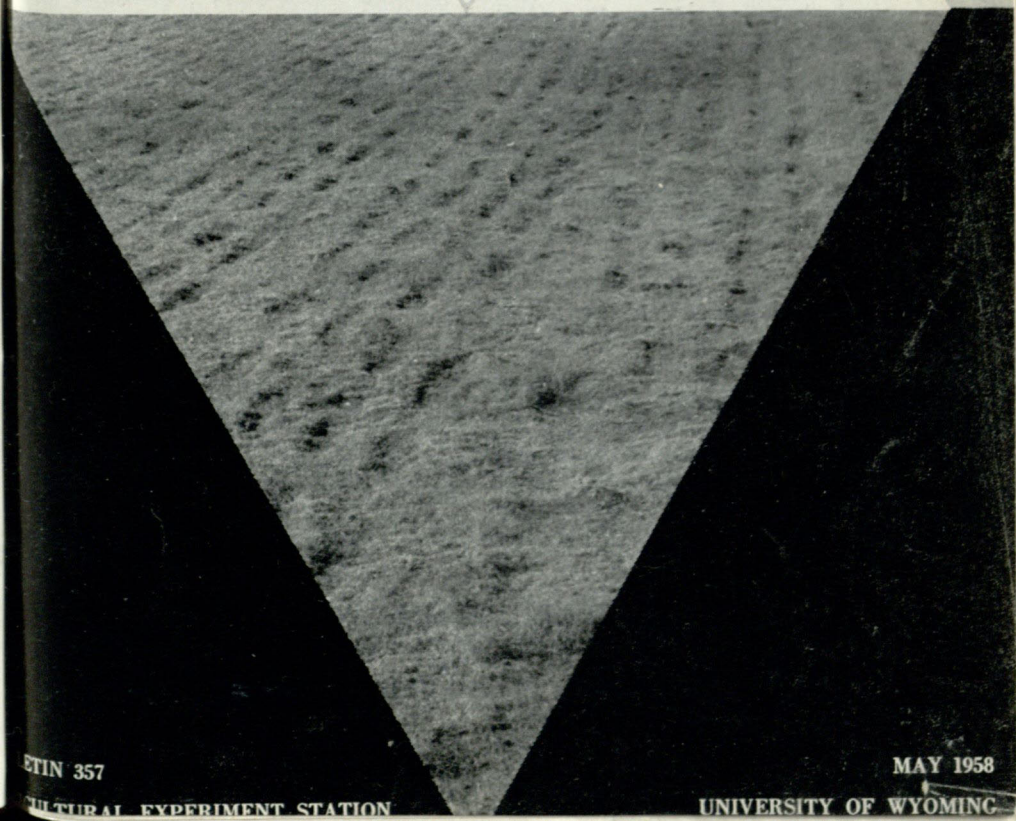
RANGE-PITTING TRIALS

in the Big Horn Mountains of Wyoming

by Robert L. Lang



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Summary and Conclusions

In the spring of 1953, range-pitting plots were established on three sites at two locations in the Big Horn Mountains of Wyoming. Site 1 was a sloping-valley area with deep soil, while Sites 2 and 3 were shallow soil areas with south and north-facing slopes respectively.

Crested wheatgrass and Russian wildrye were seeded in one-half of each plot at time of pitting, but no seedlings were established. Apparently the pitting operation did not sufficiently reduce competition from the existing vegetation to allow for seedling establishment.

Leaf-height measurements for the principal grass and grasslike species showed that in every year except the year of treatment, individual plants produced from 30 to 50 percent more height growth on the pitted areas than on non-treated checks. Seedstalk production was observed to be more profuse on the pitted plots.

Rate-of-water-infiltration studies showed a substantially greater water intake for pitted areas. Therefore pitting would be an effective means of water conservation where it could be applied.

Forage production, as measured from clipped plots during the last three years of this 5-year study, was from 32 to 68 percent greater from pitted areas than from non-pitted areas. The difference in favor of pitting was greater on the deep soil site than on the shallow soil sites.

Although much mountain rangeland is too rough, steep, or rocky for pitting, it may be concluded that mountain-range areas similar to those treated in this study could be made much more productive by pitting. In addition, water runoff from high-intensity rains would be reduced because of the water-holding capacity of the pits and a greater rate of water infiltration into the soil.

Range-Pitting Trials in the Big Horn Mountains of Wyoming[1]

By Robert L. Lang[2]

RANGE PITTING has proved to be an effective means of range improvement in the shortgrass plains area of Wyoming.

Rauzi and Lang (1956)[3] report that pitting, which removes approximately 33 percent of the existing vegetation, has brought about from the remaining plants an increased volume of growth which exceeded the production from non-treated areas. Increased production from pitting has been credited to (1) better water relations (the newly formed pits will hold 3/10 of an inch of rain), (2) more plant food available for a lesser number of plants, and (3) a significant change in vegetational composition resulting in more high-producing midgrasses. These authors also show that pitted pastures averaged 32 percent more grazing capacity over a 13-year period than adjoining non-treated pastures.

Preliminary trials reported by Barnes *et al.* (1952)[4] indicate that it may also be a practical method of increasing range-forage production from some types of desert vegetation.

Seeding and pitting in the same operation have resulted in established stands of the introduced species only on areas where the existing perennial vegetation is quite sparse.

This publication reports the results of the first range-pitting trial conducted on mountain rangeland of Wyoming.

Method of Study

Experimental plots were established at three sites at two locations on the southern part of the Big Horn Mountains. These plots were pitted with an eccentric one-way disc (see Fig. 1) in the spring of 1953, and half of each plot was seeded with a mixture of crested wheatgrass and Russian wildrye at seeding time. The pits made by this machine were approximately 4 ft. long, 7 in. wide, and 4 in. deep at their deepest point. Exclosures were established across the pitted areas and extended onto the non-treated land both above and below the treated plots as checks. A view of a pitted area with its exclosure is shown in Figure 2. This photo was taken in September of the year of treatment.

The sites treated differed in soil, vegetation, and exposure. Site 1, located near the Hunter Ranger Station in Johnson County, was a sloping-valley area of deep soil and supported a dense stand of desirable perennial vegetation. Site 2 was on a south-facing slope of shallow soil which

[1]This was a cooperative study among the following: the Wyoming Natural Resource Board, the Bighorn Permittees Association, the United States Forest Service, and the Wyoming Agricultural Experiment Station.

[2]Agronomist, Wyoming Agricultural Experiment Station.

[3]Rauzi, Frank, and R. L. Lang. 1956. Improving shortgrass range by pitting. Wyo. Agr. Exp. Sta. Bul. 344:1-11.

[4]Barnes, O. K., R. L. Lang, and A. A. Beetle. 1952. Grass establishment on Wyoming Dryland. Wyo. Agr. Exp. Sta. Bul. 314:1-23.

supported a high percentage of low-growing plants over a layer of non-decomposed organic matter. The perennial grasses were more sparse and of smaller stature than on Site 1. Site 3 was similar to Site 2 in soil and vegetation but was on a north-facing slope. Both Sites 2 and 3 were located in Elgin Park.

The soil at Site 1 was identified as a deep phase of Burgess loam. Sites 2 and 3 are shallow phases of the same soil type. The parent material of these soils is glacial granitic debris. The topsoil is dark brown to nearly black, underlain by a yellowish-brown acid loam of varying thickness.

An inventory of the vegetational composition of the treated areas was made in the fall of 1953 (the year of treatment), and leaf height measurements were made for the principal grass species in both 1953 and 1954. During the remaining three years of the study, randomly located plots were clipped in the pitted and check areas, and forage yield was determined from these samples.

A water-infiltration study was conducted on the pitted and check plots of Site 3 (shallow soil—north-facing slope) in September of the treatment year and again two years later (1955).

Results

The vegetational composition and cover at the two locations of treatment were quite different. Table 1 indicates that at Site 1 (sloping valley with deep soil), cover was three times greater than was present on the north-facing slope—shallow soil site. Idaho fescue *(Festuca idahoensis)* and fringed sagebrush *(Artemisia frigida)* occurred in conspicuously greater

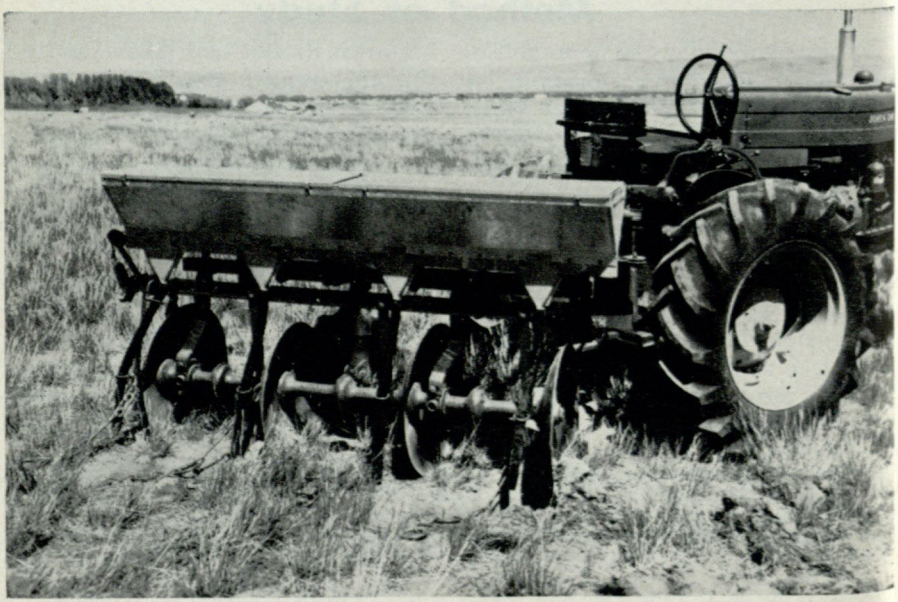


FIG. 1. A view of the range-pitting and seeding machine used in this study.

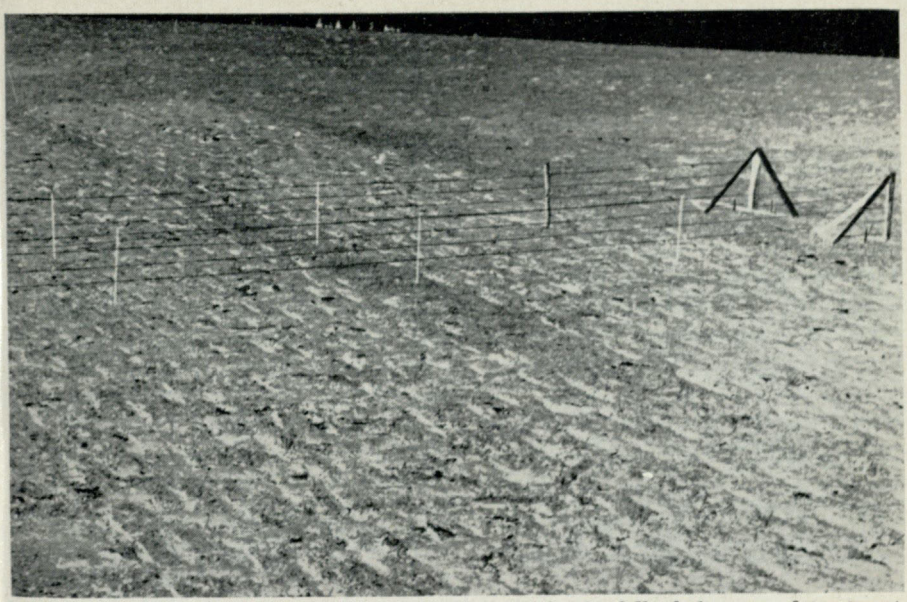


FIG. 2. A pitted area with its exclosure photographed in the fall of the year of treatment.

amounts; grassland selaginella *(Selaginella densa)* and other low-growing species were either absent or occurred more sparsely on Site 1 than on Site 3.

A count of the fringed-sagebrush plants, which was the most conspicuous forb at Site 1 (sloping-valley area —deep soil), showed that on the average there were 1.6 plants per square ft. in the treated area compared with 1.3 plants in the non-treated. Visually this difference would appear to be much greater than indicated above, because of taller growth and more abundant flower-stalk production on the pitted area.

As was previously mentioned, one-half of each pitted plot was seeded with a mixture of crested wheatgrass and Russian wildrye at the time of pitting. Seedlings of both species were noted in the pits at all three test sites, but they failed to establish. In a thorough reconnaissance in the fall of 1957, not a single plant of either of the species seeded was found at any of the three sites. Undoubtedly the competition from the remaining established perennial vegetation was too severe to allow for seedling establishment.

Differences between sites in response to pitting were as great as differences in vegetational composition and cover noted above. Table 2 shows the yield of both grasses and forbs from the different sites treated, for each of the three years in which sample plots were clipped. Grass yields were generally greater in 1956 than in either 1955 or 1957. As might be expected, the yield of forage from Site 1 was substantially higher on both pitted and check plots than that obtained from either Site 2 or Site 3. The production response to pitting on the three sites tested is shown graphically in Figure 3, as an average for the three years when harvests were taken. It may be noted from this figure that the average forb production was very nearly the same from pitted

TABLE 1—Approximate Percentage of Ground Cover and Vegetational Composition at Two Pitted Sites—1953

Species	Sloping valley—deep soil		North-facing slope—shallow soil	
	Percentage of ground cover	Percentage of composition	Percentage of ground cover	Percentage of composition
Festuca idahoensis	20.2	29.2	3.1	13.5
Carex obtusata	10.1	14.6	4.5	19.6
Koeleria cristata	2.9	4.3	.8	3.5
Agropyron trachycaulum	2.0	2.8	.8	3.5
Poa canbyi	T*	—	T	—
Artemisia frigida	8.5	12.5	.7	3.0
Cerastium arvense	5.6	8.2	T	—
Lupinus sericeus	5.1	7.4	1.3	5.7
Antennaria rosea	4.2	6.2	—	—
Geum triflorum	3.3	4.7	2.3	10.0
Taraxacum officinale	2.4	3.4	1.7	7.4
Agoseris glauca	2.2	3.2	.7	3.1
Phlox glabrata	—	—	.8	3.5
Achillea milletfolium	1.3	1.8	T	—
Arenaria hookeri	—	—	T	—
Myostotis alpestris	T	—	T	—
Selaginella densa	1.2	1.7	6.2	27.2
Total	69.0	100.0	22.9	100.0

*Species with less than 0.5 percent cover.

TABLE 2—Pounds of Forage Produced per Acre from Pitted and Check Plots on Three Sites in the Big Horn Mountains of Wyoming—1955 through 1957

		1955			1956			1957		
		Perennial Grass	Forbs	Total	Perennial Grass	Forbs	Total	Perennial Grass	Forbs	Total
Site 1										
Sloping-valley area Deep soil	Pitted	1,897	948	2,845	2,309	312	2,621	2,080	607	2,687
	Check	1,080	1,080	2,160	1,377	352	1,729	1,289	443	1,732
	Difference	+817	—132	+785	+932	—40	+892	+791	+164	+955
Site 2										
South-facing slope Shallow soil	Pitted	1,080	336	1,416	1,223	212	1,435	910	594	1,504
	Check	1,225	480	1,705	543	216	759	509	665	1,174
	Difference	—145	—144	—289	+780	—4	+676	+401	—71	+330
Site 3										
North-facing slope Shallow soil	Pitted	972	720	1,692	1,008	348	1,356	709	450	1,159
	Check	819	516	1,332	660	432	1,092	546	621	1,167
	Difference	+156	+204	+360	+348	—84	+264	+163	—171	—8

TABLE 3—Comparison of the Rate of Water Infiltration on Pitted and Non-treated Range in the Big Horn Mountains of Wyoming

	North-facing slope—shallow soil site Infiltration rate in inches per hour (1-hour basis)			
	1st 30 minutes		2nd 30 minutes	
	1953	1955	1953	1955
Pitted range	2.88	2.54	1.59	1.63
Non-treated range	1.90	1.62	1.06	1.17

and non-pitted areas. The perennial grass production, however, was substantially increased by pitting. This increase averaged from 32 percent on the north-facing slope — shallow soil site, to 70 percent on the deep soil site near Hunter Ranger Station.

Leaf-height measurements, taken for the principal grass and grass-like species each year, showed that the average leaf height was from 30 to 50 percent greater on the pitted area than on adjacent non-treated range. This fact is undoubtedly reflected in the yield data presented in Table 2, as the pitting operation removed approximately one-third of the vegetation.

Grass seedhead production was observed to be more profuse on the pitted area than on non-treated range in every year except the year of treatment.

Rate-of-water-infiltration studies were conducted on Site 3 (north-facing slope—shallow soil) in both 1953 and 1955. Results from these studies as reported by Rauzi (1956)[1] show that the rate of water infiltration into the soil was considerably greater for both the first and the second 30-minute period of a 1-hour test, and in both years on the pitted plots, than on adjoining checks. These data are summarized in Table 3.

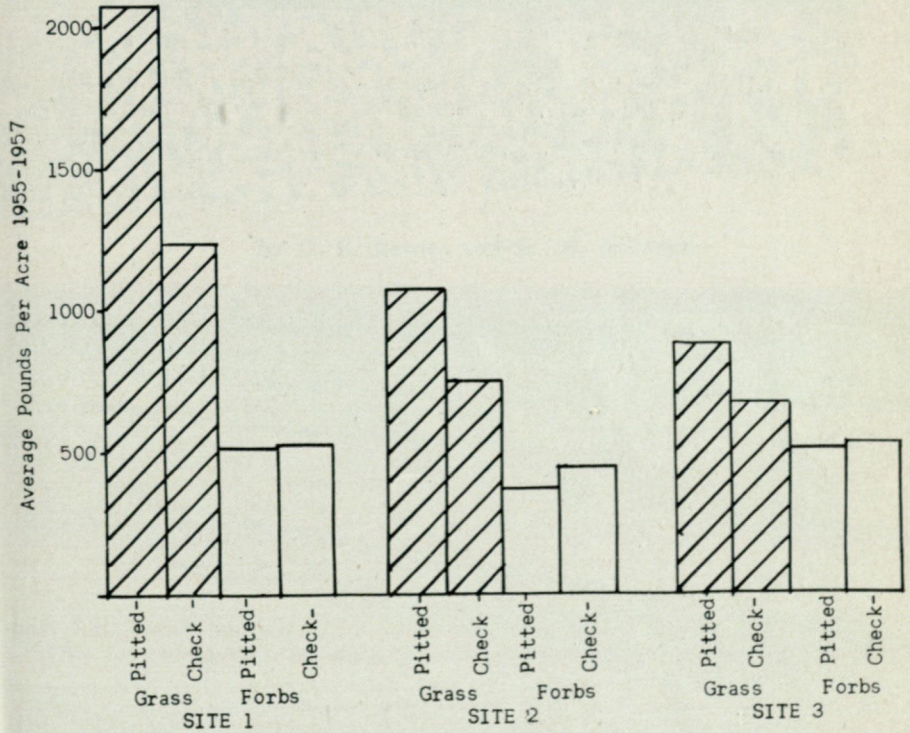
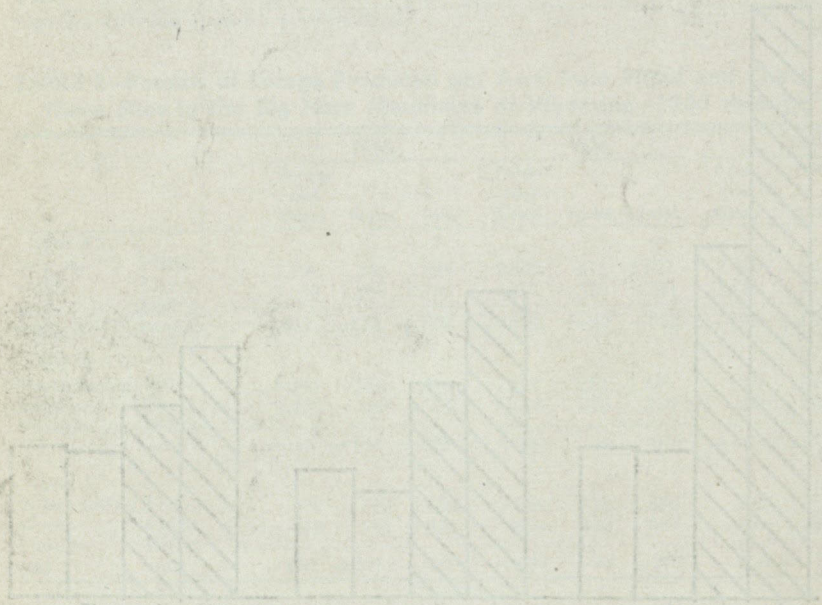


FIG. 3. Pounds of forage produced per acre from pitted and check plots on three sites in the Big Horn Mountains of Wyoming (3-year average, 1955-1957).

[1]Rauzi, Frank. 1956. Water-infiltration studies in the Bighorn National Forest. Wyo. Agr. Exp. Sta. Mimeo Cir. 62:1-7.



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