GRANULATED PHOSPHATES USED IN CALIFORNIA MOSQUITO CONTROL

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In addition to larviciding, two other control approaches have been used to a considerable degree in California mosquito control during the past half century: (1) "source reduction" and (2) "adulticiding." During the past ten years or more, increasing emphasis has been placed on source reduction, while adulticiding has decreased to a relatively minor role.

Beginning in 1952, there was a gradual change-over from chlorinated hydrocarbons for larviciding to the phosphates E.P.N., chlorthion, malathion, parathion and, during the past two years, limited amounts of Baytex. By 1955, parathion had become the toxicant most extensively used (based on acres treated) and it has maintained that position ever since, although chlorinated hydrocarbons are still used routinely by many districts, and for specialized purposes by others.

DEVELOPMENT OF GRANULAR MOSQUITO LARVICIDES. Interest in the granulated formulations of toxicants has increased since 1950. During the ensuing five years various chlorinated hydrocarbon insecticides and carriers were tried in different combinations with discouraging and unpredictable results. In 1954 a malathion-bentonite formulation appeared that looked promising. This initiated a gradual swing to investigations and trials with granulated organic phosphates. With these early phosphate investigations, as with the chlorinates, results were not too dependable and larviciding costs were relatively high. Progress in improved formulations in California came slowly until January of 1958, when the University of California College of Agriculture began to investigate the basic problems concerned with the formulation of granular larvicides and to seek alternative and improved toxicants.

TYPES OF GRANULES AND METHODS O APPLICATION. One of the first things di closed was that the proprietary formul tions being used varied widely in the ra of release of the active ingredient from th carrier; the range of release varied fro zero to little more than 20%. The bas research conducted by the University sin the beginning of its program has led to better understanding of many of the pro lems concerned with formulating granul larvicides for mosquito control purpose Where previously a 20% release was co sidered good, we now have formulatio releasing up to 60% of the toxicant in hours and 100% within 48 hours. Th program has also disclosed some of t factors affecting the rate of release. Th information should enable the formulat to provide in some degree for either a fa or prolonged release. Three different typ of formulations have emerged from t combined efforts of the University researc cooperative developments of chemical su pliers, and evaluations by various distric They are: the coated sand-core; the i pregnated type; and a combination of bo At present, commonly used impregnat or sorptive carriers are bentonite a attapulgite. In both sorptive carriers a coated sand-cores, malathion concentrati is usually 5 percent, applied at 10 poun per acre. With parathion, concentrations sorptive carriers are used as 2, 5, and 7 p cent formulations, and in coated sand-co 1, 2, 5 and 7 percent are popular concent tions. These are normally applied amounts sufficient to obtain a rate of a proximately 0.1 pound parathion per ac

The method of application is a m important factor influencing choice as type, size and percent of toxicant wh using presently available granulated l

cides. Ground application has, to the esent time, been limited to the rotary eder, horn seeder [1] and air gun.

Using the horn and rotary seeders, a nd-core 2 percent parathion formulation d a 2 percent combination sand-core rptive carrier have been the favorite anules. These have more weight than e bentonite and attapulgite carriers, ling the applicator to obtain a uniform stribution pattern with a maximum ath width. With these seeders, size of e granule used has normally been in the /20 mesh range, and to my knowledge, t more than 24 mesh. When using inimal poundage (3 to 5 pounds per acre) is recommended that the granules be in e smaller range (15/24 mesh) to pro- le the maximum number of particles r unit area. Conversely, when using gher poundage (10 pounds per acre), anules in the larger range (10/15 mesh) ord adequate coverage over a given a. Swath widths obtained with both rotary and horn seeder, particularly the ter, will vary with size and weight of granules and with applicators. Swath ge will normally be from 25 to 45 t.

Airplanes are presently being routinely d by two districts for the application of nular insecticides. These districts—dera and Kern—are both using Stear- n airplanes equipped with commercial sting or seeding distributors. With the eption of equipment, the aerial applica- ns carried on by these districts are quite ferent. At Madera, the work is done an agricultural applicator under con- t. Sand-coated 1 percent parathion nules are applied at the rate of 10 nds per acre, flying a 40-foot swath elevations of 25 to 35 feet. The Kern strict, with its own Stearman, has dified the gravity discharge gate to mit application of low gross dosage s. In 1960, with this equipment, tine treatments of 2 percent parathion nules, primarily sand-core, were made at a 5 pound per acre rate. During 1961, approximately 18,000 acres were larvicided with this equipment applying 5 to 7 percent parathion-bentonite 20/30 mesh granules at 1½ to 2 pounds per acre. Swath widths were 50 feet while flying at 25 to 50 foot elevations. Of this acreage, prehatch treatments accounted for approximately 3,500 acres, while the balance, or 14,500 acres were direct larviciding applications. Results were generally excellent. In this operation, insecticide costs amounted to 34 cents per acre at the 2 pound dosage rate, and 26 cents at 1½ pounds per acre. To obtain adequate and uniform coverage at such low dosage rates, it is necessary to apply as many particles per unit area as is practical. Success was achieved with the 20/30 mesh range, using both bentonite and sand-core formulations.

We have now been evaluating the application of granular larvicides by airplane for more than three years, and at low dosage rates the results have consistently been better than with spray. At this time we feel there is a reasonable prospect of swath widths up to a range of 60 or 70 feet, with dosage rates in the range of 1½ pounds per acre with light aircraft.

THE USE OF GRANULATED PHOSPHATE TOXICANTS. The following graph shows the use of these materials in California mosquito control.

Ecological and geographic conditions vary widely in California. We can, however, divide the state into four general regions based upon types of mosquito problems and control activities. These are: Southern California, San Joaquin Valley, Sacramento Valley and the Central Coast-San Francisco Bay areas.

In looking at the use of granulated phosphates by these regions during the past two years, we find the following:

From these data we learn that in 1960, 92 percent of the approximate 150 tons were used in the San Joaquin Valley. In 1961, the San Joaquin Valley accounted for 178 of the approximate 200 tons, or 89 percent. This can be further delineated

[1] See Raley, Mosquito News 21(2).

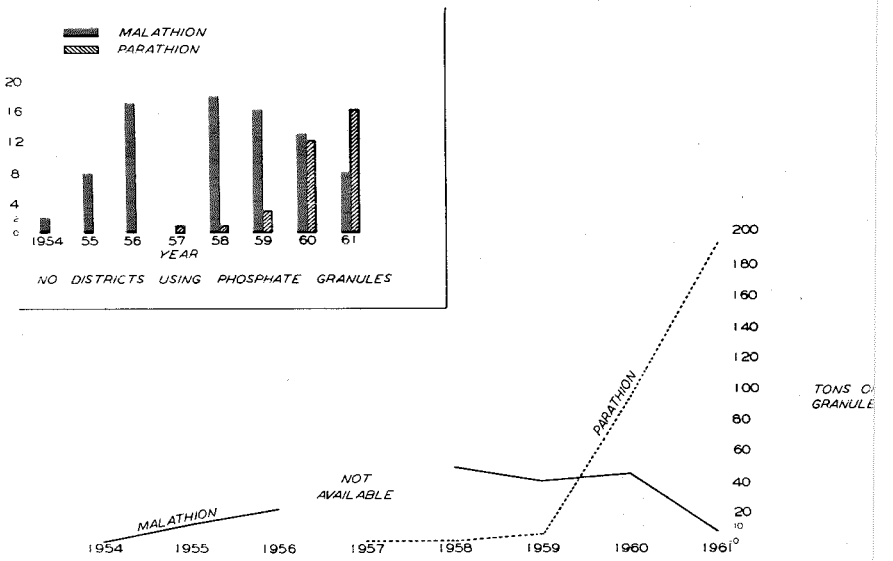

FIG. 1.—Use of organic phosphate granules in California mosquito control.

to show that the southern portion of the Valley from Madera to Kern County accounted for 80 percent of the use in the state during 1960, and 84.5 percent in 1961.

ADVANTAGES AND DISADVANTAGES OF GRANULAR LARVICIDES. I believe it is commonly understood and accepted that the primary advantage in granulated formulations of larvicides is in their ability to penetrate vegetative canopy. This is a real and important advantage under many, many circumstances and situations. Their effectiveness in this respect is exceptionally well demonstrated.

Advantages of granular formulations include 1—No residue left on food and forage crops. 2—Highly effective as pre-hatch treatments. 3—Relatively safe for operators' use. 4—Less weight per acre, which increases airplane capacity as much as five-fold. 5—Increases operators' acres treated per hour, in some cases double.

A disadvantage of granule formulations has been cost. This has been a serious problem, since dry materials as used in California have commonly been from fo to ten times as expensive as liquid l vicides. This difference however, is bei considerably reduced, particularly wi parathion formulations. New and mo effective formulations, improved produ tion techniques, along with increas volume, have all contributed to a contin ing reduction in unit cost. With c centrated formulations and low volu applications, direct costs have been reduc to only twice that of liquid parathi larvicides. This cost is further indirec reduced when other advantages of gr ulated parathion are taken into conside tion, i.e. increased speed of applicati reduced poundage per acre, pre-hatch plications, simple, inexpensive applicati equipment. You will note that I re only to parathion granules. The use of l toxic insecticides usually requires increas concentration of active ingredients as w as total poundage of inert per acre. T in turn, results in higher formulation a treatment costs. I believe I am safe saying that the acceptance and volume

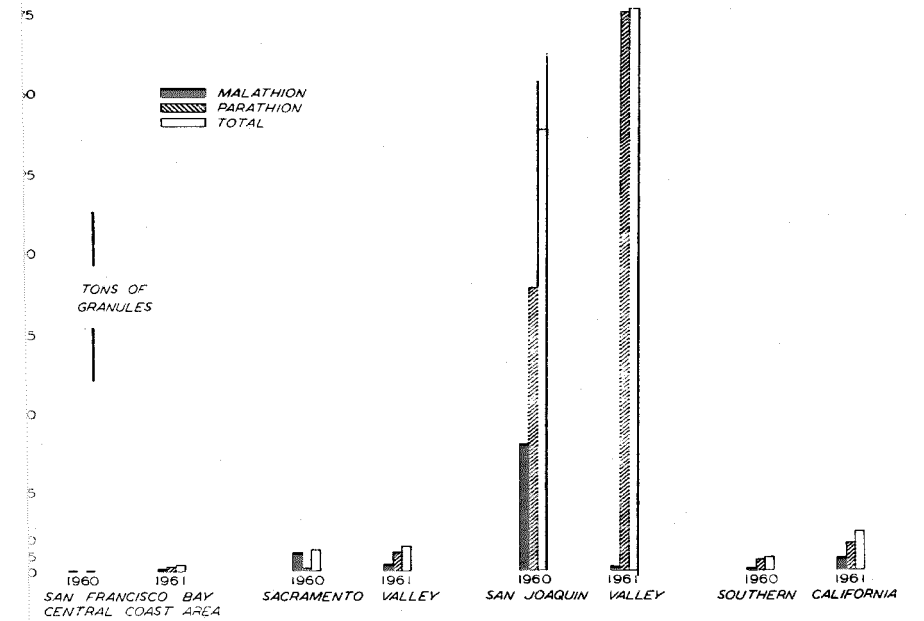

FIG. 2.—Use of phosphate granules in California by regions (1960 & 1961).

granules for mosquito larviciding purses in California is based upon the availility of suitable granular formulations parathion. Other granulated toxicants, ch as malathion, Baytex, DDT and ldrin are being used in relatively limited volume and usually for specialized purposes. The cost of suitable formulations of these materials is presently too great to anticipate their use on a volume basis in place of competitive liquid larvicides.