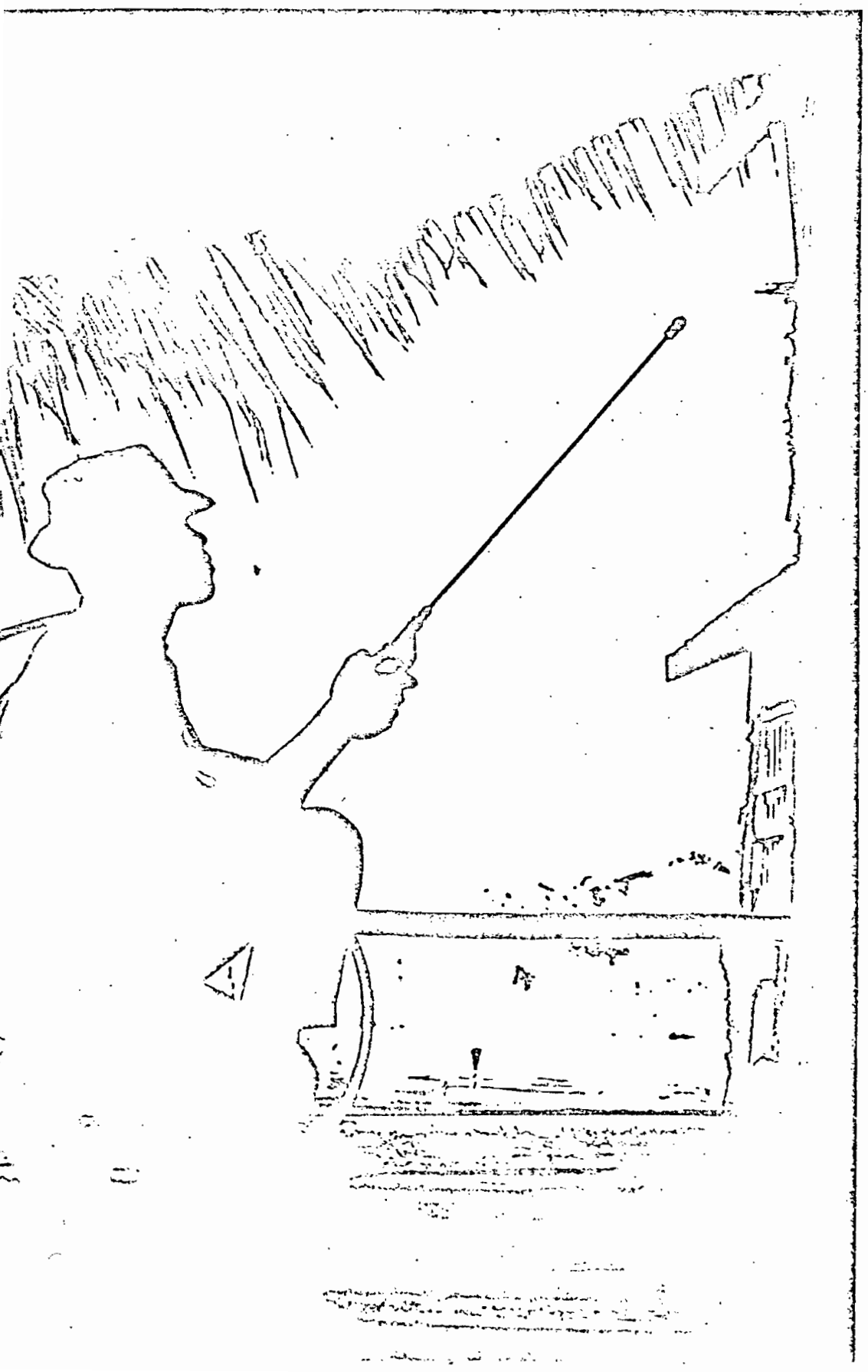
War on Hunger

A Report from The Agency for International Development



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A public health worker sprays DDT on the walls of a house in a mosquito infested area. See Page 1. *Photo by Carl*

EDITOR'S NOTE

Dr. Borlaug and His Critics

Dr. Norman Borlaug, winner of the 1970 Nobel Peace Prize, recently came under criticism for his defense of the use of chemical fertilizers and insecticides, specifically DDT. The spark that ignited the debate was an address Dr. Borlaug delivered at the 16th Governing Conference of the UN Food and Agriculture Organization in Rome November 8, 1971.

In that address, and in subsequent statements, Dr. Borlaug, whose work in the development of high-yield cereal varieties helped bring about the Green Revolution, asserted that if farmers, especially those in the developing countries, are denied the use of chemical fertilizers and pesticides, the world would be doomed to starvation. He also stated that he is not yet convinced that DDT is threatening any species of animal, or causing "discernible injury to man."

Dr. Borlaug expressed a number of other important views in his address, but they became obscured in the outburst of criticism of his position on insecticides.

There was no obscurity, however, for his opinions on DDT. Here are some of the reactions that followed his remarks:

Dr. Sicco Mansholt, vice president of the European Common Market Commission—

"We cannot be indifferent. We don't know exactly what the result of all this poison will be. . . .Ten years' use of DDT means one kilo (about 2.2 pounds) per man in the world, and it stays in the world. It is in the soil, the plants, the seas, the plankton, the fish, the man."

The New York Times, in an editorial November 26—

"The plain fact is that for protecting food crops, DDT is now a greatly diminished factor—and is rapidly becoming so for protecting cotton as well.

"In fact, it is increasingly having the reverse effect. Because pesticides wipe out their victims' natural predators and because the pests themselves in time build up a resistance to pesticides, farmers find themselves on a treadmill, compelled to use more and more chemicals to get less in the way of results. Dr. Borlaug is apparently not even aware of this dilemma . . .

". . . environmentalists do not say that DDT causes cancer, but rather that it constitutes a hazard in that respect, having produced cancer in experimental animals. DDT already present in the tissues of human beings around the world may well prove cancerous in the future, especially if it is allowed to go on building up. That it has done harm in other ways to the health of fish and wildlife and the propagation of birds should be beyond even Dr. Borlaug's capacity to doubt."

In an article in the Washington (D.C.) *Sunday Star* January 2, Dr. Charles Wurster, associate professor of environmental sciences, State University of New York, and Robert van den Bosch, University of California entomologist, wrote:

"Strong dependence on pesticides for insect control . . . is an ineffective, costly, and destructive method that is rapidly being replaced by modern, sophisticated, and effective integrated control techniques.

"DDT is incompatible with integrated control because it disrupts the beneficial balance of insect communities, often creates greater pest problems than it solves, is destructive to wildlife, and is a human health hazard. In short, most benefits Dr. Borlaug envisions are not attainable with DDT, but can be achieved by safer means."

The following article, an adaptation of Dr. Borlaug's FAO address, does not necessarily represent the views of the Agency for International Development. We are publishing it, along with the critical comments on this page, with the aim of providing the context in which the issues have been raised, and to broaden understanding of a world dilemma.

'EVOLVE OR PERISH'

By Norman Borlaug

Criticism of the Green Revolution has become a popular pastime. Perhaps it reflects the feelings of some who had predicted famine and doom for the hungry nations and, consequently, cannot yet forgive the new strategy for being successful. Some critics have said that the Green Revolution has created more problems than it has solved. This I cannot accept, for I believe it is far better for mankind to be struggling with new problems caused by abundance rather than with the old problem of famine. Certainly, loyalty to the status quo in food production—when being pressured by population growth—cannot break the chains that have bound the peasant to poverty and hunger.

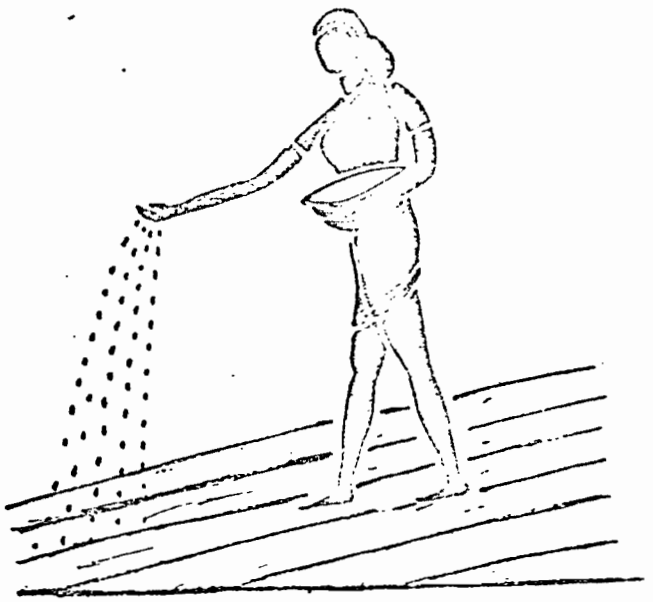
One must ask: Is it just to criticize the Green Revolution, with its recognized accomplishments, for failure to correct all the socio-economic ills of the world that have accumulated from the days of Adam and Eve up to the present?

Change we must, or we will perish as a species, just as did the dinosaurs in the late Cretaceous period.

The Green Revolution has won a temporary success in man's war against hunger and deprivation. It has given man a breathing spell. If fully implemented, it can provide sufficient food for sustenance during the next three decades. This could, hopefully, provide man time to bring population growth into balance with his capacity for providing a decent standard of living to all peoples of the world.

The continued success of the Green Revolution will hinge upon whether agriculture will be permitted to use the inputs necessary to cope with hunger. If agriculture is denied the use of chemical fertilizers and pesticides for example, the world will be doomed, not by chemical poisoning, but from starvation.

I am in complete agreement that we should try to preserve all forms of wildlife as part of our heritage, as far as it is possible to do so. On the other hand, let us not become egotistical to the point of assuming supernatural powers. A glance at the book of rocks tells us of



Drawings by B. R. Phaneendranath.

the impotency of many species, including man, against the forces of nature. Dr. Donald Spencer estimates that 99 percent of all the species that have lived, since the candle of life was first lit on the planet earth about 3.2 billion years ago, have flunked the adaptation imperative: "evolve or perish", and consequently have now become extinct.

The implied command: "evolve or perish" has been an unwritten natural law from the beginning of time. It is equally evident in the physical and biological world. Long before there was life on earth there were countless physical changes in the earth's crust. Repeatedly, mountains were built through volcanic action or by physical shifts in the earth's crust, only to be eroded away and the debris deposited elsewhere. The oceans invaded and inundated what was once the land, only to recede again. Physical changes, of course, continue to reshape the planet earth to this day.

Climates have changed time and again in many parts of our world. Vast areas that once possessed tropical climates have subsequently been covered by continental ice sheets. Areas that once were blessed with heavy rainfall have become desert and vice versa. These changes in environments have, in turn, exerted strong selection pressure on the evolution of all forms of life.

There are undoubtedly many subtle changes being exerted on the environment of the planet today that are beyond the influence and control of man. The composite effect of the present day selection pressure of the environment, affected both by man and natural influences, will undoubtedly continue to take its toll of some species that are poorly adapted to the current world environment.

The Challenge of Change

One informed estimate is that there are at present approximately 1,100,000 species of animals, many of them very simple forms, and 350,000 species of plants that currently inhabit the planet earth. Of these, the United States Fish and Wildlife Service in 1966 listed 33 species of mammals, 49 species of birds and 9 species of reptiles and amphibians, and 38 species of fish in the United States, which were either rare or endangered. In discussing the causes for reduction in numbers and possible disappearance of these 129 species, the destruction of the habitat and disturbances resulting from man's activities were paramount. Pesticides were mentioned as possible contributing factors in only two cases. In the past three or four years there has been much propaganda, but little convincing scientific evidence, indicating that DDT has contributed to the decline of the Bald Eagle, Peregrine Falcon, American Osprey and California Condor. One does not need thin egg shell hypothesis due to DDT to explain the reduction in the population of these species. The truth of the matter is that many ornithologists had reported on the reduction in populations of these large birds of prey as far back as the 1880s and 1890s, long before the time of DDT. It is almost a foregone conclusion that one or more of these species is about to flunk the imperative "evolve or perish". Its habitat is being destroyed by the encroachment of man. Protective legislation alone will not, in most cases, be adequate to save them. Dynamic research, propagation and good sound game management might do so, providing human population pressures on their habitat are not too great.

Although it is generally the long-time continuing effects of changes in the environment which exert effects on the evolution and survival or the extinction of a species, there are many other changes in the environment that affect the more short term "balance of nature", among the many species in a given habitat or ecosystem. These are the seasonal shifts we are concerned with in producing and protecting our crops or animals. The cliche "in balance with nature", which is in common usage today, is very misleading. It implies we would have a favorable "in balance with nature" to assure the protection of our crop species if the "balance of nature" were not upset by man. This, of course, is not true. Nor is there in existence a single in balance with nature ecosystem. Rather there is, within a given area, an infinite number of local and many merging more extensive ecosystems. None of them is in static equilibrium. They are in a constant state of dynamic change, responding to the changes in the environment. At different times, the selection pressure provoking change is drought, floods, frosts, heat, insect or disease attacks, or invasion of the habitat by other species.

Early in my career as a forester working in a large wilderness area completely isolated from the influence of man, I learned of the fickleness of nature. I have seen 20 forest fires ignited by a single "dry thunder (electric) storm". Some of these fires started by lightning destroyed or damaged vast areas of several forest types of ecosystems. In the same area I have seen tens of thousands of acres of lodgepole pine killed by infestation.

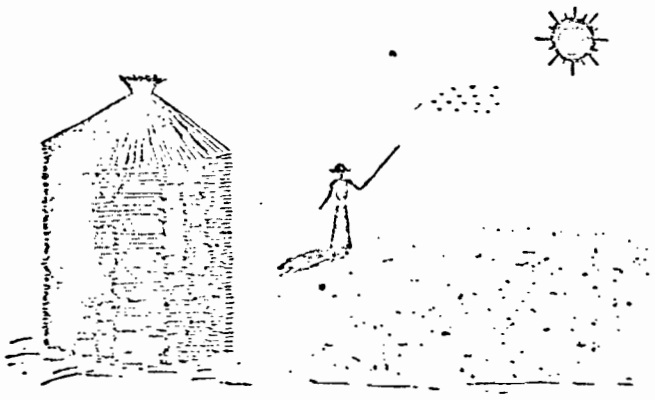
Many times I have seen attempts made to grow cotton without the use of insecticides in the native home of the boll weevil in Mexico where all of the native predators of this insect were present. The results were disastrous. Similarly, I have observed cotton grown without insecticides in West Pakistan, the native home of the pink bollworm, with all of its natural predators and parasites present. In this case also the results were disastrous. In fact, in both of the cases it was difficult to tell from casual observation whether the cotton was being grown for the production of fiber or for the production of feed for a native insect. Nevertheless, in both cases there should have been, according to environmentalist jargon, an "in balance with nature" equilibrium.

I must also point out that modern agriculture—with 3.7 billion people demanding food and fiber—has no choice but to devote extensive areas to a single crop in areas ecologically best suited to the culture of that crop. This was not true 5,000 years ago, when there was less population pressure, so that crops could be grown in small isolated fields.

It, therefore, becomes abundantly clear that we cannot rely on biological control alone to protect our food and fiber crops from the fickleness of nature. If left to Mother Nature's whims, we would harvest only one third or one half of the yield per unit of cultivated area that can be harvested using a modern balanced technological package of practices. Someday, it may be possible to use alternate non-chemical methods to control many of the insects responsible for the most severe crop and animal losses, but that day, if ever attainable, lies far in the future.

Today, conventional insecticides are needed to control 80 to 90 percent of the insect problems affecting agriculture and public health. Meanwhile, research to find new techniques and methods, must be strengthened. Present control programs must be designed to take advantage of the best materials and techniques available so as to reduce losses to an acceptable level.

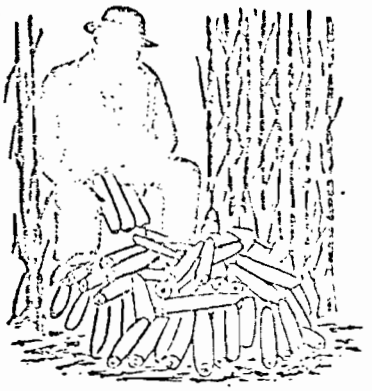
The control methods that are now being studied or used on different insects include: 1) the use of natural predators, parasites and pathogens, 2) the breeding of resistant varieties—which may provide long term protection against some species, but may be ephemeral against other species which have great genetic variability combined with many generations per year, 3) the genetic male sterile technique which has proven highly effective in controlling the screwworm, and shows promise now on a number of other species, 4) the use of attractants, both sex and food, 5) use of traps i.e. light and sound, 6) development of hormones to interfere with life cycles, 7) improvement of cultural practices, which have been long used effectively in reducing losses from species, and 8) the development of better biodegradable insecticides, that will effectively combat the target species without doing damage to beneficial insects, to wildlife or to man.



What does this have to do with the controversy over the use of DDT?

Today in the United States, conventional insecticides are still required to control 80 to 90 percent of the insect problems affecting agriculture and public health. The use of DDT in the United States has gone down greatly in the past five years, since other more effective controls have become available. It is still, however, used extensively in the south and southeastern part of the country on cotton insects, especially on the boll-weevil.

Some environmentalists would now like to have a legislative ban placed on DDT so as to prohibit it for use in the United States. Almost certainly as soon as this is achieved, the campaign will begin to have it banned everywhere in the world. This must not be permitted to happen, until an even more effective and safer insecticide is available, for no chemical has ever done as much as DDT to protect the health, economic and social benefits to the people of the developing nations.



The World Health Organization (WHO) with the assistance of the Pan American Health Organization and the United Nations Children's Fund (UNICEF) in 1955 launched a worldwide campaign against malaria, based on spraying the interior of all houses with DDT, so as to kill the Anopheline mosquito vector and break the cycle. Of the 124 countries and territories in the tropics where malaria has existed, the disease has been eradicated from 19. There are 48 other countries in which eradication programs are in progress and an additional 37 where extensive control programs are underway. There remain only 20 nations in malarial areas where no programs have yet been initiated.

There is also dramatic evidence from Ceylon of what can happen if a program is stopped before eradication is accomplished. When the campaign was initiated in the mid 1950's there were more than two million cases of malaria in Ceylon. By 1962 it had dropped to 31 cases and by 1963 to 17, at which point the spray program was discontinued for budgetary reasons. By 1967 the number of cases had jumped to 3,000 and by 1968 to more than 16,000. Before the programs could be re-established, in late 1969, two million cases had reappeared.

In summarizing the progress in this World-Wide Malaria Campaign on February 2, 1971 officials of WHO made the following statement:

"More than 1,000 million people have been freed from the risk of malaria in the past 25 years, mostly thanks to DDT. This is an achievement unparalleled in the annals of public health. But even today 329 million people are being protected from malaria through DDT spraying operations for malaria control or total eradication.

(Continued on p. 17)

'Evolve or Perish', from p. 4

"The improvement in health resulting from malaria campaigns has broken the vicious circle of poverty and disease resulting in ample economic benefits: increased production of rice (and wheat) because the labor force is able to work; opening of vast areas for agricultural production: India, Nepal, Taiwan; and augmented land value where only subsistance agriculture was possible before.

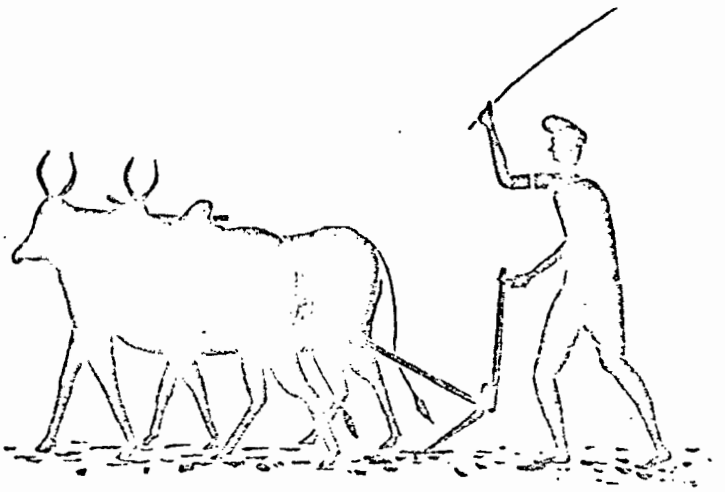
"The safety record of DDT to man is truly remarkable. At the height of its production 400,000 tons a year were used for agriculture, forestry, public health, etc. Yet in spite of prolonged exposure by hundreds of millions of people, and the heavy occupational exposure of considerable numbers, the only confirmed cases of injury have been the result of massive accidental or suicidal swallowing of DDT. There is no evidence in man that DDT is causing cancer or genetic change."

Although more than 1,400 chemicals have been tested by WHO for use in malarial campaigns, only two have shown promise and both of these are far inferior to DDT.

As more and more scientific evidence accumulates, the charges against DDT become less and less convincing. There, of course, is evidence that man and most species of birds, fish and animals that have been examined have small quantities of DDT and/or other related compounds such as polychlorinated bi-phenyls in their fat. But there is very little convincing evidence available to date which indicates that it is threatening the existence of any species, nor is it causing any discernible injury to man.

Part of the past confusion concerning pesticides in the environment derives from the tremendous improvements that have been made in recent years in chemical analysis. Prior to the development of gas chroinotography in 1956, the level of detection of many compounds with the paper chromotography was one part per million. With gas chromotography it became possible to detect one or two parts per billion, or even a few parts per trillion, both of which, of course, would have gone unnoticed 20 years ago. But such sensitive methods can also detect contaminants and in the hands of an inexpert operator may lead to wrong conclusions. A recent article by Dr. Thomas H. Jukes, a reputable biochemist, emphasizes this dilemma:

"How reliable is the test? There is a delicate analytical procedure called gas liquid chromotography with electron capture. Sometimes I wonder whether this method in the hands of inexpert people has done more harm than good. There has been a great hue and cry over alleged traces of DDT in the Antarctic penguins, amounts of the order of one or two parts per billion. I have not yet been convinced by the validity of these results. A few months ago at the University of Wisconsin, some soil samples that had been sealed since 1910 were tested for synthetic organochlorine pesticides by the latest, most delicate gas chromotographic procedure. Several pesticides were detected in 32 of the 34 samples.



The only flaw was that these pesticides not only were not used in 1910, they did not even exist until 1940."

Another complicating factor in identifying the origin of chlorinated hydrocarbons in human, animal, bird or fish tissue is that many thousands of tons of chemical wastes of all kinds have been and are still being dumped into the oceans. Do not some of these also get into the food chain?

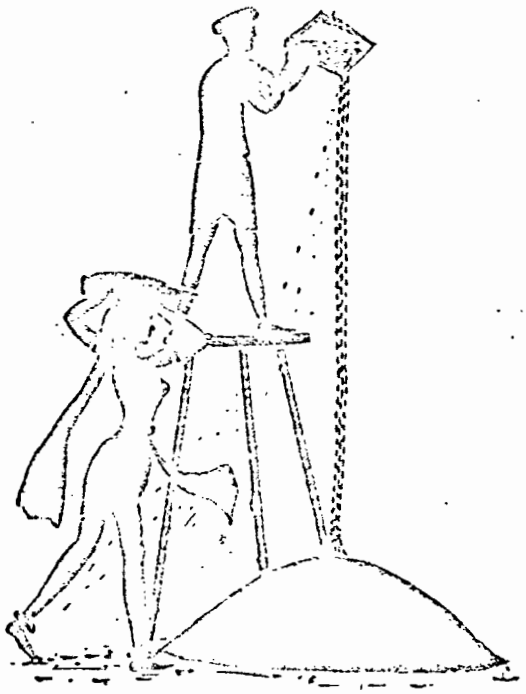
If the use of pesticides in the U.S.A. were to be completely banned, crop losses would probably soar to 50 percent, and food prices would increase four to five fold. Who then would provide for the food needs of the low income groups?

Soil infertility is the greatest curse of the densely populated developing nations of the world. Continuous cropping over centuries of time has depleted the soil of one or more of the essential plant nutrients. The result is that grain yields have reached equilibrium at a very low level, generally between 500 to 800 kilos per acre. Since the per capita area of land that is available for cultivation in these countries is very limited and cannot be appreciably expanded, most of the population lives in poverty at or near the starvation level. The only way that this vicious cycle can be broken is by the restoration of the limiting plant nutrients to a level which permits the production of high grain yields. This can be achieved by applying the proper kind and amount of fertilizer. Under most of these conditions the major elements limiting crop yields are nitrogen and phosphate, although in some soil types potassium is also limiting. Under certain situations, one or more of the minor elements must also be added in combination with the proper dosages of major elements, in order to restore high yields.

The breakthroughs in wheat, rice and maize production that are being achieved by the Green Revolution in a number of countries could not have been realized without the application of heavy doses of the right kind of fertilizers. Skilled use of chemical fertilizers will be

required in the developing nations in the next decade if these nations are to revolutionize their agriculture.

We have long had gardeners and farmers who believe that food crops produced by the use of organic fertilizer derived from decomposed plant residues and animal manures are different and superior in nutritive value from those grown from chemical fertilizer. They refuse to believe that the plant is unable to distinguish between nitrate, phosphate or potassium or any other essential element derived from the decomposition of organic materials from that applied from a sack of chemical fertilizer produced in a factory. They fail to understand the magnitude of the plant nutrient deficit, and that the use of these organic materials can do but little to solve the fertilizer needs of the world.



A recent study by Dr. Keith Barrons, a vegetable breeding and chemical weed control specialist, clearly indicates the increase in efficiency in food, feed, oil and fiber crop yield and production of 17 crops over the past 30 years. Using the average yield and production figure for each crop for the 1968-70 period as a base, calculations were made to determine the area that would have been required to provide the same total output using the 1938-40 yield figures. The results are startling. The area of 281 million acres cultivated to these crops in 1968-70 produced enough to meet the domestic needs of the U.S., with an additional amount of produce for export, valued at $7 billion. The amount of *additional land* that would have been required to produce the *same quantities of these products using 1938-40 yields and technology would have been 242 million acres*, bringing the total to more than double the area under cultivation in 1970. Much of the increase in per acre yield and total production in 1970 compared to 1940, was due to the increased use of agricultural chemicals, especially fertilizers, insecticides and weed killers. Improved cultural practices and better seed undoubtedly also played a role.

Within the past decade, because of the improved technology and higher yields, it has been possible to remove 50 million acres from cultivation and still meet both the domestic and export needs for agricultural products. Were the country still relying on the 1940 technology, however, not only would the 50 million acres now held in reserve be back under the plow, but, moreover, an additional area of 242 million acres by necessity would have been opened to cultivation. In reality, it would require considerably more than 242 million acres of additional land since the quality of much of the land is poorer than that now in cultivation. Besides it would mean opening to cultivation lands that in large part are rolling, or semi-arid, and consequently vulnerable to erosion by water and wind, and also clearing the forests. Consider the additional havoc that this expansion of cultivated area would have caused to the wildlife habitat, and especially to rare and endangered species of animals and birds that are already on the brink of extinction.

Although Barrons' study was made in the United States, it behooves all mankind to increase the efficiency of agriculture throughout the world if we wish to alleviate human suffering, conserve wildlife and improve recreational opportunities. For instance, unless the food production of East Africa is expanded to meet the region's growing food needs, the large animals in the game reserves and national parks of East Africa will be poached out of existence within the next three decades. Similarly, the elephant, tiger, and peacock will perish from India because of population pressure.

I have been a great admirer of the splendid work that has been done by game management experts in the United States in re-establishing species such as the wild turkey that was nearly extinct. Under wise management and protection many other species of wildlife have made spectacular comebacks. The tremendous success of the introduction of the Chinese ring-neck pheasant and the Hungarian and Chukkar partridge are other tremendous accomplishments. The research that has brought under control the lamprey, that threatened the survival of the lake trout, is another tremendous achievement; so is the introduction of Coho salmon into Lake Michigan and Lake Superior.

These are examples of how mankind must use the brain and mind with which he is blessed. Unlike all other species, man can take stock of himself and project ahead to see the great difficulties that will be forthcoming—from hunger, exploding unemployment, inadequate housing, clothing and education, worsening difficulties with transportation and communications, lessening opportunities for recreation, a frightening rate of depletion of non-renewable resources, and a worsening situation with the environment as well as increasing problems with social, political and civil chaos.

Unless man abandons the folly of trying to compete reproductively with the highly fertile aphids, he will flunk the imperative: "evolve or perish," and leave behind only his imprint in the book of rocks.