THE CHEMICAL CONTROL OF CALIFORNIAN THISTLE

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Californian thistle, like many other members of the family Compositae, is susceptible to various formulations of organic weedkillers, particularly of the hormone type. The destruction or temporary suppression of this weed is carried out economically over many acres in New Zealand. This being the case, I intend to deal mainly with the methods of using the new organic weedkillers to the best advantage.

In weed control the most difficult type of weed to eradicate is the deep-rooted perennial. With hormone weedkillers the most difficult type of weed to eradicate is the deep-rooted perennial with lateral roots. Annuals or perennials with a main taproot and a few subsidiary laterals are often destroyed with one application, for example, nodding thistle and catsear. On the other hand where the plant has a mass of interlacing lateral roots below the ground to supply water and mineral salts to a small area of succulent leafage and stems more than one application is required to eradicate it. This type of plant usually possesses the power of suckering or forming new plants from short rootstocks. Californian thistle is such a plant and it may also set viable seeds.

Mode of Action of Hormone Weedkillers

To destroy Californian thistle the applied chemical must be absorbed and move down the plant into the root system. The roots of Californian thistle must be destroyed to eradicate the plant. To understand absorption of the chemical by the plant cells, the nature of the chemical, the nature of the carrier or medium and the plant surface have all to be considered.

The hormone weedkillers may be divided into water-based preparations and oil-based preparations. In general the water-based preparations give poor penetration into the plant but good translocation through the plant. The oil-based esters in general are of 2 types, the volatile low-alkyl esters, which give good penetration but poor translocation, particularly if applied as an overdose; that is, their action can be likened to a contact kill. The higher low-volatile diesters on the other hand have properties intermediate between the water-based preparations and the oil-based low-alkyl esters, good translocation occurring if these esters are applied at minimum lethal doses. A parallel development in esters has been the manufacture of a water-based ester and an oil-based ester based on non-aromatic oil. Both these esters secure poorer penetration than the alkyl esters, but translocate more readily.

Carriers

The best carrier for hormone preparations for eradicating Californian thistle is water. Water has no weed-killing properties, but aromatic oils possess toxic properties. Lime and phosphatic fertilisers are also satisfactory.

Plant Surface

The plant surface of Californian thistle is succulent. Water-based preparations applied in water penetrate sufficiently well and oil-based preparations are not necessary to secure penetration.

Translocation

Once the chemical has been absorbed, to be effective it has to be transported through the plant. This process of absorption and conduction

is evidenced by the slow foliage kill or death of the above-ground parts of the plant. This is the typical reaction from an application of a water-based hormone preparation. With an alkyl oil-based ester the hormone enters the plant in the oil phase. If the oil is aromatic in nature and the application is made at a heavy rate the toxic properties of the aromatic oil damage the plant to such an extent that the normal physiological processes are interrupted. Death of the above ground parts occurs quickly. Little movement of the chemical into the roots takes place and a contact kill results, the underground storage organs are not depleted of their food reserves, and regrowths usually follow. With the higher esters an overdose can still result in a contact type of kill but normally these esters are less toxic per unit than the alkyl esters and have a greater affinity to water. These characteristics enable them to be used with a wider margin of safety. When the higher esters are applied at a minimum lethal dose the results are equal to those obtained with the water-based preparations.

Stage of Growth of Plant

In plants where translocation is essential to secure root kills, the stage of the growth of the plant is of vital importance. Plants that arise from suckers depend in the early stages of growth on the food reserves of the suckers. It is only when maximum leaf growth is attained that excess food is manufactured for purposes of storage and reproduction. This stage is indicated by the plant sending up a flower stalk. With water-based preparations the flower stalk initiation is the best time of application. The action of these chemicals is slower than the ester type of preparation—their subtle effects take longer to manifest themselves on the plant. The ester type of preparation on the other hand is quicker acting and more lethal per unit than the water-based salts and amines. They should be applied when the plant offers more resistance to the chemical and when the plant has depleted its food reserves to the greatest extent in the normal function of reproduction. This stage is noted by flower head formation.

Californian Thistle in Pastures and Crops

As with the case of most weeds, Californian thistle grows in crops of value. Fortunately this weed may be effectively eradicated with the most selective preparation of hormone weedkiller, namely the sodium salt of M.C.P. This permits Californian thistle to be eradicated in any crops that will tolerate the above preparation at 0.5lb. acid equivalent per acre. In pasture spraying clovers, particularly red and subterranean clover, offer a little more tolerance than Californian thistle to hormone weedkillers. If the same dose of hormone preparation was applied to clovers as falls on a Californian thistle plant in boom spraying, the clover would suffer almost equal damage. To reduce clover damage to a minimum the pasture should be hard grazed to reduce the absorption area (the leaf area) of clover plants and the application should be made after 2 to 3 days of fine weather. Fine weather toughens the clover leaf and thus helps to repel absorption of water-based preparations. It is for this reason that oil-based preparations, particularly the alkyl esters, should not be used for general eradication of Californian thistle in pastures where a reduction in clover content would have serious results.

In applications from aeroplanes, the spray mix used is an alkyl ester in an aromatic oil base. The spreader is diesel oil. This mixture destroys that part of the plant covered with the material but little if any translocation takes place. Regrowths usually follow such an application in the same season from buds growing from the axils of the stem and root. Clover is checked temporarily.

Crops

The main crops that will tolerate 0.5lb. sodium salt of M.C.P. are cereals, grass seed crops, potatoes, linseed, peas, clovers, asparagus and strawberries. All crop spraying is necessarily carried out when the crops offer most tolerance to the weedkiller. This is particularly so if the crops are susceptible to hormone preparations. Usually when crops are sprayed Californian thistle has not reached the stage of maximum leaf development. The control secured is therefore only temporary. In crops grown in heavy soils, Californian thistle roots are less vigorous and closer to the surface. Cultivation breaks up the root system so that new plants arise from small lengths of suckers. In many instances one application of a water-based preparation is sufficient to destroy plants of this nature when applied before maximum leaf development. On the other hand, Californian thistle grown in crops in free deep soil is more difficult to destroy completely for not all the roots are broken up with cultivation. The roots below cultivation level send up suckers that are checked but not destroyed with applications made before full leaf development.

Californian Thistle in Waste Places

If growing in waste places, associated plants of value are not usually present. The usual material employed here are the oil-based esters of 2,4-D and 2,4,5-T depending on the type of weed growth present. The action of 2,4,5-T on Californian thistle is largely contact in nature particularly at the concentrations required to eradicate scrub species. Regrowths follow the initial application, and more than one application is required per season to keep the weed suppressed.

Trial work in New Zealand

To date 62 trials have been carried out in New Zealand on Californian thistle. Approximately half of the trials were conducted in pastures and the remainder in crops. The main crops treated were cereals, potatoes, linseed, clovers, ryegrass, onions and peas. In the Canterbury and Marlborough area 37 trials have been conducted, all except 7 being on crops.

Results of Trials

1. All preparations of M.C.P. and 2,4-D have secured good results when applied at 1 to 2lb. acid equivalent per acre in water. Dust applications have been somewhat inferior but good results are obtained if the plant surface is moist at the time of application and provided heavy rain does not fall immediately after the application.
2. Inferior results have occurred where the alkyl esters were applied as an overdose—applications made in the order of 2 to 4lb. to the acre.
3. The best results have been obtained with the slower acting water-based preparations when applied at the rosette stage; with the oil-based preparations the optimum stage is the flower head formation.
4. Autumn applications have been successful where the thistles were mown in seed head and the regrowths treated as rosettes.
5. Old established patches on loose soil require up to 3 applications for final eradication. For best results the plants are treated in the rosette stage in consecutive years. On shallow, compact soil up to 2 applications are required to destroy the plant completely. Cultural practices that break up the underground root system tend to make Californian thistle more easily destroyed.

Future lines of Research

Trials are being initiated monthly in several areas in New Zealand to determine the optimum time of application, stage of growth and concentration of weedkiller. The effect of the higher esters is being studied in relation to clover damage.

DISCUSSION

Q. There is a very definite problem regarding Californian thistles and docks in cereals on heavy land.

A. Water-based esters will give good results with docks without doing excessive damage.

Q. You mentioned aerial spraying of Californian thistle as not being very successful. At what stage of growth were the thistles?

A. The Californian thistle was at all stages of growth and in all cases the results were disappointing. After application a rapid kill resulted but regrowths appeared within the month.

Q. Are results better if the stems of Californian thistle are bruised or damaged before spraying?

A. If plants are sprayed without mechanical damage, I think better control results. For example, where willows were deeply frilled and sprayed, the surrounding suckers were unharmed, but where they were frilled without cutting the cambium, the suckers were controlled.

Q. How soon after spraying Californian thistle can you stock pasture for best control of this plant?

A. Stock should not be put into the paddock until the thistles are completely dead on top.

A. Robinson: In Rangitikei they have stocked sprayed areas as soon as 2 hours after spraying, with good results.

A. Mr. Barraud: At Waverley they stocked heavily, with excellent results, immediately after spraying.

A. Mr. Skinner: We definitely recommend to put as many sheep as possible on the area, but do recommend 10 days between spraying and stocking. I am inclined to think that the grazing is more beneficial.

A. Mr. Preston: In N.S.W. skeleton weed was sprayed, and then a series of plots mowed at 1-day intervals. Counts a year later showed that after 48 hours cutting made no difference to the results.