Open Ditches.

BY C. G. ELLIOTT.

We are led to say something more about open ditches, because of their importance to the subject of tile drainage, and because of many apparent mistakes in their construction and use. It would be hard to estimate the value which our ordinary surface drainage has added to our agricultural products, and it is safe to say that the same ratio of increase would go on if the ditches already in existence were made more efficient by deepening, widening and properly grading them.

The efforts of land owners for several years past have been directed toward relieving their land of surface water in times of excessive rain. Open ditches are very slow in their action upon the land until it has become saturated, when water begins to flow over the surface until it reaches the ditches, and then the movement is very rapid toward the streams. Very much of our tile drainage is the same in effect. Drains are laid only in natural depressions, and a great deal of water which passes through the drains must first pass over the surface until it comes within the compass of the drain, when it passes off rapidly, and the whole process similar in action to the open ditch. This will probably continue to be the case, and high water evils will even increase until more systematic and thorough work in under-drainage is done. The effect will then be to hold in check the large rainfalls, and allow the water to pass off more gradually through a system of under-drains. The effect of thorough drainage in its bearing upon this question will be to give a more even distribution of the rainfall both to the streams and to the growing crops.

BEHAVIOR OF OPEN DITCHES.

Many ditches now found are very unsatisfactory to their owners, and inefficient by reason of defects which may be remedied. Owing to the labor of first construction, it is often thought best to make a small channel and rely upon the action of the water to enlarge and deepen it. If the ditch has a fall of twelve feet per mile, this action is quite effective. The sides of the ditch become underwashed and fall toward the centre, so that an obstruction is made which must be removed by hand-work. At the best the ditch is small and often overflows its banks. If the ground through which the ditch passes is flat, and but little washing away is done, it soon fills with sods and rubbish, and the ditch is pronounced a failure.

Many open ditches have just grade enough to keep their channels clear if they have the proper width, depth and side slopes. In fact, any open ditch with a fall as slight as five feet per mile will keep itself clear of sediment if it is of proper shape and graded on the bottom uniformly.

SIZE AND FORM.

Where it is designed that a ditch shall afford an outlet for a system of tile drains, and also be a water-course for a tract drained from various points above, it must be large—much larger than is usually provided. A ditch three feet deep ought to be twelve feet wide at the surface. This will give side slopes of two to one, which will not wash and cave into the channel. Another advantage which this gives the ditch is that a more even velocity of flow will be maintained, for, as the depth of water decreases, it will be more concentrated at the bottom of the ditch, and the scouring effect of the current will be maintained as long as the water flows. Another advantage is that it can be kept clear of weeds and grass more easily, for the ditch is always dry a part of the summer, and a growth of vegetation covers the sides, which growth *must* be removed if we desire to get the full capacity of the drain.

The above-described ditch may serve as a pattern, yet it must often be made wider and deeper to serve a special purpose. The writer would press this advice: Make ditches wide and deep at first, if possible. We can not afford to wait a series of years for nature to wash out and complete our work, when we have valuable land wasting every year for the want of drainage. *Strike at the root of the matter and get a drainage outlet which will be permanent and satisfactory.*

HOW TO DO THE WORK.

Usually it can be done when the ground has been dry for some time, this is just after harvest time, or still later in the fall. Determine upon a line for the ditch, making it as straight as is consistent with the nature of the land, remembering that the straighter the course the greater will be the velocity and flow of water. Use a strong three-horse team, and plow the ground with a road plow. Then with road scrapers remove the loosened earth to each side of the ditch, taking care to scatter it evenly. Alternate the operations of plowing and scraping until the work is completed to a grade as near as can be determined by the eye. A level line should then be run along the bottom of the ditch and so marked that it may be brought to a final accurate grade. A strip of grass ten feet wide should be preserved on each side of the ditch in order that the banks may be held firmly in place. A grading machine is in use in some places, which greatly expedites the work if the ground is in a suitable condition.

Advantages of Underdraining.

The following extracts are copied from Waldo F. Brown's excellent treatise on "Success in Farming:"

It prevents the drowning out of crops in wet seasons.

It enables the farmer to work the soil earlier in the spring and sooner after rains.

It prevents the souring of the soil caused by excessive moisture.

It lessens the risk of freezing out in winter grain.

It lessens the risk of surface washing.

It keeps the ground moist and the crops growing in a dry season.

It makes the ground warmer.

It permits a more thorough pulverization of the soil.

It increases the fertility of the soil.

To read this list of advantages may at first make one think of the advertisements of some patent medicines which are warranted to cure all and the most dissimilar complaints, but there is not one of the above points but what has been demonstrated practically, and can be explained scientifically.

HOW DRAINAGE IS BENEFICIAL.

To comprehend this we must consider as briefly as possible some of the characteristics of the soil, and the requirements of successful plant growth.

No soil can produce useful crops when it is permanently saturated with water. Such a soil may grow reeds and rushes, but not crops of wheat or corn.

The best condition of soil for successful plant growth is found when the particles of the soil are moist, but when there is no standing water between these particles.

Whatever means will bring about this condition, will accomplish all the results just stated as being accomplished by underdrainage.

In wet seasons, if no adequate means are provided for removing the excess of moisture that falls upon the soil, it will be continually saturated, and the crops will be drowned out. Underdrainage, by furnishing means for the escape of the surplus water, prevents this.

It needs no argument to prove that underdraining enables the ground to be worked earlier in the spring and sooner after rains, but farmers should consider the advantage connected with this. The success or failure of a crop may often be determined by the time when the ground for them can be prepared.

Water standing in the soil causes the vegetable matter to undergo what chemistry calls the acetic fermentation, thus rendering the soil sour and unfit for cultivation; of course underdrainage removes this evil by removing the cause.

The "freezing out" of winter grain is not occasioned by the excessive cold, but by the formation of ice in the upper part of the soil, which throws out the plant and leaves it to perish. If the soil is underdrained the water passes off through the drains instead of remaining in the surface soil, and this injury is avoided.

If the soil is full of water, that which falls upon it in rain must flow off over the surface, carrying with it much of the best and finest of the soil, and often doing much damage. Underdraining leaves the pores of the soil empty, so that the water falling upon it sinks directly in, to be ultimately carried off by the drains.

All these points are reasonably clear, but we now come to a claim that at first seems paradoxical:—How can draining land keep it moist and the crops growing in a dry season?

First. By enabling the farmer to thoroughly pulverize the soil, which fits the soil for drawing up moisture from below.

Second. By preventing the soil from becoming baked and cloddy. When a soil is saturated with water and becomes dry simply by evaporation, it hardens and bakes so that it is incapable of receiving moisture either from the air above or the earth below.

Third. By causing the plants to send their roots deeper into the soil. When a plant begins to grow in the spring in an undrained soil, the roots will not penetrate into the cold lower soil, filled with stagnant water, but run along through the few inches of drier surface. When the dry weather comes the sun completely dries this out, and the plant having no other source of supply, perishes. On land that has been underdrained, in the condition described as most favorable for plant growth—moist, but with no standing water between the particles, the plant sends its roots far and deep. When the sun of summer dries the ground, the plant has communication with the cool moist soil far below.

The past season has demonstrated the truth of this claim beyond a question. The best crops were grown on the well drained fields.

Underdrainage makes the ground warmer:

First. By admitting the warm air into the soil. As fast as the water is drawn off from below, the warm air follows, penetrating and warming the soil.

Second. Because a dry soil can be warmed more readily than a wet one.

Third. Because evaporation is avoided. Every one who has ever been caught in a shower of rain, and stood with wet clothes on, knows how the evaporation of the water chills him. Science teaches us that the evaporation of one pound of water requires four times as much heat as would be required to raise the same amount from the freezing to the boiling point. We see therefore that if the water that falls upon the soil remains until removed by evaporation, all the heat which should be making the soil warm is being wasted in evaporating the water.

Everybody knows that if a jug of water is wrapped up in a wet flannel, the water in the jug will not get warm as long as the flannel is kept soaked with water. Just so with the soil. It will not get warm as long as the surface is full of water.

Experiment has demonstrated the truth of the theory in this matter. One experimenter made a number of tests in two adjoining fields, one drained, the other undrained. The average temperature of the soil in the field that had been drained was 6½ degrees higher than in the other. Further experiments have fully confirmed these.

And this adds another to the seasons why drainage enables the earlier cultivation of a field and lengthens the season: the ground becomes warmer so much earlier in the spring and remains warm later in the fall.

Drainage increases the fertility of the soil in exactly the same way as pulverizing does—by enabling the soil to absorb fertility from the atmosphere.

More about Ensilage.

BY H. S. WALDO.

Many extravagant statements have been made by ensilage theorists in regard to the value of ensilage as a feed for our farm stock. It has been claimed that cows will increase in quantity of milk if taken from the best pasture and confined to ensilage; that by its use gilt-edged butter can be produced at all times of the year; that any of the farm stock (hogs and poultry included) can be fattened on it alone, and that sixty tons of green corn can be produced from a single acre in one year.

Such statements are, without doubt, very extravagant, and give rise to much argument and doubt as to whether or not it is of any especial value as a winter feed.

I think there are a great many people who get an erroneous idea of what is meant by ensilage. It seems to be generally applied to corn fodder; but rye, oats, grass or any green fodder can be ensilaged as well as corn. The reason that corn is generally used is because of the larger yield it will produce per acre.

Much has been said about the fermentation of the ensilage while in the silo, and that it acts as a stimulant, affecting cattle as alcohol does men. This is, however, an improper word to use, as there is no genuine fermentation in the silo; that is, no alcoholic or acetic fermentation. For should any collect, it, being unconfined, would at once evaporate. The change that takes place in the silo is claimed not only to help digestion, but is, in fact, a part of a veritable digestive process. The peculiar smell of ensilage is not dissimilar to the partially digested foed in the stomachs of animals feeding on vegetable food. The matter has