

grant toward the necessary working expense of this association, and in event of any member of the committee being unable to act, the executive be empowered to appoint a substitute.

All matters pertaining to legislation were referred to the executive committee, and after passing a hearty vote of thanks to the president and other officers, a most successful meeting was adjourned *sine die*.

## NOTES.

Owing to the short time at the disposal of the meeting, a most valuable paper by Judge Woods on "The Lesson of the Drainage Laws, as Applied to Good Roads," was held over, as were also papers by Mr. P. K. Hyndman, C. E., of Sarnia, and Allan Macdougall, C. E., Toronto.

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The brevity of Mr. Campbell's remarks both at the Central Farmers' Institute and Road Association meeting were quite noticeable.

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Mr. Copp, manufacturer of the American Champion Road Machine was in attendance, as was also Messrs. H. A. Brownell and Wilson, representing the Western Reversible Machine. These gentlemen had a model of the machine on exhibition and were kept busy explaining its many good points to inquiring delegates.

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It is said that no former public agitation has been as well received as that for the improvement of our public roads. The reports of the good-roads speakers who have been before the people in different parts of the province was a surprise to all.

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At the next annual meeting of the Good Roads Association there should be an exhibit of culvert pipe, road-making material, road-machines, rollers, etc. Many delegates came to the convention this year expecting to get some special information in this direction.

A petition asking for local option in taxation has been sent for signature to all the municipalities in Ontario. It sets out that widely divergent views are entertained on the subject of municipal taxation; that the best method of settling the question is by giving to municipalities the power of raising their revenues on any basis of taxation that each municipality may choose; and that the principle of local option in taxation has been adopted to a greater or less extent in the Province of British Columbia and in the Northwest Territories, besides having been passed by the popular Chambers of the Parliaments of New Zealand and South Australia.

## DRAINAGE.

Hints on Tile Draining by W. F. VanBuskirk, C. E.

(Stratford Herald.)

Under the present conditions one of the most prominent defects in the prevailing system of farm management is a want of attention to thorough drainage as a means of decreasing the cost of production, and insuring uniform as well as paying crops by increasing the fertility of the soil and avoiding losses from unfavorable seasons. Much of the tile drainage done in this district is of little use, and a large amount of money is wasted through want of knowledge in regard to the true action of water and soils in promoting plant growth.

A soil drained properly by an efficient system of deep tile drains becomes to a certain extent porous, permits the air and bacteria of nitrification, etc., to permeate to great depths and thus increases the available supply of plant food.

Further, a soil properly drained is capable of storing larger amounts of water for use of plants in time of drought, than one which has not been properly drained. An efficient drainage system will therefore not only improve and permit growth in a wet season, but will prevent to a large extent the evil effects of a dry period.

A few hints on the proper method of laying tile drains according to the best modern authorities, may be of some interest and profit.

The manner in which drainage or surplus water reaches and enters the tiles and the manner in which it flows in the mains must be understood before we can intelligently lay down any system of drainage.

When water falls from the clouds upon underdrained land it percolates through the soil vertically from the surface to the level of the water table or upper surface of ground water which will, of course, be at or near the same elevation as the bottom of the tile drains. As the rain continues, the water table will gradually rise until it is above the bottom of the tiles, when the water will begin to run in at the lower part of the joints between pipes, and will not run in at all parts of the joints until the water table rises above the top of the tile. As soon as the water begins to run into the pipes there will be a horizontal movement or flow of water towards the tile to replace that discharged, and the drains will continue to run until the water table is again lowered to the bottom of tiles.

The flow of water in the pipes is retarded by the friction of the interior surface, and this surface is greater in proportion to the volume of flow in small pipes than in large. Therefore, it follows that the main drains do not require to be so large in proportion to the volume of water delivered to them, as the branch drains.

Now it has been established beyond question that the tile drains should be put into a depth of at least four feet. And it may be taken for granted that any unfavorable results with drains at this depth, are due to faulty workmanship, material or design, and not to the depth.

If drains be put in four feet deep it will seldom be necessary to have a less distance between laterals than twenty-five feet, and in many cases a distance of fifty or sixty feet may give good results.

Lateral drains should be laid out on the ground to run directly down or at right angles to the slopes and in the line of the steepest descent, in order to secure the greatest efficiency in discharging water, as they will then remove water from one-half of the space between adjacent lines of pipe. Whereas, if they are laid parallel to the slopes, they can receive no water from the space immediately below, and must receive water from the whole space above.

The mains or outlet drains for the carrying of water from the small laterals should be laid in the lowest ground and with a uniform gradient from outlet to upper ends and should be laid in perfectly straight lines with easy curves at all necessary angles, and should be about their own diameter below the lower ends of all laterals. Where the width of the valley or low ground is considerable, it is advisable to lay subsidiary mains parallel to, and near the foot of slopes to take the water from the laterals on them, since it is not good practice to decrease the fall of such laterals at their lower ends without largely increasing their capacity.

An eight inch tile drain, laid properly with a fall of three inches in one hundred feet, will be large enough carry the drainage water of one hundred acres provided that no surface water be allowed to enter the tiles, and that the whole area be underdrained to a depth of four feet or more.

In order to make a good permanent drain, tiles must be laid to a uniform grade, without bends, either horizontally or vertically, since such bends obstruct the flow; they must have close fitting joints to prevent earth or sand entering, and must be covered with earth or clay well packed and the ditch filled without in any way interfering alignment.

The pipes should be laid upon the undisturbed earth, cut to exactly fit the lower half of pipe, and immediately after the ground has been so cut, care being taken to prevent any clay or sand entering the completed portion of the drain. Sods, straw, stones, etc., should not be put immediately over the pipes, as their use is based upon an erroneous idea of the manner in which water enters the drains, and they seriously interfere with the proper drainage of the soil. On the other hand, should it be impossible, owing to badly formed pipes, to make the top of joints between pipes perfectly tight, strips of tarred paper or other material should be placed over them.