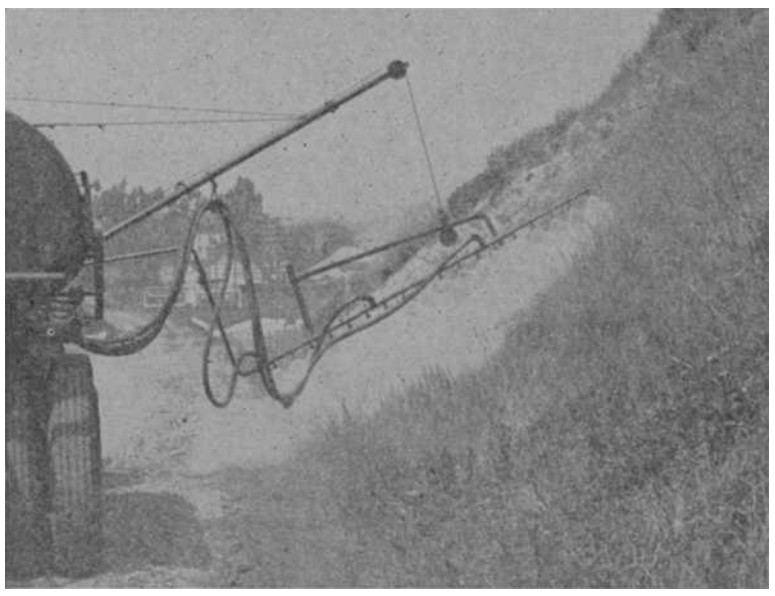
Oil Fractions And Their Toxic Effect On Plants When Used As Weed Killing Sprays Explained

A description of oil fractions and their toxic effects on weeds, extracted from the Agricultural Extension Service Circular No. 137, General Contact Weed Killers, *issued by the University of California College of Agriculture. The complete circular may be obtained without charge by addressing a request to the College of Agriculture, Berkeley 4, California.*

A. S. Crafts

In contrast to sprays in water solution, oils wet plant surfaces readily and tend to spread as thin films and run down the stems. They penetrated the crown of grasses where growing tissues that form new shoots are located. If an oil spray wets the tops of grasses thoroughly, the film may creep from four to six inches down the stems and kill all tissue from which new shoots might grow. This acounts for the satisfactory results usually obtained with Diesel and smudge-pot oil sprays, both of which are standard materials for weed killing.



Spraying diesel oil as general-contact weed killer on roadside growth to form a fire control strip. The oil should wet the tops of the growth thoroughly so a film of oil may creep down the stems to a depth of four to six inches to kill all tissue from which new shoots might grow.

Properties of Oils

To use oil sprays in weed control, the grower must know something about oils and their effects on plants. In this way he will be able to choose the best oil for his own needs.

In the oil trade, all oils are described by sets of specifications. These are either required by law or used by the manufacturer as a standard of quality for his own products. Every product must meet the specifications which its manufacturer has set up for it. These standards are intended to show a product's ability to do the job for which it was made. Certain oils now being tested as weed-killing sprays were not really intended for this use. Thus specifications listed for these oils do not necessarily show how well they will act as weed killers. There are no specifications for weed-killing oils. The only sure way to find out if an oil is useful as a weed killer is by tests in the field. Hence, in buying oils for weed killing, the grower will have to rely on the ability of the oil dealer to supply a satisfactory product.

This circular lists some of the words commonly used to describe oils and oil sprays, and tells what they mean. It also gives a simple account of the way in which oil is refined. The list should be helpful to the grower when choosing his oil sprays.

Refining

Two main processes are involved in oil refining: distillation and separation. An example of simple distillation is the boiling of a teakettle. The water in the kettle is heated to boiling temperature. At this point it turns to steam or vapor. If the steam touches a cold surface, it condenses. This condensed steam is a distillate. Since water has only one boiling point, the condensed steam is the only product resulting from the boiling of water.

Unrefined —crude—oil, on the other hand, is made up of many parts—fractions—which have different boiling points. The oil is put into a container, or tower, and heated. The fractions which have the lowest boiling point—gasoline—vaporize first and the vapors rise to the top where they condense. These fractions which evaporate quickly are the light—more volatile—ones. Other, less volatile fractions, such as stove oil and Diesel fuel, have higher boiling points, and condense later. Thus each batch of crude oil contains some gasoline, some stove oil, and some Diesel fuel, etc., and each fraction may be removed within its own boiling range.

Distillates

The liquid oil fractions resulting from distillation are called distillates. Not all the materials in crude oil can be distilled; tars and asphalt are left. The distillates are not pure compounds but contain a mixture of all compounds which turn to vapor during distilling. Some of these are called unsaturated compounds. There are more of these unsaturated compounds in an oil such as Diesel fuel, that has not been highly refined, than there are in kerosene or spray oils that have received more treatment. When a refined oil is wanted, some or all of the unsaturated compounds may be separated from the oil by use of chemicals. Sulfur dioxide is one commonly used for this purpose.

It is the unsaturated compounds which are important in weed-killing oils. They determine, in part, how well the oil will kill plants.

Gravity

The gravity, or density of an oil has to do with its weight. It is expressed in degrees A.P.I. because the gravity of oils in the United States is determined by tests set up by the American Petroleum Institute. The gravity of an oil is found by use of an instrument called a hydrometer. This is a glass tube with degree markings on the side and a bulb at one end. The bulb floats in the oil sample to be tested, and the depth to which it sinks, as indicated by the marks on the tube, is a measure of the gravity of the oil. The bulb does not sink so far in heavy oils as in light ones. The degrees are marked on the tube in such a way that gravity readings of heavy oils are lower than those of light ones.

Gravity is important in choosing a weed-killing oil. Heavy oils, which fall below 38° A.P.I., will kill crop plants as well as weeds. For use as a selective herbicide on crop plants, therefore, a weed-killing oil should not fall much below 38° A.P.I.

Flash Point

Flash point is a measure of the inflammability of an oil. One of the means for testing the flash point is the Pensky-Martens closed cup test. The oil is heated in a closed container, or cup. A slide covers a small opening in the cup. This is opened at definite intervals, and a flame is passed over the oil. The temperature at which the oil ignites is its flash point.

Highly volatile oils ignite at fairly low temperatures. All gasolines flash at ordinary temperatures—for instance, 70° F—;in fact, they will flash at freezing temperature for water. From the standpoint of safety for the operator, it is dangerous to use gasoline for weed spraying. Only less volatile fractions such as some of the thinners and solvents, are fairly safe to use. However, the spray operator must remember that all these products are inflammable. The spray mist and surrounding air may ignite and burn with great heat.

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Newly Developed Insecticides For Pest Control

Robert L. Metcalf

Scientific research by commercial and governmental interests has resulted in an unprecedented development of new materials showing great promise as insecticides. Intelligent evaluation of their potentialities will offer big dividends in improving the efficiency of present day pest control practices.

DDD or TDE

DDD or TDE is 2,2-bis-(p-chlorophenyl)-1,1-dichloroethane, $(ClC_6H_4)_2HCCHCl_2$. It is generally somewhat less effective than DDT to household insects such as the German roach and bedbug but is more effective as a mosquito larvicide. It has a decided advantage of being from about one-fifth to one-tenth as toxic as DDT to mammals.

This material can be formulated in sprays, dusts, wettable and emulsion concentrates exactly as in DDT. Doubtless is will be utilized extensively in household and livestock insecticides and may be preferred to DDT on agricultural crops wherever treated products are intended for human consumption.

Methoxychlor

Methoxychlor, is correctly named as 2,2-bis-(p-methoxyphenyl)-1,1,1-trichloroethane, $(CH_3OC_6H_4)_2CHCCl_3$.

This material gives a much more rapid knockdown of flies than does DDT, is more toxic to the German roach and is equally toxic to the bedbug. It is less effective against the human body louse, mosquito larvae, and the American roach.

Methoxychlor is only 1/25 to 1/50 as toxic as DDT to mammals, but is expected to be several times more expensive than DDT. It may find considerable use, especially in agriculture, because of its very low toxicity to warm blooded animals. This material can be formulated identically with DDT.

Viscosity

This relates to the flowing quality of an oil. To find the viscosity, 60 cc—about 2 ounces—of oil are put into an instrument called the Saybolt Universal viscosimeter. The oil is heated to 100° F. It is then timed as it runs through a small opening in the instrument.

The viscosity of an oil to be used as a spray determines somewhat the amount of pressure needed, and the size of the spray orifices. The heavier oils will not break up into drops easily, nor flow as fast as will the lighter ones. Viscosity is also a factor in determining how much of the oil soaks into the plant surfaces. A heavy oil will stay on the plant longer than will a lighter, more volatile one. Thus it may soak in in larger amounts and be more toxic. For use as a weed spray, an oil's vicosity should be about 50 seconds or less.

Toxicity

An oil's toxic effect on plants depends in part on how volatile it is and on the amount of unsaturated compounds it contains. Oils vary in their toxicity. Some kill all plants; some are selective, and kill only weeds, leaving certain crop plants undamaged. Light unsaturated compounds cause a rapid burning of leaves called acute toxicity. Heavy unsaturated compounds injure the growing parts and cause a chlorosis—yellowing of leaves. This injury comes on much more slowly and is called chronic toxicity. Very light unsaturated compounds, such as those from gasoline stock, cause burning of the leaves. Injury is not complete, however, if the spray incompletely saturates the plant, because these oils may evaporate before all tissues are killed.

Unsaturated compounds of medium weight are very toxic to grasses and most weeds. They do not kill plants of the carrot family except at high concentrations. They are usually found in unrefined petroleum distillates such as stove oil, at concentrations between 20 and 30 per cent. Heavy unsaturated compounds, such as those in Diesel and other heavy fuels, kill plants slowly by chronic toxicity. Crop plants as well as weeds are killed by such oils.

DFDT

A German household insecticide not yet available on the American market, but which is of interest experimentally is DFDT or 2,2-bis-(p-fluorophenyl)-1,1,1-trichloroethane, $(FC_6H_4)_2CHCCl_3$.

This material has proven much more toxic than DDT to the German cockroach, ants and many other insects but is less toxic to lice and bedbugs. It is especially remarkable for its rapid action, giving knockdown of flies and mosquitoes in from one-fifth to one-tenth the time required by DDT. It is somewhat more toxic to mammals than is DDT.

The DFDT has a much higher vapor pressure than DDT, giving it some fumigant action and it does not possess long residual life. This may be an advantage in the case of agricultural applications.

Benzene Hexachloride

Benzene hexachloride or gamma-hexachlorocyclohexane, $C_6H_6Cl_6$ as pure material has proven from 10 to 20 times or more as effective as DDT to such pests as the housefly, human body louse, ants, bedbugs and various species of cockroach. It is slightly more toxic than DDT to mammals.

Most formulations of benzene hexachloride on the market are crude mixtures containing about 10% active material, and are irritating to apply and possess an offensive odor. They should therefore be used with great caution around dwellings and business places. Benzene hexachloride is formulated in a variety of ways, as oil solutions, emulsion concentrates, wettable powders and dusts. It does not have as prolonged residual action as does DDT.

Chlordane

Chlordane—This material is a chlorinated hydrocarbon with the formula $C_{10}H_6Cl_8$ and is octachlorodihydrodicyclopentadiene.

Chlordane is several times as toxic as DDT for houseflies, mosquitoes, silverfish and carpet beetles, and is 10 to 20 times as effective to the German cockroach and to various species of ants.

It possesses considerable residual action but also has some fumigant properties. Its toxicity to mammals is about equal to that of DDT.

Chlordane can be formulated as sprays, dusts, wettable powders and emulsion concentrates. Because of its viscous oily nature it forms almost invisible residual films which stick very tenaciously to smooth surfaces, but are readily absorbed by porous surfaces. It is several times more expensive than DDT.

Toxaphene

Toxaphene—This waxy material is probably a mixture of isomers of octachloro-camphenes $C_{10}H_{10}Cl_8$.

Toxaphene is stated to be of the same order of toxicity to mammals as is DDT. It has proven equally as toxic as DDT to flies and bedbugs and appears to be more effective against the German cockroach. It is highly effective against carpet beetles and clothes moths, and as a mosquito larvicide.

Toxaphene has long-lasting residual properties, and should be of interest because of the adhesiveness of its residual films. It is formulated as oil solutions, emulsion and wettable concentrates, and dusts. It is expected to cost slightly less than DDT.

HETP

HETP—Hexaethyl tetraphosphate — probably $OP[OPO(OC_2H_5)2]3$ — is completely miscible with water and rapidly hydrolyzes to other phosphoric acid esters, forming acid solutions which are non-toxic and somewhat corrosive to spray equipment.

HETP solutions should be applied as soon as possible after dilution and should not be used longer than 6 hours after mixing.

Although extremely toxic to many household insects HETP has almost no residual properties and is very toxic to mammals, being nearly as toxic as free nicotine. It should therefore be used with the utmost care.

TEP

A material of very recent development is tetraethyl pyrophosphate or TEP, $O[PO(OC_2H_5)_2]2$.

It possesses nearly the same solubility characteristics as HETP, but hydrolyzes more slowly in aqueous solution so that solutions one-day old still possess considerable insecticidal effectiveness.

TEP has proven 3 to 5 times as toxic to many insects as is HETP, but is correspondingly more toxic to mammals. It also possesses strong fumigant action. Because of its extreme toxicity to mammals it is yet to be determined whether or not it will have any place in the household insecticide field.

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Leasing Of Farm Lands In State Thought To Be At Low Point Now But Increase Is Anticipated

(Continued from page 1)

ownership from one generation of farmers to the next.

Young farmers find it a way to expand their operations and earnings more rapidly than through ownership.

Truck and crop specialists may shift their operations more readily where they lease a large part of the land they farm.

Rental Arrangements

Rents naturally increased considerably in recent years with increased profit opportunities but face early adjustment to changing price conditions.

Although supply and demand for land to rent largely determine rents, the ability of the tenant to pay must be considered.

Rental arrangements need to be re-examined annually.

Trends

New procedures need to be developed to facilitate the gradual passage of a farm from owner to son or potential purchaser with little capital.

New forms of profit sharing and partnership contracts for farm operation will supplement traditional leasing practices.

More devices to bring landlords and tenants together will be needed to handle the expected increase in farming on land owned by others.

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Present And Future Research In Dairy Industry Problems

(Continued from page 1)

It is our intention to expand the present researches and to initiate others as fast as qualified personnel and suitable housing can be obtained.

We expect to undertake work in the field of dairy bacteriology, to expand our frozen products and nutritional studies, and to initiate engineering studies on cleaning dairy equipment.

We also have much additional work of a basic nature in chemistry, engineering, and bacteriology to undertake in order to increase our store house of knowledge.

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