THIS VERY PROMISING new insecticide, used extensively by the armed forces, has been released for civilian use. Available supplies will not meet the demand. Publicity given DDT during the war has caused wide interest in it and many requests for information about it.

Undoubtedly DDT will eventually be used for the control of a great many of our common insect pests, but as an insecticide, it is still largely in the experimental stage. For the present it should be used cautiously and with the understanding that recommendations made at this time are subject to correction or change.

If not properly handled, DDT may be dangerous, but anyone who will recognize its poisonous properties and will take ordinary precautions can safely use it.

DDT is now sold by most of the large insecticide manufacturers, jobbers, and dealers, and can be purchased locally or ordered thru regular dealers.

When buying an insecticide containing DDT, select a formulation suited to your needs and follow the instructions given by the manufacturer.
Some General Facts About DDT

**What DDT is.** As a pure chemical, DDT is a crystalline solid. It is practically colorless, almost odorless, and rather stable. It is insoluble in water, but soluble in varying degrees in most organic solvents. Three grades are available: C. P. (chemically pure), which has a melting point of 108° C.; purified DDT, with a melting point of at least 103° C.; and the so-called technical grade, with a melting point of at least 88° C. The full name of this organic chemical is dichloro-diphenyl-trichloroethane.1

**Effect on insects.** DDT is not a cure-all. True, it shows more promise of controlling a greater number of insects than any other insecticide yet discovered. At the same time, it is not effective when used against some insects and related pests, notably the cotton boll weevil, plum curculio, chinch bug, squash bug, Mexican bean beetle, cattle grub, screwworm, red spider, and certain plant lice.

DDT may act as a contact poison; that is, it may be absorbed thru the body. That is why many insects die after they have walked on a surface treated with it. Or it may act as a stomach poison.

Two of the outstanding characteristics of DDT should be well understood. *First,* altho DDT may be very poisonous to a given species of insect, its action is slow compared with many other insecticides. Insects fatally poisoned by DDT may live for hours or even days. *Second,* DDT often has a long-lasting, or residual, effect. DDT deposits on walls, screens, mattresses, rugs, floors, etc., may continue to kill flies, mosquitoes, bedbugs, and other insects for weeks or even months after the spray or dust was applied. There is usually much less residual effect when the DDT is applied on plants and on surfaces exposed to sun and weather. Repeated applications are usually needed to protect plants.

**Preparation of DDT insecticides.** Technical DDT is the form usually used in preparing insecticides. Neither the pure nor the technical grade of DDT by itself is a good insecticide. Nor is making technical DDT into a good insecticidal dust easy since special grinding and mixing equipment is required. Many manufacturers who have the equipment are now making good dust mixtures. Satisfactory solutions

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1DDT (dichloro-diphenyl-trichloroethane) was first prepared by a German chemist in 1874. However, its insecticidal properties remained unknown until 1939 when Paul Mueller, an employee of the J. R. Geigy Company of Basel, Switzerland, found that it would kill potato beetles. Later he reported its effect on plant lice, moths, and flies. During the past three years entomologists in state, federal, and industrial laboratories have added materially to our knowledge of the usefulness and limitations of this new insecticide.

The use of DDT as an insecticide is covered by a number of Swiss, British, and American patents, all of which are assigned to the J. R. Geigy Company. Many American and foreign companies now manufacture and sell insecticides containing DDT under licenses issued by the Geigy Company.
of DDT in oil and other solvents are not hard to prepare. Since they are patented, however, and since competition will force companies to keep the prices down, it will probably not be worth while to make them at home.

**Forms or Formulations of DDT**

Because DDT will be used under greatly varying conditions to control many kinds of insects, it will be marketed in several forms. Each formulation will have its distinct uses, advantages, and disadvantages. Following is a list of the forms now readily available.

**Prepared DDT dusts**, ready for use, are available in concentrations of less than 1 percent to 10 or 15 percent.

**DDT dust concentrates**, containing 25 to 50 percent of DDT, are used by jobbers or growers for preparing dilute dusts.

**Wettable powders** are similar to dust concentrates but contain a wetting agent to make DDT easier to use as a spray.

**Oil solutions** of several kinds are available. Some for use as household fly sprays contain as little as $\frac{1}{10}$ to 1 percent of DDT in refined kerosene. Others intended for household use on bedbugs, roaches, etc., contain 5 percent of DDT in refined kerosene. Solutions for use in mosquito control contain 5 to 10 percent of DDT with special solvents in crude or fuel oil.

**Emulsion concentrates** are solutions of DDT, an emulsifying agent, and a solvent. They can be mixed with water to make sprays.

**DDT bombs**, or "aerosol" bombs, contain DDT dissolved in liquefied gas. These bombs are for use in homes and other inclosed places.

**Special combinations of DDT** are made for very specific uses. Insecticides or fungicides, or both, are combined with the DDT.

**Technical grade DDT** is the commercial grade used by manufacturers and licensed processors.

**Dangers and Precautions**

**DDT may destroy insect balance.** The use of DDT creates certain dangers. It destroys many insects that prey on others or live on them as parasites. Normally these preying and parasitic insects hold the host insects in check. Destroying preying and parasitic insects allows those hosts which are unaffected by DDT to increase until they become pests. Good examples of pests that may increase when DDT is used are red spiders, wooly aphids, mealybugs, and some kinds of plant lice.

**May poison bees and small animals.** If too much DDT is used, honeybees, many small cold-blooded animals (fish, snakes), birds, and perhaps some small mammals may be poisoned. Reasonably correct use
of DDT should not, however, according to present evidence, greatly endanger either bees or these animals. Plants that bees are likely to visit should not be sprayed or dusted while in bloom.

**Warm-blooded animals less susceptible.** Warm-blooded animals are less likely to be poisoned by DDT than cold-blooded animals. Taken internally, DDT is not as poisonous to man and other mammals as are many other types of insecticides now in use, including many arsenical and fluorine types.

**Do not use on human food.** DDT should not be used on human food—not at least until the administrators of the U. S. Food and Drug Act have clarified their position on the matter. Neither should it be used extensively or in large amounts on forage or other feed crops when other suitable insecticides are available and can be used.

**Avoid long exposure to DDT in solutions.** DDT in oil and other solvents (but not in water) is absorbed thru the skin. Be careful, therefore, to avoid exposing yourself too much, and especially avoid repeatedly exposing yourself to DDT in solutions. When handling DDT, use the same care that you would normally use when handling other poisonous insecticides. To date, there are no authentic, recorded cases of DDT poisoning in man and none in animals except when they were treated with oil solutions or were fed excessive amounts experimentally. Until the dangers involved are better understood, however, animals should not be treated with DDT in oil or in other solvents. They can be treated with DDT in water, which does not dissolve DDT.

**Know positively the amount of DDT in formulations.** This is very important. All the recommendations for using dusts or sprays are based on specific percentages of DDT. The dangers in using DDT preparations necessarily vary with the concentrations of DDT in them. Use only those preparations, therefore, which bear on their labels the exact percentage of DDT they contain.

Reasonable applications of DDT have little or no effect on most plants. But oils and other solvents or conditioning agents used in some formulations have at times produced plant injury. And DDT has been known to injure seedling squashes, cucumbers, lima beans, and tomatoes.

**Control of Flies in Buildings**

**Space sprays.** Aerosol bombs and household or barn sprays contain very small amounts of DDT with some quick-acting material known as a knockdown agent. They are now extensively used in inclosed places to kill flies, mosquitoes, and some other insects. They are, however, only temporarily effective, as they do not contain enough DDT to produce a long-lasting residual effect.
**Residual sprays.** The residue left on surfaces sprayed or painted with DDT water suspensions, emulsions, or oil solutions containing 1 to 5 percent of DDT will continue to kill flies, mosquitoes, and some other insects from one or two weeks to several months after the spray is applied. In general the higher the concentration of DDT the longer the deposit will remain effective.

In barns and other buildings where the white deposit is not objectionable, a water suspension of a wettable powder may be used to advantage. Where such a deposit is objectionable, an emulsion or a solution of DDT in a highly refined kerosene or a similar oil may be used. Since these oils are inflammable, they create a fire hazard. *Use them with caution.*

**Control of Household Pests**

**Bedbugs.** Solutions containing 5 percent of DDT in deodorized kerosene or a dust containing 10 percent of DDT may be used on mattresses, pillows, bedsteads, springs, divans, bunks, and other infested furniture. Three or 4 ounces of spray, or 2 to 4 ounces of powder, will be enough for an ordinary double bed. Within a few hours such applications will kill all the bugs present and will remain effective long enough to kill all that may come out of hiding in search of food. Light spraying or dusting on and behind baseboards, moldings, etc., will help get quicker destruction of all the bugs in the room.

**Fleas.** One to 2 teaspoonfuls of dust containing 5 percent of DDT will kill all the fleas on a dog of average size in 1 to 5 hours after it is applied. Apparently, however, dogs can get most of the dust out of their coats. Such dusting, therefore, may not protect them for more than 4 or 5 days.

To get satisfactory control of fleas, the dog's bedding and common lounging or resting places — in fact, all infested areas — must be gone over with a 5-percent dust. Use ½ to 1 pound of this dust to 1,000 square feet of area.

*Caution: Do not spray or dust cats with DDT. They often lick enough DDT from their coats to make themselves seriously sick.*

**Cockroaches and silverfish.** For these pests, use a solution containing 5 percent of DDT in deodorized kerosene or a dust containing 10 percent of DDT. Apply on and behind baseboards, around sinks, and other plumbing fixtures, and in closets or other places commonly frequented by these pests. Such treatment will normally give satisfactory control. The length of time the treatments will remain effective depends largely on the thoroughness of application.

The small German roach or croton bug is more resistant to DDT poisoning than the other common kinds of roaches.
Reasonably satisfactory recommendations for the use of DDT for controlling flies, mosquitoes, body lice, bedbugs, and other household pests can now be made because it was used so extensively by the armed forces and because considerable research has been done in these fields. Concerning its use on insects of other kinds, we know less. Tho the results of the preliminary tests have been good, there are still many gaps in our knowledge and many details that have to be worked out.

**Fabric pests.** Unless washed or dry-cleaned afterward, wool fabrics thoroughly sprayed with a 2-percent solution of DDT in oil are well protected from clothes moths and carpet beetles for at least a year. Do not use a more concentrated solution on fabrics as the DDT may crystallize on the surface and form an unsightly white “bloom.” A DDT spray is not recommended for rayons or rayon mixtures.

Using a 5-percent solution of DDT on the walls and floors of clothes closets, behind baseboards, and in all cracks will help reduce insect damage to fabrics.

**Ants.** DDT is very effective against many species of ants. Dusting nests and runways with a 10-percent DDT dust will control most of the common ants found in and around homes. Drenching nests with a 5-percent oil solution is also effective. *Caution: Do not get the dust or spray on food.*

**Control of Insects on Man and Animals**

**Human lice.** Body lice, head lice, and crab lice can be killed with DDT powder. Generously applying a 10-percent DDT dust on the affected parts of the body will quickly destroy all the lice. It will not, however, destroy the eggs. Therefore another application will have to be made 10 days later to kill lice newly hatched.

**Animal lice.** Preliminary tests indicate that applying 1 to 4 ounces of a dust containing 5 or 10 percent of DDT will give satisfactory control of most lice attacking livestock. Thoro coverage is desirable. Working the dust into the coat, where that is possible, gives the best results. Since DDT will not destroy the nits, a second application 10 days later is recommended. Where farmers are equipped to use them, dips or sprays which contain \( \frac{3}{10} \) of one percent of DDT and which are made from wettable powders or emulsion concentrates may be used in place of dust.

For the time being at least, it does not seem desirable to recommend the use of DDT in oil solutions on animals.
**Hornflies on cattle.** Spraying cattle with water containing \( \frac{3}{10} \) of one percent of DDT will practically destroy hornflies in pastures. The spray can be made of 5 pounds of a 50-percent wettable powder in 100 gallons of water. Use 2 quarts of spray per animal. Such treatment gives protection for 2 to 4 weeks. The period of protection appears to increase as the season advances. The time between sprays can be lengthened by using more DDT in the spray.

**Houseflies and stable flies on animals.** Houseflies and stable flies are harder to kill than hornflies. A spray containing up to 2.5 percent of DDT may be needed to rid animals of these pests. If all the species of flies are involved, it is best to treat both the animals and the barn.

**Use of DDT on Stored Products**

**Seed treatment.** DDT very effectively controls most stored-grain pests. One-half to 1 ounce of a dust containing 5 percent of DDT thoroughly mixed with one bushel of seed will give excellent protection for a year and perhaps longer. The treatment will not hurt germination, nor is there any evidence that DDT interferes with the action of fungicides applied to control seed-borne diseases. In fact, it now appears that these two treatments may be combined.

When grain bins have been swept and cleaned for filling, insects that may be hiding in cracks and crevices can be destroyed and the new crop in part protected by thoroughly spraying the bin walls and floors with an oil solution containing 5 percent of DDT. Allow bins so treated to dry and air before being filled.

**Termites and wood-infesting insects.** Altho preliminary experiments have been somewhat encouraging, the use of DDT for the control of termites and other wood-infesting insects is still in the experimental stage. No recommendations can safely be made at this time.

**Use of DDT on Plants**

**Shade trees and ornamental plants.** The use of DDT on shade trees and ornamental plants has not been extensively studied. DDT, however, very effectively controls a great many insects that attack these plants. And since using reasonable quantities of it on a few miscellaneous plants involves no unusual hazards, there is no reason for not trying it. One pound of actual DDT (in the form of a wettable powder) in 100 gallons of water will make a good trial spray.

Oil solutions should not be used on plants. Neither should emulsions be used until suitable recommendations can be made.

**Fruit crops.** DDT has shown promise of controlling many important insect pests of fruits such as codling moth, apple leafhopper, grape berry moth, leafroller, Japanese beetle, rose chafer, grape leafhopper,
and others. Its extensive use on fruit crops, however, involves many hazards and cannot be recommended until more information is available. Those who may be planning to give DDT further trial on fruit crops may write to the Natural History Survey, Urbana, Illinois, for suggestions or for information on special or individual problems.

Use of DDT on Vegetable Crops

**Potatoes.** DDT appears to give excellent control of all the common insect pests attacking potatoes, according to all research data obtained in Illinois and all reported from other states. Three applications of a dust containing 1 to 3 percent of DDT or a spray containing 1 pound of actual DDT (2 pounds of a wettable powder containing 50 percent of DDT) per 100 gallons has given very satisfactory control. Fungicides approved by the plant pathologists should be added to the dust or spray to control fungus diseases.

**Onion thrips.** The effect of DDT on onion thrips has been somewhat variable. In several instances a 5-percent DDT dust applied at the rate of 25 to 35 pounds per acre gave better control than any of the standard treatments applied in adjoining plots. The use of a 5-percent DDT dust or a spray containing one pound of actual DDT in 100 gallons of water is suggested for trial.

**Squash vine borer.** Results in Illinois, Iowa, and elsewhere indicate that DDT dust containing 3 to 5 percent of DDT (applied at the rate of 35 pounds per acre to the base and main runners of squash plants) is more effective than any treatment heretofore suggested for the squash vine borer. Altho this treatment is not recommended, it is suggested for trial. Because DDT has in many instances injured young plants of the squash family, it is not recommended for use on seedlings.

**Cabbage insects.** Dusts containing as little as 1 percent of DDT (applied at the rate of 30 to 40 pounds per acre) have given excellent control of all the common species of cabbage worms. Four applications of a 3-percent DDT dust at approximately 10-day intervals gave almost perfect control of these cabbage insects. Altho there seems to be no reason for not using DDT dusts on young cabbage plants, they should not be used after the heads have formed.

**European corn borer.** In tests made during the past two years, DDT has shown promise of controlling the European corn borer. Altho it is not possible to make definite recommendations at this time, the insect has become so important that market gardeners, canners, and seed corn producers are justified in trying it on an experimental scale.