proper shape when removed from them. These samples were left in running water for almost two years, twenty-one and a half months to be exact. They were weighed at the end of seven and a half months, and then three months later, then eight months later still, also again in one and a half months, and lastly at the end of two and a half months more. The first sample gained weight on each of the four weighings, and lost on the last weighing, but the loss was only small compared with the previous gains. The net gain in weight was about 1/3 of 1% on the original weight of the tile. In the last twelve months the gain was 1/36 of 1% on the original weight, and in the last four months the gains equalled the losses.

The second sample gained on the first, second and fourth weighings, and lost slightly on the third and fifth. The net gain in weight of this sample amounted to about 1/5 of 1% on the original weight of the tile. In the last twelve months the losses exceeded the gains, the net loss being about 1/130 of 1% of the original weight. In the last four months the sample gained slightly, the gain amounting to about 1/500 of 1%.

The third sample lost weight on the first, second, third and fifth weighings, and gained slightly on the fourth. The total loss amounted to about ¼ of 1%. In the last twelve months the loss was 1/10 of 1%, and in the last four months 1/25 of 1%.

It is worthy of note that with number one and number two, which were made dry, and were therefore more porous, there was a net gain in weight, and that with the more compact tile used in test three there was a loss. Most people, I believe, would have expected that if there was any difference, there would be more loss in the porous tile than in the compact.

From the behaviour of these three samples we have been driven to the conclusion that in ordinary soil water there is no danger of good cement tile dissolving and crumbling, and consequently that cement tile properly made and properly cured must prove durable for drainage purposes, if strong enough to withstand the pressure in the earth. The strength of cement tile will be dealt with later. By properly made we mean of a strength not weaker than four to one of good cement, thoroughly mixed, made as wet as the machine will work and firmly packed. By properly cured we mean not allowed to dry out rapidly during "initial set", kept moist for a week and then subjected to weather conditions until the tile are strong enough to handle without serious breakage. This method of curing, of course, refers to cases where a steam curing plant has not been installed. Steam curing is much more effective and rapid. A day or two of steam curing will make the tile as strong as several weeks of the ordinary curing process.

The strength of cement tile was next tested. In July, 1912, we made by hand 5,000 3-inch and 1,000 4-inch cement tile on the machine, which is a "hand machine." These were made as carefully and as well as we could make them. They were shaded from sun and sheltered from wind during the first twenty-four hours, so that the "initial set" was as good as possible. They were watered a week after being made, and then stacked outside and allowed to cure during the remainder of the year. In January, 1913, forty tile of each size were broken in a crushing machine especially designed for the purpose. It was found that the average breaking stress of the 4-inch cement tile was 837 pounds. In making this test the tile were laid on one plank, another plank was placed on top of them and the pressure applied to this top plank by means of a lever, so that you will see the pressure did not act all around the tile, but simply on the highest and lowest lines of the tile. In this position it took, as already noted, nearly half a ton to break the 4-inch tile. The lowest breaking stress for any tile was 561 pounds, and the highest 1,435. The average thickness of these tile was 21/32 of an inch, their length 12.4 inches, and their weight 7 pounds 14 ounces.

By way of comparison forty 4-inch clay tile made at Port Dover were also tested. The average breaking stress was 1,178 pounds, or 333 pounds more than the average of the cement tile. The lowest breaking stress on the clay tile was 663 pounds and the highest 1,597. The average thickness was 20/32 of an inch, being 1/32 less than the cement tile, the average length 12.67 inches and the average weight 7 pounds 5 ounces.

The Port Dover tile being considerably thicker than some other makes of clay tile, it was decided to test some thinner ones, known to be giving good satisfaction; consequently thinner samples were procured from Essex County. The average thickness of this tile was 15/32 of an inch, or exactly ¾ the thickness of the Port Dover samples, and the average breaking stress was 827 pounds.

The length of these tile was 11.9 inches, and the weight 5 pounds 3 ounces. The lowest breaking stress was 668 pounds, and the highest 950 pounds.

The average breaking stress of the cement tile was 10 pounds more than that of the thin clay tile. It will also be observed that the lowest breaking stress in any cement tile was 102 pounds less than the lowest breaking stress of a Port Dover or Kingsville clay tile. Now, just what the minimum stress allowable is we are not able to say, but one thing is certain, namely, that any of the clay or cement tile tested were strong enough to stand up against the earth pressure to which they would be subjected if placed in the ground. The lowest breaking stress applied along the top line of the tile was somewhat over 560 pounds, but if the pressure was applied all around the tile as it is in the earth, it would undoubtedly take many times that to break those tile.

At a depth of three feet when the soil is so wet that it will flow like quick sand, the greatest possible pressure on the 4-inch tile is about 200 pounds on the whole upper surface of the tile, while the weakest tile tested required nearly three times this amount applied along one line to crush it. As a result of these tests of 4-inch tile we have come to the conclusion that the weakest of them were many times as strong as necessary to withstand the greatest pressure to which they would be subjected in soil conditions.

We next tested the breaking stress of some power-made cement tile manufactured at Woodstock, the average thickness of which was 18/32 of an inch, they were thus a little thicker than the Kingsville clay tile, but thinner than those from Port Dover, and also thinner than those made on the —— Cement Tile Machine. The Woodstock tile were made of crushed stone and cement in the proportion of 3 to 1 on December 4th. They were given forty-eight hours steam curing, and afterwards piled outside until January 16th. when they were shipped to us. From then until February 24th., when they were tested, they were piled inside, thus they were about two and a half months old, but during half the time they had been kept dry inside, during which little curing took place. Their average strength was 791 pounds. The weakest tile requiring 543 pounds pressure, and the strongest 956. However, only half of these tiles were broken on February 24th., the remainder were put in a trough of water where they were left for three weeks, at the end of which the average strength was 904 pounds, showing an increase in strength of 113 pounds. The weakest tile now required a pressure of 663 pounds to break it, and the strongest 1,079.

Other sizes of both clay and cement were tested, giving about the same comparative results. By these tests of breaking stress we have established a second point regarding cement tile, namely, that if properly made and properly cured they are as strong as some well known and satisfactory makes of clay tile. Hence we must conclude that cement tile thus made and cured are strong enough for tile drainage purposes.

The question is often asked, whether cement or clay tile are the more porous. In this form the question really has no definite meaning, because the proosity of clay tile varies a great deal, so also does that of cement tile; for instance, the average porosity of the Port Dover tile tested was 35.7 per cent., while the porosity of the Kingsville tile was 23.5 per cent. A similar variation is seen among cement tile, for instance, the 4-inch tile, made on the —— Cement Tile Machine, had a porosity of 27.8 per cent., while the Woodstock 4-inch cement tile had a porosity of 22.5 per cent. Power-made cement tile manufactured at Marden, (the proportion of cement in the mixture not reported to us) had a porosity of 27.7, practically the same as the hand-made cement tile.

So far as the efficiency of drains is concerned, however, porosity is not a factor in underdrainage, because the water does not enter the tile through the pores, but through joints between the tile. In order to have some definite figures upon this point we selected 3-inch, 4-inch, 5-inch and 6-inch tile of both clay and cement, using two clay tile of each size and two cement tile of each size. Having our tile ready we sealed one end of each with pitch and then set each tile, sealed end downwards, in a crock of water and measured the amount of water that would pass into the tile through the pores. The experiment was repeated twice. The first test was run for one week, and the second test was run for three weeks. In all cases we found that the water passed into the clay tile very slowly. The amount in the 4-inch Port Dover at the end of each test was just sufficient to nicely cover the bottom of the tile. This amount was measured acurately, and it was found that if the water continued to go in through the pores at the same rate, it would take the first Port Dover tile 233 days to fill with water, and the second one 420 days. The first 4-inch Kingsville tile would have twenty days to fill, and the second would have taken forty-two days. When we remember that the Kingsville tile have a much smaller porosity than the Port Dover, we should have expected that the Kingsville tile would have taken much longer than the Port Dover to fill, whereas they just took about 1/10 as long in each case, so we see that the rate at which water will pass through the wall of a tile does not depend entirely upon the porosity. Cement tile were much more variable, for instance, one 4-inch tile made on the —— Cement Tile Machine had practically no water in it at the end of the test, while the other 4-inch made on the same machine filled in about fifteen minutes. A similar variation was found in the power-made cement tile. The first 4-inch Woodstock tile would have taken 233 days to fill, while the second filled in two hours.

In examining the cement tile we observed that those which were practically or nearly watertight, had been made just wet enough that the packer produced a sort of water-lime surface on the inside of the tile. The other sizes of tile behaved much in the same way as the 4-inch. From these percolation tests we may conclude that it would take a very very long time for clay or cement tile to drain a field if we had to wait for the water to go in through the pores, hence we may conclude that porosity of tile is not a factor in the efficiency of underdrainage. The only bearing of porosity is that it gives some idea of the strength of the tile, providing thickness, length and material are the same.

The rate of making cement tile by hand did not prove from our tests to be as rapid as is frequently stated. Two men working faithfully could not exceed a speed of about 400 tile per day. There is a power attachment for the hand machine by means of which a little gasoline engine can be used to turn it. We did not make any tile with the power attachment, but we have seen them made and noted the speed for a short time from which it would appear that two men using a power attachment would probably make from three to four times as many tile as by hand.

The material required for 1,000 3-inch cement tile made of a strength of four to one is about three and a half barrels of cement and two yards of sand. For 1,000 4-inch it will require four barrels of cement and 2 1/3 yards of sand. Knowing the price of cement and sand in one's own locality he can arrive at the price of the material necessary for making 1,000 cement tile. And knowing the approximate rate at which they can be made, and the price of labor in his locality he can calculate the entire cost, or if he can make the cement tile in his spare time, he can calculate just about what wages he would be saving by making his own tile.

White Grubs and Wire-worms.

Editor "The Farmer's Advocate.":

With the advent of spring farming operations will soon be in full swing again, hence a few suggestions relative to the preparation of the ground, previous to planting, may be useful.

From observations gained last summer in Western Ontario, indications point to as serious an injury, even if not more serious, than was occasioned last year to the cereal, grass and root crops, by the white grub and wire-worm.

Usually a patch of sod, a quarter of an acre or less, in different parts of the field, killed out entirely by the white grub, is not considered at all serious by the ordinary farmer, yet, if the sum total of the destroyed area were ascertained it would amount to hundreds of acres. No two insect pests are so heavily taxing the farmer every year as these two.

Normally feeding on the roots of grass, the insidious nature of the work of these insects, usually passes unnoticed, except when a pasture or hay field is plowed up, and the land planted to some other crop. Their food supply diminished, they concentrate their attack on the freshly-planted field, at a time when the young crop is least able to withstand the drain. Wire-worms, of course, will attack the newly-planted seed, and in some instances, last year, it was necessary to re-seed the whole field, and even then a very poor stand was obtained. With the white grub, the seed must first germinate, but as this particular pest can live for several weeks on soil alone, a few days make little or no difference, other than to create an extra good appetite. As the greater part of their life is spent under the soil, it is impossible to apply any of the usual insecticidal treatments. The solution of the difficulty therefore, rests in crop rotation and thorough cultivation. Fall plowing of sod land, is perhaps the best known remedy at the present time, and indeed this would apply to all land, whenever possible. Not only are large numbers of hibernating insects destroyed by exposure to the rigors of the winter, but the heavy frosts