utmost importance, and yet one of the greatest difficulties encountered, is the mastery of the proper method of disintegration, especially of the insoluble substances and those which are likely to lose part of their content by volatilization. If a proper solution of the unknown is obtained, the analysis is comparatively easy, whereas, if not obtained, incorrect results are sure to follow. Alloys and metallurgical products containing relatively small amounts of some one substance also require special attention.

Objections have been raised to the use of technical products for unknowns, claiming that they do not give the proper amount of training. This is apt to be true where unknowns of a commercial nature are taken just as they come to hand without special effort on the part of the instructor. It is certainly not the case if care is taken in obtaining what is necessary to suit the problem in question, for there are certainly sufficient varieties of commercial products to cover the field. Aside from giving the students a training not to be had in the use of laboratory prepared unknowns, his interest is much more easily aroused and held when he can see something "practical" in what he is doing.

I have found that where lectures are combined not alone with class-room quizzing but as well with this demonstration method the student is made to think and gets a grasp on the subject well worth the time spent in its acquisition.

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HUMUS IN DRY-LAND FARMING

It has been the consensus of agricultural opinion and experience, both in this country and in Europe, that the production of wheat on the same land year after year results in steadily decreasing yields. Chemical investigations in several instances have shown this decrease in yield to be accompanied by a correlated decrease in the supply of humus and of nitrogen in the soil. Under the title of "The Nitrogen and Humus Problem in Dry-Land Farming," Mr. Robert Stewart, chemist of the Utah State Experiment Station, has recently published the results of some investigations with special reference to the effect of continued wheat growing on the non-irrigated lands of the Cache Valley in Utah.[1]

Mr. Stewart's investigations in the Cache Valley indicate that the continuous production of wheat in that section has not resulted in a reduction of either the humus or the nitrogen supply of the soil, at least during the thirty years or more that wheat has been so grown there. He finds, indeed, that in something over twenty cases where comparisons were possible between virgin soil and soil that had been cropped to wheat for several years there has been a slight increase, both in the total nitrogen and the humus in the surface foot. In the second foot of soil on these two sets of fields he finds a decrease of the total nitrogen on the cropped land, but a marked increase in the humus. His summary of results shows that on the wheat land there has been a 10 per cent. increase in the humus supply of the surface foot and a 25 per cent. increase in the second foot.

Mr. Stewart wisely avoids any generalizations upon the limited data he presents in this publication. But it is unfortunate that he does not give more consideration to the agricultural conditions and farming methods that prevail in the region of which he writes. Unless the reader of Mr. Stewart's bulletin is familiar with conditions in the Cache Valley, the results presented are likely to seem either pointless or irreconcilable with the results of similar investigations elsewhere. To one who knows those conditions, the brief statement that "Some of the farms of this district have been under cultivation for forty-five years, and apparently yield as good crops as they ever did" may seem to be a good and sufficient epitome of the situation; but if one does not know the region, this sentence hardly seems adequate.

It is true that accurate data as to the farm yields for past years are difficult to obtain and

[1] Utah Agricultural College Experiment Station Bulletin, No. 109, August, 1910.

are unsatisfactory to use, because of the uncertain factor of variable climatic conditions from year to year; but some comparisons might have been made between the yields obtained during recent years from land that has long grown wheat and the yields on virgin or nearly new fields on similar soils. Or, lacking such data, it would have been helpful to the reader had there been given some statement as to the present wheat yielding capacity of the fields from which the samples were obtained.

Unless it is shown definitely that the maintenance of the nitrogen and humus content of these Cache Valley soils is correlated with the maintenance of their wheat yielding capacity, these investigations lose much of their possible value.

As to the matter of the farming methods for wheat production on this Cache Valley land, it is the general practise to harvest the grain with a header or with a combined harvester and thresher, either of which implements leaves on the land the major portion of the grain straw, which is subsequently plowed under.[2] Mr. Stewart makes incidental reference to this feature of the agricultural practise in the Cache Valley, but he does not make it clear that in this respect that practise is essentially different from what it is in the dry-land wheat regions of the Great Plains and eastward, where it is the custom to harvest the grain with a binder and remove the larger part of the straw. This omission seems particularly unfortunate, in view of the general, and possibly misleading, inferences that may be drawn from Mr. Stewart's otherwise valuable contribution to knowledge. If, as it seems reasonable to believe, the true explanation of the observed humus maintenance lies in the practise of plowing under each year the large amount of wheat straw, it becomes apparent that similar results are not to be expected where a similar practise is not followed.

C. S. SCOFIELD

U. S. DEPARTMENT OF AGRICULTURE,
January 14, 1911

[2] See Bulletin No. 103, Bureau of Plant Industry, U. S. Department of Agriculture, pp. 31–35, issued May 31, 1907.

SPECIAL ARTICLES

SOME EXPERIMENTS ON THE PRODUCTION OF MUTANTS IN DROSOPHILA

MACDOUGALL has reported the successful production of mutations by treating the ovaries of certain plants chemically or osmotically. As long as the full account of his results is not available, it is not easy to judge to what extent it is possible to produce mutations at desire with his method. Tower has apparently succeeded in producing in various species of *Leptinotarsa* certain color mutations at desire by submitting the beetles, during the period of the growth of the eggs, to different degrees of temperature and moisture from those in which they usually live. Gager mentions that by treating the pollen or ovaries of *Œnothera* with radium, some of the new plants were entirely different from the mother plant. Morgan has published the statement that a number of the interesting mutations of *Drosophila,* which he has recently described, came from a culture which had been treated with radium.

The following experiments were undertaken for the purpose of forming a conception concerning the degree of certainty with which mutations can be produced experimentally. We tried the effects of a constant and comparatively high temperature, of radium and of Röntgen rays. The stock of *Drosophila* which we used in these experiments was given us kindly by Dr. Lutz, to whom we wish to express our thanks.

1. *Effects of High Temperature.*—Several culture dishes with *Drosophila* were put into a thermostat, the temperature of which remained constant within 1° around 30.5° C. We found that at higher temperatures we lost a large number of cultures. In the fifth generation of flies, kept in the thermostat, on February 16, a number of dark flies appeared. They were mated with normal ones of the same culture. Some of these cultures were kept in the thermostat and others were brought into room temperature, to see whether at a lower temperature they would continue to breed true. This has now been the case for five