brought out some indication of possibilities and benefits. Kumagai and Hardesty got their best results with the use of nonionic surfactants in superphosphate manufacture. With the addition of proper amounts of nonionic surfactants there is a lower density of product, moderate increase in ammonia absorption capacity, and slightly better condition of bagged fertilizer.

The additional observation that surfactants may help in keeping plant machinery clean, appears to sum up the concrete benetfis recognized at present from the use of these additives in fertilizer manufacture.

Revolution Needed in Plant Food Research

"We should not think of ourselves as God's frozen people, continuously talking to ourselves, reiterating other proofs of established facts—but we should become dangerously radical and even engage in hypothesis."

Taking off from this summary of George Scarseth's shot-in-the-arm address before the 1953 luncheon of the ACS Division of Fertilizer and Soil Chemistry, Edwin Cox, Virginia-Carolina Chemical Co. gave this year's session of the same meeting, more of the same kind of talk. Some of Cox's views:

Evolution must be replaced by revolution if plant food research is to make the progress needed to feed mankind. The lodestar is the photosynthesis reaction. We have a very low efficiency rating in our use of it—overall efficiency of use of solar energy he placed at 0.001%.

Plant food research cannot stop with restoration or replenishment of needed chemical elements to the earth. The "adequate and balanced" ration must be delivered to the digestive organs of the plant in digestible form.

No other country in the world spends so much money gathering, tabulating, and printing statistics as does the U. S. This is not enough. It is time we adopted most postulation and speculation in pursuit of knowledge to support the reaction of photosynthesis upon which depends our food, fiber, and fuels.

"The 'phenomenal' advance of nitrogen utilization in agriculture from 1938–39 to 1950–51 in these United States was 156%. In the same period with a heavier war load, Britain increased its agricultural consumption 264%. In 1950–51, the U. S. consumption of nitrogen per arable acre was one-fourth that of France; one-seventh that of England; one-tenth that of Germany; and one-thirtieth that of Holland. Nitrogen fixation is a half-century old. Evolution is a term more apt than revolution. Revolutions are 'sterner stuff' "

A portion of the enthusiastic SRO audience to which the Symposium on Chemical Aspects of Flavor and Odor played tries out phenylthiocarbamide. This chemical, according to Arthur L. Fox of Colgate-Palmolive, separates the tasters from the nontasters

Insects Favored over Humans as Taste Testers

Divergent opinions offered to explain taste and odor mechanisms . . . 10 different classes of tasters a factor in human food preferences

NEW YORK.—Although man has been eating, tasting, and smelling for millions of years, no one yet has offered an adequate explanation of how it is done. The object of the Symposium on Chemical Aspects of Flavor and Odor Perception was to present some of the divergent opinions offered as explanations for taste and odor mechanisms. The symposium presented the talents of a number of nonchemists who are active in the field of taste and odor perception, and it was generally agreed that there was an unusual opportunity for a general exchange of new ideas on the problem.

One of these nonchemists is Hubert Frings, an insect physiologist from Pennsylvania State University. As a result of taste studies originally conducted on the cockroach, Dr. Frings believes that the concept of sweet, sour, bitter, and salty as the primary tastes may be a misleading oversimplification.

Dr. Frings says that insects are ideal experimental panels for taste studies and most of his work has been concerned with the taste preferences of such usually overlooked animals as the caterpillar of the cecropid moth, and the American cockroach.

One advantage of insects over humans for this work which Dr. Frings cited is the fact that the insect is relatively free from imagination, and is usually much more cooperative than human subjects. The four major classes of tasters, based on the two chemicals, are: bitter-salty, bitter-sweet, bitter-bitter, and tasteless-salty. The tasteless-salty class, comprising about 14% of the population finds phenylthiocarbamate tasteless and sodium benzoate salty.

As a result of the taste perception studies Dr. Frings proposes a "taste-spectrum" hypothesis in place of the usually accepted theories on sweet, sour, bitter, and salty. For man he believes that the tongue has a population of taste receptors of varying sensitivity, not to taste but to ionic concentrations. The taste interpretation by the brain is based on the number, not the kinds of these perceptors which are stimulated. If only a few of the receptors on the tongue are stimulated, the brain interprets the taste as sweet; as the number of receptors stimulated increases, the taste interpretation by the brain runs up through salty, bitter, and sour.

In the insect studies Dr. Frings plotted the threshold concentrations of various salts to find the levels at which his cockroaches would not eat through them.

By comparing these threshold concentrations for number of different salt compounds he arrived at the conclusion that taste perception in the cockroach is a function of the ionic mobilities of the cations of the salts. As a result of these studies it was possible to construct a graph in which the stimulative efficiencies of different salts were plotted against the ionic mobilities of the cations. There was also a variation in acceptability with concentration of a given salt; similar shifts in taste with concentration have been reported for man.

To test the spectrum hypothesis derived from cockroaches, a number of salts were presented to human volunteers for taste testing. The human tasters thus were able to provide points on the graph for sweet, salty, bitter, and sour. With the information thus gained the mobility hypothesis was used to predict thresholds and taste for two salts which had not been previously tested. The salts, cesium and rubidium chloride, were found to have ionic mobilities like potassium chloride, the rejection threshold for the roach was found to be as predicted, and human volunteers reported that the two salts tasted like potassium chloride. This corroborative experiment is cited by Dr. Frings as another example of the similarity of taste between the cockroach and man.

One of the reasons Dr. Frings has found humans difficult taste testers may be that there are actually 10 different classes of tasters among humans. On the basis of taste testing with two odorless chemicals Arthur L. Fox of Colgate Palmolive Co. can divide humans into classes based on taste alone. He offers this as a scientific explanation of why different foods taste differently to different people.

The taste class groups are found to have distinctly different food preferences with regard to likes and dislikes of such diverse materials as sauerkraut, grapefruit, buttermilk, and cottage cheese.

The chemical taste test is based on the reactions of people to two chemical compounds, phenyl thiocarbamate and sodium benzoate. The phenyl thiocarbamate divides a random group into two large classes, those who find the chemical tastes bitter and those who find it tasteless. Using sodium benzoate each of the major classes is divided into five additional classes based on the reaction to this chemical as sweet, sour, bitter, salty, or tasteless.

Dr. Fox believes that many food preferences can be explained on the basis of taste classes. If this is valid then it would seem to be important to have representatives of each of the taste classes on any taste testing panels. However, greater weight should be given to the opinions of the panelists who belong to the four major classes of which constitute about 76 percent of the population.

Industry

Brea Chemicals at Full Production

Brea Chemicals, Inc., subsidiary of Union Oil Co. of California, is now producing more than 250 tons per day of ammonia at its new $13 million ammonia plant recently completed at Brea, Calif. Most of the output of the plant is being marketed in the form of Brea Aqua Ammonia, a high nitrogen fertilizer solution.

Brea has already set up a network of 13 distribution terminals in California, the Pacific Northwest, and Hawaii, providing 21 million gallons point-of-