of leaves and stalks, hence you must weigh the grain to get the increase. It is absolutely necessary to apply rock phosphate with manure or plow it under with a good covering of grass. It requires the acids formed in the soil by the decaying organic matter to loosen the phosphorous from the rock with which it is bound in order to make it free and available and in shape for plants to use. A good many of our soils in Wisconsin have large amounts of phosphates that are not available but bound up with rock, and while the total amount of necessary phosphate may be there, that may also be a case where the application of phosphate may be necessary.

A Member—Wouldn’t the acid phosphate be better?

Supt. Norgord—I think it probably would. Dr. Thorne found that acid phosphate put in with the manure made a net profit of $4.89 per ton, whereas the rock phosphate with manure paid him a profit of $4.47 per ton.

Supt. Norgord named the following committee on resolutions: Mr. W. S. Dexter and Mr. L. E. Scott.

Recess to 1:30 P. M.

AFTERNOON SESSION, THURSDAY, MARCH 11.

Mr. Geo. McKerrow in the chair.

CO-OPERATIVE DRAINAGE AND DRAINAGE LAWS.

E. R. Jones, College of Agriculture, Madison.

Too often as trivial a thing as a line fence has interfered with both natural and artificial land drainage. For years farmers have contented themselves with a little ditch a foot deep down to the neighbor’s land, when if the two would co-operate they might have a ditch four feet deep across the land of each and benefiting each. A large line of tile would be better still.

Vertical Drains

Sometimes farmers have got tired of waiting for the neighbor below to help them with an outlet and have dug a vertical hole, perhaps 30 feet deep, with a long handled post auger, hoping that the water would run through this opening into the subsoil. The hole is kept open by six-inch tile placed end to end. If the subsoil is coarse and the water it contains is not under pressure, some water will escape in this way. The success of a vertical drain depends more upon the condition in the subsoil than it does on the fancy drain-head at the top of the vertical column of tile that is advertised so widely by the manufacturing company as a cure-all for drainage evils. Sometimes the water moves upward instead of downward in these vertical drains. If a horizontal outlet can be secured without a deep cutting,
the vertical drain is not worthy of serious consideration, unless the neighbor below is stubborn.

**A Large Outlet Benefits All Concerned**

It is seldom that the drain damages the lower land owner. Frequently he objects because he thinks it will damage

resulted, it is usually due to the poor outlet below. I have seen a lower land owner allow his outlet to fill up so that he would have a damage claim against the neighbor above him. He succeeded in drowning himself, but failed to get his neighbor into trouble. I have yet to find a case where it has been proven to a jury that a drain, unaided by other

A Farm Profitably Tiled

*On this 80-acre field three systems of tile drainage were necessary. This shows the advantage with which two neighbors can co-operate in putting in a line of tile. An obstacle so trivial as a line fence should not be permitted to prevent economical drainage. The owner of this land says that tile pays for itself every year and that $200 expended on tile has raised the value of the 80 acres $1,000.*

him. He may be honest but not correctly informed. So long as the drain carries none but the water of the drainage basin, the deepened drain will not carry any more water in a year than did the old shallow one. It may carry it faster at times, but if so it does not have to work so long a time to do the same amount of work. Generally it is better to have a big discharge for a short time and have it over with, than to have a small amount of water bothering all of the time. Where damage has damaging factors, has caused damage below its outlet. Commonly by drying the upper land it causes the absorption of more of the rain water by the upper land, and the run-off is made actually less because of the drain.

**Co-operate with Your Neighbor for Mutual Benefit**

If you cannot agree with your neighbor with whom can you agree? Mr. Brown and Mr. Smith are adjoining land owners. Smith has 10 acres of
marsh that he can drain only by laying a six-inch tile down through 40 rods of Brown's land. But Brown also has a strip of marsh that this tile will benefit. Brown would have to have a line of four-inch tile there anyway and a six-inch tile is all that is needed to carry Smith's water also. A great many of our Smiths and Browns are putting in such drains jointly. Brown pays what

Surface Runs Usually Cheaper and Very Often Better than Capstan Ditches.

Three or more land owners can cooperate with fairness to all by extending this method somewhat. If there is a case where a man is justified in standing out against the construction of a joint drain, it is when his neighbors want to

Figure 9. An Open Ditch with Dredge.
The dredge is of the drag-line type. The ditch is seven feet deep and about 20 feet wide at the top. Such slopes as these made smooth with a garden rake and seeded with grass seed, may be made permanent and attractive. The dredge is moved on rollers worked on a track. Many marshes can be drained only by the co-operation of several land owners in digging such a ditch to carry the water to a sluggish, winding creek.

a four-inch tile would cost and Smith pays for the extra cost of the six-inch tile. If Brown wants to use this line as a main, he, too, would probably need a six-inch tile. In that case an eight-inch tile would be required to serve as an outlet for both. Brown pays for what a six-inch tile would cost and Smith pays for the extra cost of the eight-inch tile. put in a capstan ditch. These ditches are seldom made more than three feet deep, the claims of the contractors notwithstanding. They are dug with a big plow that does not dig deep enough in the high places to drain the low places at all, and it is the low places we want to drain. Near Baraboo, George Carpenter's neighbors let the
capstan ditch men put in a ditch for them, but he stopped them when they came to his land. In place of the ditch, he laid an eight-inch tile up through his marsh four feet deep. Near it he has made a little depression about a foot deep and 10 feet wide with a road grader. He cultivates this surface run just as he does the rest of his field, but it is there to carry off flood water when necessary. Not an inch of his land will be wasted after the system is completed. He wrote me that he was so well pleased with his tile that he would not take a capstan ditch for a gift. On low marshes, about level along sluggish streams, there may not be fall enough for tile. On such marshes I have recommended capstan ditches as a makeshift until the creek is dredged, so that the tile can be laid. Even here a capstan ditch is sometimes a mistake.

The Lamertine Capstan Ditches Failures.

On the Lamertine Marsh in Fond du Lac county, against my advice, they put in a network of these shallow ditches about five years ago, instead of dragging the creek and getting a good outlet for tile. They thought they were draining the marsh. Three-quarters of these ditches have stood full of water ever since they were dug. The farmers blame the marsh, when they should blame themselves for putting in such shallow ditches. The sad attempt at drainage that they have made has left a bad taste in their mouths and will delay thorough drainage perhaps twenty years.

Co-operation in Dredging

By co-operation in dredging a creek two or three miles long, twenty or thirty land owners can get a dredge on the ground that will dig an open ditch for ten cents a cubic yard. If they put it in a piece at a time, the work will have to be done by hand at a higher cost. In Iowa and Illinois they are co-operating in putting in thirty-inch tile in lines several miles in length. In Wisconsin it is safe to say that in any place where a ditch three feet wide at the bottom, six feet deep and fifteen feet wide at the top is large enough, a big tile is cheaper and better. A twelve-inch tile five feet deep, with a sodded surface run over it, will take the place of such an open ditch.

There are several ways of securing the co-operation of a neighbor in the construction of any of these outlet drains. One young fellow who was bottled up by a stubborn neighbor found a happy solution to the problem. Evening after evening the young man pleaded with the more elderly man for the right to dig a ditch across the old man’s land. Then he got interested in the old man’s daughter, and I suppose he began to plead for something else. At any rate, he married the old man’s daughter and they made a family affair of the ditch. The son-in-law not only got permission to dig the ditch, but the father-in-law helped him dig it, and I am told that the bride stood on the bank and cheered them on.

The Town Ditch Law

But all drainage controversies have not been brightened by romance. It has been necessary to enact State drainage laws to prevent one land owner from playing dog-in-the-manger to the extent of preventing the neighbor above him from draining his land. We have both a town ditch law and a drainage district law. Suppose that A can drain his land only by going through B’s land, but B is unwilling to yield. Mr. A can call out the town board. All he has to do is to prepare a petition
addressed to the town board asking for the outlet. Five other land owners anywhere in the town, and not necessarily marsh land owners either, have to sign this petition and it is handed to the town board. They advertise the date of hearing and if it appears that the benefits of the outlet will exceed the damages and cost, the board orders the drain laid out. The lower land owner must not only allow the drain to go through, but if the board decides that it benefits him also, he must pay toward it whatever sum the town board thinks is just.

**Forming a Drainage District**

Unfortunately the action of the town board is frequently governed by petty politics. In such cases, and in all cases where large areas affecting two or more land owners are concerned, the drainage district law is a better law to follow. Here three commissioners appointed by the Circuit judge take the place of the town board. A petition for a drainage district must be signed by the majority of the interested land owners. The form for the petition for drainage districts and also town ditches will be sent upon application to the College of Agriculture.

More than a hundred drainage districts have been organized in Wisconsin and several hundred town ditches have been put in. Over half a million acres have been given an outlet in this way. Most of the drains that have been put in by such co-operation have been open ditches. Recently they are putting in big tile as well as open ditches.

**Distributing the Drainage Tax**

The drainage tax for town ditches and drainage districts is based on the benefits. The benefits are estimated by the town board or drainage commissioners. Suppose that they estimate the present value of the wet land to be twenty dollars an acre, and its value after drainage to be fifty dollars an acre. The benefit is thirty dollars an acre, and if A has fifteen acres of such wet land on a forty the benefits to that forty are four hundred and fifty dollars. Supposing that all of the benefits in a district amount to $30,000.00 and the cost to the work is $10,000.00. This means that the cost is one-third of the benefit and A's tax will be one-third of $450.00 or $150.00.

Good soil adjacent to a deep ditch that was too shallow before the improvement to be tiled, receives a maximum benefit. If the soil is poorer, as if a parcel is farther away from the ditch, or if the ditch adjacent to it is shallow, or if the land is high enough that the dredging of the creek is not necessary for the drainage of that particular tract, the benefit is less. On these bases, drainage taxes in the same district may vary from two to twenty dollars an acre.

It has been argued that all of the land in a drainage basin, even the hilly land, should be taxed for the construction of a ditch in the marsh on the valley bottom. This is wrong, because when the upper land owners bought their land they paid perhaps one hundred dollars an acre for it because of its good drainage. The owner of the marsh land got his land for twenty dollars an acre because it had poor drainage. When you make the upper land owner help pay for draining the lower owner's land, you are making the upper owner pay twice for his drainage. It is good enough an investment for the lower owner to pay twenty-five dollars an acre to make his twenty dollar land worth a hundred dollars an acre. Drainage districts permit the sale of bonds to pay for the drainage. If the land owner so desires, he can have fifteen years in which to pay his drainage tax. This
enables the land to pay for its own

drainage.

**Drainage Convention and Drainage Bulletins**

In December, 1914, over a hundred

Drainage commissioners, engineers and

owners of marsh land had a convention

at Madison and organized the Wiscon-

sin State Drainage Association. They

discussed many subjects related to the

drainage of large marshes. These dis-

cussions are published in pamphlet form

and will be sent to any one upon request.

Bulletin 229 of the Wisconsin Experi-

ment Station will also be sent upon re-

quest. Drainage laws and other details

are discussed more fully in that bulletin

than this paper permits.

**DISCUSSION**

A Member—I have tile emptying into

a ditch that was dug over 20 years ago,

but the neighbor below me has allowed

the ditch to fill up and he has helped to

fill it up with stones. How can I

improve my outlet?

Prof. Jones—Get five other land

owners besides yourself in the town to

petition the town board for a town ditch

as far below you as you need it. If you

are the only one benefited, you will

have to pay for it, but if others are

benefited they also must help pay for it.

The Member—They say that the old
ditch is a town ditch. It is the only

outlet for the flood water from one thou-
sand acres.

Prof. Jones—Even though it is an old
town ditch, the old depths would have
to be established, and it is better to

start with a clean slate and organize a

new town ditch, and see that a record is

made of it in the town clerk’s office and

in 20 years you will not have to depend

on hearsay.

The Member—Can I not stop this

man from filling my ditch on his land?

Prof. Jones—You can recover damage

from him if he stops a running stream

so that it backs on you. He has not the

right to dam such a stream higher than

the surface of the ground or higher than

the bottom of a ditch that has been there

for 20 years or more. But since your

ditch has been gradually filling up, it

is hard to say what its natural depth is.

Furthermore, I believe he has the right
to dam surface water to keep it from

ingering his land. It is hard to say

what is surface water and what is seep-
age water, so it is best not to quibble

over these fine points of law. What you

need is a big tile or a ditch for an out-

let and the best way to get it is to get

the town board to lay it out, so that it

will be protected in the future.

A Member—What form of dredge is
giving the best satisfaction?

Prof. Jones—The floating dredge will
do cheaper work than any other kind,

and for that reason they are useful on

big jobs. Your floating dredge will

start at the upper end and the ditch is

full of water and they cannot see where

they are digging. Unfortunately the

sides are pretty nearly straight and big

chunks are apt to fall in. The prettiest

ditches I have seen were made with the

Austin ditcher, which gives you a slop-
ing out, and that can be seeded to grass,

but these dredges are expensive to

operate. I would rather have June

green grow on the slopes than to have a

lot of weeds. It is better for the ditch

and looks better.

A Member—I think the sooner we
can drain those pot holes the better it

will be for the public health. In the

neighborhood where I come from we

have those pot holes. In just such

places our veterinarians have found

the germ—the living worm that does

as much damage as the lung worm—

both in sheep and cattle—they origi-
nated right in those pot holes.
Prof. Jones—There is no question but what drainage improves the health conditions, and in fact one of the things they have to prove in every district before the court has jurisdiction is that the public health is going to be improved. Mosquitoes cannot find a better breeding place than these pot holes that we have. Down there in Panama, the one thing that made it possible for Americans to build that canal was the draining of the pot holes.

A Member—We have had a drainage case and we have had a decision from two different attorneys. One said as long as we had an outlet to go ahead and drain it. The other man’s attorney claimed that we were taking unnatural water in there.

Prof. Jones—You had plenty of advice, but I am more interested in knowing whether or not the ditch was dug.

The Member—It was.

Prof. Jones—and what was the result; has damage been done down below the outlet?

The Member—The man below me filled it up before it had time to damage him or benefit me.

Prof. Jones—He was acting beyond his rights. If your town ditch was legally laid out he could be prosecuted and held liable for the damage he did to your crops by obstructing your legal outlet.

The Member—The obstruction he put in the ditch damages his land also.

Prof. Jones—Then he is cutting off his nose to spite his face. It is often necessary to organize a town ditch or a drainage district to prevent a stubborn man from drowning his own crops—to help him against his will, in other words.