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Handling Hot Soils

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High-Lime Spots Can Be Improved by Sweet Clover, Drainage and Applying Fertilizers

IOWA’S high-lime or so-called alkali soils, which are a problem on many farms in 31 counties in the central part of northern Iowa, will produce as well as the other soils of the farm if they are handled right.

This is the conclusion we have reached at Iowa State College after more than 15 years of experimenting by the Iowa Station and numerous demonstrations conducted by the Extension Service and county agents, combined with the experience of many farmers.

Here are the steps you need to take if you have high-lime soils (These high-lime areas are commonly referred to by farmers as “alkali” or “hot” because of the burning effects crops show which grow on them.):

1. Make sure the ground is thoroughly drained. The tile must be adequate and have good outlets.
2. Grow sweet clover in a short rotation (such as corn, oats, clover) and allow the sweet clover to stand through the second season so that its deep roots can open up the soil and allow some of the excess lime to work out. (Another thing the sweet clover will do—it seems able to get the potash out of high-lime soils much better than other crops and will thus make more of it available to other crops which follow.)
3. Use potash or a phosphate-potash fertilizer on the land.

Here are our recommendations for applying fertilizers to these soils for various crops:

**Corn:**
- If the soil in more than half the field is very alkaline, apply 0-20-20 or 0-9-27 over the entire field at corn planting time with a fertilizer attachment on the corn planter at the rate of 100 to 125 pounds per acre, or you can broadcast 200 pounds per acre before planting.
- If the soil in more than half the field is slightly alkaline, then substitute 0-20-10 for 0-20-20.

If less than half of the field consists of small, high-lime areas, we recommend the following methods:

1. Apply 100 pounds of 0-0-50 per acre with cultivator or planter attachment on the high-lime spots, or
2. Broadcast 200 pounds of muriate of potash (0-0-50) per acre on the high-lime spots.

In addition it may be desirable on some fields where 0-0-50 is applied on the high-lime spots to apply 0-20-10 over the entire field at 100 pounds per acre with planter attachment.

**Small grain, soybeans, legumes:**
- Where less than half the field is alkaline, broadcast 0-0-50 on high-lime spots or areas at the rate of 200 pounds per acre, or 0-9-27 at the rate of 350 pounds per acre.
- If more than half of the field is alkaline, broadcast over the entire field 100 pounds of 0-0-50 per acre, or about 200 to 250 pounds of 0-20-20 or 0-9-27 per acre.

The problem of making these high-lime soils productive is more or less a continuous one. That is, tiling and growing sweet clover on the land 1 year does not solve the problem for all time. Applying potash or a combination of phosphate-potash fertilizer, in addition to drainage and growing sweet clover, will not bring about a final solution. The tile and the sweet clover are to some degree a permanent treatment because they help to get rid of some of the excess lime (calcium carbonate, bicarbonate and other salts) in the soil.

For corn it is essential to apply the fertilizer every year and with small grain or legumes every 2 or 3 years.
the soils do not show a deficiency of total potash. But when we have applied potash, it has greatly improved certain crops. So we have concluded that in some way the excess lime in the soil locks up the potash so that it is not readily available to the ordinary growing crops. That apparently is what happened to part of the potash when we applied 1,000 pounds to the acre. Most of that not used the first year became locked up and not readily available to the following crops.

Therefore, until you can get some of these excess lime salts out of the soil through drainage and growing of such deep-rooted crops as sweet clover, you need to apply potash fertilizer in order to get good crop yields. In some instances, especially on mucky, high-lime soils, our tests and demonstrations have shown that a combination of phosphate and potash will give better results than potash alone.

Crops Best Test

How is one to know whether he has an “alkali”—high-lime—spot or area on his farm? There is a test that will tell whether the land is high in lime. Your county agent can make such a test, but it will only be an indication. If you want to know just how heavy the lime concentration is—how “hot” your soil is—your county agent can send a sample in to the Soils Department at Iowa State College for an analysis.

The real test for these high-lime spots, however, is the way the crops grow on them. Corn on these soils comes up all right, but, soon after, it begins to fire along the edges of the leaves. Many plants die and those that live are stunted and produce chaffy, immature nubbins. Oats and barley seem to grow better than corn, but the heads usually do not fill well and the straw generally is heavy andlodges badly. Alfalfa, red clover, flax and soybeans on these areas are stunted in growth and show some firing. Sweet clover has a somewhat stunted growth, but does much better on these areas than any other crop. The high-lime areas vary in size from a few rods square at the edge of a pond to occasionally several hundred acres which are dotted with high-lime areas of varying degrees of alkalinity. The highest concentration of salts is usually found at the edge of former ponds or depressed areas. Usually you can note a whitish deposit on the surface in the spring or summer. The whitish deposit you see is the excess lime which is causing the trouble. Some of these spots have so much excess lime that 2 1/2 tons of the soil have an acid-neutralizing value as great as 1 ton of good limestone. Usually these soils have plenty of nitrogen. Our tests have shown consistently good results with applications of potash, and sometimes phosphate helps too.

In 1925 the county agent of Hardin County conducted demonstrations in which muriate of potash was broadcast on high-lime soils. His results were good. Later the Iowa Station supervised plots on which potash and phosphate fertilizer, alone and in combination, were applied at varying rates, including the heavy (1,000 pounds per acre) rate. The results with potash on the Station plots the first year or so after application were good, but then the potash apparently became “locked up,” and the crops began to show potash deficiency symptoms even on the plots getting 1,000-pound applications.

Treat Growing Corn

In 1935 the College and some of the county agents applied side dressings of potash fertilizer, 0-0-50, along the corn rows with a garden planter. Plots of this kind were laid out in several northern Iowa counties. We were not in search of a new method of applying the fertilizer, but we wanted to know whether or not you could apply potash profitably after corn started showing potash starvation symptoms. With this garden planter the potash was applied as close to the row as possible and at a depth of 2 1/2 to 3 inches—the approximate depth at which fertilizer would be applied with a cultivator having a fertilizer attachment.

Good results were obtained that year. On some of the plots 3 weeks after treatment the corn had turned back to a normal color, and the firing had disappeared. This work
Still another method of applying fertilizer is to broadcast it with a lime spreader or with an endgate seeder. If an endgate seeder is used, it must be thoroughly cleaned out after you finish. An old tire pump or good stiff brush is useful in cleaning. If the seeder isn’t cleaned the fertilizer is apt to cause corrodine. When the fertilizer is broadcast we find that about twice as much needs to be applied as when it is side-dressed with a fertilizer attachment on a planter or cultivator.

In the accompanying tables are shown some of the results from applying various fertilizers last year with the fertilizer attachments on planters and on cultivators.

### Handling Peat

Through the same area of Iowa in which are found the high-lime soils are also numerous peat and muck soils. These, too, are the result of draining old ponds, swamps and shallow lakes. These soils have shown a definite need for potash and phosphorus fertilizers. After years of demonstrations and experiments on these soils we offer these recommendations for the Iowa peat soils:

1. Be sure they are properly drained by adequate tiling and proper tile outlets.
2. Plow deeply and cultivate well.
3. Use phosphate and potash fertilizer.

On peat and muck soils high in alkalinity, we recommend the following fertilizer applications for various crops:

- **Corn:** Apply 100 to 125 pounds per acre of 0-20-20 fertilizer to the entire field with planter attachment at the time you plant your corn, or broadcast 200 pounds per acre before planting the corn.
- **Small grains, soybeans and legumes:** Broadcast 200 pounds of 0-20-20 previous to seeding.

If the alkalinity is low, substitute 0-20-10 for 0-20-20.

Iowa’s peat and high-lime soils can be made to produce good yields and satisfactory quality crops by proper soil management. Our experiments and demonstrations and experience of many farmers have shown this.

### RESULTS OF FIELD DEMONSTRATIONS ON CORN, 1940

<table>
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<th>Treatment</th>
<th>Yield Bu. per acre</th>
<th>Yield increase Bu. per acre</th>
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<tr>
<td>Check</td>
<td>55.9</td>
<td>10.7</td>
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<tr>
<td>115 lbs. 0-20-10</td>
<td>64.2</td>
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<tr>
<td>Check</td>
<td>56.1</td>
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<tr>
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<td>66.8</td>
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<tr>
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<td>57.5</td>
<td>10.7</td>
</tr>
<tr>
<td>115 lbs. 0-9-27</td>
<td>67.3</td>
<td>10.7</td>
</tr>
</tbody>
</table>

*Average of all plots.

The outlined area is where high-lime soils are found in Iowa. Demonstrations in 1940 with attachment for a cultivator are indicated by an “x” and those for planters with an “o.”

**Top Picture (below):** Results of plots near Mallard in Palo Alto County. Yields of 100 hills of corn are shown in front of the sacks below the signs. Poor quality ears are shown in front of the sacks.

**Middle Picture:** Plots receiving 0-9-27 yielded over twice as much as those receiving no fertilizer or those with a treatment of only phosphate (0-20-0).

**Bottom Picture:** Jim Connely of Dows is between the corn from the 100 hills of no-potash plot and muriate-of-potash (0-0-50) plot side-dressed June 28 after the corn was showing extreme potash starvation—fired and stunted.