sometimes find that when it is too wet to plow stubble land they can plow an adjoining sod field, because of the presence in the soil of many fine grass roots. The "buckshot" clay soils of the lower Mississippi Valley which can be plowed while wet without serious harm, have a high content of both lime and organic matter. Recently, in plowing an apparently uniform field, some English soil physicists

FIG. 223.—When plowing is done at a time when the soil contains the right amount of moisture, the best seed bed results

observed that the force required to draw the plow decreased greatly in a certain part of the field. It was found that chalk (a form of lime) had been applied to this portion of the field over 20 years before.

L. B. OLMSTEAD.

SOILS as Well as Plants React to Fertilizers Used

The soil does more to fertilizer than was dreamt of in the old fertilizer philosophy. Soil and fertilizer experiments of recent years have shown that the soil is not to be regarded as a receptacle which merely holds fertilizer until it is needed by the crop. It seems rather that the soil as well as the plant has an "appetite" or affinity for fertilizers. As soon as fertilizers are applied, the soil starts changing the materials that have been carefully prepared by the fertilizer manufacturer and what the crop gets is largely affected by the activities within the soil.

A great deal of study is needed before all the reactions that take place between soils and fertilizer materials are known, but exact knowledge of these reactions will evidently do much towards improving fertilizer practice. At the present time more is known of the net results of these reactions than of the reactions themselves. It is known, for instance, that rock phosphate gives good results as compared with superphosphate (acid phosphate) on some soils but poor results on others, that liming within certain limits may be highly

beneficial, whereas excessive liming may be injurious, that fertilizers which have the same composition but which are compounded of different ingredients often give quite different results, and that different plant food elements show widely different losses in drainage water. Probably some of these facts will be better understood as a result of studies that have recently been made of the fine clay material in soils.

Changes Due to Colloids

It seems that the fine clay material of the soil, usually called "colloid," is responsible for most of the changes that take place in fertilizers, except those that are brought about by the activity of the soil microorganisms. The larger soil particles are comparatively inert. The colloidal material shows little affinity for chloride, sulphate, and nitrate; hence these fertilizer constitutents are subject to considerable losses in regions where the rainfall is heavy. On the other hand reactions take place between the colloids and other (basic) fertilizer constitutents, such as sodium, potassium, and ammonium. These reactions are of the exchange or "swapping" type. Thus, if the colloid takes up some of the potassium of a fertilizer, it releases to the soil water an equivalent quantity of one of its own constituents, usually calcium or magnesium; or, if the soil is markedly acid, acid may be released. The exact quantity of potassium, ammonia, or sodium that will be taken up when a fertilizer is applied to a soil and what constituents will be released depends on the nature of the colloidal material.

The fact that there is an exchange of constituents between fertilizers and the soil colloidal material explains why a change in fertilizer treatment is sometimes beneficial. If a soil is fertilized for a series of years with a single fertilizer, the clay or colloid may become loaded with a single constituent, and have less of other elements to release to crops. Soils on which crops are likely to develop nutritional disturbances following too heavy applications of lime or fertilizers (sometimes called "weak" soils) seem to be those which contain a small quantity of colloid, or a colloid of a low exchange capacity. The so-called "strong" soils, on the other hand, seem to be those which contain colloids that insure a high capacity for exchange.

P. L. GILE.

SORGHUM Grain Can Be Harvested With an Adjusted Combine

The grain sorghums—milo, kafir, feterita, etc.—are grown mostly in the semiarid southern Great Plains area where extensive methods of farming are practiced. One of the principal difficulties in growing grain sorghums is the labor required for harvesting and threshing the crop. The combine or combined harvester-thresher, which is now used for harvesting much of the wheat grown in the grain-sorghum region, also can be used for harvesting grain sorghums. The combine, performing the two operations as one, greatly reduces the labor required for harvesting and threshing. Investigations by the United States Department of Agriculture show that the average combine harvests and threshes about 24 acres of grain sorghum per day and requires only two men to operate the machine. Two men harvest