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The Grazing Value of Intermediate Wheatgrass in the Bitterroot Valley of Montana*

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Intermediate wheatgrass *(Agropyron intermedium)* has become increasingly important as a dry-land pasture grass in western Montana as well as in other sections of the West. Its relatively high yields of herbage, its ability to remain green and palatable through much of the summer and its capacity to propagate by seed and rootstocks, make it a desirable species for sites having adequate moisture conditions.

The high price of seed has favored production for seed rather than pasture in the Bitterroot Valley. Many of these seedings are in row spacings up to 40 inches wide and produce a coarse stemmy appearing plant. This has led to much discussion of the value of this species for pasture particularly when seeded in wide rows. It is the purpose of this study to determine the grazing value of this species for summer pasture when grown in wide row spacings in this area.

LOCATION, CLIMATIC AND SOIL CHARACTERISTICS OF THE PASTURES

The study area was located on the Hagen ranch which is 5 miles northeast of Stevensville. The intermediate wheatgrass stands selected were established in 1950 on land formerly used for dry-land wheat productiton. The seeding was in 40-inch row spacings. One crop of seed was harvested in 1951. These stands occupy moderate slopes and benchlands.

The precipitation records of the U. S. Weather Bureau for Stevensville were used to describe climatic conditions of the study locality, although the ranch is about 300 feet higher and may receive somewhat more precipitation than Stevensville. Table 1 summarizes the precipitation by years starting September 1 of one year and extending to August 31 of the following year. This grouping of months was made because it was assumed that the previous fall moisture as well as other seasonal moisture would influence the herbage growth and production of the current year.

The average annual precipitation for Stevensville is 12.43 inches. For the years of the study, the precipitation for the 1951-1952 period was 13.66 inches; 1952-1953 period 10.71 inches; 1953-1954 period 13.15 inches; and for the 1954-1955 period it was 11.50 inches. The first and third years were 1.23 and .72 inches above average respectively, while the second and fourth years were 1.72 and .93 inches below average respectively. However, the sum of the May-June precipitation for the years of the study are somewhat higher than the long time average for the sum of these two months. Note the satisfactory fall moisture preceding the first grazing season and the abnormally low fall moisture for the next two grazing years. Except for the unusually dry falls in 1953 and 1954, and a somewhat higher May-June

*Clarence Hagen, on whose ranch the study was conducted, provided livestock, constructed the necessary fences, and assisted generally in the planning and execution of the study.

TABLE 1. SEPTEMBER-AUGUST PRECIPITATION FOR STEVENSVILLE, MONTANA, IN INCHES. WEATHER BUREAU DATA.

Period	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Total
Longtime Ave.	1.26	1.08	1.03	1.03	.78	.76	.80	.83	1.43	1.65	.86	.92	12.43
1951-1952	.90	1.42	.79	1.62	.57	1.04	.62	.27	3.39	1.49	1.17	.38	13.66
1952-1953	.26	.16	.74	.51	2.91	.97	.35	.59	2.56	1.29	.05	.32	10.71
1953-1954	.32	.04	.94	.98	2.77	1.01	.35	.75	1.33	1.92	1.35	1.39	13.15
1954-1955	1.15	.55	.27	.75	.51	.44	1.90	1.03	1.96	2.60	.88	.00	11.50

value in 1955, the moisture conditions appeared to be about average for total precipitation for the four years of the study. Temperature as well as precipitation influences plant growth. The spring temperatures of 1953 were below average and probably retarded the rate of growth after grazing started. The spring of 1955 was also below average and accounts in part for the late date of initial grazing.

The soils on the three pastures used were not uniform in texture but varied from stony loams in parts of two pastures to clay and silt loams of low organic matter content. In two of the pastures some alkali spots were present. These soils could be considered about average in quality for grass production before fertilizers were applied.

GENERAL PLAN OF THE STUDY

This study was planned to produce three intensities of grazing which would represent heavy, moderate and light grazing for summer pasture. Since stand ratings, including potential yield, could only be approximated at the beginning of the study, the relative rates of stocking were established by stocking each pasture with the same number of stock and varying the size of the pastures. The actual acres per pasture were 4.2, 10 and 15 for the heavy, moderate and light grazing respectively. Because the stands were not uniform the acreage was adjusted to equivalent stands. The pasture acreages of equivalent stands were estimated to be 4.2, 8 and 13 acres respectively. Eight yearling heifers were used in each pasture the first year. In 1953 eight heifers were used in the 4.2 acre pasture, while twelve heifers were started in the 8 and 13 acre pastures because of excess forage left in them in 1952. They were reduced to eight heifers in the 8 acre pasture before the season was over. In 1954 and 1955, eight heifers were used in all three pastures. The per acre allowance was .5, 1.0 and 1.6 acres per heifer.

In planning the study, it was expected that 120 days of grazing would be available on all three pastures and particularly on the two larger pastures. In that no previous information on herbage production and forage use on these stands was available, the pasture period was subject to change, depending on pasture use and animal condition. The pasture period varied from 40 days to 65 days in the small pasture (Table 2), and from 101 to 120 days on the 8 acre pasture. The 13 acre pasture provided 120 days of grazing three out of four years.

In that the length of the pasture period was not equal for all three pastures, it may be questioned that three intensities of grazing exist. It is significant that three intensities do exist because of the period of time in which the forage was grazed to the stubble heights indicated in Table 2. In the small pasture nearly maximum use was obtained in 40 to 60 days. In the other two pastures it required about 100 to 120 days to reduce the herbage to the stubble heights indicated. Table 2 presents the data on the relative use of the pastures as measured by the pasture period, animal days per acre and stubble height. The three pastures will be identified in the remainder of the report as the heavily, moderately and lightly stocked pastures.

The height growth at the time of initial grazing was considered of major importance in the study. In order to get the most out of the grazing it was considered essential that the grass growth should stay ahead of the grazing. A ten-inch average height growth

FIGURE 1. Late May growth in the moderately stocked pasture. Note the well developed leafy crown of the grass.

FIGURE 2. Height growth of grass at the end of the growing season in the moderately stocked pasture.

at initial grazing was approximated every year but the last, when the actual height was fifteen inches. The moderately stocked pasture stand was used for this reference condition. The initial dates of grazing were May 6, 1952, May 7, 1953, May 17, 1954 and May 19, 1955. Figure 1 shows growth of grass in the moderately stocked pasture in late May, 1955. Figure 2 shows growth made by the end of the same growing season.

Registered Hereford heifers were used in the first three years of the study. Commercial heifers were used the last year. They did not have the quality of the registered cattle. The initial weights averaged 474 pounds in 1952, 497 in 1953, 561 in 1954, and 465 in 1955. The first year of the study, 1952, the animals were weighed in groups by pastures and then weights adjusted for a four percent shrink. In 1953, holding pens and a scale were installed near the pastures and the animals were weighed singly after being held overnight a minimum of twelve hours in the holding pens. See Figure 3 for type of cattle used.

An application of 125 pounds of ammonium nitrate (33% nitrogen) per acre was applied in 1952. In the spring of 1953, 300 pounds of 16-20-0 ammonium phosphate per acre was used. In the spring of 1954 ammonium nitrate at the rate of 266 pounds (33% nitrogen) per acre was applied on only the heavily and moderately stocked pastures. In 1955 ammonium nitrate was used again and applied on all three pastures at the rate of 150 pounds per acre.

The pastures were cultivated once every year except the first year. This was done mainly to retard the growth of cheatgrass so that the forage would be almost exclusively intermediate wheatgrass. This was done solely for the purpose of experimental control and would not be necessary under ordinary ranch use. It is possible that the cultivation may have reduced the competition for soil moisture and contributed to a high yield of the intermediate wheatgrass stands.

RESULTS OF THE STUDY

In evaluating these grazing trials, the following were considered the important criteria: animal days of grazing per acre, beef production per acre, daily and total gains per animal, pasture utilization, as well as condition and permanence of forage. Although no one of these factors will serve satisfactorily to establish the best method or degree of use, all of them plus an economic appraisal of the results will provide an adequate basis for determining the value of this grass and the best method of use.

Animal Days of Grazing

The first measurable effect of the stocking rates is the number of heifer days of grazing per acre (Table 2). The moderately stocked pasture provided the greatest number of

TABLE 2. ANIMAL PRODUCTION AND PASTURE USE PER ACRE UNDER LIGHT, MODERATE AND HEAVY RATES OF GRAZING ON INTERMEDIATE WHEATGRASS PASTURES, 1952-1955.

	Relative Rates of Stocking											
	Light				Moderate				Heavy			
	1952	1953	1954	1955	1952	1953	1954	1955	1952	1953	1954	1955
Number of heifers	8	8+4*	8	8	8	8+4*	8	8	8	8	8	8
Acres per heifer	1.6	1.1	1.6	1.6	1	.83	1	1	.53	.53	.53	.53
Pasture period, days	120	77	121	120	120	109	101	120	60	65	40	46
Heifer days per acre	74	70	75	74	120	124	101	120	114	123	76	87
Gain per heifer, lbs.	188	199	191	177	192	189	199	197	132	188	86	111
Daily gain, lbs.**	1.6	2.6	1.6	1.5	1.6	1.7	2.0	1.6	2.2	2.9	2.2	2.4
Beef production per acre, lbs.	116	155	118	109	192	228	198	197	251	358	164	211
Herbage ht. at start of grazing, in.	10	10	10	15	10	11	10	15	10	11	10	15
Stubble ht. at close of grazing, in.	***	5		13	***	4	5	9	8	6	3	4

*Four additional animals were added in 1953 to light and moderately used pastures, based on the light use of the two pastures in 1952. However, it was necessary to remove four of the animals from the moderately grazed pasture before the end of the grazing season.

**Daily gains rounded off to nearest tenth.

***Stubble heights over 12-14 inches, not measured.

days over the four year period. The lowest was 101 days and the highest was 120 heifer days per acre. The heavily stocked pasture had the next largest, varying from 76 to 123 heifer days of grazing per acre. The lightly stocked pasture produced the fewest heifer days of grazing per acre.

The limitations of each of the pastures to produce additional animal days of grazing varied. In the heavily stocked pasture, use of the forage had reached a point where a shortage of feed from close use might result in an excessive loss in weight of the cattle and damage to the stand. In the moderately stocked pasture either the point of desirable use was reached or the remaining herbage became less palatable and loss in animal weight might have resulted from lower feed intake. In all but one year the forage in the lightly stocked pasture reached maturity and became less palatable to the cattle. They were removed from the pasture to avoid loss in weight.

Beef Production per Acre

Beef production per acre is frequently used as a significant criterion of a suitable stocking rate if it is related to number of animals involved in the production. If the same production per acre is obtained by two rates of stocking on the same acreage, then the rate of use which uses the fewest animals should be the best rate of stocking. In this case, where the acreage varies per animal, the above deduction is not as easily seen. Nevertheless the relationship is present.

The lightly grazed pasture is the least productive because of the low production per acre and the greatest acre allowance per animal. The heavily grazed pasture appears to be better than the moderately grazed pasture on the basis of beef production per acre because it produced more beef per acre three out of the four years of the study, and because of the low acreage allowance per animal. Such a straightforward evaluation cannot be made of the production of the heavily and moderately stocked pastures. Forty to sixty days is not a long enough grazing period unless animals can be marketed or moved to other pastures. Also, there appears to be a breaking off in the production of the heavily stocked pasture as there was a shorter grazing period the last two years and the beef production fell off the last two years. The first observable death of plants in the stand appeared in the heavily stocked pasture in the spring of 1956. No dead crowns have been observed in the other two pastures.

It is apparent that to fully test the heavy and moderate rates, additional years of grazing are necessary. If there is a definite breaking point in the heavily stocked pasture after a few years of use, an economic analysis would be essential before making a full evaluation of beef production of the heavy rate of stocking.

Daily and Total Gains per Animal

The relationship between time of grazing and greenness of forage is indicated in daily gains and other production characteristics of the three intensities of grazing.

The daily gains, total gains per animal and production per acre for the heavily grazed pasture were made on green feed. The high daily gains and the production per acre (as previously indicated) for this rate of stocking, are due no doubt to the higher digestibility of feed. Had the animals been held on the heavily stocked pasture beyond the time period indicated, the daily gains would have fallen off and a loss in total weight might have resulted.

The gains on the moderately and lightly stocked pastures were made on feed which was green for the first sixty days and gradually reached maturity in the next fifty to sixty days. The daily feed intake and digestibility of the feed probably was higher for the first sixty days than for the last fifty to sixty days. Except for 1952, the daily gains on the moderately grazed pasture were equal to or slightly higher than for the animals on the lightly grazed pasture.

Daily gains of the heifers in the moderately stocked pasture are presented in Figure 4. The relatively high palatability of the grass is evident from the daily gains. Two and one-half to three and one-tenth pounds daily gains were made in the first thirty days. The gains fell off the last

FIGURE 3. Heifers in the heavily stocked pasture.

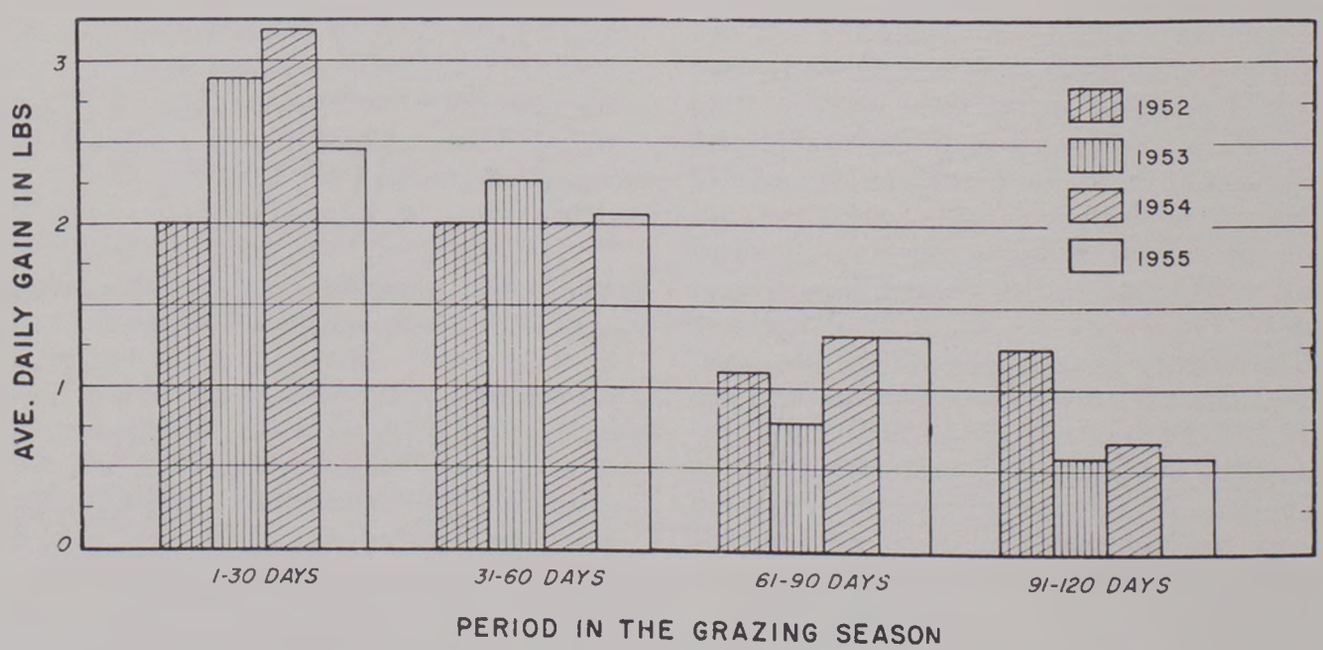

FIGURE 4. Average daily gains of heifers by thirty-day periods for the moderately stocked pasture.

thirty days of each year—approximately between August 10 and September 10. Most grasses would probably provide little or no gain as they reach maturity, and this appears to be true of intermediate wheatgrass. The average daily gains for the period of grazing on the moderately stocked pasture of 1.6 - 2.0 pounds indicate the relatively favorable forage value of this grass. The ability of intermediate wheatgrass to produce gains of 190-200 pounds of beef per animal for the grazing period of 100 to 120 days under moderate stocking would indicate the capability of this grass to produce good quality feeder cattle.

Pasture Utilization

A measure of pasture utilization is essential not only to determine the amount of use made of the forage supply, but also to indicate the relative use which can be made of the forage plants without loss in vigor or even death of plants. The possible effect of various intensities of grazing on maintaining production of a pasture is obvious.

Pasture utilization is difficult to measure. Clipping records of protected plots are of questionable value. The type of plant, especially the ratio of stem to leaf in comparing plants grazed with plants not grazed, is apt to be quite different particularly when grazing use is made on growing plants and clipping checks are made on fully developed plants. In this study the average height of stubble was considered as a rough check on plant and pasture use. In Table 2 the stubble values show that in general more stubble was left in the lightly and moderately stocked pastures than in the heavily stocked pasture.

The 1953 and 1954 figures on stubble appear to be somewhat contradictory and perhaps suggest that the heavily stocked pasture was not grazed any closer than the other two pastures. One significant point about the stubble values becomes apparent when it is recognized that the stubble heights were produced at a much earlier date for the heavily grazed pasture than for the other two pastures. The heavily grazed pasture was grazed down to the indicated stubble heights before the plants matured. Flowering, seed production and reserve food storage were all depressed by the more or less complete use of the plants in the heavily grazed pasture. When the cattle were removed from this pasture, no further growth took place. On the moderately and lightly stocked pastures, the average plant was not grazed down to the stubble heights reported until after considerable flowering, seed development and reserve food storage had taken place in the plants. This last physiological condition usually takes place after flowering and seed development, and before plants become fully mature. The grazing of the plants in the moderately and lightly stocked pastures for the last thirty days of each year was on plants which were nearly mature.

On all three pastures, the stubble values are higher than that encountered on an average pasture. The heavily grazed pasture would not be so classified by the average rancher. Figures 5 and 6 show utilization made of the grass in the heavily and moderately grazed pastures in 1955.

Vigor of Plants

The ability of a stand to start growth early in the spring is a measure of its genetic character and of the treatment it has received. The longevity of plants is likewise due to the same causes. Good vigor and longevity are important characteristics of good forage plants and good management. In the spring the stands in each pasture were checked for plant mortality. No dead plants were found in any of the pastures until the spring of 1956 at which time a loss of 23 per cent of the stand was estimated for the heavily stocked pasture. No dead plants were found in the other pastures; in fact, the stands in the moderately and lightly stocked pastures appeared to be very slowly filling in the spaces between the rows. Height growth measurements made on seed stalks of plants in protected plots and grazed areas showed a differential as indicated in the following data for 1955:

SEED STALK HEIGHTS — INCHES

Pasture	Protected	Grazed
Lightly stocked	—	32.4
Moderately stocked	40.0	31.2
Heavily stocked	39.5	22.7

FIGURE 5. Utilization in the heavily stocked pasture at end of grazing season.

FIGURE 6. Utilization in the moderately stocked pasture near end of grazing season.

This data may suggest a loss in vigor, but, as indicated previously, only the change in habit of growth due to grazing may be involved. On the basis of the available data, the decrease in the length of pasture period and the drop in per acre yields of beef and loss in vigor as well as mortality of plants, are indicative of a falling off in the productivity of the heavily stocked pasture.

AN APPRAISAL OF THE VALUE OF INTERMEDIATE WHEATGRASS FOR PASTURE

The results thus far presented as well as other information obtained in the study permits the following general conclusions. Intermediate wheatgrass has the possibility of use during both spring and summer. The spring use may be for two purposes, either for early feed or in a combination of seasonal pastures with crested wheatgrass or native range. This grass may also be suitable for summer use in connection with irrigated pasture or high quality native range. However, the native range would have to be capable of supplying green feed from mid-August through September.

Observations showed that this grass has a high palatability value until mid-August. While the leaves were generally brown by August 1, the stems remained green for a much longer period. The cattle took this relatively coarse material without discrimination between stem and leaves through most of August.

The moderately stocked pasture appears to be able to sustain a high grazing capacity rate when fertilizer response is obtained. A stocking rate of one heifer per acre for 101-120 days is significantly high in itself. An operator confronted with the necessity of increasing the forage supply of his operation might well be concerned with this fact. Even though the costs may not justify the use of a large acreage in this manner, it might well fit into a ranch operation for a limited period when no other seasonal pasture is yet available. This is frequently the case where an operator has a summer range which is not ready for grazing until late May or sometime in June.

COSTS

While the study was not set up for evaluation of the fertilizer in the production of beef from intermediate wheatgrass pasture, the results secured were dependent upon the use of fertilizer. Therefore, an economic appraisal of the results must include the charge for fertilizer. Another important cost is that of stand establishment. The gross cost must be pro-rated over the life of the stand. While the life of the stand is not known as yet, ten years is taken as a basis for calculation. The production of the pasture should be known for an equal period Since the study has been going only for a four-year period and the stand is six years old from the time of seeding, including one year for establishment and one year for seed production, a full appraisal cannot as yet be made.

Since the annual cost of $7.00 per acre for fertilizer may seem so excessive as to create considerable doubt as to the practicability of such a pasture program, some evaluation of costs and returns is desirable. The cost of establishing the stand on an acre basis, including double disking, harrowing, seed drilling, weed control, and investment charged on money used, is calculated to be eight dollars and seventy-five cents. If this cost is pro-rated over ten years, including one year for stand establishment and nine years for grazing, assuming that the stand will last ten years and continue to produce for the balance of the ten year period as it has for the first four years, the annual cost will be approximately one dollar and thirty cents. The annual production costs other than stand cost would be about eleven dollars, including taxes, fences, fertilizer and investment charge on cattle. The total annual cost then amounts to about twelve dollars and thirty cents per acre.

The gross returns from pasture production is calculated as twenty-seven dollars per acre. This is based on the production of 200 pounds of beef a year for nine years and then pro-rated to a ten-year period or 180

pounds of beef. The heifers produced were considered to grade good or better and priced at fifteen cents a pound.

With total annual production costs of twelve dollars and thirty cents and gross annual returns of twenty-seven dollars, the net annual income per acre would be fifteen dollars and seventy cents and should be available for labor costs in handling livestock, managerial charge, and return on the investment in land and for risk. In other words, the fifteen dollars and seventy cents may be considered as net income.

GENERAL CONCLUSIONS

The results of this study appear to indicate that a high rate of beef production on non-irrigated (dryland pastures) tame pastures, is possible if: (1) the soil is at least of average quality, (2) a species, such as intermediate wheatgrass, is selected and is climatically adapted and responsive to fertilizers, (3) that wide row spacings seem to be essential to intermediate wheatgrass for maximum productivity, and finally (4) the grass must be permitted to grow ahead of the grazing and yet be used when it is most nutritious.