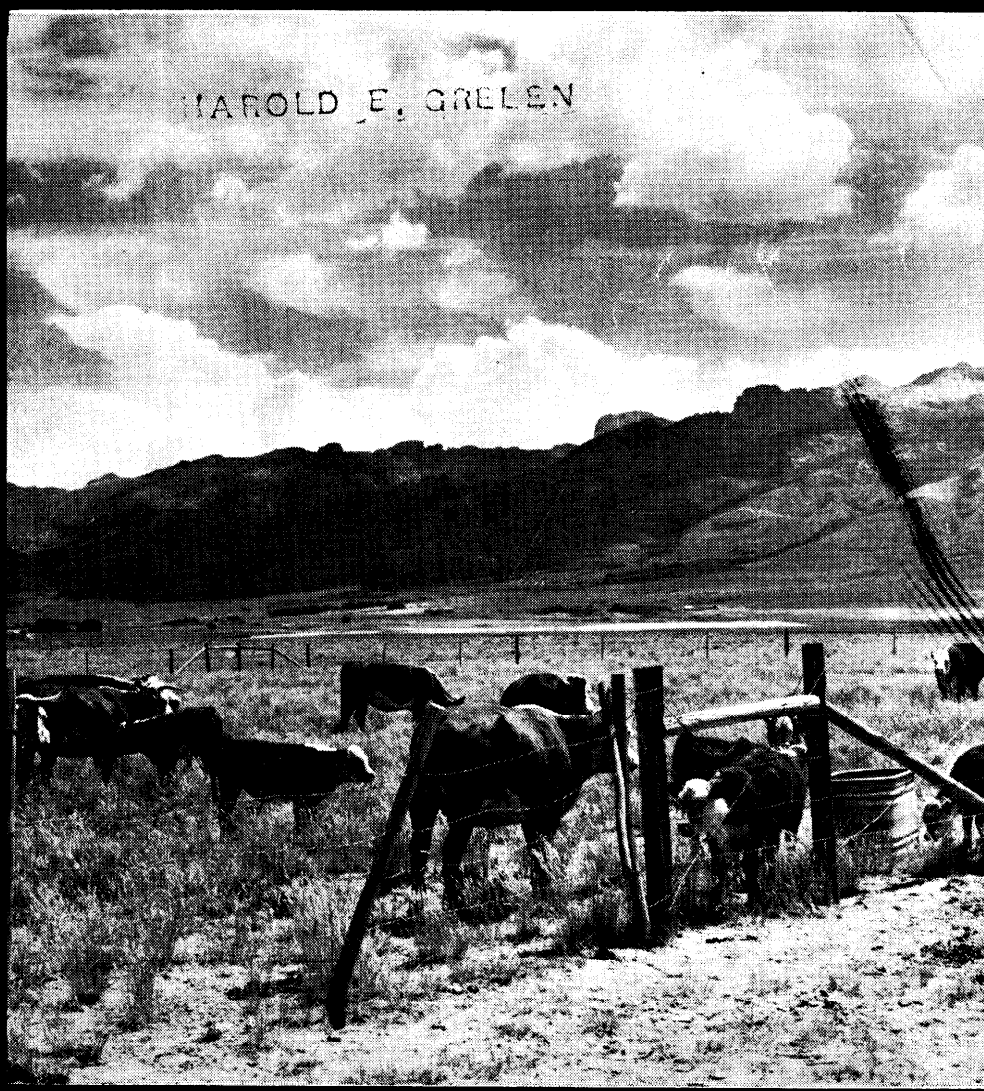
Journal of



The Trail Boss ®

American Society of Range Management

The American Society of Range Management was created in 1947 to foster advancement in the science and art of grazing land management, to promote progress in the conservation and greatest sustained use of forage and soil resources, to stimulate discussion and understanding of scientific and practical range and pasture problems, to provide a medium for the exchange of ideas and facts among society members and with allied technologists, and to encourage professional improvement of its members.

Persons shall be eligible for membership who are interested in or engaged in practicing range or pasture management or animal husbandry; administering grazing lands; or teaching, or conducting research, or engaged in extension activities in range or pasture management or related subjects.

The JOURNAL OF RANGE MANAGEMENT, published bi-monthly, is the official organ of the American Society of Range Management. The Society, however, assumes no responsibility for the statements and opinions expressed by authors and contributors.

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IN THIS ISSUE

Cover Photo — Good grass, good cattle, good country.

Pleasant Valley, Nevada, August 1961. By Bill Sonnemann, Agricultural Information Specialist, University of Nevada.

Convention Reservation Information

The following are names of other hotels and motels in Corpus Christi which are convenient to the headquarters hotel and comparable in rates:

Hotels

ROBERT DRISCOLL HOTEL—350 rooms
615 N. Broadway.....TU 2-3331
Single $ 6.00—$ 8.00
Double $ 9.00—$11.00
Twin $11.00—$19.00
Headquarters Hotel, completely new, Cabana Rooms, Swimming Pool
Blake Sweatt, Manager

SHORELINE TERRACE MOTOR HOTEL—
719 S. Shoreline Drive .....TU 3-8433
Rooms & Suites $7.00 Up
Completely air conditioned, beautifully decorated, swimming pool, overlooking beautiful McCaughan Park and South Beach near downtown Corpus Christi.

NUECES HOTEL—300 rooms
604 N. Chaparral .....TU 3-4331
Single $4.00 & up, Bayside
Family rates, most air-conditioned.

Waterfront Motor Hotels

SANDY SHORES MOTOR HOTEL 102 rooms
3200 Hamilton Blvd .....TU 3-7456
New with palm lined private beach, Fishing pier, Waterfront restaurant. Two swimming pools, Wall to wall carpet.

MAYFLOWER MOTOR HOTEL—
1601 N. Shoreline .....TU 3-3527
Restaurant, Swimming pool, Cocktail lounge. By the bay in downtown Corpus Christi.

MONACO MOTEL—38 units
1501 N. Shoreline .....TU 3-8518
Single $5.00 up
Double $7.00 up
Air conditioned, Coffee shop, Swimming pool, 6 blocks from downtown Corpus Christi.

GULF WINDS MOTOR HOTEL—32 rooms
801 S. Shoreline .....TU 4-2485
Overlooking Corpus Christi Bay, Wall to Wall Carpet, Swimming pool, Sundeck.

SEA GULL MOTEL—50 units
1617 N. Shoreline .....TU 2-5688
On Corpus Christi Bay, Coffee Shop, Swimming pool, Sundeck, free TV

SEA RANCH MOTEL—
4401 Ocean Drive.....UL 3-7366
Located in the beautiful Ocean Drive residential area, Swimming pool, Fishing pier, Private Beach.

GULF WAY MOTEL—
5837 Highway #9 .....TU 2-6535
Swimming pool, Wall to wall carpet, "Good Morning" coffee served on the breezeway.

RANCH MOTEL—29 units
4206 Highway #9 .....TU 4-3271
Single $5.50—$6.00
Double $7.00—$9.00
Carpeted floors, Swimming pool, Coffee Bar, Air conditioning

TRADE WINDS MOTOR HOTEL—102 rooms
5901 Highway #9 .....TU 3-9266
Restaurant, Heated pool, Wall to wall carpeting, Wired music, TV

HOLIDAY INN MOTOR HOTEL—70 rooms
6033 Highway #9 .....TU 4-1666
Swimming pool, Central heating, TV and wired music, Restaurant, Rooms completely air conditioned.

TALLY-HO MOTOR HOTEL—86 rooms
3901 Highway #9 .....TU 4-8885
Heated swimming pool, 5 minutes from downtown, Heat and air-conditioning, TV.

Range Management Education Council

The Council will meet in Corpus Christi at 1:30 p.m. January 22, 1962. All educators and others interested in range education are invited to attend. Obtain location of the meeting room at convention headquarters.

Harold F. Heady—Secretary

JOURNAL OF RANGE MANAGEMENT

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Editorial
INCREASING SOCIETY MEMBERSHIP

Much is said and written each year about the need for more members, especially rancher members, in the American Society of Range Management. Each new Society President and in turn each Section Chairman, appoints a membership committee and instructs it to get new members. These committees dutifully talk to their Society and Section memberships and print written pleas in the Journal of Range Management and Section newsletters for new members. But, nothing ever happens! A significant number of new members just doesn't materialize. Wonder why?

Since the first big push for members, 1948 through the early 50's, increases in Society membership have been very small. Annually we pick up the new range graduates after they find employment and a few foreign students who, at best, are only mildly active for a year or two. Total membership was around 3000 five years ago and it is still about the same today.

The membership simply isn't increasing significantly and I think it is because we do not work hard enough at the job. It doesn't do any good to talk to the membership because everyone in it already belongs. There are no potential new members there. And the newsletter and Journal articles are read only by members—no potential there either. The fact is we talk and write only to ourselves! So—I'm doing the same thing, but maybe someone who reads this will become unhappy enough to listen to the following suggestions.

Someone has to do a little missionary work—sell the Society—if substatntial increases in membership are ever to be realized. Do you ever see anyone get on his feet at a meeting of ranchers and tell of the American Society of Range Management—what it stands for, what it does and what it can do for ranchers and other administrators of range lands? Do you ever hear anyone, any ASRM member, tell ranchers and stockmen that the American Society of Range Management publishes the Journal of Range Management, the only Journal of its kind in the world—the only professional Journal devoted entirely to range management and improvement? Do you ever see an advertisement or announcement in a livestock paper or journal concerning the American Society of Range Management or the Journal of Range Management? Of course not! The only announcement of the Journal of Range Management is in Herbage Abstracts. How many ranchers ever see that?

Members of ASRM, we are talking to ourselves on this membership thing. If we desire new members and we've got to have them to keep this thing going, someone is going to have to go out and get them.

We've a little money saved — what say we spend some of it for an increase in Society membership? Let's send the President or the President-elect or the Executive Secretary to the American National Livestock Association Convention and the National Woolgrower's Convention and perhaps the national meeting of the Soil Conservation Districts Association and the Farm Bureau Federation and have him man a booth in the convention headquarters of each and perhaps even make a speech on the program. These groups will go along — all we have to do is ask them. Let's tell some of these fellows that we want for members in ASRM something about the outfit — what it has done and what it is going to do. Some of them might join-up! It's a cinch they won't as long as they don't know anything about the American Society of Range Management.

Now, let's spend a little more of that saved-up money and ask John Chohlis to carry a half page layout about the American Society of Range Management in his monthly Western Livestock Journal. It wouldn't hurt to have such a spread in some livestock magazine every month. There are many good trade journals, The American Hereford Journal, The Cattleman and the National Woolgrower just to name a few. It isn't difficult to prepare such material in suitable form. I can do it and will if Doc Young and John Clouston will tell me to go ahead and will put up the money.

Well, this is the way I size-up this membership business. I wish I were wrong but I don't think I am. The Society and every Section is going to have to change tactics — get out and beat the bushes — if they want new members. E. J. WOOLFOLK

Influence of Supplemental Run-off Water and Fertilizer on Production and Chemical Composition of Native Forage[1]

H. R. COSPER AND J. R. THOMAS[2]
Soil Scientists, Western Soil and Water Management Research Branch, Soil and Water Conservation Research Division, Agricultural Research Service, U.S.D.A., Newell, South Dakota and Weslaco, Texas, Respectively

Utilization of run-off water to produce additional forage is essential in a balanced range management program. This is especially true in the northern Great Plains where limited and erratic precipitation results in frequent drought periods. The use of water spreading systems to collect and distribute run-off water over "run-in" range sites has generally resulted in greater forage production (Mooney and Martin, 1956). However, the extra moisture received on several "run-in" range sites on the heavy clay soils of western South Dakota has failed to produce forage in proportion to the amount of moisture available. Poor grazing management and/or low fertility could nullify the benefits expected from the additional moisture.

Increased efficiency of moisture can be obtained by balancing the moisture supply with the soil fertility level. Thomas and Osenbrug (1959) found that yields of crested wheatgrass-bromegrass hay increased from 86 pounds per inch of precipitation for non-fertilized grass to 187 pounds per inch of precipitation for grass fertilized with 255 pounds of nitrogen. Moisture use efficiency increased with further additions of nitrogen. The effect of moisture on the use of nitrogen fertilizer by grasses native to central North Dakota was reported by Rogler and Lorenz (1957). Forage yields decreased from 44.9 to 9.7 pounds per pound of nitrogen added as the annual precipitation changed from 21.76 to 10.25 inches, respectively. As the same area was fertilized annually for several years the values included the effects of residual nitrogen.

This study was planned to further investigate the relationships between forage production, soil fertility and moisture. The effects of nitrogen and phosphorus fertilization on the chemical composition of the forage were also investigated.

Experimental Area

The soil in the experimental area was classified as Orman clay loam. It is slightly calcareous having a pH of 7.5, low in available $NaHCO_3$ soluble phosphorus (6.5 ppm P), relatively high in total nitrogen (0.107 percent) and mineralizable nitrogen (46.2 ppm N), and has a cation exchange capacity of 24.6 me./100 gm, in the surface six inches.

Principal grasses are western wheatgrass *(Agropyon smithii)*, green needle grass *(Stipa viridula)*, and downy brome *(Bromis tectorum)*. These grasses comprised 65 percent of the total plant population. Other plant species present included sunflower *(Helianthus spec.)*, wild carrot *(Leplolania multifida)*, American vetch *(Vicia (Americana) augustifolia)*, and tansy mustard *(Sophia incisa)*.

The water collecting and spreading systems were constructed in 1944. Water was collected from a watershed of approximately 1400 acres, concentrated in a small reservoir and distributed over a "run-in" range site of approximately 140 acres by means of spreader ditches. In years of normal precipitation the system could be expected to produce one acre foot of water per 35 acres of watershed. Water was spread on the experimental area in 1958. Moisture carried over from the 1958 season influenced yields in 1959. Precipita-

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[1] *Contribution from Soil and Water Conservation Research Division, Agricultural Research Service, U. S. Department of Agriculture, South Dakota Agricultural Experiment Station cooperating.*

[2] *Acknowledgement is extended to Mr. Louie Eberlein, Work Unit Conservationist, Soil Conservation Service, for his assistance in identifying and in determining the composition of the range grasses and herbs. We also wish to thank Mr. Ralph Kopp for donating the use of the land.*

tion data for the experimental area for the period 1957 through 1959 and from surrounding areas for a longer period are given in Table 1.

The field in which the experimental sites were located was not grazed by livestock. Instead, hay was cut and stacked each year and hauled to the livestock as needed.

Table 1. Annual and seasonal precipitation, 1957-1959

Year	Annual	April 1-June 30
	Inches	Inches
1957	18.94	12.63
1958	16.09	12.71
1959	13.54	7.52
Mean	16.19	10.95
15 year Mean	15.12	9.49

Methods

In order to determine the effect of supplemental water on forage response to fertilizer, one set of fertilizer treatments was located in the water spreading area and another identical set of treatments was located in an adjacent area outside of the water spreading area. Each fertilizer treatment was applied to an area 5 feet wide and 24 feet long. The treatments included applications of nitrogen as ammonium nitrate (33.5 percent N) at rates of 0, 40, 80 and 160 pounds N per acre and applications of phosphorus as treble superphosphate (43 percent P_2O_5) at rates of 0, 80, and 160 pounds P_2O_5 per acre in a 4 x 3 factorial design replicated three times.

The fertilizer was placed in bands 10 inches apart to a depth of two to three inches by means of small inch-wide chisels. A new area was fertilized by this method each year. Response to residual fertilizer was determined by the Kjeldahl method mined on the areas previously fertilized.

Yields were determined by clipping the forage at the end of the growing season, which normally extends from mid-April through June depending on the amount of available moisture. The forage from an area three feet wide and twenty feet long from each fertilizer treatment was clipped to a height of one inch above the ground level. All forage yields are reported on an oven-dried basis (65° C).

Total nitrogen content of the plant material was determined by the Kjeldahl method and converted to crude protein values by means of the factor 6.25. Total plant phosphorus was determined by the methods of Bolin and Stamberg (1944) and Barton (1948).

Results and Discussion

Forage Production

Forage yields on the dry range site (outside of the water spreading system) were significantly increased by the application of nitrogen and phosphorus fertilizer. The degree of response was related to the annual precipitation (Figure 1). In 1957 with above normal precipitation (18.9 inches) the largest yields was obtained with the 160 pound N- 160 pound P_2O_5 fertilizer addition. As the amount of precipitation decreased the quantity of nitrogen and phosphorus fertilizer required for maximum production also decreased. In 1958 and 1959 the respective maximum yields were obtained with the 160 pound N-80 pound P_2O_5 and the 80 pound N-80 pound P_2O_5 fertilizer combinations. Yields decreased with the application of larger amounts of nitrogen or phosphorus. Precipitation in 1958 and 1959 was 16.1 and 13.5 inches, respectively. The ripping action of the chisels on the grass sod reduced forage yields slightly in the year follow-

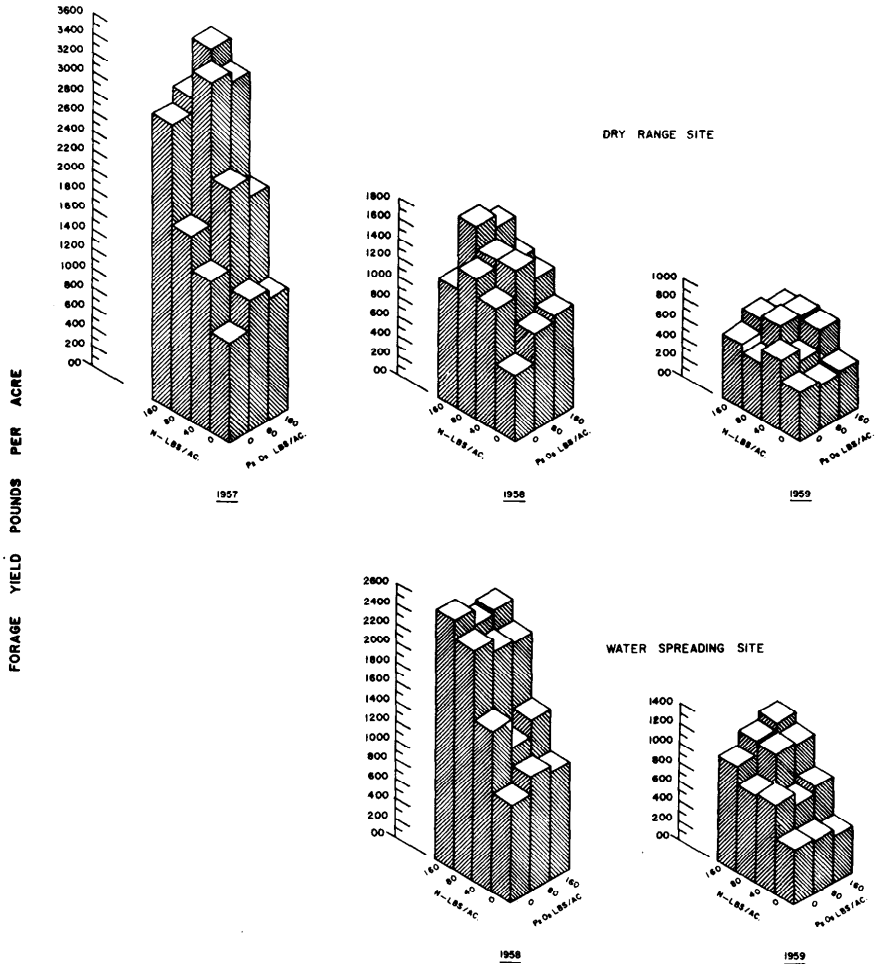

FIGURE 1. Effect of nitrogen and phosphorus fertilizer combination on forage yields on a dry range and water spreading site.

Table 2. Total yield of forage from a dryland and water spreading range site with various rates of applied fertilizer.

Fertilizer Applied		Total Yield Dryland Range Site[1]		Total Yield Water Spreading Range Site[1]
N	P_2O_5	1958-59[2]	1957-58-59[3]	1958-59[2]
		(Pounds Per Acre)		
0	0	1094	2527	1566
40	0	1908	3157	2559
80	0	2213	3631	3207
160	0	2084	4833	3711
0	80	1652	2938	1812
40	80	2355	4457	2082
80	80	2312	5357	3268
160	80	2607	5269	3532
0	160	1612	3095	1718
40	160	2008	3710	2372
80	160	2206	4979	3303
160	160	2535	5846	3568
L.S.D. .05		266	541	290
L.S.D. .01		360	723	393

[1]Oven dry basis.
[2]Fertilizer applied fall 1957.
[3]Fertilizer applied fall 1956.

ing the fertilizer application, but no effect occurred the second year.

Hay yields with supplemental water increased significantly with the use of nitrogen fertilizer (Figure 1). The largest yield of 2660 pounds per acre was obtained in 1958 with the 160 pound of N-0 pound P_2O_5 application. Phosphorus fertilizer alone or in combination with nitrogen did not significantly change forage production in 1958. However, in the drier year of 1959, the largest yield of hay was obtained with the 160 pound N-160 pound P_2O_5 fertilizer addition. The interaction between the high rates of nitrogen and phosphorus was statistically significant at the 5 percent level of probability. The apparent decrease in hay yields with the application of phosphorus fertilizer alone in 1959 was not significant.

Supplemental water increased mean forage production in 1958 on the water spreading site by 16.3, 10.1, 58.1 and 63.3 percent over forage yields on the dry range site for the 0, 40, 80, and 160 pound nitrogen additions, respectively. Yield response to phosphorus fertilizers was also enhanced by the additional moisture. Mean forage yield with supplemental water were 38.6, 21.2 and 25.7 percent greater than yields on the dry range site with the application of 0, 80 and 160 pounds of phosphorus, respectively.

The application of fertilizer to range land may create a serious problem in control of non-grass species, especially if the range condition is poor. On both range sites the non-grasses, mainly sunflower, responded markedly to both nitrogen and phosphorus. The grasses responded principally to nitrogen. Western wheatgrass accounted for most of the yield increase.

The differential response of grasses and nongrasses to fertilization points out the possibility for improving range conditions with nitrogen fertilizer additions. Rogler and Lorenz (1957) found that nitrogen fertilization and deferred grazing for two years improve range condition and production to greater extent than six years of deferred grazing.

Residual effects of nitrogen and phosphorus fertilizers applied in the fall of 1956 on the dry range site were apparent for two growing seasons (Figure 2). Significant increases in forage yields from residual fertilizer were obtained only from the 160 pound nitrogen applications alone or with phosphorus. The total yields for a three year period from the 1956 fertilizer applications are listed in Table 2. Total production increased linearly with the application of nitrogen and phosphorus fertilizer.

Significant increases in hay production were obtained from residual nitrogen at all levels of nitrogen fertilizer applied on the water spreading site in the fall of 1957. Residual phosphorus did not significantly effect yields. Table 2 shows the total forage yields for a two year period from the 1957 fertilizer application.

Fertilizer combinations that produced the largest hay yields did so with the least efficient use of the nitrogen fertilizer. Also, those combinations that produced the largest hay yields resulted in the least profitable return on a cost basis. From a physical standpoint use efficiency is defined as the increase in pounds of forage produced per pound of nitrogen applied and was influenced by the amount and ration of nitrogen and phosphorus and by the amount of

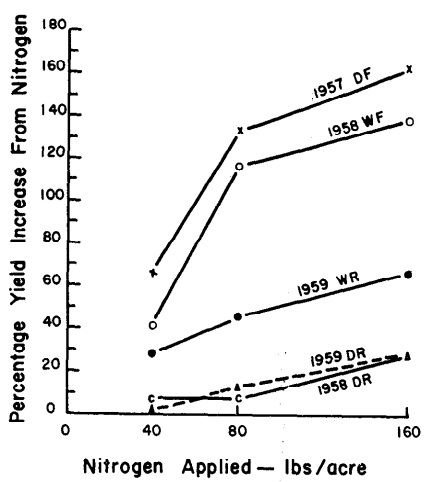

FIGURE 2. Relative yield response to fertilizer nitrogen (F), applied in the fall of 1956 on dry range (D) and 1957 on water spreading (W) site, and residual nitrogen (R).

Table 3. The mean nitrogen and phosphorus content, and the percentage of fertilizer recovered on a dryland and a water spreading range site.

Fertilizer Applied		Dryland Range Site				Water Spreading Range Site		
		Mean content of		Recovery of N		Mean content of		Recovery of N
N	P_2O_5	N	P	3 years[2]	2 years[1]	N	P	2 years[1]
				(Percent)				
0	0	1.46	0.126	.....	.....	1.25	0.149	.....
40	0	1.47	0.118	27.8	24.2	1.27	0.127	31.2
80	0	1.58	0.124	31.9	22.4	1.43	0.137	28.4
160	0	1.78	0.132	36.5	13.3	1.61	0.133	23.7
0	80	1.48	0.161	.....	.....	1.25	0.185	.....
40	80	1.46	0.146	57.0	23.8	1.20	0.167	5.5
80	80	1.58	0.158	61.1	11.1	1.39	0.164	25.6
160	80	1.83	0.141	34.4	11.6	1.58	0.165	20.0
0	160	1.50	0.174	.....	.....	1.28	0.176	.....
40	160	1.54	0.171	35.0	12.5	1.28	0.178	19.0
80	160	1.57	0.163	53.5	14.5	1.39	0.167	27.3
160	160	1.71	0.166	43.1	13.3	1.57	0.166	20.2
L.S.D.	.05	0.32	0.027			0.17	0.028	
L.S.D.	.01	0.44	0.036			0.24	0.040	

[1]Fertilizer applied fall 1957.
[2]Fertilizer applied fall 1956.

available moisture (Table 4). In general the efficiency of use of nitrogen fertilizer decreased as the amount of fertilizer nitrogen applied increased and as the supply of available moisture decreased. In a year of above normal rainfall (1957) the highest efficiencies were obtained with 40 and 80 pounds of nitrogen in combination with 80 and 160 pounds of phosphorus. Considering both initial and residual yields on the dry range site, the 40 pound N — 80 pound P_2O_5 fertilizer combination was most efficient. This 1:2 ratio was equally as efficient at the higher nitrogen-phosphorus level. With supplemental water phosphorus had very little effect on the efficiency of use of nitrogen fertilizer. The 40 pound N application was most efficient over a two year period. Comparison of the 1958 and 1959 yield changes on the dry range with those on a water spreading site show that supplemental water more than doubled the nitrogen use efficiency in several cases. In 1958 the respective mean efficiencies for all phosphorus levels were 7.5 and 12.1 pounds of forage per pound of. nitrogen on the dry range and water spreading sites.

Nitrogen Content of Forage

The nitrogen content of the forage was significantly increased by the addition of nitrogen fertilizer but decreased with the use of supplemental water and as precipitation increased. The mean nitrogen percentage of forage receiving supplemental water in 1958 was 1.04, 1.05, 1.16, and 1.41 for the 0, 40, 80 and 160 pounds of applied nitrogen, respectively, compared to percent nitrogen values of 1.14, 1.16, 1.29 and 1.46 for similar nitrogen applications on the dry range site.

The effects of a single application of nitrogen or phosphorus fertilizer, alone and in combination, on the mean nitrogen content of forage for a three year period and on the percent nitrogen recovery on the dry range site are shown in Table 3. The application of 80 and 160 pounds of nitrogen significantly increased the mean nitrogen content of the forage from 1.48 percent for the nonfertilized forage to 1.58 and 1.78 percent, respectively. The application of 40 pounds of nitrogen had no effect on the nitrogen percentage. Residual response from the 160 pound N applications significantly increased the nitrogen content of the forage for one year.

The quantity of nitrogen recovered in the forage over a three year period varied from 27.8 percent for the 40 pound N application to 61.1 percent for the 80 pound N — 80 pound P_2O_5 fertilizer additions (Table 3). The application of phosphorus fertilizer also increased the uptake of fertilizer nitrogen on the dry range during this period. The mean recovery of nitrogen with the addition of 0, 80 and 160 pounds of phosphorus for all levels of fertilizer nitrogen was 32.0, 50.8 and 43.8 percent, respectively. The effect of phosphorus fertilizer on nitrogen recovery was apparently related to the precipitation. In 1958 with 16.1 inches of precipitation the fall application in 1957 of 80 and 160 pounds of phosphorus decreased the mean nitrogen recovery for all levels of fertilizer nitrogen from 19.9 percent for the nonphosphorus-fertilized forage to 15.5 and 13.4 percent, respectively. The ratio of the amount of soil-applied nitrogen to phosphorus determined the quantity of fertilizer nitrogen utilized by the forage on the dry range. Mean nitrogen recovery was 55.2, 52.1, 35.0 and 34.4 percent for N: P_2O_5 fertilizer ratios of 1:2, 1:1, 1:4 and 2:1, respectively.

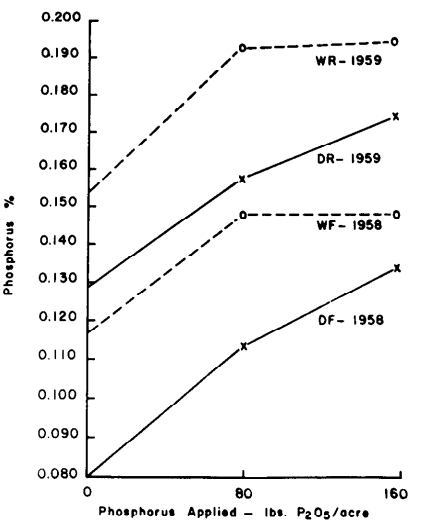

FIGURE 3. The effect of residual (R) and fertilizer (F) phosphorus applied in the fall of 1957 on the phosphorus content of forage on dry range (D) and water spreading (W) sites.

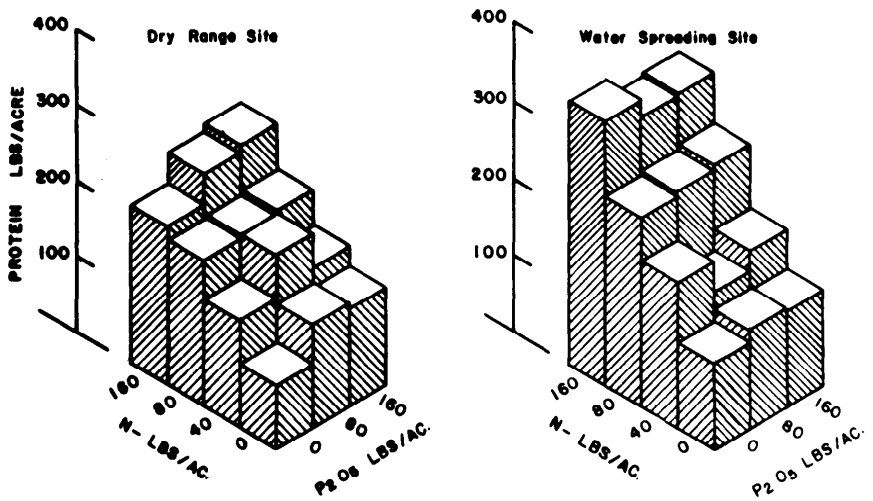

FIGURE 4. Total yield of crude protein for two year period 1958-1959 as effected by supplemental water and nitrogen and phosphorus fertilizer. Fertilizer applied fall of 1957.

The mean nitrogen content and percent nitrogen recovery in two years on the water spreading site are given in Table 3. The application of 80 and 160 pounds of nitrogen significantly increased the mean nitrogen content of the forage from 1.25 percent for the check treatment to 1.43 and 1.61 percent, respectively. The application of 40 pounds of nitrogen had no effect on the nitrogen content of the forage on the water spreading site. Residual responses were obtained from 80 and 160 pound rates of nitrogen previously applied on the water spreading system.

The quantity of nitrogen recovered in the forage for the two year period varied from 5.5 percent for a 40 pound N — 80 pound P_2O_5 fertilizer application to 31.2 percent for the 40 pound N addition. The mean recovery of nitrogen decreased from 27.7 percent to 17.0 and 22.1 percent with the application of 0, 80 and 160 pounds of phosphorus for all levels of nitrogen fertilizer during this period.

Phosphorus Content of Forage

The phosphorus percentage of the forage increased with the application of fertilizer phosphorus and with the use of supplemental water (Figure 3). Fertilizer was applied in the fall of 1957 and forage harvested in 1958 and 1959. Comparison of the phosphorus content of nonfertilized forage on the dry range and water spreading sites show that with the additional water the phosphorus percentage increased from 0.080 to 0.117 percent. Similar increases were noted in the phosphorus fertilized forage. Greater root activity and increased solubility of the soil and fertilizer phosphorus could account for the greater uptake of phosphorus by the forage (Power, *et. al.*, 1961). A significant increase in the phosphorus content of the forage two years after fertilizer was applied was noted on both sites (Figure 3, R 1959).

The addition of nitrogen fertilizer by greatly increasing forage production decreased the mean phosphorus content of the forage (Table 3). Considering all levels of applied phosphorus, the addition of 0, 40, 80 and 160 pounds of nitrogen forage containing 0.153, 0.145, 0.148 and 0.146 percent phosphorus, respectively, on the dry range site and 0.170, 0.157, 0.156 and 0.154 percent phosphorus, respectively on the water spreading site. The effect of nitrogen fertilizer on the phosphorus percentage of forage also accounts for the high phosphorus content of forage on residual fertilizer (compare immediate and residual curves, Figure 3).

The effects of one fertilizer application and supplemental water on the total yield of crude protein for the two year period 1958 and 1959 are illustrated in Figure 4. Crude protein production increased with the application of nitrogen fertilizer and with the use of supplemental water. The increase in forage yields by the application of fertilizer was significantly correlated with the increase in percent crude protein ($r=0.889$). Fertilizer applied on the dry range site increased forage yields and crude protein. Yield increases were significantly correlated with increases

Table 4. Effect of different years in applying nitrogen and phosphorus fertilizer and supplemental water on the increase in pounds of forage per pound of nitrogen.

Fertilizer applied		Dry range site[1]				Water spreading site[1]		
N	P_2O_5	1957	1957	1959	Total[2]	1958	1959	Total[3]
(Pounds per acre)		(Pounds)						
40	0	13.2	14.0	4.9	15.7	16.3	7.9	24.8
80	0	10.9	9.5	1.4	13.8	17.6	3.8	20.5
160	0	12.0	3.5	0.9	14.4	10.4	3.5	13.4
40	80	25.2	13.8	3.4	37.9	5.0	11.9	6.7
80	80	25.5	6.8	5.0	30.2	14.3	8.1	18.2
160	80	10.1	4.9	2.3	14.5	8.2	4.0	10.7
40	160	23.3	6.9	8.2	15.3	12.7	15.0	16.3
80	160	25.1	4.6	4.7	23.5	15.8	8.3	19.8
160	160	15.3	3.6	1.8	17.1	9.4	4.9	11.5

[1]A new area was fertilized each fall.
[2]Based on 3 year forage yields from fertilizer applied 1956.
[3]Based on 2 year forage yields from fertilizer applied 1957.

in percent crude protein ($r=0.625$). When fertilizer was applied to the dry range and the water spreading site the "r" values for correlation indicate better correlation was obtained between yield increases and percent crude protein increases on the water spreading site. This would emphasize more efficient use of applied fertilizer where supplemental water was used. Phosphorus fertilizer increased the yield of crude protein only on the dry range site.

Summary

The effects of supplemental water and the nitrogen-phosphorus fertilizer ratio on the yield and chemical composition of forage native to western South Dakota were investigated.

Nitrogen fertilizer increased the production of forage and crude protein on both the dry land and water spreading sites. The supplemental water received on the water spreading site increased the efficiency of use of the applied nitrogen.

Increases in forage yields on the dry range and water spreading site were significantly correlated with increases in percent crude protein.

Phosphorus fertilizer increased forage and crude protein yields on the dry range site but had little influence on yields where supplemental water was used.

The percentage nitrogen of the forage was significantly increased by the application of nitrogen fertilizer but decreased with the use of supplemental water.

Recovery of applied nitrogen was enhanced by the additional water received on the water spreading site.

Phosphorus content of the forage increased with the addition of phosphorus fertilizer and with the use of supplemental water.

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Coastal Bermudagrass Utilization: Soilage vs. Continuous Grazing[1]

R. H. BROWN, E. R. BEATY, R. A. McCREERY AND JOHN D. POWELL
Formerly Graduate Student, Department of Agronomy, University of Georgia, now Graduate Student, Virginia Polytechnic Institute, Blacksburg, Virginia; Associate Agronomist, Branch Experiment Stations; Assistant Agronomist, College Experiment Station, University of Georgia, and Superintendent, Americus Plant Material Center

For the past two centuries agriculture of the Southeast has been associated with row crops, particularly cotton, peanuts and tobacco. Recently major changes have taken place in the southeastern states. In 1959 (Georgia Crop Reporting Service) livestock and poultry accounted for 52.3 percent of Georgia's agricultural income. Only 30 years earlier livestock and poultry accounted for only 14.6 percent of the farm income.

Other changes have been equally large. Today open ranges are disappearing. Poor quality low yielding forage plants are being replaced by higher yielding crops that are more responsive to management. As late as 1936 Starr (1936) stated that increased yields of common Bermudagrass *(Cynodon dactylon* (L.) Pers.) were needed if that plant was to be of much value to the livestock farmer. Since that time the new and much superior hybrid Coastal Bermudagrass has been developed and widely distributed. To secure answers to some of the problems associated with economical utilization of this plant the research reported in this paper was conducted in the summer of 1958.

Review of Literature

Most of the published data concerning Coastal Bermudagrass utilization concerns its use as a grazing crop or as hay or silage.

The advantages of Coastal Bermudagrass in the Coastal Plains were reported by Burton (1954). Adams and Stelly (1958) demonstrated its superiority over common Bermudagrass in the Piedmont.

In the final analysis, any forage is judged by its conversion into animal products, meat or milk. Baird *et al.* (1958) reported that Coastal Bermudagrass hay was unpalatable and very inefficient for beef produc-

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[1] *Journal Paper No. 153 of the College Experiment Station of the University of Georgia College of Agriculture Experiment Stations.*

[2] *Johnson, J. C., unpublished data. Georgia Coastal Plain Experiment Station, Tifton, Georgia.*

tion. Southwell *et al.* (1956) found average quality Coastal Bermudagrass hay to be inferior to poor quality corn silage on the basis of feeding trials. Langford (1958) reported beef cattle gains of 1 to 1.2 pounds per day from grazing common or Coastal Bermudagrass or Pensacola Bahiagrass. He further reported that 2/3 of the gain was in the first half of the grazing season. Johnson[2] found Coastal Bermudagrass hay to be nearly as good as alfalfa hay for milk production. Knox *et al.* (1958) reported a TDN value of 67 to 69 percent for Coastal Bermudagrass hay while Morrison (1948) lists 56 percent as the TDN value of high quality alfalfa hay. Several tests have shown alfalfa to be generally superior to other roughages Snapp (1952) and Baird *et al.* (1958).

Ittner *et al.* (1954) and Lofgren *et al.* (1956) reported no difference in rates of gain with steers receiving alfalfa as pasture or soilage. However, soilage resulted in nearly twice the total gain per acre as from pasturage. The mowing and feeding of forage in the green state is an old practice but has not been widely used largely because of the expense involved. Kildee *et al.* (1925) reviewed the literature on soilage and quoted several reports of greater carrying capacity and production of three to five times as much TDN per acre from soilage as from conventional grazing.

Procedure

At the Americus Plant Materials Center, Americus, Georgia, an area of established Coastal Bermudagrass was divided into four paddocks of one acre. During the season each paddock received one and one-half tons of lime, 50 pounds of a mixture of trace elements, 500 pounds of nitrogen as NH_4NO_3 and 3,000 pounds of 0-10-20. The nitrogen was applied in 5 equal applications of 100 pounds on April 3, May 14, June 13, and July 15 and August 16. The 0-10-20 was applied in three equal applications on April 3, June 13, and August 16. All areas were irrigated when 50 percent of the available moisture had been removed. The test was initiated May 13 and terminated on September 17. Two treatments were tested, (A) continuous grazing and (B) soiling. Treatments were duplicated. Animals were allowed to graze continuously at will on the assigned paddocks. Animals receiving soilage were fed in the morning at approximately 9:30 to 10:00 and again in the afternoon between 5:00 and 6:00. At the time of feeding, 3 to 5 weeks old forage was harvested by means of a conventional mowing machine equipped with a pan to catch the cut forage. The area harvested was measured, the material weighed, a sample obtained and the forage then placed in a feed bunk for the animals to consume. An excess of forage was provided. Residue in the feed bunks from previous feedings was removed periodically. Forage produced in excess of that fed as soilage was harvested as hay. All such material was weighed and sampled. Samples were dried at 105°C. All samples were identified and composited weekly for further study. Shade for all lots of animals was the same. Water and minerals were provided uniformly.

Stocking rates varied depending on forage production (table 1). In each continuously grazed paddock, six quadrats, 10 ft. by 10 ft. were established to study fecal contamination at bi-weekly intervals. Animals were weighed on three consecutive days at the beginning and at the end of the experiment. These weights were then averaged for starting and ending weights. Animal weights were determined every 14 days throughout the trial.

At the initiation of the experiment, all animals were weighed in the morning starting at 8:00. At the third weighing period this procedure was changed. Animals on soilage apparently realized that fresh soilage would be available soon and stopped eating grass from the trough. The animals on continuous grazing started grazing early in the morning and were filled before 9 a.m. Weighing in the early morning thus weighed the continuously grazed animals full and the animals on soilage empty. The weighing time was changed to 2 p.m. At that time both the conventionally grazed animals and the soilage fed animals were usually in the shade.

Results and Discussion

Animal performance data in table 1 show that the steers fed soilage gained 784 pounds and

Table 1 Coastal Bermudagrass Utilization: Continuous Grazing Compared to Soiling. May 13 to September 17, 1958.

	Utilization	
	Conventional grazing	Soilage
Acres of replication	1	1
Average Grazing days per acre	735	685
Average beginning wt. (lbs.)	575.7	560.5
Average final weight (lbs.)	652.1	691.2
Average daily gain (lbs.)	0.62	1.14
Feed/gain ration		12.9
Beef produced (Acre)	457	784
Excess grass harvested:		
as hay		83*
fed but not consumed		81*
Total Beef Equivalent	457	948

L.S.D. .05 0.16 lb.
.01 0.22 lb.
C.V. 30.34%
* Converted by 12.9/1 ratio

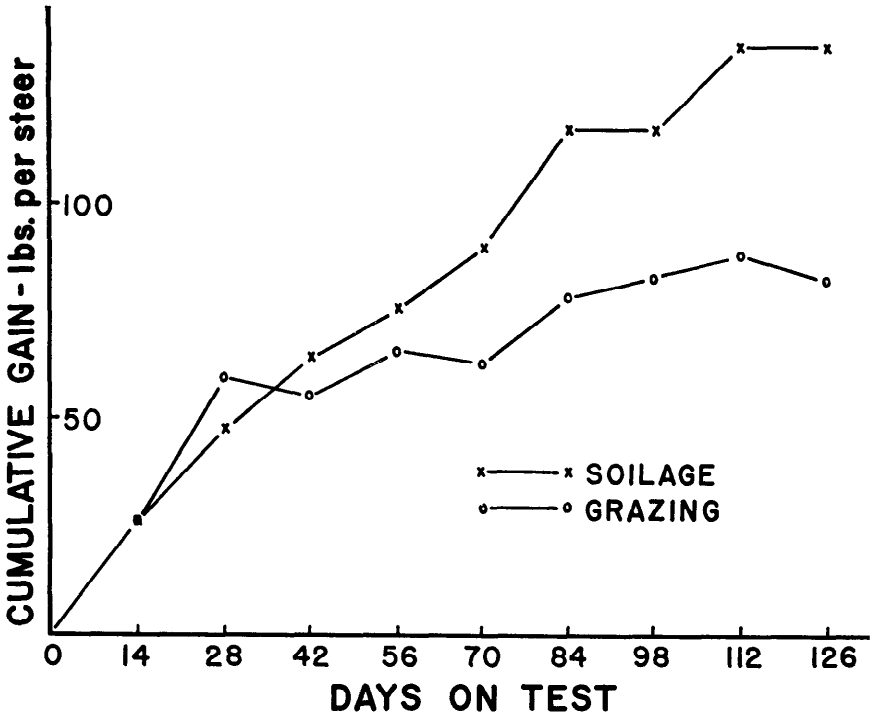

FIGURE 1. Cumulative weight gains per animal for steers on Coastal Bermudagrass as soilage and conventional grazing.

excess grass was equal to 164 pounds of beef for an acre total of 948 pounds. Animals continuously grazed gained 457 pounds per acre. This difference was significant (0.01). For the first 28 days gains on both treatments were almost equal (Figure 1). However, after that time gains of animals on continuous grazing were irregular, while the gains of animals being fed soilage continued (Figure 1). Average daily consumption of 2.35 lbs. D. M. per day per 100 lbs. body weight by the animals fed soilage produced an average daily gain of 1.14 lbs.

The continued gains of animals fed soilage indicate that the supposed lower quality of continuously grazed Coastal Bermudagrass is a management rather than a plant physiological problem. This interpretation is supported to a degree by the data in figure 2. The area of actual fecal contamination was only one-half of one per cent at the end of the first two weeks and increased to some two-and-one-half per cent by the end of six weeks. While the actual area covered by the fecal material was small, the area left ungrazed by the animals was several times larger and by the end of six weeks 35 per cent of the area was covered by so-called "halo spots." Fecal contamination caused by animals walking through the grass with soiled feet was not measured but was no doubt important.

Daily gains of animals grazed continuously were not consistent and after four weeks fell to half or less of animals fed soilage. Examination of the grass growing in the field showed that for the first four weeks of the test it was growing vegetatively and new leaf growth was available for the animals to graze during that time. At about 4 weeks after the initiation of grazing, new grass growth had ceased and the entire area was covered with

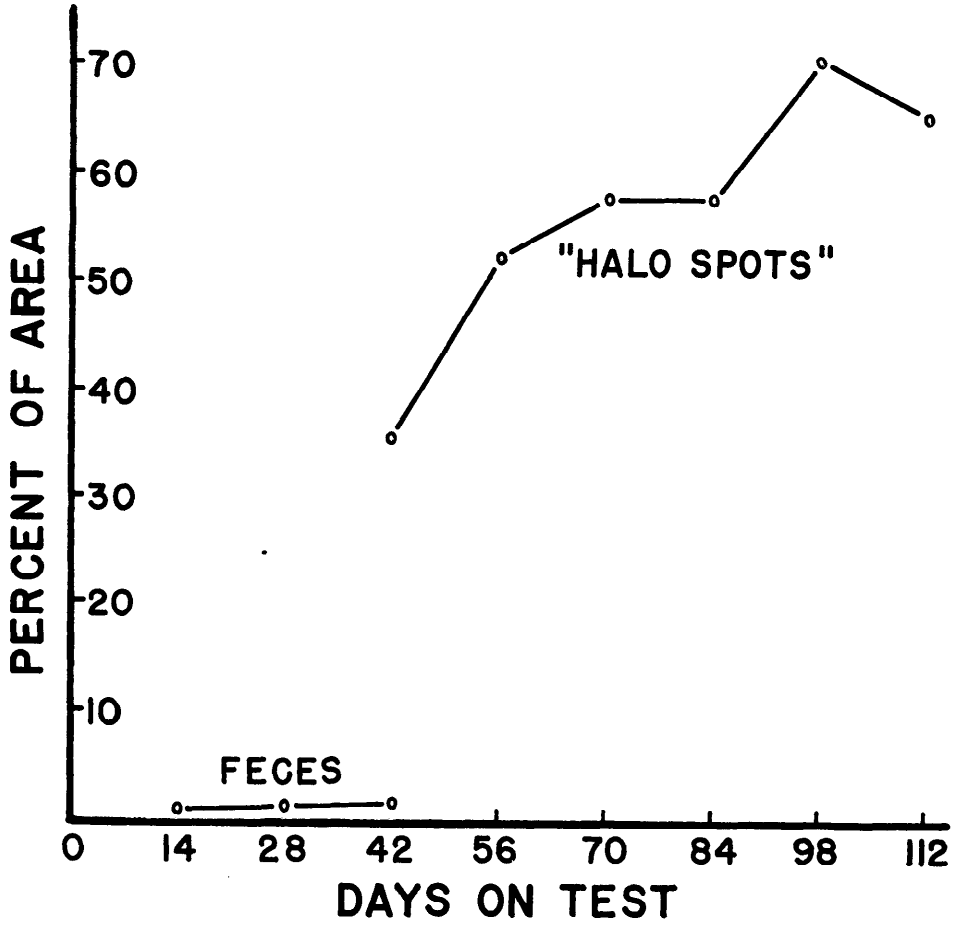

FIGURE 2. Fecal contamination of grazed Coastal Bermudagrass.

Bermudagrass stems 8 to 9 inches high. This is thought to explain the sharp decline in gain of animals on continuous grazing. The tall, stemmy, mature forage shaded the ground to such an extent that no new bud primordia initiated growth. As the animals consumed this mature and stemmy forage their rate of gain decreased. When the old growth had been grazed back to a height of 3 to 5 inches, new grass growth started from buds at the base of the plant. The new growth produced on the grazed spots was succulent and consequently these spots were overgrazed; the result being the livestock overgrazed a portion of the area and undergrazed or did not graze a considerable part.

At the end of the grazing season forage on the grazed areas averaged 4 to 5 inches in height. However, as is shown in figure 1 animals grazing this material were not gaining weight, and the forage was considered to have little or no value.

This experiment was not designed to answer grazing management problems but it is probable that rotational grazing followed by mowing the excess stemmy forage would correct part of the forage quality problem. It is believed that the continued rate of gain of animals fed soilage demonstrated that reduced animal performance of continuously grazed animals during the period from late June to early August was not due to the lack of potential forage quality. Accumulation of mature plant parts that must be removed before new grass growth can occur and/or fecal contamination are thought to be the major factors responsible for the poor performance of animals grazed continuously. Fecal contamination aggravated the condition of insufficient high quality forage brought about by mature grass accumulations.

No effort was made to determine the influence parasites had on steer performance.

Summary

1. Animals consuming Coastal Bermudagrass as soilage continued to gain weight until early September while animals conventionally grazed performed erratically after the first 28 days.
2. Per acre beef production of Coastal Bermudagrass was 948 pounds when fed as soilage and 457 pounds when grazed continuously.
3. Low summer gains of animals grazed continuously was probably due to fecal contamination of the forage and accumulation of mature forage.

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Range Curricula

HAROLD F. HEADY
Associate Professor, University of California, Berkeley, California.

Introduction

The four-year curricula in Range Management as given at fifteen colleges and universities are reviewed. Statements of the curricula requirements, course titles, credit values, and subject matter outlines for each course solicited from all schools form the basis of this report.

The project was undertaken within the Range Management Education Council as a committee assignment under the Chairmanship of the author with the help of Dr. O. E. Sperry, Texas A. & M. and Dr. E. W. Tisdale, University of Idaho. The first report supplied background information for about eight hours of discussion at the Council meeting, February, 1961 where representatives of twelve schools were present. Later, all the schools submitted written corrections and comments. The revised report as here published incorporates the many suggestions and has Council approval. The questions raised and any stated or inferred educational philosophies are my own and agreement with them by the Council is not implied.

The Council was founded in February 1960, with fourteen voting members, one from each school having a 4-year curriculum in range management. Another joined in 1961. The objectives of the Council are: "To promote high standards in the teaching of range management, to advance the professional ability of range managers, to provide a medium for the exchange of ideas and facts among range management schools, to provide liaison between teaching departments and organizations and agencies in affairs relating to range education and employment standards, and in other ways to foster wider understanding of the problems of range education."

Several points should be kept in mind for a full understanding of the comparisons. First, all quarter credit values have been multiplied by ⅔ to put them on a semester basis. Second, all averages have been based on fifteen, the total number of curricula. Third, only one curriculum for each school has been treated. Options have been discussed under a separate heading. Fourth, courses in Physical Education, Military, and graduate instruction have been completely omitted. Fifth, only stipulated courses and restricted elective choices have been included; free electives have been omitted. Sixth, placement exams in English and mathematics and matriculation requirements were not analyzed. Seventh, college and university names have been abbreviated as below to make the text more concise.

Abbreviation	*School*
Arizona	University of Arizona, Tucson
California	University of California, Berkeley & Davis
Colorado	Colorado State University, Fort Collins
Idaho	University of Idaho, Moscow
M.S.C.	Montana State College, Bozeman
M.S.U.	Montana State University, Missoula
N. Mex.	New Mexico State University, Univ. Park
Nevada	University of Nevada, Reno
Oregon	Oregon State University, Corvallis
So. Dak.	South Dakota State College, Brookings
Texas A. & M.	A. and M. College of Texas, College Station
Texas Tech.	Texas Technological College, Lubbock
Utah	Utah State University, Logan
Washington	Washington State University, Pullman
Wyoming	University of Wyoming, Laramie

Published curricula requirements must be interpreted with care. They are not static and most of them change nearly every year. Students have different interests so in order to retain flexibility and to permit the development of individual programs, a student may petition for changes in his requirements. Every curriculum includes electives, some recommended by the faculty advisor and others left wholly to the student's choice. Thus, the total program for an individual student is only approximately indicated by the listing in this report.

Departures from the norms among the curricula should be interpreted in terms of the local influence of the livestock industry, the importance of other wildland industries, departmental affiliations, and available course offerings in other departments. These effects should continue to temper each curriculum to state and regional needs.

Natural Sciences

Requirements in the natural sciences include courses in botany, chemistry, geology, physics, zoology and a few others (Table 1).

Botany: All schools require courses in general botany, plant physiology, plant ecology, and taxonomy for an average of 14.82 semester credits. Variations in course titles and unit values occur, but on the whole the bot-

Table 1. Course titles and semester credits in the natural sciences required in the range management curricula at fifteen colleges and universities, 1960.

	Botany							
	Basic		Plant Physiology		Plant Ecology		Taxonomy	
Arizona	General	4.00	Pl. Functions	4.00	Plant Ecology	4.00	Systematic Bot.	4.00
California	General	5.00	Introduction	4.00	Plant Ecology	3.00	Syst. Bot. of Fl. Plts.	4.00
Colorado	Seed Plants	6.67	Plant Phys.	3.33	Plant Ecology	3.33	Plant Classif.	3.33
Idaho	Principles	4.00	Plant Phys.	3.00	Plant Ecology	3.00	Systematic Bot.	4.00
M. S. C.	General	3.33	Plant Phys.	3.33	Plant Ecology	3.33	General	2.67
M. S. U.	Forest Botany	5.33	Plant Phys.	3.33	Plant Ecology	3.33	Local Flora	2.00
N. Mex.	Plant Biology	4.00	Plant Phys.	4.00	Principles	4.00	Plant Tax.	3.00
Nevada	General	3.00	Plant Phys.	4.00	Plant Ecology	4.00	Taxonomy	4.00
Oregon	General	6.00	Principles	2.67	Principles	2.67	Systematic Bot.	2.67
So. Dak.	General	5.33	General	3.33	Plant Ecology	5.33	Tax. Forbs & Shrubs	3.33
Texas A. & M.	General	3.00	Introduction	3.00	Plant & Range (in R.M.)	3.00	Taxonomy	3.00
Texas Tech.	General	3.00	Plant Phys.	3.00	Bioecology	3.00	Taxonomy	3.00
Utah	General	6.67	Plant Phys.	3.33	Plant Ecol. (in R.M.)	3.33	Taxonomy	3.33
Washington	Introduction	6.00	Plant Phys.	3.00	Autec. & Synec.	6.00	Systematic Bot.	3.00
Wyoming	General	4.00	Plant Phys.	3.00	Ecology[1]	3.00	Tax. of Vas. Plants[1]	3.00
Mean		4.62		3.36		3.62		3.22

	Chemistry				Geology		Physics	
	Inorganic		Organic					
Arizona	Inorganic	5.00	Organic	5.00	Physical	4.00		
California	Inorganic[2]	5.00	Organic	3.00	[2]		General	6.00
Colorado	Inorganic	6.67	Organic	5.33	General	3.33	Physics	3.33
Idaho	General	8.00	Carbon compounds	3.00	Physical	4.00	General	4.00
M. S. C.	General	5.33	Organic	3.33	General	3.33	Principles	4.00
M. S. U.	General	5.33	Organic	3.33			General	3.33
N. Mex.	General	8.00	Organic	4.00	Fundamental	4.00		
Nevada	Inorganic	6.00	Organic	4.00			Introduction	4.00
Oregon	General	6.00	Org. & Biochem.	3.33	Physical	2.00	Physics	5.33
So. Dak.	Inorganic	8.00	Organic	3.33				
Texas A. & M.	General	8.00	Organic	3.00	Agr. Geol.	4.00		
	Quant. Analysis	3.00						
Texas Tech.	General	8.00	Organic	4.00				
Utah	Inorganic	6.67	Organic	3.33	Physical	3.33	General	3.00
Washington	General	8.00	Organic	4.00	Introduction	4.00		
Wyoming	General	5.00	Organic	4.00				
Mean		6.80		3.73		2.13		2.20

	Zoology				Other Natural Sciences	
	Basic		Animal Ecology			
Arizona	General	4.00				
California	General	8.00			[2]	
Colorado	Introduction	3.33				
Idaho	General	4.00				
M. S. C.	Principles	3.33			Genetics	2.00
M. S. U.	General	3.33				
N. Mex.	Animal Biology	4.00			Genetics	3.00
Nevada	General	4.00	Ecol. of Mammals or Mammaology	3.00		
Oregon	General	3.33			Bact.	2.00
					Genetics	2.00
So. Dak.	General	5.33	Animal Ecol.	2.00	Bact.	3.33
					Ento.	1.33
					Genetics	2.00
Texas A. & M.	Vertebrate	3.00	Animal Ecol.	3.00	Genetics	4.00
Texas Tech.	General	3.00			Bact.	3.00
					Ento.	3.00
					Genetics	4.00

Utah	General	3.33			
Washington					
Wyoming	General	4.00		Genetics	3.00
Mean		3.73	0.53		2.18

[1] Plus 3 additional units in either ecology or taxonomy.
[2] An additional 6 units must be selected from statistics, genetics, botany, chemistry, geology and zoology.

any required is strikingly uniform. The first courses in plant ecology at Texas A. & M. and Utah are arbitrarily listed in Table 1 even though they are given by the range management staff. Likewise the listing of all courses in agrostology and range plants is under the "Range Management" heading regardless of the department teaching them.

Chemistry: All schools require one or two courses in general or inorganic chemistry for an average unit value of 6.80 and one course in organic chemistry averaging 3.73 units. Agricultural biochemistry is included with organic chemistry at Oregon and Texas A. & M. requires a course in quantitative analysis. The chemistry requirement is rather uniform and averages 10.53 units.

Geology: Nine schools require a course in geology and the average unit value is 2.13. At California the requirement is 6 units of soil science and geology and most students take a course in geology. The course titles include General, Physical, Agricultural, Introduction, and Fundamental Geology.

Physics: Eight schools require physics for an average of 2.20 credits. Arizona, N. Mex., South Dakota, Texas A. & M., Texas Tech., Washington, and Wyoming do not require Physics. California requires two courses.

Zoology and *Animal Ecology*: An introductory course or courses, California 8 units, is required by fourteen of the fifteen schools. The average value is 3.73 credits. Washington does not require a basic zoology course. Animal ecology is required by three schools but at one it is listed as an alternative with Mammology. Washington requires a course in wildlife management, so no curriculum is without work in zoology.

Other Natural Sciences: Three other natural sciences are included in the requirements for an average of 2.18 credits per school. These are Genetics at seven schools, Bacteriology at Oregon, So. Dak., and Texas Tech. and Entomology at the latter two.

Mathematics and Engineering

Mathematics: All schools ex-

Table. 2. Course titles and semester credits in mathematics and engineering required in the range management curricula at fifteen colleges and universities, 1960.

	Mathematics				Engineering			
	Basic		Statistics		Drafting		Surveying	
Arizona	Algebra & Trig.	5.00			Eng. Drawing	3.00	Elements	3.00
California	[1]		[2]				Surveying	3.00
Colorado	Algebra & Trig.	6.67			Map drafting & Reading	1.33	Elements	2.67
							Topographic (camp)	2.00
Idaho	Fundamentals	8.00	Elem. For. Biom. (For.)	3.00	Eng. Graphics	2.00	Elements	3.00
M. S. C.	Intro. Col. Math.	3.33	Elementary	2.67			Conservation Eng. (Agr. Eng.)	2.00
M. S. U.	Trig.	3.33	For. Mensuration	2.67	Mapping (For.)	1.33	Surveying (For.)	6.00
N. Mex.	Math. for Agr. Stu.	3.00					Agr. Surveying (Agr. Eng.)	2.00
Nevada	Algebra & Trig.	4.00	Stat. (Agr. Econ.)	3.00			Surveying	3.00
Oregon	Intermed. Alg. & Trig.	5.33	Basic Tech. (Stat.)	2.00			Forest Eng. (For.)	2.00
So. Dak.	Algebra & Trig.	6.67	Stat. Meth. (Econ.)	3.33				
Texas A. & M.	Algebra & Trig.	6.00					Topographic	2.00
Texas Tech.	Algebra	3.00						
Utah	Algebra & Trig.	7.33					Surveying & Land Mapping	2.00
Washington	Intermed. Alg. & Trig.	8.00					Plane	3.00
Wyoming	Elem. Analyses	5.00			Eng. Drawing	3.00	Conser. & Surveying (Agr. Eng.)	3.00
Mean		4.98		1.11		0.71		2.58

[1] Three years high school math. required or it is made up without credit.
[2] An additional 6 units must be selected from statistics, genetics, botany, chemistry, geology and zoology.

Table 3. Course titles and semester credits in English and social sciences required in the range management curricula at fifteen colleges and universities, 1960.

	English							
	Composition		Speech		Writing		Other	
Arizona	Composition	6.00	Principles	3.00				
California	Comp. or Speech	6.00						
Colorado	Composition	4.00	Public speaking	2.00	Tech writing	2.00		
Idaho	Composition	6.00	Speech	2.00	Tech. writing	3.00		
M. S. C.	Oral & Written Communi.	2.67	Same	2.67	Same	2.67		
M. S. U.	Composition	6.00	Speech	4.00	Journalism	2.00		
N. Mex.	Composition	6.00	Public speaking	2.00	Communi. in Agr.	2.00	Engl. elective Library use	3.00 1.00
Nevada	Composition	6.00	Speech	2.00				
Oregon	Composition	6.00	Extempore speak.	2.00	Tech writing	2.00		
So. Dak.	Composition	6.00	Oral Communi.	2.67	Writing elect.	2.00		
Texas A. & M.	Comp. & Rhetoric	6.00	Speech	2.00	Writing or Journalism	5.00	Comp. & Lit.	2.00
Texas Tech.	Rhetoric	6.00			Tech. writing	3.00		
Utah	Composition	3.00	Communication	3.00	Adv. writing	2.00		
Washington	Composition	6.00	Speech	2.00	Writing	3.00		
Wyoming	Composition	6.00	Public speaking	2.00	Journalism	2.00	Elective	2.00
Mean		5.44		2.09		2.04		0.53

	Economics				History and Gov't.		Other Social Sciences	
	Basic		Agricultural, etc.					
Arizona	Principles	3.00	Farm & Ranch Mangt.	3.00			Human Relations Electives	3.00 6.00
California	Principles	3.00			Examination required		Electives	9.00
Colorado	Intro. and Econ.	4.00						
Idaho	Principles	6.00	Econ. of conserv.	2.00			Electives	6.00
M. S. C.	The Am. Econ.	2.00	Social Sci. in Agr.	3.33				
M. S. U.	Principles	4.00	Forest Economics	3.33			Psychology Electives	3.33 2.00
N. Mex.	Introduction	3.00	Ranch & Land Econ.	6.00				
Nevada	Survey of Econ.	3.00	General Agr. Econ. Farm & Ranch Mangt. or Land Econ.	3.00 3.00	U.S. & Nev. History & Const.	2.00	Electives	5.00
Oregon	Principles	6.00	Agr. Land Econ.	2.00	Am. Gov't.	2.00		
So. Dak.	Principles	4.00	Farm & Ranch Mangt.	2.00	Natl. or State Gov't.	2.67	Sociology Electives	3.33 6.00
Texas A. & M.	Principles	3.00	Land Economics	3.00	U.S. Hist. & Am. Gov't.	9.00		
Texas Tech.	Fund. Ag. Econ.	3.00	Range & Ranch Econ. Marketing Agr. Prod.	3.00 3.00	Am. Gov't.	6.00	Am. Heritage (Hist.)	6.00
Utah	Principles	3.33					Electives	2.00
Washington	Principles	4.00	Farm & Ranch Mangt.	3.00			Electives	8.00
Wyoming	Pr. Agric. Econ.	3.00	Appld. Econ. to Agr.	2.00	U.S. & Wyom. Gov't.	3.00		
Mean		3.62		2.77		1.64		3.98

cept one require mathematics for an average credit value of 4.98 (Table 2). These are mostly courses in algebra and trigonometry but titles like Introductory College Mathematics, Fundamentals of Mathematics and Mathematics for Agriculture Students occur. At California, the exception, three years of high school mathematics are required for matriculation and students are expected to be ready for calculus or to take preparatory courses outside curriculum requirements. Students at several schools are placed in mathematics courses according to their scores on matriculation examinations.

Six schools require a course in statistics and on a basis of fifteen this amounts to an average of 1.11 units. The courses are given in Departments of Mathematics, Forestry, Agricultural Economics, and Agronomy.

Surveying and Drafting: The average requirement is 3.29 units but the range is from none at Utah and So. Dakota to 7.33 at M.S.U. (Table 2). Five of the schools which require surveying also require drafting. Plane, Topographic, and Elements of Surveying are probably given in Engineering Departments and signify fairly standard content. Titles like: Conservation Engineering, Field Practice, Surveying and Mapping courses in Forestry, Conservation and Surveying, Agricultural Surveying, and Forest Engineering are more difficult to interpret. Colorado, Washington, and M.S.U. also require forestry courses in photogrammetry and it is a recommended subject at Arizona. This much variation in the surveying and mapping requirement is difficult to justify. It may reflect a trend toward dependency on engineers for engineering in land management. Suitable courses may not be available unless certain prerequisite courses are taken and there may be other reasons. Work with aerial photos would seem to be of real value for range students.

English and Social Sciences

English Composition, Speech, and Writing: The average English requirement is 10.10 units with a range of 6 in two courses to 15 in five courses (Table 3). Every school requires composition although the requirement at California is written "composition or speech". The beginning student at many schools takes an entrance examination in English composition, and if he fails, he must pass a make-up course without credit before he can start the English requirement. Thirteen schools require a course in speech and eleven a course in technical writing or journalism. Other English courses are required at three schools.

Economics: The average unit requirement is 6.39 with variation between 3 and 9 units. The first course may be in an Economics or Agricultural Economics Department and may be labeled Principles, Introduction, Survey, or as at M.S.C., Social Science in Agriculture or The American Economy. Eight schools require Farm and Ranch Management, Land Economics, or a combination of these subjects. Economics of Conservation appears as a title at Idaho and Applied Economics to Agriculture at Wyoming. Ten schools require two courses, three ask for one course, and two schools require three courses.

History, National and State Government: These subjects are required by five schools for an average of 1.64 credits on the basis of fifteen. California has a History and Government requirement that can be met by course credit at Davis and by examination only at Berkeley. This type of requirement is stipulated by the university rather than by the Range Curriculum. Nevada, Wyoming, and perhaps others have similar university requirements.

Other Social Sciences: The average requirement is 3.98 credits but only nine schools specify a certain number of units in these subject matters. Psychology and Sociology are required mostly as restricted electives. Four schools require 8 or 9 units and the others include 2 to 6. Courses in social sciences are recommended electives at other schools.

Agriculture

Orientation: Twelve curricula require a course in orientation with an average credit value of 1.16 (Table 4). The course names include Agriculture Orientation; Forestry Lectures; Introduction to Range and Forestry; Vocations in Agriculture; Elements of Forestry, Range, and Wildlife; Survey of Forestry; General Forestry; and Forestry and Allied Professions.

Agronomy: Elements of Agronomy, Crop Production, Field Crops, Farm Crops, Plant Industry, and Plant Science in Agriculture are titles of the introductory material in Agronomy required by nine schools. The average on a basis of fifteen is 2.53 credits. Forage crops or Forage and Pasture Crops is required by seven schools and the average is 1.31 credits. One other agronomy course is required: Weed Control, at Arizona. The average agronomy requirement is 3.84 units. M.S.U., Utah, and Washington do not require work in agronomy.

Animal Husbandry: The average animal husbandry requirement is 9.84 credits with a range from 5 to 15 credits. Every school requires at least two courses. Livestock nutrition or feeds and feeding or both is required by all schools with an average value of 3.38 credits. The other credits are about half in an introductory course, livestock judging included, and half in one or two courses which emphasize management and production. Wyoming includes 3 credits in Poultry or Dairy. Anatomy and Phys-

Table 4. Course titles and semester credits in agriculture required in the range management curricula at fifteen colleges and universities, 1960.

	Orientation		Agronomy			
			Basic		Forage Crops	
Arizona	Vocations in Agric.	1.00	Plant Industry	3.00	Forage & Past. Crops	3.00
			Weed control	3.00		
California					Forage Crops	3.00
Colorado	For. & Allied Prof.	1.33			Forage Crops	2.67
Idaho	Forestry Lectures	2.00			Forage Crops[1]	3.00
M. S. C.	Agr. Orient.	0.67	Plant Sci. in Agr.	3.33		
M. S. U.	Survey of For.	2.00				
N. Mex.			Farm Crops	4.00		
Nevada	Orientation	1.00	Intro. to Plant Sci.	3.00	Forage Crops	3.00
Oregon			Elements	3.33		
So. Dak.	Orientation	0.67	Crop Production	3.33	Pasture Mangt.	2.00
Texas A. & M.	Intro. Range & For.	1.00	Fund. Crop Prod.	3.00		
Texas Tech.	Orientation	1.00	Fundamentals	3.00	Forage & Past. Crops	3.00
			Plant Breeding	3.00		
Utah	Elements For., Range, Wildlife	2.67				
Washington	Gen. Forestry	3.00				
Wyoming	Agr. Orient.	1.00	Field Crops	6.00		
Mean		1.16		2.53		1.31

	Animal Husbandry					
	Basic		Nutrition, Feeds & Feeding		Production	
Arizona	Animal Industry	4.00	Feeding Livestock	3.00	Beef Cattle Prod.	3.00
California	Intro. & Types	4.00	Feeds & Feeding	3.00	Meat Prod.	3.00
Colorado			Feeds & Feeding	3.33	Sheep & Beef Prod.	4.00
Idaho	Livestock Industry	3.00	Livestock Feeding	3.00	Beef Cattle Prod.[1]	3.00
M. S. C.	Animal Sci. in Agr.	3.33	Feeds & Feeding	2.67	Sheep & Beef Prod.	5.33
M. S. U.			Range Livestock Nut. (For.)	3.33	Range Livestock Prod. (For.)	2.00
N. Mex.	Introduction	3.00	Princ. of Feeding	4.00	Beef or Sheep Prod.	4.00
	Physiol. Farm Anim.	3.00				
Nevada	Elements	3.00	Animal Nutrition	3.00	Elective	4.00
Oregon	Intro. Dairy & Ani. Sci.	2.00	Animal Nutrition	2.67	Beef Cattle Hus.	2.00
So. Dak.	Introduction	2.67	Livestock Nutrition	2.00	Beef & Sheep Prod.	5.33
			Livestock Feeding	2.67		
Texas A. & M.	General	3.00	Animal Nutrition	3.00	Livestock Mangt.	3.00
Texas Tech.	General	3.00	Ani. Nut. & Pr. Feeding	3.00	Beef & Sheep Prod.	6.00
	Anatomy Farm Animals	3.00				
Utah	Judging	1.33	Nutrition, Feeds & Feeding	6.00	Beef & Sheep Prod.	4.00
Washington	Animal Science	3.00	Nutrition	2.00		
Wyoming	Intro. & Poultry or Dairy	7.00	Feeding	4.00		
Mean		3.22		3.38		3.24

	Soil Science				Other Agr.	
	Basic		Other			
Arizona	Soils	3.00				
California	Soil Sci.[2]	6.00				
Colorado	Soils	4.00	Fertility	3.33		
			Classification	2.33		
			For. & Range soils	2.67		
Idaho	General	3.00				
M. S. C.	General	2.67	Classif. & Sur.	2.00		
M. S. U.	Soils (For.)	2.67				
N. Mex.	Soils	4.00				
Nevada	General	3.00	Genesis & Classif.	4.00	Seminar	1.00
Oregon	Soils	4.00	Soil Survey	2.67		
So. Dak.	Soils	4.00	Classif. & Genesis	2.00		
Texas A. & M.	Introduction	4.00	Morphology	2.00		

Texas Tech.	Soils	4.00	Morph. & Genesis	3.00	Pr. Dairying	3.00
			Soil Fertility	3.00	Pr. Hort.	3.00
					Seminar	1.00
Utah	General	3.33				
Washington	Soils	4.00				
Wyoming	Soils	3.00			Farm Power & Mach.	4.00
Mean		3.64		1.80		0.94

[1]Other courses in same subject matter field substituted with permission.
[2]Or 3 units of soils and 3 units of geology.

iology of Farm Animals is required by New Mexico and Texas Tech. All the courses are given in animal husbandry departments except those at M.S.U., where two courses are given in the Forestry School.

Soil Science: All schools require a basic course in soils and its average credit value is 3.64. Seven schools require additional work in soils for an average of 1.80 credits. These titles include Classification and Survey, Morphology, Genesis, Fertility, and Forestry and Range Soils. Colorado requires 12.33 credits and Texas Tech. 10.00 credits.

Other Agriculture: Principles of Dairying and Principles of Horticulture are in the Range Curriculum at Texas Tech. This school and Nevada require a general Seminar and Wyoming includes a course on Farm Power and Machinery. These total 12 credits and average 0.94 credits for the fifteen schools.

Wildland Uses Other Than Range

Forestry: The requirements in Forestry are so varied that the average credits value of 4.49 has little value (Table 5). Eight schools do not require Forestry. Oregon and South Dakota require 2 credits, Washington 5, Texas A. & M. 6, Colorado 9.33, Idaho 13, and M. S. U. 30 credits. These do not express the whole picture because other options are usually available where curricula in range management and forestry are in the same administrative unit. For example, at M. S. U. students would take less forestry if they selected the curriculum in Forest Conservation. The forestry requirement in a different curriculum at Utah is 20 units and Arizona offers options which combine Range Management with several other subjects.

Soil Conservation and Watershed Management: Separate courses in these subjects are required by seven schools for an average of 1.78 credits on a basis of fifteen schools. Two of the seven schools require courses in both subjects. New Mexico and Texas Tech. include a conservation course only. The work in soil conservation is given by Departments of Agricultural Chemistry, Forestry, Agricultural Engineering, and Agronomy. The Watershed courses are in Forestry. Presumably most schools have some work on watershed management as it was specifically mentioned in the outlines of several Range Management courses. On the other hand, specific work on watersheds was not mentioned in course outlines or as separate courses at California, Oregon, Texas A. & M., and Wyoming.

Wildlife Management: Twelve schools require Wildlife Management with an average of 2.33 credits. Prerequisites in zoology include a basic course at all schools, Washington excepted, and animal ecology at Nevada, So. Dak., and Texas A. & M. Most students at California take work in Wildlife Management as a part of a group requirement.

Multiple Use: Wildlands are commonly considered to have one or more of five groups of uses; for forage, timber, water, wildlife, and recreation. One curriculum, Colorado's, includes courses in all five, when a summer camp course with "Recreation" in the title is considered. Forestry, Wildlife and Watershed courses are included at Arizona, Idaho, M.S.U., Texas A. & M., and Utah if the orientation courses which include forestry are considered. Courses in Wildlife and Forestry are in the curricula at Oregon, South Dakota and Washington. Watershed and Wildlife are in the curricula at N. Mex. and Texas Tech. Wildlife or Animal Ecology is included at M.S.C., New Mexico, and Nevada. No specific courses in Forestry, Wildlife, Watershed and Recreation are required at California and Wyoming.

Range Management courses which attempt to cover several of these uses in an integrated fashion are in the curricula at Colorado, Idaho, M.S.C., M.S.U., Nevada, and Washington. These courses vary in title, including Land Use Seminar, Range Planning, Resource Management, and Policy and Administration. Other courses include a chapter on multiple use and the Seminars may be on the subject. The course outlines from Wyoming were the only ones that made no mention of any multiple use aspect outside of Range Management.

The breadth and intensity of training and the degree to which all the wildland uses are integrated into land planning are not clear from the course descriptions received. Multiple use concepts may be incorporated throughout the training, as they should be in light of recent trends in the multiple use of wildlands.

Table 5. Course titles and semester credits in other wildland uses required in the range management curricula at fifteen colleges and universities, 1960.

	Forestry		Soil Conservation		Watershed Mangt.		Wildlife Mangt.	
Arizona			Soil Cons. (Agr. Chem.)	3.00	Watershed Mangt.	2.00	Wildlife Cons.	2.00
California							[1]	
Colorado	Conservation	2.00	Soil Cons. Practice	3.33	Pr. Watershed Mangt.	2.00	Principles	2.00
	Fire Control	2.00			Forestry camp	2.00	Forestry camp	2.00
	Photogrammetry	1.33						
	Forestry camp	4.00						
Idaho	Silvics & Silvicul.	5.00			Watershed Mangt.	3.00	Principles (For.)	3.00
	Field Measurement	4.00						
	Field Ecol. (Camp)	4.00						
M. S. C.							Principles	2.00
M. S. U.	Forestry	30.00			Watershed Mangt.[2]	2.67	Wildlife Mangt.	2.67
N. Mex.			Soil & Water Cons.	3.00			Principles	3.00
Nevada								
Oregon	Farm Forestry	2.00					Wildlife Mangt.	4.00
So. Dak.	Elective	2.00					Wildlife Mangt.	2.00
Texas A. & M.	Farm For.	3.00						
	Silvics & Silvicul.	3.00					Wildlife Cons. & Mangt.	3.00
Texas Tech.			Soil Cons. & Land Plan.	3.00			Wildlife Mangt.	3.00
Utah					Watershed Mangt.	2.67	Wildlife Mangt.	3.33
Washington	Airphoto Interp.	2.00					Wildlife Mangt.	3.00
	Silviculture	3.00						
Wyoming								
Mean		4.49		0.82		0.96		2.33

[1]An additional 6 units must be selected from statistics, botany, chemistry, geology and zoology.
[2]Or Big Game Mangt.

Range Management

Range Management requirements were difficult to analyze because (1) the subject matter is packaged differently in the different curricula; (2) various names are used; (3) certain blocks of subject matter are given in range in some schools but in other departments at other schools; (4) intensity of coverage varies tremendously; and (5) local range situations and administrative affiliations cause differences in emphasis. No doubt personal beliefs and training of the teachers play a part in making these curricula different and in my assessment of them. This factor is left completely to the reader's evaluation. Decisions of arrangement had to be made and after several attempts the following main blocks of material were at least partially evident:

1. Emphasis on plants including agrostology, range plants, range ecology.
2. Emphasis on techniques, surveys, mapping, utilization, condition, trend.
3. Emphasis on management, improvements, planning, economics, policy.
4. Seminar.
5. Field trips and camps.

Many courses overlapped these divisions and their placement was determined by the major emphasis in the course and in the whole curriculum. For example, methodology was widely scattered and courses listed under techniques were not necessarily all methods. About 90 percent of the average range requirements were included in the first three headings and all curricula have courses listed therein (Table 6).

Emphasis on plants: The average requirement in agrostology, forage plants and range ecology is 6.80 units. Nine schools place this material in two courses. Texas Tech. does it in one and five schools have three courses or more. The course in agrostology is given in Botany at Colorado, Idaho, M.S.C., M.S.U, Oregon, South Dakota, Utah, and Washington. Two other special courses are required; Woody Plants at Colorado and Poisonous Plants at Nevada.

Table 6. Course titles and semester credits in range management required in the curricula at fifteen colleges and universities, 1960.

	Agrostology, range plants, range ecology		Methods, utilization, condition & trend		Management, improvements, planning, economics, policy		Seminar		Field trip		Total credits
Arizona	R. Forage Plants R. Ecology R. Resources	4.00 4.00 3.00	R. Forage Evaluation	3.00	R. Management	3.00	R. Seminar	1.00	R. Field Studies	3.00	21.00
California	R. Plants Grassland Ecology	3.00 3.00	R. Inventory and Analysis	3.00	Introduction to R.M.	3.00			Field Practice (4 weeks)	0	12.00
Colorado	Ident. of Grasses (Bot.) Woody Plants (For.) R. Forage Plants R. Ecology	2.00 2.00 2.67 3.00	R. Analysis and Mangt. Plans R. Utilization	4.00 3.33	Principles R.M. R. Revegetation R. Policy R. Economics	2.00 2.00 1.33 2.00			Forestry Camp	10.00	24.33[1]
Idaho	Agrostology (Bot.) R. Plants	3.00 3.00	R. Methods & Tech.	3.00	Elements R.M. R. M. Planning	3.00 3.00	Land Mangt.	1.00	Forestry Camp	10.00	16.00[1]
M. S. C.	Agrostology (Bot.) Forage Values of R. Plants Ranges & R. Plants Grazing Influences & Practices	2.67 2.00 2.00 2.67	Range Surveys	4.00	R.M. Practices R. Renovation Practices R.M. Planning R. Policy & Adm.	3.33 2.67 2.00 2.00	Seminar	0.67	R. Inspection trip	0.67	24.67
M. S. U.	Agrostology (Bot.) R. Forage Plants	3.33 2.67	R. Techniques	2.67	General R.M. R. Administration R. Economics	3.33 1.33 2.00			Regional R.M.	4.00	19.33
N. Mex.	R. Grasses R. Botany R. Ecology	3.00 3.00 4.00	Adv. R. Mangt.	4.00	R. Management	4.00	R.M. Seminar	1.00	R.M. Camp	5.00	24.00
Nevada	R. Agrostology R. Plants Poisonous Plants	3.00 1.00 1.00	R. Study Tech.	2.00	R. & Pasture Mangt. R. Improvement Grazing Influences R. Administration	3.00 1.00 1.00 1.00	R. and Pasture Lit.	1.00	Field trip	2.00	16.00
Oregon	Agrostology (Bot.) Range Plants	2.00 2.00	R. Methods	3.33	R. Management R. Improvement R.M. Planning	2.00 2.00 2.00	R. Management	2.00			15.33
So. Dak.	Agrostology (Bot.) Ranges & R. Plants	2.67 2.00	Range Surveys	2.67	Principles R.M. R. Improvements R. M. Plans	3.33 2.00 2.00	R. Seminar	0.67	Field Studies in R.M.	2.00	17.33
Texas A. & M.	Agrostology Range Plants	3.00 3.00	R. Techniques	3.00	R. Management Adv. R. Mangt.	3.00 3.00			Summer Field Experience	3.00	18.00
Texas Tech.	R. Plants	3.00	R. M. Problems	3.00	R. Plant Mangt. Adv. R. Plant Mangt.	3.00 3.00					12.00
Utah	Agrostology (Bot.) R. Plant Communities	2.67 6.67	Tech. Problems R. Analysis Tech.	2.00 0.67	Principles Mangt. R. Improvement R. Economics	3.33 2.00 2.00	R. Seminar	4.00	R. Field Problems	2.00	25.33
Washington	Agrostology (Bot.) R. Forage Plants	3.00 3.00	Range Analy.	2.00	R. Management R. Livestock Mangt.	3.00 3.00	Land Use	1.00			15.00
Wyoming	R. Plants—Grasses R. Plants—Others	3.00 3.00	R. Surveys	3.00	R. Utilization and Improvement	3.00	Seminar	2.00			14.00
Mean		6.80		3.24		5.85		0.96		1.44	18.29

[1] Credits for Forestry Summer Camp omitted.

The material presented varies a great deal. Emphasis may be primarily taxonomic or perhaps largely sight recognition based on herbarium mounts and local flora. Some apparently give more consideration to the management and ecological aspect of the vegetation. Generally the individual species is the center of focus and such items as distribution, forage value, management problems and practices, indicator values, nutritive qualities, palatability, phenology, growth habits, associated species, habitat and climatic limitations, reactions to grazings, season of use, and successional status are mentioned. The major forage species receive primary emphasis and unpalatable, poisonous, mechanically injurious, and invading species are often included, but are not always mentioned. The course at Wyoming includes consideration of fossil records, evolution, and shifting floras. M.S.C. includes a course that emphasizes nutrition, chemical components, and animal diets. The average number of species studied probably is in excess of 150 although this is by no means clear. The plants in the Range Society contest may be the basic list of species which is modified with local plants even though no course description mentioned it. A critical analysis of the influence of the contest on course contents in schools which enter and which do not enter teams would be interesting and could show the way to a better contest.

Several course descriptions mentioned that the plants were grouped regionally rather than taxonomically. This indicates an emphasis on vegetational types or regions, ecological considerations, regional management problems, and practices. This gives the reason for including range ecology with the material that emphasizes individual plants.

The first course in ecology is listed with botany even though it is given by the range staff at Texas A. & M. and Utah. Seven schools give additional work in range ecology. The names include Ranges and Range Plants, Grazing Influences and Practices, Range Resources, Grassland Ecology, and Range Plant communities. The most common subject matter thread through these is the range type. As many as 20 or more types are described according to species, distribution, soil, environment, vegetational changes, livestock industry, management problems and practices, and range improvements. In short the subject matter concerns the plant community and its management. Of interest is that Ranges and Range Plants at M.S.C. and South Dakota, Range Resources at Arizona and Grassland Ecology at California are almost from the same mold. Utah covers this subject matter in three courses: Grassland Communities, Forest Communities, and Desert Communities.

As with the other major blocks of range subject matter there is much variation in arrangement. All those schools which do not teach range ecology under a separate heading have a liberal sprinkling of community and ecosystem ecology through the management and techniques courses. This is also true, but probably to a lesser degree, for those schools with courses in range ecology.

The environmental factor, in-

Table 7. The Average Range Management Curriculum.

	Average semester Credit requirement	
Natural Sciences		35.98
Botany (Basic*, Physiology*, Taxonomy*, Ecology*)	14.82	
Chemistry (Inorganic*, organic*)	10.53	
Geology	2.13	
Physics	2.20	
Zoology (Basic, Animal Ecology)	4.26	
Others (Genetics, Entomology, Bacteriology)	2.18	
Mathematics and Engineering		9.38
Mathematics (Algebra*, Trigonometry*)	4.98	
Statistics	1.11	
Engineering (Drafting, Surveying)	3.29	
English and Social Sciences		22.11
English (Composition*, Speech, Writing, others)	10.10	
Economics (Basic*, Agricultural)	6.39	
Social Sciences, History & Government	5.62	
Agriculture		21.22
Orientation	1.16	
Agronomy (Elements, Forage crops)	3.84	
Animal Husbandry (Basic and Production*, Nutrition and Feeds*)	9.84	
Soil science (Basic*, others)	5.44	
Others	0.94	
Other Wildland Uses		8.60
Forestry	4.49	
Watershed Management, Soil Conservation	1.78	
Wildlife Management	2.33	
Range Management		18.29
*Agrostology, Range Plants, Range Ecology	6.80	
*Methods, Utilization, Condition and Trend	3.24	
*Management, Improvements, Planning, Economics, Policy	5.85	
Seminar	0.96	
Field Trip	1.44	
Total		115.58

*Subjects required in all curricula.

dividual plant, or autecological approach is evident in some courses and the "influence" approach in others. By the latter is meant the influence of grazing on plants, vegetation, and soil. This material is similar to that given in Range Utilization. Arizona combines an analysis of the principal factors affecting range and their application to range management under the name "Range Ecology." Nevada includes discussion of grassland communities, climate, and response to herbage removal in agrostology. How widespread is the coverage of environmental factors, instrumentation, and meteorology is not clear.

Standardizing these courses is undesirable but there does seem to be need for a statement of minimum requirements. What is a reasonable number of plants with which the student should be familiar? How many undesirable plants should be studied? How well should the facility to use keys be developed? How much factual knowledge about range plant species and plant communities is needed by the range graduate? What is a reasonable balance of taxonomic, ecological and management information on ranges and range plants? These questions illustrate the degree to which the Range Management Education Council and hiring agencies might want to define an academic straight-jacket. The last question is the important one.

Emphasis on Methods, Utilization, Condition, and Trend: In all schools a course with emphasis on techniques, analysis, methods, surveys, range forage evaluation or technical problems is given. Utah has two courses. Two approaches to techniques subject matter are evident. One concentrates on range surveys, condition and trend, utilization checks, use factors, mapping, carrying capacity, photogrammetry, and range readiness. The other gives emphasis to research methods, sampling theory, statistical analysis, and sampling techniques that concentrate on such items as cover, composition, frequency, weight of herbage, and distance measurements. No course separates completely the managerial and the ecological approaches to methods. It is not clear how much methodology is taught in the laboratories of other courses but certainly there is considerable. For example, the courses with "utilization" in the title specifically mentioned use measurements and most courses in range planning start with the student making a range inventory. The course titled "Range Utilization" at Colorado includes material on the effects of animals on plants, preferences, grazing systems, utilization, and range condition. This illustrates the fact that techniques, ecological considerations, and management are combined in many range courses. The average credit value for material listed under this heading is 3.24.

Management, Improvements, Policy, Economics, Planning: An average credit value of 5.85 is in courses classified as primarily management. The work is given in one to four courses. Commonly there is a course in principles or even two in which the whole field is covered. In other cases blocks of subject matter on range improvements, range economics, administration and policy, and ranch or range planning are given as separate courses.

At this point a discussion of the introduction to range management seems appropriate. California and Wyoming give a terminal beginning course that is designed primarily for non-majors but it is taken by part of the majors. All majors at M.S.C. and Oregon are required to take the terminal beginning course and Arizona is initiating such a course. Texas has two parallel courses for non-majors. Brief handling of range is included in orientation courses at Arizona,

Table 8. The 1952 standard range curriculum with an estimate of 1960 compliance.

A. Basic courses
   1. *English,* especially writing and grammar. *(grammar 100%, writing 80%)*
   2. *Speech,* (90%)
   3. *Mathematics,* including algebra and trigonometry. (100%)
   4. *Chemistry,* including organic. (100%)
   5. *Economics,* especially agricultural. *(100%, Agricultural 80%)*

B. Technical courses
   1. *Range Management,* including plants, management, methods, ecology, multiple use, improvements, history, administration and policy, economics and field application. *(80 to 90%)*
   2. *Animal husbandry,* including feeds and feeding, nutrition, range livestock breeds and judging, management, and production. *(95% except judging)*
   3. *Zoology,* especially animal ecology. *(95%, Animal Ecology 20%)*
   4. *Soils,* including morphology, classification, fertility, erosion and vegetation influences. (*Principles 100%, others 45%*)

C. Elective courses
   1. *Forestry,* management, measurement, silviculture, fire control. (45%)
   2. *Wildlife management,* big game, predators, rodents. (80%)
   3. *Zoology,* especially animal ecology. (*95%, Animal Ecology 20%*)
   4. *Geology. (60%)*
   5. *Land surveying and mapping. (90%)*
   6. *Veterinary science. (Zero)*
   7. *Genetics. (40%)*
   8. *Agronomy,* especially forage crops. *(60%, Forage Crops 45%)*

California, Colorado, Idaho, Nevada, Texas A. & M., Utah, and probably others. The extent of this material varies from a few lectures in a course covering many fields to a separate course of about 1 credit.

Five schools treat seeding, undesirable plant control and fertilization in a separate course called Range Improvements. These are M.S.U., Nevada, Oregon, South Dakota, and Utah. M.S.C. calls the course Range Renovation Practices and includes rodent control and government policies on renovation. Colorado includes only seed production, seed testing, seeding practices and machinery under the name Range Revegetation. The variation doesn't end here as the following may or may not be included under range improvements: fencing, stock water, terraces, pitting, water spreading, roads, trails, characteristics of depleted ranges, management system, etc. Wyoming combines range utilization and improvement and mentions only relationships of range plants to soil, water, light, and use by livestock; management practices; digestibility; and grass morphology and laboratory identification.

The courses on management exhibit a great deal of variation but in total they cover the whole management field. "Range Management" by Stoddart and Smith is the text commonly used and numerous course outlines follow it closely although none exactly.

Administration and policy deal with the history of land acquisition, legislation, and federal land policies; the history, organization, functions, land use problems, policies, and personnel of the various federal and state agencies; and the grazing regulations and practices of the agencies. Colorado, M.S.C, M.S.U. and Nevada see these as important enough for a separate course. The other schools treat this subject more briefly in one of the management courses or perhaps not at all.

Colorado, M.S.U., and Utah have a course in range economics. Subject matter headings in these courses include land valuation, income, costs, tenure, taxation, fees, leases, costs and returns from improvements, ranch organization, land appraisal, credit, marketing, and others. A question is raised concerning the approach to all these subjects. Is it one of description, accounting, and the business of ranching as might be learned in a ranch study? Or is it evaluation of alternatives, and application of economic theory? Or is it an attempt to sell management to students on a dollars and cents basis?

The scope of dollars and cents application in the management courses is not evident in the outlines. The field of range economics from the economist's viewpoint is not well developed and there are precious few range technicians with degrees in economics and vice versa. If we are training professional men, the lack of economics may be the most serious deficiency. If the emphasis is toward biologists perhaps the lack of economics is not so important.

Several schools (Idaho, M.S.C., Oregon, and South Dakota) have a senior finalizing course on range planning. Colorado and New Mexico combine the planning with range analysis. The objective in these courses is to give the student training in making a range inventory and preparing an operating plan. It begins with collection of field data and proceeds through problem definition, consideration of alternative decisions and preparation of a written plan for accomplishment of the management objective. The course seeks to integrate knowledge from the biological, economic, and managerial aspects of range management. This seems to call for top-level professional attainment and the question is raised: why do not all curricula include training in range planning?

Seminar: Ten schools include seminars in their curricula. The subject matter for most of them is multiple use, current problems, or current literature. An advanced range management course at Oregon is included here because it discusses recent advances in range management and is organized on a seminar basis.

Field Trip. Eleven schools require a major field tour, summer camp, or summer experience beyond those field trips in the regular session courses. These vary from about a week at M.S.C. and Nevada to 10 weeks of forestry camp at Colorado and Idaho. The credit value varies from none for 4 weeks of work at California to 10 credits for the two forestry camps. The 10 units for those camps were not included in the totals for range management as they were already counted in Forestry. These camps are given as three or four separate courses and the same is true in part for some of the field courses in range management at South Dakota. The other trips are inspection trips where visits are made to ranches, research centers, and to see the various agency action programs. The trip under the title "Regional Range Management" at M.S.U. is one of the oldest courses of this nature and coming late in the senior year, it seeks to integrate all phases of Range Management.

Subject Matter Sequence: The sequence of range material begins either with the first management course or one of the plant courses. These are followed by methodology, range ecology, policy and administration, and economics. Usually the field trip is between the junior and senior years, although Colorado has a sophomore camp and M.S.U. has its field tour in the last quarter of the senior year. Second and third courses in spe-

cialized parts of management, such as improvements, revegetation and planning, and the seminar come last. There were a few questionable sequences: At Arizona Systematic Botany came after the course in range plants. The course in Agrostology came late in the program at Washington. Alternating work of the junior and senior years between two campuses causes a switch in order for some students at California. The planning course is in a fall semester senior position and is followed by Renovation Practices, Forage Values of Range Plants and the Seminar at M.S.C.

Total Range Management Requirements: The number of required credits in range courses varies from a low of 12 at California and Texas Tech. to a high of 25.33 credits at Utah. The course packages vary between 4 and 11. The average credit requirement in range is 18.29 units. Straight comparisons of these total units between schools is not a strictly fair comparison because the total units required for the degree varies between 124 and 151. The percentages that range management courses compose of the total curricula are as follows:

Utah	19.8
M. S. C.	18.1
Colorado	17.0
N. Mex.	16.7
Arizona	16.1
So. Dak.	13.7
M. S. U.	13.5
Texas A. & M.	12.5
Oregon	12.0
Nevada	11.9
Washington	11.7
Idaho	10.6
Wyoming	10.6
California	9.7
Texas Tech.	8.6

The above percentages show wide variation in the relative intensity of range management instruction. One cause may be that some schools place more emphasis than others on developing facility in doing the vocational types of range jobs. Another may be found in the relative amount of detail used to illustrate range management principles. Whatever the causes, optimum training in range management warrants more uniformity, unless the educational objectives differ among the schools.

Options or Majors in Range Management

Nine schools mention two or more options or majors for Range Management. These are as follows: The first named for each school is summarized in the tables and narrative parts of this report and the others are not.

Arizona	Range Management
	Range—Forestry
	Range—Wildlife
	Range—Recreation
	Range—Animal Science
California	Curriculum in Range Management
	Option in Forestry curriculum
	Option in Agricultural Production curriculum
Colorado	Range conservation
	Forest-Range Management
M. S. C.	Agricultural Production
	Agricultural Science
	Agricultural Business
M. S. U.	Forestry with R. M.
	Forest Conservation with R. M.
Oregon	Agricultural Science
	Agricultural Technology
	Agricultural Business
Utah	Range Management
	Forest-Range
	Watershed Management
Washington	Technical Range Management Option
	Science specialization option
	Range Management option
Wyoming	Range Management Science option

There seems little point in discussing these options in detail. With few exceptions they include the same range management courses that are in the option summarized for each school. The differences are in the relative emphasis on other subjects such as forestry, phases of agriculture, and business. The names indicate the emphasis. Some options are new and have not been implemented. Some meet the present Civil Service requirements and others do not.

The Average Range Management Curriculum

The average curriculum (Table 7) amounts to 115.58 credits. This is a straight listing of averages. Subjects marked with an asterisk were required in all the curricula and amount to 68.76 credits.

A committee of the Society published in 1952 (Jour. Range Mangt. 5:393-394) a "Standard Range Management Curriculum" for the guidance of schools, students and the U. S. Civil Service Commission. Those recommendations are given in Table 8. In that table each subject matter is followed by a percentage figure which is my estimate of the overall attainment of the 1952 listings. The percentages express the proportion of the fifteen curricula that require work in each subject. No single curriculum meets all of these suggestions, especially in the category of "Elective courses." There would seem to be room for improvement in one or more of English (writing and speech), agricultural economics, animal husbandry, soil science, range management, and other wildland uses in all the curricula. No school has found veterinary science important enough to include. On the other hand, several curricula require work in physics, statistics, and social sciences;

subjects not mentioned in the 1952 recommendations.

Points for Discussion

The objective of this study was to summarize the range curricula so that the Range Management Education Council would have the factual material from which they could arrive at recommendations for (1) a standard range management curriculum, ("standard" is used because the Council has not yet established specifications for a "minimum" or an "ideal" curriculum) and (2) Civil Service requirements in range management. Numerous questions and points will, no doubt, be discussed before these recommendations are written and the Council has made a start in that direction. Opinions from others are welcome and one reason for presenting this paper to the Society members is to solicit comments. A few detailed points of discussion have been suggested, and the following are some larger areas of educational philosophy that are directed to your attention.

Ranges and Range Management are not the same. A range is an ecosystem in which the interaction of vegetation and grazing animals is of primary but not the only concern. Ranges normally include vegetation which is not grazed such as trees and many so-called undesirable plants and other items like streams, lakes, barren land, and engineering developments. Range Management is the administration and business of managing ranges and other included lands on a scientific basis. It includes the management of all resources of the range including forage, timber, wildlife, water, and recreation. Knowledge of managerial practices for continuous production of all these goods and services is a requirement of professional range managers. So is a knowledge of interrelationships among these resources. It is granted that these are related fields educationally, but they become a part of range management in the management of ranges. Therefore, do the students in range management learn enough about these related fields in the present curricula?

The practice of range management gives due regard to economic and business considerations. Many range problems may best be solved through the applications of economic analysis and techniques used in business administration with respect to operations and decision making. Sorting of alternative practices to obtain the most favorable returns is done on a basis of inputs and outputs within a business structure. Do the curricula adequately train in the area that combines the biological, economic, and business aspects of managing range lands?

A range manager is a person competent to practice the profession. He deals with the application of knowledge. Some are scientists who deal with the acquisition of knowledge. A few range students want to become competent ranch operators. Other are called upon to do many vocational tasks like locating water developments, building dams, seeding ranges, and many more. Where do graduates of these fifteen curricula fit into this scale? Are they semi-professional, with a solid foundation on which they can grow to meet increased administrative and business responsibilities? Are they well grounded in the mechanics of doing a range job? Are they oriented toward a research career? Or a ranch business? Are the curricula trying to do all these things and should they? Are all the curricula trying to do the same thing and should they?

Every man is a citizen and functions as an individual in his community. He must be able to grow with and preferably ahead of his community. The University has the responsibility perhaps more than any other institution, except the home, to develop a feeling of social responsibility in the nation's youth. Do the range curricula give the student adequate acquaintance with the "cross-campus" subjects that will whet his appetite for taking part and sharpen his ability to take part in the world around him?

Useful knowledge has no limit but there is a practical limit as to how much can be attained in four years. What are those limits in terms of essential future needs?

Cattle and Timber in South Florida

E. R. FELTON
Manager, Alico Land Development Company, LaBelle, Florida[1]

In the range cattle-producing area of South Florida, it is typical to use both timbered and non-timbered lands for grazing. In recent years, cattlemen have come to realize the income-producing value of timberlands and are now following better practices for timber production on lands capable of producing timber. This realization—plus a changing taxation picture—has brought about the general practice of establishing a land-use study in which lands are classified according to primary capabilities, and each acre is utilized as fully as possible for the purpose best suited.

The Alico Land Development

[1] *Alico Land Development Company is a newly formed Florida corporation, whose properties were formerly the non-railroad properties of The Atlantic Land and Improvement Company, a wholly-owned subsidiary of Atlantic Coast Line Railroad Company.*

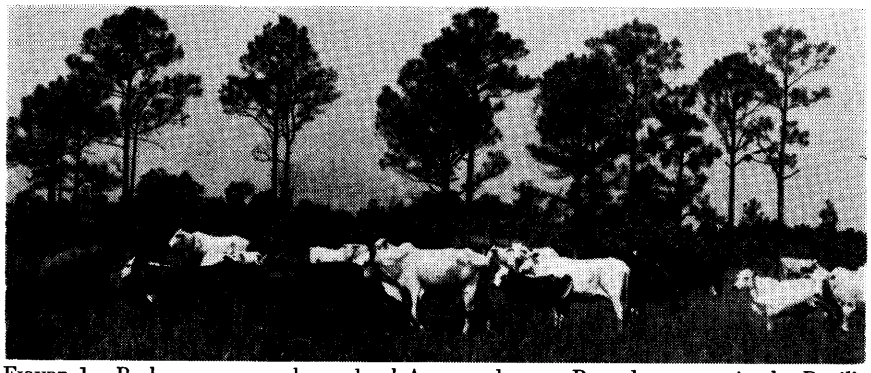

FIGURE 1. Brahman cows and crossbred Angus calves on Pangola pasture in the Devil's Garden area.

Company owns 236,512 acres in Polk, Lee, Hendry and Collier Counties, Florida. The forests are largely of South Florida slash pine interspersed with stands of cypress and mixed hardwoods. Lands classified as timberlands are managed primarily for that purpose, and grazing on these lands is of secondary importance. However, the timberlands are an important source of range when used in combination with non-timbered native range and improved pasture. Further, by following a system of rotational grazing between native range and improved pastures, the grazing pressure or stocking rate on timberlands does not interfere with forest management practices, but rather is of actual benefit by reducing fire hazard and competition.

The company's cattle program is being developed primarily on the Devil's Garden tract in Hendry County. This area includes 36,000 acres of native range and 7,788 acres of improved Pangola and Bahia grass pastures. Native ranges are primarily abandoned old fields which have reverted to native grasses, wet prairies, and flatwoods rangeland with strands of pine interspersed with ponds and oak-cabbage palm hammocks.

The Company's cattle herd totals 7,400 head of all classes, and future plans call for a gradual expansion to a total of 10,000, which we believe to be the most economical unit for Alico properties. In developing its cattle program, Alico has followed the latest developments and recommendations of Agricultural Experiment Stations to provide proper breeding, feeding and management practices. The breeding program crosses Brahman with English breeds (Angus and Hereford) to produce animals of desirable beef type and adaptability to range conditions of the area.

Cattle are grazed on a combination of native range and improved pastures. One acre of improved pasture and eight to ten acres of unimproved range—which includes both timbered and non-timbered areas—are allowed per cow and calf. By rotating grazing between unimproved range and improved pastures, this acreage supplies year-round grazing.

The management of cattle and land under this system is predicted on the seasonal requirements of the cow. For example, in the late summer or fall when the calf is weaned, the roughage requirement of the cow is at the lowest point of the year because she has only her own maintenance and that of a small embryo for which to provide. During this period the cow is placed on native or unimproved range, which is sufficient to meet the low requirements. Also, during the winter and early spring, a protein supplement is usually provided, and a portion of the native range is control burned to improve quality of roughage. It is during this period that the calf is born.

Following the birth of the calf in the spring, the cow's requirements increase so that additional roughage is needed. This is the period when improved pastures are fertilized and the cow and calf moved onto them. Both quantity and quality of roughage are sufficient to meet her increasing requirements.

During the spring and summer as the calf continues to grow, bulls are placed with the breeding herd and the cows are rebred. There is a steady and continual increase in roughage requirements, which reach the highest point of the year in late summer and early fall just prior to weaning. This coincides with the period when grass pastures make their greatest growth. It has been determined that some 70 percent of the annual production occurs during the period of April through July.

As the calves reach weaning age in late summer and early fall, they are weaned, and the cows are returned to the native range, which has had a period of rest and considerable growth has accumulated to furnish the cow sufficient roughage since her requirements are at a low ebb following weaning.

In following the management system outlined above, the cow spends approximately half of the year on native, unimproved range, and half of the year on improved, fertilized pasture as determined by her requirements. The goal of providing an adequate plane of nutrition on a year-around basis is accomplished.

The economic advantage of this system is obvious in that it permits a fairly high stocking rate and satisfactory production in pounds of beef per acre, and at the same time, timber production is maintained on the native and unimproved areas. This is the ultimate goal of a well-planned and executed land-use program.

Personal Experiences in Grazing Improvement in Chihuahua

ARMANDO R. RAYNAL

Cattleman, Union Ganadera Regional de Chihuahua, Mexico

Until recently grazing practices, routine in Southwestern United States, have not been used in the state of Chihuahua, Mexico. A climatic difference makes our conditions different and years of revolution have greatly retarded technology in Mexican animal husbandry. A definite advancement was not made until the 1950's.

My first experience seeking to break the established routine of Hereford ranching with nothing but nature for a background was in 1945, when after reading an American magazine on the use of salt to regulate meal intake, I tried it on 60 selected cows. Simultaneously it was tried by other cattlemen in the State.

The one great difference between conditions in Chihuahua and the Southwestern United States lies in the fact that while some spring moisture is general in the Southwest, the normal condition in Chihuahua is to have no spring moisture. This makes a tremendous difference in all the operations. Our grasses as a rule, are very strong from July through October which comprises the period of rain and relatively good moisture in the soil. Our pasture conditions are, therefore, characterized by highly superior grass these 4 months of the year followed by 4 months of gradually diminishing nutritional value. One thing is in our favor, however, compared to the American standard cycle. We by no means have the winter storms that occur in the United States. This lack of storms makes it cheaper to winter our cattle but lack of moisture in the spring gives us a bad taste of drought in the months of March, April, May and June.

Under these conditions cattle cannot prosper conveniently on 4 months of good grass and 8 months of poor grass. With cottonseed meal and salt supplementation the breeding herd operates rather successfully but it is almost impossible to produce fleshy cattle for slaughter during the 4 months of drought mentioned.

Here it occurred to me that grazing winter wheat would be the solution to the 8 months period of cattle losing weight. I knew that lack of moisture in the spring would nullify all possibilities of making a grain crop so I would have to gamble on making a profit on the grazing alone. My first experience with this type of operation came in the winter of 1956-57 and since then I have been using it every year with relatively good success. The procedure followed was: plowing and planting between August 1 and 31; grazing, December 1 to March 15; rest, March 15 to April 15; and additional grazing, April 15 to May 31 or until the wheat died out. On the first grazing period of 105 days recently weaned calves have consistently gained 150 pounds.

I had another experience in breaking the old routine this last spring, 1961. One great problem in grazing lies in the fact that where a mixture of palatable and non-palatable grasses is carried, a general utilization of the range very easily produces a further deterioration of the palatable species because in trying to get cattle to utilize the non-palatable grasses the good ones are overgrazed. From this it is evident that a supplementation is needed in order to induce the cattle to eat the unpalatable grasses in winter and spring. In March 1961, 500 yearling heifers were placed on a reserved 400-acre pasture of mixed grasses on a hillside with abundant scrub oak. The pasture was supplemented with a daily feed mixture of 100 grams of salt, 100 grams of cottonseed meal, 300 grams of ground oat grain per head. Until March 31 the heifers lost weight and ate but very little of the more palatable grasses. On April 1 the daily supplementation was modified to 150 grams of salt, 150 grams of cottonseed meal, 300 grams of ground oat grain, 150,000 units of vitamin A, 100 mg. of copper sulphate and 20 mg. of diethylstilbestrol per head per day. The results from April 1 to 20 were unbelievable. The heifers demolished everything that was eatable on the pasture and grazed the unpalatable grasses with the same intensity as the palatable ones. The leaves of the scrub oaks to the height the cattle could graze were removed as if pruned by hand. On April 21 the heifers had to be moved out because the degree of utilization was getting dangerously heavy. They had eaten with a devouring appetite.

Still another grazing experience was obtained also in the spring of 1961 on a 400-acre pasture heavily covered with Alfombrilla, *Drymaria arenarioides*, the poisonous weed that has killed thousands of cattle in the central part of Chihuahua. The basis of the layout was to induce a natural trend to reduce the stand of alfombrilla and an improvement of the palatable grasses. Two things were obvious, protect the good grasses on their critical period, i.e., rest the pasture entirely from July through October, and hurt if possible the alfombrilla by overgrazing in a critical period of

its growth. This is during the first growth in spring, March and April. It is on this phase that the poisonous weed starts its growth. The principle was that if the weed was overgrazed when it started growth, a heifer would not eat the half pound of green matter required to obtain toxicity. Twelve hundred heifers were on the pasture April 5 through the 30th. Eight were lost but results with the alfombrilla were encouraging. A partial kill seems to have been accomplished. The more tender plants, perhaps the 1960 crop, seem to have died. On this basis, if a kill is achieved on the plants started the previous year and, if as it is claimed, alfombrilla is a short lived perennial, the treatment should control this poisonous weed in 3 to 4 years. This experience should be combined with the previous one.

At the present a last experiment is being developed. This one consists of feeding 2-year-old heifers Morea liquid feed after they had been grazed on wheat as yearlings. Reports on gains cannot be given yet but from visual observation these heifers are doing very well. A check showed 27-month old heifers weighing 880 pounds. The importance of using Morea liquid feed comes from the availability of molasses. It is the only feedstuff available in surplus in the Country.

Curlleaf Cercocarpus[1] Seed Dormancy Yields to Acid and Thiourea[2]

LEONIDAS G. LIACOS AND EAMOR C. NORD[3]

Head of Range and Watershed Management Studies, Service of Forest Technical Works (Y.D.E.M.), Forest Service, Thessaloniki, Greece, and Range Conservationist, Pacific Southwest Forest and Range Experiment Station, U. S. Forest Service, Berkeley, California.

On many winter deer ranges there is a need to re-establish browse species that can be seeded directly on the range. Sufficient knowledge about proper planting techniques has been gained through research to enable seeding two species—antelope bitterbrush *(Purshia tridentata* (Pursh) DC) and fourwing saltbush *(Atriplex canescens* Nutt.) —on a few important deer winter ranges.

Another species which meets many requirements for improving certain winter ranges is curlleaf cercocarpus *(Cercocarpus ledifolius* Nutt.). Its seasonal growth is considered an excellent deer food. It is ecologically adapted to many locations where deer winter; it grows high enough so it can be browsed above deep snow; and it produces frequent seed crops that can be harvested and processed at nominal costs (Plummer, Stapley and Christensen, 1959).

But most attempts to establish this species by direct seeding on the range have failed. Failure is attributed largely to poor seed germination because of dormancy. Overwintering in moist soil or 30 to 90 days of artificial stratification breaks dormancy, but neither method has proved entirely practical.

This paper reports a study which promises an answer to the problem. A two-step treatment using sulfuric acid and thiourea produced over 75 percent germination in comparison to 14 percent from untreated seeds.

Methods

A total of 29 variations of 4 basic treatments consisting of thiourea, sulfuric acid, hot water and pre-chilling were applied to seed at the following intensities:

Treatment	*Intensity*
Thiourea (3 percent)	1, 2, 4, 8, 16, and 24 hours
Sulfuric acid (concentrated)	5, 10, 20, 30, 60, and 90 minutes
Hot water	Steep in 1 liter to room temperature (70°F.)
Pre-chilling	0° and 5°C., 1 to 8 days

The thiourea treatment consisted of immersing seed in a 3-percent solution for the specified period at room temperatures. The concentrated sulfuric acid bath was followed with a tap water rinse, then a neutralizing dilute bicarbonate of soda solution, and finally another rinse in tap water. The hot water treatment con-

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[1] *Plants of the* Cercocarpus *genus are almost universally known in the West as "mountain-mahogany." However, in the new Forest Service Checklist "cercocarpus" was adopted as the approved common name. This action stems from Federal Trade Commission hearings on fair trade practice in "Mahogany" which ruled that "mahogany" should not be employed for any plants but species of the genus* Swietenia *(Hayes and Garrison, 1960).*

[2] *Contribution from cooperative investigation between the Experiment Station and the California Department of Fish and Game. Work was done under Federal Aid in Wildlife Restoration Act, Pittman-Robertson Research Project W51R, entitled "Game Range Restoration."*

[3] *The research reported herein was conducted by Dr. Liacos at the Pacific Southwest Forest and Range Experiment Station, U. S. Forest Service, while he was in the United States under sponsorship of the Technical Assistance Program, International Cooperation Administration, U. S. State Department, as a visiting scholar at the University of California, Berkeley. Since 1959, he has continued his studies in this country as a participant in the World Wide Research Program, National Academy of Sciences, and returned to Greece in 1961.*

sisted of steeping the seed in one liter of boiled water until it cooled to room temperatures before removing the seeds. Seed in the combination hot-water bath and acid tests were air-dried for about 24 hours and then treated with thiourea. No rinse was applied to any seed following the thiourea bath. The pre-chilled seeds were put directly into the dishes after their removal from the cold room. All other seeds were air-dried for about 24 hours before they were set out to germinate.

Each test included 8 replications of 50 seeds placed on moist blotters in pre-sterilized covered Petri dishes and maintained at temperatures of 60° to 68°F. for 30 days. Germination was considered to have occurred when the seed radicle had elongated ¼ inch or more. Unusual or questionable germination was checked by planting such seeds at ¼-inch depth in vermiculite flats. Only those which emerged were considered capable of germinating.

Seed quality was determined by cutting 200 randomly selected seeds. Pure live seed in this lot was 54 percent. Germination percentages were adjusted to this base. Qualitative tests for saponin, a large group of complex glycosides known to inhibit seed germination in other western browse species, were determined with a Lieberman-Burchard reagent, a mixture of sulfuric acid and acetic anhydride (Van Atta and Guggolz, 1958).

Acid and Thiourea Give Best Performance

Curlleaf cercocarpus seed germination was substantially and significantly increased by soaking the seed in concentrated sulfuric acid for either 5 or 20 minutes followed by a 4-hour soaking in the thiourea solution. Seed thus treated yielded over 72 percent germination; untreated seed less than 14 percent (Figure 1). An analysis of variance on the differences between treatments showed that these two treatments in combination had significantly better germination ($P=.01$) than all others.

The 30-minute sulfuric acid bath broke dormancy, but it damaged some seed. Also at this treatment level almost all germination stopped within 2 weeks. With a 60-minute acid soak more than three-fourths of the seeds shed their coats on initial sprouting. Seeds thus affected failed to emerge when planted in the flats. Of the seeds soaked in the acid for 90 minutes, none germinated. No damage occurred with the combination acid-thiourea treatments or with the untreated seeds (Figure 2).

The hot water bath was harmful; nearly complete inability to germinate indicated that the embryos may have been destroyed by this treatment. Pre-chilling was unsuccessful; germination of all pre-chilled seed lots was less than that of untreated seeds.

Soaking in thiourea for 4 hours or more hastened the average rate of germination about 3 days as compared with no treatment (Figure 1). Thiourea applied for less than 4 hours after an acid bath did not speed up germination.

Seventy-five percent or more of the total germination from both acid and thiourea alone or in combination took place within the first 13 days. Untreated seed required 19 days to reach the same level. Although germination was most rapid with sulfuric acid treatment, it ceased after about 12 days but continued with most of the other seed treatments.

Thiourea Reduces Mold on Seeds

Mold development was suppressed on all-thiourea treated seeds in Petri dishes. One of the molds identified as a *Penicillium* sp., developed very slowly on the seeds bathed in thiourea. In the

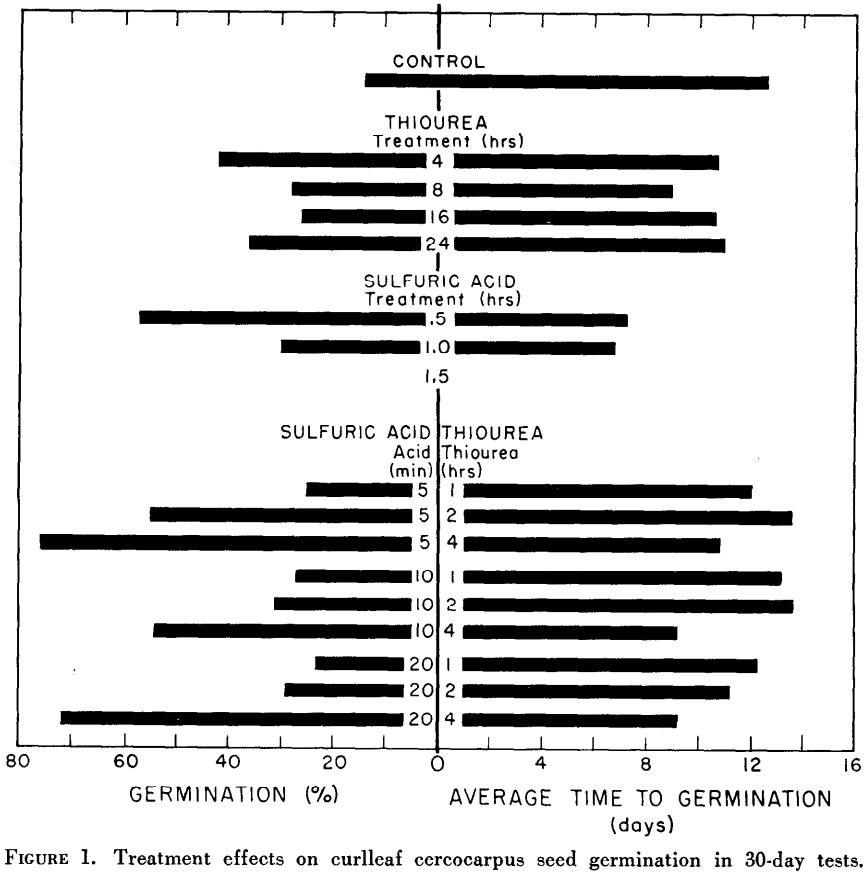

FIGURE 1. Treatment effects on curlleaf cercocarpus seed germination in 30-day tests.

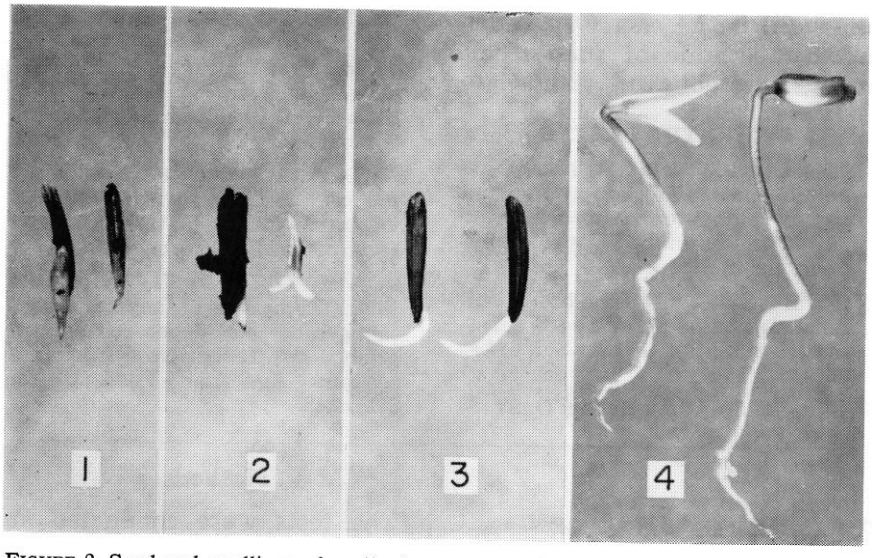

FIGURE 2. Seed and seedlings of curlleaf cerocarpus. 1. Untreated seed. 2. Malformed seedlings from 60-minute sulfuric acid soak. 3. Newly germinated seedlings from 5-minute acid, 4-hour thiourea soak. 4. Healthy seedlings resulting from the acid-thiourea treatment.

other treatments, it appeared within a few days and spread profusely. This condition was especially pronounced on seeds receiving the hot water bath (Figure 3). When the tests were stopped, all treatments except those with thiourea showed widespread mold accumulations surrounding the seeds. Under such conditions, the radicle turned brown and many seedlings failed to develop properly.

It was not determined whether the thiourea treatment inhibited or reduced harmful fungi when seed was planted in the soil. Nevertheless, it minimized an aggravating problem which frequently complicates seed analysis germination tests (U. S. Dept. Agr., 1952).

Saponin Suspected Cause of Dormancy

A strong color reaction was received when portions of the seed coat were introduced into the Liebermann-Burchard reagent, indicating that a saponin was probably present. No color response occurred when endosperm material was tested with the same reagent. The amount of saponin present and the effect this material has on germination was not determined for this species. However, the pattern obtained in these tests parallels that received in tests with fourwing saltbush, in which it was established that enough saponin was in the seed coat bracts to reduce germination (Nord and Van Atta, 1960).

Summary and Conclusions

Using 29 variations of 4 basic treatments consisting of thiourea, sulfuric acid, hot water, and pre-chilling demonstrated that seed dormancy of curlleaf cercocarpus can be broken without overwintering in the soil or extended stratification. The best results were obtained by a 5-minutes concentrated sulfuric acid bath followed by 4-hour immersion in 3-percent thiourea. This treatment combination yielded 76-percent germination as compared to 14 percent for untreated seed. Soaking the seed for 4 hours or longer in thiourea hastened germination by 2 to 3 days on the average. The sulfuric acid treatments overcame dormancy but damaged the seed. Either a hot-water bath or pre-chilling treatment reduced germination on seeds in Petri dishes. Mold formation was reduced by all thiourea treatments. Among the

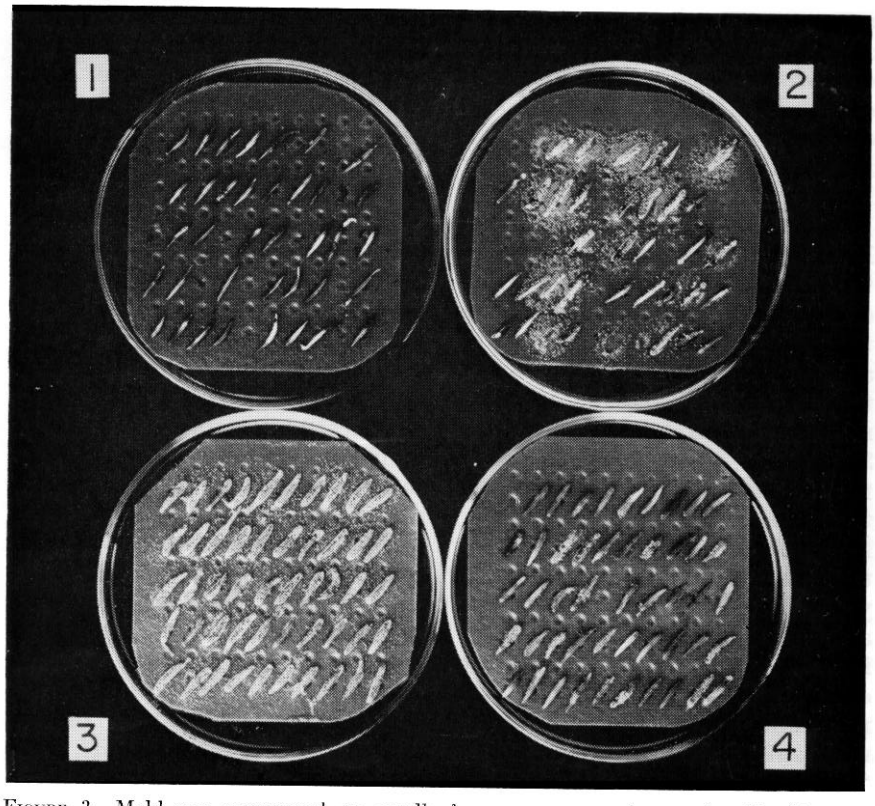

FIGURE 3. Mold was suppressed on curlleaf cercocarpus seed treated with thiourea. 1. Sulfuric acid-thiourea. 2. Sulfuric acid alone. 3. Hot water. 4. Untreated (control).

agents and conditions inducing dormancy saponin in the seed coat was suspected of contributing to this condition.

By using the combination of sulfuric acid and thiourea, seed may be pretreated, dried, and stored in readiness for spring planting. This procedure should produce good germination as well as eliminate the hazards of premature seed sprouting and the need for care in handling stratified seed. Trial field plantings will be necessary to determine the value of such treatments in establishing stands.

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Fall Seeding Versus Spring Seeding in The Establishment of Five Grasses and One Alfalfa in Southern Saskatchewan

M. R. KILCHER
Agronomist, Forage Crops, Experimental Farm, Swift Current, Saskatchewan

The problems in successful establishment of hay and pasture seedings in southern Saskatchewan are major deterrents to increased acreage of perennial forage crops. The ravages of hot dry summers and long cold winters on forage stands are enough to contend with, without adding an establishment problem which might otherwise be avoided or at least controlled as far as possible. For most of the Northern Great Plains area the annual precipitation is 15 inches or less. Throughout the northern half of this area the winter mean temperatures are below 32°F. from November through March, while the summer months of July, August and September are hot and dry. The five months of frozen soil and the three months of dry summer limits the seeding of forage crops to the remaining 4 months of the year. There is general agreement among workers that forage seedings in the plains area must be confined to fall or spring, but the recommendations differ as to the most suitable time to seed within these periods. Kirk (1937), Heinrichs (1941), White and Horner (1942), and others have concluded that fall seeding is generally an acceptable time to seed forage crops. In most instances these workers used only one or two species, crested wheatgrass usually being one. Those who did include more species conducted experiments which were often confined to fall seeding dates so that within test comparison of fall and spring seedings were not made. Since that time others have conducted dates of seeding trials with recent reports by Douglas *et al.* (1960) who favors fall seeding over spring although the type of seed bed influenced establishment more than seeding dates. Frischknecht (1959) discussed the possible advantages from fall seeded grasses in obtaining better stands because of seed vernalization. McGinnies (1960) has shown best establishments from spring seeding, although the 7500-foot elevation where his trials were conducted was considerably higher than that which occurs in plains area.

The dates of seeding trials discussed in this paper were conducted on cultivated land during the five successive years from 1947-48 to 1951-52.

Methods

The tests were conducted at Swift Current, Saskatchewan, on prepared seed beds of Haverhill loam of the Brown (Chestnut) soil zone. The climate at Swift Current is fairly typical of that through southern Saskatchewan, south-eastern Alberta, the eastern half of Montana and western parts of North Dakota. Annual precipitation at Swift Current is about 14½ inches.

Crested wheatgrass *(Agropyron cristatum)*, intermediate wheatgrass *(intermedium)*, streambank wheatgrass *(riparium)*, Russian wild ryegrass *(Elymus junceus)*, green stipa grass *(Stipa viridula)* and Ladak alfalfa *(Medicago media)* were the species used throughout the five year seeding trials. Each was seeded by itself in plots 8 feet wide and 40 feet long through a double disc drill equipped with depth control plates which provided for a ¾-inch uniform seeding depth. A uniform rate of seeding was maintained for each date and from year to year by seeding 30 viable seeds per lineal foot of row. Spacing between rows was 12 inches. Four replications in a random block arrangement were used for each seeding date. The seeding date blocks were also randomized as to location.

The trials consisted of 10 seeding dates, 5 during the fall period and 5 commencing in the spring. The fall seedings were

done at two-week intervals from September 1 to November 1, and the spring seedings, also at two-week intervals, were done from May 1 to July 1.

Final seedling stands were determined on all plots by visual ratings. These determinations were not done at specific times since many of the fall sown plots did not show emergence and/or final stand until the subsequent spring.

There seems to be lack of a standard measure or standard criteria for determining the point at which an initial stand can no longer be regarded as successful. Visual estimates of seedling stands are at best arbitrary in nature and may differ between estimators. For the purpose of this study a final seedling stand of 50 percent by visual estimate or greater was considered to provide an acceptable level for good use.

Results and Discussion

The five-year mean final seedling stands for each seeding date are shown in Figure 1. Individual yearly results showed some variation that is not indicated in these graphs, but essentially the results were similar between years. Because of these similarities and because analyses of variance showed an acceptable level of variability within years it was considered desirable to present the results as mean values in a simple graphic form.

It was evident that good emergence and seedling stands were not obtained during the late spring and early summer periods for all the crops although some, such as the large seeded intermediate wheatgrass and the native streambank wheatgrass, performed better than others.

Establishment was generally lower with seedings made in early fall compared with those made in the late fall or early spring. However, species by dates interaction showed such distinct differences that generalizations about seeding dates were not always valid. The results of the individual crops must be studied in the light of their own particular behavior before any valid interpretations can be made.

Russian wild ryegrass showed the narrowest range of acceptable seeding dates since only in the last fall seeding and in the first spring seeding were the resulting seedling stands better than 50 percent. This behavior has been observed in numerous field seedings also, and is probably the main cause of so many establishment failures. Russian wild ryegrass characteristically shows a slow seedling growth and is particularly sensitive to poor cultural practices, especially depth of seeding and adverse weed competition.

Alfalfa displayed a rather distinct, but fairly wide range of preferred seeding rates. The successful fall seeding dates were limited to late fall, but the

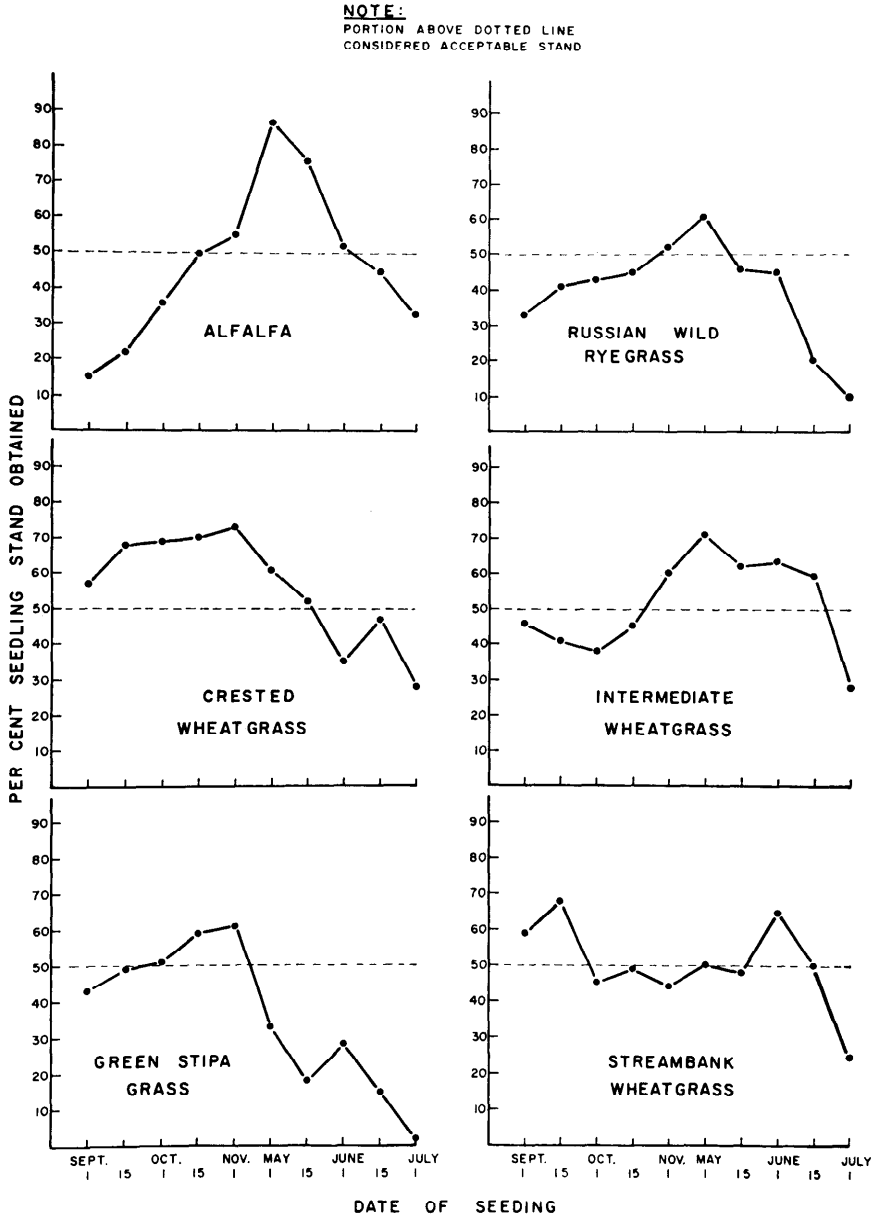

FIGURE 1. Final stands obtained at different dates of seeding during the fall and spring at Swift Current, Saskatchewan. These are average values from 5 years of trials from 1947-48 through to 1951-52.

spring seeding range for good establishment extended all throug the month of May. Since alfalfa is the legume most commonly used in grass-legume mixture plantings the seeding dates favoring the alfalfa component becomes a very important consideration. It will be seen that if the alfalfa graph were superimposed on each of the grass graphs at least some portions of the two would occur simultaneously at or above the line of acceptability.

It will not surprise anyone that crested wheatgrass showed good establishment over a wide range of seeding dates. This grass has an enviable area of adaptability throughout all of the Northern Great Plains area because of its sheer ability to establish and persist. Only during the late spring and early summer period of the seeding trials did seedling stands drop below 50 percent. The performance of crested wheatgrass has long been known and it was included in these trials as the check.

Intermediate wheatgrass had an extended seeding date range although this period was, with the exception of the Nov. 1 date, limited to spring seeding. Being a large seed with a relatively plump caryopsis this species showed good springtime survival even in drying soil. It has often been considered as not excessively winter hardy, and fall germinated seeds and seedlings have not shown good survival at Swift Current. On the other hand, its excellent establishment from spring seedings has contributed to the good stands obtained from a mixture of intermediate wheatgrass and alfalfa for hay fields.

Green stipa grass (green needle grass) showed the customary fall-preferred seeding dates which have been recognized previously by a number of workers and reviewed by Rogler (1960). Seeding from mid-September to late fall resulted in 50 percent stands or better. By contrast, all stands from late spring and early summer seedings were very poor or complete failures. Of the 6 species reported in this study, green stipa grass was the only one which did not show some success from early spring seeding.

Streambank wheatgrass did not show a consistent preferred seeding date within the seeding date shedule. Although early fall and one late spring seeding did result in better than average stands, they were not consistently better and since most dates gave stands near the 50 percent acceptability level the results could not be interpreted to favor a particular seeding time. This strongly growing, well adapted, drought tolerant grass displayed the wide range of general conditions under which it would establish.

Summary

Crested wheatgrass, intermediate wheatgrass, streambank wheatgrass, Russian wild ryegrass, green stipa grass, and alfalfa were seeded on prepared land at Swift Current, Saskatchewan on 10 seeding dates for 5 successive years. Five of the dates were during the fall while five were in the spring and early summer.

The percent of seedling stand obtained was determined for each at each seeding date. Most of them showed some preference within the fall and spring interval seeding period. Alfalfa, intermediate wheatgrass, and Russian wild ryegrass showed better results from spring seeding with some success from late fall seeding, while crested wheatgrass and green stipa grass displayed better seedling stands from fall plantings. Streambank wheatgrass showed the widest range of seeding date success.

The importance of selecting seeding dates when using alfalfa and grass in mixture is indicated.

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Annual Variability in Indicators of Sprouting Potential in Chamise

HORTON M. LAUDE, MILTON B. JONES AND WILLIAM E. MOON

Professor of Agronomy, Davis; Assistant Agronomist, Hopland Field Station, and Technician, Davis, University of California

The management of chaparral vegetation on ranges often is directed toward the encouragement of sprouting to provide browse or the control of sprouting during the conversion of the brush cover to grass. In either case an understanding of sprouting behavior is needed. Chamise *(Adenostoma fasciculatum)* is a sprouting species and a major component of extensive areas of chaparral in California.

In a previous paper Jones and Laude (1960) established relationships between sprouting potential in chamise and the level of starch reserve in the roots or of twig moisture at the time of cutting. It was recognized, however, that successful use could not be made of such factors for the indication of sprouting potential until the amount of annual variation in these seasonal trends in response to environmental conditions was established. The current study considers this annual variability over a period of four years.

Most studies of seasonal variations in stored reserves cover only a single year with the result that annual variations are not apparent. However, Winkler and Williams (1945) presented data on starch reserves in the roots of grapevines for two successive autumns, and found that whereas the percent starch was 18.5 percent on November 6 of one year it was only 6 percent on the same date the next year. They attributed the low level of the second year to early frosts which defoliated the plants thereby terminating assimilation and to the heavier crop produced the preceding summer. Obviously, stored reserves cannot be anticipated by calendar date alone.

The effectiveness of spray treatments on chamise in Southern California has been found to vary with the year.[1] Spraying near the end of the spring growing season has given the best control of first-year sprouts, but it was reported that more satisfactory results were obtained in 1958, a season favorable for chamise growth, than in 1959, a dry year.

Seasonal behavior of chamise must be considered in terms of the evergreen habit of the species when growing in areas of dry summers and relatively mild winters. Watkins and de Forest (1941) related the growth of chamise in Southern California to environment, particularly to the factors of temperature and moisture. They noted that shoot elongation may occur at two seasons. The primary period of growth is in the spring, although a secondary period of lesser activity may occur in the autumn. Both are characterized by variability from year to year in time of arrival and duration. They observed that elongation of stems ceased when air temperatures reached a minimum of 45° F.

Data are lacking on the extent to which temperatures or drought regulate the accumulation of stored reserves in chamise, but studies on other woody species provide some information. Hepting (1945) reported that in shortleaf pine (*Pinus echinata*) growing in Alabama and North Carolina, food reserves of the stem held constant during the winter, whereas root reserves, mainly starch, increased steadily all winter and reached a peak in early spring. Rutter (1957) observed that *Pinus sylvestris*, growing under mild winter conditions in England, increased in dry weight during the winter although the net assimilation rate at this season was much lower than in the summer. Low rates of assimilation were associated with summer drought. Kramer (1957) reviewed work on soil moisture in relation to photosynthesis in trees. He reported that photosynthesis was reduced by decreasing soil moisture considerably before the permanent wilting percentage was reached, and that after wilting, photosynthesis fell to extremely low levels.

Although the extent to which temperatures control assimilation in chamise during the winter is uncertain, it appears probable that the winter temperatures encountered in California are seldom low enough to prevent it altogether. Freeland (1944) studied photosynthesis in conifers during the winter in Illinois, and found that photosynthesis exceeded respiration at air temperatures above 21° F. Bourdeau (1959) noted in Scotch pine that although net photosynthesis was reduced to near zero by lower temperatures, that when the plants were brought indoors from winter conditions, photosynthesis started to increase after two or three hours. In less than 48 hours, photosynthesis in all the trees brought indoors exceeded respiration. It seems reasonable to expect that when moisture is available chamise will carry on appreciable photosynthesis and will accumulate stored reserves during the milder portions of winters in California.

Procedure

The plots were located in a natural stand of chamise on the University of California's Hopland Field Station at an elevation of about 3000 feet. The

[1] *Fuel-break report No. 6, September 30, 1960, California Department of Natural Resources, et al.*

Table 1. Temperature and rainfall for the period of study.

Month	1956-57 Rain (inches)	1956-57 Temperature °F Mean min.	1956-57 Temperature °F Mean max.	1957-58 Rain (inches)	1957-58 Temperature °F Mean min.	1957-58 Temperature °F Mean max.	1958-59 Rain (inches)	1958-59 Temperature °F Mean min.	1958-59 Temperature °F Mean max.	1959-60 Rain (inches)	1959-60 Temperature °F Mean min.	1959-60 Temperature °F Mean max.
Aug.	.....	....	....	0.00	57	81	0.00	69	92	0.00	70	88
Sept.	0.02	....	....	5.52	56	77	0.00	61	85	2.41	53	75
Oct.	1.81	48	62	7.10	44	61	0.41	53	76	0.15	52	73
Nov.	3.17	49	64	2.52	39	54	2.48	43	58	0.09	45	66
Dec.	1.01	38	55	7.32	35	49	2.16	45	60	2.36	35	54
Jan.	7.54	25	37	7.95	38	48	12.39	36	48	9.95	29	37
Feb.	8.48	35	47	20.76	38	46	9.39	32	45	9.58	31	46
Mar.	6.48	32	48	11.76	30	42	2.77	40	58	8.72	38	54
Apr.	3.67	38	61	6.04	40	57	0.68	45	66	2.34	35	53
May	5.32	42	58	0.96	47	70	0.16	43	65	2.55	41	59
June	0.00	56	80	1.60	49	71	0.00	57	81	0.00	59	85
July	0.00	61	84	0.00	66	86	0.00	70	96	0.00	68	92

methods of taking weather records, soil moisture and sprouting measurements, root and twig samples, and of making the chemical analyses were described in a previous paper (Jones and Laude, 1960). Data covered the period January, 1957 to July, 1960. At each date of sampling starch analysis of root tissue was made on six chamise plants subject to moderate browsing by deer and rodents in an unfenced area. However, whereas three plants were pooled to give duplicate samples in 1957 and 1958, six plants were analyzed separately at each sampling date in 1959 and 1960.

In addition to measuring growth by the rate of elongation of tagged shoots, the width of annual rings in stems was observed. For this purpose stems ¼ to ⅜ inch in diameter were collected from 50 plants on March 2, 1961, before spring growth commenced. The stems were killed and fixed in Randolph's fluid. Sections 40 microns in thickness were cut for study under the microscope.

Results and Discussion

The annual variability in the time of greatest starch accumulation in the root, in the maximum amount of starch stored, in the date of initiation of new spring growth, and in the date of highest twig moisture becomes apparent when results of the four years are compared. Fortunately, plant behavior for 1957 and 1958 was approximately "normal." Table 1 presents the temperature and rainfall values. The irregularities of the 1958-59 and 1959-60 seasons relate primarily to the dry periods which occurred each autumn, and these will be discussed in more detail later.

The significance of differences in starch level during the first two years is shown in Table 2. High levels occurred in the spring, lower levels prevailed in mid-summer and gradual increase was noted in the autumn. Such a consistent trend did not occur in 1959 and 1960 (Table 3). During the spring of 1959 no build-up in starch reserves was recorded, and the most significant decrease of that year was obtained in December. In 1960 the highest level was not reached until May, although the mid-summer low did appear. These data establish a considerable variation in pattern over successive years. An explanation of this variability can be attempted in terms of moisture, temperature, and growth responses.

In considering seasonal behavior of chamise it is appropriate to relate consecutive fall, winter, and spring periods which cover the annual growth cycle rather than to use the calendar year. Growth activity in this species starts in the autumn

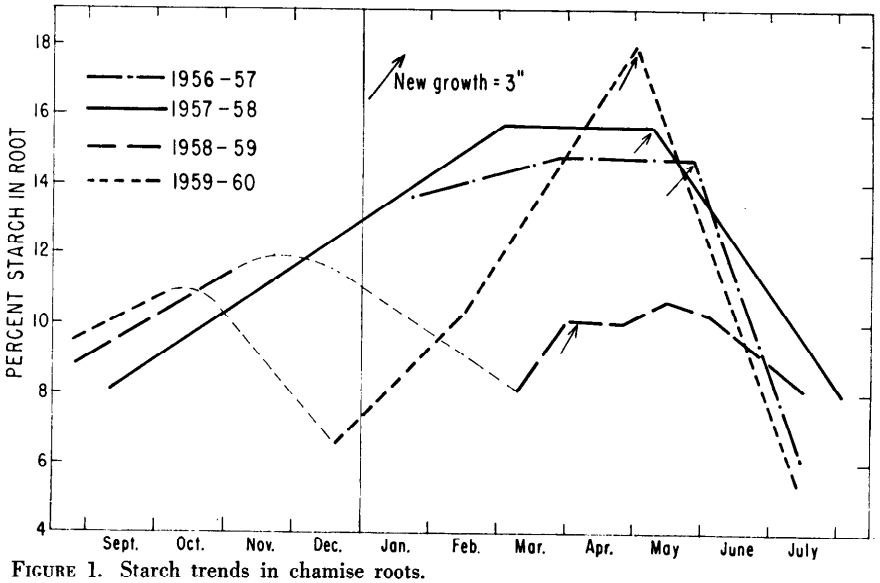

FIGURE 1. Starch trends in chamise roots.

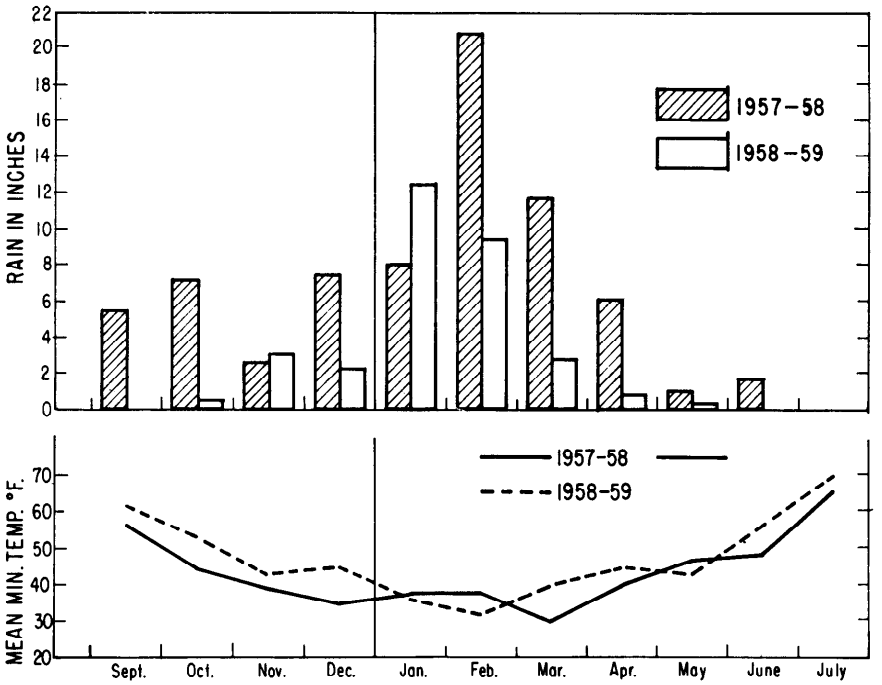

FIGURE 2. Comparison of rainfall and temperature for two seasons in which chamise differed in starch reserves.

when rains commence before temperatures drop. Stored reserves accumulate overwinter reaching a peak in early spring. The primary period of shoot elongation is between April and June when starch reserves become rapidly depleted. Although it is possible for a growth period of secondary importance to occur in the fall (such was noted by Watkins and de Forest, 1941), we detected only meager shoot elongation at this season at Hopland.

Figure 1 presents the levels of starch reserves in root tissue during the four years. The arrow on each curve depicts the date by which new spring growth had attained a length of 3 inches on the majority of shoots. This date marks the beginning of rapid starch depletion in the 3 years when winter accumulation was considerable. It also indicates the date of greatly increased twig moisture. During late winter this moisture was about 65-80 percent on a dry weight basis in the terminal several inches of the past season's growth. When new shoots appeared in the spring, they possessed a moisture content of 140-160 percent. By the time these new shoots reached lengths of 10-12 inches available soil moisture to a depth of 4 feet was virtually exhausted. Under this stress of dryness which continued over summer and resulted in a proportion of the leaves being shed, the new growth was incapable of contributing appreciably to starch reserves. If autumn rains came early while temperatures were still warm, carbohydrate synthesis and storage commenced and the ability of the plant to sprout after treatment was increased. The light-dashed segments on Figure 1 indicate intervals during which expected increase in starch reserves did not occur. In 1959-60, weather conditions at this period delayed the normal winter build-up, but did not prevent it. Although 2.41 inches of rain came in mid-September, it was largely ineffective due to the warm dry period that followed. Precipitation in October and November totalled only 0.24 inch and temperatures remained relatively high. By the time substantial rains did commence in December, temperatures were low enough to prevent shoot elongation. This condition prevailed until early May, resulting in a 5-month period conducive to assimilation and reserve storage.

The situation in 1958-59 was more complex and prevented reserve accumulation in the roots. September and October, 1958, were the warmest and driest of the four years. By early November a considerable amount of shoot dieback was observed, and occasional plants died. Except for a single cold week in mid-November, the weather remained relatively warm until January. By March temperatures again rose and the driest spring of the four years prevailed. Growth started early, producing 3-inch new twigs by April 4, a month before such was recorded for the other years. By May 14 the soil

Table 2. Percent starch in chamise roots during two years of relatively normal rainfall distribution.

Date of cutting	Starch in root (Percent)	Significance at 5 percent level Duncan's Test		
1957				
Jan. 24	13.60	a	b	
Mar. 27	14.80	a		
May 27	14.75	a		
July 15	6.10			c
Sept. 10	8.05		b	c
Nov. 19	11.05	a	b	c
1958				
Mar. 4	15.70	a		
Aug. 5	8.00		b	c
Nov. 6	11.50	a	b	c

Table 3. Percent starch in chamise roots when influenced by draught periods.

Date of cutting	Starch in root (Percent)	Significance at 5 percent level Duncan's Test		
1959				
Apr. 2	10.10	b		
Apr. 23	10.00	b		
May 14	10.63	b		
June 4	10.33	b		
July 14	8.18	b	c	
Sept. 24	10.50	b		
Dec. 18	6.55		c	d
1960				
Feb. 17	10.43	b		
May 2	18.08	a		
July 12	5.43			d

was dry to a depth of 4 feet, again earlier than in other years. Figure 2 compares 1957-58 with 1958-59 in regard to rainfall and minimum temperatures, and illustrates the warm dry autumn and spring of the latter season. It is suggested that failure of root starch to accumulate can be attributed to the shortened winter period when net assimilation was not offset by utilization through growth. It is interesting to note that Fuel-break report No. 6 (previous citation) referred to the poor results obtained by spray treatments in Southern California in the spring of 1959 compared to 1958.

Width of annual rings in the secondary xylem was investigated for the four years of this study. The stems sectioned were from plants which had been burned in 1946, so 8 or more rings were detected on most of the samples. For the first 3 or 4 years the growth increment was measurable in terms of secondary xylem deposition. However, the later rings which corresponded to the years of our study were so indistinct and variable that they did not yield useful measurements. Watkins and de Forest (1941) reported extreme irregularity in the amount of elongation among chamise stems. Annual ring variability likewise reflects a lack of uniformity in growth among shoots.

These experiments indicate that chamise normally enters a period of physiological "weakness" in the late spring and early summer when starch reserves are at a minimum. The date of this period will vary somewhat from year to year but follows the onset of new spring growth by 4 to 6 weeks. Shoot regrowth the year following cutting treatments applied at this period was reduced (Figure 3, Jones and Laude, 1960).

It is reasonable to expect that the effectiveness of treatments to control chamise may be enhanced by timing the treatment during the period of low stored reserves following winters of relatively substantial starch accumulation in the roots.

Summary

The annual variability in chamise growth and in starch reserves in the root was related to environmental conditions over a four-year period. The starch trend, date of growth initiation, and twig moisture level varied sufficiently in relation to prevailing moisture and temperature conditions as to render unreliable the scheduling of control treatments by calendar date.

Reduced vigor of sprouting is associated with treatments applied in the late spring and early summer when the high winter and early spring level of root starch reserves has been depleted. This period of low starch follows the onset of spring growth by 4 to 6 weeks. It is suggested that the effectiveness of treatments to suppress chamise would be increased by scheduling them during this period of low stored reserves.

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Native Clovers and their Chemical Composition[1]

JOHN W. HAMILTON

Associate Professor of Agricultural Biochemistry, Division of Agricultural Biochemistry, Agricultural Experiment Station, University of Wyoming, Laramie

Native clovers, *(Trifolium spp.)*, are found growing in all of the Western states. About 300 species are reported to be widely distributed throughout the world. The native clovers play an important role in soil conservation and furnish large quantities of nutritious pasturage for livestock and game animals. Ten species have been found growing in Wyoming. Six of these species were collected in Wyoming for this study. One additional species was collected in Montana, 1.4 miles north of the Wyoming-Montana state boundary. Two species previously collected from Wyoming were also found at the Montana location. A total of 117 samples representing seven species were collected. Two clovers, Montana *(Trifolium montanense* Rydb.) and brandegee *(Trifolium brandegei* Wats.), previously collected in Yellowstone National Park, were not collected in this study. Some botanists believe that Montana clover represents dwarf high-altitude plants of *T. Parryi* Gray and should not be considered a distinct species. Sierra clover *(Trifolium wormskjoldi* Lehm.) was discovered growing on a small area in western Wyoming. Sierra clover is apparently a recent introduction into Wyoming and was not collected for this study.

Nearly all of the native clovers found in Wyoming are low-growing leafy plants frequently occupying rough and rocky mountainous areas. In many locations the plants appear to be growing under extremely adverse conditions. Because of small size, they are often overlooked or bypassed. Interest in them and in their chemical composition resulted from numerous observations of the immediate and complete cropping of clovers in certain areas, by sheep and game animals. On numerous occasions difficulty or failure in obtaining samples was encountered if sheep were allowed to graze or had been trailed over the areas where the collections were to be made. The native clovers are especially valuable as range plants, because many of them grow on areas where few other palatable plants grow. Native clovers supply a large amount of extremely palatable and nutritious food for livestock and game animals.

Native Clovers Studied

The following species were collected and analyzed: Andean *(Trifolium andinum* Nutt.), whiproot *(T. dasyphyllum* Torr. and Gray), hollyleaf *(T. gymnocarpon* Nutt.), Hayden *(T. haydeni* Porter), longstalk *(T. longipes* Nutt), *(dwarf T. nanum* Torr.), and Parryi *(T. parryi* Gray). The native clovers are perennials, and most of them have comparatively fibrous roots. Most of them are small plants of the Alpine and subalpine zones with three-foliolate compound leaves and multiple flowers arranged in heads. In many areas the amount of seed produced is extremely small.

Andean

Andean clover has been found growing in various areas of the state, usually on dry, rocky hillsides, at elevations of 4,500 to 8,000 feet. Samples were collected from a rocky hillside in southwestern Wyoming. This is an early and fast maturing plant. Its seed usually matures before the rocky hills become too dry to permit further growth. The leaves remain green throughout the dry, hot summer months except under extreme drought conditions. The deep-rooted plant has a depressed, cespitose, dense habit of growth. The flowers are yellowish-white to pale purple in color with two bract-like sheathing leaves at the base.

FIGURE 1. Whiproot and dwarf clovers growing on a rocky mountainous area in Southern Montana.

[1]*Published with the approval of the Director, Wyoming Agricultural Experiment Station, as Journal Paper No. 166.*

FIGURE 2. Hayden clover growing on a rocky ledge.

Whiproot

Whiproot clover grows in numerous areas of the state. It was collected from eight locations in Wyoming and one in Montana. Collections were made in the mountains east and west of Laramie, along the Continental Divide in southern Wyoming, and southern Montana. The elevations of these locations range from 8,000 to 12,000 feet. This clover grows in dense clumps, sometimes as dense mats, usually on rocky areas. The plants vary in height from one-half to seven inches. Whiproot clover, in bloom, in the foreground, and dwarf clover growing directly back and to the right, are shown in Figure 1.

The leaf petioles are rather long and the leaflets are usually linear-lanceolate and ½ to 1½ inches in length. The flowers, grouped in a typical clover head, are quite variable in color, ranging from whitish-yellow to pink to purple and are usually bicolored.

Hollyleaf

Hollyleaf clover is common on Wyoming ranges and is scattered over the southern half of Wyoming including the Red Desert. It was collected from numerous locations in the southern part of the state. Hollyleaf clover is extremely palatable and one of the first plants on the range eaten by sheep. It has a tough root system and often grows on cutbanks, along streams or drainage ditches, and along roadsides. This clover matures seed fairly early and remains green during the hot and dry summer months. It is often found growing beneath sagebrush, especially black sage, *Artemisia nova* A. Nels., and big sagebrush *A. tridentata* Nutt.

The leaf stems are 3 to 6 cm. long and the base of the stems are covered with brown stipules. The leaflets are 5 to 10 mm. long, oval or elliptic-oblong, sharply serrated, and bluish-green in color. The heads are globose or hemispheric with 5 to 12 flowers. The flowers, whitish-yellow, are often rose tinted. The fruits are 1 to 2 seeded.

Hayden

Hayden clover has been observed growing in Yellowstone National Park, in central Wyoming, and west of Cody. The samples analyzed were collected west of Red Lodge in southern Montana. The plants were growing in rocky soil among rock ledges on a southern slope near the mountain top. Hayden clover plants with one blossom are shown in Figure 2.

The plant has creeping habits of growth similar to white clover. The leaflets are obovate, obtuse or abruptly pointed, and sharply toothed. The flower stem usually has two leaves, one large and one small, located a short distance below the head. The flowers are yellowish-white with a tinge of purple and reflex with age.

Longstalk

Longstalk clover is widely distributed in Wyoming. In habits of growth, appearance, and habitat it is similar to alsike clover. It may be identified by botanists as *T. longipes* Nutt., *T. Rydbergi* Greene, (Rydberg clover), *T. longipes* var. *rushbyi* Greene, and *T. rushbyi* Greene. Longstalk clover grows in meadows, moist valleys, pine forests, aspen stands, along roads, and beside streams. A clump of longstalk clover is shown in Figure 3.

The stems are 8 to 40 cm. tall and erect or ascending. The leaflets are usually over 2 cm. in length, lanceolate, oval to oblong-lanceolate, and sharply serrate. The flowers are white-yellow-pink-rose in color, sessile, and reflex with age.

Dwarf

Dwarf clover was collected from two areas, one in northern Wyoming and the other in Montana, 1.4 miles north of the Wyoming-Montana state line. It grows on rocky soil, in mountain areas at elevations up to 12,000 feet. This low-growing plant forms a dense mat and is easily seen when the flowers are in bloom. The plants are cespitose, 2 to 6 cm. tall, and grow erect or spreading from woody-branched crowns of roots. The petioles are slender and longer than the leaflets, which are 6 to 15 mm. long. The leaflets are narrowly obovate, linear-oblanceolate to oblong, and sometimes slightly serrate. The flowers occur in groups of 1 to 3, the majority

Table 1. Common Name, Number of Samples, Number of Collection Sites, and Composition, Mean and Range, of Certain Native Clovers[1].

Common name		Samples	Sites	Carotene mcg./g.	Ash	Crude protein	Ether extract	Crude fiber	Nitrogen-free extract	Calcium	Phosphorus	Magnesium
					(Percent)							
Andean[2]	M[4]	3	1	239.4	14.25	18.91	3.60	22.64	40.60	3.84	0.20	0.49
Andean[2]	R[4]	3	1	215.4-271.3	13.97-14.67	13.61-22.12	3.53-3.70	21.43-23.48	38.29-44.54	3.83-3.85	0.18-0.23	0.40-0.56
Dwarf[3]	M[4]	6	2	243.4	12.85	20.16	3.52	18.15	45.32	2.72	0.26	0.67
Dwarf[3]	R[4]	6	2	168.0-284.3	11.10-14.60	18.81-21.57	2.70-3.92	16.06-22.55	43.92-48.28	2.21-3.10	0.23-0.32	0.55-0.76
Hayden[3]	M[4]	4	1	253.3	11.99	23.88	3.73	17.69	42.71	2.18	0.31	0.46
Hayden[3]	R[4]	4	1	216.0-254.6	11.10-13.55	23.24-24.46	3.32-3.93	16.04-18.56	39.87-44.20	2.06-2.38	0.26-0.33	0.45-0.47
Hollyleaf[2]	M[4]	13	7	267.5	13.92	17.77	3.52	18.23	46.56	3.25	0.30	0.44
Hollyleaf[2]	R[4]	13	7	209.6-323.2	11.88-17.46	11.80-21.72	2.30-4.38	16.92-21.69	42.18-50.45	2.41-4.83	0.21-0.39	0.34-0.58
Hollyleaf[3]	M[4]	11	6	315.9	11.12	21.98	4.10	17.08	45.72	2.57	0.33	0.51
Hollyleaf[3]	R[4]	11	6	253.8-382.9	8.55-14.59	19.36-25.28	3.48-4.66	15.34-18.55	41.11-48.45	2.00-3.49	0.24-0.41	0.35-0.70
Longstalk[3]	M[4]	26	9	246.7	10.46	20.97	3.34	20.78	44.45	1.73	0.35	0.45
Longstalk[3]	R[4]	26	9	196.4-314.7	8.73-18.00	16.11-27.57	1.98-4.33	15.95-27.69	38.83-52.15	1.39-2.19	0.26-0.45	0.27-0.57
Parry[3]	M[4]	22	6	299.5	10.10	23.35	3.91	14.16	48.48	3.11	0.32	0.65
Parry[3]	R[4]	22	6	223.4-376.6	7.44-15.66	17.61-27.36	2.66-4.43	9.22-19.67	41.30-57.34	1.75-5.40	0.22-0.40	0.35-0.99
Whiproot[3]	M[4]	32	9	244.7	9.89	21.11	3.84	21.03	44.13	2.02	0.32	0.46
Whiproot[3]	R[4]	32	9	185.7-360.9	6.75-13.35	15.11-24.96	2.31-4.79	16.20-28.90	37.98-49.25	1.31-3.26	0.25-0.40	0.21-0.80

[1]All results on a moisture-free basis
[2]Collected at seed stage of growth
[3]Collected at bloom stage of growth
[4]M—Mean; R—Range

being in groups of 2 or 3, the flowers extending above the leaves and being comparatively large and showy. The corolla varies from 16 to 20 mm. in length. The flowers are reddish-purple to rose-purple in color and the fruits are 5 to 10 seeded.

Parry

Parry clover grows in the mountain areas of Wyoming and has been found in nearly all parts of the state. It prefers a habitat similar to whiproot clover and both were collected from 5 common locations. The sixth collection was made in Wyoming near the high point of the Red Lodge-Cooke City Highway. It is a showy plant and is extremely palatable to sheep and some game animals. Montana clover and *T. salictorum* Greene are believed by some bontanists to be similar and possible dwarf alpine forms of Parry clover. The leaves are rather large, mostly radical, and are 2 to 12 cm. long. The leaflets are 10 to 25 mm. long, obovate, and oval to oblanceolate. Small leaf serrations are usually present but may be absent. The numerous flowers extend above the leaves and form a typical clover head which is large and fragrant. The flowers are rose-purple or reddish-purple in color and the fruits are 3 to 7 seeded.

Review of Previous Work

Carpet Clover (*Trifolium monanthum* Gray) was collected in Nevada and analyzed by Dinsmore, Wilson, and Kennedy (1906).

The compositions of whiproot and Parry clovers were reported by Knight, Hepner, and Nelson (1908) and (1911). The present study was the result of preliminary work that indicated the high calcium levels present in some collections of Parry clover.

Methods and Procedures

The clovers were collected at the bloom stage, when possible, and samples were collected from the same site for two or three successive seasons. The samples were hand sorted, air-dried in the laboratory, and ground in a Wiley mill. Carotene determinations were made immediately after grinding. Analytical methods used were the A.O.A.C. official methods (1950). All values were calculated using moisture-free sample weights.

Discussion of Results

The common name, Kelsey and Dayton (1942), number of samples, number of collection sites, stage of growth, mean composition, and range of individual samples values are given in Table 1. Samples of early-maturing clovers were collected at the seed stage, and the compositions of these samples were grouped together.

Hollyleaf and Parry clover had the highest mean carotene values, 315.9 and 299.5 mcg./g. respectively. The values of the other clovers were somewhat lower. The levels of carotene found in Andean and hollyleaf clovers 239.4 and 267.5 mcg./g. collected at the seed stage; when scant precipitation resulted in decreased soil moisture content, were equal to those present in some clovers collected at the bloom stage. It is evident that clovers are excellent sources of carotene for a considerable period of time after maturity.

FIGURE 3. Longstalk clover growing on a gray-clay cutbank near Togwotee Pass (Elevation 9,658 feet) in western Wyoming.

The ash content of the individual samples of clover was variable with an over-all range of 6.75 to 18.00 percent. Growing conditions and nature of the soil influenced the ash content as evidenced by an individual sample range of 8.73 to 18.00 percent with a mean value of 10.46 percent for longstalk clover.

The mean crude protein content of the samples, at bloom stage, varied from 20.16 to 23.88 percent. The level of protein in these native clovers compared favorably with the mean protein content, 22.86 and 21.21 percent, for white and alsike clover collected from identical and similar locations at bloom stage. The range of values for Andean and hollyleaf clover samples collected at seed stage was 11.80 to 22.12 percent. These lower values are to be expected since the protein content of most plants decreases gradually as the plant approaches maturity and decreases rapidly after seed is matured. Most of the clover samples collected several weeks after seed maturity contained a level of protein that would have supplied the nutritional requirements of animals consuming these plants.

The mean ether-extract value of the clovers varied from a low of 3.34 percent for longstalk to a high of 4.10 percent for hollyleaf. The crude-fiber contents of most of the clover samples were low with a range from 9.22 to 28.90 percent. This is a reflection of the leafy character of these plants. These clovers are satisfactory energy sources for livestock and game animals. The range of nitrogen-free extract varied from 37.98 to 57.34 percent.

The calcium content of the clover samples was quite variable with a range of 1.31 to 5.40 percent. The lowest mean value was 1.73 percent for longstalk clover, which compares with a mean value for similar alsike clover samples of 1.67 percent. Longstalk and alsike clovers, as previously mentioned, preferred the same growing conditions and very frequently were found growing in close proximity. Samples of these two clovers collected from the same areas were comparable in regard to chemical composition. Andean and hollyleaf clover, at seed stage, were collected from the same location, a rocky hillside in southwest Wyoming. Mean calcium content was 3.84 and 4.59 percent, respectively. These as well as other values mentioned in this discussion are means of samples collected from a definite location and are a part of the overall clover averages shown in Table 1. It is interesting to compare the mean calcium values of different clovers collected from the same location. Dwarf, Hayden, and whiproot clovers collected from the same location in Montana contained mean calcium levels of 2.59, 2.18, and 2.33 percent, respectively. Dwarf and Parry clovers collected from a location in northwestern Wyoming had mean calcium contents of 2.97 and 4.55 percent, respectively. Whiproot and Parry clovers collected from a site near Laramie had mean calcium values of 2.46 and 4.38 percent, respectively, while whiproot and Parry clovers collected approximately one mile distant had average calcium contents of 1.42 and 1.90 percent, respectively. A study of the calcium levels of the clovers collected indicates that the calcium content is strongly influenced by the species of clover and the soil upon which the clover grows. Clovers with above-average abilities to accumulate calcium are Parry, hollyleaf, and Andean.

Analysis of soil samples from the growing sites indicated that soil pH and the level of calcium in the soil influenced the uptake of calcium by the plant, but there appeared to be other factors or conditions which influenced calcium uptake.

The mean phosphorus values varied from 0.20 to 0.35 percent. The level of phosphorus decreased with increasing maturity of the plant, and this is reflected in the lower mean values of 0.20 and 0.30 percent in Andean and hollyleaf clovers collected at the seed stage. In most of the clovers

phosphorus level did not exhibit a wide variation among the several collection areas.

The magnesium levels of the individual clover samples varied from 0.21 to 0.99 percent with mean species values varying from 0.44 to 0.67 percent. Samples of whiproot and Parry clovers, growing on soil derived from dolomitic limestones, having a pH of 6.2 and a magnesium content of 1.27 percent, contained mean magnesium levels of 0.57 and 0.95 percent, respectively. It appears that dwarf and Parry clovers possess a greater ability to absorb and store magnesium than certain other clovers.

An over-all study of the chemical composition of the native clovers emphasizes the nutritional adequacy of these plants. The high palatability of these clovers, along with the high levels of essential nutrients in the plants and their growth in areas where other forage plants grow sparingly, make the native clovers valuable range plants.

Steps should be taken to encourage more widespread distribution and greater growth of these plants on our rangelands. Of the native clovers studied, only longstalk clover has possibilities as a hay producing plant, and it appears to have no qualities that render it superior to alsike clover.

Summary

Samples of Andean, whiproot, hollyleaf, Hayden, longstalk, dwarf, and Parry clovers were collected from numerous areas two or more successive seasons. The chemical composition of these clovers, *i.e.*, carotene, ash, crude protein, ether extract, crude fiber, nitrogen-free extract, calcium, phosphorus, and magnesium, was determined. The levels of these components present in the clover samples varied within rather wide limits, but in nearly all samples the levels present indicated their high nutritional qualities. Parry and hollyleaf clovers contained the highest levels of carotene. Individual clover samples contained widely varying levels of ash. Whiproot, Parry, and longstalk had the lowest mean ash content of those studied. The crude protein levels of Hayden and Parry clovers were highest, being above 23 percent.

Ether-extract and nitrogen-free extract levels in the native clovers compare favorably with the level of these components found in white, alsike, and red clovers. The crude-fiber contents of the individual clover samples were quite variable. Parry, hollyleaf, dwarf, and Hayden clovers contained the lowest mean crude-fiber contents.

The calcium contents of all samples of Parry, hollyleaf, and Andean clovers collected from certain areas were greater than 3.80 percent. Whiproot and dwarf clovers growing with Parry clover contained a much lower level of calcium than did Parry. Longstalk clover contained a much lower mean level of calcium than did the other native clovers studied.

Considerable variations existed between the phosphorus content of the individual samples. Only slight differences existed between the mean phosphorus values for all groups reported, except for dwarf and Andean clovers, which were somewhat lower. The phosphorus levels of hollyleaf and Andean clovers collected at seed stage were somewhat lower, as would be expected.

The magnesium contents of the individual clover samples varied over a considerable range. Samples of Parry clover, growing on soil derived from dolomitic limestone, contained levels of magnesium much higher than samples of the same clover from other areas or samples of whiproot clover from the same location. Dwarf clover from two locations contained a high level of magnesium.

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An Efficient and Economical Pocket Gopher Exclosure

JAMES O. KEITH
Range Conservationist, Rocky Mountain Forest and Range Experiment Station,[1] Forest Service, U. S Department of Agriculture

One approach to determining the effect of pocket gophers (Family Geomyidae) on rangelands is to prevent the animals from occupying certain areas over a period of time and to compare conditions on these sites with conditions where gophers are present. Fenced exclosures have been used to deter gophers from entering study plots (Branson and Payne, 1958; Moore and Reid, 1951). Poisoning and trapping have also been used to reduce gopher numbers on study areas (Kalmbach, 1948; Julander et al., 1959; Garrison and Moore, 1956). Ellison and Aldous (1952) used a buried fence to exclude gophers on one side of their gopher-free plot and poisoned the animals on the other three sides. A rodent enclosure used by Horn and Fitch (1942), and Fitch and Bentley (1949), was apparently successful in prohibiting the movement of gophers into or out of study plots.

Costs of construction have usually limited the size and replication of elaborate fenced plots, while cheaper fences, poisoning, and trapping have usually been relatively unsuccessful in keeping plots gopher-free. A combination of fencing and poisoning described here has proved both successful and efficient in keeping study plots relatively free of gophers at a reasonable cost.

The plot design was the result of a joint study by the Rocky Mountain Forest and Range Experiment Station, U. S. Forest Service, the Denver Wildlife Research Center, U. S. Fish and Wildlife Service, and the Colorado Agricultural Experiment Station.

Study objectives required that the exclosures be about one acre in size, be of reasonable cost, permit normal use by cattle, and effectively prevent gopher invasion.

In 1956 and 1957, eight gopher exclosures were established on Black Mesa in west-central Colorado (Figure 1). Exclosures were 190 feet square, enclosed by a three-foot, wooden and hardware-cloth fence buried two feet and extending one foot above the ground surface (Figure 2). The hardware-cloth was stapled to a 2x4-inch horizontal railing attached to the top of the 3½-foot fence posts. Pieces of the railing were connected every 20 feet by a shiplap joint and were bolted to fence posts and hardware-cloth every 10 feet.

Costs of materials and labor to construct the exclosures are shown in Table 1. The average total cost of an exclosure was about $627.00. Variations in the cost of labor and machinery rental as well as in ease of digging the trenches could raise or lower this cost substantially. The trench around one exclosure was dug with a backhoe at a cost of 17 cents a lineal foot including backfill. Trenches for the other seven exclosures were scraped out and backfilled with a road maintainer at a cost of 9 cents a lineal foot. However, the cost of extra hand labor required in setting the fence when the road maintainer was used offset its cost advantage.

Resident pocket gophers were first trapped from exclosures in September 1957. Densities varied from 16 to 31 and averaged 21.4 per 190-foot-square exclosure or 25.8 per acre. Immediately after trapping was completed, gophers were carefully poisoned in a border strip 200 feet wide around seven of the exclosures. Previous studies have indicated that pocket gophers may move a maximum distance of 200 feet during the winter snow period. Gophers were not poisoned around one exclosure that was to serve as a check on the necessity for poisoning to maintain the areas free of gophers.

Table 2 shows the number of animals removed from the exclosures during 1957-60. Fifteen

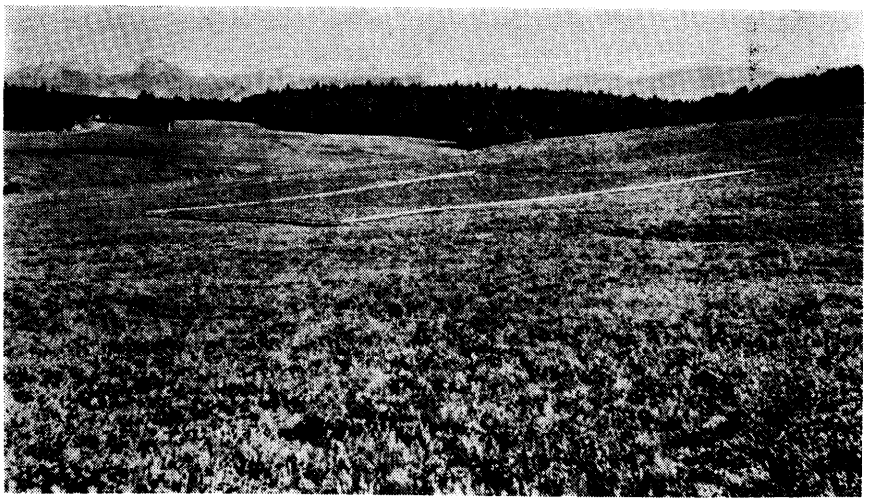

FIGURE 1. Pocket gopher exclosure in one of the experimental pastures on Black Mesa.

[1] *Central headquarters maintained in cooperation with Colorado State University, Fort Collins, Colorado.*

Table 1. Average cost of material and labor to fence a pocket gopher exclosure, 190 feet square

Item	Cost
Excavation and backfill of trench	$ 68
Lumber, 2x4 inch, No. 1, good, Douglas-fir	68
Mill work (shiplap ends of lumber and drill holes)	18
Fence posts, 3½', treated lodgepole, 3½" dia.	38
Hardware cloth, 36", ⅝" mesh, 17 gauge	280
Miscellaneous materials (bolts, staples, etc.)	11
Motor vehicle operation (transporting workers & supplies)	14
Salaries: Supervisor, ¾ man-day	12
Construction crew, 9 man-days	118
Total	$627

animals were trapped from the check exclosure in 1958. This was considerably more animals than were caught from any other exclosure and shows that poisoning in the border strip is needed to keep gophers from invading exclosures. Snow covers the exclosures from November to May, which is the period of greatest invasion. An occasional gopher invaded exclosures during summer, probably by burrowing beneath exclosure fences.

Table 2. Number of resident pocket gophers trapped from exclosures in 1957 and number of invading animals removed 1958-60

Exclosure No.	Year 1957	1958	1959	1960
1	16	1	0	0
2	31	5	2	0
3	21	1	4	0
4	18	0	0	1
5	20	0	0	0
6	27	6	2	0
7	18	1	2	3
8	20	[1]15	1	0
Total	171	29	11	4

[1]Plot periphery not poisoned in 1957.

In July, August, and late September of 1959 and 1960 gophers were poisoned outside the exclosures. This was done to reduce invasion during summer and to minimize invasion during winter. Border strips were poisoned with a bait dispenser developed and described by Hansen (1956). The poison bait used was oat groats treated with 1080 (sodium fluoroacetate). Workers walked systematically across the area about 20 feet apart. At each group of fresh mounds, bait was placed in several burrows. Mounds in the area were flattened to indicate that systems had been treated.

Poisoning in 1957 and 1958 required about 1½ man-days per exclosure. With more frequent control and with fewer animals to poison in 1959 and 1960, poisoning required less than one-half man-day per exclosure.

Vegetation is being sampled in

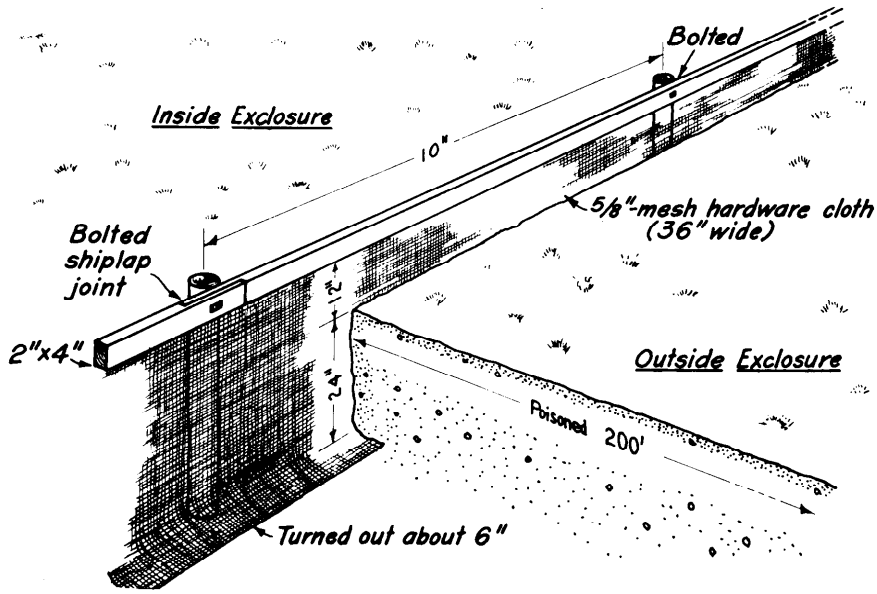

FIGURE 2. Construction detail of exclosure fence.

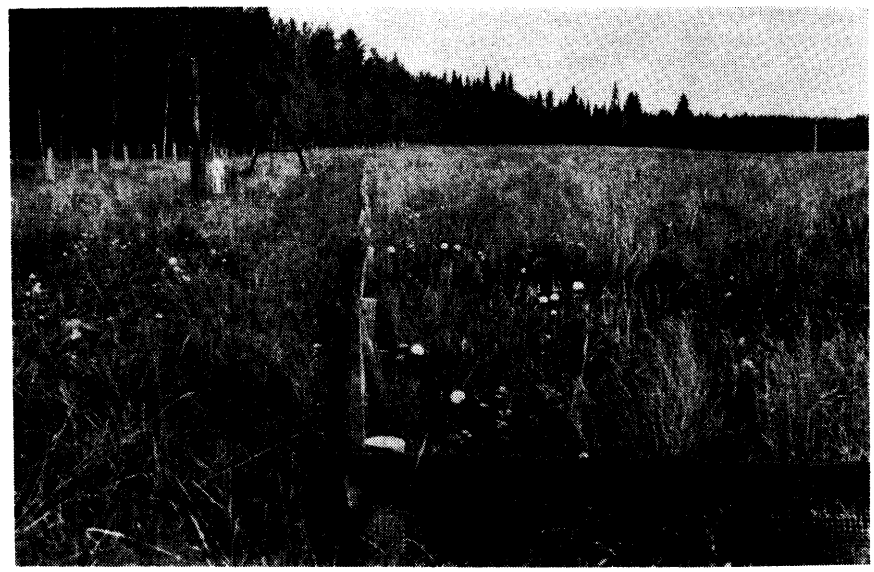

FIGURE 3. Exclosure fence two years after construction.

a central 100x135-foot area within each exclosure. Most invading gophers were trapped before they reached that area. These exclosures are large enough that, even if a few gophers invade them, the study is not necessarily disrupted.

Snow accumulates to depths of four to six feet on Black Mesa during winter. The weight of this snow has caused some warping and breakage of 2x4-inch railings (Figure 3). Though warping is unsightly, it has not affected the efficiency of the exclosures. Only ten 2x4 rails have had to be replaced since 1957.

Experience indicates that the exclosures described here are efficient and, together with border poisoning, will practically prevent invasion of relatively small areas. The exclosures have also met the objective of permitting normal use by cattle. The one foot high fence does not appear to either attract or deter cattle, for exclosures have generally received about the same grazing use as pastures in which they are located.

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TECHNICAL NOTES

MOVEABLE SHADE SHELTER, AS A RANGE MANAGEMENT DEVICE

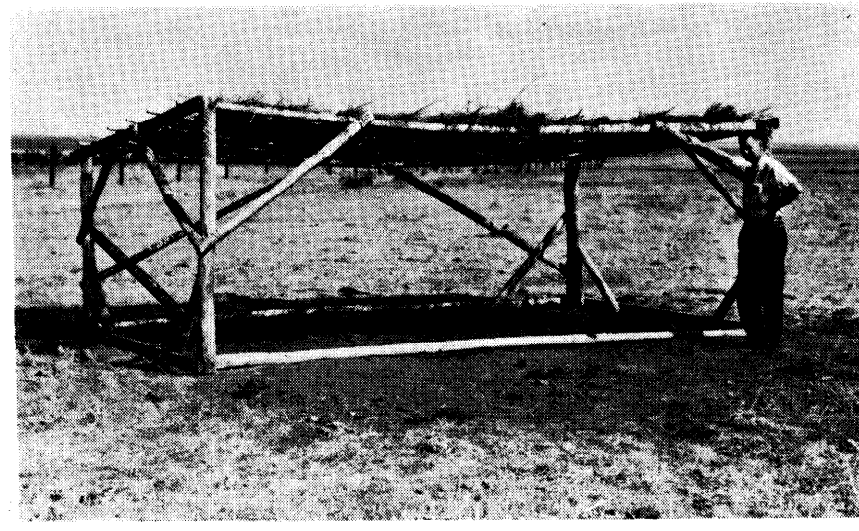
R. W. LODGE
J. B. CAMPBELL

Swift Current Experimental Farm, Research Branch, Canada Department of Agriculture, Swift Current, Saskatchewan, Canada.

The economic value of shelter and shade in range pastures has not been, to our knowledge, assessed. Ranchers however recognize their worth and this is reflected in the additional value attached to range pastures in which natural shelter and shade exist. In recognition of this, shade shelters such as shown in the figure were constructed for use in the treeless experimental pastures at the Webb-Swift Current Research Project. Observations indicate the use of the shelter by cattle, but no data are being taken as to the value.

Use of the shelter by cattle caused excessive trampling and fouling of the immediate area and for this reason, periodic movement of the shelter from place to place within an individual pasture was instituted. As a result of this, the potential value of a shelter, such as illustrated, as a range mangement device is indicated.

Experience in small pastures has shown that shelters of this type will attract cattle into areas



that are not being used. It is suggested that they might be used with good effect in attaining better distribution of cattle on larger range units. They might also be of value in extending the range of cattle away from the watering facilities.

The shade shelters in use are approximately eight by sixteen feet and six feet in height. The original shelters were constructed as a spare time employment from corral rails and used lumber. Similar shelters can be built in less than a day and for a cost not exceeding $20.00. Originally the shelters were covered with black plastic sheeting, which lasted for one year. Presently the roof is of cage wire and brush. The roof shown has been in use for four years, and the brush is now in need of replenishment. A shelter of the size shown is adequate for twenty yearling animals. Shelters up to six years old are still in use, none having yet required repairs other than re-roofing.

THE SAN JOAQUIN CAGE

STANLEY E. WESTFALL AND DON A. DUNCAN

Forestry Technician and Range Conservationist (Research), respectively, San Joaquin Experimental Range, Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, Coarsegold, California.

Certain aspects of range grazing studies, such as herbage production, vegetation composition, and plant growth and height, require that small areas be protected from grazing animals. Often large numbers of such areas or plots are needed; therefore, protection must be provided easily and economically. Various kinds and arrangements of wire and wood have been used successfully, depending on the vegetation and kind of animals involved.

The San Joaquin cage (Figure 1) was developed for use on California annual foothill ranges

FIGURE 1. The San Joaquin cage provides adequate protection to low-growing, herbaceous vegetation.

grazed by cattle. Constructed of 18 gage, 1½-inch mesh, 24-inch galvanized-after-weaving wire at the rate of three units per man-hour, the total cost per cage was $1.21. This cost combined $0.54 for 12 feet of wire and $0.67 for ⅓ man-hour of labor at $2.00.

The cage is 24 inches tall and tapers from a 29-inch square base to a 22-inch square top. This size is adequate for protecting square-foot sampling plots. Fastened to the ground by short metal or wooden stakes, it is sufficiently rigid without braces. Light weight and easy nesting facilitate transportation, installation, and storage. In past experience, with reasonable care, this type of cage has served for a 5- to 10-year period.

In 1961 more than 500 San Joaquin cages were built and used at the San Joaquin Experimental Range near O'Neals, California. A 3-step construction operation—cutting, shaping, and attaching the top—proved most efficient (Figure 2). This cage is recommended for use on low-growing herbaceous vegetation.

BASAL COVER AND PRODUCTION OF WEEPING LOVEGRASS UNDER VARYING AMOUNTS OF SHRUB LIVE OAK CROWN COVER

FLOYD W. POND

Range Conservationist, Rocky Mountain Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, Tempe, Arizona.[1]

Shrub live oak (*Quercus turbinella* Greene) is one of the major components of the Arizona chaparral. Where the oak is dense, herbaceous vegetation tends to be sparse. To give a better ground cover and increase

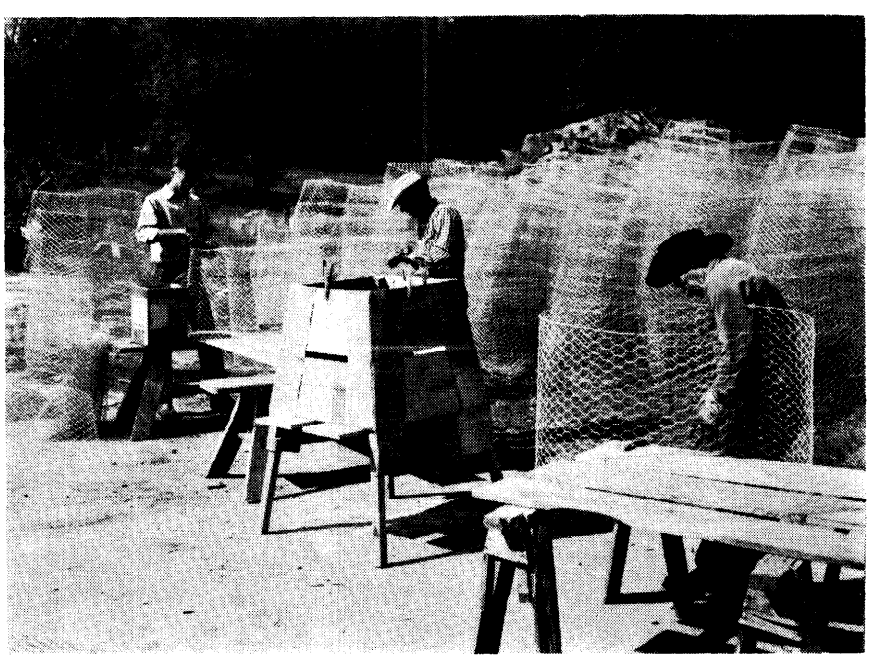


FIGURE 2. Three-step construction—cutting, shaping, and attaching top—proved most efficient.

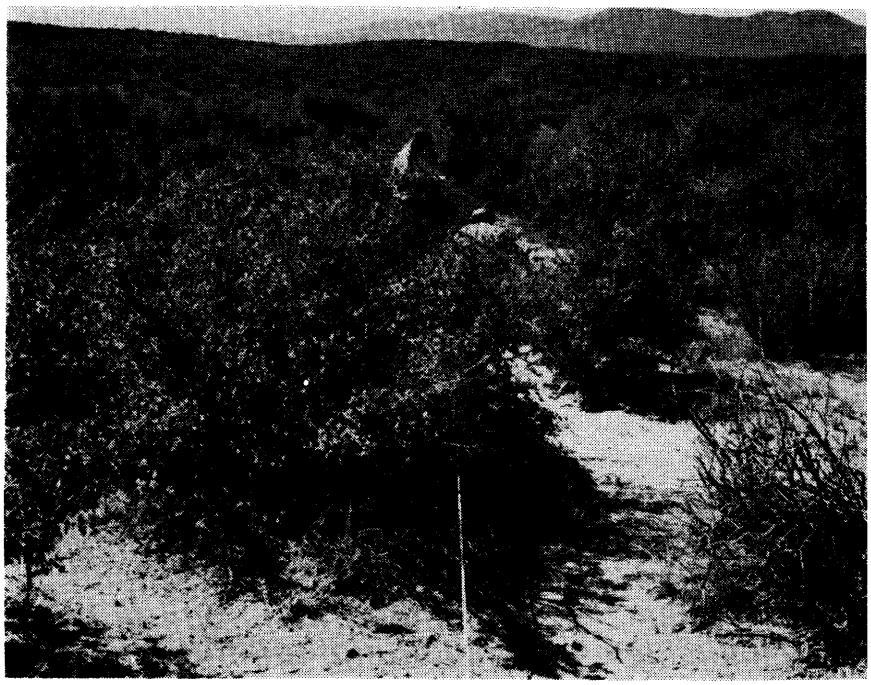


FIGURE 1. A relatively dense stand of chaparral with few herbaceous plants beneath the shrubs or in the interspaces.

forage values, weeping lovegrass *(Eragrostis curvula* (Schrad.) Nees.) has been planted following burns in many areas. Studies have shown that the weeping lovegrass tends to die out as the reestablishing oak brush thickens. The study reported here was made to determine the relationship between the production and cover of weeping lovegrass and the density of shrub live oak.

Methods

The study was located on the Pinal Burn near Globe, Arizona. The area, burned in 1952, was seeded to weeping lovegrass and fenced against grazing shortly after the fire. A good grass cover was developed, but by 1957, it had thinned as the shrubs became reestablished (Figure 1). Shrub live oak had an average cover of 30 percent.

Twenty-two areas, 50 by 87.1 feet in size, were located in the exclosure and two were reduced to each of 11 crown cover classes: 0, 10, 20 . . . , 90 and 100 percent (30 percent cover).

All shrubs, other than shrub live oak, were eliminated. Crown cover of the oak was reduced to the various densities on randomly selected areas by basal application of a mixture of 2,4-D and 2,4,5-T in diesel oil. All subsequent sprouts were killed by reapplication of the chemicals. Weeping lovegrass was seeded on all areas.

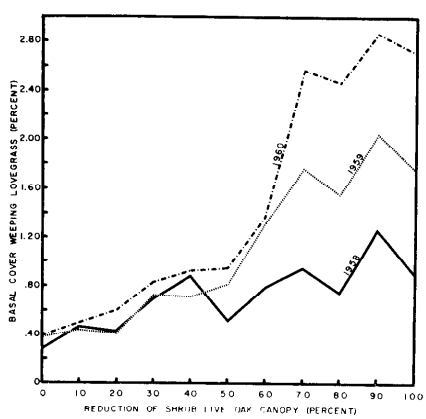


FIGURE 2. Basal cover of weeping lovegrass growing under various percentages of maximum shrub live oak cover.

Ten line transects were randomly located on each area by the Canfield method (1942). No line was closer than four feet to another line or to the edge of the area.

Production of the seeded grass was measured each year by the weight estimate method (Pechanec and Pickford, 1937). Ten 9.6-square-foot plots were placed at five foot intervals along the right side of each of two of the ten lines. Five of the ten permanent plots were estimated each year. Of the remaining five, grass production on one was estimated and clipped each year by the double sampling technique of Wilm, Costello and Klipple (1944).

Results

Basal cover of weeping lovegrass tended to be inversely proportional to shrub live oak cover (Figure 2). Percent basal cover on the various areas ranged from 0.28 to 1.26 in 1958, from 0.37 to 2.04 in 1959 and from 0.39 to 2.86 in 1960.

Although there was a good linear relationship between basal cover of grass and reduction in oak canopy the first year following canopy reduction, the relationship tended to depart from linearity more each year. On areas where less than 50 percent of the shrub live oak cover was removed, the weeping lovegrass remained approximately the same during all three years. Where more than 50 percent of the oak cover was killed, the basal cover of the grass continued to increase markedly during the second and third years.

Production of weeping lovegrass (Y) was also inversely proportional to reduction of shrub live oak canopy (X) (Figure 3). The regression equations for the three years, all significant at P=.05, are shown below.

Year	*Regression Equation*
1958	Y=269.2 + 3.74X
1959	Y=250.4 + 12.98X
1960	Y=131.0 + 15.21X

[1] *Forest Service, U. S. Department of Agriculture, with headquarters at Fort Collins, Colorado in cooperation with Colorado State University. Research reported was conducted in cooperation with Arizona State University at Tempe.*

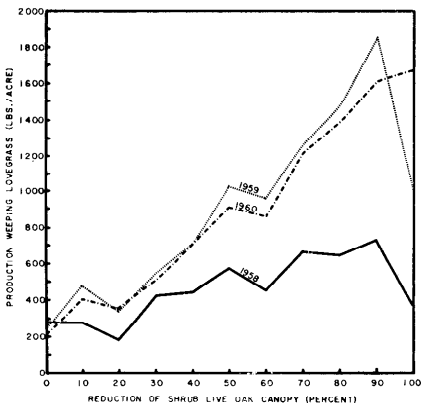


FIGURE 3. Production of weeping lovegrass growing under various percentages of maximum shrub live oak cover.

Grass production increased during the second year on all plots where the oak was reduced. Largest increases were found on plots where more than half of the oak cover was killed. Even though basal cover of the grass increased on some areas between the second and third years, the grass production of 1960 varied little from the grass production of 1959. This small variation may be due to low rainfall in the spring and summer of 1960. Production in pounds per acre on the various areas and total February-through-July rainfall for each year is tabulated below:

Year	Range in Production (lbs./acre)	Rainfall (inches)
1958	180 to 730	9.61
1959	250 to 1840	4.82
1960	220 to 1660	2.91

Summary and Conclusions

Basal cover and production of weeping lovegrass, under varying amounts of shrub live oak cover, were measured for three consecutive years. Both basal cover and production of the grass tended to be inversely proportional to amount of oak cover. With less than 50 percent reduction of oak cover, basal cover remained about the same during the three years of observation. With more than 50 percent reduction of oak cover, grass cover continued to increase during the second and third year. Grass production increased on all treated plots during both the first and second years following treatment and the increases were roughly proportional to oak canopy reduction. Production the third year following treatment closely approximated that of the second year, probably due to low rainfall.

These findings indicate that some grass production may be obtained from seeding weeping lovegrass in areas where reduction of oak cover is slight. However, to obtain good stands and high production, more than half of the oak canopy should be eliminated.

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A DURABLE, ECONOMICAL CAGE FOR UTILIZATION OR PRODUCTION STUDIES

DON E. WILBERT
Range Conservationist,
Soil Conservation Service,
Riverton, Wyoming

Many types of temporary cages are used by field workers to protect small areas from grazing in range utilization and herbage production studies. Some are of a particular design or shape to meet a specific problem or need. Most of the cages in use have several serious limitations. They are fairly expensive, difficult to construct and transport under field conditions, and are subject to damage from grazing animals.

In an attempt to overcome some of these limitations, several types of wire and various shapes of construction were tried and evaluated under field conditions. The relatively, inexpensive, easily constructed, sturdy cage described here proved satisfactory in all trials and is now being used throughout Wyoming by Soil Conservation Service personnel.

This cage is circular, of gal-

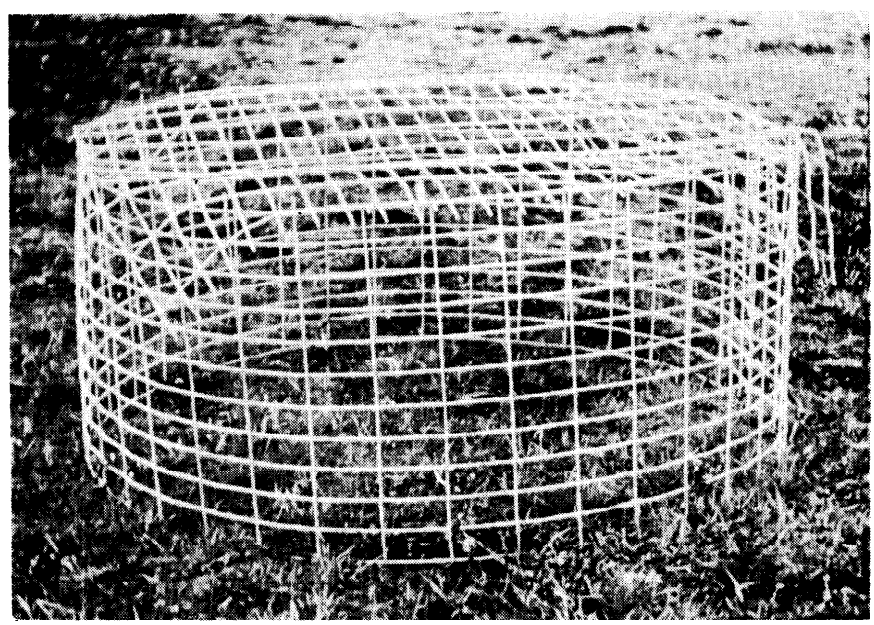

FIGURE 1. The completed exclosure. On this cage, the square corners of the top were simply bent down but can easily be trimmed off.

vanized 2 x 4-inch mesh, No. 9 or No. 11 welded wire, and is 2 feet high by approximately 4 feet in diameter. It can be constructed in 15 to 20 minutes preferably on the site where use is intended.

The type of wire recommended is available in 52-foot and 100-foot rolls, 4 feet wide. A 13-foot strip cut down the middle makes two strips, 2 feet high, enough for 2 cages. The 2 ends of each strip brought together form the circle and are joined with wire or hog rings. A 4-foot square forms the top and is fastened with wire or, again, hog rings. The four protruding corners can be bent down or trimmed off. This completes the construction of the cage. No welding or reinforcing is needed.

Twelve-inch bridge spikes, 4 to the cage, hold the small exclosure in place. The spikes can be angled toward the center across the bottom welded strand or can be wired to the cage with soft wire.

This cage protects an area of a little over 12½ square feet which is ample for a circular clip plot of 9.6 square feet except on very tall growing vegetation.

This type of cage has proven very satisfactory from the standpoint of cost and durability. The average cost, including labor, is less than $4.50. The cage has been in use on some ranges for three full years with negligible damage from grazing animals or from the elements.

The low cost, ease of construction, and durability make this type of temporary or portable exclosure very desirable under open range conditions.

COMMENTS ON "THE NOMENCLATURE OF THE CRESTED WHEATGRASS COMPLEX BY A. A. BEETLE"

A. A. HANSON
Research Agronomist, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Maryland.

A recent technical note by Beetle (1961), credits me with "a disservice to orderly recorded data both in the United States and in foreign countries." This claim is based on my use of the common names crested wheatgrass to describe *Agropyron cristatum* (L.) Gaertn. and standard crested wheatgrass for *Agropyron desertorum* (Fisch.) Schult. (1959). He may also be referring to my suggestions that the comon name "crested wheatgrass" be confined to *A. desertorum* and that *A. cristatum* be referred to as "fairway wheatgrass." Excellent background information on this general problem is included in reports by Dillman (1946) and Swallen and Rogler (1950).

I am well aware of the confusion which exists with respect to both colloquial and technical terminology for species of *Agropyron.* Unfortunately, Beetle's report contributes nothing to the solution of these vexing problems. In addition, I cannot accept his view that the name desert wheatgrass for *A. desertorum* has any status in the United States.

The first requirement of a common name of a grass is acceptance by both technical workers and ranchers so that they can, in fact, talk the same language. Common names gain acceptance through use, and are indispensable to the development of recommendations, extension activities, and the production and movement of seed. Insofar as possible, common names should not be misleading, and in my opinion the connotation of desert wheatgrass is, in fact, erroneous. Most technical workers and ranchers would not feel that crested wheatgrass is best adapted to desert sites, as the adjective desert implies.

Scientific names are essential to the maintenance of "orderly recorded data," a place which common names do not and never should attain. However, a common name can obtain a certain degree of status in the United States, when it is included in the Rules and Regulations under the Federal Seed Act (1960). Common names so listed are the only ones which can be applied to imported seed lots or to seed moving in interstate commerce. If a common name other than the one approved under the Federal Seed Act is used in a publication of the federal government, then excellent arguments exist for noting the exception in a footnote. In no less a publication than the 1948 Yearbook of Agriculture "Grass," *A. desertorum* was called desert wheatgrass without a statement that the name was at variance with the Federal Seed Act. In spite of the fact that no seed is produced or sold under the name desert wheatgrass, the same oversight has appeared in scattered publications including Weintraub's 1953 report (1953).

In 1956, the various common names applied to *A. cristatum* and *A. desertorum* were brought to the Plant Nomenclature Committee of the United States Department of Agri-

culture for review. This committee, which consists of representatives of the Agricultural Research Service, Agricultural Marketing Service, Soil Conservation Service, Forest Service, and Federal Extension Service, recommended the following usage: *A. cristatum* —fairway wheatgrass; *A. desertorum*— crested wheatgrass.

Most people would agree with Beetle (1961) in concluding that the crested wheatgrass complex is in need of critical revision. Considerable time, however, may elapse before this is possible, because of the difficulty experienced in obtaining material from behind the iron curtain. In the meantime, some taxonomists have not been entirely satisfied with either *A. cristatum* or *A. desertorum*. Sarkar (1956), for example, placed the diploid fairway form in a new species, *A. cristatiforme* Sarkar.

In the final analysis there is a possibility that the highly acceptable common name crested wheatgrass may well remain long after the name *A. desertorum* has become just another synonym.

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BOOK REVIEWS

Edited by Lowell K. Halls, Forest Service, U. S. Department of Agriculture, New Orleans, Louisiana

Medical and Biological Research in Israel. Edited by Moshe Prywes. *Grune & Stratton, Inc., New York. 562 pages. 1960.*

This survey of medical and biological research grew out of the initiative of a small group of scientists inspired by the general mood of stock taking of achievements on the eve of the 10th anniversary of the State of Israel.

With the help of more than 40 contributors, 2000 references were selected among more than 5000 and presented in two main sections. One deals with research of regional and applied nature in the field of public health and social medicine, plant sciences applied to agriculture, animal husbandry, and industrial aspects of biological research. The second section is devoted to fundamental investigations in the field of experimental and clinical research, botany, and zoology.

The historical background leading to this research, the conditions under which it was carried out, and the main problems which are or should be studied are provided in an excellent and informative introductory chapter. An additional chapter presents a short description of the institutes and organizations engaged in research in Israel.

Nobody else was better entitled to write this introduction, than Professor Saul Adler, the world known microbiologist and parasitologist whose outstanding work on tick-borne fevers has made possible the successful introduction and raising of high bred dairy and beef cattle in Israel and other countries in the Middle East. He and his work symbolize the pioneer, scientific generation which created new centers of teaching, healing and research in the remote and derelict wasteland which was then Palestine. The spirit of sacrifice and devotion is an indispensable part of the scientific achievements surveyed in this volume.

The editor coped well with this rather unusual and difficult attempt to bring together and discuss so many aspects of biological and medical research on a national basis. Such an approach might be wholly justified for those studies which deal with actual and specific problems and needs of this country. However, fundamental studies carried out in any research institute or laboratory in the world are much less suitable for such treatment.

As a whole, this book may serve as a useful guide for anyone interested in agriculture, biology, or medicine in Israel, and especially for those intending to visit there. It may also serve as a general source of references.

The readers of this Journal will naturally first turn to the 7 pages devoted to range research (misleadingly called "pasture research"), a well condensed and very readable contribution by N. Seligman (S.C.S. Israel), and to related fields of animal husbandry, plant ecology, and physiology. In these, as in other fields, the intensive research activity in Israel could well be measured by international scientific standards. Although chiefly aimed at the well-being of Israel, its people and livestock, the research might be highly beneficial for other countries faced with similar problems or with a similar natural environment.

This is true also for other newly

emerging nations which might find comfort and encouragemnt in realizing what can be achieved by a small number of well trained and devoted scientists in a small country, poor in natural resources but overburdened with security, social, and economical problems.—*Z. Naveh,* Agriculture Experimental Station, Neve Yaar, Israel.

The Plant Community. By H. C. Hanson and E. D. Churchill. *Reinhold Publishing Corp. New York, N. Y. 218 pages. 1961. $4.95.*

The subject matter is lucidly and effectively presented in four parts. Numerous illustrations are used to good advantage, but tabular data are somewhat meager. A selective list of works, many from foreign journals, comprises a generally up-to-date bibliography. Some papers of classical or historical interest are also included. As the authors indicate, this is a text designed for teaching a semester or quarter course in plant ecology, or as a supplementary reference for courses in conservation, forestry, and related fields.

The presentation of material begins logically with a discussion of species and populations as the integrating components of communities. Species variation is discussed. Characteristics dealing with species behavior and adaptiveness are recognized as important variables in community structure. Species tolerance, competition, and various physical and biological relations are discussed, and related to the success or failure of the organism in a given environment. Reference is made to Good's "Theory of Tolerance and Principle of Limiting Factors," where the authors draw a seemingly fine line in defining ecological amplitude and tolerance range of the species.

In Chapter 1, the concepts of autecology are advanced as the first step in dealing with community problems.

Chapter 2 deals with species groupings. Factors involving coexistence and how groupings of species may differ are discussed. Ecological processes such as migration, germination, ecesis, and reaction are effectively woven into the discussion. These are the operating processes of succession, which are responsible for developing new entities and for changing existing ones. The ecosystem is mentioned only briefly. Perhaps more space might have been devoted to this subject. Even though plant groupings are the primary consideration in this chapter, a discussion illustrating the interrelationships of plants as the primary producers and the consuming agencies of the ecosystem would be effective.

Analytical characteristics of the community and methods of describing and measuring them are the subject matter of Chapter 3, followed by a discussion of synthetic characters in Chapter 4. The former deals with the qualitative and quantitative criteria usually employed in characterizing a particular plant community. In the latter, the tabulation of species data used in the integration of several communities or stands into a sociological pattern is presented. Reference to the state or region where data were obtained for a particular vegetation or environmental situation vivifies the subject matter and adds reader interest.

Chapter 5 concerns community dynamics. Changes in community composition are classified as cyclic and non-cyclic. These are replacement changes within the community itself, and differ from intercommunity cycles and directional changes where one community is succeeded by another. Critical differences and the difficulties involved are emphasized so as to avoid possible confusion in type determination. As stated at the close of the chapter, the types of changes within and between communities are valuable criteria in assessing the successional or climax status of vegetation.

The final chapter is devoted to classification of vegetation. Five criteria are discussed. These are floristic composition, ecological relations, successional status, life form, and geographic distribution. Various examples of provinces, zones, and "biociations" are included. As to which criteria should be used in a particular situation depends on the purpose of investigation, and on other factors such as size of area under study. Whatever the objective, the work should include a consideration of properties of the stand or community which is the analytical unit of vegetation.

In summary, the first part of this book dealing with species and population characteristics to this reviewer is the most effective; however, as a whole it is valuable and useful as a beginning text and reference.—*Clair L. Kucera,* University of Missouri, Columbia, Missouri.

Manual of Game Investigational Techniques. Edited by Henry S. Mosby. *The Wildlife Society, Virginia Cooperative Wildlife Research Unit, Dept. of Forestry and Wildlife, Blacksburg, Va. XXII + 1:1 to 20:3 pages. $4.50. 1960.*

This book fills a need which the Wildlife Society has recognized for many years. A techniques committee appointed in 1941 prepared an outline for the book, and then went off to war. Not until 1957 was the new committee appointed which produced the present volume.

Subjects covered are record keeping, mapping, habitat evaluation, census methods, sex and age criteria, population analysis, preserving biological material, post-mortem examinations, capturing and marking wild animals, measuring mortality, controlling nuisance wildlife, food habits, literature, project planning, and report writing. This is a valuable survey and summary of the many useful techniques available to game and range managers and researchers. Thanks to the eight authors for their fine contributions! The few selected criticisms which follow will illustrate some of the book's minor shortcomings, some of which we can hope to see corrected in future editions.

For example, an added section on productivity would be useful—criteria of breeding condition, numbers of eggs and embryos produced, and numbers of young weaned or fledged.

A section of the Manual of special interest to range managers is "Evaluation of Habitat," a review of techniques for measuring vegetation and its use by animals. This is a good checklist of most of the methods available to date. The reliabilities of the various techniques reviewed are not evaluated, a failing characteristic of most reports on this subject. It is easy to describe a way to measure vegetation, but almost impossible to say whether or how well that method measures what you actually intended to measure.

The section on animal population analysis deals largely with life tables

and their uses. Unfortunately life tables are concerned only with the destiny of animals after they are born. Birth rates are of equal, sometimes greater importance in determining populations. Methods of analyzing the joint effects of births and deaths are well developed and should be presented.

The book has an atrocious pagination system. Each of 20 sections has its own set of page numbers, plus Roman numerals up front!

The welcome low price of this 328-page, hard-back, 8½ x 11-inch book is made possible by the photo-offset printing, a clearly legible product with excellent half-tone and line illustrations.—*Lowell Adams,* Pacific Southwest Forest and Range Experiment Station, Berkeley, California.

Key to Important Woody Plants of Eastern Oregon and Washington. By Doris W. Hayes and George A. Garrison. *U. S. Department of Agriculture Handbook No. 148. Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 213 pages. 1960. $2.00.*

This book was published to meet an increasing demand from game biologists, forest rangers, hunters, and recreationists for a plant key written in laymen's language. The authors have done a creditable job.

Primary divisions of the key are based on whether or not a plant is "evergreen" and the season of the year. Subsequent divisions are based upon the arrangement of twigs and leaves and the presence or absence of thorns. Each pair of alternative characteristics is given the same number for the convenience of the user. By choosing one characteristic of a pair, the user can move quickly through the key to identify the species he is interested in.

It is difficult to describe a plant without referring to the seed or flower parts, yet the authors have done a remarkable job of developing a key based on leaf and twig characteristics. Some of the descriptions are rather lengthy, but the primary characteristics are set out in bold face type and will commonly suffice to identify a plant.

The illustrations are very good and well labeled. In fact, the illustrations may be considered by many as being just as useful, if not more so, than the written description in identifying certain shrubs.

The type locality is given for all species, which adds considerably to the usefulness of the key.

Both scientific and common names are used throughout the publication. Common names are taken from *Standardized Plant Names* by Harlan P. Kelsey and William A. Dayton (2nd Ed., 1942). However, the index refers to some common names that are used in certain localities in Oregon and Washington.

Generally after a plant has been identified, the question often arises as to whether it has any forage value. The authors were mindful of this and added a section on the relative forage values of many of the plants found in the key.

Even though the authors avoided the use of technical terms wherever possible, a few technical and semi-technical terms have been used. A glossary of such terms would have added a great deal to the book, when considering its intended use is for the hunter and the recreationist, as well as the professional man who may not have the opportunity to work closely with plants year after year and becomes "rusty" on botanical terms.

Ranchers, as well as professional range conservationists, living and working in the northwest would want to have this plant key in their library,—*H. L. Leithead,* Soil Conservation Service, Denver, Colorado.

Private Grazing and Public Lands. By Wesley Calef. *University of Chicago Press, Chicago, Ill. 287 pages. 1960. $9.50.*

To the range man, technician and manager-owner alike, this look into grazing use and land tenure should excite serious study of what is the best future course for public land management. Admittedly tuned more to the eastern reader there is ample to provoke western and possibly congressional thought and interest. To those intimate with the subject there are temper-heating statements but treatment in the general should disarm most critics.

The author in the early chapters established historical, geographical, political, industrial, and weather-soil-plant relationships that have very little consolidated parallel. It may be somewhat difficult to keep interested in the full explanation of interrelated problems, but the details furnish a thorough background to the author's recommendations for future policies and procedures on management and disposal of the public domain lands.

The author gives support to common-use grazing association management as opposed to the continuing trend toward allotted areas under intensive management and development. There is here and there a note of sympathy for the technician who recognizes the objectives that should be reached in management but is faced with insurmountable obstacles such as land ownership pattern, entrenched industry, non-support, and influential interference.

The well documented facts and philosophies expressed by a professional in rural land problems should contribute to a more acceptable solution of public land management and tenure.—*Maurice W. March,* Bureau of Land Management, Cheyenne, Wyoming.

Research Proposals Due

The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of basic research proposals in the life sciences is January 15, 1962. Proposals received prior to that date will be reviewed at the spring meeting of the Foundation's advisory panels and disposition will be made approximately four months following the closing date. Proposals received after the January 15, 1962 deadline will be reviewed following the summer closing date of May 15, 1962.

Inquiries should be addressed to the Biological and Medical Sciences Division, National Science Foundation, Washington 25, D.C.

CURRENT LITERATURE

Edited by Lee A. Sharp and E. W. Tisdale, College of Forestry, University of Idaho, Moscow, Idaho

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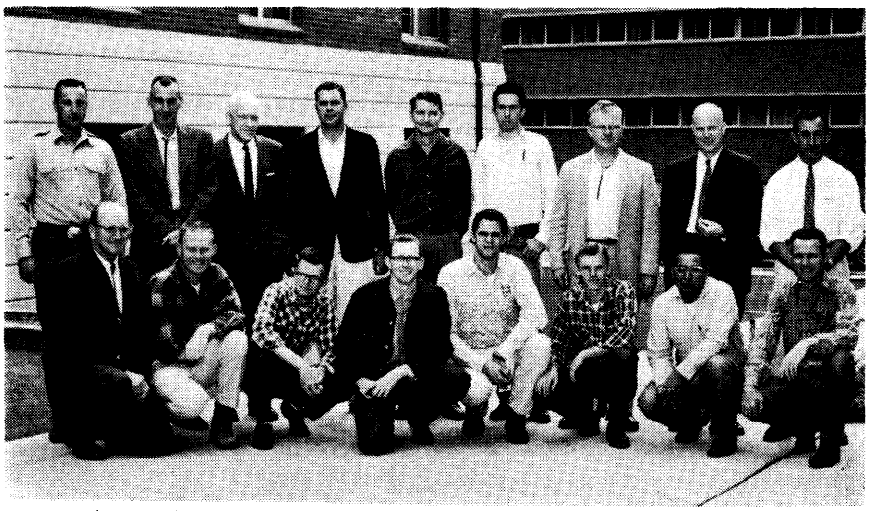
WITH THE SECTIONS

ARIZONA

The Winter Program will be held at the Sands Motel in Tempe on January 12th and 13th, 1962. The theme of the meeting will be "Contributions of Research to Better Range Management." The first day of the two-day meeting will be taken up by individual sessions which will discuss soils, plants, and animals in the economic phases of range management. The second day will be taken up by a half-day tour of the Soil and Water Research Laboratory of the Agricultural Research Service. Recent communiques from Bob Courtney indicate that there will be a women's program.



Arizona Student Chapter

Student Chapter

I hope this letter will appear in the first issue of the Journal of Range Management during the 1961-62 school year. In this way, incoming and returning students who have not been interested in coming to meetings or joining the club will be able to see this and take an interest in what we are doing. This goes for students in any University or College where there is a Chapter of ASRM. I realize that after a day of classes, sitting and listening to another lecture do not seem to be interesting. However, until a student comes and expresses his ideas, the program committee does not know what to plan. Although we had mostly lecture meetings last year, there were several other interesting activities. I hope this letter will give ideas to other clubs and stimulate correspondence between clubs.

Last year we got together only once a month for speakers and had only two dinner or cook-out meetings. We hope this year to have more social gatherings. Getting people out to meetings is a difficult problem. Our advisor, *Ervin Schmutz,* and other members of the Watershed faculty, gave the Chapter strong backing throughout the year.

At our first meeting a movie was shown and officers were elected for the following year. The officers are *Chris Williams,* Chairman, *Jerry Schnor,* Vice-Chairman, and *Jeff Holdren,* Treasurer-Secretary.

At the next meeting *Mr. Henry Boice,* one of the older ranchers in the state, discussed the transition of range management and the developments in methods. At the next meeting, following a Mexican dinner, *Mr. Charles Pickrell,* Director Emeritus of the Arizona Extension Service, told of many interesting experiences working with ranchers in the state. Then, early in December, *Mr. Schmutz* took a group of us up to the Arizona Section meeting in Wickenburg where we spent two days enjoying the meetings and social affairs of the Section.

Right after the Christmas holidays, some of us began studying with *Coach Dave Wilson* for the range plant identification contest which was held in Salt Lake City, Utah. The members of the team were *Larry Knapman, Dave McGowan, Jeff Holdren,* and *Chris Williams.*

Meetings during the second part of the year were devoted to current problems in the range field and to getting acquainted with different phases of the work. The first speaker was *Mr. Ray Perry* from Australia, who was studying at the University. Using films and maps, he very aptly explained the geographical and climatic conditions existing in Australia which make application of range management methods rather different than ours. In February, *Mr. Van Wilson,* range agent from Pinal County, discussed working relationships between county agents and ranchers, and answered questions on opportunities in that field. Our final speaker for the year was *Mr. Bob Boice,* a ranger from Globe and also the chairman of the Arizona section, who answered questions about problems and opportunities in the field of ranching. At the same time he encouraged us to send any articles to the Journal which might be of interest to their readers.

At this time I would like to encourage all readers of the Journal to attend the meetings of their local University or College chapters, to get to know the students and to offer their resources to the programs. I am sure that the fellows will be glad to have these offers and will be able to make good use of them. To get in touch with your club, just contact the school Range Department and I am sure that somebody can tell you about their next meeting.

Christopher Williams, Chairman

CALIFORNIA-NEVADA JOINT MEETING

The fabulously scenic and intriguing eastern slope of the Sierra-Nevada formed the setting for a

California-Nevada Sections Group—September 15, 1961

joint field meeting of these two sections on September 14 and 15. Over 50 ranchers, technicians, educators, and students attended the tour which high lighted the diverse problems and different kinds of range which occur throughout the area. The program was largely directed by *Charles Saulisberry,* vice-chairman for the Nevada Section. *A. S. Fausett* and *Ivan Sack* arranged the activities.

The group was shown how recreation and grazing may be integrated and where there may be conflicts in multiple use management on the Inyo National Forest. *Del Fausett* pointed out that some areas must be reserved exclusively for recreation needs of the increasing population.

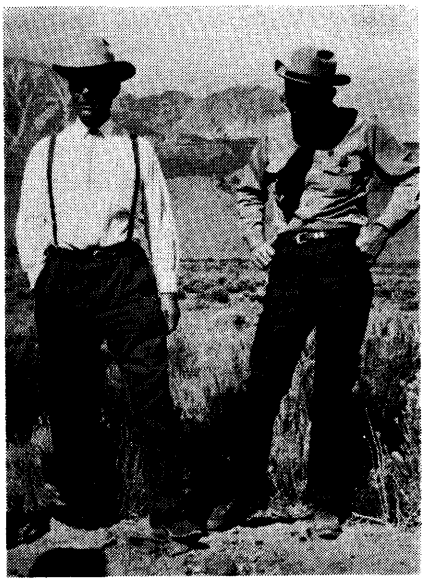
The characteristics and use of bitterbrush, which is the principal forage producer throughout volcanic Mono Basin, drew the attention of the rangemen. In places the browse has become too thick and rank for efficient sheep use. Reduction of the sagebrush at least is needed to open up the stands and make them more accessible. On other areas grazing has been extended by hauling water to heretofore unused bitterbrush stands.

The Indiana Summit Natural Area, which contains a typical stand of Jeffrey Pine which has been protected from grazing, logging, and other uses for 30 years, was visited. Adjacent areas logged off about 1880 provided good grazing for 30 to 50 years but are now declining from the grazing standpoint as tree reproduction increases and forage producing plants such as bitterbrush decrease.

Another aspect of the range industry came to the attention of the group at the *Fred Strosnider* Ranch in the Bridgeport Valley. This 1600-acre operation on a high altitude wet meadow is used for grazing from April to November. The grazing capacity is being improved by drainage, better distribution of irrigation water, and renovation of sod-bound portions of the meadow. Incidentally, *Fred Strosnider* has been a Nevada member since March 14, 1897, when he first saw the light of day in Mason Valley. He has also been a County Assemblyman and State Senator and was chosen this year as Nevada's "Cattleman of the Year."

The meeting was further honored by the attendance of *Fred Dressler,* President, American National Livestock Associations. *Mr. Dressler* spoke at the banquet on the present range livestock situation and took an active part in the discussions throughout the two-day period. Other speakers at the banquet were *Stanley Hunewill,* operator of the Circle H ranch, *Norman D. Brown,*

L. to r. Darwin Anderson, Tucson, Ariz., H. W. Miller, Pleasanton, Calif., Fred Strosnider, Bridgeport, Calif., Fred Dressler, Gardnerville, Nev., and M. W. Talbot, Berkeley, Calif.



Fred Dressler and Ranger Jack Reveal, Leevining, Calif.

past President of the Nevada Cattlemen's Association, *C. N. Saulisberry,* vice-chairman Nevada Section, and *E. J. Woolfolk,* Chairman, California Section. *Mr. Hunewill* just celebrated the 100th anniversary of ranching by his family in the Bridgeport Valley.

The second day of the tour included the crested wheatgrass grazing intensity, fertilizer and spraying tests conducted on the Sweetwater Summit area by ARS and Nevada Agricultural Experimental Station personnel.

Mr. Norman D. Brown had the group to his headquarter's ranch at Smith, Nevada, for a welcome glass of beer, a look at his fine Belgium horses, and a story of his operation. Incidentally, there were very few good judges of horse flesh in this crowd. The best guess heard on the weight of a 6-year-old Belgium gelding was 1900 pounds. *Mr. Brown* said his actual weight was 2200 pounds.

A fine barbeque lunch was served the group at the ranch home of *Jim Kilduff,* foreman of the Fairfield Ranches. This is a 50,000-acre livestock and hay operation in Mono County, California, and Douglas County, Nevada.

The tour was concluded near the town of Walker in the south end of Antelope Valley, Mono County, with a review of the changes in the native bitterbrush that have taken place with a clear cutting of Pinyon pine by *Eamor Nord.*

WYOMING

University of Wyoming range students opened their fall 1960 activities with a meeting and party to renew old acquaintances and to show slides of the many different areas where students had worked the preceeding summer. The meeting was held in the University Auditorium and refreshments were served.

Since the Wyoming Range Management Section's two western dances were such a success last year, this year they sponsored two more, one in the spring and one in the fall. The music for these two dances was furnished by the Wyoming student section's own western band, "The Range Rhythmaires."

The Wyoming range plant judging team, coached by *Herb Fisser,* travelled to Salt Lake City, Utah, this year. The team consisted of *Bill Taliaferro, James Hicks, Huey Dawson, Jim Whiting* and *Sam Jolley.* The team placed third with Bill Taliaferro placing second high individually.

During the year, two parties were held by the range students at the 4-H building. Dinner and refreshments were served and card games played. Everyone seemed to have enjoyed themselves and have already started looking forward to next year's get-togethers.

The student range field trip this year was completely revamped. Thirteen range students and twelve Animal Husbandry students, sponsored by *Dr. A. A. Beetle* and *Dr. Paul Stratton,* respectively, travelled north this year instead of their usual direction, south to Mexico. The Animal Husbandry students joined the range students on a trip that took them to Range and Livestock experiment stations along a 2,000-mile route. The major stops included Gillette, Wyoming; Miles City, Montana; Montana State College, Bozeman, Mont., and Dubois, Idaho. The trip lasted from May 5 through May 14.

The election of officers for the student chapter of the Wyoming Section was held about the middle of May. Those elected were *Sam Jolley,* President; *Lloyd Eisenhauer,* Vice-President; and *Bill Mortimer,* Secretary-Treasurer.

Twelve seniors received their B.S. degrees in Range Management this year and are now located throughout the country on various jobs.

Graduating seniors *Harry LaToush* and *James Facinelli* were drafted upon graduation. Other graduating seniors and their job plans are: *James Hicks,* Riverton-Bureau of Land Management in Rock Springs; *Gene Kamerzell,* Torrington-Soil Conservation Service in Artesia, New Mexico; *E. D. Luchsinger,* Rawlins is working on a dude ranch; *James E. Preston,* Lyons, Nebraska-USDA, Soil Conservation Service in Walden, Colo.; *William G. Sims,* Upton—U. S. Forest Service; *Bill Taliaferro,* Green River—is working on his ranch at Green River, Wyo.; *Patrick Wendt,* Rock Springs, Bureau of Land Management, Rawlins; and *Jimmie D. Whiting,* Douglas-Bureau of Land Management, Pinedale, Wyoming.

Mohammad Omar, an Afghanistan student and graduate in Range Management, returned to his home country after receiving his diploma this spring. He is now doing work in range management in Afghanistan and has built the first exclosure in the history of the country.

The University of Wyoming Range Student group is beginning to pick up more and more members every year, and the school year of '61 and '62 promise bigger and better rewards than ever for all its members.

The Wyoming Range Management Scholarship Fund for 1961 was awarded jointly to *Clayton Williams* and *Lyle K. Rolston.*

Bill Mortimer, Secretary-Treasurer.

SOUTHERN

The annual fall meeting will be held in Gulfport, Mississippi, on October 30 and 31. The program for the first day includes assembly and registration in the Markham hotel at 12:30 p.m. The afternoon, 1 to 5, will be spent touring the cattle-timber-turpentine operation of *W. L. Blackledge.*

On Tuesday a discussion panel on "coordinated land use" will occupy the entire morning. Panelists will be *W. R. Thompson,* pasture specialist, Mississippi State College; *Horace Leithead,* Range Conservationist, SCS, Denver, Colorado; *W. H. Turcotte,* Chief, Game and Fish Division, Mississippi Game and Fish Commission, and *V. L. Duvall,* Southern Forest Experiment Station, U.S.F.S., Alexandria, La.

And there may be more!

Grazing Advisory Boards Shake-up Slated

Changes proposed by the Department of the Interior will broaden membership on the Secretary's State and National Grazing Advisory Boards to give voice to mining, timber, conservation, recreation, wilderness, water, industry, and other non-livestock interests that are affected by the use and management of the public lands.

Concerned with happenings on the 59 grazing districts in 10 western States, the State and national boards, as presently constituted, represent the views and thinking of livestock groups. Both stockmen and wildlife spokesmen sit on the boards, but the voting strength is held by the livestockmen by margins as large as 10 to 1.

Livestock representatives on the State and national boards will be reduced by one-half under the new order. The vacancies will be filled by persons interested in other aspects of public lands use and management, and the advisory duties and functions of the boards expanded accordingly.

The proposed changes in the advisory board membership and functions, according to BLM Director KARL S. LANDSTROM, are the result of growing demands for land and resource use. Federally owned rangelands no longer have use only for livestock and wildlife. Other uses have been growing at a rapid rate and present day public land management must give adequate recognition to all resources on a balanced basis.

Although the change does not require a formal waiting period, the department is providing 30 days in which interested parties may comment. Written statements should be sent to Landstrom at Washington 25, D.C.

Wildlife, conservation, recreation, and similar interests long have pointed out that the present State and National Grazing Advisory Boards operate largely as a voice for a single group of public land users. The boards clearly ignore the many other legitimate demands that a growing society is making upon the important public lands administered by the BLM.

It is expected that Interior Secretary STEWART L. UDALL will hear promptly from those few groups that want to hold on to the advantages of the "good old days." The many others who view the new order as a necessary move toward improved management of the public lands should not be any less sparing in their comments.

In Memoriam

F. W. ALBERTSON, Professor of Botany and past chairman of The Division of Biological Sciences at Fort Hays Kansas State College, died after a brief illness at Hays, Kansas, on June 8, 1961, at the age of 69.

DR. ALBERTSON was born in Hill City, Kansas, received his B.S. degree at Fort Hays Kansas State College, his M.S. at the University of Missouri, and his Ph.D. at the University of Nebraska. At Nebraska, he studied under Dr. J. E. Weaver and later co-authored many papers and books with Dr. Weaver. In 1917, he married Ruby Mullen and had two children, Dr. Maurice Albertson, and Mrs. Walter Newport.

He joined the staff at Fort Hays in 1918 and remained there until his death. He was recognized and world-renowned as a grassland ecologist, an unquestioned authority on drought and grazing, two of the most important problems of the Central Great Plains. He published 34 articles on these subjects and co-authored a book entitled "Grasslands of the Great Plains". His work has been widely used by technicians in the field and has been very important in the establishment of better range management practices throughout the Great Plains. In 1956 and 1958 he and Mrs Albertson spent two years in India helping the Indian people find ways to improve their grasslands.

He was tireless and ambitious, more for his school and his students than for himself. His greatest satisfaction was in having successful students. DR. ALBERTSON'S students are scattered all over the face of the globe actively teaching about, doing research on, and managing grasslands. His students are all proud to be mentioned as "one of Dr. Albertson's boys".

His teaching was not limited to technical information about grassland ecology but was permeated by his philosophy of living. He was such a good, kind, sincere, and selfless man that all who knew him could not help but be better because of it. Listening to DR. ALBERTSON'S lecture, one felt a greater respect for man, an appreciation of our great country, and a peacefulness that seemed to emanate from him. He had the ability to talk simply and clearly about the importance of grass, soil, water, and other natural resources in a personal, practical way. He was a great teacher, a great Christian, an inspiration for learning, and instilled in his students a devotion to knowledge as it benefits mankind. He was a man who truly walked with God and appreciated the great wondrous natural beauty of God's earthly kindom.

He was a reverent and intelligent man who had made his peace with God and the world. Although he loved his work and worked at it tirelessly, he still had time to visit the sick at the hospitals several times a week and to be active in his church and in community affairs. He never grew old because he thought young thoughts, actively absorbing new knowledge and planning for the future. His plans went beyond his lifetime so that the work he had started would be continued after he was gone. He will be missed by all who knew him, not only for his good humor, insatiable curiosity, meticulous preparation for teaching and research, but also for the integrity of his professional judgment.

He gave a series of lectures at a conservation workshop in Minnesota one summer and a student who had not known him before this series of five lectures wrote the following poem about him.

Dr. Albertson

From Kansas came a kindly man
To save our soil, he had a plan
From his life's work he had found out
What conservation's all about.
He's seen rampage of drought and storm,
He's seen good crops in weather warm,
He's seen the soil in use and waste,
When from the soil men grab in haste
All that the soil will quickly yield,
With no care of wasting field.
So if you want the good to last
Read of your future from your past,
Then with the soil you'll surely share
Some of the crop, and then with care,
Your grass will strong and healthy be,
And maybe you'll become wealthy.
But don't forget as you forward plan
The devoted, diligent, studious man
Who spent his life and energy
That all mankind might better be!

W. W. Bayles

Report—Committee for Cooperation With Organizations in Other Countries

The need for better management of range and related lands throughout the world is so great, and the opportunities for helping to bring about improvement in the situation by the American Society of Range Management is such, that your Committee for Cooperation with Organizations in Other Countries hopes every member of the Society will keep this actively in mind. Scientific training of personnel of other countries along range management line, is one of the most urgent aspects. We hope all members will be alert to the opportunity to facilitate the training and the desire to obtain information on the part of all visitors who may come to the United States.

Membership in the Society is one of the best ways to facilitate range improvement and all visitors from other countries should be encouraged to join. We are informed that there are about 58 memberships in the Society at present, exclusive of U.S.A., Canada, and Mexico. Of these approximately 40 were ICA trainees who decided to join and had a large part of their dues paid by ICA for 3 years if the individual elected to join for that period. These were chiefly visitors here in 1959 and 1960. Although the contract between ICA and the Society was cancelled last year, ICA has stated it will still continue to offer each eligible ICA participant during his period of training in the USA the same opportunity for membership in the Society.

During 1960 Section contacts were arranged for each Society Section. These will continue through 1961 with only limited personnel changes. We are anticipating more fruitful activity as each year furnishes experience. One of the immediate problems is to provide Society contact with, and a continuous follow up of those people from other countries who are in the country studying range management, pature improvement, dryland or grass-land agriculture, or other closely related subjects. These visitors come largely through ICA sponsorship under its training program, through fellowships granted by FAO, or sponsored directly by their government. Some member of our committee will welcome those who come to Washington, if we are informed, provide them with a statement of the advantages to them from active membership in the Society and endeavor to have appropriate Society activities worked into their programs. We hope that a similar welcome can be afforded visitors when they are in other Section areas.

During 1960 at least 46 visitors interested in range management from overseas countries spent some time in the United States. Of these 10 were from Turkey, 5 from Argentina, 4 each from Greece and Sudan, 3 each from India and Israel, 2 each from Chile and Uganda (United Kingdom), and 1 each from Belgium (formerly of Congo), Brazil, China, Iceland, Iran, Japan, Jordan, Pakistan, Peru, Philippines, South Africa, Spain (with FAO in Honduras) and the United Arab Republic.

Some 27 visitors from overseas interested in some degree in range management attended the Fifth World Forestry Congress,

held at the University of Washington in Seattle, August 29 to September 10, 1960. The U.S. was host to the Congress and FAO cooperated in arrangements for the Congress. Six papers directly related to range were included in the regular program.

In Section I, Silviculture and Management, during the session related to Semi-Arid and Arid Land Forestry, three papers were given on Progress in the Integration of Forestry and Grazing by *Panor Margaropoulous,* Chief, Torrent Watershed Section, Ministry of Agriculture, Athens, Greece; by *Salahuddin Ahmad* on behalf of the late S.A.A. Anvery, Chief Conservator of Forests, Pakistan; and *Raymond Price,* Director, Rocky Mountain Forest and Range Experiment Station, U. S. Forest Service. Participants in the discussion of these papers from other countries included *Javier Prats LLaurado* (Spain), *Prof. Baki Kasapligil* (Turkey), *Hasan K. Qashu* (Jordan), *Prof. Allessandro DePhilippis* (Italy), *Prof. Christos Moulopoulos* (Greece), and *Mario Avila Hernandez* (Mexico). There was a very good attendance and much interest in this session, as was also the case of the following session.

In Section VII, Forest and Range Watersheds, *Kenneth W. Parker,* Director, Division of Range Management Research, U. S. Forest Service, spoke on Grazing Management Practices. Abstracts of papers by *Jean Paul Challot,* then Director General of Water and Forests, Morocco, on Grazing Effect on Soil Stability and Forest Production, and by *Miguel Navarro Garnica,* Deputy Director General and Head of the National Forest Service, Madrid, Spain, on Forest and Range Watershed in a Mediterranean Climate were read since these two were unable to attend. Comment was made on these by *Leonides Liacos* of Greece. A special paper Some Aspects of the Forest Range Problem in Portugal was submitted by *F. N. Continho* of Portugal, but read by title in his absence.

In addition to these two main sessions, other range aspects, especially over-population by game, came out in the papers Ecological Aspects of Game Control Measures in African Wilderness and Forested Areas by *B. L. Mitchell,* Biologist, Department of Game and Fisheries, Livingstone, Northern Rhodesia, and Wildlife Management and Protection in U. S. Forests by *Lloyd W. Swift,* Chief, Division of Wildlife Management, U. S. Forest Service. These were given in Section VIII, Forest Recreation and Wildlife. Also in Section X, Tropical Forestry, brief reference to range was contained in papers on Case Histories of Shifting Agriculture in the Near East by *H. F. Mooney,* Forest Advisor, British Middle East Development Division, Addis Ababa, Ethiopia, in the Philippines by *Florencio Temesis,* Nasipit Lumber Company, Manila, Philippines, and in Africa by *E. Maudoux* and *G. Geortay,* National Institute for Study of Agronomy of the Congo, Yangambi, Congo.

Dr. Robert S. Campbell, Chief, Range and Watershed Management Research Southern Forest Experiment Station, U. S. Forest Service and former President of the Society was the official representative of the Society at the first meeting of the FAO Working Party on Tropical American Grasslands at Maracay, Venezuela, September 25 to October 3, 1960. He presented a statement of the objectives and scope of the American Society of Range Management, and distributed copies of the prospectus and of the Journal and offered ASRM cooperation in organizing range people and exchanging information within the Americas.

During 1961 there will again be a good representation from many countries of visitors interested in some phase of range management. Some are continuing their studies, but a new group especially from Asia and Africa will be on hand. Sixteen attended the National meeting of the Society in Salt Lake City, where they met in a special meeting with Society officers, Section officers and contacts. A special session was also held where after a brief introduction by *George E. Bradley* of The Committee, on the Place of ASRM in Worldwide Grassland Problems, the following 6 papers were presented:

The International Age In Grassland Management by *Marion Clawson,* Director of Land Use and Management Studies, Resources for the Future, Inc., Washington, D. C.

International Scientific and Technical Assistance and the Role of the Agricultural Attache by *L. L. Roux,* Agricultural Counselor, Embassy of the Union of South Africa, Washington, D. C.

The Role of Professional Societies in Technical Assistance Programs by *Floyd D. Larson,* Assistant Chief, Near East and SW Asia Branch, Agricultural Programs Division, I.C.A., Washington, D. C.

International Action in Grassland Development by *R. O. Whyte,* Chief Crop Production and Improvement Branch, F.A.O. of the United Nations, Rome, Italy, and *Roy C. Dawson,* Technical Officer, North American Regional Office, F.A.O., Washington, D. C.

United States Training Programs as They Affect International Cooperation by *Max Myers,* Administrator, Foreign Agricultural Service, USDA, Washington, D. C.

Cooperative Assistance and Training Programs on Rehabilitation and Management of Grasslands in India and How They Can be Improved by *K. R. Patel,* Dryland Farming Investigator, Rajkot, India.

We are hoping that an equally good session related to world wide range improvement and

management can be developed for the 1962 National meeting.

Some 24 visitors from 12 countries attended the Short Course in Soil and Water Conservation held at Oklahoma State University, April 10 to 29, 1961. This included a visit to the Southern Great Plains Field Station and participation in the International Land, Range, and Pasture Judging School and Contest.

About 9 visitors from 8 countries will attend the short course in Arid Range Management and Forage Production which will be given at Colorado State University from June 12 to August 6. As a part of the course there will be a range management study trip, August 7 to 26, in the States of Arizona, Colorado, Idaho, New Mexico, Utah, and Wyoming.

In addition to FAO and UNESCO of the U. N. and the Institute of Interamerican Agricultural Sciences of the Organization of American States the committee now has the names of some 10 Range and Grassland Societies in other countries or regions and will endeavor to develop mutually beneficial contacts with them. There are also many Agronomic Societies in countries. Contacts will be made with them too, insofar as practicable.

The Ninth International Grassland Congress will be held in Brazil probably in 1964. It is planned to emphasize tropical and subtropical grassland management. The committee plans to offer its services in the organizing of the Congress insofar as that proves practicable.

Among visitors from other countries, known to the Committee as interested in range, who will be in the United States for part or all of 1961 are the following:

Jorge M. Brun, Range Management Specialist, Esquel (Prov. Chubut), Argentina; FAO Fellow at Utah State University.

Eduardo Andres Fay, with Provita, S. A., Buenos Aires, Argentina; at Kansas State University.

Oscar Angel Hernandez, Pasture Research and Management, Agricultural Experiment Station, Anguil, La Pampa, Argentina; at Kansas State University.

Carlos Domingo Itria, Alfalfa Specialist, Agricultural Experiment Station, Angnil, La Pampa, Argentina; primarily at University of Nebraska.

Jorge Morello, Professor, School of Agronomy, National University of Tucuman, San Miquel de Tucuman, Argentina; at University of Arizona.

Jorge Raul Orbea, Chief, Forage Corps, University of La Plata, La Plata, Argentina; at Kansas State University.

Ray Perry, Australia; taking graduate studies in range and watershed management, University of Arizona.

Jian Min Huang, Chief, Shimen Watershed, Provincial Department of Agriculture and Forestry, Taipei, Taiwan, China; with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Ten Po Chang, Engineer, Provincial Water Conservancy Bureau, Provincial Department of Agronomy and Forestry, Taichung, Taiwan, China; with Soil Conservation Service, including Short Course in Soil and Water Conservation.

TSE Cheng Sheng, Specialist, Chinese American Joint Commission on Rural Reconstruction, Taipei, Taiwan, China; with Soil Conservation Service.

Shin-tuan Wang, Taiwan Agricultural Research Institute, Taipei, Taiwan, China; with Soil Conservation Service.

Bekele Sissay, Assistant Forestry Instructor, Alemaya College, Dira Dawa, Ethiopia; Range Management Short Course and at University of Arizona.

Jean Paul Challot, Conservator of Forests, Paris, France; consideration of cacti and honey locust for food and forage, Arizona and California.

Ebenezer O. Asare, Soil Survey Officer, Kumasi, Ghana, Range Management Short Course and at University of Arizona.

Emmanuel John Gougas, Agronomist, Central Soils Laboratory, Athens, Greece; with Soil Conservation Service, including Short Course in Soil and Water Conservation; and California State Polytechnic College.

Puttaiah Basavaiya, Sub-Division Soil Conservation Officer, Belgaum, Mysore State, India; primarily at Michigan State University and Soil Conservation Short Course.

Mele P. Kuttysankaran, Research Officer, Soil Conservation Research Station, Kattukulam, Kerala State, India; primarily at ARS Soil and Water Conservation Research Laboratory, Westlaco, Texas.

Amal Kumar Majumdar, Superintendent of Agriculture, Midnapur, West Bengal India; Range Management Short Course and primarily with Soil Conservation Service and Agricultural Research Service.

Laxam G. Pandit, Divisional Soil Conservation Officer, Bombay State, India; primarily University of Georgia and Soil Conservation Service, including Short Course in Soil and Water Conservation.

K. R. Patel, Dry Land Farming Investigator, Rajkot, India, Rockefeller Foundation Scholarship, Kansas State, Ft. Hays.

Virendar K. Sharma, Divisional Forest Officer, Sholi Himachal Pradesh, India; with Forest Service and Soil Conservation Service, including Short Course in Soil and Water Conservation.

Oentoeng Atmosoeparto, Junior Agronomist, Malang, Indonesia; with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Entjep E. Baesoesi, Junior Agronomist, Bogok, Indonesia; with Soil Conservation Service.

Kasijono, Junior Agronomist, Jogjakarta, Indonesia; with Soil

Conservation Service, including Short Course in Soil and Water Conservation.

Kiswando, Land Utilization and Inventory Technician, Bangkalan, Mandura, Indonesia; primarily with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Kostama Natapermadi, Junior Agronomist, Bandung, Indonesia; with Soil Conservation Service.

Sugijanto Saad, Junior Agronomist, Bandung, Indonesia; with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Fakhir Jabbar, Assistant Specialist in Soil Conservation, Baghdad, Iraq; with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Naftali Tadmor, Jerusalem, Israel; graduate study at University of California, Berkeley.

Tak Wha Chung, Technician for Forest Erosion Control, Sang Book Ni; Choongchung Namdo Province, Korea, with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Mohamed Mabruk Reghei, Engineering aide, Libyan, American Joint Services, Tripoli, Libya, with Soil Conservation Service, including Short Course in Soil and Water Conservation, and Forest Service.

Martin H. Gonzales, Director, Rancho Experimental La Campana, Chihuahua, Mexico; Rockefeller Foundation Fellow, Utah State University.

Galtima Abu Bukakola, Nigeria; Range Management Short Course.

Usmanu Abba Girei, Veterinary Department Yola, Nigeria, Range Management Short Course and with Forest Service and Soil Conservation Service.

Mariano Segura, Chief, Sierra Forage Research Program, Lima, Peru; at Colorado State University.

David H. M. Clark, Pasture Research Officer, Bulawayo, Southern Rhodesia; Range Management Short Course and Soil Conservation Service.

Peter G. Jones, Agricultural Supervisor, Ministry of African Agriculture, Ridgeway, Lusaka, Northern Rhodesia; with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Pio Gimenez, Spain, Range Management Short Course.

Abdel-Rahman H. Ahmed, Assistant Land-Use Officer, Khartoum, Sudan; at University of Arizona.

A Osman-Hassan Ballal, Assistant Land-Use Officer, Khartoum, Sudan; at University of Nebraska.

Rasheed Abdel-Magid, Acting Senior Range Management Officer, Khartoum, Sudan; at Utah State University.

Hashim A. M. Mukhtar, Assistant Range Management Officer, Omdurman, Sudan; at University of Arizona.

William H. Andrews, Tanganyika; Soil and Water Conservation Short Course.

Sampop Chantaramanee, Soil Conservationist, Bangkok, Thailand; primarily with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Sitilarp Vasuvat, Soil Conservationist, Bangkok, Thailand, primarily with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Celalettin Cubukcu, Assistant Regional Director, Soil Conservation and Farm Irrigation Division, Izmir, Turkey; primarily with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Naim Dincer, Pasture and Forage Specialist, Eskishehir, Turkey; at Utah State University.

Ali Ihsan Evirgen, Work Unit Conservationist, Ankara, Turkey; with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Urfi Guney, Veterinarian, Karacabey, Bursa, Turkey, at Utah State University.

Nurham Gurel, Director, Irrigation, Maltepe-Ankara, Turkey; with Soil Conservation Service, including Short Course in Soil and Water Conservation.

Halil Isik, Conservation Technician, Ankara, Turkey; with Soil Conservation Service, including Short Course in Soil and Water Conservation, and at Oklahoma State University.

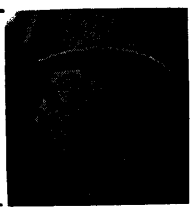
Hikmet Kucukkoca, Soil Conservation Technician, Izmir, Turkey; with Soil Conservation Service, including Short Course in Soil and Water Convervation, and at Oklahoma State University.

David Thornton, Uganda; Rockefeller Foundation Fellow at University of California.

Mohamad Fouad El-Rabbat, United Arab Republic (Syria); at University of Arizona.

Kamel Ibrahim, United Arab Republic; studying for doctorate, Utah State University.

W. R. Chapline, Secretary



Fifteenth Annual Meeting

AMERICAN SOCIETY OF RANGE MANAGEMENT

(Tentative Program)

Hotel Driscoll, Corpus Christi, Texas
January 23-26, 1962

"RANGE MANAGEMENT — ADVANCEMENT THROUGH COOPERATION"

REGISTRATION: 9:00 a.m. Tuesday, January 23 to noon Thursday, January 25

PHOTO CONTEST: Deadline for entries 2:00 p.m., Tuesday, January 23

RANGE PLANT CONTEST: 8:00 a.m. Wednesday, January 24

SECTION DISPLAYS: 5:00 pm Tuesday to 5:00 pm Wednesday

SPECIAL MEETINGS: Board of Directors' Meeting, Tuesday and Friday at 8:00 a.m.
Section Chairmen Meeting: Tuesday 9:30 a.m.

ITEMS TO NOTE ON YOUR PROGRAM:

Keynote Sessions: Thursday and Friday mornings
Social Hour and Banquet: Thursday Evening
Field Trip to King Ranch: Wednesday Afternoon
Field Trip to Welder Wildlife Foundation, Sinton, Texas, Saturday Morning
Field Trip to Monterrey, Mexico: Saturday Morning

SPECIAL PROGRAM FOR LADIES:

Check with Registration Desk for information on special tours, socials, and other programs

RANGELANDS OF THE SOUTHWEST

Tuesday Afternoon
January 23

Chairman: *Dr. R. A. Darrow,* Department of Range and Forestry, Texas A. & M. College, College Station, Texas

"Development of the Range Livestock Industry in Texas," *Tad Moses,* Agricultural Editor, Texas A. & M. College, College Station, Texas

"The Geography and Range Resources of Southwestern United States and Mexico," *Dr. Donald D. Brand,* Department of Geography, University of Texas, Austin, Texas

"Social and Economic Implications in the Use of Southwestern Rangelands," *Dr. Walter Prescott Webb,* Department of History, University of Texas, Austin, Texas

"Range and Livestock Improvement in Northern Mexico," *Armando R. Raynal,* Cattleman, Union Ganadera Regional de Chihuahua, Chihuahua, Mexico.

"Rangelands of Mexico: Their Vegetation and Management," *Martin H. Gonzales,* Rancho Experimental La Campana, Chihuahua, Mexico.

GENERAL SESSION

Tuesday Evening 7:30 P.M.
January 23

Chairman: Incoming Vice President
Invocation
Welcome to Texas
President's Address
Society Business

NOTE: The Texas Section will hold a business meeting at 4:30 p.m. on Tuesday Afternoon.

Wednesday Morning
January 24

Chairman: *Garlyn O. Hoffman,* Extension Range Specialist, Texas Agricultural Extension Service, College Station, Texas.

"Vegetational Areas of Texas," *Garlyn O. Hoffman,* Chairman

"Range Management Problems and Progress in the Trans-Pecos Area," *Donal V. Allison,* Area Conservationist, Soil Conservation Service, Pecos, Texas

"Range Management Problems and Progress in the High and Rolling Plains Area," *C. A. Rechenthin,* Soil Conservationist, Soil Conservation Service, Temple, Texas

"Range Management Problems and Progress in the Edwards Plateau," *Rudy J. Pederson,* Field Specialist, Range-Soil Conservation Service, San Angelo, Texas

"Range Management Problems and Progress in the Rio Grande and Coastal Plains," *Dr. Donald L. Huss,* Department of Range and Forestry, Texas A.&M. College, College Station, Texas

"Influence of Drought, Fertilization, and Clipping on Native Range Vegetation of South Texas," *Dr. Eamor C. Nord,* Range Conservationist, Pacific Southwest Forest and Range Experiment Station, Berkeley, California

FIELD TRIP TO THE KING RANCH

Wednesday Afternoon 1:00 P.M.
January 24

Field trip to the King Ranch and Bar-B-Que Dinner—Board buses at Driscoll Hotel

KEYNOTE SESSION

Thursday Morning
January 25

Chairman: *Gerald W. Thomas,* Dean of Agriculture, Texas Technological College, Lubbock, Texas

"Factors Contributing to the Public Image of Range Management," *Dr. Bardin Nelson,* Professor Rural Sociology, Texas A. & M. College, College Station, Texas

"Improving Communications-Research to Practice," *Dr. A. D. Stoesz,* Head, Plant Technology Division, Soil Conservation Service, Washington, D.C.

"Cooperation on Multiple-Use Lands," *Dr. Hilton M. Briggs,* President, South Dakota State College, Brookings, S. Dakota

SECTION A—RANGE HISTORY AND PRODUCTION

Thursday Afternoon
January 25

Chairman: *Milton Sechrist,* Crooked H Ranch, Phoenix, Arizona

"The Matador—Range Operations from Texas to Canada," *Dr. William M. Pearce,* Vice President, Texas Technological College, Lubbock, Texas

"Range Herd Improvement Through Performance Testing," *Stuart Bledsoe,* Ellensburg, Washington

"Range Rehabilitation by Spray and Drill," *Joseph M. Mohan* and *W. F. Currier,* U.S. Forest Service, Prineville, Oregon

"Range Fertility Program at Newell," *Harold R. Cosper,* Newell, South Dakota

"Improving Range Production in Montana," *Robert Ross,* Soil Conservation Service, Butte, Montana

SECTION B—RESEARCH METHODS AND TECHNIQUES

Thursday Afternoon
January 25

Chairman: *Dr. J. J. Norris,* Department of Animal Husbandry, New Mexico State University, Las Cruces, N.M.

"Comparison of Distance Measurement, Line Intercept and Weight Estimate, Methods of Sampling Sagebrush-Grass Vegetation," *William A. Laycock,* Intermountain Forest and Range Experiment Station, Provo, Utah

"The Use of Radioactive Isotopes to Study the Physiology and Root Systems of Grass," *Gary Mathis, Chester C. Jaynes,* and *Gerald W. Thomas,* Department of Agronomy, Texas Technological College, Lubbock, Texas

"The Micro-Unit Forage Inventory Methods," *E. L. McIlwain* and *M. E. Shoop,* USDA Agricultural Research Service, Southern Great Plains Field Station, Woodward, Oklahoma

"Soil Factors as Aids to Describe and Identify Habitat Types," *Richard S. Driscoll,* Pacific Northwest Forest and Range Experiment Station, Bend, Oregon

"Soil Moisture as a Predictive Index to Forage Yield," *Bill Dahl,* Eastern Colorado Range Station, Akron, Colorado

SECTION C—RANGE WILDLIFE & RECREATION

Thursday Afternoon
January 25

Chairman: *Dr. Clarence Cottam,* Director, Rob and Bessie Welder Wildlife Foundation, Sinton, Texas

"Range Management in Relation to Deer Habitat and Deer Productivity in the Intermountain Area," *Dr. Odell Julander,* U.S. Forest Service, Ogden, Utah

"The Relation of Deer Density to Reproduction in the Edwards Plateau of Texas," *James G. Teer.* U. S. Bureau of Sport Fisheries and Wildlife, Patuxent Wildlife Research Center, Laurel, Maryland

"Importance of Fruit Crops to Range Capacity for Wildlife," *Daniel W. Lay,* Texas Game and Fish Commission, Buna, Texas

"Vegetation-Game Livestock Relationships in East Africa," *Dr. Harold F. Heady,* College of Forestry, University of California, Berkeley, California

"Cultural Techniques for Ceanothus for Use in Artificial Revegetation of Deer Winter Range in California," *Dr. Lowell Adams,* Wildlife Research Biologist, U. S. Forest Service, Berkeley, California

"White Mountain Apache Recreation Program and Livestock Grazing," *J. Kimball Hansen,* Whiteriver, Arizona

SOCIAL HOUR and BANQUET

Thursday Evening
January 25

Social Hour: 6:00-7:00 P.M.
Banquet: 7:00 P.M.—Special Program

KEYNOTE SESSION
INTERNATIONAL COOPERATION IN GRASSLAND MANAGEMENT

Friday Morning
January 26

Chairman: *Dr. Thomas L. Ayers,* Assistant to the Deputy Administrator, Agricultural Stabilization and Conservation Service, USDA, Washington, D.C.

"Development of World-Wide Grassland," *E. D. White,* Former Director, Office of Food and Agriculture, International Cooperation Administration, Washington, D.C.

"Forecast of Grassland Development and Management in Iran and the Middle East," *H. E. Arkeshir Zahedi,* Ambassador from Iran to the United States (consider including nomadic problems, Shah's land distribution, Social and Politicial questions)

"Overcoming the Problems of Range Livestock Production in Southern South America," *W. R. Chapline,* Range and Watershed Consultant, Washington, D.C.

"Grassland Management and Development in Africa, South of the Sahara," *Peter Booysen,* Department of Veld Management, University of Natal, Pietermaritzburg, South Africa

"Grazing Practices in Turkey," *Dr. Donald R. Cornelius,* Fulbright Post Doctoral Scholar, Agricultural Research Service, Ankara, Turkey

SECTION D—RANGE CONDITION AND TREND

Friday Afternoon
January 26

Chairman: *Peter W. Taylor,* Soil Conservation Service, Boise, Idaho
"A 44-year Comparison of Two Intensities of Grazing on the Vegetation, Beef Production, and Soil Fertility of the Northern Plains Rangelands," *George A. Rogler* and *D. E. Smika,* Agricultural Research Service, Mandan, North Dakota
"Changes in Vegetation on a Portion of the Navajo Indian Reservation Over a 5-year Period," *Donavon H. Lyngholm,* Bureau of Indian Affairs, Chinle, Arizona
"Some Important and Associated Native Grasses on Central and South Florida Ranges," *Lewis L. Yarlett,* Soil Conservation Service, Sebring, Florida
"Livestock Grazing in Alaska," *Edward J. Hoffmann,* Bureau of Land Management, Juneau, Alaska
"Moisture Penetration and Corresponding Vegetation Change Under Three Types of Range Pitting," *Eugene E. Hughes,* Texas A. & M. College, College Station, Texas

SECTION E—RANGE IMPROVEMENT PRACTICES

Friday Afternoon
January 26

Chairman: *Paul L. Howard,* Bureau of Indian Affairs, Aberdeen, South Dakota
"Effect of Fertilizer on Seedling Emergence and Growth of Several Grass Species," *Norman H. Welch,* Soil Scientist, Big Spring Field Station, Texas
"Mechanical Control of Cholla in the Southwest," *E. H. Williams,* Soil Conservation Service, Tucumcari, New Mexico
"Mechanical and Chemical Renovation of Crested Wheatgrass," *Russell J. Lorenz,* Mandan, North Dakota
"Progress and Development of Paved Catchment Basins," *Joseph U. Chiarella,* Phoenix, Arizona
"Date, Rate and Methods of Seeding Grass in the Southern Plains," *Marvin C. Shoop,* Agricultural Research Service, Woodward, Oklahoma

SPECIAL FIELD TOURS

Saturday
January 27

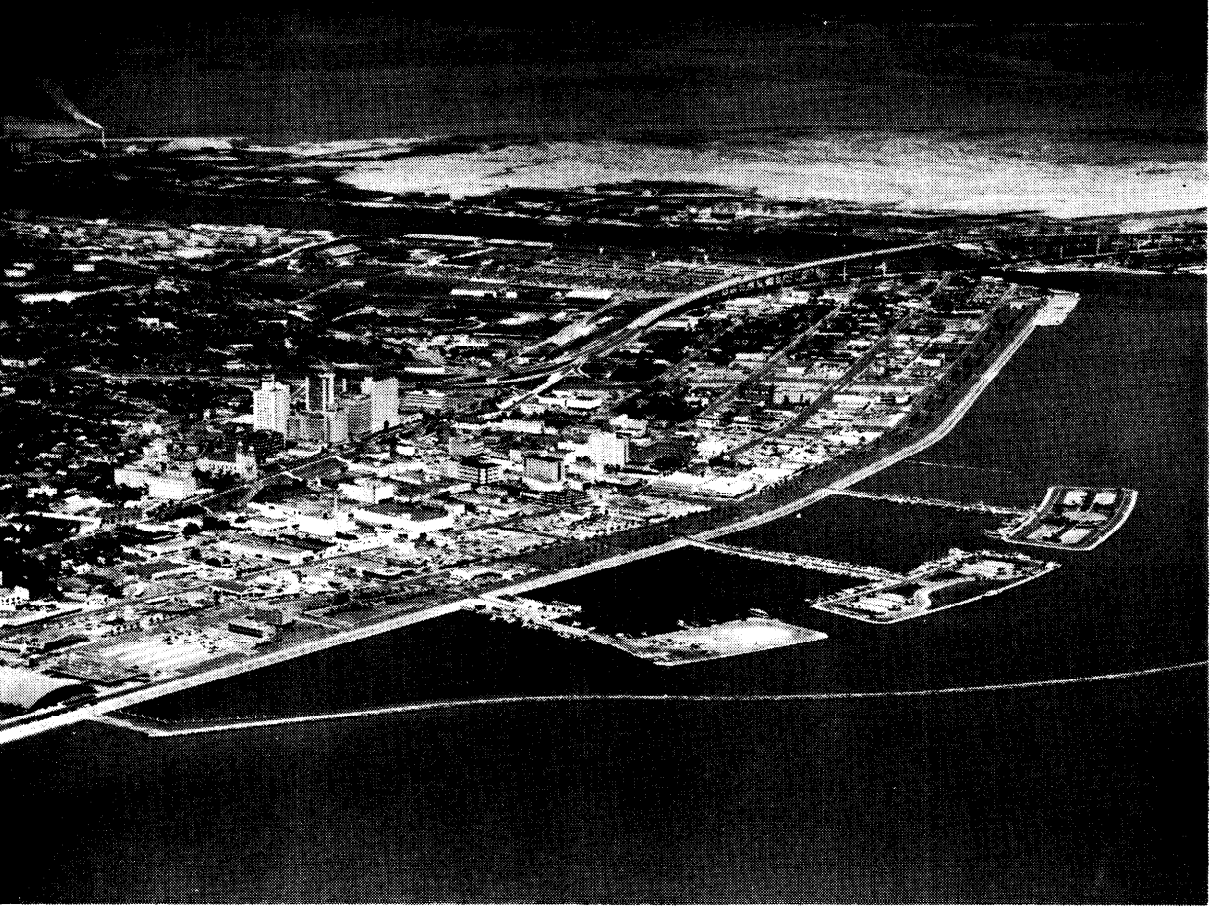
Welder Wildlife Foundation: Check with registration desk for details.
Monterrey, Mexico via Laredo: Bus Transportation—courtesy of Perry Foundation, Limited to first 41 applications.
Corpus Christi and Vicinity: Check with registration desk for details.

Land and Water Use Symposium

American Association for the Advancement of Science
In cooperation with other Societies
Denver, Colorado, December 27-29, 1961

Program

I. Land and Water Resources—R. R. Renne, Chairman
II. Optimum Uses for Resources—E. F. Frolik, Chairman
Water and Climate—General Symposium
III. Impact of Public Policy on Land and Water Use—W. E. Morgan, Chairman
IV. Projecting Management Programs—R. E. Hodgson, Chairman



CONVENTION PREVIEW

Corpus Christi, Texas Convention Capitol of the Southwest

The fifteenth annual convention of the American Society of Range Management will be held in the Robert Driscoll Hotel, Corpus Christi, Texas, January 23-26, 1962. The theme of the convention will be "Range Management — Advancement Through Cooperation." Special entertainment for the ladies and field trips to the famous King Ranch and the Welder Wildlife Refuge will highlight the program. A post convention trip to Monterrey, Mexico, is another special feature of the meeting.

Corpus Christi is one of the fastest growing cities in the nation. Its population has doubled in each of the past 3 decades. Less than 30 years ago Corpus Christi had only 17,000 residents; 20 years ago the population was barely 30,000. Today with 170,000 people, it is one of the largest cities in the Southwest, and in rate of growth is far outstripping other Texas communities.

Long before the settlement of Corpus Christi, sea-faring Spanish Conquistadores plied the waters of the Gulf of Mexico, and it was one of these, Alvarez Alonzo de Pineda, who discovered the blue waters of Corpus Christi Bay in the year 1519. The event took place on the Festival Day of Corpus Christi, said to have been first proclaimed by Pope Urban IV in 1264. The Bay was named to fit the circumstance, and Corpus Christi later derived its name from this Bay.

The Spanish, the Portuguese, the English and the French alternated in making port in Corpus Christi Bay and in visiting the coastal islands, the most famous of which is 110-mile long Padre Island. The galleons of Hernando Cortez appeared here as did the vessels of Jean Lafitte's freebooting band. At one time, the buccaneers held such sway in the area that Padre and Mustang Islands are said to have become mines of buried treasure, and even today a pleasant pastime has become the search for pirate gold in the island sand.

Corpus Christi began as a frontier trading post. It was founded in 1838-39 by Colonel Henry Lawrence Kinney, adventurer-impresario-colonizer. The small settlement, hardbitten and lawless, was called Kinney's Trading Post or Kinney's Ranch. Kinney's partner was William Aubrey for whom Aubrey Street is named. The Trading Post remained an obscure settlement

CONVENTION PREVIEW

Padre Island Cattle

until July, 1845, when United States troops under General Zachary Taylor arrived on the scene. Troops, horses and equipment had to be lightered ashore. The army remained until March, 1846, when it marched southward to the Rio Grande, the beginning of the Mexican War. An officer in General Taylor's army, writing home said of the Post: " . . . it contains few women and no ladies." A year or so later the city took the name of Corpus Christi from the Bay and as one resident put it, " . . . so as to have a more definite postmark for letters."

Nueces County, of which Corpus Christi is the County seat, was formed in January 1847. The country originally extended to the Rio Grande. Sixteen south Texas counties and parts of several others have been carved from its original confines.

POINTS OF INTEREST

Ocean Drive — From the Chamber of Commerce building, south along Shoreline past the downtown business area, one can drive directly to Ocean Drive. This scenic strip, past fabulous homes and residential properties leads to connections for the Naval Air Station and Padre Island. Look for the Bishop's traditional Spanish style home. It is marked with a cross. Take a brief spin through circular Hewit Drive on your right after passing Bessar Park and Ocean Park. These contemporary residential structures exhibit some of the most modern designs in the world.

Centennial House — The oldest building in the city and is located on a bluff at 411 North Broadway, near the downtown area. It is in perfect repair and stands exactly as it looked in 1848-49.

Centennial and Corpus Christi Museums—The Centennial is at 902 Park Street, next to South Bluff Park. Here, expositions are held featuring the leading painters of the area, as well as occasional displays of a national scope. The Corpus Christi Museum opened in June 1957, contains many wildlife, historic and educational exhibits that will appeal to both youngsters and adults. The exhibits of Padre Island shells and Indian relics, as well as the live turtles, snakes, squirrels, etc., add much to this attraction. The museum is located directly behind the Chamber of Commerce building on Water Street and is open every day in the week except Monday.

Lake Corpus Christi—It is about an hour's drive from the city center and is the body of water

CONVENTION PREVIEW

Corpus Christi Attractions—Sand, Surf, Sails

which serves as the city's main reservoir. It is located on highway #359 south of Mathis, Texas. Take Highway #9 out of Corpus Christi.

Padre and Mustang Islands—Together they comprise a 131-mile long slender strip of sunny beach extending all the way to Mexico. This South Texas landmark, unspoiled by the inroads of civilization, is available to everyone via two fine causeways. For an outing in the sun and along the surf of the Gulf of Mexico, for a drive on a wonderfully smooth beach, or for swimming the year around, no finer site exists anywhere.

Aransas National Wildlife Refuge—About two hours drive from downtown Corpus Christi, offers sights of the nation's wildlife in its own habitat. Birds and game abound, and perhaps most famous of all the creatures of nature which call it their seasonal home, is the Whooping Crane found here from November until April. Turn right 40 miles north of Rockport, on hiway #35.

King Ranch—Only an hour's easy drive from Corpus Christi, it is here that you will see the Santa Gertrudis feeding corrals, and view the Texas Longhorn cattle. Also beautiful thoroughbred and quarter horses and the historic ranch house can be seen on occasions. This is a near-million acre spread, and the largest of all the world's ranches. Take highway #44 west of the city, then left at Robstown on Highway #77. The ranch headquarters is located on the west side of Kingsville on highway #141.

La Bahia Mission—This was an important military objective throughout the period of the Texas revolution. Many historic battles were fought at the fort which is located at Goliad, only 77 miles north of Corpus Christi. Also in Goliad are the Mission Espiritu Santo de Zuniga and San Rosario.

Goose Island State Park—The only Texas State park where sea fishing is available. A large part of the park's 307 acres are on the mainland, to which the island is connected by a vehicle bridge. The Giant Oak tree located there is a charter member of the Live Oak Society of America. It is 32-feet, one inch in diameter at a point 4 feet above the ground and has a crown spread of 140 feet. It is 80 feet high and reputed to have been an execution site for the coastal Indian tribes and for early white groups that supplanted the Redmen. Under it the Tonkawas are said to have held their councils. The tree is estimated to be 2,000 to 3,000 years old.

Old Mexico—It is only a short three-hour drive away at most and offers the exciting flavors of another world in the Rio Grande cities of Matamoros, Reynosa, and Nuevo Laredo. No visa is required for a jaunt to these border communities. For a truly thrilling trip to Monterrey or to Mexico City, a visa may be obtained from the Mexican Consul in Corpus Christi.

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Photo Contest

Fifteenth Annual Meeting
Corpus Christi, Texas
January 23-26, 1962

Eligibility

Any member of the American Society of Range Management may participate. He need not be present, but it is his responsibility to have his entries delivered to the Contest and Displays Committee and returned. All photographs must have been taken by the contestant except in the range vegetation trend categories in which at least one of the pictures in the sequence must have been taken by the contestant.

Entries

1. A member may enter a maximum of five exhibits, but not more than one in each category.
2. Black and white photographs should be 5 x 7- or 8 x 10-inch prints of glossy or mat finish. They should be mounted in such a manner that the photo will remain flat.
3. Color slides must be 2 x 2-inch mounts. It is recommended that duplicates, rather than the original slides, be exhibited.
4. A typed description of 50 words or less on a 3 x 5-inch card should accompany each black and white photo. The description should include at least the title, location, and date of the photograph.
5. The contestant's name and address should be on the back of each photograph and the mounting of each slide.
6. The deadline for placing photos on display will be Tuesday, January 23, 1962 at 2:00 p.m.

Categories

Black and white

a. Individual range plant
b. Individual range animal
c. Range condition
d. Structural range improvement
e. Range or ranch scene
f. Range vegetation trend (sequence of two or more photos to show changes in native vegetation or results of cultural treatment)

Color slides

Categories a. to e. the same as black and white.

The contest and Displays Committee will determine that entries are assigned to proper categories at the time of entry.

Scoring

Each person who registers for the meeting will receive a ballot. The hours for voting will be stated on the ballot.

Awards

A prize will be awarded to the winner of each of the twelve categories. A grand champion award will be presented to the entry receiving the most votes. Awards will be presented at the banquet.

Journal Covers

Winning entries will be eligible for selection as cover pictures for forthcoming issues of the Journal of Range Management.

Exhibits and Displays

State and Area Sections and other professional organizations are urged to prepare exhibits for display during the annual meeting.

Members of the committee will assist in placement of exhibits Monday evening and Tuesday morning January 22 and 23.

All exhibits will be judged and recognition given to the exhibitors.

New Publication

GOLD AND CATTLE COUNTRY—a new book by HERMAN OLIVER and E. R. JACKMAN isn't just about the West; it is the West. Both men are well known to members of the American Society of Range Management. OLIVER is a colorful and successful rancher now retired to banking. JACKMAN, long-time range management specialist at Oregon State University, is a top notch writer—writing often with a humorous slant, and always with a fresh point of view.

This book is a first-hand account of life in Oregon's John Day Valley that, in a larger way, applies to every little beef-raising valley in the West. It makes as good reading in Montana, Wyoming and Arizona as it does in the town of John Day. It is history—76 years of it—chock-full of wit and wry wisdom, of a man's unflinching faith in his chosen profession. It contains stories of gold days in early Grant County, of catching wild horses, of freighting, of stage coaching, many of them never before in print.

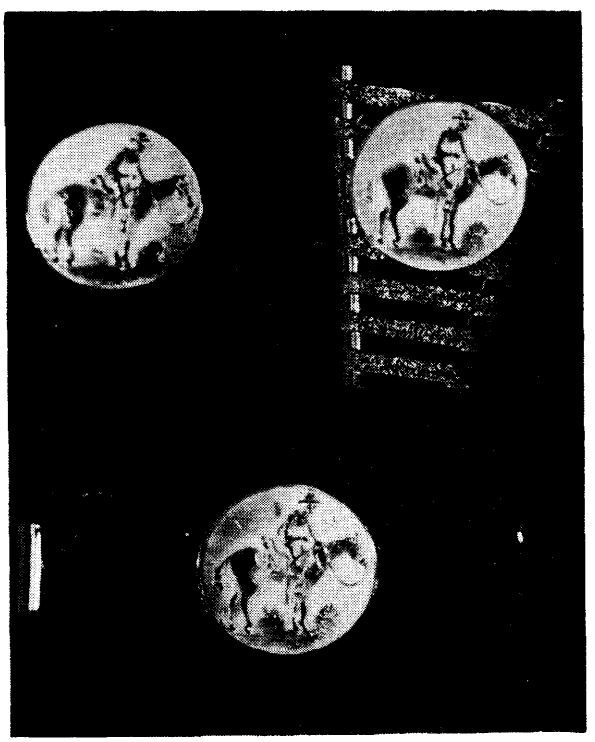
The homesteaders, the stockmen, the 1000 references to Oregon persons and places are all real. Dozens of true anecdotes emerge from corral and cow camp, each authentic down to the last button on the levis. Peering from the pages are drummers, outlaws, sun-cured sheepmen—and Oliver's grand old Portuguese father, Joe, with his sturdy philosophy, tied to the soil; his almost fanatical belief in the people who work with cattle.

HERMAN OLIVER is the best-known cattleman in the state of Oregon. The Oliver holdings in Grant County stretched across 54,000 acres of rolling ranchlands. The A2 brand is a guarantee throughout the West of quality and uniformity—of those typical big, wide Oliver cows.

Professors came from great universities, cowboys from lonely corrals, to study the famous Oliver methods of selective breeding, proper feeding and pasturing—infallible keys to the unique success of Herman Oliver, John Day cattleman.

The Oliver-Jackman combination was fortunate. During 40 years the two have been friends. They think so much alike that it is hard for the reader to say where author Oliver stops and editor Jackman begins. "Jack" knows Oregon better than any other man. You can't get so far back at the end of a road that he hasn't been there. His duties as farm crop and range specialist with Oregon State University at Corvallis have taken him to every county and community in Oregon.

The first edition of "Gold and Cattle Country" was published by Binford and Mort, 2505 S.E. 11th., Portland, Oregon. The price is $4.50.



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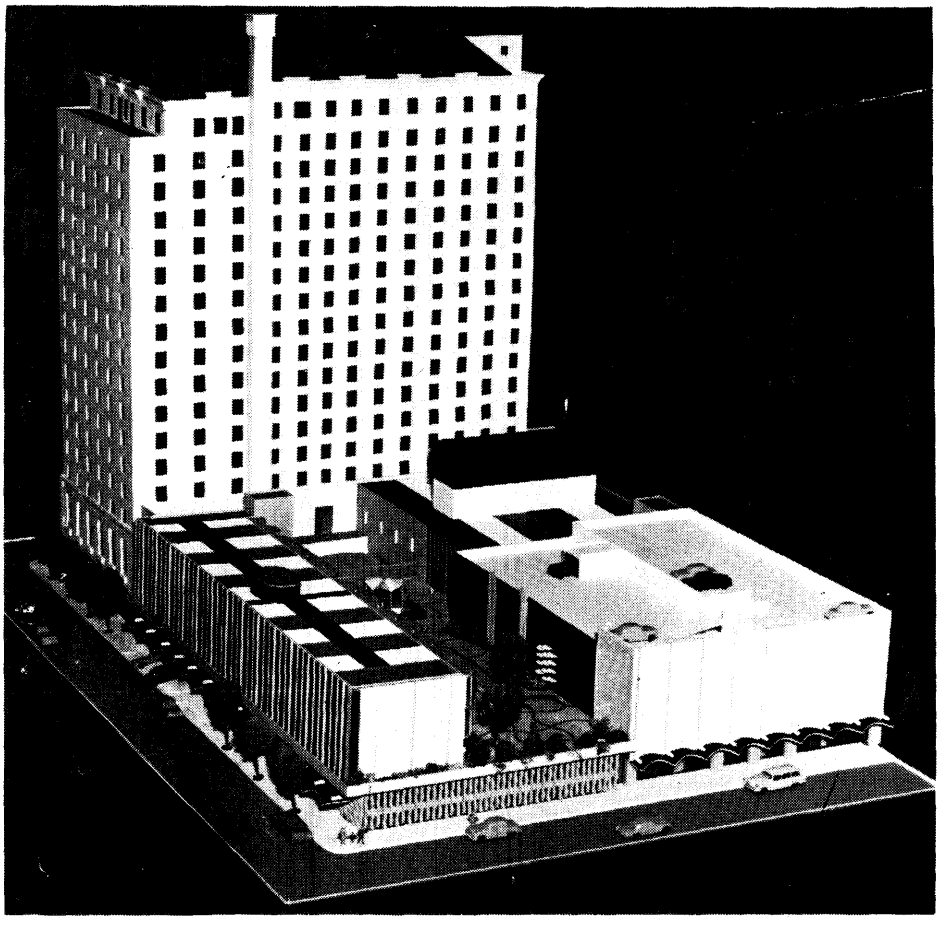

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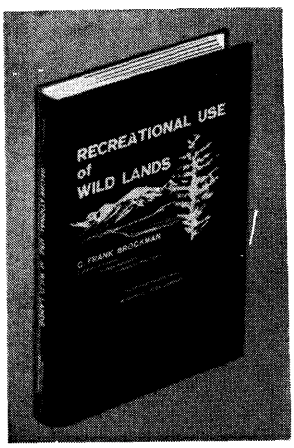

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