NEWS

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New Pesticides Changed Designs of Spray Equipment

Objective has been to attain maximum effectiveness and versatility at lowest possible cost

KANSAS CITY.—Four significant developments have occurred in agricultural sprayer use in recent years, said William H. Zehner of F. E. Myers & Bro. Co., speaking before the Division of Agricultural and Food Chemistry at the recent ACS meeting here. In the first place, he said, there has been the introduction of many new chemicals for the control of insects and fungi. Secondly, there has been the introduction of new chemicals for new purposes, such as the herbicides, defoliants, soil conditioners, and the liquid- or water-soluble fertilizers. In addition, there has been the development of new spraying methods, such as the air-blast sprayer and the tractor-mounted sprayer. Furthermore, there has been the greatly increased use of concentrated spray mixtures.

With these developments, the demand for greater versatility in spraying equipment has grown significantly. The types and characteristics of the pesticides available have broadened, said Zehner. Many pesticides can be applied very effectively at low pressures while others may require high pressure. The quantity of pesticide required per acre is variable. The same type of sprayer may be required to apply a dilute spray in addition to mixtures concentrated five to 10 times the dilute ratio.

In the development of sprayers, the objective has been to obtain the desired effectiveness and versatility at the lowest possible cost. However, the use of new pesticides and new application methods has introduced new problems and intensified the old ones. Greatly influencing the serviceability, life, and usefulness of sprayers are such factors as the effect of solvents, abrasion, and corrosion.

For example, the solvents commonly used in formulating organic pesticides have created problems in obtaining satisfactory materials for hose, gaskets, diaphragms, and pump packing, said Zehner. Although many of the synthetic rubbers have some degree of oil resistance and are better than natural rubber or the GR-S types, they lack sufficient solvent resistance for satisfactory use. Unless the service requirements are extremely severe, the nitrile compounds are generally acceptable. The polysulfide or Thiokol materials are said to be the most suitable since they have unique resistance characteristics and can be compounded to obtain the desired physical properties.

Discussing the problems of corrosion, Zehner indicated that corrosion is frequently encountered because water is the primary diluent in spray mixtures and because sprayers are exposed to weather. In some cases, corrosion has been accelerated more by the type of water used or atmospheric conditions than by the direct action of the pesticide. Of course, many pesticides are highly corrosive to the common metals, and the solvents involved can cause severe damage to general-purpose coatings.

Aircraft Sprayers. During 1952, approximately 40 million acres were treated by aircraft sprayers and dusters, said Fred E. Weick of Texas A&M College. Although this amount undoubtedly includes some acreage that was treated more than once during the year, it is, nevertheless, a substantial figure and is over one ninth of the entire area under cultivation in the U. S.

The crop treated most by aerial application has been cotton, which accounts for about 30% of the total. The next in order are wheat, rice, tobacco, and alfalfa. Nearly all of the air dusting and spraying is done by small companies specializing in this work, rather than by the farmers. There were 1725 aerial applicator firms on record in 1951. The 1952 total was over 2000. These companies have an average of between three and four planes each. Only a few firms have over 20 airplanes, and only one has over 40.

Aircraft used for dusting and spraying vary from low-powered light planes to four-engine transports, the larger planes being used in large-scale forestry and range work, said Weick. Most of the planes are converted trainers of

Discussing papers presented at the Symposium on Mechanical and Engineering Aspects of Pesticide Application held at meeting of ACS Division of Agricultural and Food Chemistry are (left to right) O. I. Berge of the University of Wisconsin, Joseph M. Patterson and James P. Carr of Food Machinery & Chemical Corp., and Fred E. Weick of Texas A&M

two general types: light, high-wing monoplanes carrying maximum chemical loads from 300 to 600 pounds and somewhat larger biplanes carrying maximum chemical loads from 600 to 1200 pounds. None were originally designed for dusting or spraying.

Special attention has been paid in recent years to the selection of the best swath patterns to be used in aircraft spraying and also to the best distribution of spray nozzles. Improved spraying techniques should result, he said, in substantial reductions in the amount of material wasted by overdosing and in a corresponding saving in cost.

Air Sprayers. Hydraulic sprayers are today used to a considerable extent and, no doubt, will continue to have their place in pesticide spraying, especially for smaller operations. The use of air sprayers, however, is growing rapidly, and they are now widely accepted by orchardists, farmers, and shade-tree experts as an important step forward in spraying technology, according to a paper by James P. Carr and Joseph M. Patterson of Food Machinery & Chemical Corp. The primary reason for the acceptance and rapid growth of air sprayers has been the sizable cost savings that can be achieved, partly because use can be made of more concentrated solutions. The basic principle of operation of hydraulic sprayers requires that a sufficient volume of liquid be projected from the nozzle or gun. With air equipment, the liquid volume can be greatly reduced.

In Lansing, Mich., in 1951, the cost of spraying for mosquito control in nine city parks with hydraulic equipment was $197.20 per round. In 1952, the same areas, plus three additional parks, were sprayed with an air sprayer for a total cost of $91.75 per round. The time required for hydraulic spraying was 20 hours while the air sprayer work was completed in nine hours.

Carr and Patterson emphasized that the necessity for chemical and equipment manufacturers to recognize the requirements and limitations of each other's products has existed ever since the practice of spraying began 70 years ago. This need has increased in importance to the point where such considerations are prime, basic factors determining the success of these products.

Herbicide Sprays. Herbicides that are effective in very low quantities per acre and which are readily mixed with water or oil lend themselves to aircraft applications, said L. L. Coulter of Dow Chemical. Most aerial applications are made with a total spray volume of 1 to 5 gallons per acre. The lower volumes increase the number of acres that can be sprayed with a given load and make the work more economical. These applications are most useful where large acreages are involved, such as in weed control in the grain of the plain states or brush control in rangeland. The control of spray drift is one of the major unsolved problems.

The actual spray equipment used in airplanes consists of a boom attached to the wing, a small wind-driven pump, and a tank to carry the spray. The pump may operate at low pressures but must be capable of volume output in the range of 20 to 30 gallons per minute. Each nozzle should have a positive shutoff so that none of the spray can escape from the boom while spraying is in progress.

Chemical Mechanisms Affecting Milk Flavor Explored

KANSAS CITY.—Heat, light, air agitation, trace metal contamination, and a host of microorganisms are a continuous threat to the chemical stability of many milk components, said D. V. Josephson of Pennsylvania State University in his Borden Award address before the ACS Division of Agricultural and Food Chemistry. Frequently, the only measurable indication of these chemical reactions is a change in flavor or odor, he said. Since flavor is the primary index of food acceptance and product improvement, research in this area is of considerable importance.

Milk and many dairy products made from it pose two main flavor problems: the prevention of off-flavors and the maintenance or development of characteristic flavors. In general, the dairy industry has had to rely heavily on trial and error methods for attaining these objectives, Josephson commented. However, recent efforts by dairy researchers have centered around the determination of the exact chemical mechanisms involved in flavor change. Indications are that greatly improved flavor control in dairy products can be achieved.

Recent studies have led to a number of conclusions. It has been found, for example, that the photolysis of methionine in milk is responsible for the "sunlight" flavor. The heat denaturation of β-lactoglobulin results in a "cooked" flavor. The decomposition of lactose and the formation of furan compounds are associated with a "caramelized" flavor. The secretion of acetone bodies in milk results in a "cowy" flavor. These areas of study, said Josephson, represent a very small part of the many aspects of dairy technology which would benefit from further research on flavor-producing mechanisms.

Steroidal Saponins. The partial hydrolysis of steroidal saponins was the subject of a paper by Merle M. Krider and Monroe E. Wall of Eastern Regional Research Laboratory. Steroidal sapogens occur in nature in a combined, glycosidal form called saponins. In most saponins obtained from leaves of agaves or yuccas, the kind and number of the sugars of the glycosidic side chain are such that the saponin is water-soluble. Upon removal of one or more of the monosaccharides from the side chain, however, the saponin usually becomes water-insoluble. Hence, water extraction followed by partial hydrolysis of the saponin establishes a simple process for physical separation of a concentrated, partially purified saponin from most of the original aqueous plant extractives.

The partial hydrolysis of the glycosidic side chain has been achieved by use of plant enzymes and weak mineral acids, the report stated. The application of one of these agents, especially the latter, to heconin in agave juice or sarsasaponin in yucca wastes permits an economical recovery of these saponins, even though they are present in the original solution in very low concentration.

Flour Proteins. Wheat flours vary widely in their baking characteristics and in their response to oxidation. These variations, said Betty Sullivan of Russell-Miller Milling Co., are determined in large measure by the amount and physical properties of the proteins in the flour. The reactive groups of gluten involved in the oxidation and reduction of flour are the sulfur-containing amino acids, cysteine, cystine, and methionine. Maturing agents exert their beneficial effect by their action on a sulfhydryl compound that is apparently held in a phosphoric acid linkage that only alkali or enzyme treatment can release. Some preliminary work on the isolation of this compound is under way.

Stability of Carotene. H. L. Mitchell, R. E. Beauchene, and Ralph E. Silker of Kansas State College reported on the ability of various compounds to inhibit the oxidation of carotene in alfalfa meal during storage. Appreciable antioxidant activity has been found in compounds related to aniline. The most promising of these is *N,N'*-diphenylhexamethylenediamine.

Carotene retention during storage is influenced by the amount of oil used in applying the antioxidants to the meal. Applications of Wesson oil at the rate of 80 pounds per ton of meal has been found to be much more effective in reducing oxidation than 16 pounds per ton. Heating of the samples at 100° C. for an hour after oil spraying results in a further increase in carotene retention.