per acre, making in all 6640 pounds of harvested produce. From this we may deduct one-seventh for water, leaving 5690 pounds. One-half, or 2845 pounds may be recorded as carbon. In 40 years therefore 113,800 pounds of carbon have been obtained from some source. The amount of carbon removed from the unmanured land may be taken as about one-third that of the manured plots. Very careful analyses have been taken of the soil and subsoil of these two experiments, as well as of the soil of all the experiments in the field. The total weight of the carbon found on the acre of the highly manured plot, at the three depths of 9 inches each, or 27 inches below the surface, was 61.916 pounds, or not much more than one-half of all the carbon removed in the crops.

In the soil of the unmanured land, which only removed about one third of the weight of carbon in the crops, the amount of carbon in the soil at the same depth was 53,768 pounds, or much less therefore than that on the land growing the large crop. The difference in the carbon is almost entirely in the first 9 inches of the manured land, and it appears that this is probably due to the much larger quantity of stubble and roots which are plowed in every year as the residue of the large crops. The relation between the carbon and the nitrogen in the soil is about 50 parts of carbon to 1 of nitrogen, and this relation does not vary much so long as carbon is not added to the soil, for although we estimate that the unmanured soil may have lost more than 1000 pounds per acre of its nitrogen, it must at the same time have lost 10,000 pounds of its carbon.

It may be observed that I have not adopted the earliest analyses which were made of the carbon and nitrogen, as they are not quite so correct as those made later on. It must be evident, however, that as the yield of the crop shows no tendency to decline, so long as the proper mineral and nitrogenous manures are applied, the removal of 2845 pounds of carbon per acre annually in the crop cannot possibly have its source in the soil, and I would venture to ask those who are skeptical in regard to the source of the carbon in plants, whether the results do not confirm all the previous experiments which have been carried out by so many eminent men of science?

At the recent meeting of the British Association of Manchester, Sir Henry Roscoe, M. P., in his presidential address, made the following remarks upon the source of the carbon in vegetation:

"The phenomena of vegetation, no less than those of the animal world, have, during the last fifty years, been placed by the chemist on an entirely new basis. Although before the publication of Liebig's celebrated report on chemistry and its application to agriculture, presented to the British Association in 1840, much had been done,—many fundamental facts had been established,—still Liebig's report marks an era in that he not only gathered up in a masterly fashion the results of previous workers, but put forward his own original views with a boldness, and frequently with a sagacity, which gave a vast stimulus and interest to the questions at issue. As a proof of this, I may remind you of the attack which he made on, and the complete victory which he gained over, the humus theory. Although Saussure and others had already done much to destroy the basis of this theory, yet the fact remained that vegetable physiologists, up to 1840, continued to hold to the opinion that humus, or decayed vegetable matter, was the only source of the carbon of vegetation. Liebig, giving due consideration to the labors of Saussure, came to the conclusion that it was absolutely impossible that the carbon deposited as vegetable tissue over a given area, as, for instance, over an area of forest land, could be derived from humus, which is itself the result of the decay of vegetable matter. He asserted that the whole of the carbon of vegetation is obtained from the atmospheric carbonic acid, which, though only present in the small relative proportion of 4 parts in 10,000 of air, is contained in such absolutely large quantity that if all the vegetation on the earth's surface were burnt, the proportion of carbonic acid which would thus be thrown into the air would not be sufficient to double the present amount.

"That this conclusion of Liebig's is correct, needed experimental proof, but such proof could only be given by long continued and laborious experiment, and this serves to show that chemical research is not now confined to laboratory experiments lasting, perhaps, a few minutes, but that it has invaded the domain of agriculture as well as of physiology, and reckons the period of her observations in the field, not by minutes, but by years. It is to our English agricultural chemists, Lawes and Gilbert, that we owe the complete experimental proof required. And it is true that this experiment was a long and tedious one, for it has taken forty-four years to give definite reply. At Rothamsted a plot was set apart for the growth of wheat. For forty-four successive years that field has grown wheat without any addition of any carbonized manure, so that the only possible source from which the plant could obtain for its growth is the atmospheric carbonic acid. Now the quantity of carbon which, on an average, was removed in the form of wheat and straw from a plot manured only with mineral matter was 1000 pounds, while on another plot, for which a nitrogenous manure was employed, 1500 pounds more carbon was annually removed; or 2500 pounds of carbon are removed by this crop annually without the addition of any carbonaceous manure. So that Liebig's provision has received a complete experimental verification."

These remarks were made by Sir Henry Roscoe without his having seen the analyses of the carbon in our soils. If so accurate a chemist considers that the source of the carbon in plants is established by our experiments without the overwhelming evidence which these analyses bring out, I think those who have already had doubts on the subject can no longer hesitate to accept as a well established fact, that the atmosphere is the source of carbon in plants.

Rothamsted, England, Oct. 31.

Cattle Classes at Chicago Fat Stock Show.

PROFESSOR G. E. MORROW.

Butchers as judges; Short-horns first; Aberdeen-Angus a close second; block and show-ring awards differ; Angus and high-grade Short-horn herds best; grades ahead at the block; heavy weights; table of gains per day, deductions therefrom; early marketing indicated.

The awards at the Chicago Fat Stock Show, just closed, were made by butchers, some of whom also had experience as feeders and exhibitors of fat cattle. As a whole, the work was more critically done than in any former year. The results showed the correctness of first impressions that, while no one breed had a clear lead of all others, the Short-horns stood first, with the Angus a close second in merit. The Herefords did well in the younger classes, and grade Galloways, Sussex and Devons, all brought credit to their feeders. It is never to be forgotten that the skill of the feeder and showman has almost as much to do with success at these shows as have the capabilities of the breed or individual animal.

As has been the rule, the carcass prizes were not taken by the prize-winners on foot, but most of these are said to have given good carcasses, somewhat over-fat, of course, but free from mounds and bunches of tallow or of oily blubber.

The sweepstakes herd was Mr. Harvey's Aberdeen-Angus, one of the finest lots of cattle ever shown at Chicago, with the Iowa high grade Short-horn herd of Mr. Moniger so