main effective over longer periods. Well-composted materials, certain lignified wood by-products, and some peats not readily decomposed have very little effect on soil aggregation. The level of aggregation, said Martin, is proportional to the amount of organic matter applied, and additional active material must be applied periodically to prevent a decline in the number of stable aggregates.

Three categories of substances, said Martin, account for the binding effects produced by microorganisms: decomposition products of organic matter dissimulation, microbial cells and colloidal gums and mucilages formed as secretory products, and synthesized polysaccharides. Uronide-type polysaccharides are very effective, Martin said, but cannot alone account for the aggregation observed in field tests. The discovery that naturally-produced polysaccharides could stabilize soil aggregation led to the search for synthetics that would do the same job, but last longer by resisting metabolism by soil microorganisms.

Organic Matter and Nitrogen. Organic matter in agronomic practices is largely a problem of proper handling of residues and nitrogen fertilization, in the opinion of S. W. Melsted, University of Illinois. No system of management or crop rotation, he declared, can be expected to maintain or build up soil organic matter if the amount of nitrogen removed in harvesting crops and other soil losses exceeds the amount of nitrogen being returned to the soil by legumes, manures, and commercial fertilizers. Nitrogen alone will not maintain soil organic matter, but must be accompanied by crop residues. Low nitrogen residues such as corn stover or grain straw accompanied by commercial nitrogen can supply a source of actively decomposible material in the soil which tends to promote good physical properties. Such conditions can be achieved for most soil, said Melsted, if the nitrogen program is adequate to meet the yield potential of the average season and if the normal crop residues are returned to the soil.

In discussing observations on the famous Morrow plots, he said that cultivation appeared to retard the formation of soil organic matter in some experiments, while adding nitrogen in excess of crop residues increased the amount of both carbon and nitrogen in the soil. Residues alone were not enough and nitrogen had to be added in order to form organic matter faster than it was being destroyed. It was indicated that normal quantities of crop residues obtainable under high fertility and a nitrogen maintenance program probably can maintain soil organic matter levels in soils which have lost considerable quantities of their inactive organic matter but which still have fairly good physical properties.

R. Bradfield of Cornell University in discussing the maintenance of organic matter emphasized the importance of considering the nature of the soil, the requirements of the individual crop as well as the climatic conditions in attempting to evaluate the importance, desirability, and feasibility of the maintenance of organic matter.

J. S. Joffe, Rutgers University, in a discussion session emphasized that the accumulation of humus varies with geographical zones as does the rate of breakdown of organic matter. He urged the study of known favorable areas and consideration of analogy in the study of organic matter maintenance. We should inquire as to the critical level, he said, and the factors which set that level as well as means of obtaining it.

Soil Conditioner Tests Show Improvement

Western soil scientists continue search for quantitative results, evolve several new methods

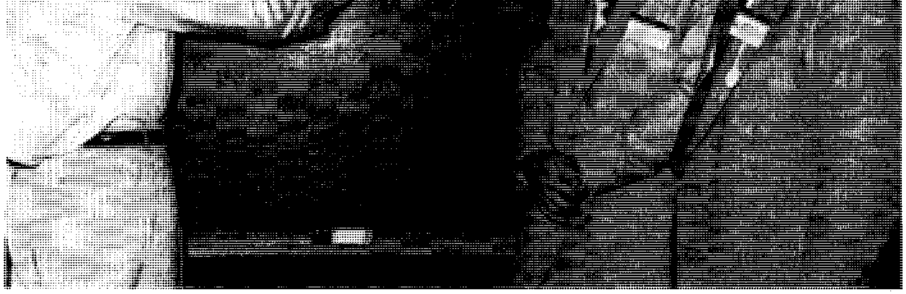
PULLMAN, WASH.—Just exactly a year ago, when Ag and Food reported on the American Association for the Advancement of Science Pacific Division's meeting (June 24, 1953, page 495), western soil conditioner researchers expressed considerable regret over lack of adequate tests. This year, western soil scientists, meeting in conjunction with Pacific Division, AAAS, here June 21 through 26, express the same need: more and better ways to evaluate soil structure.

In contrast to 1953, however, some glimmerings of light show through. Wet sieving and modulus of rupture still remain the most widespread methods for checking soil aggregation, but several new methods have promise for the future.

For instance, to check aggregate stability, James Engibous says he and his coworkers at Monsanto use what might be termed a "ball mill" approach. Ten grams of soil in 100 ml. of water is placed in a 200-ml. bottle. This bottle is then rotated (much like a ball mill, hence the name) at either 2 or 4 revolutions per second. At the end of a specified rotation period, turbidity of the sample is measured with a spectrophotometer (the higher the light transmission, the more stable the aggregate), and various conditioners and treatment practices are thus rated.

W. H. Gardner, State College of Washington, approaches aggregate stability from still another tack. He prepares a series of standard alcohol-water solutions with varying concentrations of alcohol, treats his aggregates with these standards, finds he can distinguish aggregate stability rather precisely (aggregate stable in 50%, for instance, unstable in 55%) by visual inspection of the aggregates. Using this method, he has so far been able to detect differences between 0.001% and 0.005% treatments of IBMA (the half-ammonia, half-amide salt of isobutylene maleic acid). The method,

S. J. Richards (left), University of California, Riverside, describes for Sterling A. Taylor, Utah State Agricultural College, and H. W. Gardner, State College of Washington, the apparatus he has devised to assure reproductive compacting of soils for soil conditioner tests. Formulas on blackboard are ones Dr. Gardner uses in attempts to evaluate conditioners quantitatively



in use barely a month, shows definite promise, Gardner says.

Gardner has also turned to mathematics in an attempt to approach soil conditioner evaluation quantitatively. In water infiltration studies, he uses $Q = At^B$, from which he derives $dQ/dt = ABt^{(B-1)}$, where Q is infiltration, t is time, and A and B are parameters of the system. Gardner also uses $S = Et^F$ in a similar fashion for relating depth of wetting to time.

So far Gardner finds, with the infiltration equation, that position of the curves (plotting rate *vs.* time) is a function of A and B, with (B − 1) being the slope of the curve. He has also determined that the curve approaches horizontal as aggregates get larger. Gardner feels that these equations, or ones similar to them, will permit a truer quantitative representation of soil conditioner action.

Meanwhile, still remaining is the problem of relating soil structure in the laboratory with yield in the field. As one person questioned "Will we wind up with fine, precise laboratory methods only to take our practices to the field and stumble over much cruder results based on total yield?" Such a fear was countered in part by L. A. Richards, U. S. Salinity Laboratory, Riverside, who notes some of their modulus of rupture tests in the laboratory are coordinating rather well with field results: for example, good yields with beans where the modulus of rupture is 100 millibars; virtually no yield at 200 millibars.

Nearly all soil conditioner work is done in terms of 3-inch, 6-inch, or greater depths. Yet, according to comment from an Arizona representative, crust formation after planting and after rains probably has caused more replanting than any other single factor in Arizona. Why, he wonders, is not more work being done on the very top levels of the soil—say, the top centimeter?

Soil conditioners have yet to make a big splash down on the farm. Western soil scientists expect no great use farmwise in the near future, plan to continue refining and extending their tests meanwhile. Picture use-wise is not all black, however. Good results are being obtained on turfs—golf courses, football fields, baseball fields—and seem to offer the best potential at the present for larger-than-home-gardener-volume, cost considered.

Cotton Research Aims for Lower Production Costs, Future Markets

New consumer products, greater yields of higher quality fiber and seed listed as goals

CORPUS CHRISTI.—Largely as a result of research, one section of the cotton industry, seed crushing, has progressed from a few struggling plants 50 years ago to a $300 million annual enterprise today. This was no accident, John F. Moloney, National Cottonseed Products Association, emphasized to the 15th annual Cotton Congress, held here recently. Millions of dollars worth of research—his association alone spent $1 million during the last 10 years—provided the foundation for this expansion.

In his keynote address, Burris C. Jackson, general chairman of the congress, emphasized the need for increased research activities if cotton is to maintain its present market position with other fiber and seed competitors. Competing industries are spending large sums on research and the cotton industry must follow suit, Jackson cautioned. During the general decline in textiles consumption since the middle of 1953, cotton has fared better than many other fibers. Use is down only 5% as compared with a 15% cut in rayon, comments Jackson. Last year's per capita consumption of cotton was 28 pounds—2 pounds under 1948. To maintain its position research must be accelerated to provide answers to cotton's production, processing, and marketing problems.

A well planned insect control program could profit a grower $16 in cotton production for every $2 invested in chemical control, according to J. C. Gaines, Texas A&M College entomologist. Combinations of weevilcides with DDT give adequate control of all species of boll weevils, bollworms, and the pink bollworm. Chemical control is a valuable aid in reducing damage by the pink bollworm, but may not always be relied upon to control the pest economically, stated Gaines.

Soreshin or seedling blight has often been serious on young cotton plants when germination and seedling growth is retarded by cool, damp weather, said the National Cotton Council research head, H. G. Johnston. Fungicides are being sprayed or dusted into furrows at planting time to reduce losses from these diseases by destroying fungi in surrounding soil. Treatments are easily applied with inexpensive equipment readily adapted to a tractor cotton planter, stated Johnston.

Regrowth of young tender leaves on cotton plants after defoliation often causes a stained, lower grade of cotton when crushed by a mechanical picker. No defoliants will prevent regrowth entirely, observed Johnston. However, 1953 field trials demonstrated that one chemical defoliant inhibited regrowth for as long as 30 days.

Under what conditions will defoliation pay? Widespread field tests conducted in the Mississippi Delta last year in several locations give partial answers. Each location consisted of defoliated, desiccated, and untreated plots. All plots were harvested with a spindle picker. Extremely dry weather in 1953 led to considerable natural defoliation, so there was only a slight improvement in cotton quality in the defoliated plots. There were some advantages in picker efficiency. Similar experiments in California's San Joaquin Valley upgraded cotton but showed little if any benefit in picker efficiency except in special cases where plants were lodged, reports Johnston.

Weeds Cost Western Canada $255 Million Last Year

Weeds robbed western Canadian farmers of $255 million last year, according to E. G. Anderson of Ottawa. This statement was made in a paper delivered before the Agricultural Pesticide Technical Society of the Agricultural Institute of Canada at its annual conference at MacDonald College in Quebec last month.

Mr. Anderson said this amounted to $1028 for the average farm in Alberta, Saskatchewan, and Manitoba or 20% of the total value of the major crops grown in these provinces. In all, Canadian average crop losses through weed damage were 10% of the total crop, he estimated. In the U. S. also losses were about 10% of the total crop, compared with 27.8% in India and 7 to 20% in England. Much loss was avoided in Canada through use of 2,4-D and other weed control chemicals, such as the estimated $17 million cost of spraying 9 million acres in the Prairies, where the increase in revenue was put at $45 million or 20% of the cost of the seeded acreage.

Referring to the cost of weed control research, Mr. Anderson said that for every dollar invested Canadian farmers gained $381.

Animal agriculture was a strong feature of the institute's program. L. A. Maynard of the Cornell University