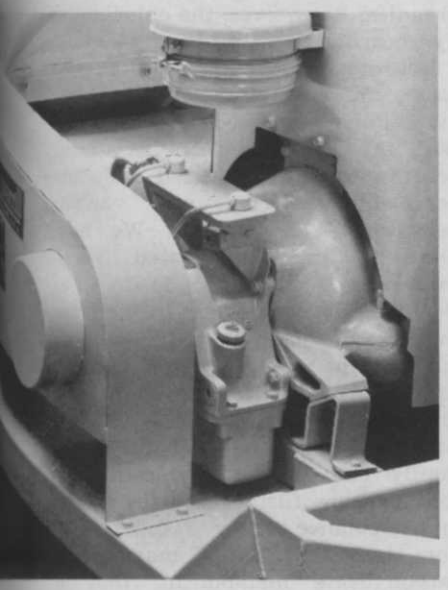
chipping vs. burning balance tips in favor of the former.

For one thing, considerable time is saved. The actual work of clearing can be done much faster; the chain saw work load is drastically reduced, burning crews are eliminated; thus man power can be used more profitably. Work crews per chipper normally vary from three to seven men and the number, of course, helps determine the time required to remove wood wastes from any given area.

But it is not unreasonable for a wood-chipping operation to achieve an overall reduction in man-hour requirements as high as 50%.

Lost time because of weather conditions or burning restrictions is minimized or totally eliminated. Chipping operations can be carried on, even on no-burning days in the highest of smog areas. The speed at which the chippers can be run is a factor, as well, and a chipper properly chosen for the job function to be performed will chip brush up to eight inches in diameter faster than two men can feed it.

Further opportunities for savings are found in trucking requirements. Wood chips take up far less room than do branches. The ratio may be as high as seven to one—thus, fewer trucks are needed to make fewer trips. In some circumstances, chip trucking time has been reduced by as much as 86% of that required to remove a comparable quantity of branches to the burning or disposal area.



Engine runs smoothly, efficiently when a torque converter is incorporated in the chipper. The engine is shielded from shock and vibration for reduced maintenance, increased service life. Photos courtesy Mitts & Merrill.

Many chipper owners have found uses for chips replacing material normally purchased. When spread around shrubs, flower beds, trees, etc., as a mulch, chips reduce the need for constant weeding. They hold moisture and permit soil aeration.

Indications are that when chips are spread around plants, they actually seem to assist in speeding healthy growth. When used in this manner, chip trucking may become essentially a productive function.

These day-by-day savings are only a part of the story. Operating and maintenance costs also contribute to the overall effectiveness of wood-chipper processing. The normal service life of chippers ranges from five to 20 years, depending upon severity of running conditions.

Maintenance is relatively simple and minimal, consisting mainly of sharpening the blades at intervals as required. The usual procedure is to carry a spare set of blades with the chipper. When blades are dulled, the spare set replaces them on the spot in a matter of minutes; however, on those chippers equipped with double-edge blades it is only necessary to turn the blade around and this can also be accomplished on the job.

Gas consumption is low, with one tank of fuel being enough for one day of operation under normal operating loads.

Chips Now a "Cash Crop"

Frequently the brush and wood chips, formerly regarded as outright waste, have a dollar value for operators. They can be sold as fuel, mulch, animal bedding, or even for cooking purposes.

Many a backyard barbecue has been made a roaring success when the steaks were flavored with the smoke from hickory, maple, cherry, apple or oak chips.

Among the several areas where wood disposal by chipping is most worthwhile, the lumber industry stands out. Because of the excessively high fire hazards inherent in logging and forestation, one of the most important responsibilities is obviously the prevention of such fires.

Piled chips present less danger of flammability than piled-up slash and brush. Because of this extremely low flammability, chipping can be carried on even during the fire season without increasing danger. In fact, chipping even eliminates virtually all of the peril.

Less solid advantages—but only a bit less important—are found in the use of chips as a light mulch around young trees and shrubs. By spreading the chips on skid trails, most of the plaguing problem of erosion can be prevented. And when green slash piles are eliminated, so are the breeding places of which many twig insects are so fond.

Chippers Pay for Themselves

As stated previously, determining the savings made possible by chipping rather than burning waste wood and brush is difficult because of the wide variance in operating conditions. It may be safely said, however, that direct costs may be reduced by as much as 50%.

Even if chipping vs. burning costs were the same, the prevention of just one forest fire would pay for many fleets of these efficient, rugged, mobile machines, and with a sale potential for the by-product, one can truly say, "they pay for themselves."

Opponents Call It Danger to Environment; Killer of Many Life Forms

By Dr. CHARLES WURSTER, JR.

Dr. Wurster is assistant professor of biological sciences at State University of New York at Stony Brook. He was recommended by the office of Sen. Gaylord Nelson as one of the leading authorities on DDT.

DURING the past quarter-century, man has subjected his environment to an increasing variety of chemical insults in the form of pollutants with molecular structures never before encountered by living organisms. Of these contaminants, the chlorinated hydrocarbon insecticides (those, such as DDT, that contain chlorine, carbon, and hydrogen) are probably more widely distributed than any other synthetic chemicals and have become one of the world's most serious pollution problems.

Residues of DDT and some of its relatives seem to be almost everywhere—in soils never treated with the chemicals, in birds and seals that never leave the Antarctic (although DDT has never been used on that continent), in most other animals and probably all humans, in the air, even in remote parts of the world, and even in the rain. Yet, after 25 years of use, the physiological mechanism of action for the chlorinated hydrocarbons is poorly understood, and we are only now discovering some of its environmental effects. We are, in a sense, conducting a biological experiment of colossal proportions, using the entire world as a laboratory.

How will it all come out? No one knows. Clearly some parts of the experiment have gone sour, and the flow of bad news increases as the data come in. Not all is mystery about these chemicals, however, for there is a great deal we do know about them.

DDT was first made in 1874, but its insecticidal properties were not discovered until World War II. With a high toxicity, great persistence, and side effects that were neither of concern nor well understood at the time, DDT was the miracle insecticide that played a heroic and glamorous role in the war, saving thousands of lives that would otherwise have been lost to malaria, typhus, and other insect-borne diseases. After the war it became a panacea for all insect problems, and its usage was greatly expanded.

While DDT has been the most widely used and extensively studied, and its residues are the most widespread within the environment, most other chlorinated hydrocarbons have similar properties and should be expected to have comparable ecological effects. These include dieldrin, aldrin, endrin, heptachlor, chlordane, lindane, and others commonly used against insects under a host of circumstances, including gardens, farms, and forests.

Properties Cause Unique Problems

In order to understand the movement and consequences of these materials within the natural environment, it is first necessary to know something of their properties. The chlorinated hydrocarbons present a relatively unique environmental problem because they combine four important characteristics in the same molecule:

1 Broad Toxicity and Biological Activity—Rather than having a toxic action that is limited to insects, as is popularly supposed, the chlorinated hydrocarbons are toxic to a broad spectrum of living organisms, including most of the animal kingdom and all vertebrates. All are nerve poisons. They cause instability or spontaneous "firing" of nerve cells, and increased doses result in tremors or convulsions—typical symptoms of acute poisoning that can occur in organisms ranging from houseflies to man. In general, if an organism has nerves, the chlorinated hydrocarbons can kill it.

Recent studies have uncovered other, more subtle, yet probably more important, mechanisms of action. At sublethal concentrations, organisms show increased nervousness, hyperactivity, and various behavioral abnormalities. We now know that most chlorinated hydrocarbons are enzyme inducers, i.e., they can induce enzymes in the liver that modify the steroid sex hormones, thus changing their biological activity and affecting vital physiological processes. At the same time, some members of the DDT family can function as estrogens, thus perhaps further upsetting hormone balance. Very recent work now suggests that DDT may inhibit carbohydrate metabolism, that it may affect the genetic material to influence future generations, and that it may be carcinogenic; each of these mechanisms needs further research.

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Defenders Say Environment —And Especially People— Endangered Without It

A BILL has been introduced before Congress to ban the nationwide sale of DDT.

Sen. Gaylord Nelson of Wisconsin has forced upon our elected representatives the necessity of making a decision.

They must decide who shall have priority of protection—people, or certain birds and fish.

The decision should be easy.

There is even a question of whether defeat of the bill would mean defeat (much less doomsday) for the birds and fish. There is strong evidence, however, that banning DDT could eventually impose death or a life sentence of misery upon literally thousands of people around the world.

Lawmakers will be weighing the merits of the case against DDT with the findings of a recently completed 18-month study conducted at the request of the U.S. Department of Agriculture.

Fifteen scientists of the National Academy of Sciences and National Research Council heard 83 principal witnesses. These spokesmen included authorities from scientific and conservation organizations, industry, universities and government agencies.

A full report of their study may be obtained from Press Service, Office of Information, USDA, Washington, D.C. 20250. A summary of the committee's conclusions and recommendations follows:

Conclusions

1. Persistent pesticides are contributing to the health, food supply, and comfort of mankind, but, in the absence of adequate information on their behavior in nature, prudence dictates that such long-lived chemicals should not be needlessly released into the biosphere.

2. Although persistent pesticides have been replaced in some uses and are replaceable in others, they are at present essential in certain situations.

3. No decrease in the use of pesticides is expected in the foreseeable future. On a world basis, increased use is probable.

4. Although the use of DDT has decreased substantially, there was no important change in the use of other organochlorine insecticides in the United States during the 10-year period ending June 30, 1967.

5. Available evidence does not indicate that present levels of pesticide residues in man's food and environment produce an adverse effect on his health.

6. Registration requirements for persistent pesticides appear to provide adequate safeguards for human health, but continuing attention must be given to accommodating new knowledge and insuring against subtle long-term effects.

7. Residues of certain persistent pesticides in the environment have an adverse effect on some species of wild animals and threaten the existence of others.

8. The availability and low cost of effective persistent pesticides have slowed the development and adoption of alternative methods of control.

9. Work on nonchemical methods as alternatives to persistent pesticides has been emphasized in recent years, and continued support for this work is needed.

10. Inadequate attention and support are being given to developing pesticidal chemicals and to improving techniques for using them.

11. Persistent pesticides are of special concern when their residues possess—in addition to persistence—toxicity, mobility in the environment, and a tendency for storage in the biota.

12. A few organochlorine insecticides and their metabolites have become widely distributed in the biosphere, appearing in the biota at points far from their places of application.

13. The biosphere has a large capacity for storage of persistent pesticides in the soil, water, air, and biota, but little is known concerning amounts of persistent pesticides and of their degradation products that are stored in the biosphere.

14. Knowledge is incomplete concerning the fate and degradation of persistent pesticides in the environment, their behavior in the environment, the toxicity of the degradation products, and the interaction of these products with other chemicals.

15. Present methods of regulating the marketing and use of persistent pesticides appear to accomplish the objectives of providing the user with a properly labeled product and holding the amounts of residue in man and his food at a low level. However, they do not appear to insure the prevention of environmen-

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DDT Is 'Compound of Extinction'

Falcon, Eagle Decline Blamed on Variation of DD

DDT Harm to Trout Claimed

UW Wildlife Expert Links DDT With Decline of Birds

DDT Opponents . . .

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2 Mobility—Unfortunately, these insecticides do not remain where they are applied, dispersal through the environment being facilitated by a variety of transport mechanisms. Obviously the chemicals can travel about within living, mobile organisms, though this mode of transport seems minor. Despite low water solubilities and vapor pressures, large amounts can be carried by vast quantities of moving water and air, and dispersal is further facilitated by the tendency of these materials to form suspensions in both air and water. Since many insecticide application procedures intentionally produce atomized droplets or particles, substantial amounts are thereby passed into the atmosphere. Less than half the amount sprayed from a plane may reach the ground. Once in the air, these materials can circle the globe in a few weeks; fallout from the air probably contributes about the same quantity of pesticides to the oceans as do major river systems.

The chlorinated hydrocarbons also readily adsorb to particulate matter like soil particles, which are carried away by wind and water. Escape into the air is further aided by the process of codistillation, whereby the chemicals pass into the vapor state associated with evaporating water. Thus a wet field will release pesticides into the air much more rapidly than will a dry one. It is clear, then, that these insecticides can be transported about much of the earth to points far distant from the original application site by currents of water and air, as well as by mobile organisms.

3 Chemical Stability—In the environment, the chlorinated hydrocarbons are very stable compounds; they probably have a half-life of many years or decades, but exactly how long they persist we do not know. Mechanisms for effectively metabolizing or breaking down these exotic materials apparently have not evolved, although certain tissues, particularly liver, can bring about gradual breakdown. DDT is slowly metabolized into DDE, DDD, and eventually other compounds, but unfortunately most of these, too, are toxic and induce liver enzymes. DDE, apparently more stable than DDT, is probably the world's most widely distributed synthetic organic chemical.

Treated areas show declining residues during subsequent years, but this "disappearance" is sometimes falsely equated with decomposition. The two are not the same. Increasing evidence indicates that much of these materials have simply gone elsewhere in their original, or slightly modified, form, retaining their biological activity.

4 Solubility Characteristics—DDT is insoluble in water—almost. DDT saturates water at only 1.2 parts per billion (ppb), making it one of the most insoluble organic substances known. Conversely, the chlorinated hydrocarbons are soluble in lipids (fats or fat-like materials). They are, therefore, invariably more soluble in any biological material, living or dead, than in water, since all organisms contain lipids. If we divide the biosphere into the inorganic (nonbiological) and the organic (biological), we must always expect the chlorinated hydrocarbons to flow from the former into the latter. Organisms, therefore, remove these chemicals from their environment and retain them.

DDT Travels Far

These four properties mean that biologically potent chemicals will contaminate non-target organisms far removed by both time and space from the site of application.

Chlorinated hydrocarbons may be absorbed by organisms through the gills, the skin, from the diet, and from the air via the lungs. Muds and other solids that hold these chemicals by absorption serve as reservoirs, feeding the chemicals into the water as they are absorbed by organisms. Living organisms accumulate these residues and become contaminated, often from an environment that may appear relatively "clean." For this reason some measurements of environmental quality are misleading. One must analyze living organisms, rather than water, to monitor water quality. Water and air are the transport media, but they contain only minute amounts of these chemicals.

Biological Concentration Occurs

Once these insecticides get into food chains, something else happens—the phenomenon of biological concentration, often called biological "magnification." Each organism eats many organisms from the next lower trophic level, i.e., the next step down in the food chain. A robin, for example, eats many earthworms, and a large fish eats many smaller fish. These food organisms are digested and excreted, but the chlorinated hydrocarbons are retained. The chemicals remain in biological material and therefore accumulate, the concentration depending on rates of intake, breakdown, and excretion.

The use of DDT in attempted control of Dutch elm disease is a clear and relatively simple example of food chain contamination. Since DDT is sprayed when the elms are leafless, only a small fraction remains on the trees. The rest is either lost into the air or settles to the earth. That retained by the tree eventually also reaches the ground. Earthworms and other organisms that work the soil accumulate the DDT and become contaminated. Many species of ground-feeding birds eat the soil organisms, concentrate the DDT further, receive a lethal dose, and die with tremors.

Flying insects also become contaminated by contact with the trees and soil, especially those emerging from soil dwelling larvae. Insectivorous birds of the treetops thereby also become involved in this mass avian mortality. In some treated areas, robin mortality has been virtually complete and birds of all species have been reduced by as much as 90 percent.

Wide areas of the coniferous for-

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Hearings In Spotlight

The Case for DDT

California Scientist Gives Warning

Up With People

And Down With the Venomous Foes of Chemical Pesticides

Scientist Testifies

DDT Defenders . . .

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tal contamination.

16. Public demand for attractiveness in fruit and vegetables, and statutory limits on the presence of insect parts in processed foods, have invited excessive use of pesticides.

17. The National Pesticide Monitoring Program provides adequate information about residues in man and his food, but it does not provide adequate information about the environment generally, because it can detect changes in residues only in selected parts of the biosphere.

18. Contamination of the biosphere resulting from the use of persistent pesticides is an international problem. Changes in techniques for using these pesticides and the substitution of alternatives here and abroad are questions of immediate concern to all mankind.

Recommendations

The Committee recommends—

1. That further and more effective steps be taken to reduce the needless or inadvertent release of persistent pesticides into the environment.

2. That, in the public interest, action be increased at international, national, and local levels to minimize environmental contamination where the use of persistent pesticides remains advisable.

3. That studies of the possible long-term effects of low levels of persistent pesticides on man and other mammals be intensified.

4. That efforts to assess the behavior of persistent pesticides and their ecological implications in the environment be expanded and intensified.

5. That public funds for research on chemical methods of pest control be increased without sacrifice of effort on nonchemical methods.

6. That the present system of regulation, inspection, and monitoring to protect man and his food supply from pesticide contamination be continued.

7. That the objectives and procedures of the National Pesticide Monitoring Program be reviewed and that the feasibility of obtaining data on quantities of persistent pes-

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USDA Pesticide Suspension Order No 'Confession'

USDA's suspension from use of nine pesticides should not be interpreted as an "admission" that these chemicals are harmful to wildlife and people, a Department spokesman told WTT's editor shortly after the announcement was published in mid-July.

One of the pesticides is DDT, which Sen. Gaylord Nelson of Wisconsin is seeking to ban nationwide through a bill now before a congressional subcommittee.

Questioned about the timing and effect of the USDA suspension with regard to this legislation, the spokesman spelled out USDA's position generally on chemical pesticides:

"We are categorically not in favor of any action that represents an across-the-board ban on DDT or any other pesticide. Any action that's taken should be on a case-by-case basis."

The spokesman added that he did not believe the Nelson bill would pass.

The suspension on the use of nine chemicals isn't necessarily permanent, the spokesman pointed out. Rather, it is for the duration of the review, expected to be completed within 30 days.

"Some programs may require a quick decision and be reinstated before 30 days," he said. "On other programs, the review (and suspension) may need to be extended."

The review was initiated, the spokesman explained, just to "show response to the NAS (National Academy of Sciences) study and recommendations and the request of wildlife conservationists."

A report by NAS and the National Research Council had recommended that "further and more effective steps be taken to reduce the needless or inadvertent release of persistent pesticides into the environment."

The spokesman said the review is to see if in fact there are more effective steps that could be taken on those programs carried out by USDA.

"Basically, we'll be looking for effective alternatives," he said, since, repeating the words of the release, "USDA programs in the past have been carefully planned and carried out to insure maximum safety to man, animals and our natural resources."

It is the Department's intention, he said, to carry out the review so that it "won't unduly delay" critical programs.

The suspension order affects programs of the Agricultural Research Service and the Forest Service involving any planned applications of DDT, dieldrin, endrin, aldrin, chlordane, toxaphene, lindane, heptachlor, or BHC.

Bills Ask DDT Ban; Pesticide Commission

Summaries of Wisconsin Senator Gaylord Nelson's two bills affecting DDT follow.

Bill 1753 would amend the Federal Insecticide, Fungicide and Rodenticide Act by adding Sec. 17. The paragraph would make it unlawful for any person to distribute, sell, or offer to sell, DDT in the U.S. after June 30, 1970. It also would be unlawful to receive DDT from any foreign country.

Bill 1799 would establish a National Pesticide Commission. Under provisions of this bill, the President would appoint three representatives from government agencies, three from the scientific and medical professions, two each from conservation and agricultural organizations and two from private enterprises for a term of three years.

The commission would be responsible for:

1. Determining and evaluating the present usage of pesticides;

2. Reviewing existing limitations on pesticide use and

Senator Gaylord Nelson

current labeling requirements;

3. Recommending standards of safety for pesticides in water;

4. Developing a continuing monitoring program for pesticides in the soil, air, water, wildlife, fish and humans;

5. Fostering research in the development of less persistent, less toxic pesticides;

6. Initiating basic research into the degradability of pesticides;

7. Conducting research on the effects of pesticides on the environment, fish and wildlife and humans; and

8. Making recommendations on the elimination or limitation of use of certain pesticides to the President and Congress.

DDT Defenders . . .

(Continued from Page 25)

ticides in the biosphere be studied.

No Danger to Humans

The strange aspect of the DDT controversy is that the cry for a total ban on usage comes at best on the basis of questionable evidence of damage to wildlife. And this absolute position is taken without apparent regard for the consequences that people would suffer.

Evidence to the contrary is too strong for opponents to contend that DDT is a threat to human life.

The summary of a study conducted by the National Communicable Disease Center at Atlanta, Ga., states:

"A study was made of 35 men with 11 to 19 years of exposure in a plant that has produced DDT continuously and exclusively since 1947.

"Findings from medical history, physical examination, routine clinical laboratory tests, and chest X-ray attributable to exposure to DDT. film did not reveal any ill effects It was estimated that the average daily intake of DDT by the 20 men with high occupational exposure was 17.5 mg per man per day as compared to an average of 0.04 mg per man per day for the general population."

Dr. Thomas H. Jukes, a biochemist at the Space Sciences Laboratory at the University of California, described recently the greatest "experiment" with DDT. It took place in India with American assistance. It began in 1953 and was stepped up in 1958.

The success of the program "depended upon the fact that DDT is a residual insecticide," said Dr. Jukes.

"At the start, there were 75 million cases of malaria in India, and life expectancy for Indians was 32 years. By 1962, 147,593,270 pounds of DDT had been used, and life expectancy had jumped to 47 years. By 1967, there were fewer than 100,000 cases of malaria in India.

"DDT is safe, and has been studied more than any other pesticide for its effects on human beings," Dr. Jukes said.

"Without pesticides, there wouldn't be enough food to go around. Most important DDT is needed by the millions of people because it is a cheap, safe residual pesticide."

At one time malaria killed two million people and left millions of others debilitated from the disease each year, another biochemist testified recently.

Ban would Be 'Disastrous'

Dr. Wayland J. Hayes, former Chief of Toxicology for the U.S. Public Health Service and now a professor at Vanderbilt University, Nashville, Tenn., said that while malaria isn't a threat to public health any longer in the U.S., it remains a major killer of people in many parts of the world.

"DDT still remains the most important single tool for control of malaria," he said.

A ban on DDT would prove "disastrous," as undoubtedly there would be a resurgence of malaria without it.

There would be a particularly adverse effect on the control of malaria in emerging nations which look to the U.S. for leadership.

Dr. Hayes said he feared people in other countries would feel that if DDT were banned in the U.S., it would not be safe for use in their countries, and that many human lives would be needlessly lost.

Dr. Jukes, agreeing, cited an article that predicted the campaign against pesticides could cause deaths and sufferings greater than those of World War II.

DDT Does Break Down

Dr. Hayes testified at public hearings on a proposal to impose a state ban on DDT in Wisconsin. Other witnesses questioned the very basis of Dr. Wurster's position against DDT that it is permanently stored and that the buildup is now endangering certain species of wildlife.

"I know of no natural situation where DDT is not degraded," stated Dr. Paul E. Porter, an associate member and consultant to pesticide commissions of the International Union of Pure and Applied Chemistry.

In addition, Porter said DDT does

not build up in plant life, soil water, fish, or mammals, beyond a naturally reversible plateau. When this level is reached, he said, it remains balanced between intake and dissipation.

Porter said DDT is broken down by nature in soil and degraded to far less toxic compounds by the action of micro-organisms present. On vegetation, it is broken down by sunlight and is additionally dispersed by rain and evaporation.

Since DDT adheres to soil particles it is not readily moved by water, making the compound relatively stable, he advised. However, what remains of DDT and its metabolites disappears at an approximate rate of 20% per year, regardless of concentration.

In streams, lakes, and ocean waters, DDT and its metabolite DDE are absorbed on matter which is present, with a considerable portion sinking to muddy water beds.

In mammals and birds, studies reported degradation of DDT through internal chemical action and excretion. A portion of the chemical components are stored in fat, but here again a stored level is reached, Porter testified, with no additional buildup of DDT residues in the animal.

Abnormally high levels of DDT residue reportedly found in many wildlife species may have been inaccurately measured and exaggerated, said Francis B. Coon, chief of the Wisconsin Alumni Research Foundation's chemical department.

"PCBs," polychlorinated biphenyls, Coon pointed out, are compounds that produce an almost identical picture to DDT when analyzed on a gas-chromatograph, an analytical instrument which "fingerprints" chemical compounds.

Until this confusion between DDT and PCBs was recently discovered, most gas chromatographic assays overstated the amount of DDT above that actually in the sample, due to the presence of the PCBs.

Birds Not Affected

DDT-fed pheasants, testified Dr. Frank Cherms, University of Wisconsin professor of poultry science, have exhibited no changes in reproduction rates.

In other tests, turkey and quail were fed 200 parts per million of DDT. The pesticide intake, Cherms said, resulted in no changes in the thickness of egg shells.

Many other factors found in the environment, he continued, could affect differences in shell thickness of wild bird eggs. If birds are frightened, by being chased, or disturbed by cars, dogs barking, horns, or jet airplane sonic booms, thinner egg shells can be the result.

In any experiments in wild birds to ascertain causes of shell alterations, it would be necessary to negate other genetic, disease, and environmental factors before DDT could be ruled the cause of egg failures, Dr. Cherms testified.

In denying that DDT is a threat to wildlife, William F. Gusey, wildlife specialist, noted that "the mammal population on a country-wide basis is in a 'sound state,' and thrifty; big game has increased in numbers for the past 30 years; and population of small game and upland game birds has been quite favorably maintained—as well as many song birds, including robins."

Gusey is a former assistant division chief of the U.S. Department of Interior's Bureau of Sport Fisheries and wildlife.

Dr. Jukes, the California biochemist, strengthens the "sound-state" appraisal of the bird populations by citing a comparison of Audubon Society Christmas bird counts for 1941 and 1960, before and after the widespread use of DDT.

"The greatest increases are in grackles, redwing blackbirds, cowbirds, starlings and robins—up 11-fold to 131-fold.

"I think by far the greatest effect of DDT on birds is to kill mosquitoes that carry serious diseases of wild birds, including malaria, Newcastle disease, fowl pox and encephalitis."

Ban Too Drastic

Banning DDT could bring many lesser adverse effects upon people, not the least of which include predictions that food prices would rise and many more Dutch elm diseased trees would fall, because substitute chemicals are more costly and less effective.

It is vital to realize that DDT still is an essential chemical for which there is no comparable substitute for certain afflictions.

American technology inevitably will solve the problem to the satisfaction of all of us. But to impose an outright ban on DDT at this time would be far more serious than to have outlawed the horse as a mode of transportation before the automobile was invented.

DDT Opponents . . .

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ests of North America have been sprayed with DDT during the past decade to control the spruce budworm. In New Brunswick, Canada, where excellent salmon streams include the Miramichi River, DDT applications have caused severe and widespread losses of salmon, trout, and other fish. After an application of DDT in 1954, not a single salmon fry was seen that year. Harmful effects extended 30 or more miles below the spray zones and lasted for several years. And effects were not limited to fish. A single treatment changed the insect ecology of the area for at least three to four years.

Concentrations Eventually Kill

Since the chlorinated hydrocarbons are concentrated as they ascend the food chain, carnivorous birds at the top of this pyramid reach the highest concentrations and face special problems. Death sometimes occurs.

In North America, reproductive success of the osprey has declined sharply. A colony in Connecticut, its habitat and other factors apparently unchanged, declined from 200 pairs in 1938 to 12 pairs in 1965. Their eggs contained 5.1 parts per million (ppm) of DDT residues and productivity was 0.5 young per nest, while Maryland birds with 3.0 ppm produced 1.1 young per nest and normal productivity was 2.2 to 2.5 per nest. Ospreys are fish-hawks and DDT residues in the fish eaten by Connecticut ospreys proved to be five to ten times higher than in the food of the Maryland birds.

Studies of the peregrine falcon in Europe reveal a widespread and rapid population decline which began during the early 1950's. The decline was characterized by egg breakage and egg eating by parent birds, abandonment of nests, and other abnormal breeding behavior, and it coincided geographically and in time with the use of chlorinated hydrocarbon insecticides. Tissues and eggs of the peregrine contained DDE, dieldrin, and heptachlor epoxide.

A highly significant, sudden, and widespread decrease in eggshell thickness and calcium content occurred during 1946-48 in several British birds of prey, including the peregrine falcon. Shell thickness and calcium content were stable from 1900 to 1946, then declined by 7 to 25 percent within a few years with no subsequent recovery. The years of decline coincided exactly with the introduction of DDT into the world environment.

DDT Biological Makeup

But what do eggshells have to do with DDT and reproduction? Quite a lot. In birds, increased absorption of calcium from the diet, decreased excretion, and deposition of calcium in bone marrow are all mediated by estrogen, a steroid sex hormone. The calcium in the marrow is later transported to the oviduct where it becomes part of the eggshell. A subnormal estrogen level interrupts this crucial chain of events in the reproductive cycle.

Recent studies showed that DDT, DDE, and dieldrin induced liver enzymes to break down steroid sex hormones in pigeons, and caused mallards and sparrow hawks to lay thin-shelled eggs and have a lower reproductive success.

In aquatic environments, the chlorinated hydrocarbons may contaminate virtually all organisms at all levels of the food pyramid. This has happened to the Lake Michigan ecosystem. DDT residues in bottom muds averaged 0.014 ppm, but amphipods contained 0.41 ppm, nearly 30 times that of the mud. Several species of fish carried residues 10 times higher than the amphipods, and herring gulls at 99 ppm were 20 to 30 times more than the fish. The gulls showed low breeding success and behavioral abnormalities, and could not withstand stress. When starved, the birds developed tremors and died of DDT poisoning while less contaminated gulls easily withstood the same treatment. (Starvation depletes fat reserves that store DDT residues, thus releasing the toxins into vital tissues.)

Fish Accumulate Residues

The Coho salmon, being a top carnivore, also accumulated residues in Lake Michigan and these were passed into the eggs. Recently almost 700,000 salmon fry died shortly after hatching. The fry were poisoned by residues in the egg yolk during final absorption of the yolk sac. Heavy mortality of trout fry occurred similarly in several New York lakes. For several years, mortality of fry from Lake George was 100 percent.

Clear Lake, California, offers another classic example of biological concentration in action. Additions of DDT to the war in an attempt to control gnats, the last in 1957, were followed by the dying of western grebes, reduction of the nesting colony from 1,000 to 30 pairs by 1960, complete nesting failure among survivors for several years, and 500 to 1,500 ppm of DDD in grebe fat. In 1967, ten years after the last treatment, the grebes still averaged 544 ppm of DDD in their fat, and the colony of 165 pairs still had very poor nesting success.

Effects are by no means limited to the top of the food pyramid. A few ppm of DDT in the water can decrease photosynthesis in marine phytoplankton. These single-celled algae are the indispensible base of marine food chains and are responsible for more than half of the world's photosynthesis. Interference with this process could have profound worldwide biological implications.

The nature and movement of the chlorinated hydrocarbons indicate that they will be transferred from the earth's treated land areas to its ocean basins, where they will accumulate. Being so insoluble in water, however, we cannot expect them to "get lost" in the oceans; they will be picked up by its living organisms. Recent analyses of fish and birds from both the Atlantic and Pacific Oceans indicate that this process is occurring.

The Bermuda petrel is a rare oceanic bird of the North Atlantic that has no contact with any continent or area treated with insecticides. Yet its eggs and chicks average 6.4 ppm of DDT residues, and reproductive success has declined significantly since 1958. Only from its oceanic food chain could this bird become so contaminated.

There are more data from the Pacific, but the story is the same.

Clearly the chlorinated hydrocarbon insecticides cannot continue to be used in the natural environment without serious degradation of the world ecosystem. Fortunately we have a choice. Many biological techniques exist for controlling insect populations, and numerous other less stable, more specific insecticides are available. These alternatives are highly effective. Man's control of pests requires ecological sanity. Which way will we go?

A lift rake and brush chipper enable Jaflo to clear fast and clean with minimum damage to other landscaping.

Jaflo's Order: Selective Clearing

By PHIL LANCE
Philadelphia, Pa.

AMERICA'S beautification program has pushed the demand for related professional service into high gear.

This is particularly evident concerning shade trees. Instead of cuting these trees in right-of-way clearings, a program of selectivity has been initiated.

"This is particularly evident with utilities and power line companies who have changed their order from clearing to preserving wherever possible," says John A. Florio, Jaflo, Inc., Allentown, Pa.

"At one time, our orders were to clear out the right-of-way for pipe lines and overhead wiring. Today, this has changed. We preserve, retain and restore wherever possible when it comes to shade trees. Because of this order, a selected program of right-of-way clearing has been initiated. This has naturally led to the demand for professional tree service."

Florio has been in the tree service for all of his professional life. He has been in business for himself several years, showing tremendous gains each year. After more than 25 years of experience as a foreman for a leading Philadelphia tree service, Florio initiated his own business several years ago.

Using the porch and then the basement of his home as a headquarters for a few years, Florio finally was forced by the demand for his services to relocate three years ago.

Today, he has a modern building on Route 309 which houses his offices, tools and some of his equipment. At present, he has five chippers, a truck equipped with an aerial bucket, a specially equipped tractor, several trucks and a variety of related tree service equipment.

Save Trees When Possible

Florio specializes in tree service, landscaping and brush control for utilities and municipalities.

"Shade trees are saved wherever possible and even, in some instances, moved and planted to maintain pace with the beautification program and as a natural shield for right-of-ways," explains Florio, "particularly at road crossings where the topping and trimming of shade trees are specifically called for.

"In the clearing of right-of-ways, requests are made for more conscientious removal. We have equipped our tractor, for example, with a rake so that it does not rip up everything during a clearing operation. Good equipment is just as important as experience in safeguarding the landscape. By combining both, we do our part in America's beautification program."

Florio provides a full professional tree service that includes removing, pruning, feeding, bracing, cabling, stump removal, cavity treatment and tree diagnoses.

Experience and information gathered from trade journals and attendance at meetings and conventions such as the International Shade Tree Conference, he said, are vital for increasing his knowledge and ability. He is a member of the International Shade Tree Conference and also the American Forestry Association.

John Florio, Jaflo owner, watches an employee tackle a stump.

Three-Way Advertising

Direct mail, advertising in the yellow pages of the telephone directory and personal contact are a continued source of inquiry and service estimates. Florio's experience enables him to give a firm estimate; and because of his reputation for adhering to the services required, he gets quick approval.

Florio has developed his crews from the bottom up.

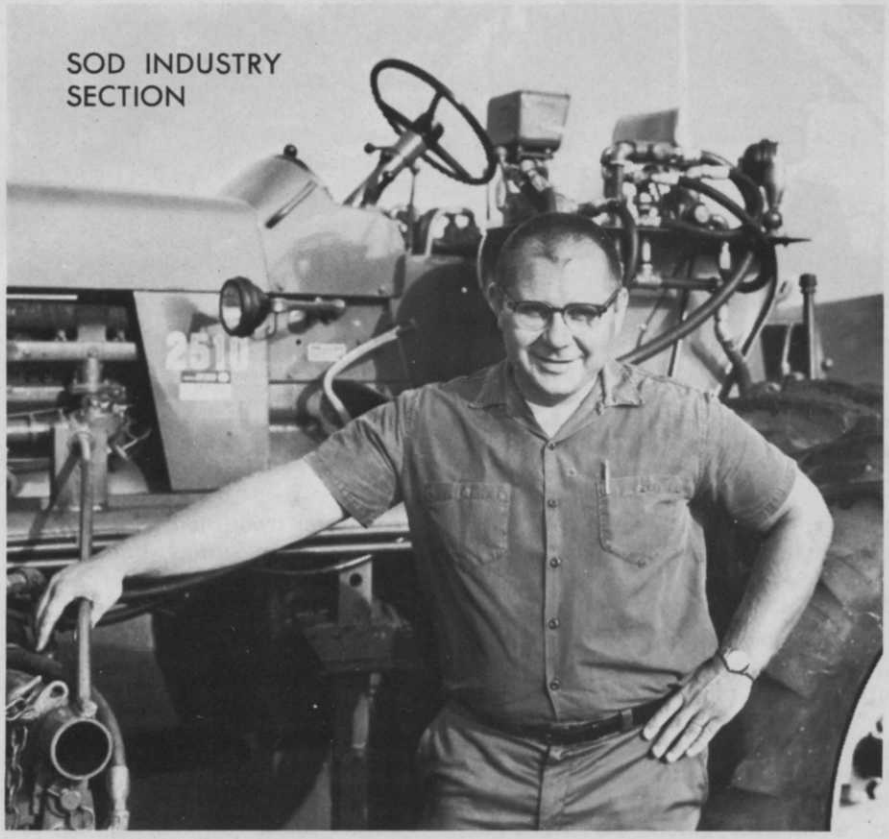
Young men are shown that there is a demand for their type of services and that there is growth potential, to attract them to this vocation. Florio feels that the industry as a whole should cooperate in attracting more qualified personnel to keep up with the ever increasing demands being made upon it.

"Modern equipment and advances are helping to take a lot of labor out of this activity," says Florio. "For example, we are now chipping rather than burning or trucking branches. This eliminates air pollution and minimizes labor. After chipping, we spread out the mulch.

"We also use powerful lightweight chain saws and this has taken a lot of labor out of this work. Our aerial bucket has been a tremendous time- and labor-saving device. Of course, there are many others.

"By building up a reputation as a specialist, particularly when it concerns shade trees, the demand for services is continually increasing. The future is bright indeed."

SOD INDUSTRY SECTION



Donald W. Morrill

'Here's What You Need To Start a Sod Farm'

By DONALD W. MORRILL, President
Shamrock Turf Nurseries, Inc.
Hanna, Ind.

MY VIEWS on developing a new sod farm are based on experience in the Chicago market, after working to develop three farms within the past dozen years.

Three principles are essential: management, site and market, and resources. I list them in order of importance to me.

Foremost, I think a person must really analyze himself before entering this business. As owner/operator qualifications:

1. Feel a genuine love for this kind of business (to the extent that you realize the occasional need of living with it 24 hours a day).

This is a manufacturing business unlike general farming. You can't just plant it and forget it. There are always problems — nature changes, labor, marketing, trucking, etc.

It takes a love for the game to get you through the rough spots.

2. Be capable of assuming the responsibilities of running a business.

As I said, this is not quite like farming; it's a business with special complications.

3. Experience in sod is essential.

I worked for another sod grower for five years. This is the minimum experience I would recommend.

4. Sales and marketing experience is valuable.

My selling experience was with Swift and Company; but any selling or related experience will prove to be profitable later on.

5. You must have management ability.

It will be necessary for you to be able to set up a budget, make the best use of labor, money, land and equipment. You'll need to know how to weigh investment against return; analyze consumer credit; and so on.

A turf farm manager must be a people motivator. He must be able to get his personnel to do what he wants them to do and exactly the way he wants them to do it. Teaching and training is what we need to do . . . not just order jobs done without ever explaining why.

Site and Market

Assuming you meet all these qualifications, let's consider site and market.

Today, 96% of the U.S. population lives in cities; the rest in rural areas. This means we must locate near the heavily populated areas.

Personally, I would not want to locate in any area that did not have a minimum population of 500,000 within a 50-mile radius.

One reason is that the distance from your market is a direct ratio to the number of loads you can haul per day and also is a yardstick to how many trucks are required.

Equally important is to avoid an area already saturated with existing or expanding sod farms. Examples are Detroit, Chicago and Milwaukee.

Let's presume you are entering the sod business to sell sod and not using it as a cover to speculate in real estate. In this situation, you will not want to sit right on the edge of a large city. Among reasons are to avoid rising property taxes, changing zoning laws, and complicated water problems, such as contamination and availability.

Let's place our model sod farm on a state highway. This location is accessible year-round; it provides good visual advertising; and in most areas it will exempt you from the frost laws that might tie up secondary roads during early spring harvesting.

The site should have adequate, clean water. Do not under rate the necessity of water. Check the average annual precipitation. Make sure an adequate supply falls during your growing season.

I would hate to figure on irrigating more than half of my requirements.

Check alternate sources of water —ponds, streams, rivers, and wells (check the water table depths to assure you can get enough volume).

I wouldn't consider a farm without putting down a test well first. In my area, we need a minimum of