TANSY MUSTARD in alfalfa was controlled by applying two pounds of diuron per acre when the alfalfa was dormant, ← in this Navajo County test. Austin Simpler, County Agent Amos Underwood and John Heward (left to right) observe the plot, in May, which had received the recommended treatment. Similar successful tests were made by County Agent Alvin Allen in Yavapai County and other extension workers.

Fascinating Story of

Herbicide Action

Robert E. Dennis

Herbicides, when properly used, alter, inhibit or terminate the growth of weedy plants. They make an important contribution in the continuing effort by American farmers to provide safe, wholesome food in abundance at reasonable prices.

Some herbicides kill all plants, or at least the plant parts with which they come in contact. In general, however, the selective herbicides are of greatest interest in field crop production. A study of the phenomena of absorption of herbicides by leaves and roots, and their translocation within the plant, helps in understanding their action.

Leaf Structure Intricate

The three dimensional line drawing of the cross-section of a typical leaf shows the complexity of leaf structure. The surface of the leaf is covered with a waxy material called a cuticle. This barrier to the entry of herbicides tends to be thicker on leaves growing under conditions of intense sunlight. Some movement of most herbicides applied to leaves takes place through the cuticle. Ester formulations of chlorophenoxy and many other herbicides may enter the plant in this way.

The stomata of a leaf also present a pathway for the entry of some herbicides. Herbicides which are soluble in water, such as certain forms of 2,4-D, dalapon and amitrole, may enter the plant through open stomata. Oils move freely into leaves through open or closed stomata. Stomatal penetration of water-soluble herbicides, and penetration of many herbicides through the cuticle, is increased by the use of surfactants. Surfactants are used to reduce surface tension of spray solutions.

A herbicide applied to leaves and stems may penetrate the cuticle and stomata, move to the food or water conducting tissue and then to other parts of the plant. The pattern of translocation within the plant is influenced by the kind and stage of growth of the plant. Sometimes the herbicide is absorbed and inactivated by cells in the leaf, and sometimes it may remain on the leaf surface and

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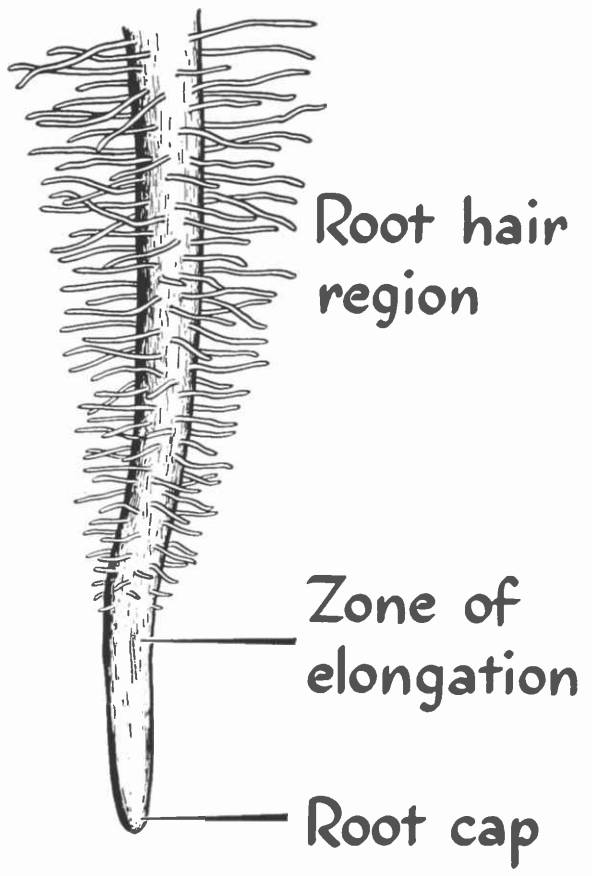
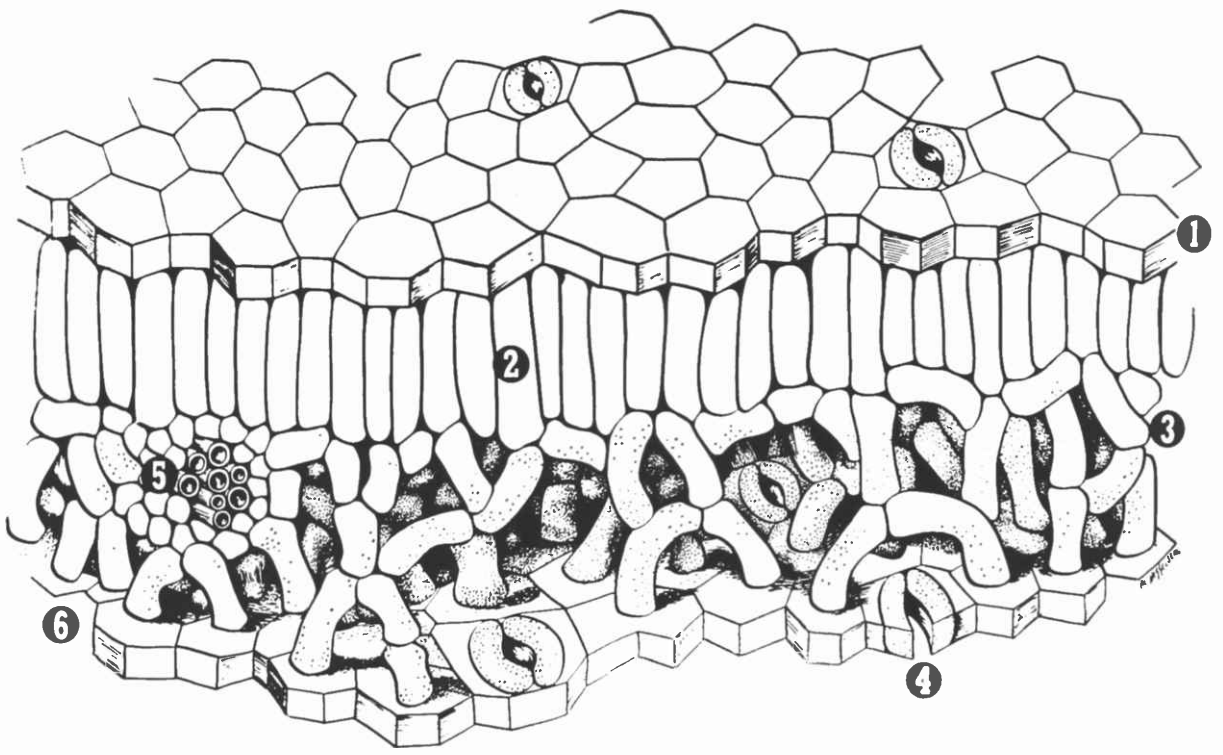


ABOVE, ARTIST'S drawing of typical root tip.



THREE DIMENSIONAL line drawing of cross section of a typical leaf. Leaf parts are 1) upper epidermis; 2) palisade parenchyma; 3) spongy parenchyma; 4) stoma; 5) vascular bundle or vein, and 6) lower epidermis.

Dr. Dennis is an agronomist with the University of Arizona Agricultural Extension Service. The line drawings of a typical root tip and the cross-section of a typical leaf are by Al Hesselberg, University of Arizona artist.

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never enter the plant. The herbicide 2,4-D appears to be absorbed and held more in the cell walls of grass than broadleaved type plants, a factor probably important in its selectivity.

Absorbed By Root Hairs

Absorption of soil-applied herbicides such as chlorate, diuron, monuron, prometryne and trifluralin occurs primarily through root hairs and through the cortex cells just behind the root cap. The line drawing of a typical root tip shows areas of particular importance in herbicide absorption. Movement of soil-applied herbicides into the plant, and to other parts of the plant, is with water and nutrients. Factors which favor rapid growth of plants also favor rapid absorption of herbicides.

Most of the water-conducting tissue of the plant is non-living. Some absorption and translocation of phytotoxic chemicals may occur even after other root tissues have been killed by a herbicide.

There are many theories concerning the reasons why herbicides kill or injure plants. Observation of treated plants and plant parts provides some information. However, finding the why of herbicidal action is very difficult.

It is known that the slightest disruption in enzyme reactions has a marked influence on the growth and development of the plant. For example, dalapon, a grass killer, reduces the production of one of the B vitamins, and this vitamin is an essential part of a coenzyme system. Substituted urea and triazine herbicides block photosynthesis, but the actual cause of death probably is not starvation. Certain herbicides block an essential step in the respiration cycle, while others coagulate protein or alter in some way the normal pattern of growth.

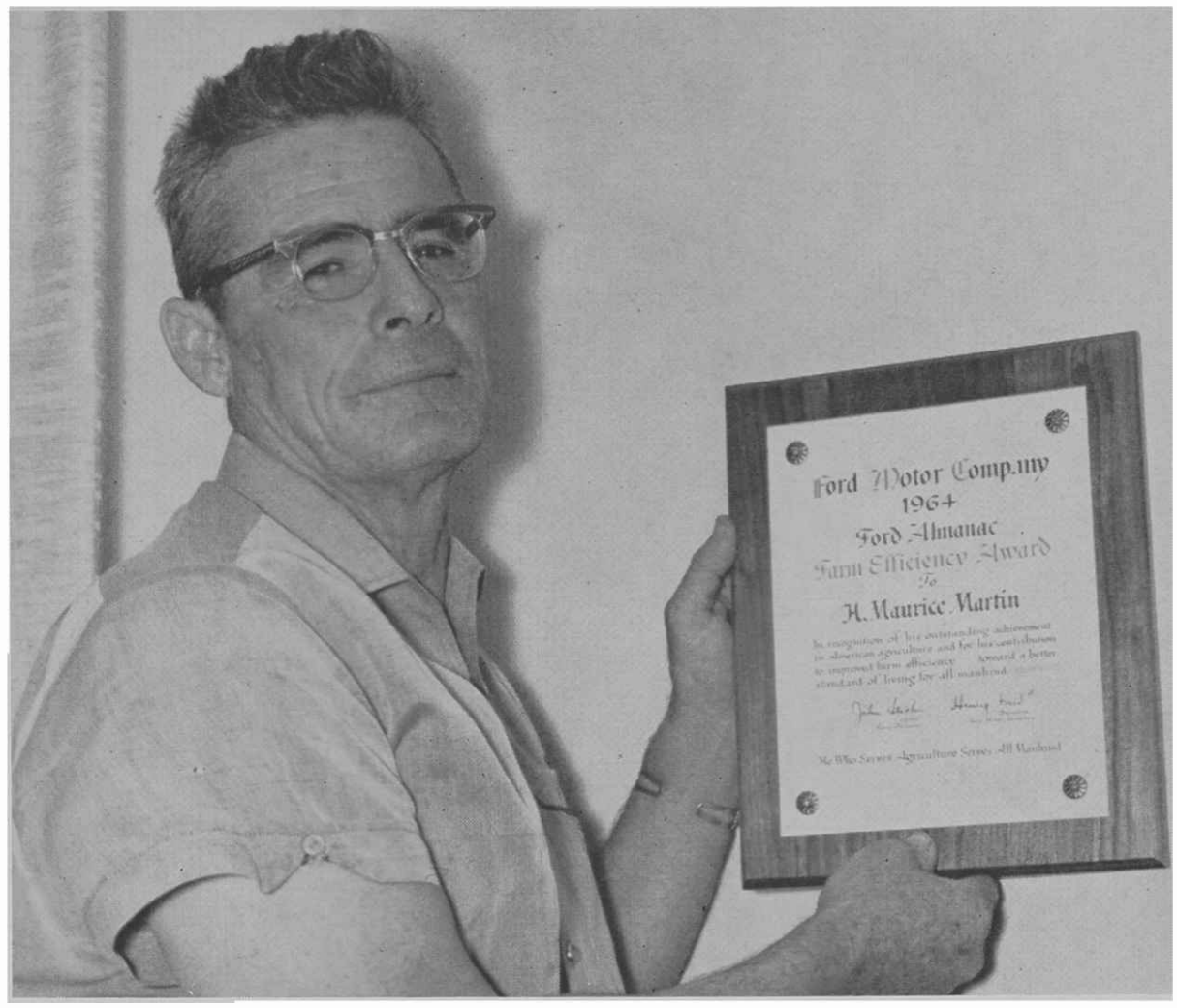
Agricultural extension agents in many states use weed control test demonstrations to show the effective use of herbicides. Dramatic results, such as those in the Navajo County tansy mustard test plot, show something of what may be expected when herbicides are used effectively. The control of weeds in cotton in Arizona, using preplant and post-emergence herbicides, is now receiving special attention.

New Formulas Appearing

Each year there are many new herbicides cleared for use in agriculture by the Food and Drug Administration of the U.S. Department of Health, Education and Welfare. Carefully planned chemical weed control tests are conducted by state experiment station and U.S. Department of Agriculture personnel. Those herbicides which are effective, and which are approved for use by the Food and Drug Administration, are included in the U of A College of Agriculture bulletin, "Chemical Weed Control Recommendations." This publication is available at each of the Agricultural Extension offices in the state.

There have been many changes in the science of weed control since World War II, when 2,4-D was developed. It seems safe to predict there will be more innovations in use of herbicides during the next five years than during the past 50 years.

Cotton Grower Honored



H. M. Martin, Casa Grande farmer, shows the plaque he won from the Ford Foundation for his outstanding farming record. With the plaque he received $2,000, which he turned over to the University of Arizona Agricultural Extension Service, to be used for further development of the electronic data processing program. "Electronic bookkeeping," as discussed by Dr. George Campbell elsewhere in this issue of PROGRESSIVE AGRICULTURE, is taking on more and more of the record-keeping chores of Arizona farmers and ranchers.

Nicotine Tastes Good, Like a Hog Feed Should

Nicotine is being mixed with swine feed in several Canadian experiments to produce leaner-type hogs.

In several years of study, Dr. Hugh M. Cunningham, the well-known Canadian agricultural scientist, has found that nicotine stimulates the release of a hormone from the animals' adrenal glands and thus helps to decrease their fat and increases the growth of lean tissue.

Dr. Cunningham began his studies with the knowledge that the hormone adrenalin moves body fat into the blood stream to be used for energy. "Energy equals protein, which in pigs is the desirable lean flesh," he says.