

affects them. The internal behavior of the plant has not been changed one bit, but a dominant factor of the normal season has been changed—the length of the daylight. So far as known the plant has to respond, and it does respond in one way or another.

#### Home Demonstrations Possible

If anyone wishes to demonstrate these facts to his own satisfaction, let him obtain some small plants of poinsettia, or grow some plants of Klondyke cosmos in spring and keep them in a very dark, ventilated room or warm, dark cellar, giving them the sunlight each day from 6 a. m. till 3 p. m. Darkening the plants in the middle of the day several hours will not produce these effects. In about a month they will flower quite out of season and prove of no little interest to all who see them and learn the methods which made them flower. In this simple experiment one has worked out a fundamental relation in the behavior of plants, i. e., their growth and flowering responses to the factor of length of day, whether it be a natural seasonal relation or an artificial control of the daylight.

H. A. ALLARD.

**DRAINAGE Ditch Clearing** The function of a drainage ditch is to remove excess water from the soil and ground surface. Injury to growing crops after a rain is often averted by the rapid removal of this superfluous water. Any obstruction in a ditch retards the velocity of the moving water and thereby partly defeats the object for which the ditch was intended.

Vegetation is the most common form of obstruction in ditches. Drainage ditches badly choked up with growth are a very common sight in every section of the country. This growth consists most generally of weeds, tall grasses, vines, bushes, and small trees. The generally bad condition of ditches throughout the country would naturally lead one to conclude that very few landowners realize that there is a great difference in the discharge or water-carrying capacity of a cleared and an uncleared ditch.

The presence of vegetation in a ditch indicates either that the landowner is not deriving the full benefit from drainage for which the ditch was intended or if he is receiving this benefit that he has invested his money in a ditch which is larger than would be required if the vegetation were kept out. Apparently the truth of the above statement is not generally accepted by the farmer, so for the purpose of showing definitely to what extent the capacity of a ditch is affected by the growth of vegetation a large number of measurements of the flow of water in ditches before and after clearing and before and after the growth of vegetation were made by the writer and his associates in the Department of Agriculture.

#### Drainage Good After Clearing

In Figures 71 and 72 are two views of the Lake Fork special ditch near Bement, Ill. One of these views was taken looking upstream and the other downstream over the same portion of the channel.

The view in Figure 71 was taken during July, 1924, when the vegetation in the channel consisted principally of bushy willows which



FIG. 71.—Lake Fork special ditch near Bement, Ill., before clearing, July, 1924

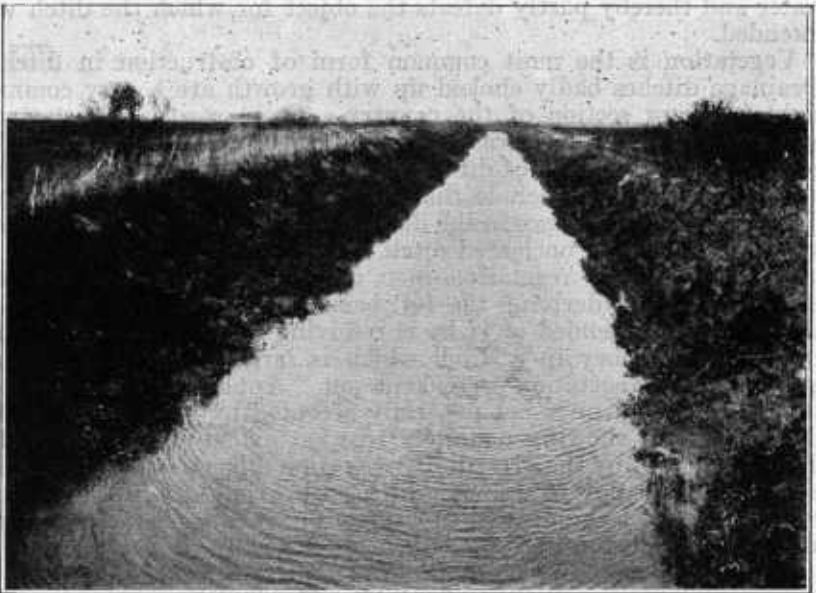


FIG. 72.—Lake Fork special ditch near Bement, Ill., after clearing, May, 1926

were in full leaf. The view in Figure 72 was taken during May, 1926, after the growth had been cut out. Measurements of the flow in this ditch were made before and after clearing and it was found

that the channel carried about 75 per cent more water after it was cleared. The cost of clearing out this channel was insignificant as compared with the losses sustained by the farmers owing to the tardy removal of the excess water after a rain. Since clearing the channel satisfactory drainage prevails.

The Kaskaskia mutual ditch near Bondville, Ill., has never been cleared since it was dug, as one might suppose, judging from the large size of the trees in the channel. A view of this ditch taken when the trees were in full leaf is shown in Figure 73. The thick foliage practically obstructs the view of the channel and the capacity of the ditch in this condition is only about one-third of what it would be if it were cleared out. Ditches of this sort afford extremely poor drainage. Not realizing the cause, landowners will often have such



FIG. 73.—Kaskaskia mutual ditch near Bondville, Ill., July, 1924

ditches dredged larger at great expense when if the growth were simply removed at a comparatively small expense adequate drainage would be provided.

#### Willow Growth Reduces Ditch Capacity

Measurements of the flow in the Cummins Lake ditch near Gould, Ark., were made to determine what effect a comparatively short-time growth produces. It was found that the capacity of this ditch before the appearance of the willow growth was about 50 per cent greater than it was after they had grown a year or two, and twice as great as when the willows were in full leaf. These measurements apparently indicate that drainage ditches should be cleared out every year in order that they be maintained in a state of high efficiency. An examination of the bottom of this ditch showed that a certain amount of silting has taken place, which is due no doubt largely to

the presence of vegetation. It is a generally established fact that where vegetation remains in a ditch over a long period of years the cross section of the ditch is greatly reduced in size by the accumulation of silt, and it becomes necessary to redredge the ditch at great expense. This, of course, is especially true where the ditch drains a somewhat rolling and hilly watershed.

#### Enlarging Ditches Often Unnecessary

The Cypress Creek drainage district near McGehee, Ark., has never been cleared since it was dredged. The trees in the channel are about 8 years old. Measurements of the flow in this channel were made when there was a heavy growth of foliage on the trees and it was impossible to see any appreciable distance along the channel. It was found that the capacity of this ditch is only about one-fourth of what it would be if it were cleared out, and that a clear ditch about one-third its size would have the same water-carrying capacity. The capacity of the ditch in its present condition is entirely too small to provide satisfactory drainage for the land in its watershed. Overflows generally occur after every heavy rain.

The results of the measurements described in the foregoing tend to show :

That the usefulness of a ditch is greatly impaired by the growth of vegetation.

That the clearing out of a long-neglected ditch will often provide satisfactory drainage and prevent injurious overflows.

That the costly mistake of enlarging a ditch is sometimes made when simply clearing the ditch would have produced the desired result.

That in most localities drainage ditches should be cleared out once a year if maintained in a state of high efficiency.

That the expense of clearing out a channel is in most cases much less than the crop losses suffered from one moderate overflow.

That vegetation in a ditch causes appreciable silting which often requires the redredging of the ditch at great expense as compared with the much smaller expense of systematic maintenance.

C. E. RAMSER.

**DRAINING Marshlands Unwisely** Marsh areas produce a greater income in many cases than do adjacent farmlands and also are indirectly valuable to the surrounding country. Through ignorance of this, there is much needless destruction of the homes of birds, fur animals, and other kinds of wild life amid such surroundings as conservationists seek to perpetuate. They do not, however, oppose the drainage of lands that will be less valuable as wild-life refuges than for agriculture or any other economic use.

The Department of Agriculture is in position to assist both the agriculturist and the conservationist in solving conflicting drainage problems. In recent years the Biological Survey has made many investigations for associations and individuals, and, as a result, a number of proposed drainage projects that were found to be unwise have been abandoned or the areas under consideration were, when suitable, made into wild-life refuges. The upper Mississippi River wild life and fish refuge furnishes an outstanding example of a marsh and water area which was recently seriously contemplated