The Effect of Soybeans on Volume Weight and Water Stability of Soil Aggregates, Soil Organic Matter Content, and Crop Yield

EDWARD STRICKLING

The status of soybeans in relation to soil fertility is still hotly debated by many scientists. Some have welcomed soybeans as the crop that will be the salvation of grain farming while others have called it a soil depleting crop equally as bad as corn. This investigation was conducted in order to help clarify this problem.

Very little is known about soil aggregation under various crops. Data on soybeans seem especially lacking. It is not clear whether soybeans increase or decrease soil aggregation although most the evidence (3, 14) indicates that they have had about the same effect as corn. Several investigations (6, 13, 8, 5, 11) have been made with other crops. The results of these experiments showed that the soil aggregation in grass plots was high when compared with soil aggregation of the plots in other crops. Experimental results on seasonal and yearly changes in aggregation are extremely conflicting. Several investigators (1, 3, 15, 16) have reported some seasonal change in the soil aggregation while other investigators (7, 11) have not found seasonal changes in soil aggregation. The results of some workers (15) indicate that large monthly changes in soil aggregation occur while others (1, 16) have reported rather gradual changes.

EXPERIMENTAL PROCEDURE

This investigation was made on 40 plots, 1/14.03 acre in area, in a rotation experiment at the Madison County Ohio Experiment Station Farm. These plots were laid out in 1940. The rotations were designed as a preliminary survey of the effect of soybeans upon the productivity of the soil. The rotations were not randomized or fully replicated so that a statistical analysis of the effects of each rotation was not carried out. However since corn, wheat, and soybeans were the main crops being tested their distribution was nearly random over the entire area. This random distribution of crops made possible the statistical analysis of the 1949 soil aggregation data. Two areas were left for roadways between the plots and were not used as roads. These areas were in continuous bluegrass and were included in this study as bluegrass plots.

Most of the soil included in this experiment is classified as Celina silt loam. A small area of Brookston silt loam is also included in this experiment. Both soils are Gray-Brown Podzolic soils developed on highly calcareous glacial till of Late Wisconsin Age.

Soil samples were taken at three dates from 11 plots in 1947, twice in 1948 from 13 plots, and six times in 1949 from all plots. The 1947 samples were taken with a spade from four different positions within each plot. The remainder of the samples were taken with a ¼-inch soil sampling tube from 20 positions within each plot. These positions were approximately the same for all the sampling dates in 1949 since they were taken in the same row of the crop each time. The distance lengthwise of the plot between each sampling position was determined roughly by counting steps. The corn and soybeans were both sampled in the row, which should intensify any beneficial aggregating effect their roots have had on the soil. The soil samples from these plots in each plot were air dried and screened as a composite sample for aggregate determination.

A wet sieve method was used for aggregate analysis of air dry soil particles between 2 mm and 1/8 inch size were wet sieved for 30 minutes in a nest of five screens. The weights of the aggregates were all corrected by subtracting the weight of the sand from the weight of the total aggregation. An attempt was made to interpret the size distribution of the aggregates, but the large aggregates were closely associated with high total aggregation. This relationship between distribution of large and small aggregates as shown in Fig. 1 indicated that it would not be possible to obtain similar results.

This relationship between distribution of large and small aggregates as shown in Fig. 1 indicated that it would not be possible to interpret the size distribution of the soil aggregates.