Enclosure 3

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THE MANAGEMENT OF TRANSMISSION LINE RIGHTS OF WAY

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PREFACE

This study was undertaken on the request of several professionals in the field of right of way maintenance. They felt the state of the art had reached a point where it would be helpful to them to have available an audit of existing maintenance practices and procedures. Their interest was to insure that their own programs were soundly based or accepted and proven management principles.

The material was gathered through a review of available literature, and visits to each participating utility to examine records and to interview key personnel responsible for managing right of way maintenance programs. The report reflects the material gathered in this manner and the first hand experience of the author. The statements made, conclusions reached, errors and omissions are the author's sole responsibility.

ACKNOWLEDGEMENTS

The author wishes to express his appreciation to two gentlemen he has known and respected for many years, Mr. J. P. Cruickshank and Mr. G. T. Robbins, for taking the time to discuss their experiences and providing insight of the evolution of modern right of way management techniques.

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Finally, there were the many individuals with the participating utilities who helped develop the story and provided data and insight concerning ther respective programs; to each a thanks:

Alabama Power Company	Mr. Owen W. Hocutt Mr. Michael Zarichnak
Delmarva Power	Mr. Edward G. Banks, Jr. Mr. William G. Longest Mr. J. Edwin Hobbs
Mississippi Power & Light Company	Mr. T. A. Dallas Mr. Robert Ferguson Mr. Ralph Hale
South Carolina Electric & Gas Company	Mr. Maurice C. Coleman
Virginia Electric and Power Company	Mr. John D. Farmer, Jr. Mr. Richard H. Moss, III

VITA

William D. Ditman received two degrees from Virginia Polytechnic Institute and State University; a BS in forestry and wildlife conservation in 1956, and a MS in plant pathology and physiology in 1962. The master's program involved the study of the use of herbicides in forest management and other facets of vegetation control. He has also studied business administration and management at Roanoke College and the University of Michigan.

He served four years in the United States Army Corps of Engineers and then, after graduate work, joined the Appalachian Power Company to manage the right of way maintenance program. He was subsequently promoted to the position of administrative assistant to the executive vice president and then to the position of environmental affairs director. In 1973, he left Appalachian Power Company to form Enviro Audits, a management consulting firm with an expertise in environmental matters.

During his career, he organized the West Virginia Weed Control Association and served as president for five years. He is also a past president of the Mountain Lake Right of Way Maintenance Council, a member of the Society of American Foresters, and an associate member of the Society of Sigma Xi.

He developed and presented the proposal to the Edison Electric Institute that resulted in the establishment of the research project studying the environmental effects of herbicides on rights of way. He served on the steering committee for three years.

William D. Ditman

TABLE OF CONTENTS

SUMMARY

The nation's electricity utilities operate thousands of miles of transmission lines that are the vital link between the production plants and the distribution points. When the operation of these lines is interrupted, vast areas, and large segments of the population, are subject to a power outage. In this day and age of almost total dependence on electricity, such situations are unacceptable to the public at large. Consequently, the electric utilities are particularly concerned about the condition of the rights of way occupied by these facilities.

A major cause of outages is tree contact; and this can result from unattended brush and trees growing up into the line, trees falling into the line, ice, wind and snow bringing branches into the line. Trees can also be a hazardous condition in the form of an attractive nuisance. Fatalities have resulted from children contacting a conductor while engaged in the child sport of tree climbing or when adults have placed antennas too close to the line. When an outage does occur, dense woody vegetation on the right of way acts as a barrier to prompt restoration of service.

Thus, right of way maintenance is necessary to insure continuity of service, to eliminate potentially hazardous conditions, and to provide access to the lines and structures. The ideal condition would be one in which the timber forming the edge of the right of way has been culled of trees that could fall into the line, the sides of which have been trimmed back so that branches can not contact the line and the right of way proper covered with a plant community that needs no maintenance and does not hinder access to the facilities.

Prior to 1945, utilities had limited options as to how the rights of way would be maintained. The universally accepted method was manual labor; men equipped with hand tools, such as the brush ax, walking the right of way cutting the woody vegetation (brush) that could grow into the lines. After World War II, the cost of labor increased, the available work force decreased, and utilities were rapidly expanding their transmission systems further compounding the problem of dwindling labor. Thus the cost of maintaining rights of way started to increase significantly, and utility managers started to search for other methods that would permit cost control.

In the late 1940's, mechanical devices, such as the brush hog, were developed and phased into right of way maintenance programs. They offered only one advantage over the use of hand labor, a reduction in the number of manhours needed to clear an acre of brush. However, they were extremely limited in where they could be used, mountains and swamps were limiting factors.

Concurrent with the development of reliable mechanical devices, chemicals (herbicides) were discovered that could be used to remove brush from the right of way. The managers of rights of way learned that this new tool, properly managed, could significantly reduce the need for labor and at the same time produce a right of way condition approaching the ideal. It was also recognized that the available tools were increasing in complexity and that the benefits desired could be realized only through a professional staff charged with the responsibility for preparing and managing a program.

TECHNIQUE CHARACTERISTICS

Manual

Background: Until the late 1940's, the standard technique for clearing transmission rights of way was manual - men equipped with brush axes walking the right of way and cutting the individual stems of brush. Adequate skilled labor was readily available and wages were modest; one person interviewed recalled the days of $2 per man per day. Conditions of employment were primitive by today's standards, one contractor in West Virginia had his men camp on the right of way during the course of a job.

After World War II, the labor situation changed very rapidly. Work rules became increasingly more liberal, fringe benefits were added and wages reflected the improving economic conditions. In 1965, the average rate paid by Vepco for a labor intensive crew was $2.70 per hour. In 1970, the average rate had been increased to $4.23; and by 1975, the rate was $6.23 for an increase of over 130% in ten years. A utility serving the Appalachia area of Virginia and West Virginia experienced an increase of 56% in the cost of labor between 1966 and 1970.

Today, labor intensive methods are still in widespread use, but a shrinking labor pool and the sharply increased cost of labor have forced utilities to seek alternative methods of maintaining their transmission systems (50)

Costs: Productivity of a manual clearing crew is contingent on several factors; density of brush, height of brush, species of brush, accessiblity of the work area and the difficulty of the terrain. Because of these variables, it is not possible to make a definitive statement as to what it costs to cut an acre of brush nor to compare widely separated areas of vastly differing conditions. Each acre must be evaluated in the context of it's geographic location and it's forest cover type.

In spite of the variables, it is possible to establish some benchmarks as to the minimum and maximum costs that can be encountered if manual techniques are used to maintain rights of way. During the survey the author found a low expenditure of 7 to 9 manhours per acre in the gently rolling terrain of South Carolina and Mississippi. The high figures recorded were 55 manhours per acre in the swamps of South Carolina and the mountains of Virgina and 60 manhours per acre in the most difficult areas of Alabama.

Alabama Power Company surveyed the entire system and determined that the cost varied from a low of 25 manhours in what they consider good terrain to a high of 60 manhours in the most difficult terrain.

A cost of 39.45 manhours per acre was reported for cutting the controls on research plots established in Pennsylvania (7).

The author used a planning figure of 30 manhours per acre when engaged in managing a right of way maintenance program in the mountainous region of Virginia and West Virginia. This figure did not include the more remote and inaccessible areas as they were being maintained by other techniques.

The manager responsible for the entire Southern Bell Telephone System reported a system wide average of 29.23 manhours to cut an acre of brush (35).

The figures cited are based on cutting brush on a regular cycle and leaving the cut material within the confines of the right of way. In the event the cycle is not followed, it is axiomatic there will be an increase in the number of manhours necessary to clear because of the need to cut the brush with power saws. One contractor interviewed estimated an increase of 50% in the number of manhours if saw work was involved. If the brush requires special handling, windrowing, removal, or chipping, the number of manhours necessary for the operation will be increased.

Results: A manual crew is able to do a thorough and complete job. It is not limited by terrain, raod conditions or the nature of the job. A manual crew usually is charged with removing danger trees along the edge of the right of way, trimming trees near residences or in urban areas and trimming the side of the right of way when it begins to encroach. However, these activities add manhours to the total job and are not performed with the same regularity as removing the stand of brush.

The right of way condition following a manual clearing operation is at best only a temporary solution to the problem of providing security to the line and access to the facilities. One manager (6) stated "hand clearing produces dense stands of hardwood growth which quickly renders the right of way inaccessible for equipment for the greater portion of each cycle." Since hand clearing does not kill the root system of the plants, the right of way quickly reverts to the original condition; if anything the brush density is increased. One study showed that brush density increased from 10,000 stems per acre to 18,000 stems per acre (12).

Because the rate of growth in any particular area tends to be predictable, the work must be carried out on a regular cycle and is repetitive. Failure to adhere to the cycle of two to five years means the brush will be of such size that saws will be necessary to cut it instead of the brush ax. The average cycle cited by utilities in the southeast United States is three years.

While making the study, the author was unable to uncover any statement or citation of any redeeming economic or aesthetic values for the stands of brush generated by a cutting operation. In many ways, the right of way is unattractive for alternative uses if for no other reason than before the brush stumps resprout, the right of way is covered with sharp stake like projections that can cause injury to the unwary or unsuspecting.

Future: Costs for manual clearing will continue to rise. Hourly wages will continue to increase, there will be additional fringe benefits and work rules will become more liberal. These changes will take place primarily to remain competitive for the limited existing sources of labor. However, there is no indication that the pool of available labor will increase; the evidence is that it will continue to shrink as rural people continue to migrate to urban areas and as industry locates new facilities in the lower cost less industrialized areas. Young people are finding this very demanding physical occupation less and less attractive as a full time vocation.

There will be other factors that will tend to increase the cost of manual operations. In some areas, there is strong public pressure to use more labor intensive methods of maintaining rights of way. In many instances, brush that was formerly cut is now being trimmed and as time goes by the crowns will develop and will require increasing numbers of manhours to maintain. Trimming is the most labor intensive operation of all. In other areas, the public is demanding that the brush be removed from the right of way (16). One contractor estimates that this more than doubles the cost of a manual clearing operation.

Mechanical

Background: Utilities have been trying for over 50 years to mechanize the process of clearing brush from the rights of way. Many devices have been tried; mechanical beaters, discs, bulldozers with specialized blades, choppers and flails. The one machine that has gained broad acceptance throughout the industry, and is considered a standard tool, is the brush hog, a large rotary mower pulled by a tractor. All of the mechanical devices have two characteristics in common; they are a substitution of a machine for labor and they are severly restricted in where they can be used.

The major constraints on the use of mechanical devices are: first, the right of way must be accessible to a wheeled or a tracked vehicle; second, the terrain must be moderate in slope and firm not swampy; third, the right of way must be free of obstructions such as rocks and oversize stumps that could damage the equipment; fourth, the brush must be of manageable size.

The maintenance cycle for the brush hog is two to three growing seasons; if this is not adhered to, a larger machine or another technique must be used to maintain the right of way. Recent years have seen efforts to develop machines that will efficiently handle larger brush so that the maintenance cycle can be extended. Another machine has been reported that not only knocks down the brush but chops the roots as well thus giving an estimated one year extension to the cycle (4).

Costs: There is little published data on the cost of most of the mechanical devices; this is probably because most of them saw little if any real commercial use. The costs for using the brush hog were found to be very uniform throughout the study area. The explanation for this is that the constraints establish a fairly standard treatment situation.

Alabama Power Company reports that it cost an average of 2 to 4 manhours per acre to clear in suitable terrain, and in difficult terrain the cost was 5 to 8 manhours.

Vepco records indicate that it costs a minimum of 2 manhours per acre to clear in areas suitable for brush hog operations.

A contractor operating within the state of South Carolina stated he used 2 manhours per acre for planning a brush hog operation.

No matter how ideal the situation or how careful the planning, in any mechanical clearing operation there will be misses because on every right of way there are spots inaccessible to machines. This means that every mechanical operation must be complemented by another technique.

The cost of the associated operation is contingent on the number of gullys, marshes and rocky hillsides encountered. Failure to pick up the misses could result in a future outage.

Mechanical operations are confined to the right of way. Tree trimming and danger tree removal must be accomplished by other means.

Results: The results of a mechanical clearing operation are practically identical to those of a manual clearing operation. There is one significant difference; the brush is chopped. This negates the need to chip, remove or other special handling. However, it does provide a perfect mulch for the propagation of seedlings and an associated increase of brush density.

Future: The cost of mechanically clearing rights of way will continue to increase in proportion to the incremental increases in the cost of machinery and the cost of labor. Over the past 30 years, the rate of increase in the cost of equipment has been much lower than that for labor.

A major cost breakthrough would be the development of a piece of equipment in the price range of a brush hog that will handle brush that has six growing seasons.

Chemical

Background: During World War II, scientists discovered a new chemical compound, 2,4-dichlorophenoxyacetic acid, that added a new dimension to the science of weed control. This unique material had the property of selectivity - i.e., controlling some plants while having no apparent affect on others. The products of this research have become known as herbicides, and their use has formed the foundation of an important new discipline (38).

In the late 1940's, utility managers became interested when they learned that the species of greatest concern to them, woody species, could be controlled while the species they most desired on the right of way, grasses, were left unharmed (41). However, the early use of these new products was not without some difficulty (27), and the state of the art advanced by stages (Appendix II).

The early users were beset by problems of erratic unpredictable results and off right of way damage due to volatility and drift. In addition, the public reacted adversely to the unseasonable discoloration (brown out) of the sprayed brush. Early research was directed toward solving these problems, and by the early 1950's, effective rates of application had been determined and less volatile chemicals developed. However, because the spray season was limited to the summer months, utilities found themselves with the labor problem they were trying to solve (14). Large crews of men had to be hired for a very short period of time, and the inadequately trained personnel were responsible for many of the early problems encountered in using herbicides. Work was initiated to find ways of extending the spray season, and techniques were developed that gave good results during the dormant season (12) thus allowing more efficient use of the existing work force. Dormant spraying also provided relief from the public relations problem of brown out. Prior to this, green dyes were added to the spray solutions in an attempt to mask the change in color, but this proved unsatisfactory as it gave a very garish appearance to the right of way.

Long before 1963 and Silent Spring, those who pioneered the use of herbicides expressed a concern about the environmental impacts and the possible effects on human health resulting from the widespread use of herbicides in a right of way maintenance program (Appendix I). A great deal has been written on this subject; and for this study it can be stated that since 1947 no herbicide used in right of way management programs has been placed in general use without meeting stringent standards established by the Federal Government (33). The efficacy of these standards is evident in that after 29 years of widespread commercial use there is no evidence in the literature of an injury resulting from the proper commercial application of these products.

In 1953, a study was initiated on a right of way in Pennsylvania measuring the ecological aspects of brush control (8). This study remains active and provides ample evidence that the changes wrought by the use of herbicides are not inherently undesirable. In fact, one wildlife manager (36) stated, "by restricting all brush control work to mechanical cutting, both the utilities and the game department have been losers." In 1970, the Edison Electric Institute funded a study (11), Environmental Effects of Herbicides, nationwide in scope that confirms and expands on the findings of earlier investigators (5).

The 1960's can be characterized as the time when brush control really became a science. The spectrum of available chemicals was expanded to include such exotics as a product which is applied just prior to leaf fall that produces no visual evidence of treatment, but in the spring the brush does not leaf out. Additives were developed that practically eliminated the problem of drift. One utility noted that most of the complaints received about the spray program concerned the oily odor following the operation; a material was found that masked the odor with the scent of bubble gum. Concurrent with all of this was a rapid development in the tools of application. From the knapsack sprayer to high volume truck mounted sprayers, mistblowers, fixed nozzle sprayers, pellets and assorted rigs mounted on helicopters.

Today, the manager of rights of way has at his disposal an array of tools that permit him to control brush; of any size, of any species, of any density, without regard to season, in any conceivable location and with complete confidence of not damaging the environment or impacting on human health.

Costs: The chemcial technique has evolved into a sophisticated combination of herbicide and application device, and the relative efficiency of these tools vs. the use of manual labor has been well documented.

Two graduate students from the University of Massachusetts using mistblowers treated 525 acres of brush in difficult terrain averaging 2.3 manhours per acre (13). In another report, a manager using mistblowers in hilly terrain cited an expenditure of an average of 3.1 manhours per acre over a period of five years (24).

TVA reported that is cost 18 manhours per acre to knapsack spray and 9 manhours per acre when using a power sprayer (49).

In another paper, TVA reported on the use of the fixed nozzle mounted on a truck - ½ manhour per acre (31).

In 1954, a manager from Southern Bell Telephone in a report cited a cost of 6.45 manhours to spray an acre of brush. This was a system wide average and included all types of work (35).

A manager from northern Maine reported 5.7 manhours per acre to apply herbicide pellets by hand to brush averaging 5000 stems per acre (39).

The ultimate expression of efficiency in substituting chemicals and mechanical devices for manpower is the helicopter. A three man crew (one helicopter) is routinely capable of a production rate of 25 acres of brush per flight hour or an expenditure of .12 manhours per acre. TVA reported an average three hour day spraying 50 acres per hour or .08 manhours per acre (31).

With every chemical operation, there must be an associated follow up operation. This operation is carried out to trim incidental trees on the right of way, to remove danger trees from along the edge of the right of way and to remove spots of brush that could not be treated with the chemical for any of a number of reasons. The cost of this work is contingent on two things, how often it must be performed and the proximity to urban areas or areas of intensive agriculture cultivation. Some lines in remote areas need no additional work, but lines near areas of dense population may require that the major effort be non-chemical.

Results: Chemical treatments convert the right of way from one cover type of vegetation dominated by woody species to another cover type of vegetation dominated by grasses or other herbicide resistant species. Counts made on the research plots in Pennsylvania show that on unsprayed areas the density of brush was over 900 stems per acre and on the adjacent sprayed areas the density was less than 30 stems per acre (7).

No chemical application gives 100% control; however, the surviving stems are inhibited in their rate of growth and are not of immediate concern. The reduction in density opens other options for managing a right of way and leads to a reduction in cost of future operations. One utility noted that after two applications of herbicides, the number of acres needing treatment diminished. A visual aerial survey indicated that adjacent property owners utilized the areas opened by herbicides for crops, pastures and other uses.

The maintenance cycle is extended as the brush density is reduced. One manager credits a two year extension of the trim cycle to a spray program (15).

Future: The costs of labor, chemicals and equipment will continue to rise, but these costs can be offset by an extension in the maintenance cycle, decreased density of brush and a reduction in the number of acres actually needing maintenance.

The major factor governing future use is public acceptance or lack of it. In some areas, local attitudes are such that the utilities are

legally prevented from using herbicides, or it is an emotional issue of such depth that the prudent course of action is to avoid their use.

It can be anticipated that new chemicals will continue to appear on the market and new techniques for applying them. These developments may in part improve the issue in the public's mind and may also prove to be more effective control agents.

PROGRAM

In comparing the relative merits of the various techniques for maintaining rights of way, a definitive statement can not be made that one is clearly superior to all others. The best technique is the one that fits the particular situation; each has a place. As one person observed, "an ideal right of way maintenance program usually includes cutting and trimming, as well as foliage, basal-stem and stump spraying (48)." The various ways of fitting these techniques together to achieve cost control and ideal right of way conditions has been described by many professionals in the field (2,16,19,25,26,32,37,44).

Three of the most informative reports on the results that can be realized with an organized program concern Vepco, Consumers Power Company and Central Hudson Gas & Electric Corporation.

Between 1957 and 1968, the transmission system of Vepco doubled; however, the total expenditure for right of way maintenance was essentially the same in 1968 as in 1957. Or stated another way, the cost per line mile in 1957 was 175 dollars and this decreased to about 100 dollars per line mile in 1968. This was accomplished in spite of inflation and other increases in costs (18).

Consumers Power Company expressed cost control in terms of the number of manhours necessary to maintain a mile of line. In 1950, the number of manhours necessary to keep a mile of line clear of brush was 38.2 and by employing the latest methods over a period of years the figure was reduced to 6.8 manhours in 1967. During this period of time the cost of maintaining a mile of line dropped from 56 dollars in 1947 to 40 dollars in 1967, and line conditions had improved (45).

The Central Hudson Gas & Electric Corporation spent an average of 105.08 dollars per mile per year between 1945 and 1952. From 1952 until 1962 there was a transition period in which spray operations were factored into the brush control program. By 1963 the cost per mile per year had dropped to 62.04 dollars per mile (1).

The author has the good fortune of having first hand knowledge of these three programs; he has interviewed the key men and has made extended visits to the service areas of Vepco and Consumers Power Company. There are two observations that can be made: each program is uniquely designed for the particular service area, but there are several factors held in common.

First, each company has established goals and a plan to achieve these goals. The plan is founded on historic data and a detailed set of records of past experience. The plan is flexible and is reviewed on an annual basis in an orderly manner; the final plan is the result of some

type of comprehensive field survey so that fine adjustments can be made. One plan the author is personally familiar with consisted of a five year projection of needs that was revised annually to prepare the immediate one year forecast.

Second, each company has a professional staff to manage and supervise this vital function.

Third, each company has extensively used chemical techniques to achieve cost control and desirable right of way conditions, but the techniques used are those particularly suited to the area served.

Fourth, the program of each can be characterized as innovative and imaginative. There is an integration of all techniques to achieve the desired results. There has not been a slavish adoption of one method to the undesirable exclusion of the others.

All of this suggests a policy statement of what constitutes good management:

Suggested Policy Statement: Right of way maintenance is a necessary and vital activity in the provision of reliable service to our customers. Tree related problems are one of the major causes of outages; and while they cannot be completely eliminated, a sound program of vegetation management can reduce the number of problems caused by tree contact.

It is the policy of X Company to use only tested and accepted vegetation management techniques in a coordinated and planned program administered by competent and trained professionals. These management techniques include manual, mechanical, chemical and combinations of these.

While it is recognized each plant community is a dynamic entity, the goal of any right of way maintenance program is the establishment of a self-sustaining community compatible with our lines and acceptable to neighboring property owners.

A major tool used to achieve such communities is the modern selective herbicide. As regards the use of these materials, it is the policy of the X Company to use only materials that have been properly registered with the Environmental Protection Agency. These materials will be used for the approved purpose in the approved manner, and at the approved rate.

It is the policy of the X Company to keep conversant with the state of the art and to take advantage of any improved techniques insuring economy of use, continuity of operations and environmental integrity.

Vepco: This electric utility is headquartered in Richmond, Virginia and serves over one million customers in the states of North Carolina, Virginia and West Virginia. The system has over 4,000 miles of transmission line and over 35,000 miles of distribution line sited in every type of situation from the heavily urbanized to the remote rural.

The service area can be described as one of great diversity. It stretches across the Atlantic Coastal Plain, the Piedmont Plateau to the Appalachian Mountains - going from sea level to elevations over 4,000 feet above sea level. Within this area are forest cover types representing three major forest regions; northern, central and southern (40). It is doubtful if any other utility is faced with managing such a diversity of growing conditions and species.

The program is managed by a multidisciplinary team headed by Mr. John D. Farmer, Jr., Superintendent of Forestry and Timber Products. Mr. Farmer has over 17 years of professional experience and has served as the President of the Mountain Lake Right of Way Management Council, Inc. and is a member of the steering committee of the Electric Power Research Institute (EPRI) research project studying the environmental effects of herbicides used in right of way management programs.

The program is diversified; incorporating all techniques of maintaining rights of way. It can also be described as innovative. Vepco has a long standing cooperative program in which property owners desiring to convert the right of way from brush to another use that will not interfere with the operation of the line, such as crop land, are paid a fee to assist them in this effort. In addition, Vepco has long had a program of informing property owners of species of trees that can be planted in the vicinity of power lines with assurance they will not become hazardous conditions.

The actual work is carried out by contract crews, but Vepco has a force of trained and experienced inspectors to insure compliance with all contract provisions and with accepted work practices. Only contractors meeting certain standards of quality are permitted to bid on work.

APPENDIX I

2,4,5-T
The Improbable Controversy

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2,4,5-T
The Improbable Controversy*

On September 7, 1974, a major newspaper carried this headline, "Factions split over deadly herbicide". The article discussed Senate hearings concerning the controversy over the herbicide 2,4,5-T (2,4,5-trichlorophenoxyacetic acid). Enviro Audits has researched the circumstances surrounding this case and concludes there is no justification for public concern over the continued use of this important material.

Background

On July 14, 1944, two scientists from the New York Agriculture Experiment Station, Dr. C. L. Hamner and Dr. H. B. Tukey, made the hoe obsolete when they successfully conducted a test using 2,4-dichlorophenoxyacetic acid (2,4-D) to remove bindweed from apple nursery stock. The use of chemicals to control weeds was not a new idea nor a new practice - the unique characteristic of this chemical and other related compounds (2,4,5-T) was their selectivity; broad-leaved plants were killed but grasses were not harmed.

It did not take long for others responsible for vegetation management to grasp the significance of this discovery and to adapt the materials for their own purposes. Farmers adopted the materials to clear weeds from grain crops and pastures. Foresters found that hardwood weed trees could be removed from developing stands of economically importnat conifers. Public utility foresters used the materials on rights-of-way to control woody vegetation that endangered service. Highway and railroad maintenance engineers also found them important in keeping safe conditions along the roadways. Even the week-end farmer, the urban homeowner, found the materials useful in keeping lawns attractive and free of weeds. Within a short period of time, they were in use nationwide on millions of acres as the prime weapon in the fight to control economic loss due to unwanted vegetation.

Critical Review

This acceptance precipitated a vast and continuing research effort on uses and environmental impacts by such agencies as the state agriculture

*Review commissioned by the Mountain Lake Right of Way Management Council, Inc.
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experiment stations, the U. S. Department of Agriculture, the U. S. Forest Service and the major chemical companies. Consequently, these are probably the most studied of all pesticides; the number of research papers is so great that citation is impractical. The results of the past three decades of study and use demonstrate that the approved commercial applications of 2,4,5-T are in no way hazardous to humans, domestic animals or wildlife. This evidence comes from such typical sources as:

> In 1950, two scientists at the Michigan Agriculture Experiment Station conducted field studies on grazing livestock using two to four times the normal dosage and concluded the use of 2,4,5-T for pasture weed control was a reasonable safe practice.
>
> The director of the Westmoreland Nature Sanctuary in New York in 1959, while reporting on tests he had conducted, stated there was no evidence of any adverse effects on the high populations of wild birds, mammals or reptiles resulting from the use of 2,4,5-T.
>
> A scientist at Oregon State University in 1970 reported on experiments conducted to determine if 2,4,5-T was persistent in forest floors. The tests demonstrated it was degraded by microbial activity.
>
> In 1972, Dr. James G. Wilson, of the Children's Hospital Research Foundation, in a lecture to the Southern Weed Science Society reviewed the known information and concluded 2,4,5-T represented no hazard to human reproduction.

As a result of its safety, there has been universal acceptance. Anyone who has treated weeds within the past 25 years in all probability, knowingly or unknowingly, has been in contact with this material. In view of this great exposure of the population to 2,4,5-T, it is remarkable, that in this year of 1974, there is no record in the available literature of one medically documented case of human or animal injury resulting from the commercial use of 2,4,5-T.

In 1963, Rachel Carson's book, Silent Spring, focused attention on man's use of pesticides to manipulate his environment and raised the ugly spectre that 2,4,5-T might be carcinogenic in nature. As a result, the chemical industry, state and Federal research agencies reviewed existing data and concluded there was no evidence to support this allegation. No one could find a substantive reason to limit or restrict the usage of this material; and, in effect, while the controversy surrounding the general use of pesticides continued, 2,4-D and 2,4,5-T seemed to have been cleared of suspicion.

In 1968, in an atmosphere of public hysteria, the controversy over the war in Viet Nam raged bitter, and all actions of the military were suspect. The public learned the armed forces were using chemicals in the war effort. In fact, the military was using a material containing 2,4,5-T, agent orange, to open up the jungle for security reasons. Fueled by South Vietnamese newspaper reports, the public was subjected to sensational stories of

increased human birth defects in Viet Nam. In response to this, a blue ribbon group of scientists - recommended by the National Academy of Science - was dispatched to Viet Nam to determine the facts. On return, the commission reported no evidence of health hazards resulting from the use of agent orange. This still did not quiet the cries for banning the use of 2,4,5-T.

In 1971, the Federal Government, through the U. S. Environmental Protection Agency, responded to this pressure and initiated an action leading to a formal public hearing. The procedure was protracted, all parties to the controversy shared all available data, all who asked to be heard were heard, all the issues were reviewed - the hearing judge exhausted every possible source of information to insure a thorough and complete record. The net result was that on June 24, 1974, the notice to hold a hearing was withdrawn by the EPA because the evidence that would determine the outcome of the proceedings was scientifically unavailable. After eleven years of intense effort, those who opposed the use of 2,4,5-T were unable to produce any evidence of health hazard resulting from commercial use of this material.

Conclusion

Enviro Audits has surveyed over 100 documents from various research institutions; interviewed knowledgeable scientists, such as Dr. Kenneth L. Carvell of West Virginia University; and reviewed the record of the recent EPA proceedings. In this record of the commercial use of 2,4,5-T spanning 25 years, there is:

No evidence of hazard to domestic animals,

No evidence of hazard to game, birds or fish,

No evidence of hazard to humans, and

No evidence of persistence in the environment.

We can only conclude from the mass of evidence supporting the safety of 2,4,5-T and the total lack of any conflicting data; there is no health hazard to the public from continued use of this product.

November, 1974

Sources

For those who would like more first-hand information concerning this improbable controversy, several sources are recommended.

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APPENDIX II

Interviews

Mr. John P. Cruickshank (Retired)
Biographical Sketch

Mr. Cruickshank was raised on a farm in Texas, served in World War I and then then attended Texas A & M graduating in 1922 with a degree in electrical engineering.

He joined the General Electric Company and remained until 1925 when he accepted a position with the Appalachian Power Company. He rose to the position of District Superintendent of the Huntington District in which capacity he was responsible for all operations; distribution, transmission and production. After serving on active duty with the U.S. Army Signal Corps during World War II, he was appointed Transmission and Distribution Manager for the Appalachian Power Company remaining in this capacity until his retirement in 1965.

As T & D Manager, Mr. Cruickshank was particularly known for his unusual interest in the right of way maintenance problem - spending several weeks annually observing and studying actual field conditions. For many years, he personally directed and managed the right of way maintenance program; in so doing, he became acutely aware of the need for better ways and means of carrying out this expensive and important activity. He developed a cost control system that served as a model for the entire American Electric Power Company; he spearheaded the development of a research project at the Virginia Polytechnic Institute and State University to investigate brush control; and he developed a professional staff within the company.

He is a Fellow of the American Institute of Electrical Engineers and a Life Member of the Mountain Lake Right of Way Management Council.

We cleared rights of way for one overriding reason - to permit construction crews to build lines. However, after the lines were built and in operation, the woody brush if left unattended would grow up and ground the line; and when we lost a conductor in a valley, we lost days, not hours, in restoring service. In the cities we had a tree trimming problem; storms would break off limbs, and they would fall in the lines breaking them down and interrupting service.

Our early right of way maintenance techniques were pretty crude; we used the brush ax, hand saw and mattox. In those days there were no mechanical devices or power saws. However, there was an abundance of low cost labor in those hills available for part time work - this was the lowest cost and really the only method of clearing right of way.

In order to keep our lines clear, we had a rule of thumb, a three year cycle; but it depended somewhat on the weather which governed the rate of growth. Each line required an inspection to determine how close the brush was to the conductors; some we cut in four years, some in five and we even had spots requiring cutting every two years. This was all determined by a foot patrol of the lines.

After World War II, as the economy improved, the labor supply dried up, and we were compelled to look for other ways of performing this essential task. I became interested in the brush hog after watching one clear an overgrown pasture field, but the terrain was too rocky and down time made it uneconomical. I had other objections; the work had to be done too often, every two years, and it did not kill the roots, only the tops. It provided the perfect mulch for seedlings to sprout in; organic farming is what we were doing. Another effort to compensate for the deteriorating labor situation was to take a large drum, 4 feet in diameter, filled with water for weight and armed with cutting knives that chopped the brush. It beat the brush down and was very economical where we could use it - the cost was far less than for hand clearing. However, it had the same limitations as the brush hog.

From 1946 on, we were looking for anything; I personally would listen to anyone who had anything to offer about clearing right of way. As a result, we explored many new ideas and stumbled onto many things. We even tried to electrocute brush - it seems silly now, grown men walking the right of way with the unwieldy equipment, but we were in earnest then. Sometime in the late 1940's, a chemical salesman appeared in my office with a product called brush killer, a misnomer if ever there was one. I forget who called on me first with the claim of being able to kill brush, and I do not remember the chemical. However, I was interested because we had been killing weeds in substation yards with chemicals - if there was a chemical to kill weeds in substation yards, there was probably something that would kill brush. Our first job was a three mile section of line, and we used knapsack sprayers to apply the herbicide - the results were such that I was interested in going further.

The next year, we did a ten mile section of line with a pump mounted on a truck and men on foot dragging a hose with nozzles. This section of line was selected because a truck could travel the right of way.

We thought we could spray the line one time and have the perfect right of way - it would be free of vegetation that could grow into the conductors, free of vegetation that would impede access in case of emergency or for routine maintenance operations, and the right of way would not need further care and attention.

Frankly, the results of those early jobs fell far short of our hopes and expectations; those of us with the job of managing these rights of way had to change our concepts and goals. We found that the brush was selectively controlled; some species were eliminated, some were propagated and some were not bothered one way or the other. At the time the chemical companies were not sure of what concentrations to use, and the ones we used were too weak. This caused us to spend a lot of time improvising in the field until we came up with what looked like the best rates of application for our particular set of conditions. I often accused the chemical companies of making us do their job for them. Seriously, what we were learning was that results obtained in one area of the country with a certain spray application might not be repeated in another area because of many variables. I remember a fellow by the name of Egler who had this method that would solve all problems - we invited him down to try it out on one of our lines. It just did not do what he said it would; we had to hand clear; we lost control; ailanthus was grounding the 138 kv line.

There was an exhibit outside White Sulphur Srpings the telephone company made claims for. After touring the area, we had a discussion as to the best way to duplicate the results; I became concerned because the professionals from the chemical companies were in sharp disagreement, how was I to make a decision? I suggested to several others that we get the Virginia Polytechnic Institute to investigate products, and ways and means of controlling brush. We came up with a grant of money and set out to find answers in our own territory with our own people, and that's how we met Dr. W. E. Chappell.

Dr. Chappell developed a research program that for practical solutions to our problems was second to none. As a matter of fact, the work was so important that the old Mountain Lake Brush Control Conference was built around it, and people from all over North America attended to get the latest word on the art of controlling brush. There were many benefits from this project; the most important were, we had a consultant that helped us select and evaluate herbicides and ways of applying them. I considered him a staff member with a knowledge of chemicals and plant growth. He saved our company a lot of money by screening chemicals that were available; and before I bought, I had Dr.

Chappell give me a report. I believe this helped us to get public acceptance of the whole program; he and I often visited with our critics and had the pleasure on more than one occasion of converting them to the support of our program.

Although chemical spraying was an advance in the technology, it still did not solve all the problems. During the early 50's, we were limited to spraying during the growing season, consequently we found ourselves with the labor problem we were trying to solve. We needed 33 spray crews totaling over 200 men for a very short period of time; so we could not keep up with the program. This prompted our decision to search for other methods.

I had seen spraying of cotton and mesquite in Texas; so we contacted the fixed wing people to see if they could fly our jobs. They could not; so this caused me to look at the helicopter. I might digress for a minute; I was interested in the helicopter for another reason. We had started to construct some of our lines using the helicopter; so there were no construction roads to provide access. It seemed that it would be necessary to maintain the right of way using the helicopter.

Somewhere in there we came up with the idea of a combination of spraying - that is foliage spraying and dormant spraying. The idea of spraying during the dormant season was perfected by Dr. Chappell; a real benefit of the work we were sponsoring at VPI. This allowed us to more effectively use the best trained men.

I was sold on helicopter spraying; it was economical and effective. We began to look at the entire system on a five to ten year cycle. We initiated a distribution spray program - as you know, it's just as difficult to get a truck into the mountains to spray a distribution line as it is to spray a transmission line.

Even though I went 99% to a spray program, there were areas where we were unable to spray and we had to continue hand clearing. There were also situations in which it was more economical to hand clear; such as when we had a stand of pine, it was easier to cut. We also worked with the state game commissions in Virginia and West Virginia to put game food plots on certain sections of our rights of way.

I kept costs; we initiated a system of records in order to sensibly manage; I had to know what these activities were costing us. I was unwilling to leave supervision of this fledgling program to others - the spraying was very technical. However, as the task increased in complexity and the system grew, I found that I could not spend the necessary time on this work; so I decided to expand my staff. I needed a man with the technical knowledge of herbicides and their use, and an appreciation or knowledge of utility economics, and the ability to meet the public and work with regulatory agencies. This person would be

responsible for managing the entire right of way maintenance program. The position was that of right of way maintenance supervisor and the duties included:

1. Obtaining adequate brush control over all rights of way in the system.

2. Insuring that the results obtained were commensurate with the costs.

3. Supervision of the program, planning, forecasting and proper delegation of responsibility to subordinates.

When I retired, we were starting to see the payoff of our efforts. We had accomplished control of the brush under the lines even though it was not a perfect right of way. We were realizing economies from our program; lines were on a five to seven year maintenance cycle instead of three to five years as it was when we were hand clearing. The years after World War II were years of rapid expansion meaning more acres to be maintained; yet in 1965 when I left the company we had a labor force of less than 200 men when previously it had exceeded 400. We had people take us to task for this reduction in our work force, but what they failed to realize was that the pool of people with the necessary skills had dried up, young men just did not want to learn this very difficult skill. We had contractors forfeit their contracts because they could not get labor; they just folded up. By the early 1960's, contractors had to import labor from Canada to clear rights of way.

There will still be new thinking - how often and with what - that will be governed largely by technological developments. This merely means that with the economic pressures of today, it is more imperative than ever that a utility have a good strong technically oriented person with primary responsibilities for the right of way maintenance program.

John P. Cruickshank
John P. Cruickshank

Janet C Steele
Notary Public

My Commission Expires October 21, 1977

George T. Robbins (Retired)
Biographical Sketch

Mr. Robbins describes himself as a self-educated man who was a lineman climbing poles for an electric utility when he was sixteen. His experience spans five decades and includes involvement with every aspect of the electric utility industry. He started out with a small company in western North Carolina that was sold, merged and merged again util he finally ended with Virginia Electric Power Co. in 1950. During his entire career he was responsible in some degree for right of way maintenance, and he organized an effective right of way maintenance program with each company. The results of his efforts are well documented, and he is a recognized authority in the management of vegetation control problems.

East Coast Public Service Company
(Parent company of Northwest Carolina Utilities and Virginia East Coast Utilities)

1923	Hired
1925	Local Manager
1931	District Manager
1940	Division Manager
1941	Vice President and Division Manager
1944	Vice President and Supt. of Operations; member of the board of directors

Virginia Electric and Power Company

1950	Asst. Supt. of Transmission
1953	Supt. of Transmission
1960	Supt. of Forestry and Timber Products
1968	Supt. General Services
1969	Manager General Services
1971	Retired

While active he served on the Edison Electric Institute Task Force Committee on poles and participated in a program with a committee on tree inhibition. He was an active participant in the Mountain Lake Right of Way Maintenance Conference, serving on the Executive Committee and later named a life member. He helped found the West Virginia Weed Control Association and served on the Board of Directors.

G. T. Robbins

When I started work in 1923, our service truck was a Model "T" Ford without battery and starter; it used a magneto. As you can imagine at that time all right of way clearing and maintenance was done by hand with saws, axes and brush axes. While labor was cheap, we often let it grow until it was burning the lines. Very often I was sent out to help clear a line in trouble and after swinging a brush axe for several days I decided there must be a better way.

Our right of way control program was simple. We cut the brush on a three year cycle. This meant the brush was 16' to 18' tall. Sometimes we let it go until it was so large we had to cut it with cross saws.

The first improvement came in 1945 with the advent of the brush hog. It cut and ground up the brush into chips and scattered them over the right of way. From an appearance standpoint, this was an improvement over hand cutting and piling the brush; windrowing we called it. However, from an economical standpoint we did not get much relief as the brush had to be cut on a two year cycle rather than three years. Brush over 8' tall would damage the cutter. Also the scattered chips acted as mulch on the right of way and the regrowth increased in density and growth rate.

Finally in 1947, what I had been searching for since 1923 presented itself. I heard about chemical control of weeds and the possibility of brush control with 2,4-D and 2,4,5-T esters. I decided to experiment with chemical control as there had to be something better than what we were doing.

First I went to an orchard man who was proficient in the art of spraying, and he advised me as to the type of equipment we should purchase and where to buy it. After gathering all this information, I proceeded to purchase a spray rig and ordered several drums of Esteron chemical which was a mixture of 2,4-D and 2,4,5-T. The first three years I sprayed brush no chemical salesman ever called on me. I just worked out my program and solved my problems on my own. If we did not like the results, we changed the mix until we got what we wanted. There were no manuals available to help us and it was a matter of trial and error learning how to use this new tool.

After our third year we had gained a fair amount of expertise in the art of chemical control. We experimented with various concoctions and learned that the first check to make of a sprayed area was to determine brownout. The second check was to be made several months later to determine root kill. A good brownout proved proper distribution technique had been used but this did not always assure a good root kill. Very often we would get a good stem kill but poor root kill.

About 1951 the chemical companies started sending out salesmen to

help us. Some of these had chemical engineering degrees, and they were a great help, but we still had to depend a lot on our own ingenuity. The species of brush was the determining factor in deciding the chemical mixture to use and the proper rate of application.

In 1950 when East Coast merged with Vepco, I soon found Vepco was not employing chemical control of brush on their rights of way. They had no system wide program of brush control and there was no strong informed individual to promote this program with management. I attempted this with the system transmission department and the superintendent was reluctant to embark on such a program as he had previously awarded a contract to a nationally known right of way contractor to apply chemical on the right of way of a 110kv line and the results had been very poor.

I finally convinced the superintendent to let me apply chemical on a two mile section of right of way in a wet low ground area near our headquarters in Petersburg on which the growth was so profuse it had to be cut every two years. He agreed and after one year he was so impressed with the results that we initiated a spraying program including several transmission lines. In 1953, I became Superintendent of Transmission and with the next spray season, in 1954, I expanded chemical control on the transmission network.

The results of this program on the transmission rights of way was so good that by 1959 we had reduced the annual right of way maintenance cost approximately 50 percent. The company was so impressed that they authorized me to organize a system tree and brush control section in the Transmission and Distribution Department and to expand chemical control to all distribution lines that were so located as to be included in the program. In 1960, the responsibility of the section was further expanded to include all tree trimming, initial clearing of all new distribution and transmission lines, pole and wood products maintenance, and landscaping of all buildings, substations and other facilities. My personnel included four graduate foresters and one arborist.

I am positive that the creation and later expansion of this group was a direct result of the confidence and appreciation of the success of our chemical brush control program.

Other innovations that were adopted during the period 1954 to 1971 included use of helicopters to apply chemical on our transmission lines. Also basal spraying during the dormant season. Ground spray rigs were improved and capacity increased to spray larger swaths. New and improved chemicals were made available by the chemical companies. The helicopter could spray as much right of way in one day as a 1950 model ground spray rig could accomplish in two weeks.

In addition to reducing cost of right of way maintenance with

chemical control there were other benefits such as appearance. With root kill the right of way vegetation was changed to grass and broom sedge. With the brush eliminated the line crews could traverse the right of way much faster to make emergency repairs to the lines or accomplish routine maintenance.

It had been customary for our line construction department to request the reclearing of transmission lines prior to a rebuild; but with the use of herbicides to eliminate woody growth these requests stopped. Sometimes we would have thousands of people out of electrical service due to storm damage, a plane hitting the line or some other problem. These serious and costly outages were reduced due to the improvement in the right of way.

One of the amazing things to me is the recent outcry over the use of herbicides to control brush growth. I was involved with using herbicides on rights of way for 25 years and in all of that time we never had anyone suffer personal injury or be affected by the herbicide. I do not know how the electric utility industry could possibly get along without this wonderful tool. I suspect that if the utilities had to stop using herbicides; the same group of people now opposed to them would soon be in the manager's office banging on the desk demanding the right of way be sprayed once they saw what a problem a cut right of way was.

Today the supermarket sells these same people beautiful peaches, apples, pears, tomatoes, corn and other agriculture products. All without a blemish from worms and insects as a direct result of the use of chemicals. Suppose the use of these chemicals which are much harsher than herbicides was discontinued, would these same people accept the worm ridden fruits and vegetables?

George T. Robbins

Notary Public

My Commission Expires October 21, 1977

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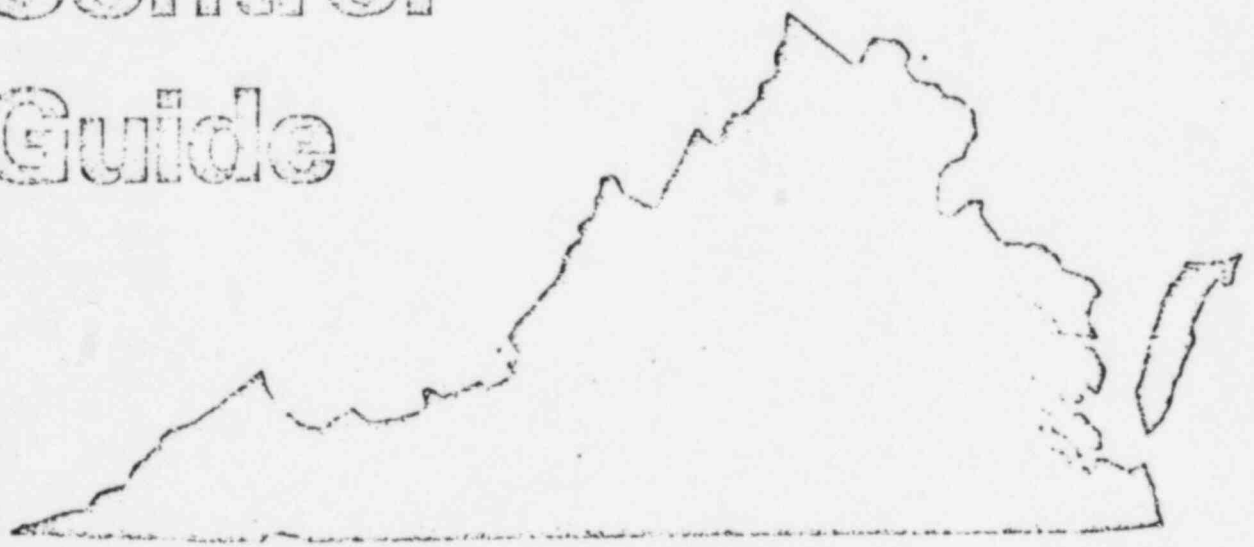
ENCLOSURE 4

CONTROL SERIES 1
JANUARY 1975

1975 Virginia Weed Control Guide



EXTENSION DIVISION • VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

BRUSH AND UNWANTED FOREST TREES

W. E. Chappell and J. S. Courtney

Control of Undesirable Forest Trees and Brush CS 46

The treatments given in this section are not for use in crop land unless otherwise indicated under a given crop section. Registration for use of 2,4,5-T on food crops, around homes, recreational areas, ponds and ditch banks has been canceled. These actions do not eliminate registered use of 2,4,5-T for control of weeds and brush on range, pasture and forest or rights-of-way and other non-crop land.

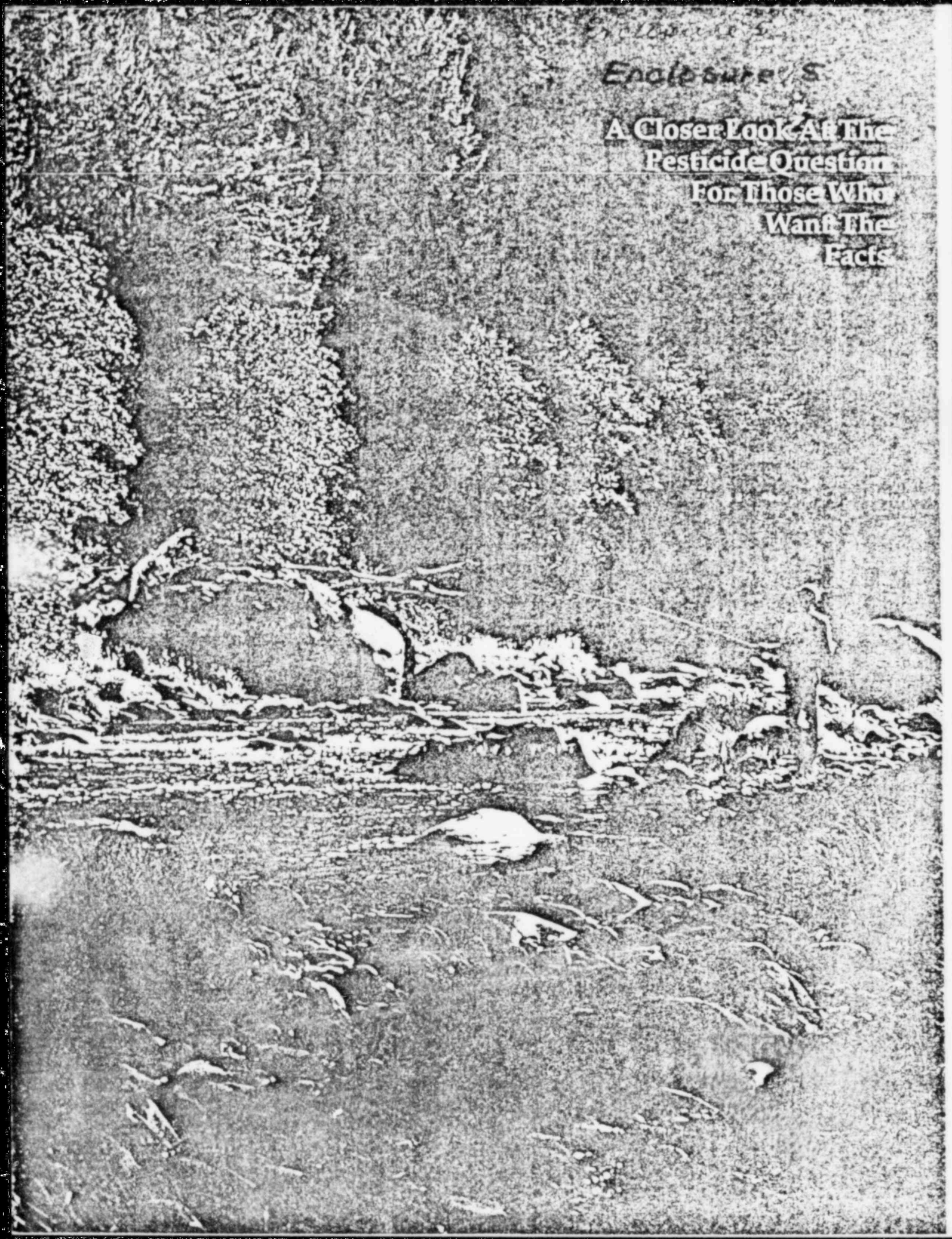
BRUSH CONTROL

Problem and Application Technique	Chemical and Application Rate	Remarks
FOLIAGE SPRAY High volume application with hand gun or fixed nozzle	2,4-D and/or 2,4,5-T* 8-12 lb ai in 30-60 gal of water/A	Apply uniformly over top of brush as a coarse spray. Pine, cedar, and ash are resistant.
Ground applications often use volumes ranging from 100-500 gpa. Our research has shown good results with volumes as low as 30-60 gpa if uniform coverage can be obtained.	amitrole-T 6-10 lb in 30-60 gal of water/A	Apply uniformly to foliage of black locust, sumac, and ash in June and July.
	AMS 65 lb + 6 oz spreader-sticker/100 gal of water	Wet stems and foliage thoroughly. Density of brush will determine rate/A. Use on all species during June and July. May be used near susceptible crops.
	picloram + 2,4-D (Tordon 101 or Amdon 101) 1 gal/100 gal of water	Apply uniformly over top of brush as a coarse spray. Use on all species during June and July. DO NOT APPLY WITHIN 100' OF DESIRABLE PLANTS OR ALLOW PICLORAM OR DICAMBA TO CONTAMINATE WATER USED FOR IRRIGATION OR OTHER DOMESTIC PURPOSES.
	dicamba 1 1/4 lb + 2,4-D or 2,4,5-T* 2 1/2 lb/100 gal water	
Low volume application to foliage	2,4-D + 2,4,5-T* (invert emulsion) 8-12 lb/A in 16-24 gal of water	Use aerial or ground equipment such as Amchem Spra-Disk or Rhodia Visco-Rhap system. Use on all hardwood species during June or July.
	picloram + 2,4-D (Tordon 101 or Amdon 101) 1-3 gal in 10-20 gal/A	Apply during the growing season with aerial equipment. Use either drift control agent or equipment that prevents drift by control of droplet size. DO NOT APPLY WITHIN 100' OF DESIRABLE PLANTS OR ALLOW PICLORAM TO CONTAMINATE WATER USED FOR IRRIGATION OR OTHER DOMESTIC PURPOSES.

* 2,4,5-T is not to be used around the home, recreational areas, ponds or ditch banks, or similar sites.

Enclosure 5

A Closer Look At The Pesticide Question For Those Who Want The Facts



A Closer Look At The Pesticide Question

In the minds of pesticide users — the farmer, the forester, the home gardener — there is no question about the utility of pesticidal products. We need them in America if we are to continue to feed our own expanding population, let alone millions of less fortunate people in developing nations where starvation is still a frightening reality. We need insecticides to protect our forests from destructive beetles and caterpillars, our homes from ants and termites, our stored foods from a myriad of pests. We need herbicides to reduce the cost of agricultural crops, to renew grass cover on our prairies, to restore the flow of water in once-dry creek beds, to improve the shrinking habitat of our nation's wildlife — to enhance the quality of our environment.

Like many other useful products, pesticides can be hazardous. Fortunately the hazards created by their use can be quantified and evaluated; unfortunately, our lawmakers and the general public, depending on newspapers, magazines and television for most information on current problems, are seldom given quantitative data on many essential applications of pesticides.

The media are expected to keep us informed on subjects involving the public welfare, and we believe they try to do just that. But good news makes bad copy and cold statistics have little news value. In a matter as serious as human survival, however, it can be dangerous to misinform the public and the lawmakers by repeating unsubstantiated claims or by distributing the unsubstantial fruits of wishful thinking.

This booklet attempts to publicize some of the less-known facts about pesticides and their uses — not with bare claims, but with quantitative data from respected impartial sources.

It must not be assumed that the use of quotations from writings of leading environmentalists implies their endorsement of our principal theme. We sincerely hope, however, that all readers, even those presently opposed to the use of pesticides, will give the data presented here their thoughtful consideration.

"We know that the white man does not understand our ways.
One portion of the land is the same to him as the next,
for he is a stranger who comes in the night
and takes from the land whatever he needs.
The earth is not his brother but his enemy,
and when he has conquered it he moves on."

Chief Seattle addressing President Pierce,
as quoted by John Strohm in *National Wildlife.*

The chief was right of course. In our relatively brief residence in the New World, we have changed the face of the land: we have leveled hills, drained wetlands, straightened wild rivers, removed vast tracts of virgin timber, creating conditions that have led to soil erosion, drought, and even dust storms. The growth of industry and new technologies have provided weapons to accelerate the attack. Over the years, careless exploitation of the land, prodigal waste of its natural resources, together with the pressures of a burgeoning population, have contributed to the current environmental crisis.

Now we are all learning to accept the earth as our brother. We no longer speak of "taming the wilderness" or "conquering nature." And technological man knows that he must be his brother's keeper. In the words of Senator Henry Jackson writing in 1973, "A new age is dawning.... It is the Age of Environment which has pricked America's collective conscience and triggered far-reaching action on many fronts."

It is too late, however, to let nature take its course. The mass application of modern technology without sufficient knowledge and coordinated planning has visibly wounded the natural systems. But the wounds are too deep to mend themselves. We are committed to the continued use of the best remedies science and technology can devise, and we must use them wisely, with adequate understanding of the possible consequences.

Is It Safe To Eat Or Drink Anything?

The world is becoming so overcrowded it is already hard to find clean air to breathe and pure water to drink. The Clean Air Act of 1970 has done some good, but the program is behind schedule. Water cleanup has begun, but we still have a long way to go. According to the National Wildlife Federation, "Conceivably, nothing less than an effort comparable to the space program will turn the situation around."

At the same time, human encroachment continues to reduce wildlife habitat to such an extent that nearly 24,000 species of plants and animals may soon be placed on the endangered species list for lack of adequate cover, water and food. We hear or read almost daily of the dangers of cancer, species mutations and birth defects caused by food additives and farm chemicals — especially insecticides and herbicides.

We Americans are deeply concerned about these reports and worried about the future. Assailed as we are by dire predictions of a dismal future or even of the imminent destruction of our great water planet, many Americans may be convinced that the good life we have known is doomed. We tend to worry about whether we and our children will be able to survive in the artificial environment science and technology have been creating.

What has happened to science and technology? Have they lost the ability to protect us from disease and ward off threats to our environment? We think not. Chemicals, properly used, are our most valuable tools for water purification and many methods of pollution abatement.

Toxic substances released purposely or inadvertently into lakes and streams, or belched into the atmosphere from chimneys and smokestacks have done fearsome damage to our surroundings and to animal and human health, and only in the past few years have environmental stewards begun to succeed in checking or even reversing the decay.

Like many other chemical products, pesticides are toxic, but they are applied sparingly to specific targets under precisely controlled conditions, usually by experienced workers and almost invariably in compliance with government-approved specifications. Thus the American public is protected.

If you thoughtfully examine the evidence provided here, we believe you will agree that Americans risk greater dangers from the possible reduction of our arsenal of pesticides than we do from their continued use.

Cancer – For Some Types, The Rate Is Declining

First of all, let us state a significant fact about cancer — it is predominantly a disease of old age. If people or animals are kept alive long enough, their chances of succumbing to this disease are significantly increased.

The American public's preoccupation with cancer is maintained by constant reminders in the press, on the radio, and on television, of the dangers involved in eating or drinking common items of diet — not only those containing synthetic dyes or sweeteners, but even such good old favorites as red meats, bacon and our morning coffee.

The most current thorough study of the relation of cancer to the environment is to be found in *The Sixth Annual Report of the Council on Environmental Quality*, published in December, 1975 and available from the U. S. Government Printing Office. According to this publication, "Both mortality data and surveys on incidence conducted by the National Cancer Institute point up three trends within the overall increase — a rise in cancer for white and black males, an approximately steady rate for black females, and a decline for white females. As indicated . . . cancer incidence has remained relatively uniform for some body sites since 1930 but has changed markedly for others. The most dramatic changes are the nearly twenty-fold increase in lung cancer for males, and a *two-thirds decrease of stomach cancer in both males and females*" (emphasis added).

"The increase in lung cancer for males is primarily attributed to heavier smoking, coupled with impacts from other environmental pollutants; the stomach cancer decline is understood less, but it may be linked to diet."

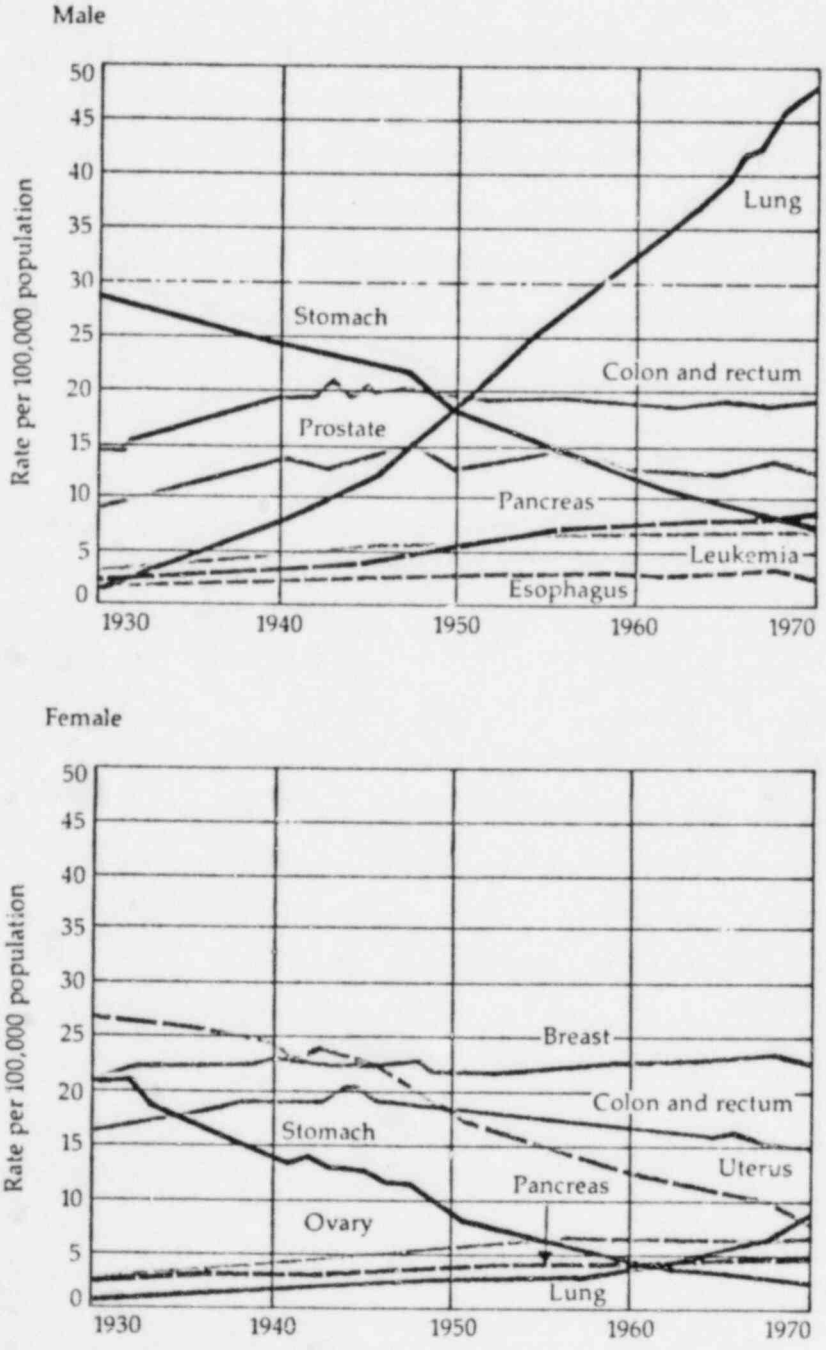
Thus we find that our diet, which consists largely of pesticide-protected foods, may be linked to a *decrease in cancer* over the past forty-odd years.

Let us look a bit further. If pesticides were a cancer threat, we should expect to see the greatest incidence of the disease down on the farm, where pesticide users are regularly exposed and where runoff from fields might enter the waterways. This is not the case.

What does the U. S. Government report tell us about geographical factors? "Analysis county by county," it says, "reveals that a majority of the areas of high mortality are located in the large cities. For example, the high mortality in Illinois reflects rates in the Chicago area."

Often, expert opinion is abused. For example, in October, 1975, a major television network

Cancer Mortality Rates, by Site and Sex, 1930-70
(age-adjusted to U.S. 1940 population)



Source: David L. Levin, et al., *Cancer Rates and Risks*, DHEW Publications, U.S. Government Printing Office, 1974, as quoted in Sixth Annual Report.

broadcast a special program titled "The American Way of Cancer." The participants were for the most part knowledgeable scientists, and official sanction was implied by the presence of an expert on additives from the EPA. From such a group one might have expected an objective analysis of the problem; unfortunately, they chose to overlook basic data. Only once, for example, was it mentioned in passing that the chances of getting cancer are reduced if one stops smoking. The major thrust of the attack was against (a) pesticides, (b) DES, a synthetic hormone used to increase beef production, (c) sodium nitrite, a food preservative, (d) Red Dye No. 2, a food coloring, (e) PVC, a plastic, (f) asbestos, and (g) various chemicals, including poisons such as arsenic. It was implied that cancer is an increasing problem and that these are major sources of that disease. It was also claimed that the United States is number one in cancer, when in fact this country stands about midway among the industrialized nations in cancer incidence.

Our present discussion is confined to pesticides and it is not our intention to discuss hazards arising from any other possible sources of cancer. We certainly agree that the public should be protected against exposure to any dangerous chemical, toxic emission or industrial waste.

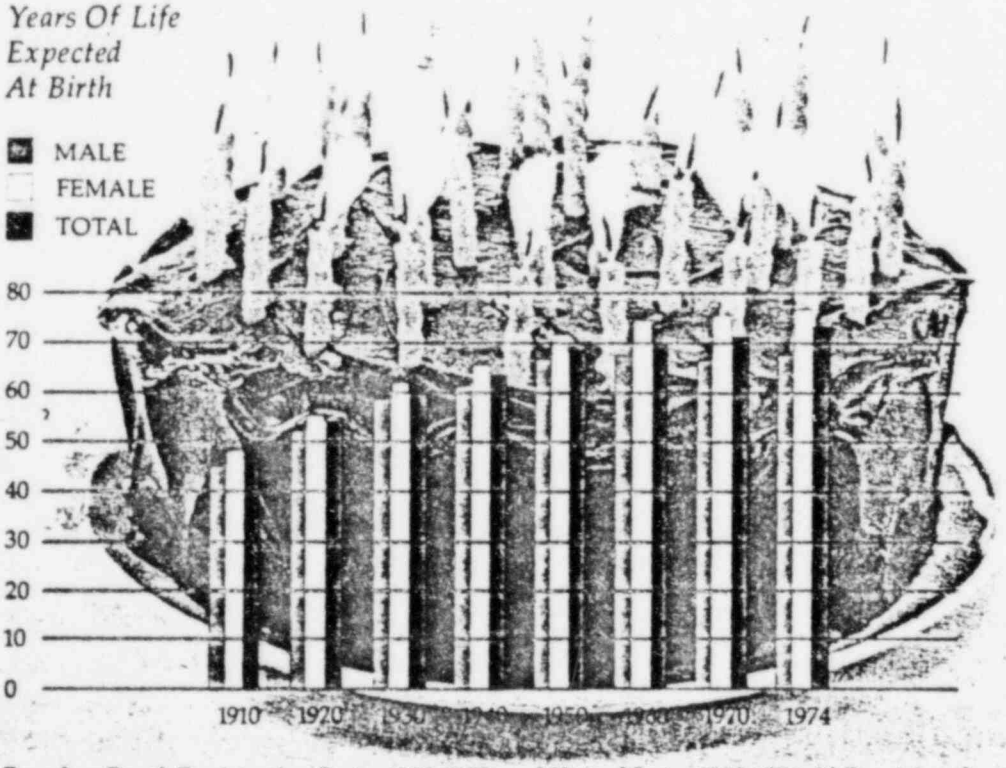
The TV documentary, however, was seriously flawed. For instance, the overall rate for many kinds of cancer has been declining for the past 20 years. Lung cancer

continues to become a more significant threat, yet most of the alleged carcinogens discussed in "The American Way of Cancer" have not been implicated as causative agents of that type of cancer. It would have been more enlightening to reveal that lung cancer has accounted for most of the increase.

In late 1975, Accuracy in Media, Inc. received a letter from the American Cancer Society confirming that there has probably been a leveling off, if not a decline, in cancer in the United States if we exclude lung cancer from the picture. Omission of lung cancer from our present discussion is justifiable inasmuch as about 80 percent of such cancers are attributed to smoking by the American Cancer Society; items of diet are not considered a major factor in such cancer.

The use of pesticides has had its greatest increase within the past 25 years. During the same period, the life expectancy of Americans has increased.

In this older population we would naturally expect an increase in stomach cancer if the increased use of pesticides on crops were implicated. We might also expect a significant increase in female cancer, cancers of the esophagus, and cancers of the abdominal area and colon, yet the U.S. Government statistics show no such trend.



Based on Death Registration States 1900-1925, and United States 1930-1974, (1) Provisional.
Source: Division of Vital Statistics, National Center for Health Statistics, 1974 Data.

Of Mice And Men

An important function of the kidneys and liver is to detoxify and eliminate body wastes and foreign materials. These organs are primary defenses against the intrusion of toxic substances and, for this reason, among the first organs to show signs of fatigue when called upon to resist repeated stress from the ingestion, inhalation or skin absorption of poisons. In fact, when they are called upon to eliminate excessive quantities of any substance for extended periods of time, they eventually lose their capacity to resist oncogenic (tumor-producing) processes. Many chemicals can be shown to be carcinogenic, mutagenic or teratogenic (that is, they can cause cancer, hereditary changes or birth defects) in prolonged animal experiments. The actual effect depends in part on the species used for the tests and their life expectancy. Strains of mice and rats used in laboratory experiments are generally chosen for susceptibility to the condition under study, and appear to be more subject to the effects of many chemicals than we are. Being short-lived animals, with a life expectancy of about 2½ years, they can be exposed constantly in the laboratory to relatively large quantities of toxic materials most of their lives and into relatively old age, when their organs, particularly the kidneys and liver, are least resistant to such insult. Under such conditions, some substances normally considered harmless to people can act as carcinogens (cancer producers) or teratogens (producers of birth defects), possibly even such common foods as table salt.

In the hearings conducted in 1963 by Senator Abraham Ribicoff of Connecticut and a Senate subcommittee, Dr. Wayland J. Hayes, Jr., Chief of the Toxicology Section, Technology Branch, of the Communicable Disease Center in Atlanta, testified that one form of cancer, leukemia, has been produced in rats by use of a pure feed. In his own words: "We can synthetically produce leukemia in rats by a special purified diet, which we had wished to use for certain experimental reasons. The leukemia was transmissible from rat to rat . . . ."

The appearance of tumors in rodents that are subjected to large amounts of irritants over a major part of their lives is not surprising. Naturally, such tests can indicate the possibility of producing cancer or birth defects in rodents under extreme conditions; they do not prove that the amounts of such chemicals encountered in the human environment will or can produce cancer or birth defects in people or in other animals.

An Exercise In Futility – Zero Tolerance

The *toxic threshold* may be defined as the dose level of a test material below which toxic effects are not observed. This is a useful concept. It has an important practical application when scientists are called upon to assess the risks involved in the use of chemical tools that are considered indispensable for protecting our forests, our water resources and our food and fiber supplies. This practical concept, which has been used in the discussion of teratogens by the World Health Organization and the U. S. Food and Drug Administration, has been seriously challenged by the opposing concept of *zero tolerance*, which was given legal status in 1958 by the "Delaney clause" of the U.S. Food and Drug Law.

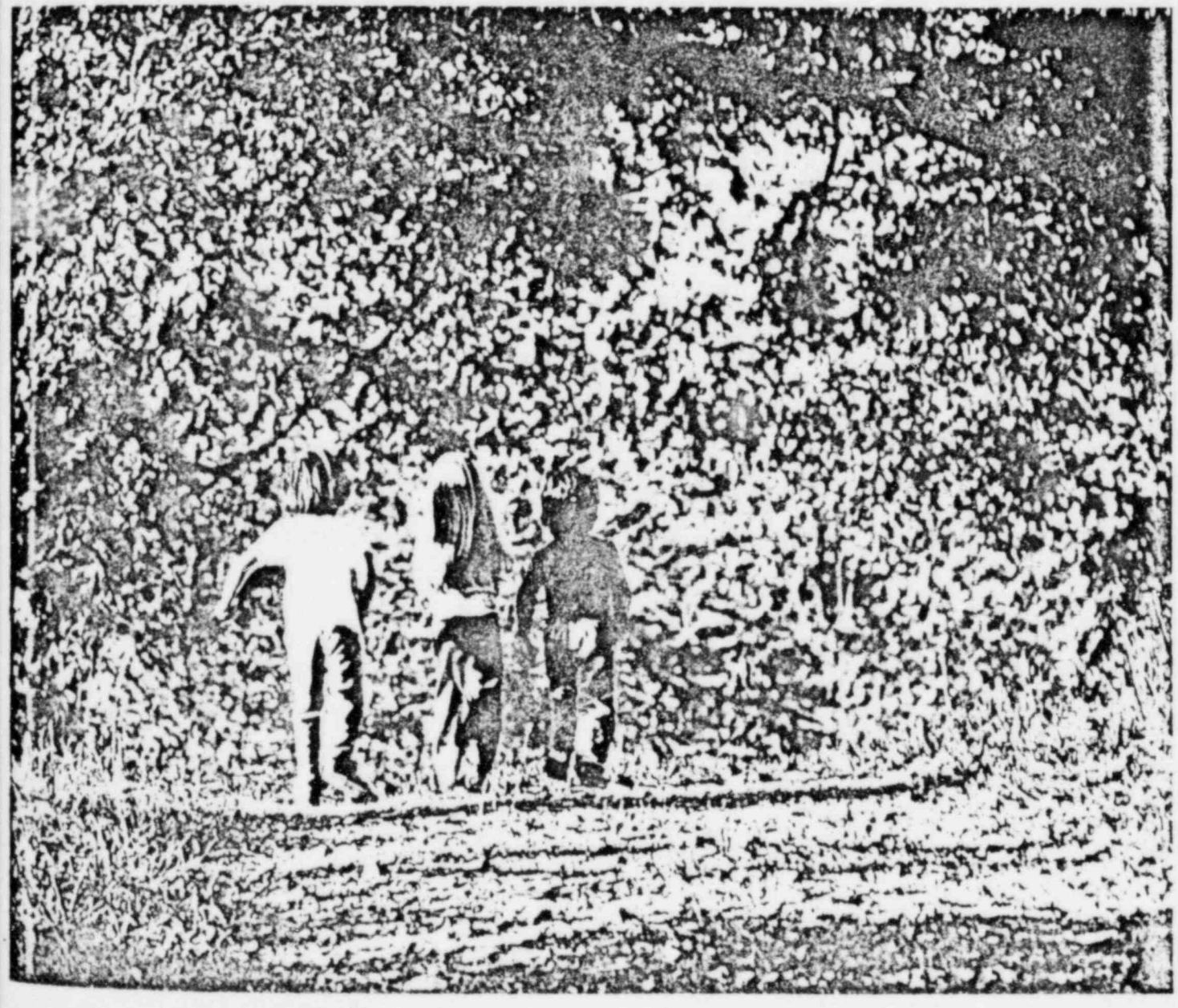
The proof of zero risk is patently impossible, both logically and scientifically, and strict application of the principle would impoverish the store of chemical tools now used in the control of dangerous pests and in environmental improvement. As our discussion progresses, we shall have more to say about the practical limits of testing and the validity of the threshold concept.

It is no exaggeration to state that any substance may be toxic at some concentration or in some volume, and that laws requiring proof of absolute freedom from toxicity are pointless. Chemists are now able to detect quantities of toxic materials so minute that their findings may be of little more than academic interest. One part per billion, for example, is equivalent to one minute in 1901 years and one part per trillion to about one minute in *1,901,000 years*.

James G. Wilson, Children's Hospital Research Foundation and Department of Pediatrics and Anatomy of the University of Cincinnati College, states that all chemicals will produce birth defects when applied at a high enough rate at the proper stage of development, if they do not kill the mother.

The important message is this — if you eat and drink sensibly, quit smoking, avoid non-prescribed drugs, and exercise moderately, you will be doing just about everything the normal person can do to protect your health. Home-grown, tree- or vine-ripened fruits and vegetables, when available, usually look and taste better than those that are mass-produced, picked green, and shipped from distant sources, but there is no special virtue to foods grown without pesticides and with manure rather than with synthetic fertilizers: those offered by your own grocer are as safe as any in the world.

If zero risk were required in the products of all industries, every company manufacturing motor vehicles would be shut down immediately and permanently, all physicians and surgeons would inevitably be deprived of their tools, and most other tools, machinery and chemical agents would be banned.



Accidental Poisonings Attributed To Pesticides.

The hazards involved in the use of pesticides are well recognized and documented. Like all tools, they must be handled properly to prevent injury to production workers and to farmers, foresters and other users. Pesticides, as commercial poisons, might be expected to represent a major source of injury. Assuming this to be the case, the U. S. Environmental Protection Agency (EPA) actually established a pesticide "hotline," with a toll-free number in Washington to receive reports of pesticide misuse or accidents. According to the EPA, "misuse of pesticides annually injures hundreds of thousands of farm workers and hundreds of these workers die."

What are the facts? First, what about the hundreds who allegedly die? According to statistics for the years 1971-73 published by the National Agricultural Chemicals Association, there were 13 fatalities from pesticides in 1971, 17 in 1972 and 10 in 1973. Of these, nine were from agricultural herbicides in 1971, five in 1972 and four in 1973.

Of course, not all poisonings result in death and not all are accidental. The following two tables prepared by the National Clearinghouse for Poison Control Centers show the incidence of poisonings from various causes.

According to the same source, children up to four years of age account for the greatest number of pesticide poisonings. In addition, most reports of ingestion of agricultural pesticides involve insecticides and rodenticides. Generally the hazard appears to be comparable to that of common household poisons. The greatest hazard is not to the user and not to the innocent bystander, but to children who should not be allowed access to the materials. To a large extent, the problem is to teach people to keep all poisons in their original containers in a safe place out of reach of children and to observe all label precautions. Most farm workers treat pesticides with respect, applying them as directed.

PRODUCT GROUP
Medicines
Cleaning & Polishing Agents
Petroleum Products
Cosmetics
Pesticides
Gases & Vapors
Plants
Turpentine, Paints, Etc.
Miscellaneous
Unknown
Total

PRODUCT GROUP
Medicines
Cleaning & Polishing Agents
Petroleum Products
Cosmetics
Pesticides
Gases & Vapors
Plants
Turpentine, Paints, Etc.
Miscellaneous
Unknown
Total

(1) Unknown intent; gesture; suicide intent.

TABLE 1 – Poisonings – All Products By Year And Number Of Incidents

ACCIDENTAL			SELF POISONING (1)			OTHER (2)			TOTAL		
1971	1972	1973	1971	1972	1973	1971	1972	1973	1971	1972	1973
45,921	54,223	52,206	20,953	10,634	24,080	8,298	9,275	11,331	75,172	84,132	87,617
15,388	19,798	18,601	338	355	357	773	1,099	1,250	16,499	21,252	20,208
4,792	5,711	5,739	43	56	60	186	315	446	5,021	6,082	6,245
6,748	9,306	9,327	52	54	72	115	105	216	6,915	9,465	9,615
5,370	6,260	5,958	170	219	208	906	1,175	1,336	6,446	7,654	7,502
117	204	162	7	28	10	857	1,046	1,113	981	1,278	1,285
5,801	6,739	7,599	45	47	50	469	601	813	6,315	7,387	8,462
5,819	7,111	6,680	73	78	89	458	562	827	6,350	7,751	7,596
7,875	10,670	9,746	128	188	258	2,008	2,407	2,772	10,011	13,265	12,776
911	1,411	895	746	681	701	733	900	692	2,390	2,992	2,288
98,742	121,433	116,913	22,555	22,340	25,885	14,803	17,485	20,796	136,100	161,258	163,594

TABLE 2 – Poisonings – All Products (Percent Of Annual Total Incidents)

ACCIDENTAL			SELF POISONING (1)			OTHER (2)			TOTAL		
1971	1972	1973	1971	1972	1973	1971	1972	1973	1971	1972	1973
46.5	44.8	44.7	92.9	92.3	93.0	56.1	53.3	54.6	55.1	52.3	53.5
15.6	16.5	15.9	1.5	1.7	1.5	5.2	6.2	5.9	12.2	13.3	12.4
4.9	4.7	4.9	0.1	0.3	0.2	1.3	1.8	2.2	3.7	3.8	3.8
6.8	7.8	8.0	0.2	0.2	0.3	0.8	0.6	1.0	5.2	6.0	5.9
5.4	5.2	5.1	0.8	1.0	0.8	6.0	6.7	6.4	4.7	4.7	4.6
0.1	0.1	0.1	<0.1	0.1	<0.1	5.8	6.0	5.4	0.7	0.8	0.8
5.9	6.4	6.5	0.2	0.2	0.1	3.2	3.4	3.9	4.6	4.6	5.2
5.9	5.5	5.7	0.3	0.3	0.3	3.1	3.1	4.0	4.6	4.8	4.6
8.0	8.3	8.3	0.6	0.8	1.0	13.5	13.8	13.3	7.5	8.2	7.8
0.9	0.7	0.8	3.4	3.1	2.8	5.0	5.1	3.3	1.7	1.5	1.4
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(2) Kick trips; inhalation; unknown; miscellaneous. *Source:* National Clearinghouse for Poison Control Centers

The following table prepared by the Department of Health, Education and Welfare (HEW) gives the number of deaths by age due to accidental poisoning by pesticides, fertilizers and plant foods. The apparent discrepancies between the following data and those quoted earlier are to be attributed to the varying definitions of what constitutes a pesticide. As in the other charts, the category "pesticides" includes rodenticides.

AGE	1970	1971	1972	1973
Under 5	14	14	18	10
5 - 14	6	7	2	3
15 - 24	5	6	4	5
25 - 44	5	5	4	5
45 - 64	4	5	4	4
65 and over	10	6	6	5
Not Stated	—	—	—	—
Total	44	43	38	32

The number of deaths due to pesticide poisonings was relatively moderate even before the new generation of pesticides became available and arsenicals were still in common use. Carrying the data back to 1965, we find that the total at that time was 65. In 1946, it was 77. Thus there has been improvement, possibly due to better safety education.

It is to the credit of the EPA that the "hotline" was promptly discontinued and that the exaggerated report of deaths of farm workers was repudiated. The fact that the incident occurred, however, is an indication of how widespread the unreasoning fear of pesticides has become and how easily false information can affect the responses of government agencies.

The World Food Crisis

It is difficult for the average American to comprehend the magnitude of the world food crisis. Even in these times of high unemployment, poor Americans are far better fed than their counterparts in most of the world. The population of the United States accounts for no more than six percent of the world's human inhabitants, yet this relatively minor group controls roughly half the income and produces about 60 percent of the food supply.

According to *Food and Population: The Next Crisis*, by Douglas N. Ross, more than two billion people in the least industrialized regions of South Asia, Central Africa, and South America live at subsistence food levels, and "some beginnings of mass starvation are likely to appear before 1985 if there are any falterings in crop yields."

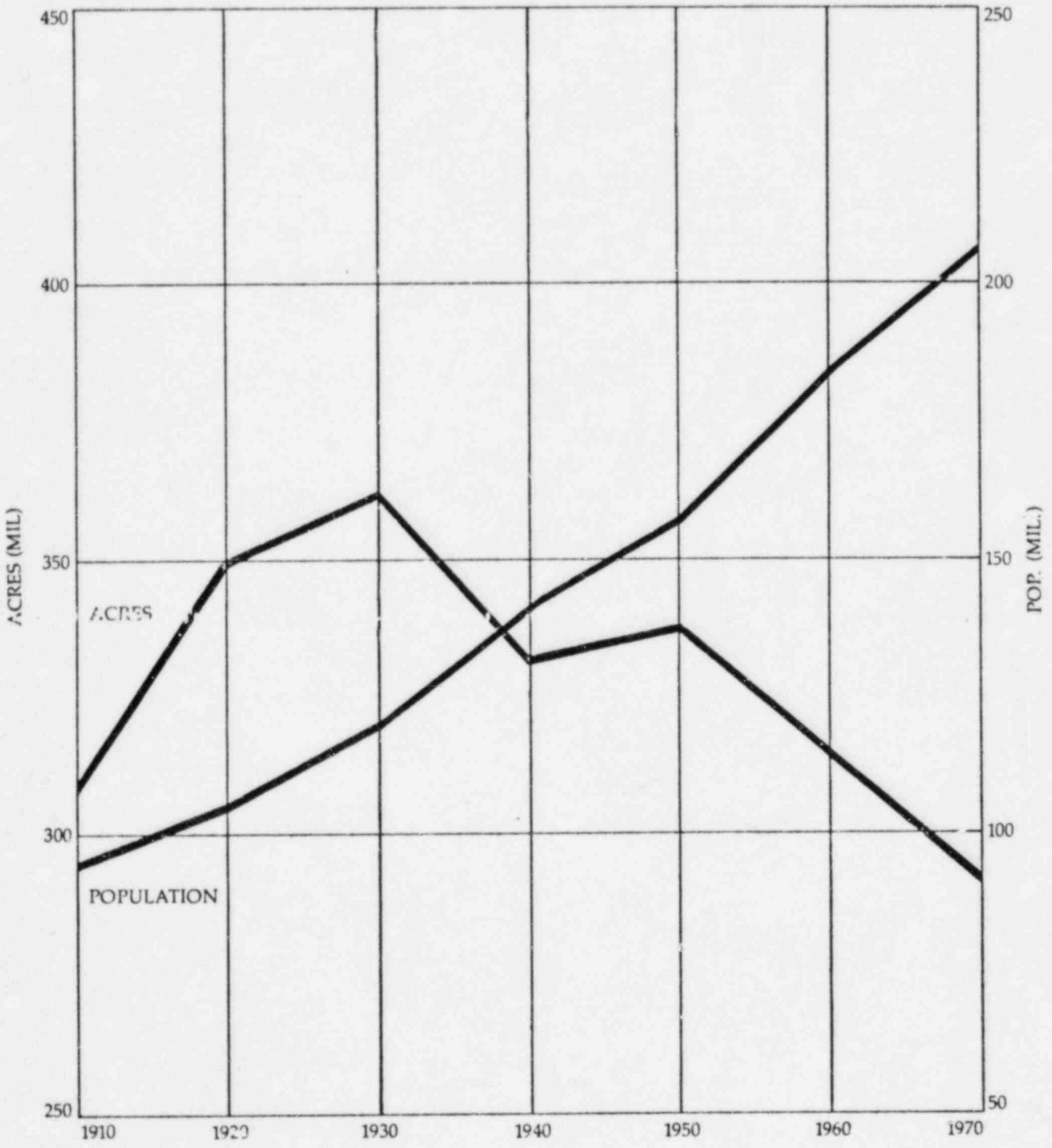
American agriculture, like that of other technologically advanced nations, has made great strides in productivity over the past 20 or 30 years. In the United States, millions of people have left the farm, yet those remaining have managed to raise enough food to nourish a rapidly growing population and export enormous quantities of wheat and other farm commodities to less productive areas.

The figure on page 17 clearly shows the enormous increase in the American population since 1910, the increase in crop acreage between 1910 and 1930, and the subsequent significant decrease in crop acreage.

The figure on page 18 shows the dramatic increase in yields per acre of several crops since approximately 1940 after many decades of almost constant productivity.

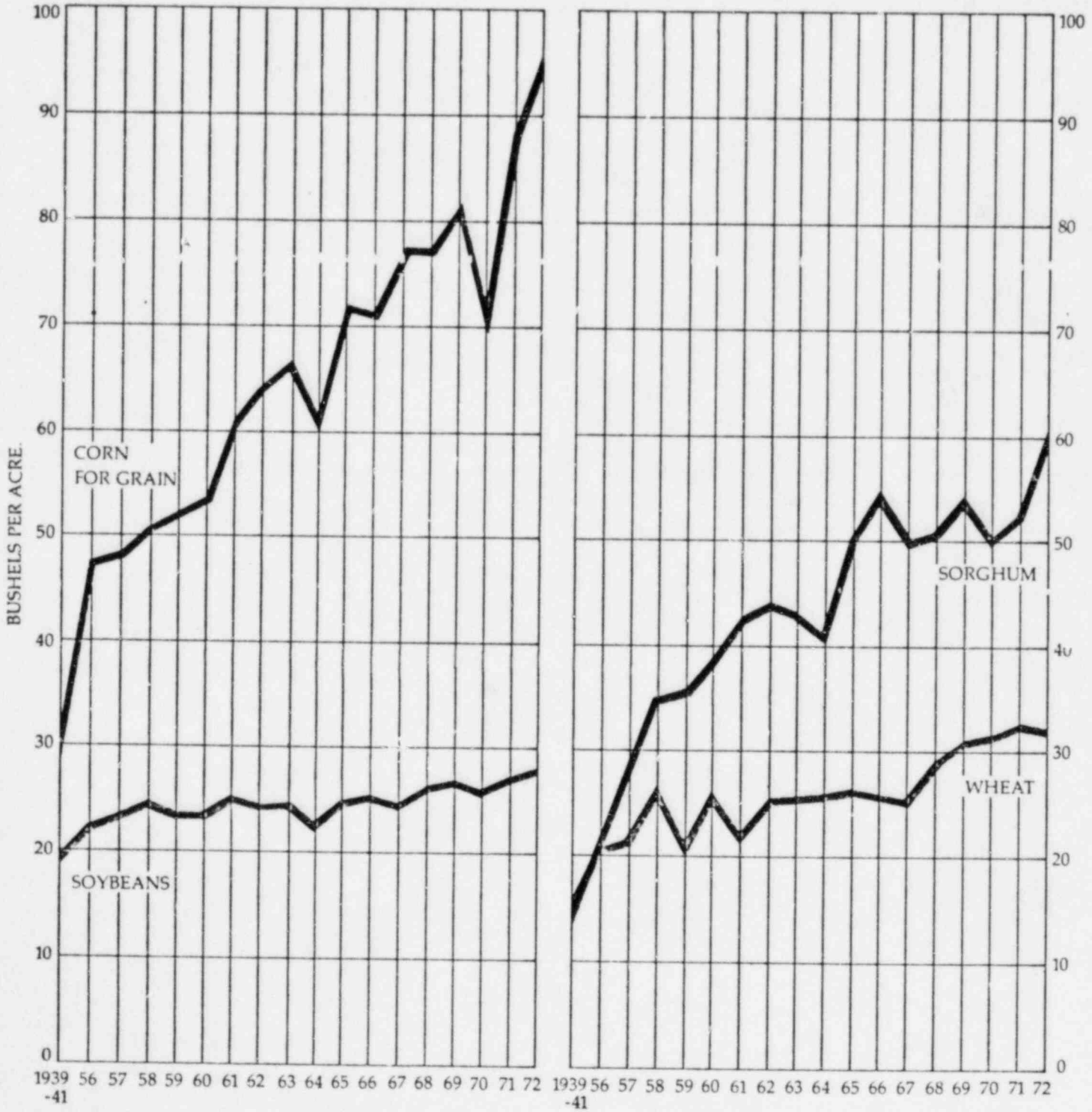
In Nairobi, during the third annual meeting of the United Nations Environmental Program, one of the delegates asked (perhaps rhetorically) whether pesticidal contamination through efforts to grow more food would be better or worse than malnutri-

Effect Of Increased Yields On Ratio Of Crop Acreage Harvested To Population: United States, 1910-70.



Source: The Food In Your Future, Keith C. Barrons, Van Nostrand Reinhold, 1975.

Production Per Harvested Acre Of Select Crop By Year In The United States (48 States)



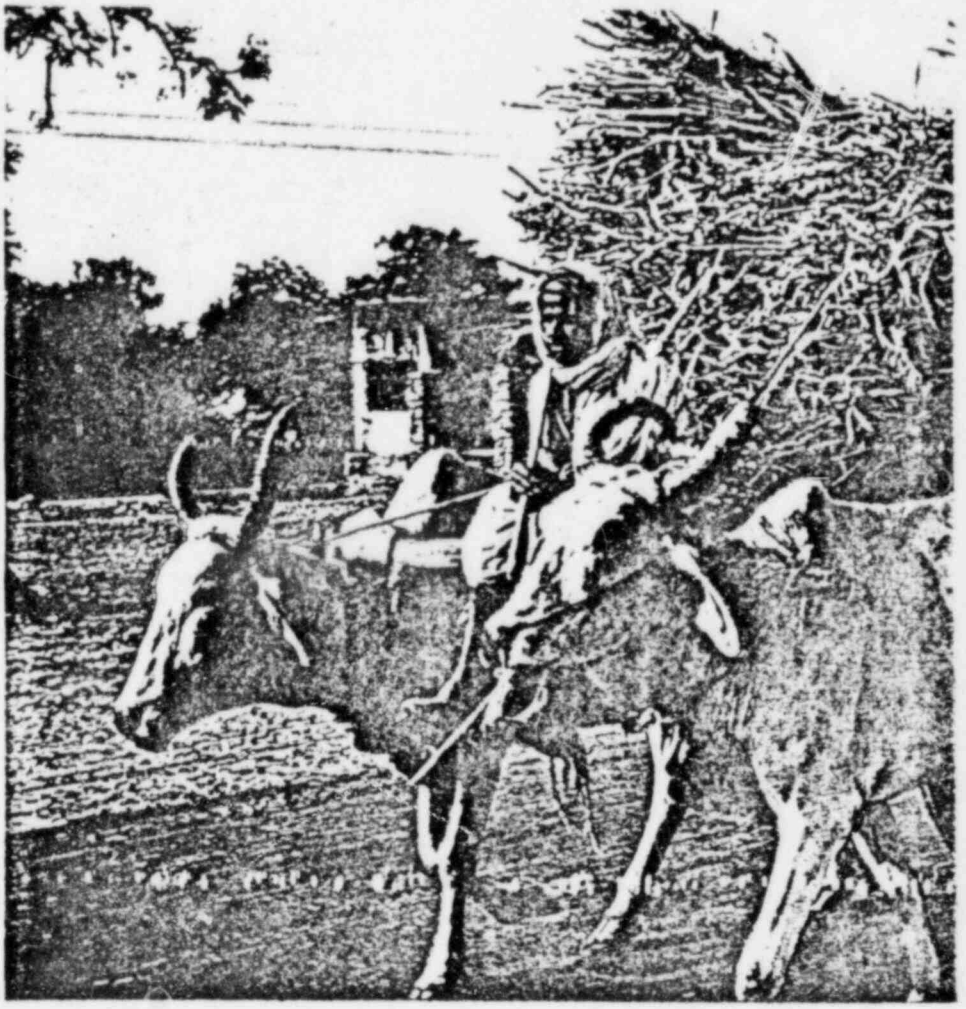
Source: U.S. Department of Agriculture. *Agricultural Statistics 1972*. United States Government Printing Office, 1972.

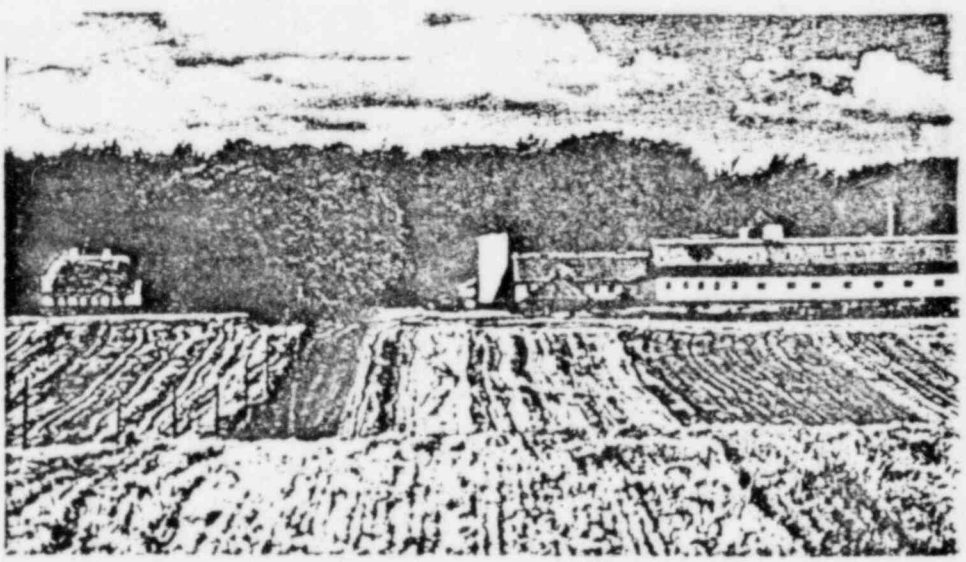
tion due to inadequate food. It is not certain whether his query was motivated by a wish to express traditional conservatism or by a genuine hunger for objective facts. His delegation was from India. Indira Gandhi, on the other hand, in the 1975 Book Of The Year of the *Encyclopaedia Britannica*, wrote: "The scarcity of pesticides may strike developing countries with even more severity than the fertilizer shortage."

Naturally the yield revolution in the United States cannot be attributed solely to the use of pesticides. Credit must also be given to better management practices, better fertilization, genetically improved crop varieties and increased mechanization. Pesticides, however, are essential to our continued success in increased food production, and probably account for about 20 percent of the increase since 1940.

An executive report to President Nixon in 1970 stated: "It is believed that one of the most economical and effective ways to further increase the food supply involves more intensive agriculture on lands already under cultivation. This course probably will necessitate greater use of agricultural chemicals. For example, it has been estimated that the world use of pesticides may need to increase from the 120 thousand metric tons used in 1966 to 700,000 metric tons to double food production."

Estimates based on current usage of phenoxies suggest that banning these herbicides alone might result in a loss of 290 mil-





lion dollars a year in farm production, even at 1970 prices. Labor requirements would possibly be increased by 20 million man-hours, and 5.7 million acres now in use for recreation or wildlife habitat might have to be put back into food production.

American farmers would certainly forego the sizeable outlay of funds for pesticides if they dared. They realize, however, that the output of their farms without pesticides would be reduced immediately by about 25 percent and the price of their products increased some 50 percent. It is estimated that American farmers spent nearly three billion dollars in 1974 for pesticides and their application—a tremendous sum, but a necessary expenditure.

In spite of an increase of some 42 percent in food prices in the United States between 1972 and 1975, the percentage of income spent on food has been estimated to be lower in 1975 than it was in 1930. Between 1960 and 1973, the percentage dropped from 20 percent to an estimated 16.4 percent.

Inflation has taken its toll during the past few years, but the overall record is a good one, made possible only by the efficiencies of modern agricultural methods. Increased materials costs due to overregulation and the depletion of the farmer's arsenal of agricultural tools, particularly pesticides, would certainly change that record drastically. Worse yet, the next food crisis could be our own. The question could well be: "Which 50 million Americans will suffer or die of malnutrition?"

Food Expenditures And Income Trends, 1960-73

YEAR	INDEX, 1960 = 100		Food Expenditures as Percentage of Income
	Disposable Personal Income	Food Expenditures[1]	
1960	100.0	100.0	20.0
1961	104.1	102.8	19.8
1962	110.1	106.1	19.3
1963	115.6	109.1	18.9
1964	125.2	114.9	18.4
1965	135.2	122.4	18.1
1966	146.2	131.2	18.0
1967	156.1	134.0	17.2
1968	168.8	142.3	16.9
1969	181.2	148.5	16.4
1970	197.6	159.9	16.2
1971	213.1	167.6	15.7
1972	227.7	178.3	15.7
1973[2]	251.1	205.0	16.4

[1] Excluding alcoholic beverages.
[2] Estimated.

Source: Handbook of Agricultural Charts. Based on data of Department of Commerce.

The 2,4,5-T Rumble – What Is It All About?

Few herbicides have been as highly praised or thoroughly maligned as 2,4,5-T. The phenoxy herbicides, 2,4-D and 2,4,5-T, which have been widely used for some 25 years, are two of the most highly respected, trusted tools of the farmer and forester. Their use was never seriously challenged until the U. S. forces in Vietnam began defoliating the jungles with Agent Orange, a herbicidal mixture containing 2,4,5-T. Suddenly, in newspapers and magazines and on the air, the familiar farm chemical 2,4,5-T was being denounced as a war material, dangerous to man and beast—a destroyer of woodlands and a threat to humanity that probably caused abortions and birth defects, possibly even cancer.

For example, in September 1974, the Moscow correspondent of the Baltimore Sun, after interviewing a North Vietnamese doctor, wrote a scathing denunciation of the herbicide, which began: "While American authorities continue to debate whether the chemical herbicide 2,4,5-T is too deadly to use, hundreds of Vietnamese are developing liver cancer almost certainly as a result of the defoliant's widespread use in Indo-China for a decade." *Science* magazine reported that Vietnamese mothers were giving birth to monstrous babies and that many mothers had to be deliberately aborted of the "bundle-like" fetuses to avoid bleeding to death. Many newspapers have carried emotion-charged reports characterizing brush control with 2,4,5-T by the U. S. Forest Service as "biological warfare."

These charges against 2,4,5-T, and others too numerous to report here, have been given wide publicity. Less well-known are the results of investigations reported in 1975 by a task force created by the Council for Agricultural Science and Technology, a tax-exempt national organization composed of 15 scientific societies related to agriculture and forestry.

The report of this task force offered the following conclusions:

☐ *"The committee could find no conclusive evidence of association between exposure to herbicides and birth defects in humans.*

☐ *"Claims that the herbicides have rendered the soil permanently sterile; that is, unfit for any plant growth are not supported by chemical and biological studies of herbicide persistence in the soils of South Vietnam and are contrary to worldwide experience with the herbicides used.*

☐ *"The safe and effective use of herbicides on agricultural forest and industrial lands in the United States has been amply demonstrated.*

☐ *"The atypical military usage in South Vietnam has no relation to, and no bearing on, the peaceful uses of herbicides in the United States and throughout the world."*

The National Academy of Sciences, at the request of the Congress also conducted a study on the effect of herbicides in South Vietnam. The committee consisted of 17 scientists from six countries, representing a broad spectrum of disciplines. This committee found no damage to soils. There were herbicide traces in the soil, but not sufficient to retard plant growth. They estimated that cultivated areas on which crops had been destroyed could be replanted within one year. It was also concluded that the death of vegetation has not had lasting effects on plant nutrients within the ecosystem, with the possible exception of potassium. The NAS study group also found no evidence of soil hardening serious enough to render the areas barren. And, in their words, "The Committee could find no conclusive evidence of association between exposure to herbicides and birth defects in humans."

According to Dr. Boysie E. Day, Professor of Plant Physiology at the University of California, Berkeley, scientists are "in general agreement that 2,4,5-T is a plant killer, not an animal killer." According to Dr. Day, 2,4,5-T has less potential for causing birth defects than such everyday chemicals as aspirin, Vitamin A, Vitamin C, and common table salt. Speaking at the 27th annual California Weed Council, Dr. Day stated, "After five years of agonizing over 2,4,5-T, the EPA has withdrawn all proceedings against this compound. The EPA is right about this. They have seen the scientific evidence for this move, but they are taking terrific abuse from uninformed people."

According to Dr. R. G. Harvey, University of Wisconsin agronomist, there is an 8000-fold safety factor in normal use of 2,4,5-T over the amount necessary to cause embryonic effects in rats. If a 130-lb woman ate 3.3 lbs of food every day that contained 0.2 parts per million of 2,4,5-T, her total consumption would be 0.3 mg/day, which is more than 8000 times less than the levels shown to cause birth defects in six animal species, including rats, mice, sheep and monkeys. The average woman is not likely to encounter the herbicide in her diet in any amount, even occasionally. And if by some rare chance she came into contact with traces of 2,4,5-T, it is unlikely that they would amount to as much as 0.2 parts per million. A survey of food samples collected over a period of 13 years showed only three samples that contained any traces of the herbicide. In those three, the levels were 0.001, 0.008 and 0.19 parts per million. The 8000-fold safety factor is obviously conservative. Referring to silvex or 2,4,5-

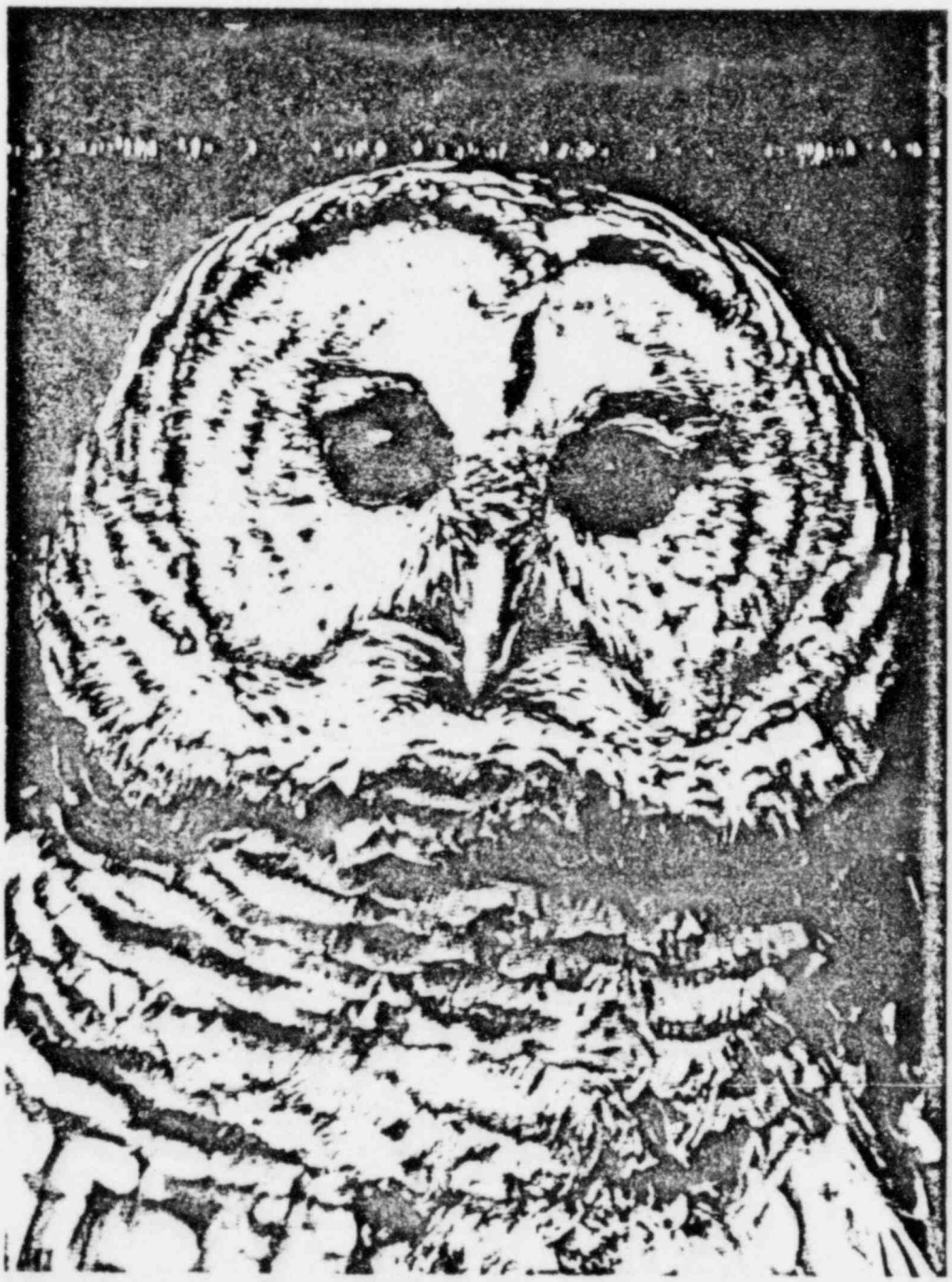
TP, a relative of 2,4,5-T also containing dioxin, Dr. Harvey stated that the 130-lb woman would have to drink 48,000 gallons a day of the material as applied to get the minimal effect.

Actually 2,4,5-T itself is not a particularly hazardous herbicide. The great controversy rages over the presence of minute traces of a very toxic chemical, 2,3,7,8-tetrachlorodibenzo-p-dioxin, better known as TCDD, or simply dioxin, an impurity formed in the process of manufacturing the herbicide. The average amount of dioxin in Agent Orange, as used by the U. S. Air Force, was approximately 1.91 parts per million on a weight basis. By contrast, the dioxin content of the farm herbicide currently used is much lower. A 1975 survey of ten lots of a commercial formulation containing 2,4,5-T showed dioxin contents in 9 samples ranging from 0.01 to 0.02 parts per million. The content of the tenth was 0.04 parts per million. We have noted that Agent Orange, which was literally dumped on Vietnam, has not been implicated in any observed cases of cancer or birth defects by the scientific task force investigating its use. Unlike the Air Force chemical, the farm herbicide, 2,4,5-T, is used carefully in limited controlled quantities and in accordance with EPA-approved label instructions.

According to Dr. Philip C. Kearney, Laboratory Chief, Pesticide Degradation Laboratory, Agricultural Environmental Quality Institute at Beltsville, Maryland, whose laboratory received the USDA Superior Service Award in 1974 for dioxin research, science knows the following about dioxin in the environment:

- ☐ "TCDD does not leach vertically in soils."
- ☐ "Significant amounts of TCDD are not taken up by plants and none could be found in harvested grain or soybeans."
- ☐ "TCDD disappears slowly from soils and about half is lost after 1 year. It is less persistent than most chlorinated hydrocarbon insecticides, but more persistent than 2,4,5-T."
- ☐ "TCDD is not translocated from the point of application on the leaf surface to other parts of the plant. Some of it is washed off with rainwater."
- ☐ "TCDD destruction may be caused by sunlight in water, but not on soil surfaces."
- ☐ "TCDD is not made from the breakdown products of 2,4,5-T in soils or in sunlight."
- ☐ "Large amounts of TCDD fed in animals' diet can be eliminated in the urine and feces, although there are some residues in the liver."
- ☐ "TCDD was accumulated from water by fish in laboratory studies. Recent field monitoring data suggests this may not be a problem."

Stated briefly, TCDD (dioxin) is not likely to accumulate in the soil. Moreover, the herbicide, 2,4,5-T, does not create further quantities of dioxin as it decomposes. Most scientists believe (and Dr. Kearney is apparently one of that number) that 2,4,5-T can be used safely with dioxin contents as high as 0.1 part per million, a much higher rate than that found in commercial formulations as they are currently applied.



False Rumors Never Die – They Don't Even Fade Away

Despite the weight of evidence to the contrary, the shrillest opponents of 2,4,5-T still claim that it was developed as a weapon of war, that its impurities are building up in the environment and slowly poisoning the population, that it provokes cancer and birth defects, that it is little used by farmers, and that its social values are slight compared to its hazards. These charges are heard again and again at hearings, principally in the testimony of laymen. The attackers choose to ignore the herbicide's extensive use in agriculture and forestry for more than a quarter of a century; they misquote government reports to alarm the public about the increase in cancer, failing to acknowledge that the major increase is in lung cancer and that rural dwellers are generally less subject to cancer than city dwellers are. They also spread unfounded allegations of human poisonings and birth defects which, without evidence, they attribute to the use of 2,4,5-T. New horror stories appear from time to time, make the rounds of the newspapers and some magazines, achieve wide publicity and leave poisonous residues that build up and persist in the public's mind long after belated publication of the retractions and corrections.

For example, in late 1974, spectacular news stories appeared in many papers denouncing the herbicide 2,4,5-T as the source of dioxin which was implicated in human poisonings and in the deaths of 63 horses, 12 cats, 5 dogs, and hundreds of wild birds in eastern Missouri. Bold, strident headlines denounced the herbicide, and the most spectacular of the reports rehearsed many of the familiar but unjustified charges against 2,4,5-T. But it was eventually discovered, long after these inflammatory accusations had made their rounds, that the dioxin in question had been released in relatively high concentrations, not from the use of a herbicide, but as a contaminant in waste oil that had been spread on three horse arenas and one road in 1971 to control dust. Nor were herbicides even the original source of the poison: it had been created as an impurity in the production of hexachlorophene, a chemical formerly used as an antibacterial cleanser.

But one of the most damaging reports arose in 1975 from the premature publication of inaccurate test results by the EPA itself, although in the past that agency consistently resisted efforts by opponents of 2,4,5-T to ban the herbicide. This unfortunate announcement was prompted by a letter from 21 congressmen to the

EPA Administrator urging that use of 2,4,5-T be suspended or that hearings be resumed. In the words of the congressional group, "the risk to public health from the use of 2,4,5-T on rice is unequivocally greater than any social value derived from such use." The reference to rice is surprising, since water and fish from a reservoir in Arkansas, in which irrigation water is collected from rice fields protected for 20 years with 2,4,5-T, have been tested by use of the most refined and sensitive equipment currently available and found to contain no traces of dioxin, even though the average detection limit is below 10 parts per trillion.

The EPA responded to the congressmen by reporting incomplete results of residue tests on beef fat samples from cattle grazed on rangeland that had been treated with 2,4,5-T. The EPA noted that 34 of 100 beef fat samples had been analyzed and that about one-half of the 34 showed positive dioxin residues. In a memorandum to the Deputy Assistant Administrator for Pesticide Programs, the agency wrote that the dioxin residues in about one-half of the 34 samples "may be above the normal margin of safe dietary exposure." The memo further explained that "studies including teratogenic and other toxicity effects indicate" that these levels "may present a health hazard to man based on the application of normal margins of safety."

This message was promptly picked up and reported throughout the country: "EPA has found unsafe levels of TCDD in half of beef fat samples derived from cattle grazed on rangeland previously treated with the herbicide 2,4,5-T." Opponents of the pesticide naturally enlarged upon this damaging statement.

The truth is that the material was not properly identified, since the equipment used in these preliminary analyses was limited in its ability to discriminate among the various components being studied. In chemical analysis, such indefinite readings are commonly referred to as "noise" or "background." Subsequent studies using the technique of high-resolution mass spectrometry have disproved these erroneous allegations. At the present writing, 90 percent of the samples have been thoroughly studied without any finding of dioxin content. EPA scientists agree. The remaining ten percent cannot be proven to have a dioxin content. But, when all the facts are in, it will be difficult to undo the damage created by the erroneous reports.

Another false report was put into circulation in February and March 1976 in testimony before the Committee on Environment and Natural Resources of the Minnesota House of Representatives by supporters of a bill to ban the use of 2,4,5-T in that state, who stated that the herbicide is already banned in British Columbia. This statement has been contradicted by Dr. Alexander B. Morrison, Director of Health Protection in Canada. Dr. Morrison, who de-

scribed the hazard from 2,4,5-T as unbelievably low, stated that the production and sale of 2,4,5-T in Canada is permissible with a maximum dioxin content of 0.1 part per million, the same limit that is in effect in the United States.

"I believe," he said, "that there is not the slightest evidence that the dioxin content of 2,4,5-T preparations available for sale in this country has caused the slightest bit of harm. There's just not any evidence of that at all.

"If we were to go back and accept discredited American work, which we're not prepared to do, but if we did that and took the level of 20 parts per trillion in animal fat, as the Americans thought they had, we would find that in order to achieve a teratogenic dose you would have to eat a thousand pounds of fat a day.

"Now that represents in turn about 10 steers. So, if you can eat 10 steers a day you might get enough dioxin to give you a teratogenic dose. You'll die long before the teratogen gets to you if you try and eat 5,000 pounds of beef a day."

Enough said about 2,4,5-T. The story of this one herbicide has been given in some detail because it is under severe attack now. Loss of such herbicides to the farmer and the forester through misunderstanding of their value and their hazards, would be a great loss to the public.

Saving The Environment – Science Holds The Key

"We are today witnessing the inevitable impact of the tidal wave created by the scientific revolution more than a century old. It is simply too late to declare a moratorium on the progress of science.

"The real question is not whether *we should use our new knowledge, but* how *to use it."*

Barry Commoner,
Science In Survival

Herbicides Help Reduce Erosion, Conserve Water, And Improve Wildlife Habitat

Bulldozing and earthmoving can contribute to erosion. Brush that crowds in and takes over the open spaces is of little value since it has limited ability to anchor the soil; in fact, many species, such as mesquite, are almost as efficient as blotters in robbing the soil of moisture and nutrients. The best protection against erosion is a good thatch of grass, which can be established without difficulty when selective herbicides are used properly for brush control. In the southwest, vast areas have been returned to native grasses "as high as a horse's belly," where mesquite and other undesirable brush, seeded long ago in the manure of cattle and droppings of birds, or sprouted from fence posts, had formerly grown unwanted but unchecked. In the region between the Rocky Mountains and the Sierras, similar results have been obtained by eliminating sage and chaparral. In both areas the result has been to return the land to its original condition after long years of misuse.

In West Texas, a 20-mile-long stream, Rocky Creek, which had dried up early in the 1930's was recently restored to life by cutting brush and spraying 2,4,5-T herbicide. This is not surprising. People in various countries who are concerned with water conservation and watershed management have long appreciated the importance of chemical brush control in programs to increase available surface and ground waters.

Why is a large pine forest so quiet? Possibly because its carpet of needles and the overtopping shade provide too sterile an environment for many animals. Enlightened wildlife management people provide clearings in both pine and hardwood forests, where deer, rabbits and other animals can find browse. The least disruptive way to accomplish this is to use herbicides. Such clearings have been created successfully in northern Wisconsin, for example, by Department of Natural Resources crews using TORDON® brush killer.

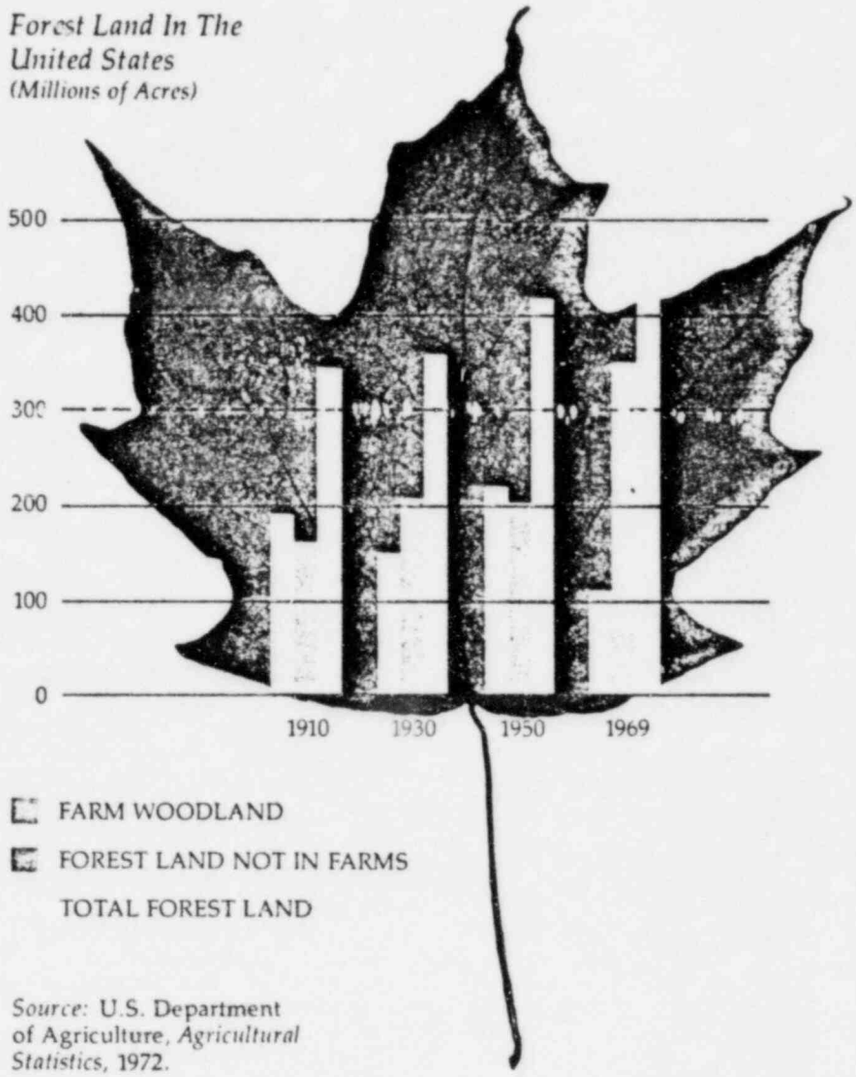
Firebreaks must be maintained to control forest fires, and right-of-way areas must be kept cleared. Long experience has shown that chemical control of vegetation in right-of-way corridors and firebreaks is the most effective way to prevent regrowth. Chemical control also reduces the need for repeated mechanical disturbance of the soil: the result is far less erosion. By selective spraying, leaving low desirable shrubs such as rhododendron and berry bushes, right-of-way areas have been made attractive to deer and other wildlife.

In Pennsylvania, a 15-year study on a utility right-of-way showed that the sprayed area was taken over by original ground cover plants such as bracken, sedges, herbs and blueberry. These studies, which were reported in 1967 in the Purdue University Agricultural Experiment Station Research Bulletin, also indicated that rabbits, grouse and wild turkeys actually preferred the sprayed corridor to the adjacent woods.

Summarizing five-year findings on stump control in which fenuron and 2,4,5-T were used following timber clearcutting, Dr. Robert Shipman of Pennsylvania State University reported that no harmful effects had been observed on non-target organisms such as insects, wildlife and man. The treatment improved tree reproduction and increased the availability of browse for deer. According to *Lancaster Farming*, January 25, 1975, "Soil organic matter, nitrogen, calcium and phosphorus increased during the five-year period. The findings indicated that nutrients are recycled rapidly in cutover mixed oak-hickory stands. Concern over deterioration of the forest ecosystem from a nutrient-loss stand[illegible]nt was minimal under these[illegible] and site conditions."

[illegible]y used in forestry, herb[illegible]n help restore America's [illegible]resources. The increased [illegible]duction resulting from [illegible]n farms also permits [illegible]n of land that otherwise could be cultivated for food production in a hungry world.

Forest Land In The United States
(Millions of Acres)



Source: U.S. Department of Agriculture, *Agricultural Statistics*, 1972.

Regulation And The Danger Of Overregulation

"Knowledge will forever govern ignorance, and a people that mean to be their own governors must arm themselves with the power that knowledge brings."

James Madison

It would appear obvious from the evidence just presented that insecticides and herbicides, properly used, are not among the most hazardous elements of our environment. Medicines, motor cars, machinery of every description, all present greater threats to our lives and well-being. This is not due to any virtue of the pesticides themselves, but rather to the care used in their production, distribution and use.

Environmental awareness in the 1960's produced a spate of new laws along with agencies committed to their enforcement. On the whole, the laws and agencies, including the Environmental Protection Agency, can serve the public well. It is doubtful whether further complications and red tape will improve performance. On the other hand, it can be demonstrated that revisions and restrictions requiring further expenditures of time and money would not only discourage the development of new, sorely needed products, but would increase the ultimate cost of pesticides to the farmer, forester and homeowner, and the prices of foods and other commodities in the marketplace.

A Brief History Of Regulation

Pesticides have been under government regulation since 1910, following enactment of the Federal Insecticide Act, which was administered by the United States Department of Agriculture (USDA). With the revised Federal Food, Drug and Cosmetic Act of 1936, accountability was shifted to the Food and Drug Administration, and that agency was made responsible for testing materials to prove them "poisonous or deleterious" to the satisfaction of the court when action was desired to remove them from the market. The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), enacted in 1947, extended the scope of the 1910 act to include rodenticides and herbicides. Premarketing registration was required for products to be shipped interstate, and a system of label claims and registration was established. The act was enforced by the USDA. In 1954, The Pesticide Chemicals Amendment to the Federal Food, Drug and Cosmetic Act provided for a system of fees to support the procedures involved and established better procedures for obtaining tolerances to be used in determining possible exemptions for pesticides. It was administered by the Department of Health, Education and Welfare (HEW). The Food Additive Amendment of 1958 expressly excluded pesticidal chemicals, pesticidal residues on crops and in processed foods when such residues had resulted from legal uses of pesticides on crops. This amendment included the "Delaney clause" on carcinogens, which stated that no additive shall be deemed safe if it is found to induce cancer when ingested by man or animals. The Federal Environmental Pesticide Control Act of 1972 significantly amended the FIFRA of 1947. It is administered by the EPA. This act does the following:

☐ *Requires all U.S. pesticides to be registered or approved by the Federal Government;*

☐ *Classifies pesticides for general or restricted use–those that are restricted to be applied only by or under the supervision of certified applicators due to hazard to the individual or to the environment;*

☐ *Establishes state applicator certification programs (in which farmers may be certified as private applicators) and cooperative enforcement programs;*

- ☐ *Prohibits the misuse of pesticides (any use inconsistent with the label is a crime, whether or not personal or crop injury results or residue exceeding the tolerance is found at harvest), adds civil to increased criminal penalties, and otherwise strengthens enforcement;*
- ☐ *Shortens administrative review procedures;*
- ☐ *Requires pesticide-producing establishments to be registered and to submit information regularly on production and sales volume;*
- ☐ *Authorizes indemnification of certain owners of pesticides that are suspended, then cancelled; and*
- ☐ *Authorizes the EPA Administrator to establish pesticide packaging standards, regulate pesticide and container disposal, issue experimental use permits, conduct research on pesticides and alternatives and monitor pesticide use and presence in the environment.*

It is obvious that the pesticide producers and users are already operating under regulations which can serve and have served to minimize the hazards of pesticide products. The requirements for testing and providing data for registration, re-registration and application of these products are stringent and costly. We feel that the pesticide industry and the public are both amply protected. The low number of poisonings attributed to these products and the overall good health enjoyed by farmers and rural dwellers testifies to the success of the current measures.

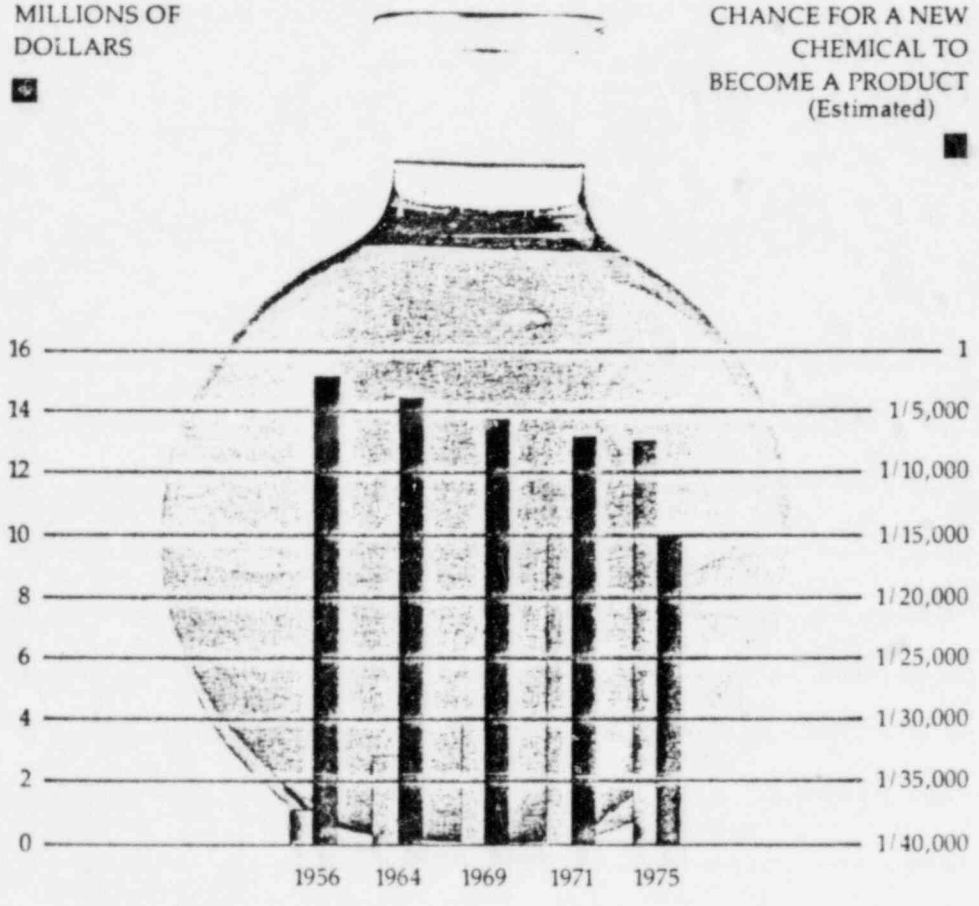
As we have seen, despite frightening headlines and impassioned oratory against the use of herbicides and insecticides, Americans can eat freely of the bounty of their land without fear of being poisoned. They are already witnessing a slow but positive cleansing of the air and water. But not all the credit belongs to the enforcers. The producers of agricultural chemicals can boast of a long, but unpublicized history of concern for the consumers of their products. In fact, the most refined techniques of purification and testing were developed by industry, and industrial laboratories still perform most of the elaborate tests required to ensure the purity and safety of their products, often performing investigations for the United States Government, under contract.

It should be kept in mind that all uses of pesticides and all methods of pesticide application that are now permitted in this country are registered with the U.S. Environmental Protection Agency. Any practice resulting in high residues or hazards to public health could result in withdrawal of the registration.

The Cost Of Developing Pesticides

Making a new agricultural chemical available is a costly, time-consuming process. After a new product is discovered, it is usually not ready for market for at least eight or ten years. The costs are enormous. Inflation has contributed greatly to the increase, but growing registration costs are also an important factor. Part of these costs result from the larger staff required for the increased registration activities. At The Dow Chemical Company, for instance,

Estimated Cost Of Developing An Agricultural Chemical



Source: Proceedings of the 30th North Central Weed Control Conference, Milwaukee, December 1975. From a paper presented by Dr. Wendell Mullison.

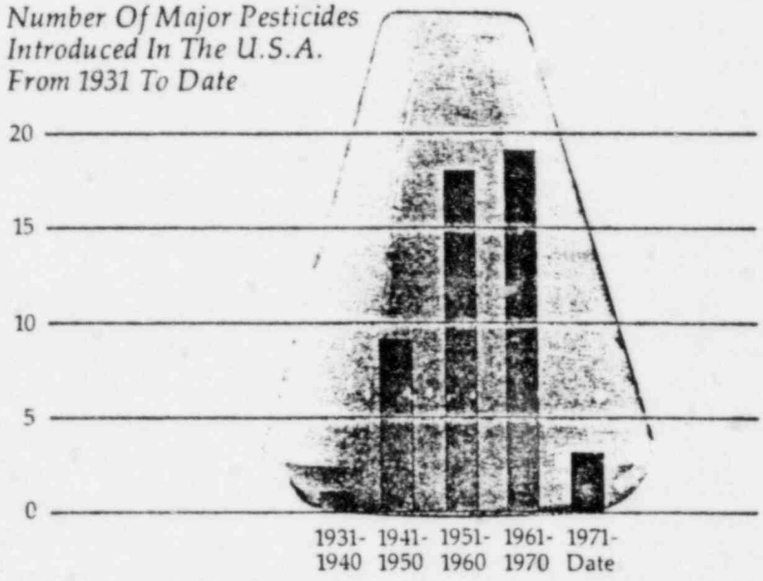
there was nobody engaged full-time in registration work in 1956. Today, Dow has 18 full-time professional and support people working on registration procedures, aided by personnel from other departments.

The increased cost, partly owing to increasing stringency of tests, has had an adverse effect on the number of major pesticides introduced within the past few years. Actually many unnecessary regulations are proposed by members of the legal staff of the agency, people who have only a minimal practical knowledge of agriculture. As a result, scientists are often unable to comply fully with the requirements. In such instances, industry must operate under doubtful rules which have the force of law but go far beyond the intent of the lawmakers. The next table indicates what has been happening to new developments since 1970, compared to similar activities in the years between 1941 and 1970.

The following table shows how our research dollars are being spent as a result of increased registration requirements:

The present law has been costly, but it has provided a wide margin of safety to the public. New regulations, however, and excessively expansionist interpretations of existing legislation, would increase the bureaucracy almost beyond comprehension, drastically increase the cost of producing pesticides and the ultimate cost to the consumer. These would grant broad discretionary banning powers to

Number Of Major Pesticides Introduced In The U.S.A. From 1931 To Date



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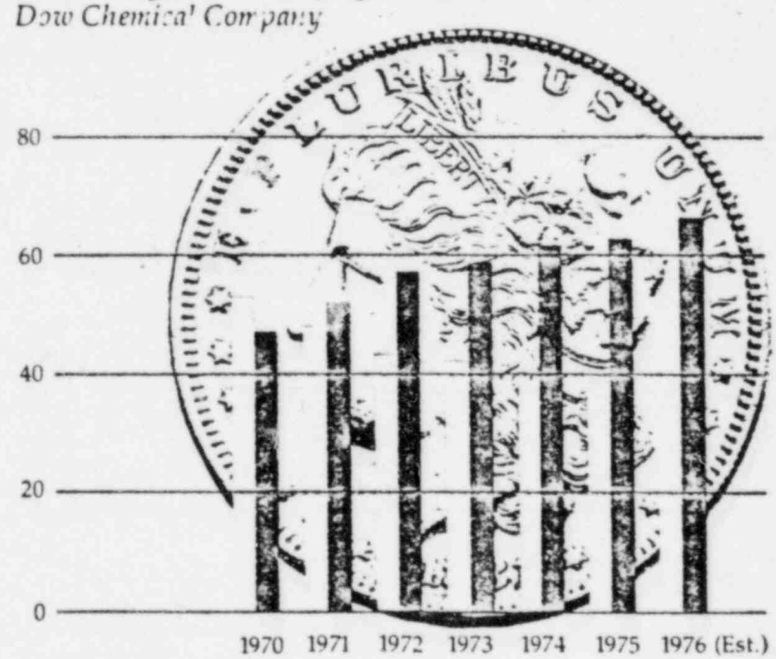
Recent Trend In Percentage Of Research Dollars For Discovering And Developing Pesticides At The Dow Chemical Company



Compiled by Dr. C. A. I. Goring, The Dow Chemical Company.

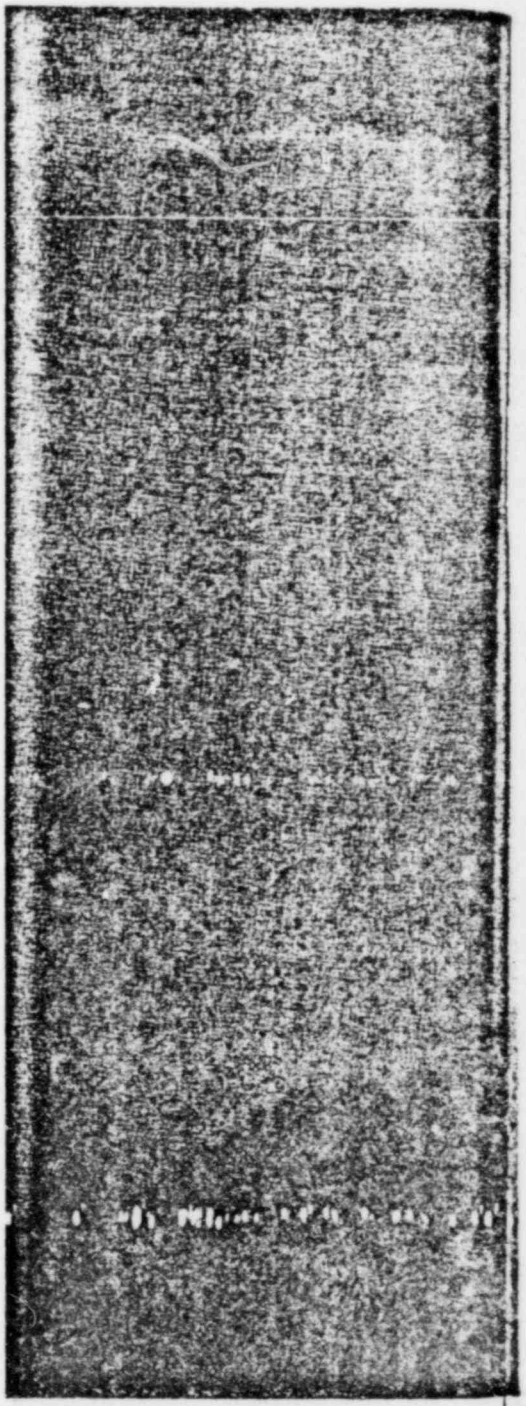
Average Time Necessary For Dow To Obtain Pesticide Registration Or Tolerances In The United States, 1970-1975

TYPE OF REGULATORY ACTION	NUMBER OF APPLICATIONS	TIME IN WEEKS
Minor label or formulation change	175	18
New relatively minor use	61	51
Obtaining tolerances and registration of a new product or a major new use	40	131

Compiled by Dr. C. A. I. Goring, The Dow Chemical Company.

the EPA Administrator and establish banning as the primary policy for eliminating potential hazards, a measure that ought to be employed only when there is proof of imminent hazard to man or his environment. The Administrator could also restrict usage and establish production quotas, and he could arbitrarily force any pesticide producer to carry out prescribed testing to prove zero risk, an exercise we have already characterized as futile. Innovation would be further stifled at a time when we need every possible useful tool for feeding a crowded hungry world.

If the risk-benefit concept as originally proposed by the Congress were adhered to, the American people would be more than adequately assured of safety and abundance. The intent of legislation currently in force is good, and Congress is to be lauded for the enactment of needed pesticide legislation. However, the EPA has progressively expanded its authority. In fact, that agency has created for itself a combined legislative-judicial structure, and its actions go far beyond the authority Congress had proposed for it. Knowledge of this situation should be made more readily available. If such knowledge can be provided to enough of the American taxpayers, we are confident that they will reject further complications of the already costly pesticide regulations and will make their opinions known to Congress. At stake are the present fairly reasonable costs of food and the assurance that the food supply will continue to be adequately produced and protected by the development of technological improvements.



A Time For Activists

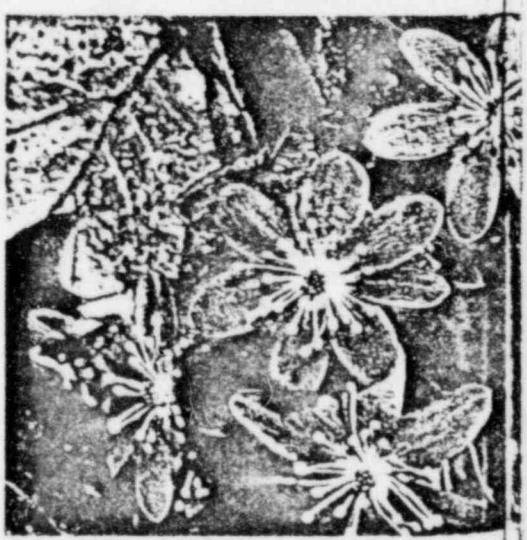
"This land is ours to enjoy, ours to preserve, ours to transmit."

Abraham Lincoln

Recent efforts to preserve or restore the American environment have begun to yield visible results. We all want clean air, clean water, and uncluttered wholesome surroundings. We also want to preserve our land's natural beauty for our own enjoyment and that of the generations to come.

This is not the time to sit back and congratulate ourselves on our successes; we still must look for ways to conserve and increase our supplies of food and energy to keep pace with the growing demand, but we must learn to proceed carefully and deliberately so as to avoid the mistakes of the past and to preserve the delicate balance of our ecosystems. We need all our knowledge, all the resources of science, to avoid a conflict between these goals. And, it is not enough simply to preserve the balance of nature; the balance has to be tilted ever so gently in our favor if we plan to survive. We must remember that man has always been and will continue to be an integral part of nature.

Land conservation and preservation of wildlife habitat are usually not taken seriously in nonindustrial areas of the world, where the pressures of starvation often overshadow most other problems. But the most urgent need for land conservation is here in this most industrialized of all countries, where new highways constantly nibble away at available farm and forest lands, where housing developments are expanding in all directions, and where opulent vacationers flock by the millions to lakes, parks, and wilderness areas. We Americans must continue to protect our wildlife heritage for the sake of our children—constantly strive to increase and improve habitat for wild animals and birds. In many states, the populations of deer, game birds, and fish have increased dramatically—in most cases as a result of deliberate manipulation of the environment. This situation could be reversed if our agricultural efficiency were reduced and we were forced to return the new forests to food production.



This booklet is the first in a series prepared by The Dow Chemical Company to acquaint the public with little known facts about subjects of paramount importance to everyone who eats to live or otherwise uses products of the farm and forest. The text was written and edited by Henry V. Lewert, Senior Technical Editor for Dow's Agricultural Products Department. Most of the nature photographs are the work of Eugene E. Kenaga, Associate Scientist, Health and Environmental Research, The Dow Chemical Company.