen of another variety dusted on the seed producing parts. Lincoln is not a hybrid, but a pure line selection from a hybrid population.

For north central Iowa Richland is recommended for the fertile land and Mukden for the less fertile. For central Iowa, Richland, Mukden, Lincoln and Black Hilum Manchu are recommended. But don't grab your pencil to order some Lincoln seed — for it won't be generally available until 1945. There is no Lincoln seed for sale now.

In southern Iowa, Lincoln, Black Hilum Manchu, Dunfield and Illini are recommended as the topnotchers in yield. Here again you will have to wait a bit for Lincoln — it can't be 1944.

Best Cultural Practices

In order to obtain the highest yields with the variety recommended for your section, the beans should be planted in medium width rows, 20 to 32 inches apart, although there is no advantage to this method unless the beans are cultivated. Since cultivating machinery for medium width rows is not generally available on Iowa farms, here's a proven practical method of increasing the

Comparison of Lincoln with Standard Varieties in Iowa

Variety	*Maturity*[1]	*Height (inches)*	*Lodging*[2]	*Bu. per acre*
Southern Iowa 1940-41-43 — 6 Tests				
Richland	9-18	27	1.5	18.1
Mukden	9-22	33	2.3	17.9
B. H. Manchu	9-24	34	3.0	21.9
Lincoln	9-25	34	2.8	25.0
Dunfield	9-26	33	3.3	21.0
Illini	9-28	36	4.1	22.5
Central Iowa 1939-40-41-42-43 — 12 Tests				
Richland	9-18	34	2.0	30.0
Mukden	9-24	41	2.7	30.2
B. H. Manchu	9-25	41	3.1	32.4
Lincoln	9-27	41	3.0	36.4
Dunfield	9-30	40	3.2	32.3
Illini	10-1	44	3.9	31.8
Northern Iowa 1940-41-42-43 — 8 Tests				
Richland	9-26	35	1.7	25.7
Mukden	9-29	44	2.3	23.5
B. H. Manchu	9-30	41	3.1	26.1
Lincoln	10-2	42	2.9	27.0
Dunfield	10-2	39	3.1	24.4
Illini	10-4	44	3.7	25.1

Comparison of Early Soybean Varieties

Northern Iowa 1940-41-42-43 — 7 Tests				
Earlyana	9-23	41	3.6	30.4
Wisconsin Manchu 606	9-25	39	3.4	28.1
Wisconsin Manchu 3	9-25	40	3.7	28.5
Richland	9-26	36	2.1	28.0
Northern Iowa 1939-40-41-43 — 8 Tests				
Habaro	9-14	28	2.2	23.1
Richland	9-22	33	1.7	24.5

[1]Maturity — (Month and day) 90 to 100 percent of pods ripe (brown).
[2]Lodging — A score ranging from 1 (erect) to 5 (prostrate).

number of rows. Adjust the wheels of your two-row corn planter to plant as close as possible; shorten the marker even more. This will space alternate rows closer (about 24 inches has been found satisfactory) than the planter wheel adjustment makes possible. The removal of the outside sweeps from a two-row cultivator makes possible the cultivation in the usual manner of the narrow alternating row widths.

In a good many fields, weeds in the bean rows have been a factor in limiting acre production. Unlike corn, which usually is cross cultivated, it is necessary to kill weeds in the rows of beans before the weeds appear above ground. A harrow, weeder and rotary hoe are good speedy tools for this job.

The correct rate of planting helps to eliminate weeds, thereby contributing to yield. One bushel per acre of *good* seed is the recommended rate in medium width rows. Narrow rows drilled 7 inches apart require 2 bushels per acre, and wide, 42-inch rows, require 45 pounds. *Good* seed means 90 percent or higher in germination and it must be free of sticks, pods, cracked beans and the like.

Date of planting studies indicate that beans planted between May 10 and 25 have yielded more than those planted later. However, if beans are drilled or broadcast seeding should be delayed until May 25 to May 31 in order that more weeds may be germinated and killed.

Inoculation is necessary to insure best results in yield and quality of the crop, if the soybeans are grown for the first time or if previous inoculation did not form nodules on the roots. If you are not certain of the necessity of inoculation, you had better inoculate for it is cheap insurance against low yields.

If the above practices affecting yields are followed, all in all, there will be less risk in growing beans than any other extensively grown Iowa crop. The importance of soybeans to the farm pocketbook is receiving more and more attention.

Comparison of Lincoln with Illini and Dunfield in 61 replicated tests in Ohio, Indiana, Illinois, Iowa, Missouri and Nebraska during 1938-42, inclusive.

Variety	*Maturity*[1]	*Lodging*[2]	*Bu. per Acre*
Lincoln	9-26	2.2	33.7
Dunfield	9-26	2.9	27.2
Illini	9-27	3.1	27.9

[1]Maturity — (Month and day) 90 to 100 percent of pods ripe (brown).
[2]Lodging — A score ranging from 1 (erect) to 5 (prostrate).

About the Tables

Hundreds of strains and varieties have been compared each year through a long period of years, with plantings in different parts of the state. The data in the tables on this page are for the past 5 years. Only those varieties of immediate interest to Iowa farmers are included.

Maturity. The date of maturity given in the tables is the date when the pods are mature. At this stage no damage to market quality will result from a severe killing freeze. From the maturity date given, however, at least a week or 10 days of good drying weather will be required before the beans are ready to combine.

In order to compare differences in maturity between two varieties that are *not* given in the same table, approximate difference can be established by comparison with the same variety in two tables. For example, Earlyana in one table is 3 days earlier than Richland. In another table Habaro is 8 days earlier than Richland. Habaro can, therefore, be assumed to be approximately 5 days earlier than Earlyana.

Height. Note in the tables that Richland is shorter than any other variety except Habaro. So, Richland and Habaro should be grown only on the more productive soils in the areas recommended.

Lodging. The smaller the number in the table the better the variety stands up. Richland stands up the best of any commonly grown variety, which together with its early maturity makes it ideally suited to the more productive soils in the part of the state where recommended.

Yield. Variety yields are directly comparable within a table and we believe they indicate quite accurately the relative yielding ability of the varieties. Small differences in yield between any two varieties within the same table probably are not significant.

Shall WE Discard Our Plows?

By G. M. BROWNING, R. A. NORTON and J. B. DAVIDSON

One of the live topics of the day is whether the plow is ruining our land, whether farmers to save the soil for this and future generations must stop the age-old practice of plowing in preparing their land for cultivated crops.

In this article the authors discuss the results of experiments conducted here in Iowa in which plowing is compared with other means of preparing seedbeds for corn. In general, we think many of you Iowa farmers who read the results of these tests will decide — if you haven't already — that perhaps you are not quite ready to junk your plows. — Editor.

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IOWA FARMERS, like those of most other states, generally plow their land with a moldboard plow in preparing a seedbed for corn. This places the residues — weeds, stubble, manure and the like — at the bottom of the furrow.

New machines have been developed over a period of years that were supposed to replace or supplement the moldboard plow. Some of these machines have met the needs of certain types of farming and in semi-arid regions are rapidly replacing the plow. Most of the new machines are built to take advantage of the fact that crop residues, weeds or other material, if left on the surface, are very helpful in controlling wind erosion and in conserving soil and water. We wanted to find out whether plowing under this residue was necessary and desirable in Iowa, and so have conducted experiments with different types of machines over a period of 5 years.

In general these are the conclusions we have drawn to date from our experiments (later and additional experiments may bring different results, different conclusions):

1. Subsurface tillage with residues on the surface is helpful in conserving soil and water.

2. The yield of crops was generally considerably less where the seedbed was prepared with subsurface tillage implements as compared with plowing (Clarion soil was an exception).

3. A satisfactory seedbed cannot be prepared with our present tandem disks in heavy sods of sweet clover and alfalfa. It is possible that a subsurface tillage implement to cut the main roots of alfalfa and sweet clover, followed by the disk or other implement to dislodge the plants and weeds so that they will not continue to grow, will do the job of the plow and still leave the residue on the surface to help control erosion.

4. It is easier to plant and cultivate corn on plowed ground, but machines have been developed in these studies that will operate satisfactorily through trash. (Studies are being continued to develop machines that will include the desirable features and discard the undesirable ones of our present machines.)

5. Weed control is more of a problem on subsurface tilled than on plowed land. We cannot be sure, however, that weed control will be more or less of a problem until the same system has been used on a field for several years.

6. Several of the methods that we have tried offer promising possibilities of cutting labor and power costs and conserving soil and water in production of row crops, but they cannot be recommended generally in Iowa until we have been able to solve the problems such as decreased yields, weed control and nutrient deficiencies.

Used Elsewhere

The question of whether plowing is desirable has recently become a live topic. Several years ago wheat farmers in areas of limited rainfall changed from the moldboard plow to machinery that will operate through trash, because they found that it was more economical to prepare a satisfactory seedbed with the new machines and that the residue left on the surface controlled soil blowing and reduced the loss of soil and water.

Practices which leave crop residue on the surface are not new even in the Corn Belt — for years we have disked stalks down for oat seeding instead of plowing. An increasing number of farmers are using the disk to prepare a seedbed for corn on land that was in soybeans the year before. Some farmers have reported disking second-year sweet

Top: Preparation of land for corn by means of two 45-inch sweeps attached to a mounted hard ground lister frame. Residues from the previous corn crop had been chopped with a stalk cutter. Just before planting the sweeps were operated a second time in such a way as to split the original path of travel. Below: A section of rotary hoe, pulled backwards, was used to break clods.

clover land instead of plowing, but, in general, this has not been satisfactory because the ground is too hard for the disks now available.

In sections of the country where wheat and barley are seeded in the fall following a soybean hay crop, the disk or field cultivator is generally used in place of the plow.

The Missouri system of small grain-lespedeza which is so popular in that state is a "trashy" system of farming, in that the seedbed is prepared with a disk or a field cultivator, leaving most of the residue on the surface or mixed with the first few inches of the surface soil.

Light mulches or "trashy" material on the surface are especially helpful in getting good stands of grasses and legumes.

Recently there has been considerable interest in the possibilities of retaining crop residues on the surface in the production of corn and soybeans under the more humid conditions found in the Corn Belt. This interest arises from the fact that keeping crop residues on the surface helps conserve soil and water.

The Iowa Station, in cooperation with the Bureau of Plant Industry, Soils and Agricultural Engineering and the Soil Conservation Service, has been studying this problem since 1939 on the Clarion and Webster soils at the Agricultural Engineering Farm near Ames, and on the Marshall silt loam soil at the Soil Conservation Experimental Farm near Clarinda in 1942 and 1943. In these studies we were trying to find the effect of different methods of preparing the land on the yield of corn, the cost of operation and the loss of soil and water.

Clarion, Webster Studies

The Disk and Plow. At Ames in 1939 yields and seedbed and planting costs on corn plots prepared with a tandem disk were compared with those on plowed plots. The field had been in soybeans the previous year. The yield on the plowed plots was 60.9 bushels per acre and on the disked plots 58.2 bushels an acre. It required about two-thirds as much labor and power to prepare the seedbed and plant corn on the disked plots as on the plowed plots.

But there was a "fly in the ointment" — the soybean straw left on the surface of the disked plots interfered with the corn planter, and some bunches of straw were hauled off the field after planting in order to avoid cultivation trouble.

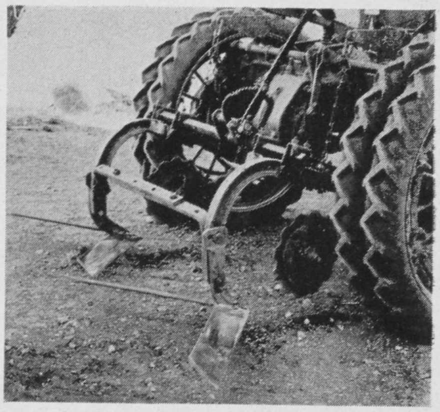
The Lister and Plow. A new machine called a subsoil lister was tried on the Webster soil in 1940. By using this machine, we hoped to accomplish four things: (1) Leave the residue near the surface, but move it out of the corn row so that it would not interfere with early cultivation; (2) plant the seed not so far below the surface and therefore in more fertile soil than with ordinary lister planting; (3) prepare a better seedbed in the furrow than is done with an ordinary lister; (4) reduce the cost below the amount required for plowing and surface planting.

The yield on the plowed plots was 82.2 bushels and on the listed plots 82.8 bushels an acre. About two-thirds as much labor and half as much power were required to prepare a seedbed and plant corn on the listed as on the plowed plots. The lister was used again in 1941, but was not satisfactory because corn on the listed plots was seriously damaged by an extended wet period early in the season and, as a result, yields on the listed plots were 15 bushels less than on the plowed plots.

In general, we do not think listing on the Webster and other soils that are slowly drained is dependable because of damage from too much moisture during wet periods. The lister is being used successfully, however, in western Iowa, and we are conducting tests to see if it is suitable on other soils at different locations in the state.

Subsurface Cultivator vs. Plow. Another machine, the subsurface cultivator, was tried at Ames in 1941. Several of the subsurface tilled plots were damaged, owing to wet soil. Under these conditions we found the yields from different methods of subsurface tillage were 7 to 13 bushels below those of plowed plots.

In 1942 we started a long-time experiment on the Clarion and Webster soils at Ames to compare different cultural treatments and methods of handling crop residues. On the Clarion soils in 1942 and 1943, the subsurface tilled plots planted to corn following corn yielded 41.3 bushels and the plowed plots 40.1 bushels. On the other hand, the Webster soil when subsurface tilled averaged 33.1 bushels to the acre compared with 48.9 bushels for the plowed plots. The increase in favor of plowing was 15.8 bushels to the acre.



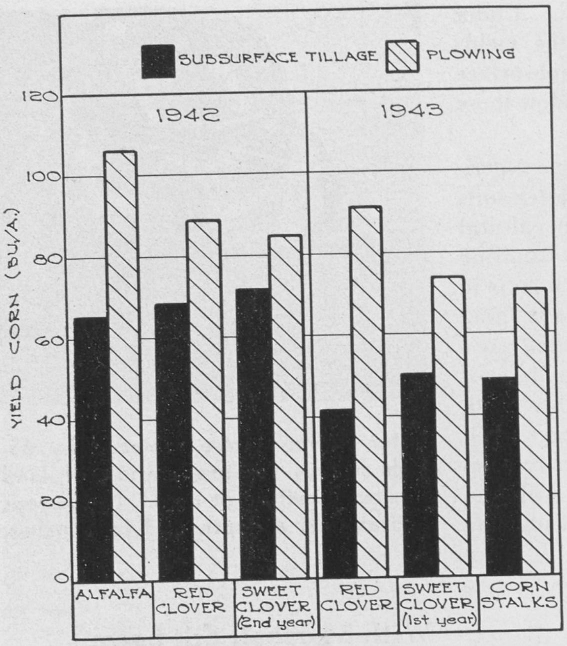
Lister bottoms were replaced by 45-inch sweeps for preparation of land for mulch culture of corn. The sweeps operated at a depth of 3 to 5 inches.

With Marshall Silt Loam

Subsurface Cultivator vs. Plow. Our tests in 1942-43 at the Soil Conservation Experimental Farm near Clarinda included residues of alfalfa, red clover, cornstalks, and first and second year sweet clover. In all tests for both 1942 and 1943 the stand and yield were reduced by subsurface tillage as compared with plowing (Chart p. 10). The average yield on the plowed plots for all experiments was 85.8 bushels as compared to 57.5 bushels on the subsurface tilled plots, or an increase of 28.3 bushels in favor of plowing. A part of this difference was because of the stand — the number of stalks on the plowed plots was 143, while the number on the subsurface tilled plots was 110.

The corn on the plots prepared with the subsurface cultivator showed symptoms of nitrogen deficiency early in the season. The plants were lighter green in color and smaller than those on adjacent plowed plots. Some of the residue was mixed with the soil during cultivation. The late summer rains made conditions favorable for the organic matter to decompose, liberating nitrogen for the plants. Later in the season the plants had a normal green color but

Front view of cultivator equipment used for tillage of corn under mulch culture. Weed control was more of a problem when the soil had not been plowed. The residues on the surface also caused some trouble during planting and the cultivation of the crop. Plowing materially increased yields in comparison with subsurface tillage.



At Clarinda the yields of corn in plowed plots were larger than for surface tillage.

matured later than plants on plowed plots as shown by the higher moisture content at harvest time.

Residues Decrease Erosion. Measurements were made of the amount of soil that washed off of plots that had been prepared by plowing, listing and subsurface tillage. The corn rows were all on the contour. During the period Jan. 1 to Nov. 30, 1943, the subsurface tilled plots lost 9 tons of soil per acre, the plowed plots 34 tons, and the listed plots 2 tons per acre. The cornstalk residue on the surface reduced the soil loss to about one-fourth of that for the plowed plot but allowed a greater loss than contour listing.

Need More Studies

In general, subsurface tillage with residues on the surface, was found helpful in conserving soil and water. Under the conditions of these experiments, however, the yields have been materially reduced by subsurface tillage when compared with plowing. Of course, it should not be concluded, on the basis of these studies, that subsurface tillage will not work. By introducing new practices and machines or modifying the present ones, it may be possible to overcome the problems that we found.

Insect Problem

One of the problems that we wonder about is what effect leaving residue on the surface may have on insect control. About half of Iowa's counties now have corn borers. The borer winters in cornstalks, weeds or other plants with coarse stems. Disposing of residues by plowing is one of the measures of control recommended. Would subsurface tillage, or other practices which leave the residue on the surface, intensify the corn borer problem? The same question may be asked about the control of chinch bugs, grasshoppers and other insects which need trash for protection.

Tests will need to be conducted over a number of years to see how the new practices stand up under different weather conditions. A practice or machine may be well suited to a particular soil or crop and not suitable under another set of conditions. That is the reason why we should not put too much confidence in studies that are not carefully conducted or that have been developed under entirely different farming conditions than we have in the Corn Belt.

Studies are being continued and new developments will be reported as soon as they are completed.

More acres of improved varieties of field crops were inspected for certification of seed during the summer of 1943 than in any previous year.

Lists of Iowa growers of certified seed may be obtained from County Extension Directors or from the Farm Crops Dept., Ames.

Preparation of seedbed on second year sweet clover land. In this operation a stalk cutter was used ahead of the subsurface tillage machine. Immediately before planting the corn, the subsurface tillage machine was operated a second time.

We Need More Drainage

It Is One Way to Increase Our Acreage And Yield for Larger Total Production

By C. H. VAN VLACK

MANY THOUSANDS of acres of crops in Iowa were lost in 1943 because of inadequate drainage. And the situation was practically the same in 1942. What will be the report a year hence? The 1944 production goals call for over 14½ million acres of intertilled crops. The large increase in cultivated crops confronts Iowa farmers with many critical production problems. Where will these extra acres be found?

Thousands of acres of the most fertile land in the world are in Iowa, and they could produce record yields if they were adequately drained. Many fertile acres could be brought into production in 1944 by the use of some simple drainage practices during the coming spring and summer. Much of some drained areas of the state is reverting to swamp land because of failure of existing drainage systems. Principal among the causes of drainage system failures are: (1) Physical structure of the soil, (2) improper design of ditches, (3) improper construction, (4) lack of inspection and maintenance.

We are going to discuss here construction and maintenance of drainage systems, with most consideration given to tile drainage. We need to keep in mind an important fundamental principle in soil management and cropping — satisfactory drainage can be obtained only when the physical properties of the soil are properly conditioned.

The shallow subsoil in some parts of Iowa is so heavy and tight that tile drainage won't do the job until deep penetrating roots have opened it. The growth of sweet clover before drainage will assist greatly in certain southern and northeastern Iowa areas. Proper cropping practices and good soil management are fundamental considerations in any drainage undertaking.

This washed out bulkhead caused loss of tile back 65 feet into the field. The loss is continuing and will until re-laid and a substantial bulkhead, such as shown in the design on the next page, is constructed. Adequate foundation, an apron for the water to spill on and properly placed wing walls are essential. The old material will be useless in reconstruction.

Photo — Courtesy Mason City Brick and Tile Co.

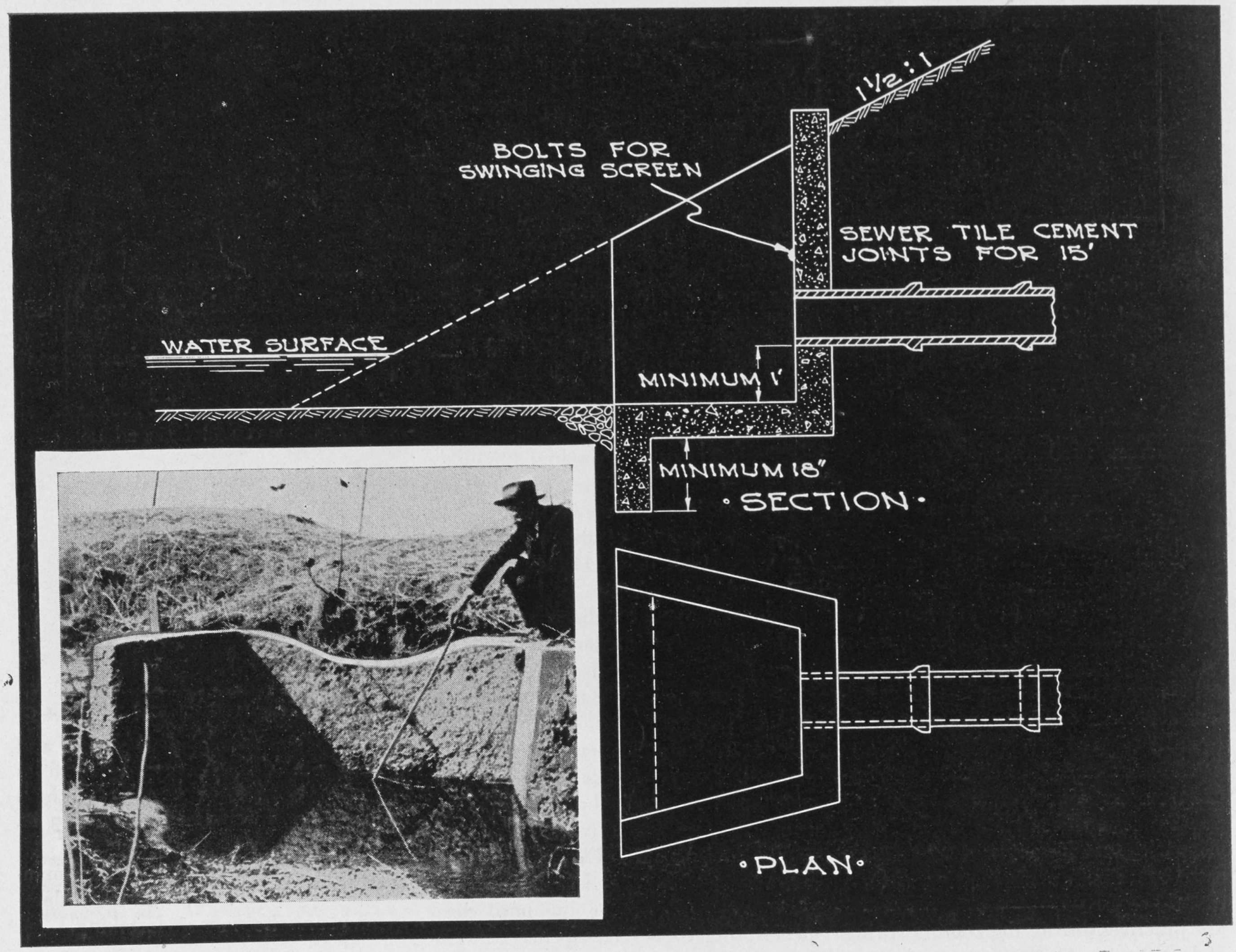
It's important to lay the tile and cover with a few inches of earth as soon as possible after the ditch is dug to avoid damage from caving in.

The Tile Outlet

The first problem in planning and installing a tile line is to locate a suitable outlet. Probably more failures with tile drainage have been caused by an inadequate outlet than by all other causes of unsatisfactory operation put together. Since a natural waterway, an open ditch, or another tile line may be used as an outlet, often the cooperation of a number of landholders is necessary to construct an open ditch or outlet channels before tile drain construction becomes feasible.

Protection should be provided the tile outlets against washing of the banks of the ditch into which they discharge. A substantial bulkhead of stone or concrete with an "apron" below the tile for the water to spill on is essential.

It is good practice to construct the bulkhead as soon as the lower end of the tile ditch has been dug, then the first tile can be cemented firmly in position. At the same time, protection is afforded the mouth of the ditch while construction is underway. Because of probable damage from alternate freez-



The plan drawn here is for a concrete bulkhead. The minimum thickness of concrete wall, apron and wings is 6 inches. Eight-inch thickness is important for structures serving above a 5-inch tile outlet. Tile of 24-inch diameter or larger should have bulkheads with 10-inch wall thickness. The overall length of the concrete apron should be at least three times the diameter of the tile. Reinforcing tie rods should connect the wing walls with the main wall. Where surface overflow will enter the main ditch at the same point as the tile, a weir notch should be provided as shown in the bulkhead photo at left.

ing and thawing, it is desirable to substitute corrugated galvanized iron culvert pipe whenever possible for the first few feet of tile next to the bulkhead.

Location of Tile Drains

The location of tile lines is governed by that of the outlet, topography of the area and character of soil and subsoil. Through rough land and where the area does not involve more than one farm, the use of the "natural system" may be employed. As the name would imply, this means simply laying tile along the depressions where the soil is too wet for cultivation, with as much fall as possible toward the outlet. Some of these lines will empty into others. Thus a branching system may result with mains, sub-mains and laterals.

In rather flat areas which are uniformly too wet for cultivation, however, it is advisable to design a complete system of some rather regular layout, such as either the "gridiron system" or the "herringbone system" (see illustrations). The former, which is one of the most efficient systems possible for tiling wet areas, consists of a main ditch running across the lower end of the area with one set of parallel laterals entering it.

Less total length of tile is required for the gridiron than for the herringbone. The junction of the laterals with the main in either system should form an angle of between 30 and 60 degrees. The mains should follow the general direction of the natural water courses, while the laterals should be laid in the direction of the greatest slope.

Hillside wet spots (seepy areas) should be drained by laying a tile drain across the slope above where the ground shows most wet. That will intercept the water brought to the surface by an impervious layer of soil which prevents its downward flow.

Depth and Spacing

The important consideration in tile drainage is to remove rapidly the surplus water from the soil zone which is penetrated by a large portion of the crop roots. A common practice is to place tile 4 feet deep in light, open soils and 2½ to 3 feet deep in tight soils.

Within limits, the greater the depth of the tile, the greater can be the spacing of the tile lines. The texture of the soil, however, should have much to do with the spacing of drains. In very tight clay soil 30 to 40 feet should be maximum; heavy soils, but with granular structure, 70 to 80 feet; glacial drift and sandy loam soils with clay subsoils 100 feet; sandy and gravelly soils 150 to 200 feet.

It is possible to overdrain where tile is placed too deep. While the usual function of tile is to remove excess water from the soil, under some conditions it is desirable to retain available moisture in the soil. An instance would be that of muck soils. That might apply also to other light soils during dry seasons when shallow-rooted crops are being grown.

Secure Most Possible Fall

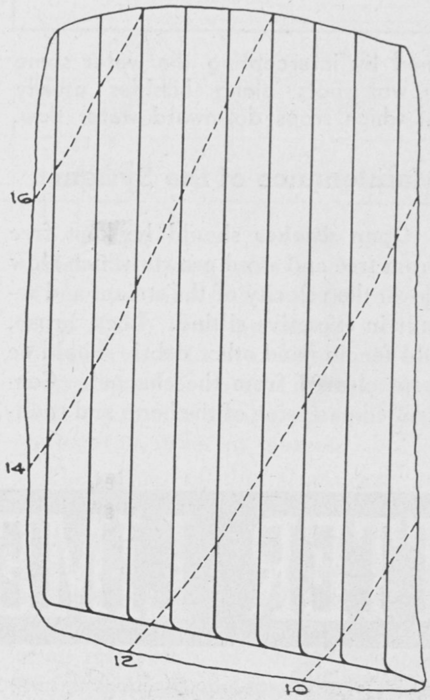
The greatest possible grade or fall should be provided a tile drain. There is no danger of too much fall in underground drainage, but there is danger of too little, especially when tiling soils which tend to seep in and silt the drain. Less than 1 inch fall to 100 feet in a 4-inch drain should be avoided. A fall of 2 inches or greater should be obtained, if possible, to prevent trouble by filling up. Larger tile can be laid with less fall than smaller sizes. With any size of tile the greater the fall the greater the carrying capacity of the tile.

It is important to keep the grade of the tile line uniform. At least avoid changing from a steep grade with high water velocity to a flatter grade with lower water velocity. Such a change may cause the tile to fill with sediment.

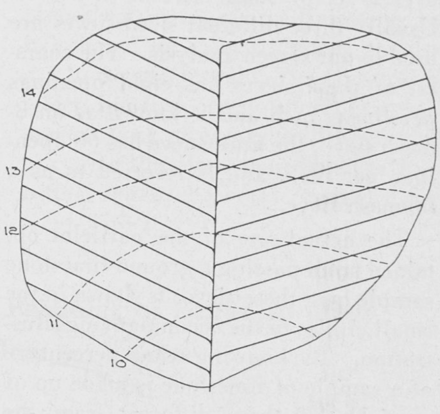
Lessening the grade often saves much deep digging, but it entails serious hazards. Since water's capacity to carry silt is dependent upon its velocity, reduction of that velocity, though ever so little, will cause some depositing of the silt. Water at a velocity of 2 miles per hour will carry particles of soil weighing 64 times as much as those which can be carried by water moving at 1 mile per hour. Hence, if instead of digging a little deeper through a rise in ground level to maintain grade, you reduce the grade to save some digging, you might easily reduce the velocity of the water one-half or its silt-carrying capacity to only one sixty-fourth of what is was before. Accordingly, many of the larger particles would be deposited in this section of the tile with the result that before long the tile would be seriously choked.

Selection of Tile

Since water enters the tile at the undersides of the joints like leaks in a boat, and not through the walls of the tile, porous tile are no more efficient than impervious tile. In general, soft tile which absorb large quantities of water are weaker than those which absorb small amounts. Good drain tile should be round with clean-cut ends so as to lay to grade in a well shaped ditch bottom. For the larger sizes (12 inches and larger) good qualities are assured by specifying that all tile used shall meet the standard specifications of the American Society of Testing Materials. These specifications are available from the Secretary of the Society at Philadelphia, Penn., and cover both clay and concrete tile.



The gridiron system (above) is the most efficient system for flat areas or for land with an even, continuous slope. The main should extend along the short side of the field or land with the parallel lines of drains being laid out on the uphill slope.



The herringbone system is well suited to areas which lie on both sides of a narrow swale. Note that laterals on one side of the main enter it at points midway between those on the opposite side. If streams enter the main opposite each other, they will retard flow of water into the main.

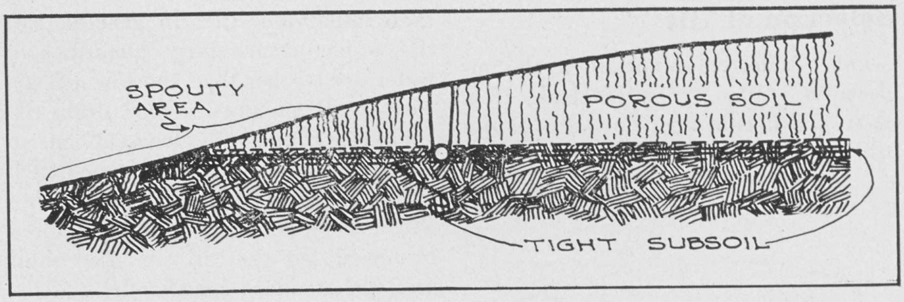
Tile size depends upon the area to be drained, porosity of the soil, topography and the grade or fall which can be obtained. Tile smaller than 5-inch should not be used except for a short steep grade. The carrying capacity of a 5-inch tile is twice that of a 4-inch tile. While this rate of increase in capacity does not continue for each increase in tile size, the capacity of a larger tile is much greater than is indicated directly by comparison of diameters.

To secure the proper and most economical balance in tile sizes for an extensive drainage system of mains and laterals, a competent drainage engineer should be employed. He will take into account the run-off to be taken care of, the most suitable depth and spacing of laterals, the available grade and the arrangement of the drains into systems that will best suit the land and most economically provide thorough drainage.

Laying the Tile

Digging for tile should begin at the outlet and proceed upstream. Great care should be taken not to excavate below grade. A high spot in the ditch has the effect of reducing grade which results in the tile gradually filling with silt at that point, since the reduced velocity causes the heavier particles of soil being carried by the water to be deposited as pointed out above under the cautions in reducing grade. For extensive systems and especially when labor is scarce, it is advisable to use a tile-trenching machine.

Tile laying should follow the trench digging as closely as possible. The ends of the tile should be made to fit together tightly by turning as needed. Any irregular fitting should be adjusted so that the top side fits closely with the more open portion of the joint on the



Seepy ground on hillsides should be drained by intercepting the water some distance above the "spouty" area, since wet spots along hillsides usually are caused by an impervious layer of soil which stops downward water flow.

underside. Oftentimes pieces of broken tile can be used to cover small openings on the tops or sides to prevent soil from getting into the tile.

The importance of laying the tile and covering with a few inches of earth (blinding) as soon as the trench is completed to grade cannot be overstressed. Caving of the banks is always likely.

Maintenance of the System

Open ditches should be kept free from tree and weed growth which slow down the velocity of the stream and result in excessive silting. Logs, brush, old fencing and other debris should be kept cleared from the channel. Controlled pasturing of the berm and spoil-banks will help prevent tree and weed growth and will cause no serious difficulty if hogs are not used in the pasture.

Unless obstructions are kept out of the channel, silting will not only diminish the capacity of the ditch, but will submerge tile outlets emptying into the ditch.

Tile drains to be effective must be kept open. It seems to be the common impression of landowners and others that once tile are installed they should continue to function indefinitely without any attention. The chief difficulty is that of keeping the outlets in good condition. Root growth may cause tile stoppage. Any hole or "cave-in" over the tile line indicates that a tile is out of position or has broken. This damage should be corrected at once or else the line above will become filled with silt.

★ FINER, BETTER LIME, PLEASE!

By B. J. FIRKINS and W. H. PIERRE

DURING THE PAST 4 years, Iowa farmers have used over 5 million tons of ground limestone, approximately four times as much as in any similar period prior to the AAA Conservation Materials Program. This limestone is helping materially in producing record crops on several million acres of good crop land. But many million acres still need to be mobilized for maximum production by liming.

Now more than ever before, we need to get the quickest results and the greatest efficiency possible from the limestone we use. This means, first of all, using limestone that is finely ground — limestone that contains a large percentage of "dust." Unfortunately, much of our ground limestone is too coarse for maximum war-time value, as our study here shows.

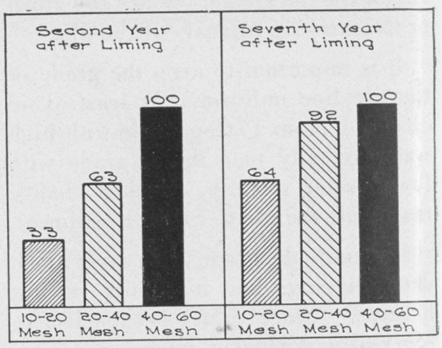
Fineness Speeds Benefits

Many ground limestones contain particles that vary from dust in size to particles that are the size of gravel. When limestone is applied to the soil, the fine particles dissolve readily and combine with the soil acids to neutralize them and to furnish calcium to the plants. The coarse particles, however, dissolve very slowly and many of them will not be of any value in the soil for a number of years after application.

It is very important, therefore, to determine the fineness of any ground limestone if we are to know its value. Fortunately, this is easily done by passing a small sample of the ground limestone over a set of small screens or sieves. Usually three different sized sieves are used in our screen analysis. The coarsest of these sieves has eight openings per linear inch and is known as an 8-mesh sieve; the finest sieve has 60 openings per inch, and is referred to as a 60-mesh sieve.

The actual size of the particles obtained from passing a ground limestone sample over these sieves is shown in the small circles in the accompanying illustration. By knowing what percentage of a sample of limestone is made up of particles of these different sizes the value of the limestone during the first few years after it is applied to the soil can be easily calculated.

Particles held on an 8-mesh sieve have relatively little value in correcting soil acidity during the first few years after application, whereas the particles that pass a 60-mesh sieve are practically all available during the first few months after application. It is for this reason that the fineness specification usually recommended, and that used in the AAA program, requires that at least 90 percent of the limestone particles should pass through an 8-mesh sieve.



Relative value of limestone particles of different sizes in increasing yield of alfalfa on Tama silt loam. (The mesh size of 40-60 is taken as 100%.)

Fine Lime Boosts Alfalfa

The benefits that are obtained by using limestone that is finely ground are

The average screen analysis of 182 samples of ground limestone, compared to that of the 25 coarsest and the 25 finest samples.

Particle size	Percentage in each size group		
	25 coarsest samples	25 finest samples	Av. of all samples
Held on 8-mesh	33.0%	6.0%	18.0%
8-20 mesh	30.6%	19.0%	27.2%
20-60 mesh	19.0%	24.8%	23.6%
Passing 60-mesh	17.4%	50.2%	31.2%

well illustrated in some results we obtained with alfalfa on Tama silt loam soil. Three different grades of limestone were compared. The limestone in all cases was thoroughly disked into the soil in early spring before seeding the oats and alfalfa.

When the alfalfa hay was harvested the following year, it was found that the 40-60 mesh limestone, the finest grade used in this experiment, had increased the yield of alfalfa by an average of 1.69 tons per acre; whereas the coarsest grade, the 10-20 mesh limestone, had increased the yield only 0.58 tons per acre.

These results are shown on a relative basis in the accompanying bar graph. The 10-20 mesh limestone was only 33 percent as effective as the 40-60 mesh material. With time, of course, the coarser particles gradually become more available. Even after 7 years, however, the 10-20 mesh limestone was only 64 percent as effective as the finer grade.

Score Card for Fineness

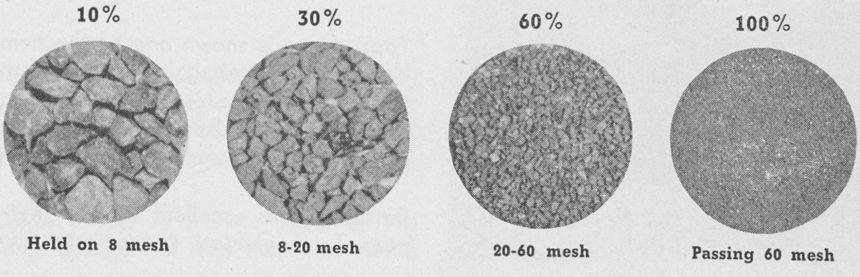
On the basis of such data as reported here for alfalfa, we have prepared a score card or rating for calculating the value of any ground limestone on the basis of its screen analysis. By the use of this score card it is possible to determine about what percentage of any limestone will be available in the soil in the first year or two after application, and thus to compare ground limestones from different sources.

The values of this score card are given in the illustration showing size of particles. Note that the portion of the ground limestone which passes through a 60-mesh sieve is considered to be 100 percent available. This material is often referred to as "dust." The portion of the limestone that is held on the 8-mesh sieve, however, has a rating of only 10 percent availability during the first 1 to 3 years after application.

Other states such as Illinois, North Carolina, Ohio, Pennsylvania and West Virginia have also established ratings for evaluating limestones of different degrees of fineness. In general, there is good agreement among the various ratings. The Illinois rating shows higher values for coarse limestone, but it is based on a 5-year rather than on a 1 to 3-year period. The Ohio rating which is based on considerable experimental work gives slightly lower credit to coarse limestone than does the Iowa rating but is in general in good agreement with it.

Availability of Limestone Particles of Different Sizes

Percent Availability in 1-3 Years



Much Lime Too Coarse

During the past season, 182 samples of limestone were obtained from different parts of the state in order to determine the quality of limestone now being sold to Iowa farmers. A weighed sample from each ground limestone was poured over the different size sieves in order to find out the proportion of coarse and fine particles. Tests were also made of the purity or neutralizing value of each limestone.

The results obtained show that the ground limestones now used in the state vary greatly in agricultural value, and that many of them are of relatively poor quality. As an average for all samples, 18 percent of each sample was too coarse to pass an 8-mesh sieve and only 31.2 percent was sufficiently fine to pass the 60-mesh sieve. Moreover, only 38 percent of all samples met the commonly accepted standard that at least 90 percent of any ground limestone should be fine enough to pass an 8-mesh sieve.

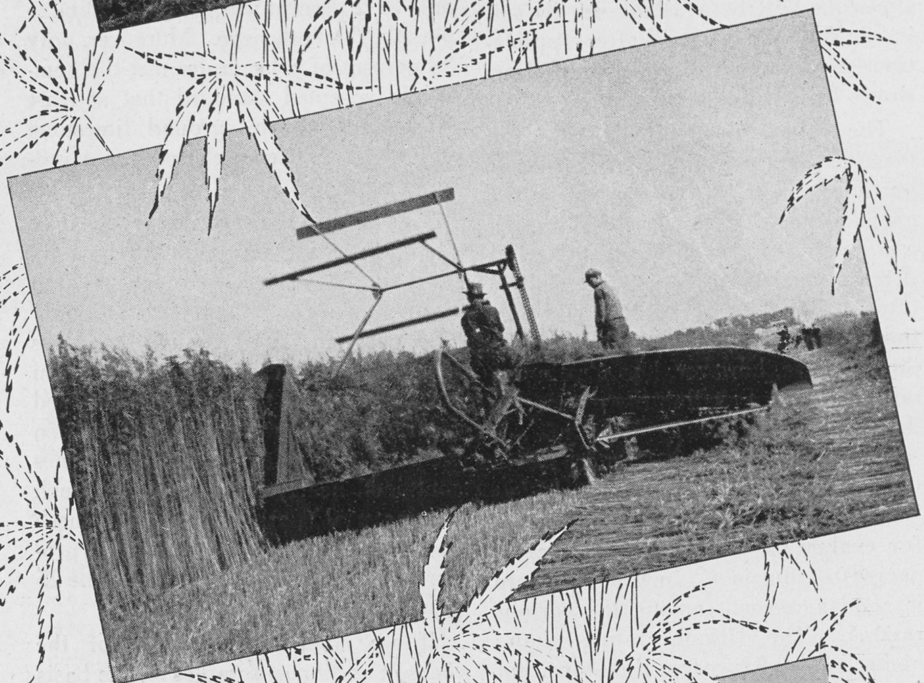
As shown in the accompanying table, the 25 coarsest samples showed an average of 33 percent of material too coarse to pass an 8-mesh sieve and only 17.4 percent fine enough to pass through a 60-mesh sieve. This is in striking contrast to the values obtained for the 25 limestones that had been most finely ground. The finer limestones contained nearly three times as much fine material (passing through 60-mesh sieve) and only one-fifth as high a proportion of coarse particles as did the 25 coarsest samples.

If we compare the value of the coarsest and finest samples on the basis of the relative efficiency of the different particle sizes shown in the illustration, we find that where it would take 2 tons of the most finely ground limestones to grow a good crop of alfalfa on a given soil during the first year or two after liming, it would take 3½ tons of the coarsely ground limestones to give the same results.

Purity of Limestone

The purity or neutralizing value of limestones is also an important factor in determining their agricultural value. The neutralizing value of limestones is usually expressed as "percent calcium carbonate equivalent," or "% C. C. E." Pure calcium limestone gives a C. C. E. value of 100 percent.

(Continued on page 24)



We're

By C. P. WILSIE and C. A. BLACK

WHEN IT BECAME apparent that our regular supply of manila fiber (abaca) would no longer be available for making rope and other cordage, the Government turned to American grown hemp *(Cannabis sativa)*. Iowa farmers, along with those of some other states, were asked to produce fiber, an essential war material.

This job which Uncle Sam handed to the Iowa farmer was a new one — few on Iowa farms had had any previous experience with the crop. In Wisconsin and Kentucky, where a small acreage had been grown yearly since World War I, farmers had learned that hemp requires uniformly fertile soil and that for high yields of good quality fiber, a thick stand of tall but slender stalks was essential. Good rotations and a liberal use of manure had helped them to produce successful crops.

Just how this new crop would respond to our prairie soils in north-central Iowa, with our somewhat different farming practices as well as different climatic conditions, no one knew. It was apparent that we needed much more information on the choice of fields, seeding practices and the use of fertilizers.

The Iowa Agricultural Experiment Station, accordingly, has conducted field and laboratory experiments during the past year to help solve some of the problems facing the Iowa farmers as well as the managers of the 11 mills constructed in the state to handle the 44,000 acres of hemp grown.

Early Planting Desirable

For best results in Iowa, we believe that hemp should be planted between April 25 and May 15. In a field experiment conducted at Ames in 1943

Top: Here is shown one of the hemp harvesters operating in northern Iowa.

Middle: The stalks are spread on the ground in an even swath for retting.

Bottom: This excellent crop of hemp near Traer yielded 4 tons per acre.

Learning About HEMP!

hemp sown April 20 to May 5 produced a better stand, grew taller, and produced a considerably higher yield than when sown after May 20. Plantings made on May 5 were slightly superior to those made on April 20.

Drill Seed if Possible

Uniformity of stand is essential for the best production of good quality fiber. A comparison of drilling and broadcasting of seed at Ames showed an average of 9 plants per square foot at harvest in 20 broadcast plots and 18 plants per square foot on 20 drilled plots. The yield of hemp on the drilled plots averaged about 10 percent higher than on the broadcast plots. Not many farmers in the Iowa hemp area own drills, but we believe it's highly important to make as full use as possible of the drills available.

Seeding Rate Studied

Hemp seed is planted at the rate of 5 pecks per acre in Wisconsin while but 3 to 4 pecks are used in Kentucky. Experiments at Ames and Kanawha (Hancock County) in 1942 indicated no significant increases in the yield of stalks by increasing the seeding rate from 3 up to 5 pecks per acre. The percentage of fiber, however, increased slightly with the higher seeding rates, and the total yield of fiber, therefore, was somewhat higher when 5 pecks of seed were planted.

In 1943, rate of seeding experiments (using from 3 to 6 pecks per acre) conducted at four locations showed that the total stand of plants was increased directly by increasing the seeding rate, as also was the stand of small and dead plants. The desirable plants, capable of making line (long) fiber, however, were affected much less by seeding rate. For example, at Kanawha increasing the seeding rate from 3 to 6 pecks per acre changed the stand of desirable plants at harvest time only from 10 to 14 plants per square foot, and at Crystal Lake (on peat soils in the same county) increasing the seeding rate from 5 to 11 pecks per acre changed the stand of desirable plants only from 7 to 10 plants per square foot.

With only slight increases in effective stands, yields were changed but little by increasing the seeding rate. At Kanawha the 5-peck rate gave a slightly higher yield than the other rates used. In all other experiments rate of seeding produced no significant differences in yield. We believe that if seed supplies are short, 4 pecks or less might be used, but when sufficient seed is available 5 pecks probably is desirable because of the slightly thicker stand, smaller diameter stalks and higher percentage of fiber obtained from that rate.

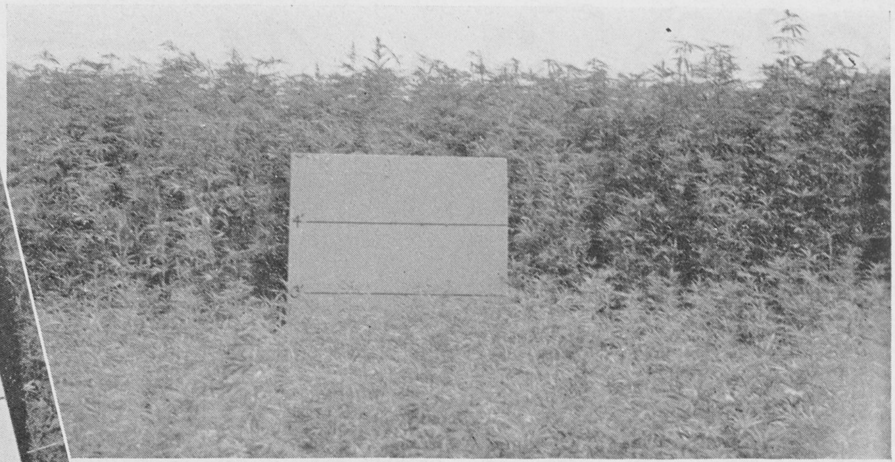
Nitrogen Most Important

A lack of sufficient available nitrogen in the soil was the principal cause of the sickly yellowish-green color and the poor growth of much of the 1943 Iowa hemp crop. Eight fertilizer experiments on important soils in Story County and in five of the hemp-producing counties showed that nitrogen gave the most benefit, followed in order by phosphate and potash.

The acre increases in yield of retted straw ranged from 0.4 to 0.8 tons for nitrogen (125 pounds of ammonium sulfate), from 0.1 to 0.6 tons for phos-

Top: Mechanical turner, developed by Joe Kucera and Eric McElhinney, two Tama County farmers, turns the stalks over to promote more uniform retting.

Below: This is a rear view of the same machine in operation near Britt.



Above: Hemp responds to commercial fertilizers on many Iowa soils. Hemp shown in the foreground received no fertilizer while that in the rear received 500 pounds of 20-10-5 fertilizer to the acre.

Left: The yield of hemp is influenced greatly by the previous crop. The bundles from left to right show the comparative growth following sorghum, corn and soybeans. Best yields followed alfalfa and clover.

phate (250 pounds of superphosphate), and a loss of 0.3 to a gain of 0.3 tons for potash (42 pounds of muriate of potash). Where nitrogen was added at the rate of 500 pounds of ammonium sulfate, the acre increases in yield ranged from 1.1 to 2.7 tons of retted straw.

These results show the value of added nitrogen in producing a high-yielding crop of hemp. The amount of nitrogen added in 125 pounds of ammonium sulfate was not enough to give the maximum yield of hemp in any of the cases tested. Where 500 pounds of ammonium sulfate were used along with phosphate and potash, the total yield was satisfactory in all cases (3.4 to 5.9 tons), and the quality of the hemp was raised from No. 3 or No. 4 to No. 1 or No. 2 (except for one field where the hemp graded No. 1 without any fertilization). In one experiment, $20 spent for fertilizer raised the acre value of the crop from $51 to $228.

Phosphate Also Needed

All the experiments showed that phosphate was of some value, although the effect on the growth of hemp was less striking than that of nitrogen. The main reason why a larger increase was not obtained with superphosphate is probably that the growth of hemp was limited by the lack of nitrogen. In other words, when there wasn't enough nitrogen, the hemp could not grow much better no matter how much phosphate was added.

Potash was in general of little or no benefit so far as yields were concerned. This is mainly because there is a good supply of available potash in the soils of the hemp-growing area. There is an indication, however, that on the higher yielding fields, the inclusion of potash in the fertilizer mixture with nitrogen and phosphorus benefited the yield of hemp. There is also a possibility that the potash had a favorable effect on fiber quality which was not measured by the yield of straw. This question cannot yet be definitely answered because our experiments on fiber quality have not been completed. We believe, however, that only where the potash supply in the soil is low enough to decrease the yield would there be a marked effect on fiber quality.

Fertilizing the 1944 Crop

In view of the marked response of hemp to the application of heavy amounts of nitrogen, a fertilizer high in nitrogen should be used where fertilizer is applied. In 1943, most hemp fields were deficient in nitrogen where the previous crop had been soybeans, corn, oats, or sorghum. It would therefore be safest in 1944 to fertilize such fields for hemp unless it is certain that the availability of nitrogen in the soil is high. The 10-6-4 fertilizer probably will come as near meeting the requirements as any now on the market. Based on this year's results, 500 pounds to the acre should give good returns. In many cases this amount probably will not be enough to give maximum yields.

The use of manure should not be overlooked. Manure applications may give good results, but this year we observed that the amount added in the ordinary application was not enough to produce good hemp on an otherwise poor field. Moreover, the growth was in many cases very irregular because of poor distribution. Therefore, when manure is applied for hemp, the field should be covered heavily and uniformly.

Where manure additions or leguminous crops have raised the soil supply of available nitrogen to a high level, fertilizer nitrogen is not needed. In such cases the use of about 200 pounds of 0-20-0 or 4-16-4 probably would give the best results.

Effect of Previous Crop

Our study of a large number of hemp fields in Iowa in 1943 indicates that the preceding crop is very important in determining the yield of hemp. The rating for the various crops shown in the accompanying table is based on yields of hemp obtained in fields which had grown two or more different crops in 1942. The yield of hemp following each crop is calculated as a percentage of the yield after clover and alfalfa.

These two crops were considered together because they were of about equal value in producing a good crop of hemp. Corn and oats also were considered together because their average effect on hemp was about the same.

A rating of various crops grown in 1942 with respect to their effect on the yield of hemp in 1943.

Crop in 1942	*Relative yield of hemp, taking the yield following clover and alfalfa as 100*
Alfalfa-Clover*	100
Soybeans	75
Corn-Oats	57
Sorghum	35

*Second-year red clover or second-year sweet clover. Crops grown on ground which does not need lime.

The order of the different crops in the table is in accordance with their effect on the available nitrogen in the soil. Alfalfa and clover should be placed at the top of the list only when they have been grown on land which does not need lime and when there has been 1 year of pasture or hay (or more in the case of alfalfa) following the year of seeding.

Red clover grown on acid soils without liming or inoculation generally did not fix enough nitrogen to produce maximum growth of hemp. Following clover grown on acid, unlimed soils, the hemp fields probably were about as good as those following soybeans. In areas where the soils are naturally acid, alfalfa is very seldom seeded without inoculation and preliminary liming. Consequently, the hemp fields were uniformly good following alfalfa.

We found that clover which was plowed up in the fall of the season in which it was seeded, or in the following spring, was not of much benefit for hemp. Clover fields which had been allowed to run out to timothy, bluegrass or weeds generally did not produce good hemp.

A further important consideration in regard to the effect of previous crops on the yield of hemp is the number of years the beneficial effect of a leguminous crop will last. The information collected in 1943 shows that the yield of hemp the second year after alfalfa sod was practically as good as it was the first year. No definite information is available on hemp grown the third year after alfalfa, but a few observations indicate that the effect of alfalfa, as measured by hemp growth, drops off rapidly during that year.

Hemp following second-year red clover or sweet clover was practically as good as hemp following alfalfa. However, hemp grown the second year after the clover had been plowed under was considerably poorer — about equivalent to hemp the first year after soybeans. Hemp grown 3 or more years after clover was little if any better than without any clover at all. With soybeans, practically all the beneficial effect on hemp was obtained in the first year.

Harvest, Turn Early

Hemp is cut when the male plants are in full bloom. In Iowa harvesting about Sept. 1 would appear desirable because of the more favorable conditions for retting that are likely to occur in early autumn. Weather data show that temperature and moisture conditions, especially in the western part of our hemp area, usually are much less favorable in October than in September.

TO INSURE GOOD YIELDS OF HEMP

1. **Select soils uniformly high in fertility and well-drained but not drouthy.**
2. **It should follow alfalfa or clover wherever possible. Other fields should be fertilized with 500 pounds of 10-6-4.**
3. **Early seeding is desirable.**
4. **Drilling the seed is preferable to broadcasting.**

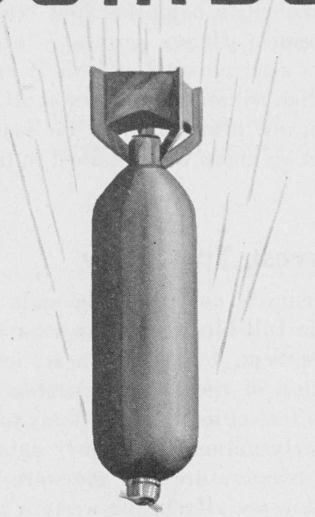
Early harvesting may be facilitated to some extent by early planting.

Hemp fibers are in the inner bark around the central woody portion of the stalk and are loosened by the action of molds and bacteria. "Retting" is partial rotting and should proceed to the point that the fibers may easily be separated but not so far that the fibers themselves are attacked and weakened.

To promote uniform retting in the field, turning the stalks usually is necessary. In both the 1942 and 1943 seasons, late September and most of October were not favorable for retting. Partially retted hemp, however, when turned in the swath by early October, completed retting fairly well in both seasons. Without turning, much of the hemp in Iowa is likely to be poorly retted, resulting in an un-uniform quality of fiber.

In this Kossuth County field, the hemp at the left followed soybeans, while that at the right followed second year sweet clover. Average yields of hemp following alfalfa or sweet clover were about one-third more than those following soybeans.

FERTILIZER BACKS BOMBS



ONE SOURCE of "ammunition" for the "war food front" which many an Iowa farmer should seriously consider using this year is commercial fertilizer. If used wisely, it can profitably increase crop production.

Furthermore, the increase in intertilled crops, such as corn and soybeans, and the decrease in small grain and rotation hay and pasture will mean a heavy demand on the fertility reserves in the soil. But the purchasing power of agriculture is greater now than ever before, so that we can afford to spend some of that money to keep up or increase our soil fertility against the day when margins of profit may not be as large as they are today.

Agricultural Experiment Station trials, conducted throughout the state on numerous kinds of soils, and farmers' experiences show that the use of fertilizer is becoming more and more important in increasing yields and producing crops more efficiently.

This need for fertilizer is not a new problem in Iowa. Many Iowa soils were cleared of timber or broken out of prairie 75 to 100 years ago, and intensive cropping since then has reduced fertility reserves to the point where these will need to be replenished at increasing rates as time goes on.

The amount of fertilizer used in Iowa in the past has been quite low, but has increased sharply in the last few years. The accompanying chart shows that there has been nearly an eight-fold increase in 7 years. Some of this increase is due to the activities of the AAA.

Need 390,000 Tons

We estimate that Iowa farmers could use about 390,000 tons of fertilizer to advantage in 1944 on field crops and pastures. This would be an increase of five and one-half to six times that used in 1943. These estimates are based on extensive trials the Iowa Station has conducted throughout the state, and on the expectation that larger acreages will be planted to intertilled crops, that present average yields will need to be maintained or increased and that the carrying capacities of pastures need to be increased markedly.

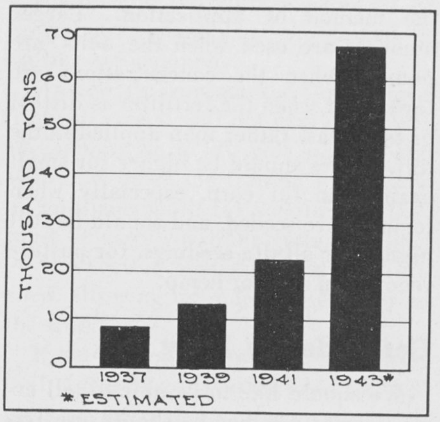
We estimate that nearly 24 percent of the state's $11\frac{1}{2}$ million acres of corn should be fertilized with commercial fertilizer to obtain maximum production. Likewise, 32 percent of the small grain, 21 percent of the winter wheat, 80 percent of the hemp and 15 percent of the permanent pasture should be fertilized.

The percentage of any crop to be fertilized should vary, however, depending upon the kind of soil and the section of the state. (See the accompanying map of Iowa.) Soils differ greatly in their response to fertilizer. Climatic conditions also have a bearing; greater response is generally obtained where rainfall is plentiful.

In general, the Northeast Dairy area needs fertilizer most, followed in descending order by the Southern Pasture area, the Eastern Livestock area, the Cash Grain area and the Western Livestock area. For instance, 49 percent of the total corn acreage in the Northeast Dairy area should be fer-

A common practice of applying fertilizer is with a planter attachment.

By A. J. ENGLEHORN and H. R. MELDRUM



Fertilizer tonnage reported sold in Iowa last year reached a new height.

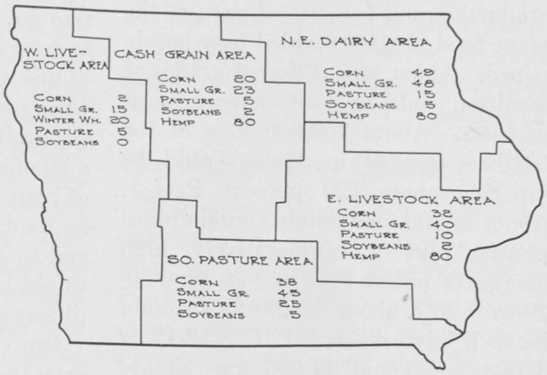
tilized to insure maximum production. Thirty-eight percent of the corn acreage should be fertilized in the Southern Pasture area, 32 percent in the Eastern Livestock area, 20 percent in the Cash Grain area and 2 percent in the Western Livestock area. Similarly, the percentage of the small grain acreage that should be fertilized is 48 in the Northeast Dairy area, 45 in the Southern Pasture area, 40 in the Eastern Livestock area, 23 in the Cash Grain area and 15 percent in the Western Livestock area.

The requirement of pasture land for fertilizer also varies, but the order is not the same as for the grain crops. The highest acreage is in southern Iowa, where we estimate one-fourth of the pasture land should be fertilized, largely because many of these grass lands are poor soils and are in poor condition.

Indications are that 15 percent of the pasture land in the Northeast Dairy area, 10 percent in the Eastern Livestock area and 5 percent in the Cash Grain area and in the Western Livestock area should be fertilized for increased production.

The only sizeable acreage of winter wheat occurs in western Iowa, where we estimate 20 percent of the acreage should be fertilized for best production. The hemp acreage is small, but experience of the past year indicates that about 80 percent of this crop should be fertilized in each of the three areas where it is grown.

We estimate that 5 percent of the soy-



Estimated percentage of crop and pasture land that would need fertilizer for maximum production in 1944 (shown by type of farming areas).

WARTIME FERTILIZER RECOMMENDATIONS FOR FIELD CROPS IN IOWA

1944

Crop	*Kind of Soil*	*Kind of Fertilizer (1)*	*RATE OF APPLICATION (lbs./acre) (2)* — *Drilled or Broadcast*	*Applied in row or hill*
Corn	Moderately productive or well-manured soils	0-20-0	125-175	80-100
	Soils receiving little manure; sandy and certain slowly-drained soils	0-20-10 or 2-12-6 or 4-16-4	125-175 200-250 150-200	80-100 125-165 100-125
	Peaty soils and soils moderately deficient in potash	0-20-20	175-225	100-125
	High-lime soils with high potash deficiency	0-10-20 or 0-9-27	250-300	125-150
Small grain and clover seedings	Moderately productive soils Sandy, high-lime, or relatively poor soils	0-20-0 0-20-10	150-200 150-200	
Alfalfa seedings (with or without nurse crops)	Moderately productive soils Sandy, high-lime, or relatively poor soils	0-20-0 0-20-10	200-300 200-300	
Pasture (renovation)	Unproductive soils	0-20-0	200-300	
Sugar beets	Moderately productive soils	0-20-0	200-250	125-150
Hemp	Soils that have been manured heavily or had a good stand of alfalfa or clover during the past one or two years.	4-16-4 or 0-20-0	150-200 125-175	
	Good soils that have not been manured heavily or have not grown good alfalfa or clover during the past one or two years.	10-6-4 (3)	500-600	
Soybeans	Experiments indicate but little effect from direct application of fertilizer, except on relatively poor soils. On such soils, 0-20-0 or 0-20-10 at 150-200 pounds per acre, broadcast, may be desirable.			

(1) Refers to grade or analysis. The first figure stands for % total nitrogen (N); the second for % available phosphoric acid (P_2O_5); the third for the % water-soluble potash (K_2O).

(2) When substitutions are made for fertilizers listed above, the rate per acre should be adjusted so as to add approximately the same amount of plant food elements. On poorer soils the higher rate should be used. When rock phosphate is used, the recommended rate is 500 to 1,000 lbs. per acre, per rotation.

(3) If this fertilizer is not available, use a nitrogen fertilizer, such as ammonium sulfate (20-0-0) or ammonium nitrate (31-33%N) at a nitrogen equivalent rate.

Government Regulations

1. F.P.O. 5, Rev. 2, establishes the grades of mixed fertilizers which may be offered for sale in the various states. Superphosphates, rock phosphate, some nitrogen and potassium fertilizers will also be available. 2nd R Rev. MPR 135 establishes maximum prices of fertilizers to consumers.
2. The approved Victory Garden fertilizer for 1944 is 4-12-4.
3. Farmers are eligible to use fertilizer in 1944 regardless of whether they used it in previous years.
4. Application for fertilizer must be made on official forms supplied by dealers.

bean acreage should be fertilized in the Northeast Dairy area and in the Southern Pasture area, but only about 2 percent in the Eastern Livestock and Cash Grain areas and none in western Iowa.

Use Proper Grade

It is important that the proper grade of fertilizer[1] be used so that maximum production and full use of each of the plant food elements added may be obtained. About nine different grades of fertilizer could be used on field crops in Iowa. About 268,000 tons of the fertilizer needed in Iowa should be superphosphate (20 percent P_2O_5). About 56,000 tons should contain phosphorus plus a comparatively high amount of potash such as 0-20-10, 0-20-20 or 0-9-27, about 54,000 tons should be such mixtures as 2-12-6, 3-12-12 or 4-16-4 and about 11,600 tons should contain high amounts of nitrogen such as 10-6-4 or 20-0-0. The kind of fertilizer used will depend largely on the crop and on the soil. (See the accompanying table.)

The small grain crop, which is primarily oats in which legume seedings are made, should be fertilized largely with superphosphate if the soils are average and fairly well managed. But on sandy, relatively poor or high-lime soils, 0-20-10 should be used. About half the fertilizer used on winter wheat should be superphosphate and the other half 4-16-4.

Corn needs a wider variety of grades. Slightly more than one-third of the fertilizer used on corn should be superphosphate (20 percent P_2O_5). About one-sixth used should be 0-20-10. According to Experiment Station trials, a fertilizer containing both phosphate and potash, such as 0-20-10, will give good returns on some of the more poorly drained soils of northeast Iowa and on the heavy clay-pan soils of southern Iowa. Very good results with 0-20-10 have also been obtained on the Carrington soils of northeast Iowa.

Corn grown on the high-lime areas of northern Iowa usually requires a fertilizer containing some superphosphate and a considerable quantity of potash. Fertilizers such as 0-20-20 and 0-9-27 are needed for this purpose. In many parts of the state, especially in the eastern third, other grades shown in the table have been found to be beneficial. These grades, which may be 2-12-6, 3-12-12 or 4-16-4, contain a small amount of nitrogen in addition to the phosphorus and potash.

About 10,000 tons of ammonium sulfate or its equivalent (20-0-0) could be used advantageously for corn. Most of this would be used on third-year corn when previous crops have used much of the available nitrogen supply. It takes a lot of nitrogen to produce a good crop of corn, so the nitrogen fertilizer would be used to balance the plant nutrients and to guarantee that the most benefit would be obtained from any other fertilizers applied.

Our experience of the past year indicates that hemp when grown on average soils requires substantial quantities of a fertilizer high in nitrogen such as a 10-6-4 grade, while if the soils have been manured, a grade such as 4-16-4 is satisfactory.

Superphosphate should be used on permanent pastures, especially for renovation of poorer soils such as are found in southern Iowa. These pastures can be made to produce much more efficiently if fertilized and reseeded.

Rates of application will need to vary depending on the soil fertility, on the crop, on the grade of fertilizer and on the method of application. Larger amounts are used when the soils are poorer, when the concentrations are lower and when the fertilizer is drilled or broadcast rather than applied in the hill. Rates should be higher for small grain than for corn, especially when legumes are seeded, and should be still higher for alfalfa seedings, for pasture renovation and for hemp.

Get Order in Early

We should like to be able to tell every farmer whether he should use fertilizer and how much. But the answer is not that simple when we are talking about all areas of Iowa. If there ever was a year when farmers could afford to try fertilizer, surely this is the one. Income is good and we need to make certain every acre counts to the utmost.

The fertilizer needs we have discussed are potential needs and the fertilizer industry may not be able to supply the demand. Because of transportation, labor and storage difficulties, it will be necessary for farmers to make application early to insure delivery. When fertilizer is bought early, it is important to provide dry storage. New fertilizer distributors also should be ordered early.

We are certain that fertilizer, used in the right manner, will "back the bullets" and help many a farmer financially.

[1]The grade of fertilizer refers to the percentage composition of the material. According to law the content of each plant food element must be stated on each label. Such figures as 0-20-0, 0-20-10, 2-12-6, etc., refer to the percentage composition; thus, a 2-12-6 grade contains 2 percent total nitrogen (N), 12 percent available phosphoric acid (P_2O_5), and 6 percent water soluble potash (K_2O).

Know and Guard Your Electrical Equipment

By HELEN VIRGINIA JOHNSON

WITH THE CONVENIENCES that rural electrification has brought to farm homes in the past few years have come added responsibilities. This is especially true in the use of electric appliances — irons, toasters, mixers, waffle irons, sweepers and washers.

Electrical appliances in the home have been built for use under certain limiting conditions. These conditions usually are stated on the name plate or somewhere on the appliance. The information on the name plate contains either all or some of the following facts: On a heating device will be found data about volts, amperes, ohms and A.C. or D.C. current; an appliance with a motor will be marked with volts, amperes, H.P. (horsepower), cycles and the type of current.

In these days of limited supplies, when it is especially important to safeguard those electrical appliances which we do have, knowing all the facts about the local electric power is essential. Information on the voltage supplied by your power plant can be obtained by calling the company.

An electric iron marked for use on a 120 volt circuit will not heat as rapidly to capacity on a 110 volt supply, and will slow down the ironing job. When an appliance built for a certain voltage must be used where the voltage is lower, the heating element could be shortened, allowing more heat to develop in the iron.

If the converse were true — a toaster built for 110 volts being used on 120 volts — more watts (heat) would be developed, and the toaster would burn out sooner. In addition, the toast would probably burn most of the time.

Electric Clock

Electric clocks are built for certain frequencies (cycles). Of the three frequencies — 60, 50 and 25 cycles — developed by power companies, 60 is by far the most common. The number of cycles per second determines the time keeping of the clock so if the clock isn't operating on the proper frequency, it won't keep time correctly. The wrong frequency also is harmful to the clock.

Another example of the effect of lowered voltage on heating appliances is sometimes seen when home appliances are connected to outlets by means of extension cords. The extension cord increases the resistance through which the current has to travel with the result that less current reaches the appliance. Frequently appliances are plugged into circuits intended only for electric lights. Such circuits would be wired with smaller wire than that used in appliance circuits. Since a fine wire offers much greater resistance to the flow of electricity than does a heavy wire, the too fine wire on a circuit, plus the lengthening of the wire by means of extension cords, causes a considerable drop in voltage on the line. That means too few volts are actually applied to an appliance requiring high heat.

Irons or roasters connected by an extension cord to a light circuit might make a dangerous fire hazard. Ordinarily, so large a load on the line would blow the fuses. But sometimes this is prevented by an oversized fuse. A light circuit needs a 15 ampere fuse with No. 14 wire. Putting in a fuse of high amperage when a large number of appliances are to be used is exceedingly dangerous, for overheated wires may cause a fire. It also causes some loss of power on the line to the appliances. Furthermore, the appliances themselves do not perform properly. Heat appliances will not get hot enough.

Know Your Fuse

There is more to be said about the matter of blowing fuses. Fuses are made of critical materials that must be conserved. A fuse prevents fires by blowing when wires get overloaded and become heated. If there were no fuse to blow, the wires of the circuit probably would melt, or the wires in the appliances might melt. The appliance or circuit would then be useless. If a combustible material were near the hot wires of the circuit, a fire would result.

A fuse will blow when the line has too many appliances on it, or when a "short" circuit develops. In the case of a short circuit, the current going through the line becomes tremendously large, because the resistance has become exceedingly small.

To determine how many outlets are on a single circuit, remove one fuse; then turn on all the lights and appliances in the house. Adding up the amperes of all those that are "blacked out" will give the total load on the circuit. Each appliance and each light bulb tells how much power (watts) each uses. The light bulbs tell indirectly:

200 Watt bulb —	1.67 amps.
150 Watt bulb —	1.25 amps.
100 Watt bulb —	.83 amps.
60 Watt bulb —	.50 amps.

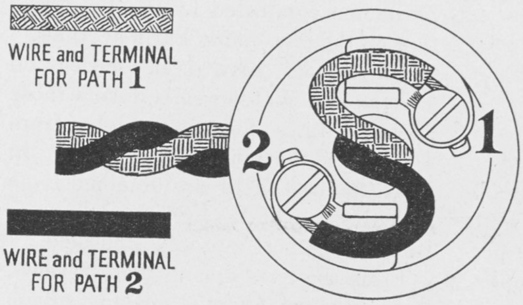
The appliances, on the other hand, will have the number of amperes of current that each uses printed directly on the name plate or somewhere on the bottom. If not, the wattage will be stated, and the number of watts divided by the number of volts gives the number of amps of current that the appliance draws off the line.

Irons, waffle irons, toasters, small radiant heaters and other heating appliances usually use about 5 or 6 amps. A roaster usually uses 10 or 12 amps. Motor-driven home appliances always use less than 5 amps. In other words, it takes less electricity to run the washing machine for an hour than to iron for an hour.

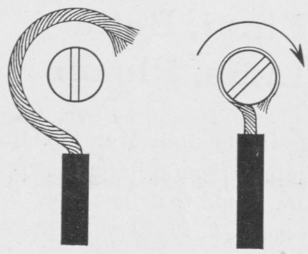
Checking Short Circuit

The most common short circuit occurs when the wire covering on a cord that has been used a long time wears away until two bare wires touch each other. Electricity then refuses to go through the appliance, where it would normally have been converted into heat. Instead, it goes directly back to the power house, developing heat on the line and thus blowing the fuse.

Since most "shorts" are caused by worn cords or plugs, it is a good idea for homemakers to know what to do about them. While plugs and cords differ somewhat in their actual construction, they are alike fundamentally. There must be a path for the electricity to leave the main line and come into the cord through the wall plug. Then there must be a path for it to leave the cord and go into the appliance through the appliance plug. When it has gone through the appliance, there must be a complete way for its return to the main line again. This means, then, a path into the appliance and a path out of it. At no time should it be possible for the electricity to jump from the incoming



When viewed from the top, looking down, as in the drawing above, the wires of a properly repaired wall plug make the letter S. By all means do not let the electricity have a chance to jump from wires 1 to 2.



To repair a wall plug, scrape back the insulation for 1/2 inch. Make a loop and place around the screw so that the screw will turn toward end of wire.

path to the outgoing path without going through the appliance.

If two bare wires are rubbing, they may be insulated from each other by wrapping each with friction tape. If the electricity is jumping from one path to the other within the plug, the plug can easily be taken apart and studied. First, one must note that the two paths are separate. Sometimes just a little wisp of wire may be touching the other side. Within the plug, especially in an iron plug, there are little grooves where the wires should be. There are always two screws or terminals in every plug to which the wires of the cord are attached. The wire ends should be twisted and fastened to these — one screw is meant for each electrical path.

The greatest difficulty is to put the wire around the screw properly. This can be done most easily and efficiently as shown in the accompanying illustration.

Finer, Better Lime, Please

(Continued from page 15)

In our study of the 182 limestones obtained from different parts of the state, we found that they averaged 83.0 percent C. C. E. The 25 poorest samples, however, averaged only 64.3 percent whereas the 25 best samples averaged 96.3 percent equivalent. Because of this difference in neutralizing value it would take exactly 3 tons of the poorest to be equal to 2 tons of the best.

Conclusions

The marked demand for and the rapid increase in the use of limestone during the past few years probably accounts for the tendency toward a lowering of standards. This is unfortunate at the present time. We need to increase the amount of limestone used on Iowa farms, but we also need to get the greatest returns possible in terms of bushels of corn and tons of alfalfa from every ton of limestone used.

The bottlenecks in production are largely due to shortages of labor and transportation. It takes the same amount of labor and transportation facilities to produce and haul limestone that is of low quality, or is so coarsely ground that much of it will not become available in the soil during the next few years, as it does to produce, haul and spread limestone that is of high quality and quickly available in the soil. Moreover, the particles of limestone that are so coarse that they remain in the soil practically unchanged for several years are making little contribution to food production and the war effort.

Our slogan for the present war production program should be "Use more limestone of better quality to maximize food production."

Oat Seeding Rate

WITH the price of seed oats high and a large demand for oats to feed, Iowa farmers may well consider carefully the amount of oats per acre that they sow next spring.

Some information on rate of seeding — its effect on yield, lodging, date of ripening and the like — has been obtained during the past 2 years in experiments conducted by the Iowa Station on the Agronomy Farm at Ames.

Tama oats have been seeded on Clarion and Webster soils during those 2 years at rates of seeding ranging from 1 bushel to the acre to 4½ bushels. In 1942, the best yield was obtained from a seeding rate of 2½ bushels to the acre. In 1943 the best rate was 3 bushels.

From the tests during these 2 years, it appears that there is not any advantage in seeding more than 3 bushels to the acre.

In both years there seemed to be no connection between the rate of seeding and the height the oats grew, how they stood up or lodged. There seemed to be no connection in 1942 between the rate of seeding and bushel weight of the oats harvested, but in 1943, in a less favorable growing season (for some reason which is not known), the bushel weight increased from 30 pounds at the 1½-bushel rate to 34 pounds for the 4½-bushel rate.

In 1943 the yield per acre from 1 bushel of seed was 68 bushels to the acre and for the other rates as follows: 1½ bushels of seed — 70 bushel yield; 2 bushels — 72 bushels to the acre; 2½ bushels — 74; 3 bushels — 76; 3½ bushels — 76; 4 bushels — 74; 4½ bushels — 73.

In 1942 there was no increase in yield from seedings of 2½ bushels to the acre up to 4½ bushels. In fact, as in 1943, the yield dropped off from seeding rates higher than 2½ bushels to the acre.

New Seedling Potato

A new seedling potato named Sequoya has been developed and introduced by the United States Department of Agriculture which appears to have a lot of resistance to injury by leaf hopper.

If such a variety adapted to Iowa can be found, it will be a great improvement over the varieties we have now, for it will eliminate most of the four or five sprayings that are necessary to avoid hopper injury.

The Sequoya, Irish Cobbler and Early Ohio were planted adjoining a bean patch to insure plenty of hoppers in a field test by the Iowa Station in Iowa last year. Except for one spray with lead arsenate to control potato bugs, the potatoes were left unsprayed throughout the season. The foliage of the Sequoya remained green with scarcely a suggestion of hopper burn while the Cobblers and Ohios were severely burned.

Sequoya yields well in northern Iowa and is an attractive potato. But it matures 2 to 3 weeks later than the Cobbler which is a serious objection.

Further crosses between the Sequoya and an earlier variety will be made the coming year with the hope of combining immunity to hopper burn and early maturity.

Rate to Plant Soybeans

If you plant soybeans in rows about 32 inches apart, then the rate of seeding for maximum yields with seed of high germination need not be more than 1 bushel to the acre.

This is the conclusion reached after 4 years of testing five varieties of soybeans seeded at rates ranging from 0.6 bushel to 2.2 bushels to the acre. In these tests conducted on the Agronomy Farm of the Iowa Station at Ames, the yields from the different rates varied only slightly, up to seeding rates of 1.8 and 2.2 bushels to the acre. These heavier rates gave significantly lower yields.

The heavier rates of seeding also showed more lodging. In 1942 with the early frost, the badly lodged beans were damaged more than those that stood up well because lodging retarded maturity. Therefore, too heavy rate of seeding soybeans may cut down the quality as well as the yield.