After hybrid corn breeding programs were started, work at the Iowa Station was done with the corn carrying the waxy starch genetic character. The workers thought it might be of use some day, and they had done some work in "building" this character into the good hybrids.

Some of the first hybrids into which the character was introduced appeared to yield about 10 percent less than other similar hybrids. But this has been improved, and last year in tests in north central Iowa the Iowa Station found the waxy hybrids yielding within about 3 percent as much per acre as similar hybrids with ordinary type starch.

Farmers who grow the waxy corn this year are guaranteed a price 12 percent over ordinary type corn. It is grown and handled exactly the same as ordinary corn and is similar in appearance. Only by testing the starch with iodine can it be identified from corn with ordinary type starch.

Fields require some isolation, for if it is pollinated with ordinary type corn, the starch is ruined for commercial use as a tapioca substitute.

**Corn Borer Story Coming**

Iowa farmers in some of the counties in eastern Iowa this year are likely to get better acquainted with the European corn borer than they would like.

Recent surveys have shown that the borer has now reached Harrison and Pottawattamie counties on the Missouri River. Before the end of the season and after the second generation has appeared, the entomologists believe that every county in Iowa probably will have the borer in it. Surveys are now under way to find out how far west in the northern counties the borer has traveled.

But whether or not we like this pest which threatens corn, our number one crop, we have it and we are going to have to find out how to farm in its presence.

In the next issue of Farm Science Reporter we plan to bring you an up-to-date picture of the situation in Iowa, what methods are being tried to lessen its damage and other points that arise from our experience of this year.

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**FARM SCIENCE REPORTER**

Editor: FRED E. FERGUSON

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ERODED SOILS

When the top soil has washed away or blown away—crop yields drop. Most farmers know this. But just why won't the subsoil produce as well as the original top soil? Is there any particular element that we can add to eroded soils which will step up crop yields? These are questions we have been looking into at the Iowa Station.

For several years we have been making tests out over the state comparing yields of corn on eroded and non-eroded soils. These tests have shown that:

1. Yields on some soil types are often less than one-half as large on severely eroded as on non-eroded soils.

2. One of the causes for the lower yield on eroded soils is that the subsoil which remains after the top soil has washed away has too little available phosphorus.

3. The difference in yield from eroded soils depends on the type of soil.

4. The drop in yield will be less when good crop rotations are followed and when lime, manure and fertilizers are used.

We reached these conclusions after we had checked corn yields on soils with normal depths of top soil, with part of the surface soil eroded and when nothing but the subsoil remained. We did this in a number of counties over a period of a half dozen years and on several different types of soil.

With definite proof that soil erosion will result in lower yields, we wondered to what extent this might be explained by a difference in the amount of available phosphorus. We knew that the physical structure of eroded soil is poorer and that there is less organic matter. We suspected that the amount of available plant food is probably much lower.

In order to determine the effect of erosion on the phosphorus needs of the soil, experimental work was done with some of the same soils with which we had made extensive field tests to determine the effect of erosion on yields. We can say from these studies that the lower yield of corn on eroded soils is at least partly due to a lack of sufficient phosphorus for best plant growth. We reached this conclusion after making tests in the greenhouse and in the laboratory with soils on which we had obtained yield data.

The soils we studied in the greenhouse were “paired” samples, taken from 24 fields in which we had obtained the yield of corn according to the depths of top soil. By “paired” samples we mean that we used a sample of an eroded soil and of one not eroded out of each field. Each of these pairs of samples was on the same soil type and each field had been in the same rotation and uniformly treated.

Enough soil was obtained to fill six 2-gallon pots. We added 20 percent superphosphate at a rate of 400 pounds per acre to half the pots, leaving the other three untreated. Sudan grass was then grown. Above: Up-and-down-hill farming is taking away the top soil which is best phosphorus source. Below: When the thin top soil of Shelby silt loam is gone, most of the phosphorus available to plants is gone.
grown and yields obtained to find the soil's need for phosphorus. Enough nitrogen and potash were added to insure that these elements would not be limiting.

Test Three Soil Types

This test was made with three of the major soil types of the state: Fayette silt loam, Tama silt loam and Shelby loam. Fayette silt loam occurs commonly in the more rolling areas of such northeast Iowa counties as Allamakee, Clayton, Dubuque and Jackson. (See accompanying map of Iowa.) It is a light brown or grayish-brown soil which was formerly timbered and which never had a very deep top soil.

Tama silt loam is found in the gently rolling areas of central and east central Iowa and is typical in Marshall, Tama, Poweshiek and Cedar counties. This soil is dark brown to black in color and was originally covered with tall grasses. In the rolling areas of southern Iowa in such counties as Lucas, Decatur, Wayne and Ringgold, the Shelby loam is found. It is dark grayish-brown in color and once had tall grasses on it.

The yield of corn in the field taken on these soils was much lower when the top soil had been eroded than when it was of normal depth. (See table 1.) The greatest decrease occurred on the Shelby loam, the second on the Tama silt loam, and the least on the Fayette silt loam. Since these yields were taken in 1941 on the Tama silt loam and in 1942 on the Shelby silt loam and in 1942 on the

Phosphate fertilizer gave most response in Shelby, least in Fayette.

Fayette silt loam and Shelby loam, they are not exactly comparable.

Higher corn yields are usually obtained on Tama silt loam than on the other two soils and the lowest are on the Shelby loam. The percentage decrease in yields because of erosion is greatest for the Shelby loam and least for the Fayette silt loam. The yield decrease on the Tama silt loam is between the decreases on the other two soils. The amount of decrease, at least in part, is because of the nature of these soils. The Shelby loam has a shallow surface layer below which is a heavy and tight material known to be low in available plant nutrients. The surface layer is deeper and the subsoils are better in texture in the Fayette and Tama soils.

Greenhouse Test Results

The growth of sudan grass on these soils when placed in pots in the greenhouse indicated that the differences in yield are due to a greater lack of phosphorus available for plants on the eroded soils. (See table 2.) The growth of the plants showed that all of the soils needed phosphorus whether eroded or not, but the need for phosphorus was greater when they were eroded.

There was an interesting difference between the three soils. The Fayette silt loam gave the least response when phosphate was added, and there was not much difference between the response of the eroded and non-eroded samples to phosphate fertilizer. This corresponds with the corn yields in the field. Fayette corn yields dropped 15 bushels because of erosion as compared with a 51-bushel drop on the Shelby.

The greatest response in the growth of sudan grass from the use of phosphate fertilizer occurred with the Shelby loam which had been eroded, indicating a definite lack of available phos-
TABLE I. THE INFLUENCE OF DEPTH OF TOP SOIL ON THE YIELD OF CORN.

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Eroded Yield</th>
<th>Non-Eroded Yield</th>
<th>Percent Decrease From Erosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tama silt loam</td>
<td>41.7</td>
<td>69.2</td>
<td>38.7</td>
</tr>
<tr>
<td>Fayette silt loam</td>
<td>63.4</td>
<td>78.2</td>
<td>18.4</td>
</tr>
<tr>
<td>Shelby loam</td>
<td>28.5</td>
<td>79.1</td>
<td>64.0</td>
</tr>
</tbody>
</table>

TABLE II. YIELD OF SUDAN GRASS ON ERODED AND NON-ERODED SOIL WITH AND WITHOUT PHOSPHORUS.

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Without Phosphorus Yield</th>
<th>With Phosphorus Yield</th>
<th>Increase for Phosphorus</th>
<th>Percent Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tama silt loam</td>
<td>34.2</td>
<td>54.0</td>
<td>19.8</td>
<td>58</td>
</tr>
<tr>
<td>Fayette silt loam</td>
<td>15.1</td>
<td>19.4</td>
<td>4.3</td>
<td>28</td>
</tr>
<tr>
<td>Shelby loam</td>
<td>7.2</td>
<td>21.5</td>
<td>14.3</td>
<td>199</td>
</tr>
</tbody>
</table>

Check Chemical Test

Another type of test commonly used to indicate the available phosphorus content of soils is a chemical one based on the amount of phosphorus extracted from the soil by a dilute acid. Most of the so-called quick tests for available phosphorus operate upon this principle. Since we were also interested in finding out how the chemical test compared with the greenhouse test, samples of these soils were tested in the laboratory for their content of acid-soluble phosphorus. The results of these tests are compared with the greenhouse tests in the accompanying chart.

In agreement with the greenhouse tests, the chemical tests showed that, on the average, the Fayette soils contained more available phosphorus than the Shelby soils and that the non-eroded soils tended to have slightly larger amounts of available phosphorus than the eroded samples. The Tama soils, which contained some-

what smaller amounts of available phosphorus than the Fayette soils according to the greenhouse test, also showed smaller amounts in the chemical test.

In the case of the Tama soils, however, the average phosphorus content of the eroded soils as determined by the chemical tests was larger than that of the non-eroded soils, yet the greenhouse test showed that the eroded soils are more deficient in phosphorus. Although the chemical test showed that certain soil types contain on average a more available phosphorus than others, it failed to show that eroded Tama soils are more phosphorus-deficient than the non-eroded soils. Other studies we have made also show that this test is not very satisfactory as a sole means of determining the phosphorus fertilizer needs of individual soils.

One of the possible reasons for the weakness of the chemical test when applied to individual soils is that it does not measure the amount of phosphorus in the soil organic matter which becomes available to plants as the organic matter decomposes. Since about one-half of the total phosphorus in the surface layers of Iowa Prairie soils is in the organic matter, this may be of considerable importance in supplying phosphorus to the growing plant.

Some information on the amounts of organic phosphorus lost by soil erosion was obtained in a study of the eroded and non-eroded Tama soils. This study showed that the organic phosphorus content of the non-eroded soils averaged 554 pounds per acre, whereas the content of the eroded soils averaged only 454 pounds per acre. The larger amounts of organic phosphorus in the non-eroded Tama soils probably explain, at least in part, why these soils were less phosphorus-deficient than the eroded soils.

Since the results we obtained in the greenhouse and in the laboratory agreed very well with the yield tests in the field, we are led to the conclusion that one reason why low yields are the rule when crops are grown on eroded soils is that the phosphorus in the subsurface soil layer is not as readily available to the plant as that in the surface soil.

Other reasons undoubtedly are that eroded soils are lower in the amount of nitrogen and possibly potassium, especially in an available form. They also have a lower content of organic matter and are generally of such physical structure as to prevent the plant growth. Phosphorus fertilizer will help, but it cannot fully restore such badly eroded fields as this.
Here's a close-up of a “birdsfoot” plant. It gets its name from the seed pods shaped like birds’ feet.

**BIRDSFOOT** trefoil shows considerable promise as a perennial pasture legume for use in southern Iowa. Small plot and field plantings we have made show that it thrives growing with bluegrass. Cattle graze it freely, and when grown with bluegrass the forage production is not only increased but the birdsfoot trefoil, like alfalfa, continues to grow through the summer when bluegrass “takes a nap.”

Birdsfoot trefoil (Lotus corniculatus L.) is a long-lived, winter-hardy perennial with a branching, tap-like root system, with many stems growing from each crown. The plants form a thick carpet effect when grown alone. The stems, in comparison with alfalfa, are more slender and are inclined to lodge but may reach a height of 12 to 36 inches when supported by such grasses as timothy, redtop and orchard grass. The plants produce many yellow, pea-like flowers from late June through July. When ripe, the seed pods extend outward at right angles from the stalk, giving the appearance of a bird’s foot.

Like other legumes in common use, birdsfoot trefoil came from abroad. It is native to the Mediterranean region and northward to the Scandinavian peninsula. Birdsfoot trefoil has become naturalized by MAURICE E. HEATH and H. D. HUGHES (growing wild) in several parts of the United States, notably western Oregon and eastern New York.

It is not definitely known just how or when it was introduced into this country, but it is known to have been here more than 65 years. It did not attract much attention as a forage legume, however, until the last 10 years.

There are two types of birdsfoot trefoil, commonly referred to as the “narrow-leaf” and “broad-leaf” strains. Observations during the last 6 years show that the broad-leaf type is the more desirable for Iowa. It is superior in winter hardiness and its forage yields are nearly double those of the narrow-leaf variety. Our results obtained thus far indicate that birdsfoot trefoil will not compete with alfalfa as a hay crop.

**Establishing Stands**

Although stands of birdsfoot trefoil have been obtained on untreated soils low in fertility, it responds markedly to limestone and phosphate fertilizer in stand establishment and forage yields.

Small plot and field plantings show that birdsfoot trefoil makes its greatest contribution to Iowa farms as a pasture legume when grown with bluegrass. It is more sensitive to competition from bluegrass during establishment than the common legumes such as red and sweet clover. When seeded in a bluegrass pasture it is very important to thoroughly work up the bluegrass sod with a disk or spring-tooth harrow.

Following seeding operations, the seedbed should be rolled with
a cultipacker to firm and cover. On bluegrass pastures that have been limed, phosphated and thoroughly renovated, we have obtained from 3 to 9 plants of birdsfoot trefoil per square foot from a seeding rate of 6 pounds per acre. It has been observed to mature and shatter seed when pastured. When a thin stand is obtained, it can be expected to improve by its own reseeding.

The seed of birdsfoot trefoil is small and round and intermediate in size between that of red and alsike clovers. There are approximately 375,000 seeds per pound and the seed weighs 60 pounds per bushel. The hard seed content commonly is found to be as high as 50 percent. The seed should be inoculated prior to sowing. The inoculant used for other common legumes is not satisfactory. Special cultures have been isolated and are now available from various commercial concerns, or soil from around well nodulated plants may be used with good results.

Seed Production Problem

One of the problems encountered with this species has been that of seed production. The amount of seed produced here at Ames has been very small. Our observations in southern Iowa indicate that a much greater quantity of seed may be expected there. At the present time, seed of birdsfoot trefoil is very expensive. It ranges in price from $1.50 to as much as $2.00 per pound. A very poor commercial seed crop was produced in 1943.

Before birdsfoot trefoil can be generally recommended to Iowa farmers as a pasture legume, we believe that a greater number of trial plantings should be made on farms to observe its performance on many soil types and under actual grazing conditions. Within the last 2 years field plantings have been made in each of 10 counties well distributed across southern Iowa. Additional experience and observations will be obtained from these plantings as to the best methods of handling this legume when a crop of seed is to be harvested. In the meantime, birdsfoot trefoil will continue to remain on the list of promising new legumes for pasture purposes in Iowa.

Iowa Growers

Those who are interested in seeing this new legume growing will find plantings on farms operated by the following Iowa farmers: Elmer Nollen, Pella; Raymond Levis, Russell; Chester Sutton, Derby; Joseph Templeton, Otley; Delbert Mayberry, Anamosa; A. J. Johnson, Elkader; Julius Lynch, Harlan; Sam Taylor, Toledo; Ralph Chase, Decatur; Merle Travis, Bedford; H. C. Flint, Winterset; and Herbert Barrow, Keosauqua.

We have had this pasture legume under observation at Ames through a period of nearly 10 years. Since 1942 we have been watching it under pasture conditions on the college Pasture Improvement Farm near Albia. Here it has spread and thickened under the most unfavorable conditions both as to soil and grazing management. This year we are establishing two new birdsfoot trefoil pastures. Our respect for this pasture legume increases each year.
By MARGARET W. MAHLER

... They Performed Satisfactorily

Margaret Mahler with war model cooker (left) and the aluminum (right).

WHAT ABOUT these new wartime pressure cookers? Will they perform the big and important task of preserving food from the Victory gardens as satisfactorily as did the prewar models of cast aluminum?

We have been looking into those questions here at the Iowa Station and our answer, in general, is that the war model will do just as good a job—perhaps even better—than the old models.

The familiar cast-aluminum pressure cooker, which was one of the standbys when canning time came, has been another of the casualties of the war. The manufacturers met the challenge, however, by putting on the market the war model pressure cookers which are made of steel, covered with porcelain.

Because these war model canners do not look like the prewar pressure cookers and because they have a different method of indicating the pressure, folks have wondered about their reliability. To determine the answer, we checked one of these pressure cookers in the Household Equipment Laboratory at Iowa State College.

How New and Old Differ

This cooker differs from the prewar model in the method by which the lid is clamped to the kettle and in the type of pressure indication. Instead of using the clamps which screw down on the lid and hold it in place, there are notched projections around the edge of the lid which interlock with similar projections on the kettle. Turning the lid a short distance is all that's needed to fit it in place, and a rubber gasket completes the seal.

In place of the usual pressure gauge, a set of weights is placed over the petcock. A single weight is used if 5 pounds pressure is needed, two weights for 10 pounds and three weights for 15 pounds. The desired pressure is indicated when the weight—or weights—rotate, due to the steam escaping through a series of holes at the top of the weight. We checked the temperatures obtained at each of the pressure settings and found them to be very accurate. This accuracy might well be maintained from year to year since there are no gears or levers—such as those in most pressure gauges—to get out of order.

Since steam must escape during the entire cooking process in this victory model, folks have wondered, "Would there be a possibility of liquid being drawn out of the jars?" There was also the possibility that perhaps the jar or jars directly under the petcock from which the steam was escaping would lose more liquid than the other jars.

Test With Carrots

These questions on the performance of the new canner were checked by canning carrots in quart jars. At the same time similar jars of carrots were processed in one of the prewar cast-aluminum pressure cookers. Three different types of lids were used—the metal self-sealing tops, the glass tops which are held in place with the metal bands that screw down over the glass, and the zinc, one-piece screw lids. In each case, the lids were used as directed by the manufacturer.

The loss of water from the jars
of processed food was checked in two different ways—the weight of the liquid that was lost and the difference in the level of the liquid before and after processing. The first method—that of checking the weights—is probably more accurate since several factors might influence the level of the liquid besides the actual amount lost. These uncontrollable factors would include: the amount of water taken up by the carrots, the number of carrots in the jar, and the temperature of the liquid and carrots when the jars were packed.

Lids Make More Difference

The results show that there is very little difference in the performance of the two canners. There is more variation between the different types of lids. In every case there was less liquid lost from the jars which had been processed in the war model canner than from those jars processed in the aluminum pressure cooker.

The difference in the amount of liquid that was lost shows up more definitely when the weights of liquid are compared than when the difference in the level of the liquid within the jar is considered. The position of the jar within the cooker seemed to have no effect upon the quantity of liquid that was lost. The accompanying table summarizes the results of the checks on canning. The figures in the table are those obtained by averaging the results of three runs.

In actual operation, the war model pressure cooker had one definite advantage over the prewar model. There was no chance that all of the air might not be exhausted from the kettle before the petcock was closed. In the prewar models, the air had to be carefully exhausted in order to be sure that the temperatures indicated by the pressure gauge were accurate. This exhausting is done by following the directions that come with the cooker which say to allow a steady stream of steam to escape for 5 to 7 minutes before closing the petcock. In the war model pressure cooker, steam escapes during the entire processing period. Consequently the air would always be exhausted and you can be sure that the food is being processed at the desired temperature.

These results indicate that foods can be canned just as successfully with the war models of pressure cookers as with the prewar models. Consequently, there should be no loss of those Victory garden products because of a lack of prewar pressure cookers. If the directions which the manufacturer sends with each cooker are followed carefully, it is possible to have those thrifty and patriotic shelves full of vegetables from your garden, regardless of the model of your pressure cooker.
Survey Among Farmers of Webster County Shows How Much It's Cutting Production

By M. B. RUSSELL and B. J. FIRKINS

Farmers in north central Iowa have had severe crop losses the last few years because of poor drainage. How much loss?

From a survey which we made in one county of this Clarion-Webster soil area, it appears that poor drainage cost the farmers of Webster County about 400,000 bushels of corn in 1943, 20,000 bushels of soybeans and 50,000 bushels of oats. Losses were probably similar in other counties of this area.

To arrive at these estimates we visited 110 farmers in Webster County last February and obtained their estimates of the damage to 1943 crops as a result of inadequate drainage. The 110 represented approximately 5 percent of the farms in Webster County.

Farmers were selected at random from all parts of the county, except those on the rough broken land along the Des Moines River or approximately 12 percent of the area of the county. In compiling estimates for the whole county, we took into account the fact that the area sampled did not include this 12 percent of the county.

From the questions asked in the survey, we found that in 1943 inadequate drainage reduced the corn yield of Webster County by about 400,000 bushels or approximately 4 percent of the total production of 9,500,000 bushels.

Stated another way, this loss amounts to about 3 bushels per acre if equally distributed over the entire 147,000 acres of corn grown in Webster County last year. The total corn loss was equivalent to a complete crop failure on 6,000 acres.

The loss of soybeans from poor drainage, estimated to be 20,000 bushels, is equivalent to a complete crop failure on 1,000 acres, or approximately 2 percent of the total 1943 acreage of the county.

Damage to oats in 1943 was estimated to amount to about 50,000 bushels or about 1 1/4 percent of the total oat production. This loss was equivalent to a complete failure on, roughly, 1,200 acres of oats.

In addition to the damage caused by poor drainage the farmers recognized additional loss caused by the "alkali" rims around the poorly drained pockets. Crop damage arising from "alkali" injury was not included in the totals reported in the survey.

Of the 110 farms studied, 71 were listed by the farmers as being 100 percent drained (either artificially or naturally). When the amount of damage to the corn crop was tabulated for these 71 farms and for the remaining 39 that indicated incomplete drainage, it was found that although the extent of damage was higher on the incompletely drained farms, considerable crop loss occurred on farms that were classified as "completely" drained.

<table>
<thead>
<tr>
<th>PERCENTAGE OF CORN CROP LOST WITH &quot;COMPLETE&quot; AND &quot;INCOMPLETE&quot; DRAINAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of corn crop lost</td>
</tr>
<tr>
<td>No loss</td>
</tr>
<tr>
<td>0 to 5%</td>
</tr>
<tr>
<td>5 to 10%</td>
</tr>
<tr>
<td>10 to 15%</td>
</tr>
<tr>
<td>15 to 30%</td>
</tr>
<tr>
<td>Total number of farms</td>
</tr>
</tbody>
</table>
The fact that 20 percent of the farms listed as completely drained suffered greater than a 5 percent loss in corn production indicates that the drainage system was not working properly or that the system was inadequate. On many of the farms that were classified as 100 percent drained, the farmers said there was need for additional laterals in certain fields.

### Pockets Are Problem

Small areas of low-lying land or "pockets" that are surrounded by higher ground were listed as one of the most important causes of inadequate drainage. The farmers interviewed attributed 30 percent of the crop damage to this cause alone. Some of these areas are so small and are surrounded by such high ridges that it is often impractical to run a tile line to them. A large number of such "pockets" can be economically drained, however, and many farmers are planning to run tile lines into these pockets as soon as tile lines are available.

In many cases tile lines actually run through these areas but fail to remove the water rapidly enough to prevent serious crop injury. The failure of the existing tile line may be due to broken or plugged tile or to the "sealing-over" of the soil over the tile line. This latter condition results from the destruction of the granular or crumb structure of the surface soil and is caused by (1) the loss of active organic matter that occurs under intensive rotations lacking legume and grass crops and (2) the working of the soil when it is too wet.

Working of soil when too wet probably occurs more frequently than farmers realize since their farming operations are governed by the condition of the field as a whole and not by these small pockets. Consequently, there is the tendency to "mud-through" these small wet areas at the same time that the rest of the field is being worked. Such a practice sets up a vicious cycle since each time the soil is worked when too wet decreases its "drainability" with the result that it dries out even more slowly and is therefore worked a little wetter next time and so on.

Because these pockets receive a considerable amount of surface water from the surrounding higher ground, the demands on the tile that drains the pocket are much greater than on an area of level land of equal size. One solution to this problem is to install surface intakes at the low point in the area; this will allow the large volume of surface water to enter the tile quickly and thus be removed before the crop is damaged. It was evident from the survey that farms which had properly functioning intakes were having less crop damage in the low-lying pockets.

### 13,000 Acres Idle

We estimated from the data collected in this survey that there were approximately 13,000 acres of crop land in Webster County that were not used in 1943 because of inadequate drainage. Three-fourths of this or about 10,000 acres actually need drainage; the remaining one-fourth is adequately drained but is not being cropped because the farmer can't get to it owing to adjoining undrained areas.

Two or three feet below this wooden bulkhead is the opening of a tile system on one Webster County farm. The first necessity of a properly working tile system is an adequate outlet and this means that it should never be submerged in water if it is to carry the water away from the fields at a rapid rate. In the interview farmers seldom mentioned the lack of a good outlet as a fault of their drainage system, but a study formerly made in Webster County showed many of the outlets to be poor.
Above are a few of the steers of Lot V, one of the four to get a full feed of corn during the 175 days on feed. Their margin topped all lots.

In our cattle feeding experiments this year, which ended the first of June, we followed up our tests of the past 2 years in which we were trying to find out whether it pays to chop hay for fattening steers and whether limited grain feeding with good quality steers would pay during this war period. There were other questions too that we wanted to answer if possible such as: In chopping hay for steers, should it be coarse or fine? How long a period should good quality yearling steers be fed?

The tests with six lots of eight steers each gave us these answers:
1. You can produce pretty acceptable beef with corn silage and a limited feeding of corn.
2. There is no advantage from the standpoint of gains to chop hay for fattening steers. We conclude that if you can put up your hay to advantage by chopping it, then go ahead and chop, but chopping hay won't increase its value for fattening cattle.
3. Cattle seem to prefer hay that is not chopped too fine.
4. This year with the prices we used, it paid to feed good quality steers for 6 months rather than to sell them after 4 or 5 months of feeding—the margin per steer was larger after 6 months of feeding. But a part of this larger margin was due to an increase of about $1.00 per hundred in the price of fat cattle.

The experiment was divided into two main parts—(1) whole hay compared with chopped hay and (2) a full feed of silage and shelled corn, as compared with a full feed of silage and limited feeding of shelled corn to 45 and 90 days of the 175 days of feeding.

Limiting Grain

Some people have suggested that with limited feed supplies and the unusual need for meat, it is not good procedure to put feed into feeder cattle. In other words, they would slaughter the feeder cattle direct. In order to get some information on the yields and grades of beef from feeder steers, we sent five representative steers to the Iowa Packing Co., Des Moines, and had them slaughtered just as the other steers were going on feed.

Of these five steers, four graded commercial and one utility. The dressing percentage ranged from just under 53 percent to not quite 55 percent. The steers sold for $10.70 per hundred. They averaged nearly 700 pounds on foot. The selling price was under their actual cost, so it was not profitable.

Lots I, II and III in our feeding tests were fed and handled exactly the same except for the shelled corn. Lot I was full-fed shelled corn for only the last 45 days on feed; Lot II was full-fed shelled corn for the last 90 days and Lot III was full-fed shelled corn from the start. In addition to corn, these three lots all were full-fed corn silage from the start, and had daily allowances per steer of 1 pound of alfalfa hay, 1½ pounds of linseed meal, 1 ounce of mineral mixture and block salt self-fed.

For the first 90 days of the test, the two lots of steers which had silage alone gained an average of 2.21 and 2.06 pounds per day, while those full-fed shelled corn with silage from the start averaged 2.77 pounds per day. After 120 days of feeding, those limited in corn to 30 days and the steers that had received no corn averaged 2.16 and 2.02 pounds per steer daily; those on full feed of corn averaged 2.73.

At the end of 5 months—150 days—the limited grain steers averaged 2.05 and 2.02 and those on full feed 2.52 pounds per day. After 175 days, those full-fed corn 40 and 85 days averaged 1.96 pounds per steer daily and those...
full-fed corn for the entire period 2.36.

But margins may be of more interest than rate of gain. At the end of 4 months (120 days) of feeding, the Lot I steers which had received no shelled corn showed an estimated margin over feed cost, crediting feed saved by the hogs, of $9.93; those which had been full-fed corn for 30 days had an estimated margin of $7.94 and those full-fed corn from the beginning of the experiment $13.14. After 5 months on feed the estimated margins were $14.95 for Lot I (this lot had been on full feed of corn only 15 days); Lot II, $10.11 (full feed of corn for 60 days); and Lot III, $14.73.

When the steers were sold at the end of the 6 months' feeding period, the actual margins per steer over feed cost, crediting feed saved by the hogs, for the three lots were: Lot I, $16.40 (this lot had a full feed of corn for 45 days); Lot II, $18.66 (full-fed corn 90 days); Lot III, $23.83 (full-fed corn for 6 months).

Steers Too Good?

Some of the feeders have expressed the belief, and we agree, that probably limited grain feeding might prove more profitable with cheaper cattle—that the steers we used this year were of too good quality to make limited grain feeding profitable.

One of the possibilities we are considering for our tests of the coming year is to compare cattle of different quality and price on limited grain rations.

With the outlook for a smaller corn crop and possibly some soft corn, the work of this year should point the way to use this corn profitably. The silage-fed cattle all showed a profit, and even those full-fed corn only 45 days of the 6 months when sold graded 3 good and 5 choice; those full-fed corn 90 days graded 2 good and 6 choice, while all of the steers full-fed corn from the beginning graded choice, or double A.

These results indicate that corn silage with only a small amount of corn, in addition, will produce pretty acceptable beef.

Chopped Hay Tests

This is the third year that comparisons have been made between steers on regular or whole alfalfa hay and chopped hay. The first year the steers on chopped hay showed the larger margin. The second year the results were reversed and those fed the long hay showed the larger margin. This year, there was practically no difference between the steers on chopped and regular hay.

Our conclusion is that there is no advantage from the standpoint of the steers in chopping hay.

<table>
<thead>
<tr>
<th>Lot I</th>
<th>Lot II</th>
<th>Lot III</th>
<th>Lot IV</th>
<th>Lot V Chopped</th>
<th>Lot VI Chopped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn silage</td>
<td>Corn silage</td>
<td>Corn silage</td>
<td>Alfalfa hay</td>
<td>Alfalfa hay</td>
<td>Alfalfa hay</td>
</tr>
<tr>
<td>Sh. corn</td>
<td>Sh. corn</td>
<td>Sh. corn</td>
<td>Sh. corn</td>
<td>Sh. corn</td>
<td>Sh. corn</td>
</tr>
<tr>
<td>40 days</td>
<td>85 days</td>
<td>90 days</td>
<td>30 days</td>
<td>45 days</td>
<td>60 days</td>
</tr>
<tr>
<td>Feeding period:</td>
<td>120 days</td>
<td>180 days</td>
<td>180 days</td>
<td>90 days</td>
<td>120 days</td>
</tr>
<tr>
<td>Av. daily gain</td>
<td>1.96</td>
<td>1.96</td>
<td>2.36</td>
<td>2.35</td>
<td>2.40</td>
</tr>
<tr>
<td>Feed cost 100 lbs. gain, crediting feed saved by hogs</td>
<td>$12.87</td>
<td>$13.91</td>
<td>$13.55</td>
<td>$14.20</td>
<td>$13.25</td>
</tr>
<tr>
<td>Selling price, Des Moines</td>
<td>$15.25</td>
<td>$15.65</td>
<td>$15.90</td>
<td>$16.40</td>
<td>$16.25</td>
</tr>
<tr>
<td>Margin per steer over feed cost, crediting feed saved by hogs</td>
<td>$18.40</td>
<td>$18.66</td>
<td>$23.33</td>
<td>$26.15</td>
<td>$31.38</td>
</tr>
<tr>
<td>Dressing percentage</td>
<td>60.6</td>
<td>61.1</td>
<td>63.1</td>
<td>63.7</td>
<td>62.3</td>
</tr>
<tr>
<td>Grade of steers</td>
<td>3 good 2 good 3 choice 7 choice</td>
<td>5 choice 6 choice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*One steer was taken out of Lot III before the end of the experiment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The steers of Lot I (above) received corn only 45 days of the 175 they were on feed, but with silage, full-fed, they made satisfactory beef.

It may be advantageous from the standpoint of putting up the hay to chop it. If so, then it will be satisfactory for fattening steers. In our trials we have observed that the steers seem to prefer hay that is not chopped too fine. This year the coarser-chopped hay was that which was chopped in the field with a forage harvester. One lot of steers was fed on this and a similar lot got hay chopped and blown into the barn with an ensilage cutter having a hay cutter attachment.

If hay is cut with an ensilage cutter it will not be too fine. If it is ground too fine, it won't be satisfactory. Steers do not like finely ground hay.

There were three lots this year which got no silage but hay, a full feed of corn for the entire 6 months, 1 pound of linseed meal per steer daily, mineral mixture at the rate of 0.75 ounce per steer daily, block salt self-fed. Lot IV had whole hay, Lot V hay chopped with forage harvester in the field and Lot VI hay chopped at the barn with ensilage cutter. These three lots showed the largest margins per steer over feed cost of the six in the experiment.

The accompanying table shows some of the main results of the cattle feeding experiments of the past year.

The California Experiment Station has recently reported that they have had some trouble with cows bloating on chopped alfalfa hay, but no bloating on long hay.
They Should Have the Best Feed, Care, Housing That Are Available

By JOSEPH W. KELLY

7. Feed abundantly a ration that is “built” to produce eggs. It does not pay to make your hens and pullets roam over the farm and “hunt” their feed.

The Feeding System

Various systems and all kinds of rations are used in feeding birds for egg production. These include:

1. All-mash,
2. Grain feeding,
3. Mash and grain,
4. Cafeteria or free-choice,
5. Moist mash,
6. Pellets and various combinations of these systems.

The system used most commonly is probably the mash and grain method. An 18 or 20-percent protein mash is kept before the pullets constantly. The birds are given about as much grain in the late afternoon as they will clean up. Usually they will eat about equal parts of mash and grain.

Another system that is popular with Iowa farm people is the free-

Pullets need plenty of feeder space as well as a good ration to produce eggs at a good rate. Have at least two 8-foot feeders for each 100 pullets.

IT IS GOING to take a lot of careful planning, good care and management to make our laying flocks pay for the scarce and valuable feed and labor of the coming year.

Most poultry keepers are aware of this, but just what can one do to help the situation? Here are a few suggestions we have to offer:

1. Keep only pullets unless you are a breeder and have unusually valuable old hens. Pullets will lay more eggs and the death loss will be lower—if they are good pullets that have been well cared for.

2. Cull strictly several times a year. That culling may well begin now, getting rid of the old hens as rapidly as possible so that they are all gone well in advance of the time the pullets start laying.

3. Put the house in the best possible shape, and insulate it if possible—a straw loft will result in a warmer house in winter and a cooler one in summer.

4. Give your laying house a thorough cleaning and disinfecting before the new pullet flock goes into it.

5. Make sure you have plenty of feeder space. There should be two 8-foot feeders, permitting the pullets to feed from both sides, for each 100 birds.

6. Don’t neglect the watering. One hundred layers will drink between 5 and 6 gallons of water daily.

SUGGESTED WARTIME LAYING MASHES

<table>
<thead>
<tr>
<th>18 Percent protein</th>
<th>26 Percent protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>95 lbs.</td>
<td>Ground yellow corn</td>
</tr>
<tr>
<td>75 lbs.</td>
<td>Pulverized oats or barley</td>
</tr>
<tr>
<td>90 lbs.</td>
<td>Ground wheat (or wheat bran or middlings)</td>
</tr>
<tr>
<td>50 lbs.</td>
<td>Alfalfa meal (17% protein)</td>
</tr>
<tr>
<td>10 lbs.</td>
<td>Dried milk</td>
</tr>
<tr>
<td>15 lbs.</td>
<td>Soybean oil meal</td>
</tr>
<tr>
<td>20 lbs.</td>
<td>Corn gluten meal</td>
</tr>
<tr>
<td>25 lbs.</td>
<td>Oyster shell or limestone flour (95% calcium carbonate)</td>
</tr>
<tr>
<td>40 lbs.</td>
<td>Steamed bone meal **</td>
</tr>
<tr>
<td>10 lbs.</td>
<td>Fine salt</td>
</tr>
<tr>
<td>2 lbs.</td>
<td>Feeding oil*</td>
</tr>
<tr>
<td>1 oz.</td>
<td>Manganese sulfate</td>
</tr>
<tr>
<td></td>
<td>502 lbs.</td>
</tr>
</tbody>
</table>

1. Feed approximately equal parts of whole grains (shelled yellow corn and oats or wheat) and mash when the 18-percent protein mash is used.

2. Self-feed grains with the 26-percent protein concentrate.

3. The amount of vitamin A and D feeding oil included in these mash is based on an oil containing 400 A.O.A.C. chick units of vitamin D and 1,000 international units of vitamin A per gram. Feeding oils containing more or less of these vitamins per gram should be adjusted accordingly.

4. Steamed bone meal can be replaced with rock phosphate or other suitable calcium and phosphorus materials containing less than 1 percent of fluorine.
choice method. With this system one keeps before the birds all of the time a 26 to 32-percent protein concentrate in a separate compartment of a feed hopper and grain in other compartments. This system allows the birds to satisfy their individual appetites. Some will eat more grain and less mash than others.

The free-choice method of feeding has the advantages of reducing the amount of labor and of keeping feed continually before the birds. Late or early chores will make no difference. Furthermore, the birds will eat more whole grain, thereby tending to reduce feed cost. The pullets will consume about one part of a 26-percent protein mash to three of grain. The total protein intake with either system of feeding will probably vary between 14 and 16 percent.

For good egg production, a well-balanced laying ration is indispensable. Ordinarily 20 to 40 percent of the total protein is derived from animal sources—dried milk, meat scraps, meat and bone meal—but because of the war, our laying rations now contain only from 1.12 to 2.25 percent, and the rest is made up from vegetable sources. It is important, then, to supplement the laying rations with proteins, minerals and vitamins obtained from tender, green feed whenever possible.

During this wartime period we have continually found it necessary to keep adjusting the laying rations to use the feeds available. The laying rations which we are suggesting now are shown in the accompanying table. We have listed both an 18-percent protein mash and a 26-percent protein concentrate.

The mash suggested are planned for egg production—not for breeding flocks.

Make Room for Pullets

Some of our poultrymen this year will probably be facing the problem of housing their early hatched pullets with only one laying house available and that being used by hens that are still laying. If pullets are left on the range until they start laying, they may undergo a partial molt and stop laying when they are transferred to the laying house.

Now if you are going to depend on your pullets for eggs during the coming year and are going to sell your old hens, then you had better move the hens out of the laying house in time to get it cleaned up and ready for the pullets. These old hens that are still laying may be transferred to range shelters or to some cheap shelter that can be fixed with roosts, nests and space for the feeders and water containers.

It seems far wiser to take a chance of throwing these old hens out of production than to leave the pullets out too long with the possibility of throwing them into a molt by moving them after they have started laying. Most of the old hens are probably close to the end of their laying period and will be marketed anyway.

About 2 weeks before the pullets are brought in to the laying house, shift them from growing mash to the laying mash which they will be fed when they are housed. It's enough of a change to move the birds without making them adjust themselves to a new mash. This shift to a laying mash while still on the range is just one more precaution against forcing the pullets into a molt.

By the time the pullets are into heavy production, most of the hens will have stopped laying and can be on the market.

The only poultryman who ordinarily can afford to keep yearling or older hens in addition to pullets is the man who is producing hatching eggs—the breeder.

Put your time and energy and valuable feed into the pullets—they are the revenue-producers.

A Discussion of Why Food Spoils, Jars Break, Explode or Lose Too Much Liquid

O NE OF THE REASONS women have difficulty with the spoiling of canned fruits and vegetables is that they fail to get proper seals on the jars. This was revealed in the survey which was made last fall by the Iowa State Nutrition Council and Iowa State College. This survey was reviewed in the April issue of Farm Science Reporter.

From our observations here at the Iowa Station and from facts gathered elsewhere, we are presenting here the best information that we have concerning this problem and others in canning.

Spoilage—Self-Sealing Lids

A great deal of spoilage, as revealed in the survey, occurred when a certain brand of self-sealing lids was used. Other brands of self-sealing lids also entered into the picture. Whether certain self-sealing lids were actually inferior or whether merely more of them were available on the market remains a question. Very likely more were available at retail stores.

Why should self-sealing jar lids cause so much spoilage?

Perhaps many women in their desire to do the canning job well, did not read carefully the new specific directions for this type of lid and, instead, followed the habits formed in previous years.
The self-sealing cap consists of a flat metal lid held in place with a screw band. Rubber compound “put” on the underside of the metal lid takes the place of a separate rubber ring. The “right adjustment” is to screw it down completely and firmly, but without doing a vise-like job. There is enough “give” in this cap to allow steam to escape during canning. When the canning process is finished, this type of jar cap should not be touched to make it “tighter.” Any attempt to tighten at this time may break the seal.

The amount of rubber compound on the self-sealing jar cap must no doubt be less than in previous years. This fact necessitates a thorough examination of the jars to be used. Since the seal takes place at the top of the jar rim, this rim must be smooth and flawless — without nicks or “bumps.” The less rubber compound on the jar lid, the more important it is for the jar rim to be flawless. One should examine the jars beforehand and eliminate all of those that are unfit for use with the self-sealing lid. These same jars, however, may be usable with another type of jar cap.

Excess water loss in canning will cause small particles of food to get under the rubber compound of the self-sealing lid. As a result, the lids may loosen.

Explosions and Breakage

Canning explosions have frequently occurred when three-piece lids have been used. The three-piece cap consists of a metal screw band, a glass lid and a separate rubber ring. When the jar is filled, put the lid on the jar, rubber side down. Screw the metal band on firmly; then turn back one-quarter turn. This type of jar closure should never be sealed tight before processing. There must be some way for steam and air to escape. The three-piece cap requires a looser adjustment than any other type. When the canning process is finished, the screw band should be tightened to complete the seal. This is especially important in oven canning.

Lack of head space at the top of a jar—filling the jar too full—may also cause an explosion. Solid food should be put into a jar, covered with a good proportion of liquid and proper head space left at the top of the jar for the food to expand. Starchy corn, peas and beans may need 1 inch of head space. For other vegetables and fruits ½ inch is sufficient. As this space gets smaller due to expansion of the food, the pressure increases proportionately.

The filling temperature also affects the size of the head space. The cooler the food is at the time of filling, the less head space there will be later.

Sudden cooling of jars may cause breakage and even explosions. Slow cooling, such as leaving the jar in the pressure cooker for a while, will prevent some bad accidents. When the jar is cooled too quickly, too great a difference in pressure between the outside and inside of the jar will result in bursting of the jar if the seal is quite tight.

Explosions have occurred where women have held over jars which had been packed hot and would not go into the pressure cooker because it already was filled to capacity. Later, these jars were placed in the cooker and processed. Undoubtedly, they had sealed themselves while waiting.

Explosions can also be prevented by slow release of pressure when pressure cookers are used.

Square jars are more likely to break during processing than round ones. The forces resulting from pressure within the jar tend to make a square one want to bulge at the sides. In glass jars this might mean breakage.

Loss of Liquid

Loss of liquid in the jar depends upon several factors. In the pressure cooker it is generally believed that liquid is lost because the pressure exerted by the vapor in the jars is at some time greater than in the cooker. There are two times during processing when the two pressures may not be equal, if the pressure cooker cools rapidly or if the pressure fluctuates while processing.

Loss of liquid is greater the smaller the head space. Also, more liquid would escape if the jars were filled at a low temperature rather than a high one, for expansion would be greater.

In the pressure cooker the seal is also a factor in water loss. It has been found that the amount of liquid lost is much less when a tight seal rather than a loose seal is used. The largest proportion of liquid is lost in pressure cooker processing when the pressure is released at the end of the processing period. The shorter the period of steam escape, the greater the loss of liquid from the jar. It is advisable to release the pressure slowly, taking from 8 to 10 minutes to do so.

Three-Piece Cap

With the 3-piece cap it is essential that the adjustment of the lid be not too tight because of the danger of explosions or breakage.

Two-Piece Cap

The 2-piece lid should be screwed down fairly tight, but do not attempt to tighten it after the jar has been processed, because of the danger of breaking the self-seal.