Aggregate Formation in Soil

2. INFLUENCE OF VARIOUS CARBOHYDRATES AND PROTEINS ON AGGREGATION OF SOIL PARTICLES

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Geoghegan & Brian (1948) reported that bacterial polysaccharides of the dextran and levan types had a marked aggregating effect on soil particles. Further, it was observed that aggregating effect was related to the intrinsic viscosity and molecular weight of the substances. These results suggest that other viscous substances of high molecular weight may have an ameliorative effect on soil structure.

EXPERIMENTAL

The aggregating effect of various carbohydrates and proteins was determined by the method of Geoghegan & Brian (1948).

RESULTS

Results are presented in Table 1. The amounts of the different substances applied to soil are expressed as percentages of the air-dried soil and the figures quoted for aggregation are the means of duplicate results.

Table 1. *Influence of various carbohydrates and proteins on aggregation of soil particles*

Substance	Percentage aggregation* when 0.25% of the substance was applied to soil
Crude polysaccharide from a strain of <i>Penicillium luteum</i>	50.1
'Cellofas W.L.D.'	45.5
'Cellofas W.F.Z.'	25.6
Quince gum	25.5
Pectin	3.4
Inulin	0.8
Egg albumin	32.9
Trypsin	4.5
Pepsin	1.2
Pancreatin	1.1
Control	1.2

* For substances giving an aggregation greater than 10%, S.E. for the mean of two determinations = ± 1.09 .

DISCUSSION

The crude polysaccharide from *Penicillium luteum* had a definite aggregating effect, although less than that of levans and dextrans (cf. Geoghegan & Brian, 1948). This indicates that under natural conditions fungal polysaccharides, like bacterial polysaccharides, may play an important role in soil structure formation.

The results obtained with egg albumin, trypsin, pepsin and pancreatin suggest that some proteins are capable of aggregating soil particles. Proteins from plants and micro-organisms are present in soil organic matter, and it is possible that some of these substances may help in the formation of water-stable soil crumbs.

It is interesting to note that 'Cellofas W.F.Z.', although more viscous than 'Cellofas W.L.D.', is less effective as an aggregator; the former is the sodium salt of carboxymethyl cellulose and the latter an ether of cellulose.

Inulin, which is composed of anhydrofructofuranose units, the linkages being at positions 1 and 2 of the fructose chain, is unable to aggregate soil. This is not surprising, because solutions of this substance have low viscosities. Haworth (1936) claims that the inulin molecule consists of a laminated series of fructofuranose rings which are not joined end to end as in the case of cellulose or starch, and that this spatial arrangement is responsible for the low viscosity of solutions of the substance.

Pectin, the specific viscosity of which is greater than that of levans from *Bacillus subtilis*, failed to aggregate soil, and quince gum which is still more viscous only caused 25% aggregation. This is important as it shows that, while substances capable of aggregating soil have high viscosities, there is no reason to expect that all viscous substances will improve soil structure.

Work along these lines will provide information on the relative powers of different substances to aggregate soil particles, and will help to elucidate the relationship between chemical structure and the ability of a substance to form water-stable soil crumbs.

SUMMARY

The aggregation of soil particles by viscous substances other than levans and dextrans has been assessed. Results show that while some biological products have a moderate aggregating effect it does not follow that all viscous substances will improve soil structure.

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REFERENCES

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