

crop, as corn, then the cereal. A clean summer-fallow is an effective means of eradication, and is often followed, where the weed has gained a very strong hold of the land. Light cultivation is all that is required, keeping the plant from appearing above ground.

These plants, and many others, are dealt with in Bulletin 188, entitled "Weeds of Ontario," by J. C. Howitt, which may be had on application to the Ontario Department of Agriculture. Every farmer should know the weeds, and the various weed bulletins are a great help in this direction.

### Oat Hay.

The season's hay crop being light in many sections, some stockmen may find their supply a little short of the quantity required to meet the demands made upon it by their animals. Where this is the case, it is necessary to make use of whatever material there is at hand that can be used to fill the gap caused by the shortage of hay. For this purpose some use oats, which, if cut at the right stage, can be made into very suitable dry feed. If a mixture of peas and oats has been sown, so much the better, as the peas will add an extra amount of protein. Any of the various cereals can be used for this purpose, but very often oats give a larger yield of dried roughage per acre than the others, and consequently are more often employed for this purpose.

A very important factor in the making of cereals into hay is the time of cutting. The best time to cut is just when the grain is in the early milk stage, at which time the stems and leaves may be cured into bright hay of very good quality, and reasonably free from dust. If cut too green, the cereal grasses contain so much sap that they are very hard to dry, and require a great deal of air and sun, and even then it is hard to get the forage cured properly, so that it is free from dust. If left until too far advanced toward maturity, the fibre in the plants increases so fast that the digestibility of the dry roughage is very materially lowered. As the plant matures, the large amount of amide nitrogen gradually decreases, while the more valuable albuminoid substances increase. The percentage of proteid material is greatest in the young plant, but there is a stage in the plant's growth where the fibre increases rapidly, thus decreasing the digestibility by adding to the percentage of this substance, while the percentage of proteid material decreases, but some of the amides are changed to digestible albuminoids. From practice and analyses, it has been found that the greatest amount of digestible nutrients are found to be present when the grain is just beginning to fill, or in the early milk stage. A portion of a field of grain that has been badly lodged by a heavy storm, or by land overrich in nitrogen, causing a soft straw, might quite properly be used for this purpose, because crops, under such conditions, usually give a poor yield of grain.

The cereals are used quite extensively for hay in the States bordering on the Pacific Coast, and the speed of the light horses and endurance of the work horses of those regions is often attributed to this fact. It has been known that, where horses have been sent from this district to race on the Eastern tracks, a supply of cereal roughage has been sent with them, which testifies to the value placed on this kind of feed by those who have tried it.

If it is cut at the proper time, and is well cured, it will compare very favorably with clover and timothy, two of the common crops used for hay in Canada. Timothy hay contains about 2.8 per cent. digestible crude protein, 42.4 per cent. digestible carbohydrates, and 1.3 per cent. digestible fat, and clover hay about 7.1 per cent. digestible crude protein, 37.8 per cent. digestible carbohydrates, and 1.8 per cent. of digestible fat; while good oat hay should contain about 4.7 of digestible crude protein, 36.7 per cent. digestible carbohydrates, and 1.7 per cent. of digestible fat. It will be seen by the foregoing that the oat hay is much richer in protein than the timothy, and, while not so rich as clover, it would contain a higher percentage than a mixture of clover and timothy, which is quite a common hay mixture in this country. In digestible carbohydrates, there is very little difference in the three, and in fat they are much alike, so it is seen that oat hay, if properly cured, is one of the best of roughages, and, where conditions are such as to cause a shortage of hay, this crop can be used to good advantage for this purpose. A portion might also be used for summer feeding.

Present investigations, concludes an American bulletin by W. L. McAtee, prove that the services of grosbeaks in destroying insect pests are invaluable. Each kind pays special attention to certain pests which, if unchecked, would cause enormous losses. Few of our birds are to be credited with more good and with fewer evil deeds than the grosbeaks, and none more clearly deserve protection by the practical farmer.

### Cutting Grain for Seed.

Grain-growing is one of the principal phases of Canada's agriculture, and, to make the best of this, it is necessary that a very high quality of seed is produced. Many grain-growers make it a special line of their business to produce seed of a high standard, and are, so to speak, "breeding seed grain." Harvest is now at hand, and in many districts much of the winter wheat will have been reaped before this is read, while in other districts harvest will not have begun.

One of the important points to be considered in producing the strongest and best of seed is the degree of maturity at which the grain is cut. Plants use up all their energy in the endeavor to produce seed and to insure the propagation of their species. As the grain begins to ripen, the sap containing the soluble plant food is taken up to the seed, and the seed is thus matured in the best possible manner. There are several stages in the maturity of grain, from the early milk stage to the dead-ripe stage, when the grain has absorbed all the possible nutrient material from the straw, and the straw is about to break or crinkle down.

Many grain-growers cut their grain a little on the green side, claiming that a brighter sample is obtained, and that the sap retained in the straw gives it a higher feeding value, as it is not quite so fibrous and is a little more palatable. This is no doubt true, but where seed grain is the primary object, the crop should not be cut until fully matured. As soon as the growth of the plant ceases, the seed takes all the plant-food material from the stalk and stores it within itself, and it is important that the plant be not cut until all the constituents are so stored that can possibly be stored in this way. The seed, besides carrying the young embryo plant, must contain enough food material to keep the young plant alive after germination and before its roots have food from the soil. A great deal depends on the size and plumpness of the seed, because a large, plump seed is a stronger seed, and will produce a healthier, more growthy plant than a small, shrunken seed. In germination, suitable temperature, accompanied by moisture, causes the starch of the seed to be changed to sugar, and the plant food held in the seed is changed to an available form for the maintenance and growth of the young germ. It must always be remembered that the young, sprouting plant must depend for a certain time on the food material within the seed itself. For this reason, grain that is being grown for the production of high-class seed should not be cut too green, but should be left to mature to the ripe or dead-ripe stage, and only be harvested in time to prevent serious loss from shelling or from breaking down so that the heads are cut off and lost.

### Cutworms, Armyworms, and Grasshoppers.

May Bulletin No. 123, of the Agricultural Experiment Station, in connection with Minnesota University, deals with cutworms, armyworms and grasshoppers. The usual remedies for cutworms, including thorough cultivation, poisoned bran, traps consisting of boards or shingles, and protection with paper, etc., are given. Armyworms, particularly the wheat-head armyworm, are not found frequently in any locality, but in case it should appear, a knowledge of preventive measures and remedies would be of value. Fall plowing and rotation of crops are given as great means of preventing the ravages of this pest. If the crop is threatened, deep furrows should be plowed across the line of march of the worms, with the steep side of the furrows toward the crop to be protected. Post holes, eight or ten inches deep, in these furrows for traps. Paris green or arsenate of lead may be used to spray a strip along the worms' line of march, the former two or three pounds in 100 gallons of water, and the latter four or five pounds in 100 gallons of water. A heavy roller is sometimes used for crushing the worms where they are very thick. Clean culture along fence rows and other places is always advisable in fighting this insect. Grasshoppers have worked mischief in many seasons, but last year was one of the worst. The seventeen-year locust or harvest fly is not a true locust or grasshopper, but is often confused with them. Large tracts of land which are left uncultivated offer ideal places for the egg-laying and propagation of the grasshoppers. In districts where large tracts are held by speculators, the insects do much damage. The species which did the damage in Minnesota in 1910 were the red-legged locust or grasshopper and the two-striped locust or grasshopper.

The remedies given are several, which are quite simple and effective. Grasshoppers lay their eggs in late summer and fall, and their eggs hatch in spring. Deep fall plowing and thorough harrowing destroys many of the eggs. The young hoppers just hatched may be plowed under by beginning at the outside of the field and plowing toward the center. Plowing a strip to check the advance of the hoppers, is recommended where a crop is threatened. To kill the young hoppers,

four methods are given, the first being the Criddle mixture, which consists of one part Paris green to about one hundred parts fresh horse manure, by measure, made soft with water and spread over the land or in a strip which the hoppers are likely to cross.

Young hoppers are sometimes killed by burning over an affected tract, while poisoned bran is also used in proportion of two parts of Paris green to twenty-five parts of bran, by measure.

Hopperdozers are a great help. They are made of sheet-iron, about 16 feet long, about 20 inches wide, and 4 inches deep, with a canvas two feet high at back and ends. This is placed on runners, and drawn by a horse at each end. The canvas back is drenched with kerosene, and about two quarts of the oil are poured on the water in the pan or trough. The machine is drawn back and forth across the fields on warm days, and is an effective means of destroying the insects, as a grasshopper is doomed if he gets in the kerosene, even if he hops out again.

### Wanted!—Dry-weather Crops.

On one side of the concession, oats a sickly, whitish green, headed out prematurely at eight inches; across the way, a dark, luxuriant green, just heading at three feet. Even in the same field, corresponding conditions are to be seen as between older, upland and new, freshly-broken sod. The timothy meadow stubble is as brown as an August pasture, but the alfalfa on the ridge that gave a three and a half foot cutting in June is again covered with a thick, green sward six inches high.

What makes the difference? Primarily, two things: Soil in "good heart" and moisture, though some particular variation in method may have affected the result.

Since we do not count on enough rainfall during the growing period to insure a full crop, where is the moisture to be got? From the reservoir below. During autumn, winter and spring plenty has fallen. It is a question of storage, so that there will be food and drink for the plants at the critical time. Part of the rainfall runs away, part evaporates, and part soaks away. How are we to check those spring torrents, stop that evaporation, and stay that soaking? In other words, how are we to hold the moisture that we have? We might as well make up our mind on the start that it will not be by any one magic method of so-called "Dry Farming," but by a combination of things that are called "Good Farming."

It may seem contradictory, but one of the first steps towards holding moisture is drainage. Lowering the level of the water table, and taking away by gravitation the surplus accumulating, say, in spring, we warm, aerate, mellow and open the soil particles, or multiply what are called the pore spaces in the soil, so that it has more room to hold water in a condition of availability for the roots of the crop. In case of a field properly supplied with tile drains, the excess of surface water is drawn off more gradually, and without the loss of the surface soil through washing, nor does it dry out into that hard-caked condition in which evaporation goes on most rapidly. And then the drained land can be worked first in spring and the early-sown grain is a winner ninety-nine times out of one hundred, because it has a root system and leaf-covering that defy the drouth.

This brings us to the main point, the composition and mechanical condition of the soil as means affecting its moisture-holding power. The number or grouping of soil particles and pore spaces is greatest in a soil well supplied with humus, and humus is best furnished by barnyard manure and plants like clover and alfalfa, which latter has the happy faculty of going down after water, like an artesian well-digger. In a system of tillage to hold moisture, as a rule, deep fall-plowing will probably be found best. The upper ten or twelve inches of soil is thus made porous, becoming, as Dr. John A. Widtsoe, of Utah Agricultural College, calls it, a sort of temporary reservoir to absorb and hold the rain or melting snow. A good deal of mischief has probably resulted from a lot of teaching, in recent years, favorable to shallow plowing or skimming. As June and July rains become less frequent, people will likely find it advisable to hark back to the old system of honest fall plowing. Shallow spring tillage may be best for spring grain following a corn crop for which the land has been heavily manured and given ideal cultivation. It should be in prime condition to hold moisture if the seed-bed has been thoroughly worked and mellowed. Even after the grain is up an inch or two, a sweep of a light harrow will do good, killing young weeds and making a soil mulch to prevent evaporation. For corn, roots and garden crops, repeated cultivation is the plan of campaign. There is real magic in the cultivator and the hoe. The old teaching laid emphasis on breaking the crust after rains, as soon as one can make a fine, shallow mulch. But even when the soil looks dusty, it will be found to have settled down together sufficiently that the little