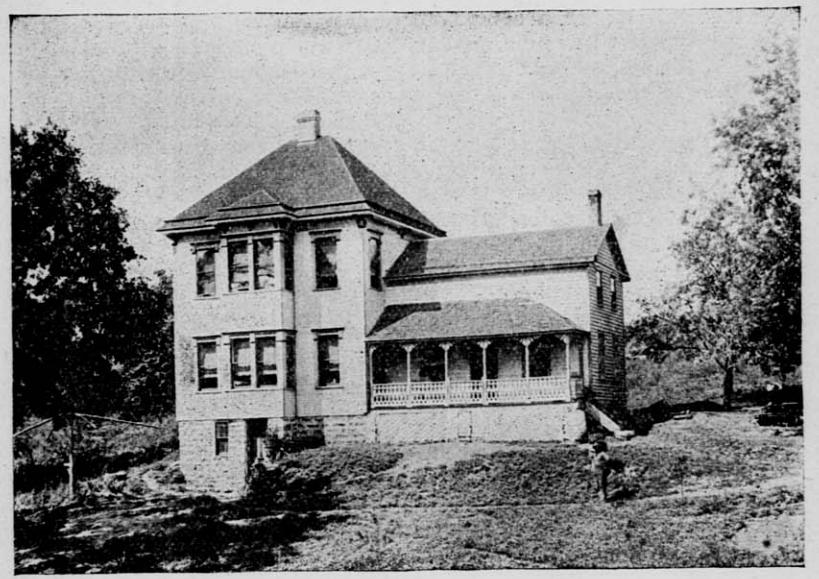
TILLAGE.

THOMAS CONVEY, Ridgeway, Wis.

Mr. Chairman, Ladies and Gentlemen:—The subject of tillage comprises such a large field that it will be out of the question to discuss it in all its bearings. Tillage refers to the preparation of land for the crop, to the seeding of the crop, to the care of the crop, and to the kinds of crops that you raise, in order to improve the mechanical condition of the soil and to retain the fertility, so that it will be utterly impossible to fully discuss this question in the time allotted me. I will confine myself, therefore, to speaking with reference to plowing, harrowing, cultivating and rolling.



FARM RESIDENCE OF THOS. CONVEY.

Plowing.

We find a great diversity of opinion in regard to the time in which to plow and the manner in which to plow. Along the whole eastern side of the state we find that the tendency is to do fall plowing, and that the opinion is, that it is necessary to do that, in order to get fairly good results. On the south and west, where the soil is lighter, spring plowing is preferred in the majority of cases, more particularly with those farmers who like to keep a growing crop on their land as nearly all the time as possible. There are certain advantages connected with fall plowing that we should take into consideration. Of course it facilitates the putting in of the crop to have a portion of the spring work done in the fall; besides that, the action of the frost and the other elements tend, in a measure, to pulverize and reduce fall plowed land and get it in very much better condition to yield up its fertility to the crop the following season. It will retain moisture to a greater extent and will give better results, especially with stiff, clayey soil.

On the other hand, in those parts of the state where they run their farms very much to grass and like to top-dress that grass land with manure, they find that spring plowing gives good results. In that case the texture of the soil is such that the spring plowing can be done early and the soil reduced to the proper conditions to receive the seed with comparatively little labor. Besides, it removes the coarser part of the manure, the liquid portions of which have been leached out into the soil; it removes the coarser portion of manure out of the way of cultivation, and in a measure delays the sprouting of weed seeds, so that crops will get a start before the weeds are started, and it will be easy to care for the crop later on. In the majority of cases on light lands this will give better results, because the growing crop on the land tends to retain the fertility, and guards against the surface washing and blowing of the soil that you find prevails in some portions of the state. Where the farms have been run largely to grain or even corn, and the mechanical conditions are not just right, and where it does not partake of the character of new land, not being light, mellow, and inclined to dry out early in the spring, fall plowing should be depended upon. After all I question the utility of that style of farming, unless, of course, your land is of such a character that you cannot get on there sufficiently early in the spring in order to get in the crop in good time, because we all realize that the early crop is the paying crop.

Deep vs. Shallow Plowing.

Now, with reference to the matter of plowing deep or shallow. It is a subject that every farmer should carefully study from his own standpoint. Some subsoils are comparatively rich in fertility. There, of course, the soil may be deepened by deep plowing, but the plowing should be a little deeper each year until the desired depth is obtained. Where grass or manure is plowed under of course it is better to plow shallow unless it might be for a root crop and of course deeper plowing would have to be depended upon in that case, but for a corn crop on grass land, and especially grass land top-dressed with manure, shallow plowing—four or five inches in depth—will give good results. There is a serious objection to shallow plowing, and that is, the deeper soil is prepared, the greater the capacity of the soil to take up and retain moisture, so that if the soil is deep it will take up the rainfall to the full point of saturation. It has been determined that land prepared to the depth of ten inches will take up two inches of rainfall, which would be an extremely heavy rain, of course.

Harrowing.

Proper use is not made of the harrow; that is, we neglect to harrow when we should and in that way save a great deal of moisture in the soil. Fall plowed land that is intended for a late crop should be harrowed early in the spring. The object should be to simply drag on the surface, kill whatever weed seeds have germinated and prevent the evaporation of moisture. Now, in case the land is fall-plowed and you wish to put in a late crop of corn or potatoes, it would be better not to try to level the whole surface; it would be better to harrow lengthwise rather than crosswise and leave it rough. Successive harrowings will get land in proper condition to put in your crop, and in that case the cultivation necessary to take care of the crop will be in a large measure done, even before you sow the crop, and the moisture retained in the soil. There is another valuable feature in this, and that is that it is so much easier to get the soil in proper condition when it has the right amount of moisture in it. Slight harrowing,

when the soil has a sufficient amount of moisture in it, will save very much labor later on.

It is surprising to see how many farmers spring plow for corn, or in fact for any crop, and neglect to harrow until they get through plowing. If it is a dry time it is impossible to get it in proper condition; it is lumpy and dry, double the labor, and will not produce half the results. If rain does not come the crop starts unevenly, or if rain does come after seeding it down the field is lumpy, and in condition to dry out rapidly, and a poor crop is obtained. Harrow every half day, if necessary. Fall plowing is better left in a rough condition during fall and winter, if intended for a spring crop. Harrowing winter grain in the spring gives good results. Just try it. It closes cracks or fissures made by the frost, breaks up the crust, kills weeds, and will put in grass seed in the very best manner. I like it better than sowing the latter on snow.

Cultivation.

The idea in Wisconsin at the present time is to give shallow and frequent cultivation. Those of you who read the market reports know that in the state of Iowa at the present time, although it is a much better corn state than Wisconsin, there is about half the corn crop not fit for market. They plant it earlier than we do, and have even a better corn soil, and climate. Many parts of our state are not at all adapted to the early maturity of many varieties of corn, but I have yet to hear of a case in our state where the corn crop was not fully matured, as was the case in Iowa last season. I attribute this very much to the difference in the methods of cultivation, because the Institute has been preaching shallow and frequent cultivation all the time. Now, if we attempt to reason along this line we can understand why we get better results in shallow cultivation of any kind of a cultivated crop than from deep cultivation. The surface soil ought to be the richest part of the soil, and if we attempt to cultivate to the depth of three or four inches, we realize that we cut off the roots and force them down into the subsoil where it is cold, and where the fertility, if there be fertility there, is not in proper condition for plant food. So we will see if we study this matter, that we will not be as much inclined to follow deep cultivation as some of us have been in the past.

Tools for Cultivation.

Now, with regard to the kind of implement that is necessary to secure shallow cultivation. You take those large shovel cultivators and in order to stir up the entire surface of the soil it is necessary to run them deep, so it is not possible to carry on shallow cultivation with a large shovel cultivator; besides they lift up and loosen the soil rather than pulverize it, and that is an objectionable style of cultivation. The proper implement to cultivate with to get shallow cultivation is one you can adjust to the depth you wish, and at the same time stir the entire surface soil, and the implement should enable you to do this without going to more than two or three inches in depth and leave the surface level. If you can secure a cultivator where these conditions all exist it ought to be satisfactory for any kind of crop. Remember when I speak of shallow cultivation I am not advocating shallow preparation—the deeper the preparation the better because soil of that kind will take up and retain moisture better, but the subsoil should be reasonably compact and only the surface soil cultivated. I have examined crops where the deep system of cultivation has been followed, and found that where the land is ridged up, that it dries our very rapidly, in fact, in a dry time there will be no moisture present near the surface, and consequently no roots. Now, you evidently drive the feeding roots of the

plant down in the subsoil, and yet you expect to get good results from cultivation of that kind. Of course where you give this cultivation to your corn crop particularly, it will check the growth until the root system is rebuilt, it may make a larger growth of top, but it will be at the expense of the maturity of the crop, and the final yield of grain. You take any kind of a cultivated crop, where the surface is kept fine and level, and you can find moisture within an inch or two of the surface.

Deep cultivation is not detrimental to the retention of moisture, provided the surface is left fine, and comparatively level, but usually it is uneven and loose, but more mischief is done by root pruning. This very materially affects the quality of the grain, especially corn. Immature corn is undesirable for seed; it has a large per cent. of moisture, is deficient in dry matter, and lacks feeding value; hence the bulk or weight of such a crop is not a true test of merit.

Another style of cultivation that is very injurious is hilling up around the plant and leaving a hard surface in the center. This is quite common with potatoes. You build a roof to run the water from around the plant —a hard surface in the center to carry the water off, or if perchance some of it should soak into the ground the compact soil affords the open door for its escape. And yet you fervently if not piously pray for rain, and continue the same foolishness.

Rolling.

Another feature connected with tilling is rolling. It requires more judgment to do rolling at the proper time and in the proper way than to use any other implement we have on the farm. There is one form of rolling that I want to speak about, and that is the rolling of a corn planter when you plant corn, that is in the wheel-marks. Many of you do not realize when you allow that wheel mark to remain there for any length of time that it compacts the soil and takes moisture out of it and crusts it over; that is the reason that corn farmers advocate immediate harrowing, or in the case of a stiff soil to use some implement that will throw a furrow. But it should never be neglected, the harrow running in the same direction that the corn planter went. You might think from the fact that the weeds will grow very rapidly in that wheelmark that it will be favorable to the crop, but you must remember that weeds will sprout at a lower temperature than the corn will, and the leaving of that wheeltrack there not only takes the moisture out of the soil but takes the heat as well.

I was not put on this subject to discuss corn, but I would like to call your attention to some advantages that would be likely to occur in harrowing or cultivating immediately after planting, and that is that it guards against insects or gophers attacking the corn plant; it checks the growth of the weeds and enables you to give cultivation more readily and prevents the evaporation of moisture. We do not begin to realize the necessity of giving good cultivation. You can take two pieces of land, one rich in fertility but poor in texture, and get better results from good cultivation on poorer land than you will from greater fertility on the other. Of course when you get new land you probably get texture, and fertility, but a good deal of our old land that has been run to grain continuously without sufficient grass or manure, is very much out of condition; it is lumpy, hard and poor in fertility, and in order to make the fertility in the soil available the land has to be reasonably well cultivated. It not only takes the fertility out of the atmosphere in a measure, but it actually catches and holds fertility that would escape from the soil when rapid evap-

oration is going on. For this reason we want to pay strict attention to stirring the soil just as soon after a rainfall as it is possible to get on it. Of course we cannot work soil that is too wet, but if we have a slight rainfall in a comparatively dry season, in a day or so you will have drier soil than you had prior to the rain, from the fact that there is a connection established between the moisture in the subsoil and the surface—and this promotes evaporation.

You should always harrow after rolling, because if you leave a rolled surface it will dry up very rapidly, whereas if you harrow after rolling it will prevent the rapid escape of moisture.

DISCUSSION.

Mr. Kellogg—I would like to ask you to explain the benefits of subsoiling and how it can best be done, aside from what you have already said in regard to the retention of the moisture.

Mr. Convey—A man who has never done any subsoiling should not attempt to explain, yet we understand the principle of it. It deepens the soil so that the rainfall will readily go down in the soil. It will retain moisture and at the same time afford an opportunity for the roots to find plant food and have access to the subsoil.

Mr. Kellogg—I would like to ask if any one here has had experience in regard to this subsoiling?

Mr. Coe—I have subsoiled a little, and we find a good deal of benefit from subsoiling where we have quite hard, stiff, packed subsoil; it breaks it up and makes it hold more moisture, and to a great extent it takes up the rain and more readily gives it up to our growing crops in a dry time. We have had the best results from subsoiling in the fall of the year.

Mr. Kellogg—What kind of a subsoiler are you using?

Mr. Coe—The one we have is an old-fashioned one; it has a beam like a comomn plow with a strong, long standard, about twenty-two inches long, and on the bottom of the standard is a cast iron diamond-shaped point about fourteen inches long by eight inches broad and considerable higher in the center. This runs in the bottom of the furrow, breaking up the subsoil as deep as you want, making it in good mechanical condition. Then we also have the best results by subsoiling two years in succession. The first year we run the subsoiler north and south, and the next year we like to run it east and west and break it all up and get a good condition.

Mr. Arnold—In his address Mr. Convey said a thing that I doubt the propriety of. He said that in the eastern portion of the state where we have clay soil, they plow in the fall, while in the western part of the state where we have lighter soil they plow in the spring.

Mr. Convey—In the southern part of the state, and in the southwestern part, fall plowing is really rather an exception.

Mr. Arnold—It is possible that our custom is not in accord with the best way of doing things. In my experience fall plowing is the best for my land, spring plowing for heavy clay, and it seems to me there is a good reason for it. The light soil wants to be plowed in the fall so that it can compact itself and put itself in condition just right for the plant root during the summer; it will retain moisture with this surface cultivation we speak of, whereas a stiff clay, if plowed in the fall becomes too compact, just the condition that it should not be for a good growing crop, but in the main I think the fall plowing is best all over if it has proper cultivation—proper tillage before the crop is put in. The great trouble with the farmer is that he does not give it sufficient cultivation before

the crop is put in. The main share of the cultivation should be done before the crop is put in the ground, and when this is well done we may be sure that a good crop will follow, provided we do not dig too deep in the soil. I believe the great reason why they failed to raise a good corn crop in Iowa is because their system is to use much deeper cultivation. In the state of Wisconsin by reason of the Farmers' Institutes it has been pretty well pounded into our heads that in order to have an early crop, we must allow the roots to come near the surface and not cut them off. I had rather not have it cultivated if I wanted an early crop than have it cultivated deep.

Mr. Convey—There is a great deal of land on the east side of the state that needs underdraining, and it would be quite difficult in the spring to get it sufficiently dry to plow early enough and the bulk of the farmers there practice fall plowing and get better results. With the lighter lands in the south and southwestern portions of the state you can compact the soil by cultivation. There is one thing you should not neglect in spring plowing, and that is to harrow before the land gets too dry. The tendency on light lands should be to keep a growing crop just as long as possible, and where you follow that system on the farm you will get good results and retain more fertility near the surface than if you fall plow and allow the soil to blow and surface wash and then prepare for a crop in the spring. I have tried both systems and I like the spring plowing of the clover sod very much better than the fall plowing.

Mr. Chadwick—Would you recommend the rolling of the corn immediately after planting and then harrowing.

Mr. Convey—Where you give a sufficient harrowing before planting it is scarcely necessary. I like to prepare the land well before I attempt to plant, and then we harrow just after planting.

There is another matter I have not spoken of, and that is the discing of corn ground for a grain crop. It is very desirable in every respect, except one, and that is with shallow preparation the land will wash very badly. On land that is inclined to be too rich for the oat crop, where you disc it in, you will get better results; the exposure to the elements of the surface soil during winter will bring the very best condition for crops. So where land is clean and well cultivated, and more particularly where the corn stalks are all cut off, discing in the preparation of the corn stubble is preferable to plowing in every respect, save that of washing.

Mr. Chadwick—Do you roll that grain after putting it in?

Mr. Convey—Well, we haven't rolled it very much recently, though it might be an improvement to do so. Now the washing that I refer to is about the time you sow the seed before the grain is fairly well started. It is not a deep washing, but it leaves little ruts all over the surface of the field and it is inclined to occur where the land has been well cultivated, even where it is comparatively level.

Mr. Reed—Is there any sulky cultivator made with which you can cultivate shallow and keep it regular?

Mr. Convey—There is a style of cultivator made with levelers attached and you can have them so arranged that you can adjust the depth of cultivation, even with a sulky cultivator. I have one of that kind. Mine is a disc cultivator.

Mr. Gray—Have you ever observed the effect of early fall plowing on loosening the subsoil? I have noticed that early plowing immediately after the crops are harvested we would generally find hard pan in the bottom of the furrow on these stiff soils and if you

attempt to replow later in the fall that hard pan is all gone, and it is mellowed up to the depth of the original plowing.

Mr. Convey—That is true, and that accounts for the improved condition of land that is underdrained. The water percolates through the soil rapidly and it dries out rapidly; the wetting and drying tend to create a crumbly or loose condition of the soil, so that land that is underdrained improves in condition for several years after.

Mr. Brooks—Don't you think there would be a great deal more fall plowing done in your part of the state if it was not that they have to guard so against the washing of the soil?

Mr. Convey—The washing and blowing of the soil are the serious objections to fall plowing.

Mr. Brooks—If your land was as level as it is in the eastern part of the state don't you think you could follow fall plowing?

Mr. Convey—I have followed fall plowing for a number of years and I have come to the conclusion that as near as I can I will keep a growing crop on the land; the mechanical condition is very much better and there seems to be better results. The advantages are all in favor of fall plowing, I think, except that one fact; where you keep a growing crop on the land it tends to retain the fertility, prevents the washing and improves the mechanical condition of the soil as well.

Mr. Arnold—I think the soil should be occupied, it should not be without a tenant. Soil that is left bare cannot help but lose its fertility. I am of the opinion, however, that in the southern and western parts of the state, in order to mature the best crop, if the ground is not too rough, the time to plow the ground is in the fall of the year; let it rot, and then it will not blow. There is something to be lost and there is something to be gained. We lose this crop that is occupying the ground and the fertility is being lost when the ground is idle. Nature sees to it that there is some kind of a growing crop on the ground, if possible, but if you want a good crop next year you must perhaps lose some of this fertility in order to insure a good crop next year to have the ground sufficiently compact.

Mr. Convey—I apprehend that Mr. Arnold speaks of plowing under a sod or something of that kind, where it is absolutely necessary that you do fall plowing in order to get the land in condition for the next crop, for instance tough sod, but I speak particularly of the clover sod that has only been in clover one or two years. It is just as easy to reduce it to a condition fit for the use of the crop as it is stubble land. Where grass land is allowed to remain until spring "Is it advisable to allow that grass to grow just as large as possible before cropping?" is a question I am asked. It is not. At the Experiment Station they have determined where they spring plowed land reasonably early and they took proper care of the soil afterwards, and later on compared the soil with that where the crop was allowed to grow as late as possible prior to plowing, they found in the first place that with early plowing they had twenty pounds of moisture to the cubic foot, whereas in the latter case it showed only six pounds of moisture; besides, where you allow a crop to grow large and woody, like that, it may form a layer between the subsoil and the surface soil and intercept the moisture that would arise by capillary action. Besides, where you allow it to become woody it is difficult to produce decay under those conditions, when moisture may be deficient, consequently good results will not be obtained. Therfore there is a necessity of plowing reasonably early.