Cost and Returns from Reseeding Plains Ranges in Wyoming

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Highlight: *Variable costs of reseeding 64 range sites totaling over 10,000 acres of plains type range in Wyoming averaged $14.26 per acre, and total costs averaged $16.31 per acre at 1972 cost levels. Information obtained from the ranch operators, together with experimental information from various sources and budgeting methods over time, were used to estimate a flow of returns. Investment costs of the reseeding occur immediately, as do costs for deferment. In the third year after reseeding, some beneficial effects are achieved. Full benefits of reseeding, including a higher percentage calf crop and a larger number of heavier yearlings available for sale, are not achieved until the fifth year. Allowing for the lag in response, the rate of return on reseeding Wyoming plains ranges is estimated at approximately 21.5% at 1972 cost and price levels.*

Over 80% of Wyoming's 62.4 million acres are classified as range and pasture land. Although the primary use of range in Wyoming is grazing, much of the land is not producing forage at its potential economic or physical level.

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The objectives of this study were to determine practices and inputs used, costs, and returns from reseeding ranges. Information was obtained from ranchers and farmers in the eastern or Great Plains counties of Wyoming through personal interviews. Usable responses were obtained from 30 ranch operators who had reseeded 64 range sites totaling about 10,000 acres prior to 1973.

The following criteria by C. W. Cook (1966) represent suggestions when converting sagebrush range into seeded grassland:

1) Annual precipitation should be at least 11 inches and 13-14 inches for best results.

2) Soils should be 24 inches deep to allow roots to become properly established.

It should be noted many of the sites where range reseeding was done on ranches in Wyoming met the precipitation requirement, but would be considered marginal with respect to these soil criteria.

Inputs Required and Costs

Data were obtained on methods of seedbed preparation and planting, physical inputs used, and costs at the time reseeding was done. Costs were then calculated at 1972 price levels to

Table 1. Input requirements and costs of range reseeding.

Item	Moldboard plow	Disk plow	Offset disk
Operators	9	7	6
Reseedings	25	12	17
Acres			
Total	1,207	1,850	5,695
Average	48	154	335
Man-hours, average per acre[1]			
Primary tillage	.96	.64	.64
Other tillage	1.10	.30	.25
Planting	.37	.33	.26
Cost per acre			
Labor	$6.22	$3.22	$2.93
Fuel	1.92	.91	1.11
Repairs	3.23	1.67	2.54
Seed	5.00	5.16	4.64
Other	.23	3.80	.60
Sub-total	16.60	14.76	11.82
Fixed costs	2.98	1.28	1.55
Total costs	19.58	16.04	13.37
Range			
From	12.80	11.10	9.44
To	29.70	22.13	17.73

[1] Tractor and implement time are about 10% less than man-hours.

give a standard base for reference and comparisons. Fixed costs, including depreciation, interest on machinery investment, and taxes, were prorated between machinery use for reseeding and other uses for the machine on the ranch. Most of the machinery was used for other purposes also, reducing the fixed costs chargeable to reseeding.

Five tillage methods–moldboard plowing, disk plowing, chiseling, offset disking, and tandem disking–were used and data for three methods used by 22 operators were presented in Table 1. Two operators reseeded 190 acres using tandem disking as the primary tillage method at a total cost of $12.17/acre. Four operators reseeded 595 acres using a chisel for tillage at a cost of $13.09/acre. Two other operators used combinations of custom work and noncustom work. Elimination of competition through complete tillage and good seedbed preparation was important to successful reseeding. Any of the tillage methods which accomplished these things would be satisfactory from a biological standpoint.

Crested wheatgrass (*Agropyron desertorum* or *Agropyron cristatum*) was used on about 75% of the acreage. Other wheatgrasses were also seeded, as was Russian wildrye (*Elymus junceus*). Alfalfa and clovers (*Medicago media, Medicago sativa, Melilotus officinales,* or *Trifolium hybridum*) were seeded on 27 of the range sites and about 30% of the acreage. The average planting rate of grass and legumes seeded on the 64 sites surveyed was about 11 lb/acre. That amount of seed insured rapid establishment and productive stands.

A small grain nurse or cover crop was planted on seven of the reseeding sites to reduce wind or water erosion and protect sandy textured soils. The nurse crop was pastured or harvested as hay or grain, depending on the specific climatic and growing conditions.

Effects on Forage and Livestock

Forage Production

Estimates of forage production and carrying capacities before and after reseeding were also obtained. Percentage

Table 2. Effect of reseeding on forage production.[1]

Item	Moldboard plow	Disk plow	Chisel	Offset disk
Operators	10	7	5	6
Reseedings	26	12	7	17
Acres	1,337	1,850	1,235	5,695
Production–AUMs/acre				
Before	.29	.20	.37	.29
After	.76	.81	1.00	.69
Percentage change				
After/before	262%	405%	270%	238%
Increase	162%	305%	170%	138%

[1] Includes results of the chisel method done on a custom basis and one moldboard plow method which was excluded from the cost summary because it was a combination of custom and operator performance.

increases in forage according to reseeding method varied from 138% to 305%. The average carrying capacities of native range before reseeding varied from .20 to .37 AUM/acre. Average carrying capacities of reseeded range varied from .69 to 1.0 AUM/acre (Table 2).

The increased forage production results were consistent with results found in many experiments and other studies of reseeding (Barnes and Nelson, 1950; Bedell, 1973; Campbell, 1963; Cook, 1966; Cook et al., 1967; Frischknecht and Harris, 1968; Houston and Urick, 1972; Hull, 1972a, 1972b; Hull and Klomp, 1966; Jeffries et al., 1967; Pingrey and Dortignac, 1959; Rauzi et al., 1971; Rumsey, 1961). Forage production results from a few of those studies are summarized in Table 3. Crested wheatgrass compared very favorably with other wheatgrasses or Russian wildrye in any of these studies where comparisons were made.

Reseeding was very successful, as only two seedings totaling 90 acres, or less than 1% of the 10,000 reseeded acres, failed. Both failures, one caused by a very heavy rain and one unexplained, were successfully established by replanting. Annual weed infestations the first year after seeding were a problem on some sites and were treated by spraying or mowing.

Table 3. Summary of forage production results of selected crested wheatgrass range reseedings in the northern plains and Intermountain areas.

Location and time of experiment	Unit of measure	Native range	Reseeded
Utah, 1956–64[1]			
Eureka	lb/acre, air dry	190	1,148
Benmore	lb/acre, air dry	199	965
Miles City, 1964–68[2]	lb/acre, air dry	410	1,680
Idaho, 1955–64[3]			
Blackfoot	lb/acre, air dry	–	1,187
Raft River	lb/acre, air dry	–	1,169
Wyoming			
Archer, 1942–49[4]	ewe and lamb days	60	143
Gillette, 1959–62[5]	cow and calf days	8	16
Wheatland, 1971[6]	lb/acre, air dry	–	701
Archer, 1971–72[6]	lb/acre, air dry	–	1,177
Archer, 1965–69[7]	lb/acre, air dry	–	762
Gillette, 1965–69[7]	lb/acre, air dry	–	513

[1] Cook, 1966.
[2] Houston and Urick, 1972. Crested wheatgrass-alfalfa mixture.
[3] Hull and Klomp, 1966.
[4] Barnes and Nelson, 1950.
[5] Jeffries et al., 1967.
[6] Bedell, 1973.
[7] Rauzi et al., 1971.

Table 4. Summary of cattle performance (lb/head, avg daily gain) factors for early spring grazing on selected range reseedings in the northern plains and Intermountain areas.

Location, dates, and kind of animal	Native range	Reseeded
Benmore, Utah, 1956–64[1]		
Cows	1.02	1.73
Calves	1.37	2.02
Cebolla Mesa, N. Mex., 1953–57[2]		
Cows	1.21	3.23
Calves	1.16	2.18
No Agua, N. Mex.[2]		
Yearlings	1.50	2.15

Sources:
[1] Cook, 1966.
[2] Springfield, 1963.

Ranch operators generally did not give specific information on the amounts livestock gained and the percentage increases in calf crop due to grazing reseeded range. They did give general impressions that increased weight gains and increased calf crops were livestock benefits resulting from grazing reseeded ranges, which were consistent with experimental results.

Experimental results have shown calves and yearlings increased gains about 20 lb/season or more through grazing reseeded ranges from 4 to 6 weeks in the spring (Cook, 1966; Frischknecht and Harris, 1968; Springfield, 1963). The same studies showed large advantages in producing gains on cows between calving and breeding seasons (Table 4). That would suggest a flushing effect. A grazing trial at Fort Robinson, Nebr., did indicate beneficial effects (Anonymous, 1964). Higher percentages of 3-year-old cows were in heat within 50, 70, or 90 days after calving when grazing crested wheatgrass than when grazing native ranges (Table 5). Such performance should allow advancing calving dates and closer bunching of calf crop.

Grazing comparisons of reseeded and native ranges in southeastern Montana found that breeding herds grazing reseeded ranges in the spring weaned about 10% more calves than breeding herds grazing native spring ranges (Houston and Urick, 1972).

Other Benefits or Problems

A number of operators reported the grazing season was lengthened because of earlier grazing of the reseeding before the native species were ready. Increased spring pasture forage reduced the winter feed requirements on some operations. Special use calving and breeding pastures were often developed through range reseeding programs.

Deferment of grazing on reseeded sites, a recommended practice, was generally used, and varied from 1 to 3 years.

Table 5. Percent of 3-year-old cows returning in heat within different periods after calving, Fort Robinson, Nebr.

	Post-calving pasture	
Days after calving	Crested wheatgrass	Native range
50	32	16
70	64	41
80	77	57
90	79	70
110	92	95

Source: Fort Robinson Beef Cattle Research Station, Field Day Report, April 30, 1964.

Accommodating the livestock inventory during reseeding and deferment caused some management and feed problems. Reducing livestock numbers, grazing other range more intensively, buying hay, or renting pasture are methods of providing for the effects of nonuse on the reseeded area. The latter two methods were considered in making the evaluations, and the results using purchased hay, the more costly alternative, are presented here. Deferment was accomplished without additional fencing or water development.

Grass tetany, an often feared cause of death loss sometimes associated with grazing reseeded pastures, was reported by only one of the operators. Perhaps fear of grass tetany is exaggerated.

Legume species were mixed with grass species on some reseeded sites to increase forage production. Bloat problems were not reported, although some operators expressed concern about the possibility. Also, legume mixtures on reseeded sites inhibit control of broad-leaf weeds by chemicals.

Economics of Reseeding

Hypothetical ranch models based on northern plains cattle ranch studies were used to show forage and livestock effects and changes in net returns before, during, and after reseeding. A ranch model using a cow-yearling operation with 125 acres of crested wheatgrass pasture was compared to the same ranch model with an additional 951 acres of reseeded range to allow 35 days use between calving and breeding seasons. Reseeding was assumed to cost $16.31 per acre, the average cost for 64 sites, and about 15% more than the average cost for the disk plow, chisel, and offset disk methods. Reseeded range was assumed to produce feed at .7 AUM/acre while native range produced at .29 AUM/acre. Other assumptions, data items, and conclusions stemming from the analysis are summarized in Table 6.

The critical assumptions with respect to increased calf crop and gains of calves and yearlings are well supported by research. The other data and results flow logically from them. Calf crop is based on calves weaned as a percent of cows in the herd at calving time.

Comparisons Before and After Reseeding

Increasing a calf crop from 83.3% to 91.6% constitutes an 8% increase in calf crop. This assumption may seem optimistic but calf crop weaned in the northern plains and intermountain areas has been averaging under 80% and an 8% increase from 70%, 75%, or 80% would seem within reach and produce about the same results. Since requirements for replacements remain about the same, the number of heifers available for sale is increased by about 17% and the number of steers by about 10%. The weight of animals, regardless of age, is increased about 6%. The net effect of all changes is to increase gross incomes by 13%, even after allowing for slight reductions in price per pound for heavier animals. Since costs do not increase greatly, excluding the investment for the reseeding, the effect is to increase net ranch income by 26% and return to land by 64%.

The Return Flow

The simple comparison of results before and after reseeding, although easily understood, ignores problems of time and transition from the initial to the reseeded operation. Cash flow budgeting and discounting were used to estimate changes through time.

Table 6. Assumptions and results of analysis of range reseeding–comparisons of before and after situations.

Item	Before reseeding	After reseeding	Percent change
AUM equivalents	6,287	6,676	6.2
Percent calf crop	83.3%	91.6%	8.3
Weights (lb)			
Heifer calves	355	375	5.6
Steer calves	375	395	5.3
Yearling heifers	650	690	6.2
Yearling steers	705	745	5.7
Cull cows	1,000	1,000	
Inventories (No.)			
Cows to calve	314	314	
Yearlings	262	288	10.0
Number sold			
Cull cows	47	47	
Yearling heifers	77	90	16.9
Yearling steers	129	142	10.0
Weight sold (Cwt.)			
Cull cows	470	470	
Yearling heifers	500	621	24.2
Yearling steers	909	1,058	16.4
Price ($/Cwt.)			
Cull cows	$24.41	$24.41	–
Yearling heifers	$35.96	$35.34	–1.5
Yearling steers	$40.01	$38.88	–2.8
Value of sales	$65,858	$74,550	13.2
Operating expenses	$34,317	$34,790	1.4
Net ranch income	$31,541	$39,760	26.1
Operator's allowances[1]	$19,947	$20,761	4.2
Return to land	$11,594	$18,999	63.9
Return to land per AUM	$1.84	$2.86	55.4

[1] Includes $6,000 for labor, 5% of gross receipts for management, and 6% interest on working capital.

Year-to-year changes for a hypothetical reseeding situation involve the following steps:

Year	Actions and Effects
–1	Normal operation the year before reseeding.
0	Reseeding year–951 acres are reseeded, $13,561 variable cost is incurred for reseeding and $2,324 for buying hay, because of deferment. There is no effect on output or gross receipts.
1	The year after reseeding and the second year of deferment. There are costs for buying hay, but no effect on output or gross receipts.
2	Very moderate grazing allowed. Costs and returns are as in the normal operation.
3	The first full-use year. There are beneficial effects on conception, and calf and yearling weights increased by 20 lb each. There are slight increases in gross receipts and net income as heavier yearlings are sold.
4	Calf crop increases to 91.6%. Yearling sale weights reach maximum, because increased gains were realized on calves in the previous year and on yearlings in the 2nd year.
5	Full benefits of increased calf crop, heavier yearling sale weights, and larger number of yearlings sold are achieved.

Full productivity on the reseeded ranch situation was reached in 5 years after reseeding and was assumed to continue over 25- or 40-year life spans. Studies of seedings in Idaho in the 1930–40 era indicate this length of life is a reasonable expectation (Hull, 1972a). Effects on receipts, costs, and returns during the reseeding, deferment, and transition years are shown in Table 7. Changes in return to capital of the model ranches during these years are also shown.

Table 7. Flow of sales, expenses, net ranch income, return to capital and change in return to capital as a result of reseeding on the hypothetical ranch models over 25 and 40 year life spans.

Year	Total sales ($)	Total expenses ($)	Net ranch income ($)	Return to capital ($)	Change in return to capital ($)
–1[1]	65,858	34,317	31,541	22,248	–
0	65,858	50,202[2]	15,656	6,363	–15,885
1	65,858	36,641[3]	29,217	19,924	– 2,324
2	65,858	34,317	31,541	22,248	–
3	66,751	34,405	32,346	23,008	760
4	67,615	34,588	33,027	23,646	1,398
5[4]	74,550	34,790	39,760	30,032	7,784
6	74,550	34,790	39,760	30,032	7,784
7–25	74,550	34,790	39,760	30,032	7,784
7–40	74,550	34,790	39,760	30,032	7,784

[1] Basic ranch model situation.
[2] Includes $34,317, operating expenses of basic ranch; $13,561 total variable costs of reseeding 951 acres; and $2,324, cost of purchasing extra hay.
[3] Includes $34,317 operating expenses and $2,324 cost of extra hay.
[4] Stable condition was reached in year 5 and continued to provide the same annual return to the end of the time period.

The present value of return to capital was discounted at 8% in order to account for uncertainty and time lapses between income expenditure and receipts resulting from the reseeding improvement practice (Table 8). The present value of the flow of returns was positive at the end of the 8th year after reseeding, indicating that the reseeding investment, costs, and an interest of 8% had been paid in full by that time. The true or internal rate of return was about 21.5% for the 25- or 40-year life.

A Stepwise Approach to Range Reseeding.

The previous analysis assumes reseeding of 951 acres in a single year. The average size of reseeding as indicated by Table 1 was 156 acres, including the moldboard plow method, and 260 acres for the other two methods. It may be necessary or desirable to spread a reseeding as large as 951 acres over several years.

Requirements for AUM's and acreage for a stepwise

Table 8. Changes in return ($) to capital due to reseeding, undiscounted and discounted at 8% interest for 25 and 40 year periods.

Year	Undiscounted returns	Present value of returns discounted at 8%	
		Annual	Cumulated
0	–15,885	–15,885	–15,885
1	– 2,324	– 2,152	–18,037
2	–	–	–18,037
3	760	603	–17,434
4	1,398	1,028	–16,406
5	7,784	5,298	–11,108
6	7,784	4,905	– 6,203
7	7,784	4,542	– 1,661
8	7,784	4,205	+ 2,544
9–25	7,784	38,361[1]	40,905
Total	147,413	–	
9–40	7,784	48,089[1]	50,633
Total	264,173	–	

[1] Discounted annual returns cumulated for the 9 through 25 or 9 through 40 year time periods.

approach to range reseeding are indicated in Table 9. One-half the total yearling heifer inventory for the hypothetical ranch operation used in the previous evaluation would require 74 acres of reseeded range for breeding pasture for 1.2 months of grazing. Two-year-old heifers to be rebred would require 107 acres. That 181 acres of reseeded range would likely return considerably more than 20% on investment.

The balance of the cow herd would require 560 acres of additional reseeded range, about 4% of the ranch rangeland, and produce a return at around 20% indicated in this analysis.

Steers and heifers to be sold would produce lower rate of return to reseeding investment, since the gain advantage on yearling steers and heifers is much less than the combined advantage of increased percent calf crop, and increased weight of calves expected from the cow herd and yearling heifers.

It is quite possible that a good level of returns would be realized on reseedings adequate to carry the livestock inventory for 1.6 to 1.7 months, instead of 1.2 months used in this analysis. If more reseeded range is provided, it will merely increase the ranch carrying capacity without further enhancing the livestock reproductive efficiency or rate of gain. Returns to such additional reseedings would likely be much less than a 20% return estimated by this analysis.

The stepwise approach to range reseeding for this hypothetical ranch would allow seeding over a period of 4 years with around 150 to 300 acres seeded each year. That would reduce the labor, machinery, and capital requirements in any 1 year, tend to reduce the risk of complete failure, reduce problems, and perhaps costs associated with deferment, allow for some learning experience in 1 year's seeding to be applied in subsequent years, and result in high rate of return to the range reseeding.

Summary and Conclusions

Based upon the foregoing analysis, range reseeding appears to be a very profitable undertaking. The assumptions made in connection with the evaluation are consistent and well supported by research. Their application to actual ranch operations is quite plausible also.

Some economic evaluations of range reseeding done in the past have been based upon evaluating the effect of an increased carrying capacity without making any allowance for increased livestock gains or reproductive efficiency. When potential increases in reproductive efficiency or livestock gains are ignored, then evaluations have suggested that range reseeding is marginal from an economic point of view. This analysis would suggest that when those factors are considered and evaluated on a reasonable or perhaps even a conservative basis, then range reseeding appears to be highly profitable.

Table 9. Reseeded acreage required for various classes of stock.

	Requirements				
Kind	No. of cattle[1]	AUMs[2]	Reseeded acres[2]	Percent of range	Returns expected
Yearling heifers to breed	72	52	74	0.5	Much above 20%
Two-year-old heifers to rebreed	50	75	107	0.8	Much above 20%
Cows with calves	260	391	560	4.0	About 20%
Market steers and heifers	216	147	210	1.5	Below 20%
Extend grazing from 1.2 to 1.7 months			396	2.8	Below 20%
Extend grazing season further				Any amount	Below 20%

[1] Allows for death loss through the calving season.
[2] Allows also for bulls and nursing calves.

Literature Cited

Anonymous. 1964. Field Day Report. Fort Robinson Beef Cattle Research Station. April.

Barnes, O. K., and A. L. Nelson. 1950. Dryland pastures for the Great Plains. Wyo. Agr. Exp. Sta. Bull. 302.

Bedell, Thomas E. 1973. Prevent grass tetany. Wyoming range roundup. Wyo. Agr. Ext. Serv. No. 14.

Campbell, J. B. 1963. Grass-alfalfa versus grass-alone pastures grazed in a repeated-seasonal pattern. J. Range Manage. 16:78-81.

Cook, C. Wayne. 1966. Development and use of foothill ranges in Utah. Utah Agr. Exp. Sta. Bull. 461.

Cook, C. Wayne, L. A. Stoddart, and Phillip L. Sims. 1967. Effect of season, spacing and intensity of seeding on the development of foothill range grass stands. Utah Agr. Exp. Sta. Bull. 467.

Frischknecht, Neil C., and Lorin E. Harris. 1968. Grazing intensities and systems on crested wheatgrass in central Utah: Response of vegetation and cattle. U.S. Dep. Agr. Tech. Bull. 1388.

Houston, W. R., and J. J. Urick. 1972. Improved spring pastures, cow-calf production, and stocking rate carry over in the Northern Great Plains. U.S. Dep. Agr. Tech. Bull. 1451.

Hull, A. C., Jr. 1972a. Growth characteristics of crested and fairway wheatgrasses in southern Idaho. J. Range Manage. 25:123-125.

Hull, A. C., Jr. 1972b. Seeding rates and row spacing for rangelands in southeastern Idaho and northern Utah. J. Range Manage. 25:50-52.

Hull, A. C., Jr., and G. J. Klomp. 1966. Longevity of crested wheatgrass in sagebrush-grass type in southern Idaho. J. Range Manage. 19:5-11.

Jeffries, N. W., R. L. Lang, M. May, and L. Landers. 1967. Cow-calf production on seeded and native range. Wyo. Agr. Exp. Sta. Bull. 472.

Pingrey, H. B., and E. J. Dortignac. 1959. Economic evaluation of seeding crested wheatgrass on northern New Mexico rangeland. New Mexico Agr. Exp. Sta. Bull. 433.

Rauzi, Frank, Leland Landers, and Alan Herold. 1971. Renovating crested wheatgrass stands. Wyo. Agr. Exp. Sta. Res. J. 52.

Rumsey, Walter B. 1971. Range seedings versus climax vegetation on three sites in Idaho. J. Range Manage. 24:447-450.

Springfield, H. W. 1963. Cattle gains and plant responses from spring grazing on crested wheatgrass in northern New Mexico. U.S. Dep. Agr. Prod. Res. Rep. No. 74.