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Reseeding Medusahead-infested Ranges

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Medusahead (*Elymus caput-medusae* L.) is a weedy annual grass that occupies vast acreages of rangeland in Idaho (6), California (3) and Oregon (7). These references provide a detailed discussion of the weed and the manifold problems associated with it. Briefly, medusahead is objectionable because of its low forage value and its extremely competitive nature. Often there are 100 medusahead plants per square foot; 500 to 1,000 plants per square foot are not uncommon. Thus, little space, moisture or mineral nutrients remain to support native forage grasses. These grasses are seldom abundant enough to compete effectively with medusahead.

Range reseeding with well-adapted forage grasses is, therefore, indicated as a means to suppress medusahead and to increase the useful forage production of infested ranges. However, reseeding may be limited because much of the medusahead-infested rangeland in Idaho is steep and rocky (Fig. 1).

There are three categories of infested range: (a) land that cannot be reseeded except by aerial broadcasting; (b) land that cannot be tilled but which possibly could be seeded with a heavy rangeland drill; and (c) land that can be tilled and seeded with conventional implements. No surveys are available concerning the acreage in these categories but it is obvious that the first two involve the greatest area and that the third is comparatively small. Nevertheless, tillage is possible on many thousands of acres. It is likely that the most useful range improvements can be accomplished on land in this category.

Before large-scale reseeding is attempted on any of this rangeland, information is needed on control of annual weeds, seedbed preparation, time of seeding and performance of forage grasses. Studies to provide this information were conducted in southwestern Idaho from 1958 to 1965 by the Idaho Agricultural Experiment Station in cooperation with the Bureau of Land Management, United States Department of the Interior.

The studies in general

A considerable amount of herbicide testing was accomplished in an attempt to devise a chemical fallow for seedbed preparation on sites that are too steep and rocky to permit tillage. No single herbicide treatment gave weed control adequate to insure the survival of forage grass seedlings.

However, the herbicide testing program provided important information. It identified the true nature of the "medusahead problem" and led to two principles of weed control which guided the planning of subsequent reseeding treatments.

First, the real weed problem was not medusahead alone, but a complex of annual weed species that included the following: downy brome or cheatgrass (*Bromus tectorum* L.) annual sunflower (*Helianthus annus* L.), prickly lettuce (*Lactuca seriola* L.), tumbling mustard (*Sisymbrium altissimum* L.), Russian thistle (*Salsola kali* L.), fiddleneck (*Amsinkia retrorsa* Sukad.), and foxtail fescue or six week fescue (*Festuca megaluara* Nutt.). Under certain circumstances one or several of these species limited the success of reseeding. The species varied so widely in time of germination, emergence and susceptibility to herbicides that no single chemical treatment was effective on all weeds.

FIG. 1. A typical stand of medusahead in southwestern Idaho. Heavy infestation is clearly seen in center foreground. Some 750,000 acres in this area are infested with the weed.

FIG. 2. This plot was burned in June 1960 and disced in April 1961. The photograph, taken in August 1961, shows the "release" of broadleaved weeds when medusahead is killed.

Generally, medusahead was one of the easiest species in the complex to kill with herbicides, but its removal "released" other annual weed species (Fig. 2). Consequently, the net result was to alter temporarily the composition of the annual weed population rather than to reduce overall weed population enough to sustain a range reseeding.

Second, the herbicide studies showed that two successive crops of annual weeds should be killed before bloom to assure survival of forage grass seedlings. Single treatments that gave weed kills as high as 98 percent were not adequate, but kills of 85 to 90 percent for two years in succession permitted forage grasses to become established. Dormant weed seed was the principal reason for this. Seeds of all weed species in the complex germinated too irregularly for a single treatment to give effective control.

The premise that control of two successive annual weed crops is necessary for successful reseeding was investigated in three experiments with various combinations of tillage, herbicides and burning. The kinds and levels of tillage and herbicides used are indicated in Tables 1 through 4. Herbicide rates are given on their active ingredient (a.i.) basis. Burning was accomplished in the manner described by McKell *et al* (4).

1958-59: Tillage, herbicides, burning and a uniform discing

The first experiment investigated the influence of dual treatments on the control of annual weeds and on the subsequent stand of crested wheatgrass (*Agropyron desertorum* [Frisch] Schult.). The 1958 treatment schedule included burning, dalapon, discing and plowing (Table 1). The second treatment, on April 8, 1959, consisted of a uniform discing of all plots, followed by seeding of the wheatgrass. The results (Table 1) demonstrated that annual weed control sufficient for satisfactory crested wheatgrass stands could be obtained with any of the multiple treatments. Although weed control was adequate with all treatments, better grass stands were obtained with either burning or dalapon than with plowing or discing. This was true of the seedling grass stand in 1959, and of the ultimate grass stand in 1962. The firmer seedbed in the burned and dalapon-treated plots appeared to be the reason for the better grass stands. These results encouraged continued investigations with minimum tillage as a means to revegetate medusahead-infested ranges.

TABLE 1.—The influence of tillage, herbicides and burning on ground cover of weedy annual grasses and on crested wheatgrass stands (1958-59 treatments).

Treatments applied for seedbed preparation[1]		Weedy annual grasses, July 1959 (% ground cover)	Crested wheatgrass stands[2] (Avg plants per 50 sq ft)	
1958	1959		Seedlings July 1959	Mature plants July 1962
Plowing, 6-8" depth	Disc	5.4	19.5c	16.7bc
Discing 3-4" depth	Disc	16.0	17.8c	14.5c
Dalapon, 2 lb/acre[3]	Disc	13.2	34.0a	27.7a
Burning	Disc	11.7	25.6b	23.5ab

[1] The plow, disc and dalapon treatments were applied April 17, 1958, and the burn treatment August 6, 1958. All plots were disced at the same time the following spring, on April 8, 1959, and seeded with crested wheatgrass on April 16, 1959.

[2] Means with the same letter suffix are not significantly different ($P \leq .05$).

[3] Chemical applications here and throughout this publication are active ingredient basis.

TABLE 2.—The effects of burning, herbicides and tillage seedbed treatments on weed control and crested wheatgrass stands (1960-61 treatments).

Treatments applied for seedbed preparation[1]	% control annual weeds[2]	Crested wheatgrass stands (Avg plants per 100 linear ft)	
		Seedlings July 1962	Mature plants July 1963
2 lb/acre dalapon on 3-2-61 plus 2 lb/acre 2,4-D on 4-25-61	87.1a	71	45
2 lb/acre dalapon on 4-25-61 plus 2 lb/acre 2,4-D on 4-25-61	48.5bc	30	35
2 lb/acre dalapon on 4-25-61	45.0c	20	42
2 lb/acre amitrole on 4-25-61	63.2b	128	88
Disc on 5-4-61	96.3a	69	45
Plow on 5-8-61	96.9a	83	46

[1] All plots were uniformly burned in June 1960.

[2] Percent control compared to untreated control plots. Means with the same letter suffix are not significantly different ($P \leq .05$).

1960-61: A uniform burn plus tillage, herbicides

A second experiment with two successive treatments for annual weed control was initiated in 1960. The first treatment was a uniform burn of all plots on June 21, 1960. This was the earliest date that medusahead foliage would burn well and it was before the seed shattered. The burned area was left until spring 1961 when the second treatments were applied. They included both herbicides and tillage methods (Table 2). No further weed control measures were applied. The entire experimental area was seeded with Nordan crested wheatgrass on September 14, 1961.

The uniform burn in June 1960 was of distinct value. Compared with paired unburned plots, burning reduced the medusahead population 84.6 percent in 1961 and destroyed great quantities of annual weed seeds. However, its most useful function was to remove the dense mantle of medusahead litter that impedes tillage and the performance of herbicides. Moreover, burning caused the surviving weed seeds to contact the soil surface where they germinated and were killed by the second series of treatments.

All of the follow-up treatments applied in the spring of 1961 gave a high percentage kill of medusahead. Consequently, the species was practically eliminated from the treated plots. But difficulties were evident with the control of cheatgrass and other annual weeds by the herbicide treatments (Table 2). Conspicuously better control of the total annual weed complex was obtained with the disc and plow treat-

TABLE 3.—Effects of six seedbed preparation treatments and post-establishment atrazine treatment on weed cover and on stand and yield of crested wheatgrass.

Treatments applied for seedbed preparation in 1961	No atrazine applied			1 lb/acre atrazine applied in November 1963		
	weed cover[1]	grass stand[2]	grass yield[3]	weed cover[1]	grass stand[2]	grass yield[3]
2 lb/acre dalapon on 3-2-61 plus 2 lb/acre 2,4-D on 4-25-61	78.3	15	291	9.6	23	1754
2 lb/acre dalapon on 4-25-61 plus 2 lb/acre 2,4-D on 4-25-61	85.0	10	145	7.4	13	582
2 lb/acre dalapon on 4-25-61	83.6	15	164	16.0	17	872
2 lb/acre amitrole on 4-25-61	65.7	30	363	11.3	34	1017
Disc on 5-4-61	68.3	19	363	6.7	20	1453
Plow on 5-8-61	85.1	16	326	1.7	17	944

[1] Percent ground covered by annual weeds, July 1964.
[2] Average number of crested wheatgrass plants per 50 square feet, July 1964.
[3] Pounds of air-dry forage, July 1964.

ments. However, 2 pounds per acre of dalapon applied on March 2 and followed by 2 pounds per acre of 2,4-D on April 25 gave a level of weed control that was not statistically inferior to that given by either discing or plowing.

In spite of the rather mediocre weed control furnished by some of the herbicide treatments, the seedling grass stand was excellent on all plots when the soil froze in late November of 1961. In March of 1962, considerable freezing and thawing of the soil surface occurred. Soil heaving caused severe mortality to the grass seedlings. The seedling stand (Table 2) was poor and too variable for a reliable statistical analysis. The dense stand shown for the amitrole treatment resulted from one favorable plot that did not freeze and thaw. Otherwise the treatment was not superior to the March 2 dalapon plus 2,4-D application or to the disc and plow treatments.

More reliable and meaningful data were obtained from the ultimate grass stand in 1963 (Table 2). Sparse but generally uniform and acceptable grass stands developed from all of the treatments. Thus, two treatments consisting of burning followed by either amitrole, dalapon plus 2,4-D, discing or plowing provided annual weed control adequate to establish crested wheatgrass.

However, a different annual weed problem became apparent on these ranges in 1962 and was more pronounced in 1963. The multiple weed control treatments, in effect, created a partial botanical void. The space was filled not by the slow-growing wheatgrass seedlings, but by

FIG.3. Effects of different treatments are visible in these photographs, taken in July 1964. The area at extreme top was burned in 1960, treated with 2 lb/acre of dalapon in March 1961 and with 2 lb/acre of 2,4-D in April 1961. Atrazine was applied at 1 lb/acre in November 1963. The middle section received no atrazine. The area in the lower photo received no dalapon or atrazine. Air-dry forage yields in 1964 were (from top to bottom) 1754, 291 and 36 lb/acre.

TABLE 4.—The influence of herbicide and mechanical seedbed treatments in 1962 on ground cover of annual weeds and crested wheatgrass stand.

Treatments applied for seedbed preparation in 1962	% foliage ground cover of:								Crested wheatgrass stand[1]
	medusahead		cheatgrass		broad-leaved annual weeds		all annual weeds		
	1962	1963	1962	1963	1962	1963	1962	1963	
2 lb/acre dalapon plus 1 lb/acre silvex on 3-19-62	0.5	0.7	10.7	25.0	56.2	22.5	67.4	48.2	2.7
2 lb/acre dalapon plus 2 lb/acre 2,4-D on 4-16-62	0.0	2.0	9.5	45.0	0.5	16.5	10.0	63.5	3.7
2 lb/acre amitrole on 3-19-62	3.7	7.2	3.7	18.7	54.4	16.2	61.8	42.2	1.0
2 lb/acre amitrole on 4-16-62	2.2	11.0	2.0	13.7	26.2	25.0	30.4	49.7	6.2
Disc on 5-7-62	0.0	3.5	0.0	13.7	0.0	24.0	0.0	41.2	24.5
Control	3.7	5.2	8.0	22.5	34.2	21.0	49.4	48.7	6.7

[1] Stand measured in average number of plants per linear foot in September 1963. Nordan crested wheatgrass was seeded October 21, 1962.

rapidly growing annual weeds that originated from dormant, soil-borne seeds (Fig. 3). As a result of this severe weed competition, the crested wheatgrass plants remained in a juvenile state for three years. Their growth was too slow to be of any importance in the suppression of annual weeds.

A portion of each plot was treated with atrazine at 1 lb/acre in November 1963. The results were extremely favorable, for the annual weed cover in 1964 was reduced to a low level (Table 3). Although some atrazine injury was noted on the wheatgrass plants in April 1964, no wheatgrass mortality occurred in comparison to the high mortality in the untreated portion of each plot. Favorable rainfall in late spring and early summer of 1964 resulted in an almost spectacular response of the wheatgrass plants to the removal of annual weeds by atrazine (Fig. 3). Yield differences in the order of three- to six-fold (Table 3) attest to the severe competition annual weeds afford perennial grasses.

1961-62: Inadequate control from herbicides alone

A third reseeding study was started in 1961 to further explore the use of dual treatments. The site was occupied predominantly by medusahead, but it supported more than the usual amount of cheatgrass. All plots were burned on June 22, 1961. The second treatments (Table 4) were applied in the spring of 1962.

In this experiment, the herbicides generally did not give adequate control of the annual weed complex. The dalapon plus silvex treatment applied in March was especially disappointing. It had been anticipated that an early dalapon application would be effective on cheatgrass and that silvex would have sufficient residual activity to kill broad-leaved weeds that germinated in April. Neither supposition was true. The March application of amitrole failed for the same reason: it was applied before the peak germination of broad-leaved weeds. The April treatments with dalapon plus 2,4-D and amitrole alone were effective on broad-leaved weeds, but they gave only marginal to unsatisfactory control of cheatgrass.

The poor weed control in 1962 plus a previous accumulation of dormant weed seeds in the soil resulted in a high total annual weed cover on all herbicide-treated plots in 1963 (Table 4). As a consequence, discing was the only treatment that gave sufficient weed control in 1962 to sustain the wheatgrass seeding made in 1963. In this experiment, the use of a chemical fallow to establish crested wheatgrass was a failure. Cheatgrass competition in the spring of 1963 appeared to be the major reason for the poor wheatgrass stands, but several broad-leaved weed species also contributed.

TABLE 5.—The influence of fall and spring seeding on seedling and mature plant stands of six forage grasses (Bissell Creek exclosure).[1]

Time of seeding:	Seedling stand[2] (plants per 10 linear ft. of row)				Mature stand[3] (plants per 10 linear ft. of row)			
	Fall 1961	Spring 1962	Fall 1962	Spring 1963	Fall 1961	Spring 1962	Fall 1962	Spring 1963
Nordan crested wheatgrass	9.1a	32.6	18.2b	45.3	8.5a	16.8a	15.5ab	21.2
Siberian wheatgrass	5.0ab	29.0	17.3b	37.0	5.0b	15.5a	10.3c	20.7
Topar pubescent wheatgrass	10.0a	34.6	20.2ab	40.5	10.7a	16.0a	16.3ab	19.3
Oahe intermediate wheatgrass	8.3a	38.1	27.7a	38.2	8.7a	17.8a	17.7a	18.5
Whitmar beardless wheatgrass	5.5ab	31.5	15.8b	43.0	4.3b	10.2b	3.2d	19.0
Vinall Russian wildrye	1.2b	28.3	7.0c	42.3	2.0b	15.7a	11.3b	18.8
Average	6.5	32.7	17.7	41.0	6.5	15.3	12.4	19.6

[1] Means within each column with the same letter suffix are not significantly different ($P \leq .05$).

[2] Seedling stands for fall seedings were determined the following spring; those for the spring seedings were determined in June of the seeding year.

[3] All mature stands were determined in July 1965.

Forage grass performance testing

Six forage grasses were tested in four nurseries in southwestern Idaho beginning in 1961. Two spring seedings and two fall seedings were made. The seedbed for all nurseries was prepared by burning followed by tillage at a 3- to 4-inch depth. Because of the difficulties with survival of grass seedlings on range reseedings primary attention was given to stand establishment. The grass species tested and the data regarding the seedling and mature stands of the grasses are shown in Table 5.

A conspicuous aspect of these data is the difference in seedling stands of all grasses between the spring and fall seeding dates. Highly significant differences in favor of spring seeding prevailed in both years. Field observations indicated that soil heaving from alternate freezing and thawing in late winter and early spring caused considerable mortality to the fall seedings in both years. This appeared to be the principal reason for the advantage of spring seeding over fall seeding. Also, similar results were noted with the rather poor grass stands that were obtained in the reseeding study related to Table 2.

However, it is important to note that the mature stands for all seedings showed a considerable reduction below that of the seedling stand (Table 5). Relative reduction of the spring seedings was greater than the fall seedings. Mature stands from the fall seedings, while still lower than the spring seedings, were probably as dense as these ranges can support. Hence, it appears that spring seedings are preferred, but fall seedings are not precluded. The latter would be desirable in the case of large seedings requiring considerable time to complete.

Nordan crested wheatgrass displayed consistently strong seedling vigor in each of the four seedings shown in Table 5. Moreover, seedling survival was sufficient to provide good mature stands at all seeding dates for the variety. These results are supported by Foster and McKay (1) who have noted the excellence of Nordan crested wheatgrass for seedling vigor and stand establishment.

Seedling vigor and the ultimate stands established by Siberian wheatgrass, Topar pubescent wheatgrass and Oahe intermediate wheatgrass were generally good. Stands of acceptable density were furnished by all of these varieties.

The mature stands of Vinall Russian wildrye and Whitmar beardless wheatgrass were generally inferior to those of the other varieties. Seedling vigor of Vinall Russian wildrye was characteristically poor. Whitmar beardless wheatgrass usually produced good seedling stands

TABLE 6.—Average percent basal density and yield of six forage grasses seeded March 29, 1962, at Bissell Creek.[1]

Variety	Percent basal density[2]			Air-dry forage yield	
	1963	1964	1965	1964	1965
Nordan crested wheatgrass	29.8abc	14.1	21.1ab	1336ab	1720ab
Siberian wheatgrass	23.2cd	12.9	16.8b	1260ab	1383bc
Topar pubescent wheatgrass	21.9d	13.0	19.1ab	883cd	1381bc
Oahe intermediate wheatgrass	26.8bc	12.1	15.5b	1505a	2110a
Whitmar beardless wheatgrass	36.3a	9.5	13.2b	1092bc	1420bc
Vinall Russian wildrye	31.9ab	12.9	23.5a	602d	913c

[1] Means within each column with the same letter suffix are not significantly different ($P \leq .05$).

[2] Determined by actual measurement of the plot area covered by basal foliage.

but its mature stand showed a high mortality. This was at least partially caused by rodent feeding on the crowns of the plants during winter. Rodent damage was more severe on Whitmar beardless wheatgrass than on any other variety.

The 1962 spring seeding had an especially uniform stand. For this reason the nursery was used for the forage yield and basal density terminations shown in Table 6. With the exception of Russian wildrye, the varieties yielded well. A dry-weight average yield of approximately three-fourths ton per acre demonstrated that the medusahead-infested ranges in southwestern Idaho have potential for greatly improved forage production.

Nordan crested wheatgrass was outstanding for both yield and basal density. These results in addition to its excellence for stand establishment made Nordan crested wheatgrass the most desirable grass for reseeding in the area under investigation. The high yield and generally excellent stands of Oahe intermediate wheatgrass are also noteworthy. These attest to the vigor of the variety as explained by Slinkard (5).

Each year in all of the four nurseries, Topar pubescent wheatgrass was extensively defoliated by the Banks grass mite (*Oligonychus pratensis* Banks). For this reason the variety yielded poorly. It is not a promising candidate for reseeding in southwestern Idaho.

Summary and conclusions

Investigations into the revegetation of medusahead-infested ranges in southwestern Idaho showed that two factors are essential. First, broad-spectrum control of annual weed species is necessary, for the competing vegetation is a complex of annual weeds rather than medusahead alone. Second, two successive crops of annual weeds should be killed before they bloom or produce viable seed in order to reduce the weed seed reserve and thereby assure survival of wheatgrass seedlings.

Under certain experimental conditions these requirements were satisfied by each of the following dual treatment schedules: tillage plus tillage, tillage plus herbicide, burning plus tillage, and burning plus herbicide. The most consistently successful treatment included at least one tillage operation. Either discing or plowing was satisfactory, but discing was preferable because it left the firmest seedbed and worked best on rocky sites.

The most desirable herbicide treatment was dalapon followed by 2,4-D. Generally it furnished sufficient weed control, but on some sites the treatment failed to control annual weed species such as cheatgrass. This limited survival of wheatgrass seedlings in one experiment.

Burning was particularly desirable as the first of a dual treatment schedule. With proper timing, fire destroyed the current crop of developing medusahead seeds and great quantities of medusahead and other weed seeds in the litter. Seeds not killed fell to the soil surface where they germinated and were killed by the follow-up treatment. But the most important benefit from burning was removal of the dense mantle of medusahead litter that impedes tillage, lowers the performance of herbicides and prevents preparing a quality seed bed.

Although the dual weed control treatments reduced the annual weed populations, a large quantity of dormant weed seed remained in the soil. This led to a second problem. In some cases the site was reoccupied by fast-growing annual weeds before the slow-growing wheatgrass plants were large enough to compete effectively. Atrazine applied when the wheatgrass plants were two years old showed promise for overcoming this difficulty.[1]

In four seedlings over a two-year period, Nordan crested wheatgrass was outstanding for seedling vigor and ultimate stand establishment. Nordan also had a high relative yield and basal density compared with five other forage grass varieties. It is presently the most desirable grass for reseeding medusahead-infested ranges in southwestern Idaho.

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[1] At this time atrazine is not registered by the USDA for this purpose. However, an application is in progress to obtain the necessary label clearance.

Suggestions for reseeding

On the basis of these studies, certain methods of reseeding are sufficiently promising to merit limited field testing. The trial seedings should be restricted to relatively small areas, but they should be large enough to provide a practical measure of the feasibility of applying herbicides by air and of using heavy equipment on the ground. Seeding areas of 100 to 300 acres would seem to meet these requirements.

Procedures for various sites include:

Method A—Burning Followed by Herbicides

This method is for sites that are too steep and rocky to permit tillage but which could be drilled and which have no more than a trace of cheatgrass in the medusahead stand.

1. Select the area to be seeded. Consult with the proper fire control officials and construct the necessary fire guards.
2. Do not graze or otherwise disturb the medusahead stand in the spring.
3. Burn as soon as the medusahead foliage will support vigorous combustion. The date will vary with seasons, but it will usually occur between June 20 and July 1.
4. The following spring, spray with a 3 lb/acre (commercial product) of dalapon in water at a volume of 5 to 10 gallons per acre. Apply as soon as medusahead germination is complete but before the boot stage. This will usually range from March 1 to April 15.
5. Spray with 1 lb/acre of 2-4-D between April 25 and May 10.
6. In the fall or the following spring seed with Nordan crested wheatgrass at 6 lb/acre.

Method B—Burning Followed by Discing

On sites that will permit tillage, discing is the preferred treatment to follow burning. It will reduce annual weeds to a low level. Success of the seeding will then depend most upon favorable rainfall in April and May of the seeding year.

1. Treat as per items 1, 2 and 3 in Method A.
2. In the spring following the burn, disc 3 to 4 inches deep as soon as the soil is dry enough and germination of annual weeds is abundant.
3. Seed Nordan crested wheatgrass as soon as possible after discing —not later than April 15.
4. Spray with 1 lb/acre of 2,4-D any time after the wheatgrass seedlings have 2 to 3 leaves but before the broad-leaved weeds have developed beyond the bud stage.

Method C—Discing Followed by Discing

In instances where burning is not desirable, an extra discing can be used as a substitute for fire.

1. In the spring before the first discing, subject the area chosen for seeding to severe livestock use.
2. Disc when annual weed growth has depleted the soil moisture below a level that will support the germination of weed seeds, but do not allow the growing weeds to mature viable seed. In most seasons this will be approximately May 1 to May 10. Disc 3 to 4 inches deep and leave fallow for the remainder of the summer.
3. If rainfall is sufficient to germinate the annual weeds before October 15, disc again and seed immediately with Nordan crested wheatgrass.
4. Otherwise proceed as per items 2, 3, and 4 of Method B.

Besides the usual protection from livestock use, grasshopper control should be anticipated in reseeded areas. Control the insects at an early date before the wheatgrass seedlings have been defoliated. Range seedings in Idaho can fail from grasshopper depredation as well as from drought, weed competition and too-early and excessive utilization.

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Appendix A

Costs and benefits of range reseeding

Although this study was not involved in the costs and benefits of reseeding, it is obvious that economics must be considered in revegetating any rangeland including medusahead-infested ranges.

A detailed study by Caton and Beringer (1) in 1960, involving 47 seedings in southern Idaho ranging from 10 to 7,500 acres in size, gave the following average revegetation costs per acre: mechanical seedbed preparation $3.61; seed $4.15; seeding $1.67.

Costs varied widely depending upon size of seeding, terrain, cultivation depth and frequency, and kind and quantity of seed. Generally these seedings ranged from $12 to $5 per acre, decreasing in cost as the size increased.

Present costs for mechanical preparation are estimated[2] at $4.50 per acre. Seed costs appear to be the most changeable factor. Presently Nordan crested wheatgrass will average about $0.50 per pound or $3.00 per acre.

Present per acre average fixed costs for reseeding medusahead-infested ranges are estimated as:

Discing or cultivation	$4.50
Seed (6 lbs. of Nordan)	3.00
Seeding (range $0.50 to $2.00)	1.00
Total	$8.50

Additional alternative per acre costs in revegetating medusahead-infested ranges:

1. Burning (including safety measures)		$1.00
plus		
2. Second cultivation (2nd year)		4.50
or		
3. 2 qts. 40% 2,4-D	$1.50	
2.8 lb. 80% dalapon	3.60	5.10

[2] Correspondence, Ralph S. Samson, Extension Conservationist, Agricultural Extension Service, University of Idaho.

Total costs of revegetating medusahead-infested ranges would accordingly range from $14.00 to $14.60 per acre.

Benefits from range reseeding are more difficult to determine. In this instance, the control of a secondary noxious weed is involved. Frequently the alternatives are cleaning up the infestation or permitting large range areas to become infested and thereby result in negligible value. Accordingly, the acre cost could be calculated on the infested area alone or adjusted to the vast acreages protected from infestation by control.

Caton and Beringer (1) reported the following average annual returns from 3 years of grazing a crested wheatgrass seeding near Burley:

Average acres per animal unit month	0.60
Average pounds beef gained per acre	47.4
Average gross return per acre @ 20c per lb. gain	$9.48

By making numerous cost-price adjustments including fencing, interest on borrowed capital, deductions for returns from non-improved range, etc., they calculated the long-term returns from reseeded range to average 220 percent for 20c beef, and 142 percent for beef at 15c per pound.

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