

in for 12 to 15 years, and I feel that I am entirely to blame that I have still undrained lands, which are too wet to work at this late date (May 25th), while the drained fields are green with growing crops for nearly one month, having begun this year on April 8th, and last year on April 4th. Corn ground is in poor shape around here now, except where drained, and I am sorry to say that few farmers have done much here at draining. Farmers could soon have their farms in good shape if they only made a beginning at draining, by placing drains in the worst places at first, and they would soon see so much benefit that they would likely keep on at it.

Although some may think it strange, the drained land is certainly more moist in a dry time, and crops will continue to grow better on it than on other land. A good deal of heavy clay is hard in a dry time, because it previously had been sodden with water, and perhaps had been tramped on by cattle, or driven over with loads, while in a wet state. Farmers can take loads of manure or other things over drained fields in spring, at times when they can scarcely drive an empty wagon over wet, undrained lands.

Crops come to maturity earlier on drained soil; grain is heavier and plumper, and of better quality. I believe hay is of better quality, and that there is more nutriment in it, as farmers know that hay off dry ground is superior to that off wet, swampy land.

I feel that in this article I cannot do this subject of underdraining justice, so much can be said in its favor.

Farmers who have surface ditches deep enough to carry off surface water, often have to cut their crops in small sections, perhaps angling or gore-shaped, because of the too-deep ditches to cross over with machinery. My opinion is that no tile drain should be less than 3 feet below the surface, for several reasons, and I believe 4 or 5 feet deep would be better. They should be some distance below where frost goes, as the little water veins which form where water filters to the drains may be destroyed by frost, or the water in drains, where not deep, may be frozen until late in spring, thereby losing some benefit from drains at a particular time. Fewer drains will do where deep, as they then draw the water from soil farther away, and, "what is worth doing at all, is worth doing well."

I commenced underdraining by placing 6-inch tile in main hollows, and then 4-inch, 3-inch, and 2½-inch branches through other wet parts of the field; and not many drains on the low hills, with branches not quite parallel, but more by random, and found out that the more porous soil in low land dried much faster than the hills, and I had to wait some days for the hills to get dry enough; also some wide places between drains, or else mud them in, and on those muddy places the crop would not be very good. The branches at first were fifty feet or more apart, and the crops were good near drains, and not so good middle-ways. When I afterwards placed branch drains through the spaces, the crops were evenly good all over. We afterwards, in other fields, ran 4-inch, 5-inch or 6-inch mains through hollows, and 2½ or 3-inch branch drains in parallel lines, 25 and 30 feet apart, over hills and hollows, the ends of said branches joining on to mains where they came in contact with them. Two rods apart would do very well.

I will give you the approximate cost of thoroughly underdraining a 12-acre field, most of which was done in 1897, the larger mains having been in some years previously. There were 2,602 feet of older main drains, and 18,568 feet of new drains, mostly small branches, making a total of 21,170 feet in a 12-acre field, which we put in from November 17th to December 21st, 1897. I cannot give the exact figures, but cost of tile and labor was about from \$160 to \$480, part 25 and part 30 feet apart, parallel drains, over hills and hollows, besides 4-inch, 5-inch and 6-inch mains in hollows. The cost of the labor was about \$240, and of tile about \$220, for 21,170 feet. I believe every drain is working well yet, and I know no reason why they should not continue to do so for ages. If they were not working, I would soon know it. Soon after rains, a dry belt can be seen over every drain.

Making underdrains is much like pruning trees—the work may be done about any month in the year, and we often put them in during winter, when there was not too much frost, and sometimes when snow was drifting. Farmers, during spare time, may do underdraining. On hard, heavy clay, the best time is when the ground is wet to the bottom of the drain, and water in ditch can show you the fall, and then it can be dug easier.

I believe, three crops, because they are better, would fully repay the farmer who thoroughly underdrains, besides the saving in labor in the much easier working of soil after, and not having to make many surface drains. The 12-acre field above mentioned was considered poor, having been rented to several tenants, who named it the "hard field." After draining, we plowed with common plow 7 inches deep, followed by subsoil

plow, 6 inches deep, part in fall, and part in spring, and field yielded 80 bushels per acre; heaped measure, clean, plump, very heavy oats; while the next field, similar soil, not drained, yielded 45 bushels per acre, not as good oats. Another year, plowed in a similar way, the oats were about 100 bushels per acre.

I consider ¾-inch fall per rod is sufficient, but would prefer to have more. We brought a 5-inch main from a spring in one hollow to ease a 6-inch main there, along the face of a hill, and through the hill another way to outlet, a neighbor saying that we ran the water up hill, but by a spirit level we had a fall of between 3 and 4 inches per 100 feet; and, after making holes in 5-inch drain for branches, we found the chips of tile next day, at outlet, nearly one-half mile away, and no sedi-

the several branches helping to keep main and outlet clear of sediment.

I think the best time for draining on heavy clay is in April or May, when days are long and clay soft, and the next best time in October, November and December. The work can be done by hand with common spades and shovels, and the bottom with long, narrow, ditching spades. On our hard-bottomed soil, I think the best way is to plow top both ways with common plow, and then below with subsoil plow. I purchased a very good subsoil plow many years ago from the Watson Manufacturing Co. for \$10, which, by narrowing handles, would plow down four feet. Six rounds up and down will plow 3 ft. deep. With doubletree 8 feet, horses on each side of drain, and long, heavy chain from doubletree to plow,

to sag down and hold plow firm to bottom of drain, then men with spades and shovels can easily throw the loosened soil out. I had ditching machine, but it was not satisfactory, and did not go down more than 2½ feet, which did not suit me.

I have not been troubled yet with roots of trees getting into tile, but have heard of such being the case elsewhere. Some trees that grow best in wet places, such as willows, poplars, elm, or swamp oak, might possibly block drains, but I do not think the roots of fruit trees and many other kinds which do not thrive in wet places would block drains. Where tile drains pass trees

that are likely to block drains, it would be a good plan to cover tile first with waste slack lime or old mortar, which would check the roots of any kind of tree, and above such coarse, waste lime place a deep covering of good soil. We have killed grass on driveways in this manner.

We have had very little experience with sediment getting into tile. In clay soil, there is very little danger of this, if tile are joined together properly. I had a few cases where main tiles were placed in with large pieces broken off ends, and soil settled in, but we patched them up with broken pieces of tile, and the heavy rains flushed the tile out clean.

Perhaps underdraining benefits fruit trees more than anything else. Any farmer can see that the poorest fruit trees are those in the wet places, if there are any there at all. My common red-

sour cherry trees were about four times as good where drained as they were in other places; while, with regard to peach trees, there is really no comparison, as they will not grow in sour, wet land. We thought peach trees would scarcely grow on our clay soil, but I planted a few on well-drained land 15 years ago last spring, and last summer the Longhurst peach trees had borne their 10th crop, some years heavy, some light. This year, all the peach trees two years old and over, perhaps 1,500, are pink with blossoms.

Peach, plum, cherry and pear trees bear heavily on drained soil here almost every year after

they are two or three years old. I have Lombard plum trees, 10 years old last year, which bore seven heavy crops in eight years. Many farmers around here did not have enough plums for their own use last year. The trees were on undrained soil, and were not sprayed, while most of our nine-year-old plum trees, on well-drained soil, sprayed twice, yielded from eight to twelve large baskets each, and prospects are bright this year.

I have maps of position of tile in farm, length of mains, branches, etc., and distances apart; also size of tile, showing connections. The branch drains should not be at right angles with mains,



Burbank Plum Graft Three Years Old.

Growing on well-drained, heavy soil, on farm of Jas. Marshall, Wentworth Co., Ontario.

ment in the drain. We opened a 5-inch main to-day for branches, and tile was clean, and clear water running therein.

The outlet may be protected by placing lower end of main in wooden box of swamp oak, with cleat to hold end of pipe, or other durable material; a good hard sewer pipe would do. It does not make as much difference as some people think, whether outlet is on the level, or two feet below level, as long as you have plenty of fall, or have the head of main on higher land. It is well to have all the upper ends of mains or branches on as high ground as possible; if this is done, there will be little danger of drains blocking with silt, as the water pressure will force it out. I had a 6-inch main that was 3 feet below surface on road, at outlet, for about two years, and it boiled up like a spring, until a sewer-pipe cul-



Peach Trees on Underdrained Heavy Soil.

Trees planted 16 feet apart, on farm of Jas. Marshall, Wentworth Co., Ont.

vert was lowered to level of outlet, and we have one now that has to rise 2 feet on side of road, the cattle in summer tramping it full of mud, but it always clears itself, because the head is much higher. Where there is not much head, it is necessary to keep outlet clear.

A 6-inch tile will carry a large quantity of water, with 1-foot fall per 100 feet; and if that size is not sufficient, one or two more could be placed parallel some distance away, thus draining other places; and I think branch drains, running to one or two mains, and all to one outlet, if possible, are preferable to many drains running to as many outlets, the pressure of the water from