Chemical Control of Sagebrush Larkspur

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Sagebrush larkspur (*Delphinium megacarpum* Nels. & Macbr.) is a poisonous low larkspur common to the sagebrush range in southeastern Oregon. Its habit of early spring growth and great abundance on some deteriorated ranges makes it an extremely dangerous plant which is responsible for many cattle losses in the spring.

Attention has been directed to the possibility of obtaining chemical control of larkspur with emphasis upon simultaneous control of big sagebrush (*Artemisia tridentata* Nutt.). This paper records the larkspur mortality results obtained in spraying trials designed to study the susceptibility of big sagebrush, and suggests a procedure for obtaining simultaneous control of the two plants.

Procedure

Larkspur and sagebrush densities were taken by area list-count prior to spraying in 1953 and again in 1954 in an experiment designed to study the susceptibility of big sage-

brush to various spray solutions. Larkspur density was taken on permanent sub-samples of 5 square feet. The mean initial larkspur density was 3.9 plants per sub-sample.

The treatments included in the experiment were as follows:

Dates of Spraying.....................................6
  D_1, April 20............................
      larkspur completely emerged
  D_2, May 4............................
      larkspur full basal leaf and
      Sandberg bluegrass heading
  D_3, May 18............................
      flower stems showing
  D_4, June 1............................
      early flower
  D_5, June 17............................
      full flower
  D_6, July 8............................
      early seed
Materials 3
  M_1, Propylene glycol butyl ether
      ester of 2,4-D
  M_2, Propylene glycol butyl ether
      ester of 2,4,5-T
  M_3, Butyl ester of 2,4-D
Acid Equivalent Rates per Acre............2
  R_1, 1 pound
  R_2, 2 pounds
Solvents 3
  S_1, Water
  S_2, Diesel Oil
  S_3, Emulsion with diesel oil: water ratio at 1:2
Volume Rates per Acre.....................2
  V_1, 3 gallons
  V_2, 6 gallons

Further details of the experiment have been reported by Hyder and Sneva (1955).

Since larkspur was found on only 259 of the 432 plots, with a variable number of samples per treatment, the analysis of mortality required a more complex form of least squares analysis.

By the method of least squares, the constants and the regression coefficient were estimated from the data. This method involves solving a set of simultaneous equations and is presented by Anderson and Bancroft (1952).

Results

Dates of spraying, materials and acid rates caused significant variations in larkspur mortality, but all solvents and volume rates were equally effective.

Among materials there was but little difference between the two forms of 2,4-D; therefore, the results are summarized to compare 2,4-D and 2,4,5-T each at acid rates of one and two pounds per acre by dates of spraying (Fig. 1). In all dates of spraying, 2,4-D at one pound per acre killed more larkspur than 2,4,5-T at two pounds per acre.

The large and consistent decrease in mortality as the season progressed is especially interesting. Those dates of spraying were compared to the growth development of larkspur to serve as a guide to time of spraying in other years. On April 20 the larkspur was completely emerged, on May 4 basal leaves were nearly full grown with an average height of about four inches, on May 18 a few flower

LARKSPUR MORTALITY
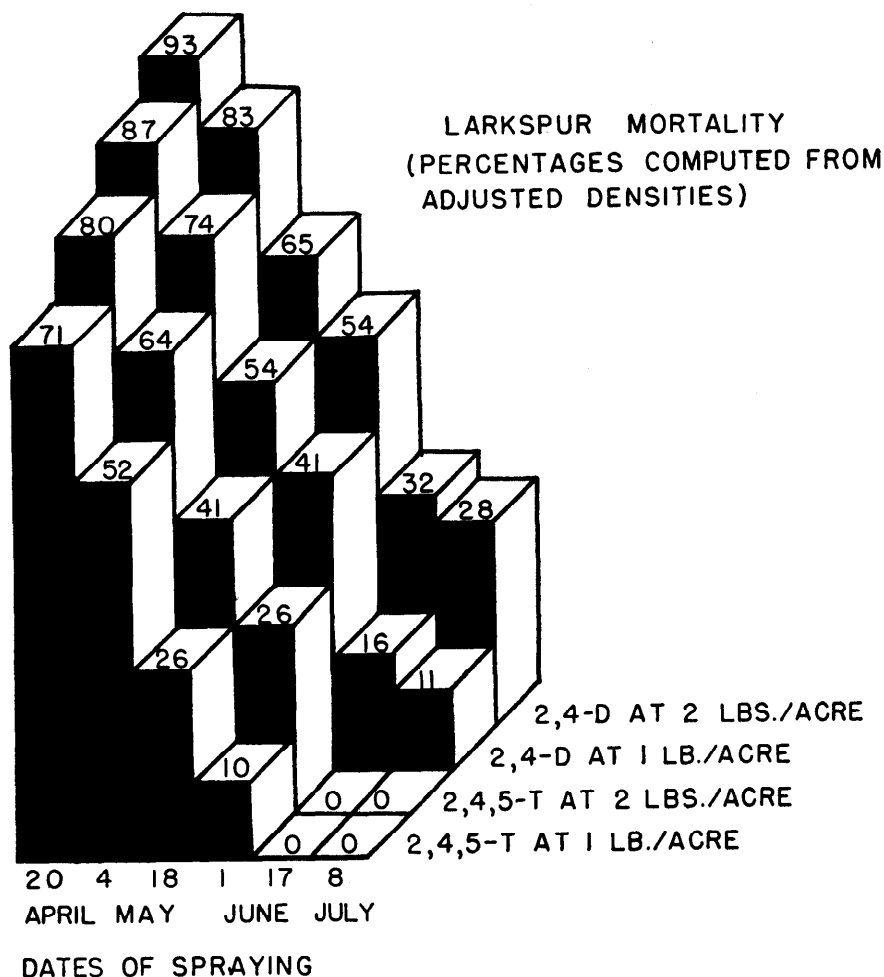(PERCENTAGES COMPUTED FROM
ADJUSTED DENSITIES)

FIGURE 1. Percentages of larkspur killed with 2,4-D and 2,4,5-T, each at one and two pounds per acre, when applied on six dates in 1953.

stems were showing, on June 1 many plants were in early flower, on June 17 mature plants were in full flower, and on July 8 were in early seed development. Along with the growth development of larkspur it is important to note that Sandberg bluegrass (*Poa secunda*), which is used as an indicator of the season when big sagebrush is most susceptible to growth regulators, was heading on the first of May.

The average mortality rates of big sagebrush resulting from applications of 2,4-D and 2,4,5-T on the various dates are shown in Figure 2. These average results are presented to permit a comparison of larkspur and sagebrush susceptibility on the various dates of spraying. Further details of sagebrush mortality have been presented by the authors (1955) elsewhere.

Discussion and Conclusions

Effective control of sagebrush larkspur may be obtained with an ester formulation of 2,4-D at one to two pounds of acid per acre, if the material is applied shortly after the larkspur has emerged. It was observed that plants in flower at the time of spraying were not killed. Since there was a fairly high percentage of plants which did not produce flower stems, some mortality with 2,4-D was obtained throughout the season of spraying in 1953. It is not known whether leaf growth on big sagebrush contributed to the seasonal decline in larkspur mortality due to increasing interception of spray droplets in the overstory vegetation. However, the lack of difference between volumes of three and six gallons supports a conclusion that the sea-

sonal decline in mortality was primarily due to p h y s i o l o g i c a l changes.

It has been reported (Bohmont, 1952 and Mueggler, 1952) that other Delphinium species were resistant to 2,4-D and 2,4,5-T when spray materials were applied at the bud to early flower stage of development. The present experiment supports their results in that sagebrush larkspur was also tolerant at that stage of development, and in that 2,4-D was more effective than 2,4,5-T.

When considering a program of larkspur control on this range, it is well to remember that its abundance is indicative of too-little competition from understory grasses, and possibly to protection and shading by the sagebrush. The most effective program of larkspur control will require (a) sagebrush control and (b) good grazing management. Nevertheless, it is desirable to reduce the stand of larkspur when spraying for the control of big sagebrush. When the major objective is that of sagebrush reduction, spraying should be delayed until Sandberg bluegrass is heading and the larkspur has obtained full basal-leaf growth. At that time 2 pounds of an ester form of 2,4-D applied in water at a total solution volume of 5 gallons per acre will provide good control of
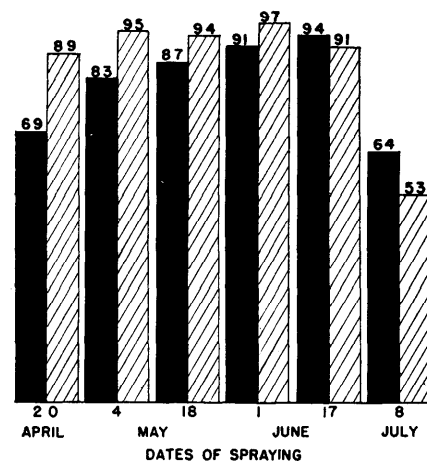

FIGURE 2. Big sagebrush mortality (per cent) resulting from applications of 2,4-D (*solid black*) and 2,4,5-T (*hatch*) on six dates in 1953.

both plants. Since 2,4,5-T is more effective than 2,4-D on big sagebrush at that stage of growth, a 1:1 mixture of the two materials at a total acid equivalent rate of 2 pounds per acre might be used with better success. However, herbicide-cost considerations at present seem to favor the straight 2,4-D material.

Summary

Larkspur mortality data were taken on plots used in an experiment to determine the susceptibility of big sagebrush to ester formulations of 2,4-D and 2,4,5-T at acid rates of one and two pounds per acre. The materials were applied at biweekly intervals from late April to early June in solvents of water, diesel, and diesel emulsion at three and six gallons per acre.

Solvents and volume rates gave essentially the same mortality rates on larkspur. Materials, acid rates and dates of spraying were significant sources of variation in mortality. At an acid rate of one pound per acre, 2,4-D was consistently more effective than 2,4,5-T at two pounds per acre.

Best control results were obtained on April 20, when larkspur was completely emerged. Percentage kills of 87 and 93 per cent were obtained at that time with one and two pound rates of 2,4-D. Two different ester forms used gave similar results. Larkspur mortality dropped with each consecutive date of spraying, and it was observed that plants sprayed when in flower were not killed.

Simultaneous control of big sagebrush and sagebrush larkspur may be obtained with an application of 2 pounds of an ester form of 2,4-D at the time of heading on Sandberg bluegrass. This stage of vegetative development will generally occur prior to larkspur flower-stem elongation.

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I am a strong believer in the Sections wherein lie our future strength and leadership. For those Sections that do not have field trips and tours, I urge you to try them. They have proven worthwhile whenever tried.