Range Improvement Research

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Chemical Control of Big Sagebrush

Present recommendations

Apply 1 1/2 pounds (acid equivalent rate) of butyl ester 2,4-D using 5 gallons of water per acre. Spray only when the sagebrush is growing vigorously, and observe all practices common to a good application. Further details are available in publications listed below.

Current research

There are two projects scheduled for completion in 1955. These were established to find whether nutrient element additives may be used to increase growth regulator effectiveness, and to compare the kills resulting from standardized formulations of the isopropyl, butyl, and ethyl esters of 2,4-D; 2,4,5-T; and MCPA.

Application of information for improvement of Squaw Butte range

We plan to spray 1200 acres in May 1955. This area will be used for early spring grazing in conjunction with seeded fields of crested wheatgrass. It may be inspected by visitors attending the 1955 Field Day. This area will be sprayed to obtain effective control of big sagebrush and larkspur using 1 1/2 pounds of 2,4-D per acre. Total cost is less than $2.50 per acre.

We hope to continue spraying about 1000 acres each year until about 10,000 acres of range has been improved.

Publications available

1. "Controlling big sagebrush with growth regulators," by D. N. Hyder, published in Jour. of Range Management, March 1953.
2. "Spray to control big sagebrush," by D. N. Hyder, Oregon Agric. Exp. Station Bulletin 538, January 1954.
3. "Effect of form and rate of active ingredient, spraying season, solution volume, and type of solvent upon mortality of big sagebrush," by D. N. Hyder and F. A. Sneva, Oregon Agric. Exp. Sta. Technical Bulletin 35.

Herbage Response to Sagebrush Control

Summary of results

A plot experiment was used to measure herbage yield response to sagebrush elimination by grubbing and sagebrush control by spraying as compared with untreated plots. Treatments were applied in May 1951.

In 1952, 1953, and 1954 the sprayed plots produced 882 pounds per acre more of grass and 1,226 pounds per acre more of total herbage than untreated plots. Grubbed plots in the same 3 years produced 841 pounds more of grass and 1,507 pounds more of total herbage than untreated plots. Those total increases in yields must be divided by three to obtain average annual values.

Herbage yields, basal intercepts, and numbers of plants by species show that Squirreltail and June grass responded more than other grasses to sagebrush control.

In conjunction with the plot experiment, a 40-acre pasture was sprayed for brush control in May 1952. In 1953 and 1954 this pasture produced over twice as much forage and yearling gains than was obtained before spraying.

Results are indicative of the importance of plant nutrients and moisture in big sagebrush-bunchgrass competition.

Site selection for spraying

Big sagebrush range in fair condition having uniform distribution of deep-rooted bunchgrasses, which yield about 150 pounds of herbage per acre, is suited to improvement by spraying for the control of sagebrush. If you can walk along stepping from grass to grass (deep-rooted species) with only occasional misses, you may be assured of successful range improvement.

Current research

There are many ways to extend our information regarding range improvement following sagebrush control. One of the questions needing answer has to do with ranges in poor condition. Can they be satisfactorily improved by spraying? Some species, such as Squirreltail (Sitanion hystrix), can increase quite rapidly. Perhaps seeding methods can be adapted to sprayed ranges. Part of the answer will come from an experiment initiated by Dr. D. W. Hedrick in cooperation with Squaw Butte personnel. This experiment will compare herbage response to sagebrush control on a site in poor condition with that on a site in fair condition.

Preliminary work has already been done on seeding into sprayed sagebrush with fair success.

A plot experiment is also under way in which sprayed areas have received nitrogen fertilization to find whether the grass understory may be closed quickly and retard the reinvasion of sagebrush.

Previous experiments are continued and will be expanded to the large-area spraying program being initiated in 1955. Here one of the foremost questions will be: How soon will sagebrush come back so spraying is needed again?

Publications available

4. "Herbage response to sagebrush spraying," by D. N. Hyder and F. A. Sneva, presently being processed for publication.

Big Sagebrush-Bunchgrass Competition

Current research

Special attention to the nature of competition between big sagebrush and native bunchgrasses came about in the study of herbage responses to sagebrush control. We hope to find what truth may be involved in our present suspicion that big sagebrush can dominate and invade because: (1) there is too little nitrate in the soil for grasses to compete vigorously for soil moisture, and (2) sagebrush can compete for the small amount of nitrate more vigorously under these soil and climatic conditions than can bunchgrasses.

This is a new research endeavor which may not be fully developed for several years. At present, attention is directed to vegetation response and trends under continuing annual fertilization with ammonium nitrate. The experiment includes both seeded (crested wheatgrass) and native vegetation.

Chemical Control of "Sagebrush Larkspur" (Delphinium megacarpum)

Summary of results

Larkspur becomes abundant on the range because there is too little competition from grasses and too much shading by sagebrush. Increasing grass cover, and improving grazing management are the first requirements in larkspur control. On areas suited to improvement by spraying for sagebrush kill, it is desirable to kill larkspur in the same operation.

Simultaneous control of sagebrush and larkspur may be obtained with an application of 1 1/2 to 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.

Publications available

5. "Chemical control of sagebrush larkspur (Delphinium megacarpum) with special emphasis upon the simultaneous control of big sagebrush (Artemisia tridentata)," by D. N. Hyder, F. A. Sneva, and L. D. Calvin, presently being processed for publication.

Chemical Control of Rabbitbrush

Summary of results

Preliminary results obtained in 1950 indicate that chemical control of green rabbitbrush (Chrysothamnus viscidiflorus) with 2,4-D and 2,4,5-T is indeed feasible. In five consecutive dates of spraying with acid rates of 2 and 3 pounds per acre, the average stand reduction was 75 per cent. Other plants had sprouted back from the base of stems.

In general, the best time for spraying coincides with that of big sagebrush. However, the entire effective period was about 2 weeks later than that for sagebrush on the same plots. Crown kills on rabbitbrush seem to be fairly easy to obtain, but complete kill is more difficult.

For those who wish to make demonstration-trial applications, we suggest an ester form of 2,4-D be applied at a rate of 3 pounds of acid per acre in water at 5 gallons per acre. Spray may be applied at full-leaf development on rabbitbrush.

Current research

With the near completion of research on the chemical control of sagebrush, specific attention may now be given to the feasibility of rabbitbrush control procedures. Work has been initiated in 1955, and will increase in 1956. At the present time primary attention is being given to time of application, rate of application, and differences among growth regulator materials.

Methods for Planting Crested Wheatgrass

Summary of results

Drought and improper seed coverage are generally considered to be the two most common causes of seeding failures on the range. In the past 4 years seeding trials have been undertaken with the objective of finding planting procedures which will reduce those risks of failure. More precisely, the effects of soil firming by rolling and soil mulching by harrowing upon seed-soil and plant-soil relations have been observed.

The most optimistic interpretation of results is that seeding failures caused by drought may be eliminated. However, the practical consideration of time required to complete the seeding job limits the choice of planting time. Plantings are most commonly made in late fall. For small-area seedings, planting may be accomplished in the spring when soil moisture and temperature are satisfactory with assurance of successful stands even though it doesn't rain after planting.

Unfortunately, dry fluffy seedbeds need firming most, but cultipacking is nearly impossible unless there is enough litter on the surface to prevent skidding. Also, depth bands on drill disks are not very effective on a fluffy seedbed. Once a seedbed becomes fluffy, drilling operations should be suspended until the soil is moist to plow depth.

Do not roll after drilling. Too much firmness above the seed can be detrimental to germination causing poor aeration and mechanical restriction to emergence.

A firmed seedbed is more susceptible to wind erosion. Seedbed preparation which leaves litter on the surface is critically important on light textured soils.

Present recommendations

Roll to firm the seedbed; or roll, then harrow, to a depth of about 1 1/2 to 2 inches before drilling the seed to a depth of 3/4 to 1 inch as controlled by depth bands on drill disks. This may be done in late fall (October and November) or early spring.

On trashy and rocky seedbeds where a grain drill is difficult to operate: broadcast the seed onto a soil surface still irregular from plowing with a drill box or fertilizer spreader, then roll to cover the seed and firm the soil. After rolling, harrowing to a depth of 1 1/2 to 2 inches is advisable where the litter and rocks will permit.

It must be observed that care in site selection, elimination of competition, protection during establishment, and effective grazing management will be followed.

Current research

Consideration is now being given to the possibilities of developing seeding equipment more specifically suited to range seeding conditions. Firming the seedbed by pressing furrows 7 or 8 inches wide shows a great deal of value with respect to soil moisture relations and grass survival. It may be possible to develop equipment which will plant the seed at a uniform depth centered in the bottom of pressed furrows and covered with moderately firm soil. This will be a special project undertaken by the Oregon Agricultural Experiment Station under direction by R. M. Alexander, Assistant Director; Jeff Rogers, Head, Department of Agricultural Engineering, and W. A. Sawyer, Superintendent, Squaw Butte-Harney Experiment Station.

As equipment development progresses we will need to do more work on defining seed-soil and plant-soil relations which will give the best and most productive stands of grass with the least risk of failure.

Publications available

6. "Soil firming may improve range seeding operations" by D. N. Hyder, F. A. Sneva, and W. A. Sawyer, presently being processed for publication.

7. "Seed- and plant-soil relations as affected by seedbed firmness on a sandy loam range land soil" by D. N. Hyder and F. A. Sneva, presently being processed for publication.

Nitrogen Fertilization on Crested Wheatgrass

Summary of results

Yields of crested wheatgrass have been taken in the past 2 years to find the response to surface applications of ammonium nitrate applied in the fall. Fertilization rates have been 0, 10, 20, 30, and 40 pounds of nitrogen per acre. Average annual yields over the two years were 833, 923, 1288, 1286, and 1567 pounds of grass per acre respectively by fertility rates in the order shown above. Yields are presented at 12 per cent moisture.

It has been interesting to find that soil moisture has been depleted at a much earlier date under fertilization. Fertilization to increase forage production on the range does not appear to be generally profitable at the present time. If sagebrush re-invasion may be retarded or prevented by fertilization, this additional value, along with increased productivity, may justify practical applications in the near future. Seeded areas under fertilization may provide sufficient early spring forage on smaller pastures and save on seeding and fencing costs.

Current research

The project from which the above results were obtained will be completed in 1956. A new project has been initiated which should provide a better understanding of fertilization requirements. In this experiment, crested wheatgrass stands have been seeded in drill rows spaced at intervals of 6, 12, 24, and 36 inches. Ammonium nitrate will be applied at nitrogen rates up to 160 pounds per acre. Applications will be made in annual and biennial intervals.

Legume-Grass Trials

Legume

Fifteen alfalfa varieties were seeded in three-row plots in 1952 for adaptability evaluation.

In 1953 and 1954 seasonal yields were taken on August 1st and crude protein analyses of selected varieties were made. The yields of these varieties for 1953 and 1954 are given in Table 7. The large difference in yields between years is a direct reflection of the difference in precipitation. Total precipitation in 1953 was 15.68 inches as compared to slightly over 7 inches for 1954.

TABLE 7. Yields of Alfalfa Varieties in Terms of Tons of Air Dry Matter Per Acre

Variety	1953 Tons/A	1954 Tons/A	Variety	1953 Tons/A	1954 Tons/A
Semipalatinsk	1.79	.64	Buffalo	1.13	.44
Rhizoma	1.58	.46	Pilca Butta	1.12	.38
Sevelra	1.52	.64	Ranger	1.08	.40
Nomad S-1	1.38	.40	Alaska falcata	.94	.25
Ladak	1.36	.42	Talent	.93	.42
Nomad S-2	1.31	.50	Arizona Chilean	.93	.30
Grimm	1.27	.40	S. D. falcata*	.89	.38
ND 1271	1.23	.38	Nemastan	.69	.24

* Poor stand on all plots

The crude protein content of samples of six varieties taken August 1st in 1953 and 1954 are given in Table 8.

TABLE 8. Crude Protein Values of Six Varieties Sampled on August 1, 1953 and 1954

Variety	1953	1954
Rhizoma	12.86	12.37
Semipalatinsk	10.45	11.56
Alaska falcata	13.10	11.30
Ladak	10.42	10.46
Sevelra	10.61	10.17
Nomad	9.34	9.90

Of main interest is the comparison of these values with our native grasses, which usually contain between 3 and 5 per cent crude protein at the same time. If we can successfully establish and maintain grazing alfalfas under dryland conditions, it appears late season grazing will be the proper use period both from the standpoint of fulfilling our animal nutritional requirements and of giving the alfalfa plant maximum opportunity to survive under adverse conditions.

Grass

Four strains of standard crested wheatgrass; two strains of fairway crested wheatgrass; one strain each of Siberian, tall, and Whitmar wheatgrass; Sherman big bluegrass; and sheep and hard fescue were seeded in five-row nursery plots in May 1952.

The seasonal yields of these species and strains within species for 1953 and 1954 are given in Table 9.

TABLE 9. Mean Yields of Grass Species and Strains Within Species on August 1, 1953 and 1954, in Terms of Pounds of Air Dry Matter Per Acre

Species	1953 Yield	Relative rank	1954 Yield	Relative rank
Siberian wheatgrass	2129	(1)	820	(2)
Tall wheatgrass	2119	(2)	499	(5)
Standard crested wheatgrass (Mandan)	1579	(3)	403	(8)
Whitmar wheatgrass	1551	(4)	582	(3)
Standard crested wheatgrass (Nebr. 10)	1506	(5)	453	(6)
Standard crested wheatgrass (Commercial)	1492	(6)	406	(7)
Sherman big bluegrass*	1421	(7)	1336	(1)
Standard crested wheatgrass (42-1)	1408	(8)	371	(9)
Fairway crested wheatgrass (Commercial)	1386	(9)	318	(10)
Fairway crested wheatgrass (1770)	1276	(10)	252	(11)
Hard fescue*	1106	(11)	509	(4)
Sheep fescue*	1085	(12)	---	

*Poor stands obtained on some plots

Differences in yield between years is largely due to seasonal precipitation. In 1953, 6.60 inches of rain fell during the period of April to July inclusive as compared to 2.74 inches for the same period in 1954. Of interest in Table 9 are the relative yield ratings of grasses. Note in particular the outstanding performance of big bluegrass and Siberian wheatgrass in the dry year of 1954.

Alfalfa-grass compatibility

An experiment has been initiated in which Siberian wheatgrass, Whitmar wheatgrass and Sherman bluegrass will be seeded alone and in combination by alternate drill rows with Nomad alfalfa and Alaska falcata. Drill-row spacings will be 12 and 24 inches. The primary objective is that of finding if the alfalfa will contribute directly to increased grass yields under these soil and climatic conditions.

In this experiment Hyder, Cooper, and Sneva are pooling their efforts to learn more about the possibilities of using alfalfa on this range which receives an average annual precipitation of 10 to 11 inches.

Experiments involving grazing trials may follow the present work.