SAGEBRUSH CONTROL IN OREGON[1]

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In the past 3 years there has been a marked increase in programs of range revegetation in eastern Oregon. Mr. E. R. Jackman, Oregon Extension Specialist in Range Management, reports that in the past 3 years there have been over 25,000 acres of sagebrush cleared by burning and 21,000 acres cleared by plowing. Eastern Oregon now has 156,000 acres of crested wheatgrass and about 40,000 acres seeded to other species, or a total of about 200,000 acres of seeded range. This acreage is presently increasing at the rate of approximately 15,000 acres each year. The improvement of native forages by spraying for sagebrush control is accelerating rapidly, and is now at the rate of about 15,000 acres a year. The plans set forth in the past 3 years suggest that this may jump to as much as 30,000 acres in 1958.

It is estimated that Oregon alone has nearly 10 million acres of sagebrush range. Perhaps 3 to 5 million of this is well suited to improvement through the aid of some cultural practice. Cultural practices can easily involve the investment of $10 or $15 million in the next 50 years. This would require the treatment of about 60,000 acres each year, as compared with the present rate of about 300,000 acres.

Clearing and seeding operations are expected to continue to about the present rate for several years. However, a preponderance of the seedings made to date, as well as research on seeding methods, has been on the more favorable sites. As seeding extends onto less favorable sites, it is approaching a point where the productive potential of the range may fail to justify the cost and increased risks involved in seeding. This situation presents a real challenge to research. The improvement of stands of native forages by controlling sagebrush is expected to double and triple within 5 years. Obviously, we must accept the responsibility which this future demands.

Range personnel are looking to chemical sagebrush control with keen interest because it appears to be relatively free of investment risk, relatively cheap with costs ranging from about $2.25 to $3.50

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per acre, and it is easily and quickly accomplished by aerial spraying leaving them with more time for other activities. Perhaps the ease and speed of aerial spraying has induced some neglect for the importance of site selection and management planning. Such neglect offers nothing more than future anguish.

We shall summarize some of the differences in spraying requirements, set forth the objective we all desire, and review some characteristics of herbage response which measures the extent to which that objective may be achieved. In listing spraying requirements we do not imply a cut-and-dried thing. The area of choice and substitution is important in adapting the requirements to local conditions, but is not treated in this paper.

SPRAYING REQUIREMENTS BY VEGETATION TYPES

First, let's take a look about the sagebrush-bunch range on the Oregon High Desert. Differences in the vegetation must be recognized because there are things to remember about certain vegetation types when choosing an area for spraying.

Big sagebrush in pure stands on level or slightly rolling topography, with a fair to good understory of grasses, is the most favorable type for initial efforts in spraying. Clumps of grass should be frequent enough to permit one to step from clump to clump without too many misses. Furthermore, there should be a fair abundance of those species which respond most rapidly to sagebrush control. Here we may spray with an ester 2,4-D at 1½ lb/A in 5 gallons of water and obtain excellent kills when the sagebrush is growing rapidly. We spray in May and June but determine the proper timing anew each year by the developmental stage of associated vegetation. Big sagebrush is susceptible from the time new leaves are fullsized, or from the time sandberg bluegrass is headed until the herbage of this grass is losing green color rapidly.

Seeded range which has been invaded by sagebrush and rabbitbrush is another favorable area for initial efforts in spraying.

Rabbitbrush (principally Chrysothamnus viscidiflorus) is quite commonly found in association with big sagebrush. Sometimes the rabbitbrush is well hidden by the sage and will be detected only by close observation. Experimental trials have shown that both species may be killed with a single application of an ester 2,4-D. Figure 1 shows that we must apply an ester 2,4-D at an acid rate greater than 2 lb/A to be confident of kills in excess of 80 percent. The 3 lb/A rate is recommended as optimum and desirable. Figure 1 also shows that rabbitbrush susceptibility was incomplete prior to June. In other years this importance of timing has been equally true. Figure 2 presents sagebrush mortality on the same plots. To be confident of sagebrush kills in excess of 80 percent requires an application of over 1 lb/A of ester 2,4-D. An acid rate of 1½ to 2 lb/A is recommended as optimum and desirable. Figure 2 also shows that sagebrush susceptibility develops much earlier in the season than does the susceptibility of rabbitbrush.

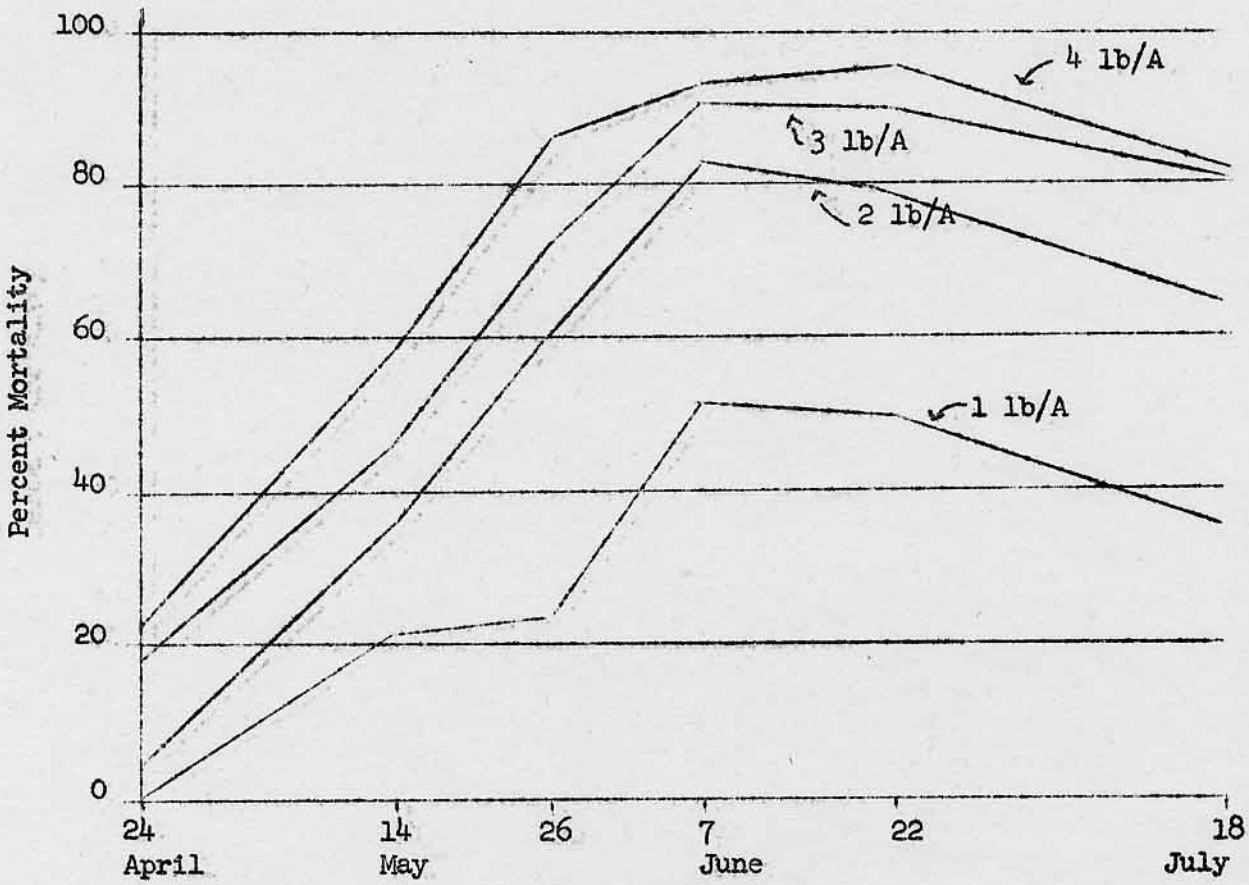

Figure 1. Mortality of green rabbitbrush sprayed with 2,4-D butyl ester on 6 dates--1956.

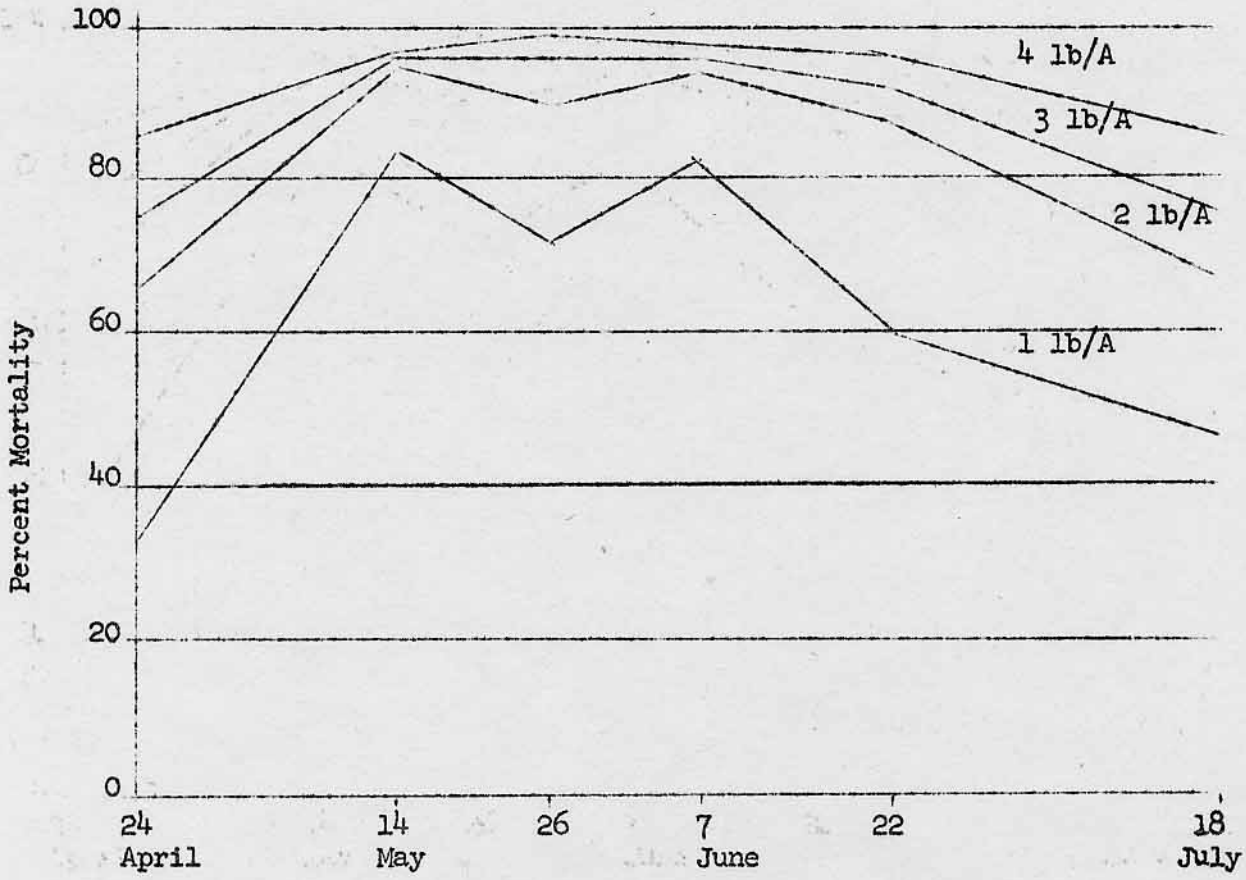

Figure 2. Mortality of big sagebrush sprayed with 2,4-D butyl ester on 6 dates--1956.

Figure 3 provides a direct comparison in seasonal susceptibility between these two weeds with sagebrush mortality resulting from 2 lb/A and rabbitbrush mortality resulting from 3 lb/A of 2,4-D butyl ester. In May we can obtain selective sagebrush control and leave the rabbitbrush to wreck havoc in the future. Both species may be killed in June if favorable growth conditions are sustained.

We also note that as growth activity diminished in late June and early July, the mortality of sagebrush decreased more quickly than did rabbitbrush mortality. In mixed stands we have never killed rabbitbrush and left sagebrush; however, we have received two reports of selective rabbitbrush kills. In drought years rabbitbrush does not develop sufficient susceptibility to permit satisfactory kills because soil moisture is depleted too early. One suspects that it might never be killed satisfactorily on some dry sites. Thus, for the simultaneous control of big sagebrush and green rabbitbrush (or for rabbitbrush alone) we recommend the application of an ester 2,4-D at 3 lb/A in water (with emulsifier) at 5 gallons per acre. This must be applied after rabbitbrush twig growth exceeds 3 inches in length, when sandberg bluegrass is flowering and forming seed, and when other bunchgrasses as Sitanion hystrix, Koeleria cristata, Stipa thurberiana, and Agropyron spicatum have headed out. The spraying season should be terminated when the herbage of sandberg bluegrass is losing green color rapidly, or when soil moisture reaches the wilting point at a depth of 6 to 8 inches below the surface.

Big sagebrush and sagebrush larkspur may also be killed with a single application of 2,4-D, but the timing is even more difficult than is the timing for simultaneous sagebrush and rabbitbrush control. This larkspur (Delphinium megacarpum) is very similar to other species which we call low larkspurs, but we do not have results from spraying trials on other species. Figure 4 shows that sagebrush larkspur is easily killed with 2,4-D when sprayed prior to the appearance of flowering stems. The best larkspur kills were obtained before sagebrush kills became satisfactory, but in the week immediately after sandberg bluegrass headed out both plants were killed quite well. We sprayed 1,200 acres of Squaw Butte Range in 1955 with timing chosen to obtain sagebrush control with the bonus of larkspur control. The application was 1.4 lb/A of butyl 2,4-D in water at 5 gallons/A on May 19 and 20. Sagebrush mortality here was 95 percent and larkspur mortality was 75 percent as sampled one year later. Furthermore, there was further decrease of larkspur in 1956 making a total reduction of 90 percent 2 years after spraying. Considering the hazard of improper timing with respect to species susceptibility, we must recommend an application of ester 2,4-D at 2 lb/A in water at 5 gallons per acre in the week immediately after sandberg bluegrass has headed out. At that time flowering stems will be apparent on some larkspur plants. It is worthy to note that this timing is generally more severe on forbs than is later timing. Consequently, it is not recommended for ranges which produce an important quantity of forb herbage.

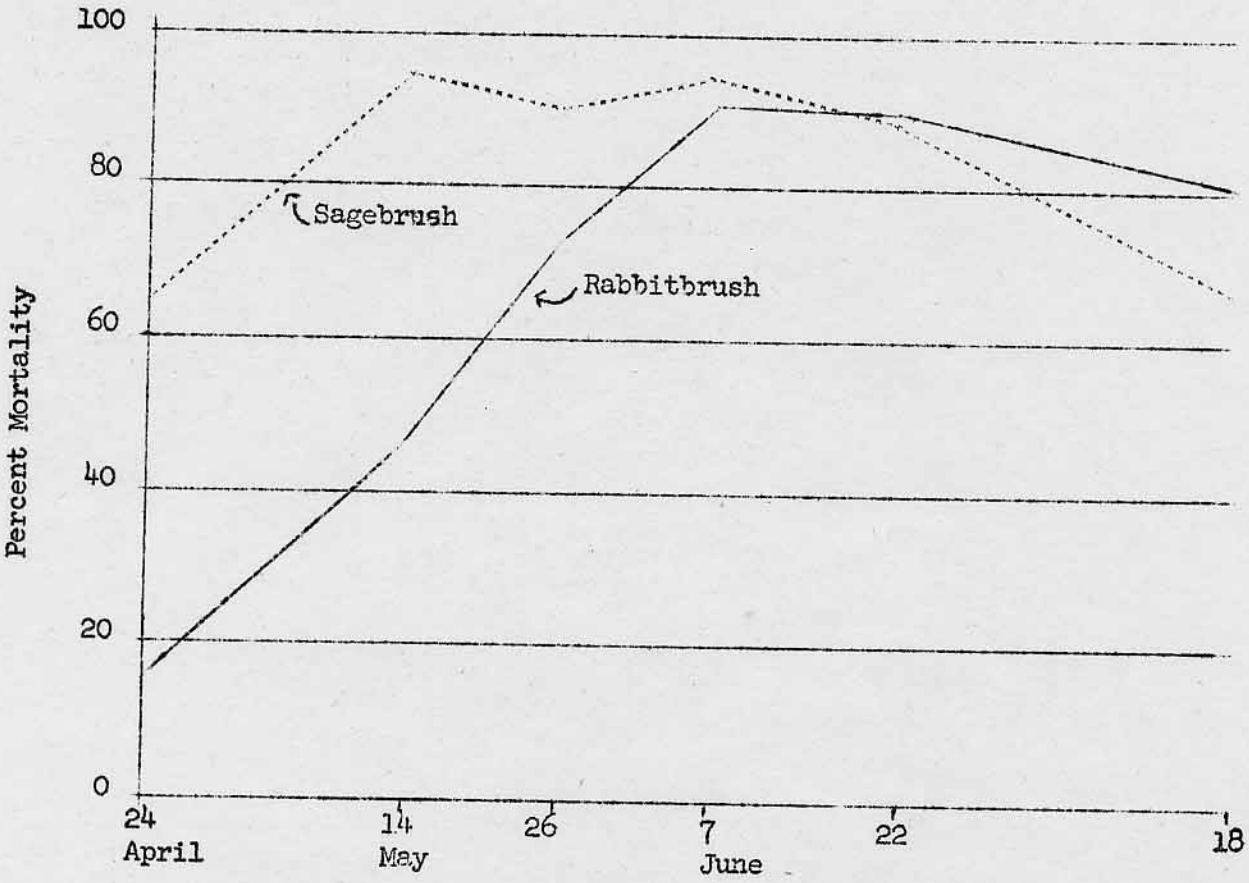

Figure 3. Mortality of rabbitbrush at 3 lb/A and sagebrush at 2 lb/A of 2,4-D.

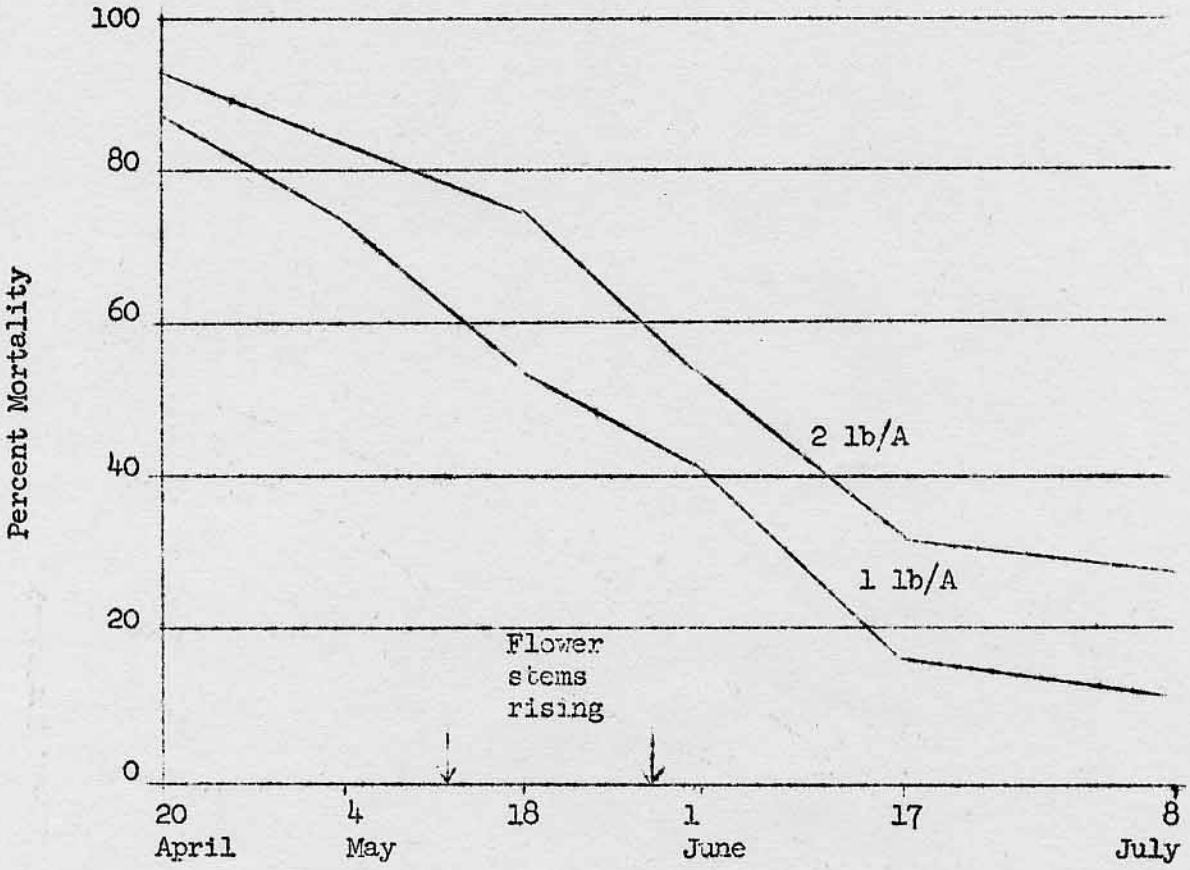

Figure 4. Mortality of larkspur sprayed with 2,4-D butyl ester on 6 dates--1953.

Big sagebrush is found growing in association with bitterbrush on deep soils just below and in the lower Ponderosa Pine zone. With an annual precipitation of 12 inches or more, potential forage production is high. Of special concern on those areas is the importance of keeping the bitterbrush, which is a good browse forage for deer and livestock. The spraying problem is selective sagebrush control. Trials so far have shown both good and poor selectivity of sagebrush. The details of timing and acid rates are not complete, but it appears that early season spraying will kill the sagebrush without serious injury to bitterbrush.

When sagebrush is found in association with a tree overstory the problem in spraying is obvious. For best sagebrush kills the spray should be released within 10 to 15 feet above the brush. To obtain good sagebrush control when spraying above Juniper, it is advisable to apply 2 lb/A of 2,4-D ester in water, or perhaps an oil emulsion, at 10 gallons per acre. It should also be observed that Ponderosa Pine is injured with 2,4-D but Juniper is not.

Next we consider the low sagebrush type. This is Artemesia arbuscula which grows to a height of about 12 to 18 inches and is generally found growing in pure stands rather than in mixture with big sagebrush. Low sagebrush appears to be equally as susceptible to 2,4-D as is big sagebrush. Nevertheless, we do not expect that brush control will pay off as well on this type. Low sagebrush grows on shallow soils which are relatively low in productive potential; furthermore, this species is desired as a winter browse for deer and antelope. We do not recommend spraying for the control of low sagebrush unless full consideration is given to multiple-use benefits.

OBJECTIVE IN BRUSH CONTROL

Brush control, through competition release, will increase forage production. However, this is not the main objective to be held in view. Our objective should be an improvement in range condition. The increase in forage production can pay the way for brush control, but an improvement in range condition will pay profits in conservation and forage production for many years to come. A more selfish and short-time objective can leave the range in poor condition--unsuited to a continuous improvement program. All of the background of knowledge and experience must be invoked to assure proper grazing management. Unsatisfactory examples are already available. In one case protection from grazing was believed to be assured because livestock water was 3 or 4 miles away. In spite of this distance, the cattle concentrated upon the sprayed area and ate all the grass, but avoided grazing upon the surrounding unsprayed range. No doubt, the area sprayed will produce a lot of weeds and cheatgrass for several more years under such overuse, but the end product may well be a wasted range. One can only hope that the sagebrush will return quickly and provide some soil protection.

Spraying with 2,4-D is relatively new, but forage management is the same old story--it is necessary to maintain control over the season

and degree of grazing use. Deferred grazing is highly recommended in the year of spraying and in the year following spraying. Thereafter judicious grazing is essential. With deferred grazing the grasses respond to sagebrush control and produce nearly 3 times more herbage beginning in the first year after spraying. Measurements and observations have shown a tremendous increase in heading and seed production, an increase in the basal size of the grasses, some increase in the numbers of grasses, and a big increase in herbage yield.

Table 1 summarizes herbage yields in the first three years after spraying as compared with yields on untreated check plots. Briefly, the comparison is three times as much grass on sprayed plots. We also found that a good stand of grass can use soil moisture more quickly in the spring and summer than can a good stand of sagebrush. This indicates that the sagebrush will find it more difficult to reproduce new plants in a good grass stand than in a good sagebrush stand. This point is emphasized by the profusion of sagebrush reproduction and lack of grass improvement in exclosures on Squaw Butte range which have been protected for over 20 years.

The study of species succession on sprayed areas has shown that squirreltail, Koeleria, and bluegrasses respond most quickly and abundantly to sagebrush control. Since we desire to close the community as quickly as possible after spraying, it is important that these early-responders be present in the understory upon areas chosen for spraying. Other species such as Thurber needlegrass, giant wild ryegrass, and bluebunch wheatgrass have responded more slowly--requiring 3 or 4 years to show important increases. Although squirreltail has been the most rapid increaser, its response has been temporary. On a field sprayed in 1952 squirreltail provided the dominant aspect one year later. Four years later squirreltail produced only 6 percent and bluebunch wheatgrass produced 26 percent of the herbage. To our surprise, the forb population and production has also increased without showing much decrease even in the year after spraying. Prior to spraying this field produced an average annual herbage yield of 225 lb/A--in the 5 years since spraying herbage yields have averaged 700 lb/A. These factors indicate an improvement in range condition from fair to near excellent in 5 years during which time it has turned off on the average $2\frac{1}{2}$ times more beef than prior to spraying.

Although the sagebrush is returning slowly, the improvement obtained should never be completely lost.

Table 1

Herbage production comparing untreated plots with plots sprayed for the control of big sagebrush

Year	Herbage production in lb/A oven dry: Sprayed in 1951	Unsprayed	Increase by spraying
1952	528	173	355
1953	807	220	587
1954	461	177	284
Average	599	190	409