SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....$3.50 a year.
Great Britain and Europe..... 4.50 a year.

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FORTY YEARS OF WHEAT CULTURE IN OHIO.[1]

OHIO lies within the borders of what is known as the winter wheat belt of the United States — a region, the soil and climate of which are especially adapted to the culture of this cereal. The State possesses two great natural arteries of traffic, one on its northern and one on its southern boundary, and before the advent of the railway it was crossed by two lines of canals, each extending from the lake on the north to the river on the south, and affording outlets for its productions that served a very important function in its early history. Lying, as it does, right in the gateway between the East and the West, it has been crossed by line after line of the great transcontinental railways, while its rich mineral resources have caused the building of multitudes of other lines, running in all directions, until its territory is now traversed by a network of railways, aggregating within the State nearly 8,000 miles of main track, besides more than 2,000 miles of sidings.

Under such circumstances it is not surprising that the culture of wheat became at an early date, and has ever continued to be, a leading branch of Ohio's agriculture, and that the State should not only have liberally supplied itself with bread, but have had much to spare.

Because of this relative prominence of wheat culture in the agriculture of the State, the Experiment Station has made the study of wheat a leading feature of its work, and the statistical study now published has been undertaken primarily for the purpose of obtaining such assistance as it might give in the conduct of the station's experimental research. It was hoped that this study might throw some light upon such problems as the relative adaptability to wheat culture of soils of different geologic origin and history, and the effect of differences of latitude, of drainage, and the use of commercial fertilizers, and it is believed that some of the conclusions which it seems to warrant should be carefully considered by the farmers of large areas of the State.

[1] From the Bulletin of the Ohio Agricultural Experiment Station, Nov., 1891.

A glance at the geological map of Ohio shows three broad bands running across the State from north to south. That on the east embraces the coal measures, and extends across nearly one-third of the State; then follows a narrower strip, underlaid with Waverly rocks and bordered by a narrow belt of Huron Shales, while the western half of the State lies over limestones.

As the Waverly rocks are chiefly sandstones or calcareous shales, this formation would offer a sharp contrast between soils of such origin and those derived from limestones, were it not for the fact that, in the case of Ohio, both these formations are covered with a thick bed of glacial drift. The drift, however, is considerably modified by the underlying rocks, and it would seem that if there were any marked differences in the value for wheat culture of soils of the widely different character produced from these different formations it should be indicated in this case.

Omitting the four counties in the north-western corner of the State, which overlie the outcrop of Huron shale in that region, viz.: Williams, Fulton, Defiance, and Henry; the five counties which lie on both sides of the belt of Huron shale, extending north and south through the State, namely: Erie, Crawford, Delaware, Franklin, and Pickaway, and the five counties lying immediately north of the coal region and chiefly over conglomerates, namely: Lake, Geauga, Ashtabula, Summit, and Trumbull, the remaining seventy-four counties have been divided into three parallel belts, according to latitude, and subdivided according as they lie over the limestones, shales, or coal measures, making nine groups in all.

In the northern belt are included twelve limestone counties, viz.: Lucas, Ottawa, Wood, Sandusky, Paulding, Putnam, Hancock, Seneca, Van Wert, Allen, Hardin, and Wyandot; seven counties over the Waverly, viz.: Lorain, Cuyahoga, Huron, Medina, Richland, Ashland, and Wayne, and six counties over coal, viz.: Portage, Mahoning, Stark, Columbiana, Holmes, and Carroll.

In the middle belt are eleven limestone counties, viz.: Mercer, Auglaize, Marion, Shelby, Logan, Union, Darke, Miami, Champaign, Clark, and Madison; four Waverly counties, viz.: Morrow, Knox, Licking, and Fairfield, and seven coal counties, viz.: Coshocton, Tuscarawas, Harrison, Jefferson, Muskingum, Guernsey, and Belmont.

In the southern belt are twelve limestone counties, viz.: Preble, Montgomery, Greene, Fayette, Butler, Warren, Clinton, Highland, Hamilton, Clermont, Brown, and Adams; three Waverly counties, viz.: Ross, Pike, and Scioto, and twelve coal counties, viz.: Perry, Morgan, Noble, Monroe, Hocking, Athens, Washington, Vinton, Meigs, Jackson, Gallia, and Lawrence.

It appears that in the northern belt the counties over Waverly rocks have given a larger average yield over the entire forty-year period under review than those in the same latitude, which are underlaid with limestones or with the rocks of the coal measures, and that the rate of increase in yield during the past twenty years is also larger in the counties over the Waverly.

In the middle belt the result is just the opposite: the limestone counties show the larger yield and the greater rate of increase.

In the southern belt the limestone counties show the larger yield, but the Waverly counties show a greater rate of increase.

The counties overlying the coal measures stand below either of the other divisions in yield per acre in each of the

belts, the difference increasing in the more southerly latitudes. In rate of increase they stand between the other two divisions. The topography of these hilly, coal counties is a sufficient cause for their lower yield, and is probably the chief cause, as the rocks of the coal measures comprise both limestones and shales, and it is probable that the soils derived from them are not naturally inferior in fertility to those found in the remainder of the State.

As between the soils lying over limestones and those over shales, these statistics do not yet justify any opinion regarding their respective adaptation to the production of wheat. It is probable, however, that the middle and southern belts of counties afford a more just basis of comparison between the two geological formations than the northern belt, because in this northern region the overlying drift has been derived, to a large extent, from the rocks excavated from the lake basin, and which are both limestones and shales.

Within twenty years the area annually sown to wheat in Ohio has increased from an average of 1,800,000 acres during the eighth, to 2,500,000 acres during the ninth decade. This area represents twelve per cent of the area in farms within the State, but several counties are sowing annually 18 to 20 and even 25 per cent of their farm lands to wheat. In 1881 a total area of 2,800,000 acres was sown, and there is no good reason to doubt that with the continued clearing away of the forest and the reclamation of waste lands by drainage it will soon be possible to devote as much as 3,000,000 acres to wheat without infringing upon any other agricultural interest, and this, even though the hill counties should reduce their acreage by one-half. Such an increase, at the present rate of production, would represent an annual product of 40,000,000 bushels.[1]

But it is not to be supposed that Ohio farmers will rest content with a yield of only thirteen bushels of wheat per acre. The northern third of the State has increased its average yield within forty years by nearly three bushels, and the middle third by from one to two bushels, and it is reasonable to expect a similar increase within the next forty years, notwithstanding the fact that the rate of production seems just now to be at a standstill. It is to be expected that progress in this, as in other matters, will be more or less spasmodic, and that its actual rate can only be measured at long intervals; but it is not impossible that the time may come when the average from the entire State will equal the present average of Summit county, which means a total average production of about 60,000,000 bushels, or bread for twelve million mouths. Such a yield would be far below what has been attained in Great Britain, where the average yield is now 28 bushels or more per acre and is steadily increasing. This high yield is not due solely to the superiority of the soil and climate of that country, for the time has been when the average yield of Great Britain was very much smaller than it is at present.

Ohio's population has increased by a little more than two millions since 1850, while the total wheat yield has increased by an average of more than 14,000,000 bushels per annum, comparing the average of the first decade with that of the decade 1850–9, so that production is keeping far ahead of any possible consumption within the State. Production will eventually reach a limit, while population may expand indefinitely, but at present rates of increase, both of population and of wheat production, it will probably be several centuries before Ohio shall contain enough people to consume all her wheat.

[1] 48,000,000 bushels were harvested in Ohio in 1888.

What is true of Ohio is true to a greater or less extent of the entire winter wheat belt of North America. The area now sown to wheat in this region may be expanded largely without infringing upon other productions, and the rate of yield may and will be very materially increased by better husbandry, including an intelligent use of manures and fertilizers, and more thorough drainage.

Let there be given a little stimulus in the shape of higher prices for wheat and we shall see a rapid expansion in the total production in this country, while there are still undeveloped regions in South America, south Africa, and Australia, which will eventually be made to add largely to the world's supply of breadstuffs.

This is not said by way of discouragement. I believe that the future outlook for the Ohio wheat grower is eminently a hopeful one, but I do not expect to see the very great increase in price of wheat that is being predicted by certain statistical writers. In my judgment, the great opportunity for the Ohio wheat grower lies in increasing the yield per acre, in reducing the cost of production, and in improving the quality of the grain. Such a course will render him independent of the market, and then if higher prices do come he will be doubly benefited.

It appears from this statistical study of the wheat harvests of Ohio that the average yield of wheat is increasing in the northern and central sections of the State, while it is at a standstill, and standing at far too low a point for profit, in the southern and south-eastern counties.

It would seem that the profitable culture of wheat on the steep hillsides of southern Ohio is a hopeless undertaking; that the great problem before the wheat grower of the central belt of counties is winter-killing, a problem which may be partially solved by underdrainage and the intelligent use of clover and manures; and that in the northern counties climatic influences are more generally favorable to wheat culture than elsewhere in the State.

The statistics indicate that the wheat crops of Ohio have been slightly increased by the use of commercial fertilizers, but it appears that the average cost of this increase has equaled its market value, and that a general improvement in the methods of agriculture has contributed more largely to the increase of Ohio's wheat crops than the use of purchased fertility.

It would seem that the total area under wheat might be considerably enlarged, and at the same time more closely restricted to lands adapted to tillage, and that the yield per acre may be so increased that the total product shall reach double the quantity now annually produced.

CHAS. E. THORNE.

THE ANTHROPOLOGY OF EUROPE.

"THE Anthropology of Europe" was the title of a course of lectures (the Rhind lectures) delivered in Edinburgh last October by Dr. Beddoe, ex-president of the Anthropological Institute of Great Britain, of which we find the following brief abstract in the *Scottish Geographical Magazine:* Dr. Beddoe, in his earlier lectures, dwelt chiefly on some of the problems of anthropology, briefly on the question of priority of dolichocephalic or brachycephalic types, briefly also on the great Aryan question, and at greater length on that of the influence of environment, towards modifying of types, to which he repeatedly referred during subsequent lectures. He noted the very frequent occurrence of broad, even very broad, skulls in conjunction with very narrow ones in some of the earlier, if not the earliest, "finds," a circumstance not