pression which is the accompaniment of a murky atmosphere.

WASTE IN WHEAT-CROPS.

IN most of the wheat-producing regions of North America a yield of thirty bushels per acre is exceptional, and one of forty or more, remarkable or extraordinary. Most farmers are content to get a return of fifteen or eighteen bushels, and only twelve and one-half is the average yield throughout the United States. The usual increase is thus only about ten or twelve fold, and only very exceptionally thirty or more fold. Doubtless most persons who have given the subject any attention wonder why it is that among all farm products the return should be so small for the amount of seed sown. In a late number of the *Contemporary review*, Dr. Paley has discussed this subject, and brought out a number of interesting facts.

A single grain of wheat will produce from five to seven ear-bearing stalks: experiments seem to show that the latter is the normal number. The single blade 'spears' first into three, then into five or more side-shoots, every one of which, separated and transplanted by hand, will form a new plant. Each ear contains, on fairly good land, from fifty to sixty, sometimes even seventy, grains. Three or four of the terminal grains are generally smaller, or otherwise defective, and are rejected in winnowing and screening the wheat. But as a fair average, on a moderate estimate, a single grain can produce three hundred, and there is a possibility of four hundred, or even more. This means, of course, that every bushel sown can, theoretically at least, yield three hundred bushels; but, as we have seen, the actual yield is only a small portion of this.

In tracing, then, the bushel sown to the twelve or fifteen bushels that come into the farmer's granary, we have to inquire what proportion of the seed germinates, how much of it is destroyed by birds, mice, insects, and how much grain is shed from over-ripeness, or lost in harvesting and threshing. A very considerable quantity, without doubt, is the aggregate loss from these causes combined. Still the immense difference between the quantity that can be, and theoretically ought to be, produced, and that which actually goes into the wheat-bin, remains to be accounted for. The loss of grain in the various processes of harvesting evidently must be much greater than is commonly supposed. If one take a ripe wheat-ear, and strike it on a table, he will see some grains fall out; and, if he examine where a wheat-sheaf has fallen, he will find not a few kernels that have been shed. Certainly the 'volunteer' growths after harvesting are sufficient evidence of waste.

To ascertain, with something like accuracy, the actual produce of the wheat-plant, Dr. Paley planted a small piece of garden-ground, of moderate wheat-growing quality, with three separate parcels, each of fifty average wheat-grains. Of these three parcels, the first (A) was sown broadcast; the second (B) was set in two rows, after the manner of drilled wheat; the third (C) in separate grains six inches apart, — all carefully covered with earth. Besides these, he planted twelve grains three and a half inches deep (D), and three grains in each of three holes, one inch deep (E). Of group A, twenty-five came up, and produced one plant of three stalks, six of four, three of five, seven of seven, and three of nine, with a total of one hundred and forty-eight ear-bearing stalks; of B, thirty plants grew, giving two of two stalks, eight of three, one of four, ten of five, six of seven, two of ten, and one of eleven, with a total of one hundred and fifty-one; of C, thirty-two plants grew, producing a total of one hundred and forty-eight ear-bearing stalks; of D, not a single one germinated; and of E, only one, which did not thrive well. The nearness of the totals of the first three is remarkable. If thus we estimate an average of three stalks from each grain sown, and for each ear fifty sound grains, we should have a yield of one hundred and fifty fold.

What, then, are the reasons of such an extraordinary difference between theory and practice? Besides the various kinds of blight, such as smut and mildew, affecting the straw or the ear, and greatly diminishing the production, there are other causes why wheat is said to thresh out badly, which are less visible while the crop is standing. One of these is the partial filling of the ear: there is more chaff than there should be in proportion to the grain. There is a popular idea about the wheat-plant which is entirely erroneous. It is thought, that, if high winds prevail while the wheat is in flower, the anthers, which are seen dangling from the ears, will be blown off, and the grain will not set through the loss of pollen. Year after year we see this stated in agricultural papers and grain reports. But the fact is, these anthers, when protruded, have already performed the office of impregnation, which takes place within the closed glumes. The 'flowers' seen hanging down are exhausted anthers, and wholly useless. The following experiments seem conclusive proof of this. Let one gather a dozen green wheat-ears from a plant that is just beginning to flower, and keep them for an hour or two in a warm room in a glass of water. The anthers may then be watched in succession in the very act of being protruded

through the tips of the glumes, which open just a little to let the thread-like filament hang out, and then close up tightly. One should then remove the ovary, with stamens and pistil, of a plant just about to flower, and, by breathing on them gently, the anthers will be seen to burst with a spasmodic motion, scattering the pollen in part upon the pistil. Immediately after the bursting of the anthers, the filament becomes restless, and begins to move. Contrary to the usual nature of this organ in plants, it is elastic; and one may watch it increasing to the length of half an inch, carrying with it, as it creeps along, the now empty and useless anthers. These observations will prove that the filament does not expand till after the discharge of the pollen, and consequently that the ovaries have been already fructified when the wheat is in flower.

This exceptional elasticity of the filament is a wonderful fact. Its purpose is to make room within the narrow seed-case for the enlarged grain by ejecting the used-up organs of the inflorescence. Occasionally, in a ripe wheat-ear, it will be found that they have not been got rid of, but lie shrivelled and crushed up within the glumes.

In social plants, which, like wheat, naturally grow best when they grow by themselves to the exclusion of others, the great law of 'the survival of the fittest' will ever be in active operation. Many feeble plants will die out, or dwindle to a stage only short of extinction, thrust out of existence by more vigorous neighbors.

The foregoing observations seem to prove that much yet remains to be studied in the habits of the wheat-plant before we shall arrive at a scientific knowledge of wheat-raising. To prepare the right soil (for too rich soil produces stalk to the loss of seed), to sow most judiciously, to withstand the injuries of mildew, insects, birds, etc., to prevent loss in harvesting or threshing,—all are problems that deserve more attention than they have received, in order that the usual yield of fifteen bushels may be increased toward the possible one hundred and fifty.

POISONOUS MUSSELS FROM IMPURE WATERS.

THE not infrequent occurrence of poisoning from eating mussels makes the discovery of any facts concerning the causation of such poisonous qualities a subject of special interest. In the following, gathered from several recent German publications, it appears that impure waters will produce such effects, and hence it impresses the necessity of careful sewerage regulations upon such seaport cities where food-supplies are derived more or less from the immediately adjacent waters.

In Wilhelmshaven, a city of north Germany, a few months ago, a large number of people were suddenly taken sick after having eaten of the common edible mussel of Europe and North America (Mytilus edulis), obtained from the harbor. Several thus poisoned died from the effects, in one case within a few hours.

The subject has attracted much attention throughout Germany, both from the public and a number of scientific men. It was ascertained later that the mussels of this harbor, when transferred to other waters, lost their poisonous nature; and, *vice versa*, harmless mussels, placed in the harbor, in a week or two acquired poisonous qualities. From the report by Professor Möbius, of his researches upon the subject, it appears that the basin or harbor of Wilhelmshaven is closed in by a breakwater, so that the water becomes stagnant and unfreshened by the tides, the breakwater only being opened at high tides to allow the entrance of ships. The sewerage of the city is not discharged into the harbor, but into the open sea, and all ships are prohibited from throwing matter into the water that could cause pollution; nevertheless the stagnating water, as will be seen, is impure, and highly dangerous in its effects upon animal life. The only fishes that live in the harbor are eels and whiting. Others that find entrance at the opening of the sluice-gates soon lose their activity, and can be easily caught in the hand; even the eels in summer are observed in a weakened condition swimming sluggishly near the surface.

Numerous and repeated experiments showed that the mussels, when freshly taken from the water and cooked, possessed a most virulent poison, killing rabbits in from two to ten minutes. It was also shown that these mussels, taken from situations where the currents of outside water entered, were not at all poisonous. Hence it is evident that the water of the harbor contains qualities that render the mussels poisonous without appearing to injure them.

The researches of Professor Virchow and Dr. Wolff have shown that the poisonous nature was not due to decomposition. The mussels, when freshly taken from the water, gave no external signs of disease. From the extended studies of the latter author, however, as given in the last number of Virchow's *Archiv*, it appears that all portions of the body were inert except the liver, and that in every case rabbits and guinea-pigs inoculated with a portion of this organ died in from two to twenty minutes. The liver is a large, yellowish brown, soft body, enclosing the