before they become serious, and to maintain continuous surveillance in order to prevent infestations from getting out of hand. In this respect, inspectors from the Mosquito Control District are most helpful in reporting their observations of hyacinth problems while covering the county on their own work. The residents of the county generally know who to call, and reports of water hyacinth outbreaks are easily telephoned in.

With mosquitoes, at times we can hope that the problem will go away of its own accord. With hyacinths, this is almost never true, and the residents of the county remain happy with the program, since a report of their troubles generally results in visible action within a very short time.

A major disadvantage of a program such as ours is the lack of adequate technical information within our organization. Obviously, a small program oriented to the narrow problems of one county, cannot afford a complete staff, well trained in their field. For much of our technical information, we must look outside of our area for help from others, and it is to this end that we are represented at this meeting.

We feel that a small local program meets the needs of our area and our people, but without the cooperative help of many of you in this room, we would be unable to carry out the effective program which we now enjoy. We appreciate this opportunity to share our experiences with you, and we sincerely trust that you will be willing to share your experience with us for many years to come.

Hazards Encountered In Herbicide Use

By

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Herbicides used in vegetation control programs engender several hazards which are distinct from, but associated with, the inherent toxicity of the specific chemical. Regulation of these hazards under field conditions is dependent upon proper chemical selection and use. Particular reference herein is to aquatic and right-of-way vegetation control programs. More detailed information and suggestions are available (1,2).

PERSONAL HAZARD

Hazards to operating personnel or to by-standers are slight if adequate procedures are followed. Economical, effective herbicides of low toxicity are available for most situations. Appropriate protective clothing and equipment and instruction in safe procedures minimize hazard to operating personnel. Proper application methods should preclude exposure to others. Except in unique cases, there is little justification for using inorganic chemicals.

ENVIRONMENTAL HAZARD

Since herbicides are intended for vegetation control, it is expected that deliberately or accidentally sprayed plants, not tolerant of the particular chemical, will be injured or killed. Responses of other biological organisms in the environment are less well known. The possible effects of control programs on fauna depend, in part, on the specific herbicide. Few of the most widely used, effective herbicides, i.e., dalapon, 2,4-D, 2,4,5-T, have been directly implicated in animal kill under field conditions. Side effects have been noted; aquatic oxygen depression associated with decomposing vegetation. Some of the more toxic chemicals may be usable without major detriment to the more mobile aquatic organisms by selective spraying so that only part of an area is treated on each application date.

Commonly used herbicides may be placed in relative classes which reflect their personal and environmental hazard levels: greater hazard; acrolein, inorganic arsenicals, chlorates, DNBP, PCP and blended solvents, intermediate hazard; amitrole, diquat, endothals, paraquat and TCA, lesser hazard; dalapon, 2,4-D, 2,4,5-T, substituted triazines and substituted ureas.

CULTIVATED PLANT HAZARD

Crop damage is the most common hazard encountered in herbicide use. Many of the ornamental plants of homes, parks and nurseries are sensitive to some herbicides, especially the chlorophenoxy (2,4-D and related) chemicals which visibly affect plant appearance and growth.

Agricultural crops may be damaged in two ways. Illegal herbicide residue contamination of marketable produce is a relatively new but potentially important hazard. Herbicide residue tolerances exist for few vegetable and field crops. The accelerated state and federal monitoring programs may reveal more widespread occurrence of herbicide residues than we realize. The most obvious crop damage is that reflected by plant or fruit appearance, yield and quality (1,2).

IDENTIFICATION OF CROP DAMAGE

Verifying herbicide damage in crops is not always easy. Climate, crop culture, diseases, insects and viruses may induce symptoms similar to injury caused by some herbicides. Generalizations are precluded by differential susceptibility among the crop species. The kind and severity of the symptoms are related to the particular ccrop and intensity of exposure. Mild responses may not be detected. Mainly, injury is ascertained by visual examination of plant roots, stems, branches, leaves and fruit. Characteristic damage syndromes are associated particularly with the chlorophenoxy herbicides (1,2). When exposure is heavy, plants may die before symptoms can develop. Apparent or true recovery may occur and exposed plants may not be examined when definite symptoms exist. Corraborative symptoms from susceptible weed plants are useful. In some cases, sensitive analytical techniques may detect very small quantities of herbicide on or in plant tissue.

CAUSES OF CROP DAMAGE

Poorly controlled application, the most common cause of crop damage, may result from improper choice of chemical, misapplication to sensitive plants, or, most frequently, chemical drift as a fine mist from the spray site to sensitive vegetation. Also, treated waters may be used for crop irrigation or pesticide spraying; too little information is available on the fate of herbicides in treated waters.

The basic cause of damage can be ascribed to personnel and operating procedures. Safe chemical usage is based on identification of the vegetation problem, selection of the correct chemical and effective application. Related considerations are locations of sensitive crops, chemical formulation and dosage, application equipment and climatic conditions.

PREVENTION OF CROP DAMAGE

1. By organization (1,2)
    a. Up-to-date base maps of operating areas with susceptible crops designated and with notations of safe wind directions and velocities.
    b. Accurate logs or records of each herbicide appli-

cation including site, date, climatic data, chemical formulation and dosage, carrier and volume, spraying pressure, spray equipment and personnel.
   c. Adequate training of supervisory and operating personnel in proper procedures.
2. By operating procedures (1,2)
   a. Proper choice of chemical, formulation and dosage.
   b. Proper equipment and application methods.
   c. Adherence to wind direction and velocity precautions.

SUMMARY

Herbicides generally are and will continue to be used safely to minimize associated personal, environmental and crop hazards. The most common hazard is injury to agricultural crops in which appearance, yield or quality are affected. This damage usually results from improper application traceable to personnel and operating procedures. Effective organization and operating methods reduce all hazards.

REFERENCES

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2. --. 1963. Use 2,4-D safely. University of Florida Everglades Station Mimeo Report EES 64-12.

Use 2,4-D Safely [1]

*Everglades Station Mimeo Report EES*64-12

November, 1963

By

J. R. ORSENIGO [2]

Chlorophenoxy herbicide (2,4-D) injury to susceptible vegetable crops in the Everglades farming area increased greatly during the past year. Much of this crop damage was related to sugarcane weed control operations. Additional cases of crop exposure may have been undetected or ignored.

Poorly controlled use of 2,4-D (and 2,4,5-T) is a direct, immediate hazard to vegetable production in the area.

AGRICULTURAL CROP DAMAGE

The most common damage is visible: vegetable appearance, quality and yield are affected. Contamination with illegal residues is a new and more subtle form of damage to food crops. A 2,4-D tolerance has been established for only one vegetable.

NON-AGRICULTURAL CROP DAMAGE

Many plants of urban areas; ornamentals, home gardens and nurseries, are susceptible also to damage by chlorophenoxy herbicides.

DETECTION AND IDENTIFICATION OF DAMAGE

Positive determination of 2,4-D damage is not always simple since diseases, insects, viruses and cultural and climatic conditions may cause plant responses similar to herbicide injury. It is likely that minor cases of chlorophenoxy herbicide damage are not perceived. Primary detection of 2,4-D injury is based on visual symptoms in crops. Injury is characterized most commonly by petiole epinasty and deformities of expanding and new leaves, and, in some cases, stem, root and fruit abnormalities. Plants without visible symptoms, or those apparently recovered, may have sustained damage not manifested until harvest when losses in yield and quality are noted. Fruit abnormalities are found often in tomato and snapbean exposed to 2,4-D drift. Included among susceptible crops are: cabbage, celery, eggplant, lettuce, okra, pepper, radish and southern pea.

New analytical methods permit chemical detection of minute quantities of 2,4-D in or on plant tissue.

CAUSES OF 2,4-D DAMAGE

The immediate cause of damage usually is the physical drift of spray particles, as an aerosol or mist, from the treatment site to sensitive plants. Vaporization and vapor drift after application are less common causes.

The underlying cause of damage may be traced to personnel and operating procedures. Safe use of 2,4-D requires properly trained and supervised personnel, knowledge of susceptible crop locations, proper chemical formulation and dosage, proper application equipment and operation, and, attention to wind conditions.

Fine particles of spray mist can drift or be wind-borne for considerable distances. Damage symptoms in tomato and southern pea have been noted several miles from cane fields receiving aerial sprays of 2,4-D.

AVOID CAUSING 2,4-D DAMAGE BY:

1. Effective organization
   a. Establish and maintain up-to-date a base map of fields and adjacent areas, particularly indicating location of nearby (1 - 2 miles) vegetable crop fields. Note safe wind direction and velocity for 2,4-D application in each field.
   b. Maintain an accurate log or record of each 2,4-D application including date, wind direction and velocity, formulation and dosage, water volume, spraying pressure, spray unit number and personnel for each treated field.
   c. Train supervisory personnel in proper spraying procedures and stress their responsibility for safe application and continued supervision of crews.
2. Effective procedures.
   a. Use the proper 2,4-D (and/or 2,4.5-T) formulation. Amine salts are preferred and practically preclude vapor-type injury. Low-volatile esters usually are satisfactory. Never use other esters.
   b. Use proper chemical dosage. Never apply more than the cleared rate (2 lb./A acid equivalent for 2,4-D) and use a lower rate if it will control the problem weeds.
   c. Use proper equipment. Crop damage can be minimized or avoided by preventing spray drift during application. The most effective way to prevent drift is to increase spray droplet size; adhere to the following:

      Adjust boom height as low as possible consistent with good spray coverage of weeds. Use a brush boom sprayer.

      Use correct nozzles — large-diameter orifice flat-fan herbicide or flat-fan flooding tips. Cone tips should not be used; they develop a wide range of droplet sizes and cause excessive misting.

      Operate at low spraying pressures — not over 25 psi at the nozzle tips.

      Use low volume sprays — in water at 10 - 20 gallons of spray per acre.