Some Probable Future Developments in Control of Noxious Range Plants

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BY CONSIDERING changes that have occurred in the field of noxious range plant control during the past few years, it is possible to make some predictions as to probable future developments. It was recently stated (*5*) that more revolutionary changes and improvements in the chemical control of weeds have taken place since 1940 than during all agricultural history prior to that date. This comment referred specifically to weeds in cultivated crops, but is probably equally true with respect to control of noxious plants on range lands. The development of herbicides and the equipment for applying them has advanced so rapidly that the entire philosophy regarding noxious plant control on range lands has changed. Thus, in 1939 it was stated that even if the spraying of water alone would kill Klamath weed, the cost of trucking it over the rough terrain would exceed the value of the land. Less than 9 years later, more than 100,000 acres of range land were effectively and economically treated by airplane spraying for control of a single noxious plant, sand sagebrush (*8*).

New and Better Chemicals Needed

The practical use of chemicals for noxious plant control on range lands is hampered by lack of a selective herbicide which will kill when applied in low volume. A selective herbicide, of course, is one which kills the noxious plant but does no serious damage to the associated desirable species. The now commonplace 2,4-D is an example of a selective herbicide which, because it may be applied by mass application methods, has made chemical control of some noxious plants practical on range lands. Throughout the field of noxious plant control 2,4-D has been so generally tested and so widely discussed that many of us tend to forget the vast number of other similar or related organic compounds which are also known to have growth regulating effects. Very little is known about most of these new chemicals, of which many exist only in relatively minute quantities in laboratories. More than a thousand have been subjected to laboratory screening tests (*9*); but the overwhelming majority have not been tried under field conditions. It seems reasonable to believe that effective herbicides for many of our noxious plants may be found among this great number of organic compounds.

It is known that the selective toxicity of these organic herbicides depends not upon morphological differences between plants, but upon inherent specific differences in physiological response. For example, while cotton may be seriously damaged by minute traces of 2,4-D, a pound to the acre is required to kill sand sagebrush and even larger dosages have so far been ineffective on mesquite, juniper, and cactus. The closely related 2,4,5-T, although not effective on some important noxious range plants, appears to be more toxic than 2,4-D to most woody plants.

Perhaps some of our problems will be solved through use of the new dinitro and pentachlorophenol compounds. To date, these substances have been used mainly to fortify the various light oils applied for pre-emergence control of weeds in cultivated crops. These two chemicals have not been widely tested on noxious range plants, but in recent tests in southern Arizona the immediate toxic effects were outstanding among many chemicals tested on cholla cactus.

The discovery that the ammonium and sodium salts of trichloroacetic acid will kill grass but apparently will not permanently injure broadleaved plants has so far had little impact on the control of noxious range plants. This is due, no doubt, to the fact that we are not usually interested in killing grasses on range lands. Recent tests in Kansas (*6*) indicate that the ammonium salt known as "ATA" is effective in preventing the emergence of annual grasses. The large dosage rates required with this chemical makes its use on range lands questionable, but if costs can be brought down, either "ATA" or the sodium salt of trichloroacetic acid may well have a place on range lands as, for example, in the elimination of cheat grass prior to reseeding.

Developments in herbicidal oils, though less spectacular than those with the organic herbicides, have kept pace both in number and uses made of them. Toxicity in oils lies mainly in the aromatic fraction. Noxious plant control workers know that modern highly refined diesel oil is not as toxic as that formerly available. However, a variety of new and better herbicidal oils, some of which are almost specific for the weeds in many economic crops, are now on the market. In the case of some plants, oils fortified with chemicals such as 2,4-D or pentachlorophenol have resulted in more effective kills than are obtained by the use of the oil alone (*1*). An increasing amount of these new oils, with and without fortifying substances, will no doubt be used in the control of noxious range plants, both as contact herbicides for individual plants or groups of plants, and as carriers for other selective plant killers which are applied by mass application methods.

For a long time range men have observed that there is often little or no grass under the crowns of various woody plants. This relationship has usually been explained entirely on the basis of light suppression or competition for moisture. Recently, a chemical substance having marked toxic effect on tomatoes and other test plants was isolated and identified from the leaves of brittlebush (*Encelia farinosa*), and similar substances have been reported to be exuded by the roots of brome grass and guayule (*3*). The realization that some plants may produce substances which are differentially antagonistic to other associated plants may have opened up an entirely new concept as regards the composition of plant communities. The investigation of additional plants will no doubt lead to the discovery of other natural plant growth inhibitors and may ultimately lead to the isolation of new herbicides.

Better Methods For Applying Chemicals

As a result of the general improvement in equipment for applying herbicides of all forms, including both dusts and liquids, chemical control of noxious plants will no doubt become cheaper and will be used more extensively on range lands.

Outstanding in this field has been the development in the use of the airplane. Beginning with one plane in 1921, the number of airplanes doing spraying and dusting work in the United States increased to 200 by 1939. Today, there are 75 aerial spraying companies in California alone (*7*). Helicopters cost more initially than airplanes and are also limited in load carrying ability. However, they can hover and turn at right angles and, under some conditions, may be more economical than airplanes in actual use.

There has been very little research in the use of planes for noxious plant control purposes. However, planes possess certain unique traits which make them especially well adapted for applying chemicals on range lands. Although these are fairly obvious, they should be mentioned.

First is the factor of speed. A single plane operating under ideal conditions can spray up to 1000 acres per day.

Secondly, a plane is largely independent of the vegetation and type of soil surface over which it flies. On the basis of tests now being conducted in Arizona, there is reason to believe that control of Tamarix in river bottoms may be accomplished in the future by spraying of 2,4-D from the air. Mechanical control of this plant along streams poses a major engineering problem, is expensive, and usually not very effective.

A third feature which favors use of the airplane is the complete lack of mechanical disturbance to vegetation and soil. Anyone who has seen the havoc wrought by the mechanical removal of large trees such as juniper and mesquite will know what this means.

Lastly, and this is important, airplane spraying costs are already comparatively low, $2.00–$4.00 per acre, and with the increasing use of airplanes, greater competition between operators, and more effective herbicides, spraying costs may be further reduced. On crop lands the efficiency of planes for spraying is considered to increase in proportion to the size of the area treated, and it would seem that the use of planes for noxious plant control on range lands awaits only the development of effective herbicides for use on the specific problem plants that are involved.

Better Sprayers for Ground Use

Ground spraying rigs capable of applying as little as $2\frac{1}{2}$ gallons of liquid per acre are now available in sizes ranging from those that can be carried by hand to large trailer-mounted units. The development of chemical resistant neoprene hoses has been of great practical significance, and improvements in nozzles together with the use of higher pressures makes possible the dispersing of herbicidal liquids as true aerosols or in particles of raindrop size. This equipment, although developed for use mainly in orchards, can be used in some rather inaccessable areas and will no doubt find increasing use for spraying small isolated groups of noxious range plants.

New Trends in Mechanical Equipment

The trend in mechanical eradication equipment for use on range lands is preponderantly toward ever larger machinery. As the first step in eradicating mesquite on his range, a Texas operator pulls 400 feet of $2\frac{1}{2}$–inch steel cable between two of the largest crawler-type tractors currently manufactured in the United States. With two of these rigs he treats up to 27,000 acres of mesquite per month. Cabling does not result in complete removal of all mesquites, and follow-up treatment is required. Tractor-mounted "dozers" and large sub-surface plows called "root-cutters" are also being used in Texas. Employment of this large equipment has many limitations and disadvantages. Obviously, the use of equipment weighing thousands of pounds causes serious disturbance to the soil and to any desirable vegetation which is present. Further, the purchase of extremely heavy tractors by most individual ranchers is prohibited by economic considerations; although this latter problem might be solved by cooperative purchase and use by a pool of ranchers.

Many ranchers consider mechanical eradication to be a stop-gap procedure. The wholesale acceptance of airplane spraying for control of sand sagebrush by men previously accustomed to burning, mowing, and grubbing of this plant would seem to be an indication of the rapidity with which chemical control will be accepted for other undesirable range plants whenever it is feasible.

Biological Control

Future developments in the field of biological plant control are difficult to foresee at this time. The classical example of cactus eradication by insects in Australia is well known (*2*). More recently, some favorable results are being obtained in the control of Klamath weed in California through the use of two species of beetles, *Chrysolina hyperici* and *C. gemellata* (*4*). It seems likely that biological control will not be of any great importance so long as we are dealing with native range plants rather than introduced species. However, we should certainly continue to be on the lookout for any promising leads which may develop in this field.

Probable Trends in Research

Despite many advances which have been made from the "cut and try" type of studies in noxious plant control, there remains a serious need for basic research. This is especially true with respect to most of the noxious range plants. The most effective control measures can be developed only when we understand certain basic relationships of individual problem species. For example, control by spraying requires a knowledge of absorption and movement of chemicals, while effectiveness of burning and grubbing depends on sprouting characteristics. Prevention of reinvasion of treated areas demands an understanding of factors involved in reproduction of the individual noxious plant.

Consequently, the trend in noxious plant control research probably will be toward the study of individual plant species on specific problem areas. The emphasis will be shifted so that research on individual plant responses may catch up with research on methods and materials. Many of the necessary investigations will require a degree of control which can be obtained only in the laboratory.

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