better employed than in speech-making, therefore, hoping that this meeting will be an agreeable and profitable one to all, I hereby bid you welcome.

RESPONSE TO ADDRESS OF WELCOME.

L. E. SCOTT, Stanley, Wis.

Mr. Mayor, Ladies and Gentlemen:—The pleasure expressed is mutual, and it affords us much pleasure to be with you in this Closing Farmers' Institute.

It is a pleasure to those who live further south and perhaps a revelation to many of them to witness the great development that is going on here in what they have been pleased to term northern Wisconsin, but which, as your mayor says, is really central Wisconsin. We notice, with pleasure, the disposition on the part, not only of your farmers, but of your business men of the city of Marshfield to co-operate with us in this great educational work.

We thank you, as mayor of the city, for these words of welcome, and assure you that we appreciate them, and while we are here we will try to behave ourselves at least, and do the best we can to make this a profitable week.

IMPROVEMENT OF MARSH LAND.

ED. REICHENBACH, County Surveyor, Jefferson, Wis.

The low estimate placed on the average unimproved marsh, owing to the limited amount of its present product, has in recent years revived considerable interest among farmers who are familiar with results obtained from proper drainage and cultivation. And from a financial point of view the real value of land may reasonably be based upon the amount of its product under improved conditions. And further, the utility of substantial country homes, providing wholesome conditions for the industrial training of future generations of farmers, represents certain fundamental principles justifying our best energies in agricultural pursuits. In the list of items contributing to the development of the world's resources, the proper drainage of our marshes deserves intelligent consideration and as an inducement to encourage the purchase and improvement of marsh lands, certain knowledge of their productiveness under improved conditions is necessary.

The long continued and extensive demand for country homes, the marvelous development of American agricultural resources by means of labor-saving implements and modern methods of tillage, and the improved facilities for transporting farm products to good markets, have given popular stability to investments in farm lands and these conditions are naturally followed by perceptible advance in values of most lands capable of human habitation; even the most remote nooks and corners of the earth are sought out for speculation and development. The further utilization of our own native resources now becomes a subject of vital interest to the thoughtful farmer. Although large areas of fertile marsh lands are as yet comparatively undeveloped, Wisconsin ranks high in domestic and commercial importance.

These conditions being considered, let us investigate the question of successful tillage of the thousands and thousands of acres of fertile marsh lands situated right in the very midst of regions possessing ample markets, railroads, schools, churches, highways,
and all modern conveniences essential to the welfare of modern civilization. There are splendid opportunities for investment of moderate means in property surrounded by wholesome conditions where established advantages exist. The development of resources now lying dormant in our unimproved marshes should receive due consideration before investing large sums in high-priced land. Thousands of the highly improved farms in southern Wisconsin are estimated to be worth high prices. Other thousands of farms among these contain wet depressions, ponds, and marshes, which, if drained and properly cultivated, will be worth many times their present estimated value. A long list of practical examples might be cited if space permitted in this paper.

Some Results of Tile Draining.
A noteworthy philosopher in the early history of intelligent farming announced that to make two blades of grass grow where but one grew before is a public benefit. If he should return to Wisconsin and investigate the results of tile drainage, he would include potatoes and corn in the list of benefits. A farmer drained his marsh and planted fifty bushels of potatoes where none grew before. He harvested one thousand bushels and he estimates that the tile drains increased the value of his land four-fold. These drains were laid about six rods apart and two to three feet deep, on a grade of eight inches per thousand feet. Greater depth could not be obtained without extending main drain long distance in a neighbor’s land, and, although the lower land suffered from excessive moisture, causing frequent loss of crops, the owner would not have a tile drain laid. The potatoes were grown in 1902, during an unusually wet season. The surface soil was a black loam with a bit of peat intermingled, and the lower strata was a light clay and hardpan containing some stones.

Another practical example of the results of tile drainage is that of a farmer who laid twenty-five miles of drains in a farm of 320 acres. The larger part of this land was too wet much of the time even for wild pasture, a large per cent. of the remainder was usually too wet for cultivation early in the season and during rainy summers, and among the higher elevations were wet depressions and ponds which interfered with advantageous working of the surrounding or adjacent land. The crops grown were inadequate to justify the amount of money and labor expended. After the drains were laid, clean, smooth fields a mile long yielded ample feed for ninety cows and half as many young cattle; potatoes and hogs were sold by the car load, and now the farm is sold for the net sum of thirty-five thousand dollars. The branch drains on this place are laid eighty to one hundred feet apart, and their arrangement is such that all the water delivered by the branches is carried off by three main tile drains and there is not an open ditch on the farm.

A Tile-Drained Peat Marsh.
Here is an example of the results obtained from a tile-drained peat marsh of sixty acres. The place had been robbed of its natural product nearly half a lifetime without any substance being returned to the marsh, except during the wet seasons when the hay could not be harvested, because the peat was too soft to enable teams to work on it. The peat was three to five feet deep, would burn freely if dry, and was underlaid with light clay and ledges of thin, flat limestone. Before drainage it was estimated that this marsh would produce interest on six dollars per acre. The average land buyer would not have been willing to pay six dollars per acre for this marsh. Three tile drains of good size and depth were laid on a fall of one inch per hundred feet, one through the middle and one at each side, and these were united to a large main tile drain. Ordinary quantities of stable manure were spread out evenly over the well-
cultivated surface, and corn, timothy, red-top and alsike clover were successfully grown, the usual product being about two-thirds that of regular farms and there was no failure in sixteen years.

An Ohio Onion Crop.

The great onion plantations on peat marshes in Ohio have produced wonderful results with proper drainage, fertilization and thorough cultivation. One of these immense gardens of one hundred and sixty acres in the wet season of 1902 produced seventy thousand bushels of onions and the quality and size of the fruit is far superior to onions grown on clay land. Thirty thousand bushels of onions is not an unusual yield in this wonderful garden and thirty thousand dollars per year is not an unusual income from the sale of these onions. This place is strictly a peat marsh, of the sort which will burn and drift in high winds when dry, and the drainage is two to three feet deep on extremely light fall. Large quantities of stable manure and commercial fertilizers are applied in accordance with established methods and the cultivation is thorough in every particular. Tomatoes and celery of excellent quality thrive equally well on this land. The famous celery fields, embracing several thousand acres in Michigan, were originally peat marshes, duplicates of which are quite numerous in Wisconsin.

Drainage for Low Lands in Wisconsin.

The ordinary clay marshes of Wisconsin, and the usual depressions, ponds and wet parts of cultivated fields, require little or no fertilization after proper drainage to produce good crops. I can cite numerous examples among prominent farmers who successfully grow all kinds of crops on tile-drained land, which before drainage was waste land, and since corn and clover,—the best feed for dairy stock—thrive best on this land, it follows that land values will advance and as dairy interests grow the land best adapted to produce forage crops will become the most valuable.

In southern Wisconsin there are hundreds of farms more or less disfigured with ponds, marshes, and crooked depressions too wet for cultivation, and many of these waste places are so situated as to form crooked boundaries and odd shapes within regularly cultivated parts of fields. The disadvantages of working between and around these barriers are not denied, and it should be quite as easy to comprehend the advantages of having such nuisances removed by drainage, to enable farmers to advantageously work over the entire length and breadth of their fields without the loss of time and damage to crops while turning back at the ponds. In many instances the actual loss of time and crops at these superfluous turning-back places will, in a single year, exceed the cost of drainage and the superior quality of these wet places, if drained, would yield even greater reward for money and labor expended. To avoid unnecessary waste is one of the leading elements of success in business.

A sample not unusual in the results following tile-drainage in Wisconsin marshes is that of a forty-acre tract which was previously listed on the tax roll as “swamp land.” It was considered waste space, with the exception that an inferior quality and scant quantity of marsh grass and weeds were produced, and bog shoes were required to enable teams to work upon it. The place was tile-drained at a cost of sixteen dollars per acre and later produced as large crops of corn and hay as regular farm lands costing high prices.

During the last twenty years I have personally superintended the drainage of upwards of twenty thousand acres of land. This is but a percentage of the total area of the land requiring drainage in Wisconsin. There are scores of farmers who would not take the trouble to investigate the claims made for tile drainage as a reliable
means to improve farm lands; meanwhile a more progressive class of farmers recognize the dormant resources awaiting development in our unimproved marsh lands, and with proper knowledge of the existing facts concerning the agricultural possibilities of fertile Wisconsin marshes now in the market at very reasonable prices, there is a marked tendency to hesitate about investments in the scattered remnants of cheap lands yet remaining in the out-of-the-way land markets of the far west, where life may be too short to profit by the long waiting for the common comforts of life to materialize.

Land Values in the West Increasing.

Time was when splendid selections of land in the far west and southwest could be made at trifling cost. Conditions have changed. As the American Indians retreated civilization advanced. It is now a popular theory that numerous modern conveniences are essential to human welfare and happiness and the rapid settlement of new lands has resulted in marked increase of land values, even in the new west. Modern families desire congenial environment among an advanced class of people. Established business conditions and reliable political and social rules have gained prominence.

But what has all this to do with tile-draining the marshes? So far as the congenial surroundings of home contribute to domestic comforts, and so far as the improved conditions of the soil render financial success a simple task, these statements are applicable. The average farmer cannot afford to occupy a farm simply for the pleasure of a country residence and improved lands have advanced in value to such an extent that makes it a financial consideration to buy and improve cheaper farms in an equally good country. In due time these cheaper investments will command a liberal net gain above actual cost of improvements and, if it is wet land, tile drainage will be a leading factor in producing the results sought.

DISCUSSION.

In the absence of Mr. Reichenbach, Mr. C. P. Goodrich of Ft. Atkinson was called upon to lead the discussion.

Mr. Goodrich—I have attended court a good many times and listened to the witnesses giving their evidence, and have heard the lawyers cross examine them, but this is the first time that I was ever in court where the witness, after giving his direct evidence, disappeared and another man was called on to answer the questions on cross examination.

Supt. McKeown—I want to say that Mr. Reichenbach is the county surveyor of Jefferson county, and for some sixteen or eighteen years preceding Mr. Reichenbach in that capacity, Mr. Goodrich held that office, so it comes very appropriately that Mr. Goodrich should answer your questions, because he has done lots of surveying and draining in Jefferson county.

Mr. Coe—Is it your opinion that a good many of the farms of southern Wisconsin could be drained advantageously?

Mr. Goodrich—I feel sure they could, because I know that a good many of them have been drained so as to make them a great deal more valuable. I have done some of that work on my own farm. I commenced about eighteen years ago on some land that was not very valuable. Well, I bought it for $25.00 an acre, and the tile draining added $50.00 an acre to its value. I could have sold it for $75.00 an acre right away.

Mr. Brigham—And how much did that tile draining cost you?

Mr. Goodrich—About $20.00 an acre.

Mr. Brigham—What fall did you have?

Mr. Goodrich—An inch to a hundred feet will do, if you can't get more, though that is a very light fall, and the tile must be well laid so that there are no places where the water will stand and deposit sediment.
Mr. Brigham—What depth do you lay tiles?

Mr. Goodrich—It depends on the kind of land. On my land I put them down three and a half and four feet, for the reason that the water came from below and made the land cold and wet, and the further down I got the tile the better it would drain the land, for it intercepted that water before it reached the surface. On some other land that I have tiled, clay land where the water would hardly soak through at as great a depth, I put them down three feet, and that is deep enough.

Mr. Scott—What is your opinion about this so-called hard pan in central and northern Wisconsin? Can we drain through it?

Mr. Goodrich—I have had no experience in it, but I think you can drain through it. It will seem almost impossible sometimes, when you know that water will not soak through two inches of that soil in its natural state, but after the tiles have been laid, and the ground frozen, it commences to thaw out from the bottom. The land is expanded and heaved up when it is frozen, then when it thaws out from the bottom the surplus water goes out and it never settles back to be as solid as it was before.

Mr. Everett—It seems to change the character of the lower strata entirely.

Mr. Goodrich—Very much. Mine used to be so sticky that I could hardly plow it at all before it was tile-drained, when it was wet, and when it was dry, it would turn up in great chunks like rock. It does not work that way at all now; it has let in the air and taken out the surplus water. It is the first land I can work in the spring, or after heavy rains.

Mr. Hume—Will it pay to tile what is called "swamp" land in this country, where we raise a pretty good crop of grass?

Mr. Goodrich—if it will produce a better crop now than after it is tiled, of course it won’t pay.

Mr. Hume here exhibited a bunch of tall grass to illustrate the pending question.

Supt. McKerrow—What do you call that grass?

Mr. Hume—I think it is Red Top.

Mr. Reitbrock—No, that is Blue Joint.

Mr. Goodrich—Will this produce a continuous crop year after year if it is cut in July at the time it is in the best condition for hay?

Mr. Hume—I think so.

A Member—It will cut four tons to the acre, nine years out of the ten.

Supt. McKerrow—Then will it pay to tile it?

Mr. Goodrich—Not unless it is so soft you can’t get onto it.

Mr. Gaffney—Could you use small stones to take the place of the tiling?

Mr. Goodrich—I never have had any experience in that, but I have seen some land that was drained that way, and after awhile the drains were filled up.

Mr. Gaffney—Do you put anything at the head of the drain to keep the sediment from running into the tiles?

Mr. Goodrich—Into the top end, yes. Cover it with a flat stone, or something that will keep the mud from coming into it.

Mr. Hill—This paper speaks about draining peat lands and about raising large crops of onions. Have you had any experience in draining peat lands?

Mr. Goodrich—I have drained some that had some peat, perhaps one or two feet in places, but I never raised onions. I had to put manure on that land before it would raise anything very well.

Mr. Hill—How far apart would you have your drains?

Mr. Goodrich—Mine are four rods apart in some places. There are a great many places where you can by one line of tile drain a great deal of land. In one place I have a hill, and at the base of that hill are some of the wettest parts of the marsh, the water that goes into the ground back on the upland comes out of that place. By putting a line
of tiles right along the base of that
hill, I dried the land for fifteen or
twenty rods below that.
Mr. Hume—A great deal of the
marsh land in this country is overflow
land. Would not ditches be better
than tilling?
Mr. Goodrich—Perhaps so. If it
would raise valuable hay, that is an-
other question.
Question—What is the average size
of your tiles?
Mr. Goodrich—The small drains,
three inches, at least, and that is as
small as I would recommend.
Question—Will cattle thrive when
turned onto pasture land with that
kind of grass that is shown here?
Mr. Goodrich—I don’t know, prob-
ably somebody else can answer that
better than I can.

A Member—They couldn’t reach the
top of it.
Mr. Roberts—I drained some peat
land three years ago and I got a fine
crop of flax on that land. I have had
two immense crops of corn on it since,
and I don’t know of any way that the
farmer can spend money that will
bring back quicker returns than for
tiles if he has low land.
Question—How does the frost af-
ect this tiling?
Mr. Goodrich—It won’t hurt it any-
where, except at the outlet if it is ex-
posed, where it freezes and thaws.
Question—Doesn’t it ever heave
them?
Mr. Goodrich—Never did mine.
Mr. Roberts—I make a long box at
the end of the tile, a plank box.

GOOD TILLAGE.

THOS. CONVEY, Ridgeway, Wis.

Few farmers appear to realize the
importance of good tillage. I will
first consider the improvement of the
soil.

Three Requisites for Producing Good
Crops.

To produce good crops, so far as the
condition of the land is concerned,
three things are essential: sufficient
available plant food; moisture, and
proper mechanical conditions, and the
latter is by no means the least. Only
a small percentage of the plant food in
even a very rich soil is immediately
available; the tendency to waste in a
soil bare of growing plants, especial-
ly at moderate or high temperature, is
unavoidable. The loss of soluble plant
food is principally through leaching.
This loss is principally nitrates, or the
available form of nitrogen. A soil rich
in nitrates may lose fertility rapidly by
exclude free oxygen, deoxidation takes
place, which sets free nitrogen gas.
While a sufficiency of moisture is ab-
solutely indispensable, an excess of it
is equally bad, for nearly all farm
crops refuse to grow in a water-logged
soil.

Aeration of soil is rarely considered
in tillage, free oxygen is just as es-
sential, as potash, phosphoric acid, or
nitrogen. Unless the land is kept in
such condition that oxygen can reach
root hairs or terminal roots of plants,
growth is impossible. This is true
even of trees—only the hardiest of our
forest trees can survive much tramp-
ing or compacting of the soil. The
humus or organic matter in the soil
can only be prepared for plant food
through the admission of oxygen,
hence the disadvantage of getting ma-
nure too far from the surface. In a
heavy clay soil, or a water-logged one,
being so saturated with water as to
it may remain unavailable for years.