COLORADO FLOWER GROWERS ASSOCIATION

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THE HERBICIDE ERA

K. L. Goldsberry[1]

In 1962, Rachel Carson aroused the world with her book, *Silent Spring*, in which she proclaimed there was a lack of available information about pesticide residues and their persistance in the environment. Following publication of the book, many scientists, the public, and the Federal Government all responded by evaluating the major insecticides, especially DDT. The horticulture industry was even touched by the elimination of deldrin, endrin, and other highly potent chlorinated hydrocarbons.

Frank Graham, Jr. (1970), author of *Since Silent Spring*, not only described the reactions of the world to the writings of Rachel Carson, but reported the mounting evidence that confirmed her fears . . . pesticides of all types present problems in our environment and mankind is still basically complacent to them.

The use of herbicides has become common place in this century. Virtually every homeowner knows about and/or has used, 2,4-D in his yard. Graham (1970) described the use of 2,4-D and 2,4,5-T on Vietnam forests and croplands to help eliminate enemy hiding places. He also reported that a 2,4-D based chemical called picloram had been applied to a pasture where mules grazed. The mules were used to plow a tobacco field and after planting, the plants became malformed. Researchers learned that the picloram had passed through the mules' digestive systems and contaminated the tobacco crop.

Plantsmen of all types have always been concerned with factors associated with growing media — salts, aeration, drainage, and pH. Other areas of concern have included water purity, malfunctioning heaters, peat nutritional levels, and insects and diseases including the control thereof. Evidence is mounting that the greenhouse operator of today, is in some instances, at the mercy of herbicides. In fact, they might be considered the number one potential incurable problem.

Atmospheric Contamination

Federal regulations have been established in some areas of pesticide application. Farmers cannot use more than two pounds per acre of 2,4-D. The state of Iowa, because of volatility possibilities, has further limited application to one pound per acre (Graham, 1970). During visits to DesMoines, Iowa greenhouses in early summer of the mid

[1] *Associate Professor of Horticulture.*

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1960's, leaf malformations of poinsettia stock plants were observed. The problem was attributed to atomspheric contamination due to a highly volatile form of 2,4-D. Most people do not know the ester from of 2,4-D is highly volatile and the amine or acid types have a lower volitility. The ester form is usually the only one available at retail outlets. Application of the ester type 2,4-D to a homeowner's lawn could not only effect ornamental plants in his yard, if the wind is from the right direction, but an adjacent greenhouse crop could receive permanent damage.

The application of Hyvar X, another volatile herbicide, to a fence row in 1972 resulted in a loss of pepper plants in the adjacent field for a distance of nearly 50 feet. Application was apparently made during a mild day in the spring before the plants emerged. The herbicide "drift" settled on the soil and remained persistant (Fig. 1).

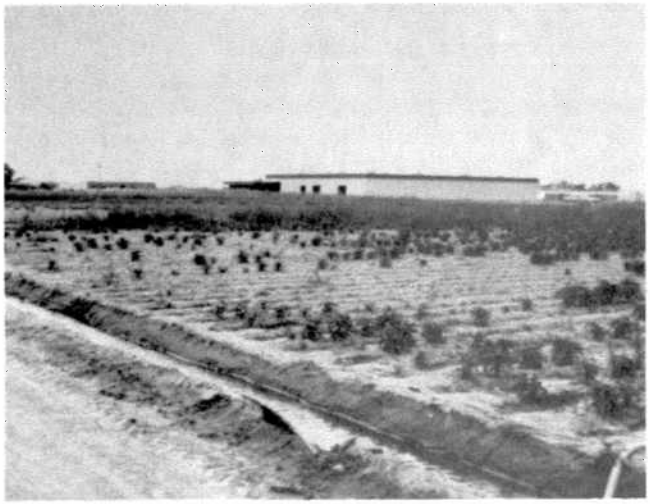

Fig. 1: Loss of pepper plants in a field where herbicide drifted from a fence row application.

Aerial applications of weed killers have presented problems. Lettuce grown in southern Colorado has been contaminated with 2,4-D and 2,4-D/dicamba due to drift from barley field application. The frequent problems with head lettuce contamination led to a research program by Heikes, et.al. (1975), to determine the effects and early symptoms, so the farmer could easily decide if the crop should be "turned under."

Soil Contamination

Most field soils have been subjected to some type of herbicide. A farmer or grower may swear nothing has been applied, but never consider the possibilities of drift from an adjacent area or irrigation water contamination.

A miscellaneous crop grower contacted the University in October, 1974, requesting assistance on a problem with poinsettias. The problem was immediately diagnosed as an herbicide response and the State of Colorado pesticide section was asked to analyze soil samples. Beans were also planted in the original soil mix — they germinated, but were highly malformed by the time the first true leaves developed. The pesticide laboratory found .015 ppm 2,4-D in the basic soil and .081 ppm in the 0-47-0 analysis fertilizer used in the mix. The method of contamination was never determined. The poinsettia crop was delayed, the plants and bracts small — they were sold at a reduced price (Fig. 2).

Fig. 2: Early symptoms of 2,4-D or Banvel-D in poinsettia growing media.

The spring of 1975 brought problems to a grower who was trying bedding plants for the first time. Before transplanting was completed, plant malformations were observed in the first plants. The cause was diagnosed as herbicide damage. The state pesticide laboratory found .06 ppm 2,4-D and 0.1 ppm Banvel-D in the soil mix. The grower had stayed away from field soils because of possible contamination and obtained his soil from the irrigation ditch banks. He didn't realize some irrigation companies spray their right-of-ways with herbicides. The pansies and marigolds were only mildly affected — the remaining plants, a total loss.

A third grower diagnosed his own poinsettia problem in 1974. Weeds in front of the greenhouse had been sprayed; after making the mixture, the can of concentrate was inadvertently set on the potting bench. The last "drip" that always runs down the side of a container created a wet area on the bench. Noticing this, the bench was wiped dry and the remaining herbicide left to "evaporate". A couple of weeks later, poinsettia soil was mixed and placed on the bench for future use. Two months after planting, approximately 15 malformed plants were found — enough contaminate was apparently left on the bench and absorbed by a definite volume of soil.

Fertilizer Contamination

In 1970 the potato fields of southern Colorado were fertilized with di-ammonium phosphate (DAP), a common nutrient source for numerous horticultural crops. During the early part of the growing season, plant malformations were observed and investigation as to the cause started. State and private pesticide laboratories identified the cause

as the presence of Dinoben, an herbicide form, introduced through the di-ammonium phosphate fertilizer.

Di-ammonium phosphate is made from "spent acid". When the chemical process proceeds in one direction, a weed killer is formed. In the opposite direction, a pure fertilizer is formed. A portion of the process produces DAP in the impure or contaminated form, which is generally used to "mud up" oil wells.

The contaminated fertilizer used on the potato fields led to a lawsuit, resulting in a 2 million dollar cash settlement. The projected damage to future crops was based on the persistance of dinoben.

In 1971 a bedding plant grower had the unfortunate experience of obtaining one bag of impure DAP in a load of fertilizer. Most of the contents of that single bag were used and the plants responded rapidly to the presence of dinoben. The majority of the crop was tossed and a settlement made.

The impact of another contaminated fertilizer has probably not been realized. A miscellaneous pot plant grower obtained a bone and blood meal fertilizer mix. It was included in the potting soil and within a short time, all the plant materials were distorted, indicative of a hormone type weed killer. The pesticide laboratory found 10.9 ppm 2,4-D present in the meal. The source of contamination is not known, but a conjecture suggesting it could have been ingested by the animals before they were killed has been presented.

Recently, several growers, after using a new ammonium nitrate shipment, observed malformed plants. The malformations were diagnosed as herbicide damage and investigation on possible causes started. The Colorado pesticide laboratory found concentrations as high as 16.7 ppm 2,4-D and 2.9 ppm Banvel-D in the fertilizer.

Water Contamination

The most recent contamination problem occurred during the spring of 1976. A grower had planted his poinsettia stock plants and given them the first pinch. The new breaks were malformed and diagnosed as weed killer damage. Tests of the container soil indicated the presence of Banvel-D. The original soil and other component parts were not contaminated. The water analysis, however, did indicate the presence of Banvel-D at a concentration of .0028 ppm.

In September, another water analysis was taken and .01 ppm Banvel-D identified. The poinsettias were hard and short, with curled young leaves. The geraniums were delayed and the first flowers malformed. Both plant species started growing better following a pinch and the use of city water. The contaminated water was from a shallow well.

Discussion

Many growers have hidden behind the use of peat-like mixes thinking that herbicide or salt problems were over. Some have used local peats through the years and with little problem, but periodically they get in trouble with various salts. A recent report revealed possible contamination of peat from Canada. It is understood that American railroad companies send their cars to the peat bog areas to be loaded with baled peat. The cars are then moved to various destinations where peat-like mixes are made. On one occasion, a car being used to carry peat had been filled with 2,4-D on the preceeding shipment. Although not verified to our knowledge, it is very possible that the outer portions of the bales of peat were contaminated.

The problems associated with herbicides are no longer hypothetical — they exist. One grower has commented, "I would much rather have a disease or nutrient problem than some weed killer present — I can generally solve them, but overcoming an herbicide is out of the question."

The horticulturist — whatever his area of interest, is going to have to be more conscious of potential herbicide problems. The following check list is suggested in order to eliminate potential herbicide hazards or to help diagnose a problem.

1. Field soils should always be tested for nutrient content. A second test should involve the germination and growing of beans in small soil samples. The plants only need to obtain the first true leaves. If the presence of leaf malformation is questionable, have the soil in which they were growing analyzed at the State Department of Agriculture laboratory.

2. Shallow well water should be frequently monitored for changes in chemical content. The presence of herbicides should also be considered. Beans or tomatoes germinated and grown in perlite will respond rapidly to contaminated water. If questionable malformations exist, have the water analyzed at the Agriculture laboratory.

3. Many growers and/or grower co-ops purchase fertilizers in large lots. One bag of each type of fertilizer should be retained until the next lot is received. If contamination is questionable, never release the full bag. Each bag should be marked with the analysis and lot number.

4. Never use the same spray tank for both weed killers and insect or fungicide spraying. Some people recommend washing out tanks that have contained an herbicide with a household ammonia solution — don't take the chance.

5. Never store weed killers in or near facilities where any materials used in the culture of plants are stored.

Chemical engineers have often indicated that herbicide contamination can be overcome by mixing activated charcoal in the growing media. Judd (1973) recommends the application of 1 tablespoon of activated charcoal per flat and planting oats as in indicator. If the plants become yellow and tips turn gray, the presence of an herbicide should be expected.

Such a procedure might be considered for small amounts of growing media, but is unrealistic where several yards are required. A water suspension of Gro-Safe* activiated charcoal material was applied to a contaminated bedding

*Trade name of I.C.I. America Inc. product.

plant crop; none of the material penetrated the soil surface. The use of charcoal in growing media is probably not economical.

Even though studies on herbicide symptoms are under way at Colorado State University, the era of herbicides is here. It is probably impossible to turn it around. Thus the greenhouse operator will have to be constantly aware of potential herbicide contaminates in every aspect of plant culture.

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Anon: 1976. Environment fears put more crop chemicals in doubt. *The Grower* (British). 86(7):311.

Paraquat and Benlate are two horticultural chemicals that may be completely banned by 1980 if pattern of events that led to eliminating DDT and TEPP continues. According to a report in Chemical and Engineering News, EPA has drawn up a list of chemicals that "may be too hazardous to man or the environment." The list includes endrin, BHC, dimethoate, di-allate, tri-allate, PCNB, paraquat, carbaryl, monuron, benomyl, rotenone and 2,4,5-T. Creosote is also listed. The inclusion of rotenone (a supposedly safe material based on natural plant products) and carbaryl (heralded as a safe replacement for DDT) seems odd.

Nearer home, ethoxyquin may not be available after 1977 worries apple growers. There are fears too that methyl bromide awaits the same fate.

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Colorado Flower Growers Association, Inc.
Dick Kingman, Executive Director
2785 N. Speer Blvd., Suite 230
Denver, Colorado 80211

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Direct inquiries to:
Office of the Editor
Horticulture Department
Colorado State University
Fort Collins, Colorado 80523