Nutritive Value of Some Browse Plants in Winter

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The general reduction of browse forage upon game ranges in recent years due to high concentrations of game animals has impaired the carrying capacity of many winter ranges. Game herd reductions, especially if accompanied by mild winters, may be sufficient to restore many of these impaired ranges to a satisfactory state of productivity. In other cases more direct measures may be required. Artificial re-establishment of desirable species will doubtless be necessary to renovate the more seriously damaged areas.

The preferences of game animals for different forage species do not provide an adequate basis for the selection of plants to be used in revegetation. Knowledge of the nutritive values of browse plants will aid in selecting superior winter forage, provided that the more nutritious plants are equally well suited to revegetation procedures. These considerations led to digestion studies of native forages. Some results were reported earlier (Smith, 1952). These data complete the digestion studies thus far conducted.

Procedures

The deer were confined to specially designed digestion cages (Smith, 1950a and 1952). The forage offered was collected from the range and brought to the feeding site where, by means of hand clippers, the buds and current twig growth were removed. This procedure, though laborious, permitted more accurate determinations of forage consumption and aided in securing representative samples for chemical analyses.

The chemical determinations were made by chemists in the nutrition laboratory at Utah State Agricultural college. Methods of feed fractionation and analysis common to digestion trials were employed.

Plants tested were birchleaf mahogany (*Cercocarpus montanus*), cliffrose (*Cowania stansburiana*), chokecherry (*Prunus virginia* var. *melanocarpa*), and oak (*Quercus gambelii*). Two additional tests were made on Utah juniper (*Juniperus utahensis*). An attempt was made to conduct trials using sumac (*Rhus glabra*) but the deer refused to eat it. No explanation could be found for this behavior for it is observed to be eaten by deer in the wild.

The animals used varied in age from fawns to mature animals and exhibited various degrees of domesticity. Some had been raised as pets and were fairly tractable under handling. Others had been caught in the wild and had been kept in the pens for varying periods prior to being used. In general, the wilder animals, although being more troublesome to put into and remove from the cages, behaved better under confinement provided the cages were darkened. If it was possible for them to see through openings in the cage walls they became disturbed during the process of feeding and collection of the excreta. By contrast, animals that were raised as pets, on the approach of anyone, kept up a continual bleating and pacing within the confines of the cage and, in general, accepted the poorer forage species less readily. In no case was an animal trapped from the wild and immediately placed in a cage.

Results

The average composition and digestion values secured are shown in Table 1. The digestibility coefficients are lower than comparable figures for most ordinary stock feeds, and lower than those found in the case of sagebrush (*Artemisia*

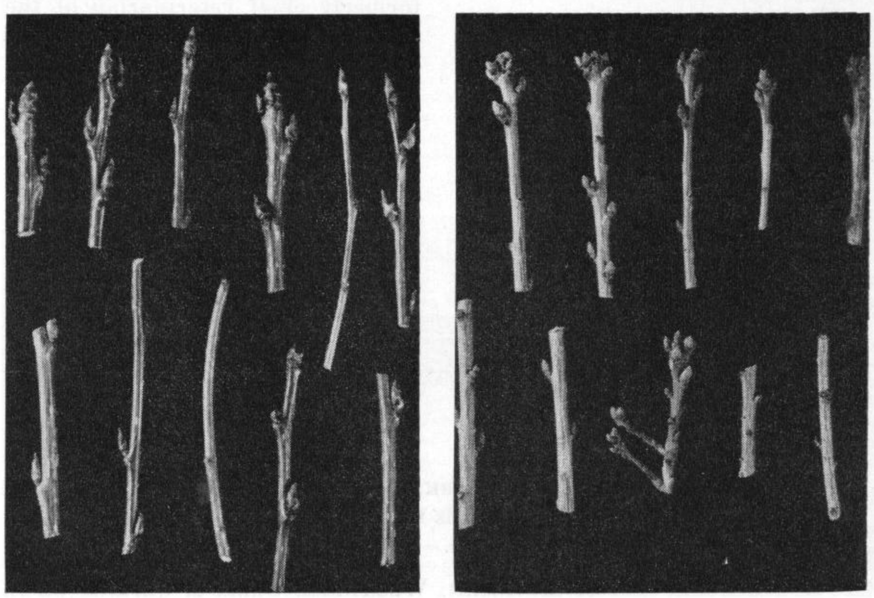

FIGURE 1. Material of chokecherry, *left*, and oak, *right*, as it appeared ready to be offered to the animals.

Table 1. Average percent composition and digestibility of some native browse plants during winter.

	No. of tests	Composition: Protein	Composition: Ether extract	Composition: Crude fiber	Composition: Nitrogen-free extract	Digestion Coefficients: Protein	Digestion Coefficients: Ether extract	Digestion Coefficients: Crude fiber	Digestion Coefficients: Nitrogen-free extract
		%	%	%					
Juniper*	4	6.2	14.1	24.9	50.3	16.8	58.9	33.7	70.4
Birchleaf mahogany	4	7.2	4.5	34.7	52.1	48.5	37.6	31.8	60.0
Cliffrose	5	8.4	10.8	23.0	52.6	39.8	47.7	4.4	59.4
Chokecherry	4	9.9	2.4	29.1	53.6	48.4	23.3	8.8	56.1
Gambel oak	5	5.4	3.2	34.0	51.0	10.7	38.4	16.6	53.6

*Includes data from two tests reported earlier (Smith 1952).

tridentata) and curlleaf mahogany (*Cercocarpus ledifolius*). Especially low digestion values were secured for protein in juniper and oak, and for crude fiber in cliffrose and chokecherry.

Table 2 shows the digestible nutrients present in all the browse plants tested in these and earlier trials. Some common livestock feeds were selected from Morrison (1943) and their nutritive values included in order to provide a basis for comparison with the forages tested. It is not possible in all cases to find livestock feeds which have closely similar values. It would appear from these comparisons that the browse plants tested are but fair to poor roughages. The best of them might be considered to be acceptable maintenance rations. The poorer ones are perhaps not adequate maintenance forages.

Only sagebrush and curlleaf mahogany appear to be reasonably nutritious forages. Juniper and oak have especially low nutritive values in the case of protein. Chokecherry provided few digestible nutrients from the ether-extract or the crude-fiber fractions. Even fewer nutrients were provided by the crude fiber in cliffrose.

Admittedly, there may be a source of error in the data secured. Many of the plants are high in ether extract, part of which is probably composed of volatile oils. These oils disappear from the plant residues during the process of digestion but may not be assimilated by the animal. Ordinary digestion calculations make feeds appear to be more valuable than they actually are when unutilized materials are present in the ether extract fraction. Were it possible to correct for the materials not utilized by the animal nor appearing in the collected waste products, the balance between protein and other fractions would be improved. The wide nutrient ratios shown here may not in actuality exist. Juniper and sagebrush especially might prove to be much lower in total nutrients than these data indicate. Some idea of the magnitude of this error can be secured in the case of juniper. Previous tests have shown that the volatile oil content of Utah juniper averaged 2.10 percent (Smith, 1950). This amounts to 15 percent of the ether extract fraction or approximately 4 percent of the total nutrients. Disregarding this portion under the assumption that it contributes nothing to the animal would reduce the total digestible nutrients to 60.8 rather than 63.5 as here calculated.

No attempt was made to obviate this source of error in the earlier tests. In some of the last tests

Table 2. Digestible nutrients in pounds per hundred pounds (oven dry) of browse plants compared with nutrients in some common livestock feeds.

	Protein	Ether extract	Ether extract x 2.25	Crude fiber	Nitrogen-free extract	Total digestible nutrients	Nutritive ratio
Sagebrush	7.3	8.8	19.8	10.0	41.0	78.1	1: 9.7
Common millet hay	8.2					68.9	1: 7.4
Curlleaf mahogany**	6.0	4.0	9.0	6.9	43.6	65.5	1: 9.9
Timothy hay (before bloom)	6.3					56.6	1: 8.0
Juniper	1.0	8.3	18.7	8.4	35.4	63.5	1:62.5
Milo stover	1.2					53.6	1:43.4
Birchleaf mahogany	3.5	1.7	3.8	11.0	31.3	49.6	1:13.2
Field pea straw	3.5					57.4	1:15.2
Cliffrose	3.3	5.2	11.7	1.0	31.2	47.2	1:13.3
Sudangrass straw	3.6					49.3	1:12.5
Bitterbrush**	2.7	3.0	6.8	5.8	29.6	44.9	1:15.6
Bunchgrass hay	2.9					53.1	1:17.0
Chokecherry	4.8	0.6	1.4	2.6	30.1	38.9	1: 7.1
Alfalfa straw	4.9					46.0	1: 8.4
Oak	0.6	1.2	2.7	5.6	27.3	36.2	1:59.3
Corn husks	0.5					45.7	1:86.3

* Nutrient data on common feeds from Morrison (1943).

** The values reported for curlleaf mahogany and bitterbrush differ slightly from those reported earlier (Smith, 1952) since they were first reported on an air dry basis.

energy determinations of the forages were made, but due to misunderstanding between the persons making the collections and the chemists, it was possible to complete calculations on only five tests. Two sets of data for oak showed 1.14 and 0.83 Calories of metabolizable energy per gram of food material consumed. In two tests cliffrose gave values of 1.64 and 1.06 Calories per gram, and in a single test chokecherry gave a value of 1.14 Calories per gram. These values compare with metabolizable energy values of 1.64 and 1.26 Calories per gram for timothy hay and wheat straw respectively.

Attempts to use specific gravity values of the urine from these tests, to calculate metabolizable energy values for the digestion tests of the same species made earlier, yielded results so variable that they were regarded as valueless. These results were not unexpected, for it had been observed that the urine output and its apparent density varied tremendously among individual animals while on the same feed. The meager data secured do not, however, indicate that the comparative nutritive ratings of these three species secured from digestion trials is unfair. Moreover, the basis for determining any measure of energy production involves the assumption that the loss of energy through gaseous discharge is the same as it is with domestic animals on common livestock feeds. It is doubtful, therefore, that greater precision results from attempts to determine energy values of such forages as were tested so long as no respiration chamber data exist for plant materials of similar kinds.

It must further be recognized that feed values other than digestible nutrients are not here considered. Vitamin contents, for example, of living plant materials are very likely superior to the dried forages to which comparisons are made.

Two of the plants reported, bitterbrush and sagebrush, have been used in digestion trials in California (Bissell, *et al.,* 1955). The results secured there gave lower TDN values in the case of sagebrush and higher values for bitterbrush than have been found by us. No clear reasons for the differences found appear, although it may be noted that the level of intake of sagebrush achieved by us was more than twice that secured by Bissell —1.32 lbs. per hundred weight as compared to 0.6. Moreover, our own figures are supported by digestion values secured from sheep (Smith, Turner, and Harris, 1956). By contrast, less bitterbrush was consumed in our trials than in the California trials, a fact which may have influenced the values secured.

Summary

Birchleaf mahogany, cliffrose, chokecherry, and oak were used as feeds in conducting digestion trials with mule deer. The digestion coefficients secured were somewhat lower than those found for sagebrush and curlleaf mahogany in earlier tests.

Calculations of the total digestible nutrients reveal that the nutritive levels of the range plants tested are from fair to poor during the winter months, when the tests were made. However, the apparent nutritive contents of these plants may differ from their actual values due to the volatile oil contents of the plants tested. The oil contents are known to be high in juniper and may possibly be so in other species. Digestion calculations have the characteristic of attributing values to the volatile oil fractions which are probably not utilized.

An attempt was made to avoid the error involved from this source by making energy determinations of the materials tested. Through misunderstanding, only five sets of energy data were secured involving but three of the species tested. The data thus secured, though meager, do not indicate that energy determinations of the feeds and by-products provide a more critical measure of nutrient value than total digestible nutrients based, as they are, upon the use of average values secured from quite dissimilar feeds and with domestic animals.

Two of the plants tested have been subjected to similar tests in California. In the case of sagebrush our values are higher, and with bitterbrush, lower, than were secured by the investigators there.

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