

Consumption of Native Forage Species by Captive Mule Deer During Summer

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AMONG the problems related to evaluating the degree to which competition takes place between game species and domestic livestock are those of determining the forage species which are preferred by each class of animal and the amounts of forage consumed. Field observations may be expected to yield qualitative results. Methods of analyses which have been used to date are poorly adapted to providing quantitative data, although forage estimates in terms of weight may under certain conditions be practicable. In consequence of the importance of information relative to forage consumption and the problems involved in securing such information, studies were conducted in which mule deer were confined to pens and fed fresh native forage.

PROCEDURE

During the summers of 1947 and 1948, two mule deer were held captive near Logan, Utah and fed fresh forage daily. The feeding period began in May 1947 and near the first of June 1948, terminating in each instance about the first of October. During 1949 and 1950 both deer and sheep were fed for one-day periods to determine the relative preference for individual forage species.

The deer used for the summer-long feeding periods were trapped on a state feeding ground during March of 1947. They were short yearlings at the time, hence were one and two years old during 1947 and 1948, respectively. During 1949 a yearling doe caught from the range during the winter of 1948-49 and a two-year-

old buck which had been caught as a fawn and raised as a pet were used. In 1950 the same buck was used as in 1949 and a yearling doe which had been trapped during the previous winter. The sheep used were dry ewes which had been culled from range bands prior to entering the summer ranges.

The animals were held in individual pens. Forage was collected from the ranges in the vicinity. Browse forage was collected by cutting stems of the brush and tying these into large bundles. The bundles were then placed upright against a rack where they were secured by means of wire. The cut stems were inserted in cans filled with water. Each bundle was weighed when it was placed in the pens. Additional bundles were weighed and disposed in a manner similar to those offered the deer but were placed out of reach of the animals. When the browse was removed from the pens and weighed, these check bundles were reweighed as a means of calculating what the weight of the browsed bundles would have been had no consumption of forage taken place from them.

Samples of the browse were taken from the check bundles when the material was removed from the pens. These were dried and used to determine the dry weight basis of the material consumed. Experience indicates that samples can be removed which contain the same proportion of leaves and twigs that the deer remove.

The main object of keeping plants in water was to insure that the foliage would

be maintained in a fresh attractive state. This objective was accomplished in the main, although not all plants reacted alike under this treatment. Some species lost moisture quite rapidly and at the end of the twenty-four hour period appeared rather wilted. The willows especially were observed to behave in this fashion. Others such as curlleaf mahogany and juniper increased in weight upon being placed in water. Elderberry was found not to be adapted to feeding in this fashion and after one or two trials the foliage was removed in the field and fed as were the herbaceous plants.

Herbaceous plants were clipped in the field and placed in mangers. During the early summer they did not wilt severely, but as the weather became dry and warm, they remained fresh but a short time.

both the browse and herbaceous feeds fresh and attractive.

Samples of the forage were taken for determination of the dry weight when the material was placed in the manger. Material not eaten was removed from the manger and reduced to dry weight. This weight was subtracted from the total placed in the manger after that had been corrected to dry weight on the basis of the sample taken.

The feeding tests were discontinued about October 1. At that time the leaves were falling and it was believed that further tests would be inaccurate.

RESULTS

Table 1 shows the average daily consumption of forage classes by the two deer during three-week periods.

TABLE 1

Average daily consumption in pounds by two mule deer during the summers of 1947 and 1948 by periods, and average consumption in pounds per hundredweight (air dry)

PERIOD DATES	1 MAY 1-30	2 MAY 31- JUNE 20	3 JUNE 21- JULY 11	4 JULY 12- AUG. 1	5 AUG. 1-22	6 AUG. 22- SEPT. 12	7 SEPT. 13-30
YEAR	1947*	1947 1948	1947 1948	1947 1948	1947 1948	1947 1948	1947 1948
<i>Browse</i>							
Deer 84	0.81	1.46 2.50	1.89 3.55	1.60 3.02	2.48 3.13	3.14 4.35	3.81 4.97
Deer 85	0.88	1.56 1.96	1.72 3.06	1.62 2.69	2.48 3.03	3.00 3.85	4.01 4.15
<i>Herbs</i>							
Deer 84	1.28	1.24 1.54	1.23 1.94	0.96 1.20	0.69 1.08	0.73 1.13	0.52 0†
Deer 85	1.30	1.09 1.49	1.16 1.33	0.95 1.23	0.65 1.38	0.68 0.70	0.61 0
<i>Total</i>							
Deer 84	2.10	2.70 4.03	3.12 5.49	2.55 4.22	3.17 4.21	3.87 5.48	4.32 4.97
Deer 85	2.18	2.65 3.46	2.88 4.40	2.56 3.92	3.14 4.40	3.68 4.55	4.62 4.15
<i>Consumption, pounds/cwt</i>							
Deer 84	3.13	3.48 3.74	3.68 4.71	2.76 3.44	3.12 3.43	3.57 4.31	3.84 3.67
Deer 85	2.91	3.15 3.56	3.18 4.24	2.65 3.55	2.99 3.75	3.23 3.64	3.87 3.16

* Feeding was not conducted during May 1948.

† None offered.

This was partly counteracted by erecting a canopy of camouflage netting over the feeding pens and spraying the manger, the walls, and the surrounding ground with water. The resulting increased humidity and shade aided in keeping

There is a noticeable increase in the amounts of browse material consumed from period to period while there is a corresponding decrease in consumption of herbaceous material. This decrease in the amount of herbaceous material con-

sumed is attributable to the fact that the herbs dry up as the season advances, hence, during the last months few species were sufficiently green to attract the animals. Browse then made up the greater part of the diet.

In the early spring and summer, forbs appeared to constitute the bulk of the feed. This is not verified in all cases by the data in Table 1. The moisture content of the forbs was consistently higher than in the case of browse species. For this reason, although until mid-summer the total volume of browse consumed seemed less than the volume of forbs eaten; only in May was the consumption of herbaceous material greater than that of browse on a dry-weight basis. By the middle of September 1948 herbaceous material was so dry as to become of little significance. During 1947 more favorable moisture conditions existed and herbs constituted more than 15 percent of the diet even during late September. Figure 1 shows the average percentage of the daily diets made up of browse and herbs throughout the feeding period.

The data on consumption by species are given in Tables 2 and 3. Two factors

make these data imperfect measures of forage preference. The great number of species involved made it impossible in the time period involved to form all the possible combinations of species. Furthermore, the amount consumed from any species varied greatly from one feeding to another, making it difficult to insure that every species fed was equally available at all times. These factors probably make it impossible to evaluate precisely the preference shown toward any species. It is believed, however, that these data are indexes of the desirability of the species fed as forage for deer.

Other species than those shown in Tables 2 and 3 were fed. Only those with average daily consumption equal to or greater than five percent of the average daily forage intake are included. In general, consumption of the browse species was higher than that of forbs. Only four forbs ever constituted as high as 20 percent of daily food intake.

During specific periods, forb species were found to be of greater importance than indicated by the averages in Table 3. During period one the browse leaves were poorly developed and early growing

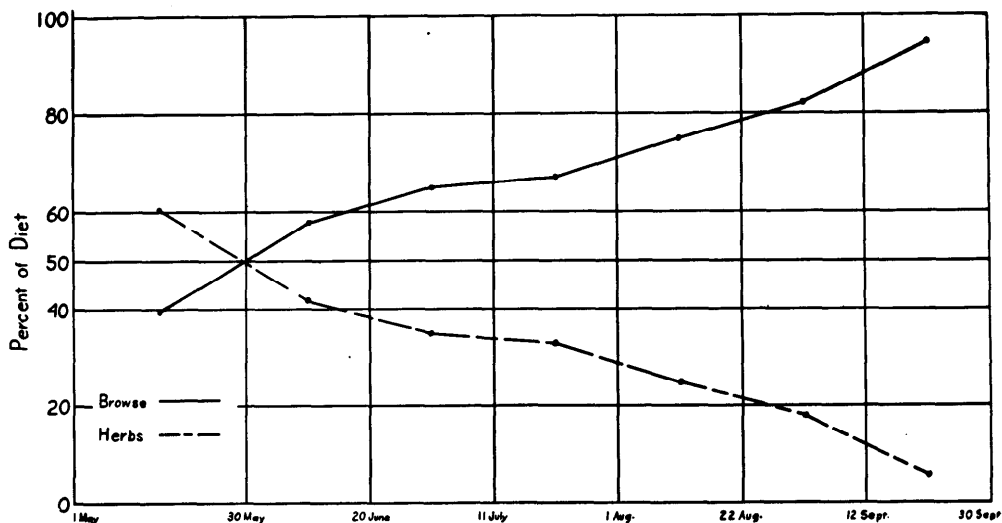


FIGURE 1. Percent of browse and herbs in summer diet of mule deer

TABLE 2

Preference indexes of northern Utah range forage for mule deer during summer*

SPECIES	PERIOD							AVERAGE FOR SUMMER
	1	2	3	4	5	6	7	
Browse								
<i>Salix scouleriana</i> (Willow).....	—†	18	29	19	32	48	39	32
<i>Cornus stolonifera</i> (Dogwood).....	—	14	22	17	39	32	37	27
<i>Quercus gambelii</i> (Gambel oak).....	—	13	20	32	21	33	37	26
<i>Salix exigua</i> (Sandbar willow).....	—	23	21	22	26	32	25	25
<i>Populus tremuloides</i> (Aspen).....	28	24	20	19	28	28	33	24
<i>Rhus glabra</i> (Sumac).....	22	12	22	22	14	33	19	22
<i>Amelanchier alnifolia</i> (Service berry).....	7	18	16	23	29	28	56	21
<i>Acer glabrum</i> (Rocky Mountain maple).....	—	9	3	16	16	26	27	20
<i>Cercocarpus ledifolius</i> (Curleaf mahogany).....	19	15	13	21	24	34	27	20
<i>Prunus melanocarpa</i> (Chokecherry).....	14	18	22	20	25	33	27	20
<i>Rosa spp.</i> (Rose).....	20	18	17	16	30	21	28	20
<i>Salix bebbiana</i> (Willow).....	—	15	20	17	21	26	12	20
<i>Sambucus coerulea</i> (Blue elderberry).....	23	9	12	19	21	23	25	19
<i>Ceanothus velutinus</i> (Snowbrush).....	—	20	16	17	23	12	17	18
<i>Pachystima myrsinites</i> (Mountain myrtle).....	—	20	12	14	33	23	19	17
<i>Cowania stansburiana</i> (Cliffrose).....	—	27	15	5	27	8	8	15
<i>Rubus parviflorus</i> (Thimbleberry).....	—	0	18	12	27	16	5	15
<i>Sorbus scopulina</i> (Mountain ash).....	—	—	7	8	8	9	29	15
<i>Ribes aureum</i> (Golden currant).....	—	13	16	29	—	—	—	15
<i>Cercocarpus montanus</i> (Birchleaf mahogany).....	10	21	13	20	14	11	17	13
<i>Lonicera involucrata</i> (Honeysuckle).....	—	9	8	15	18	19	18	13
<i>Betula fontinalis</i> (River birch).....	—	—	—	15	16	9	—	13
<i>Physocarpus malvaceus</i> (Ninebark).....	4	6	14	16	14	24	9	12
<i>Acer grandidentatum</i> (Big tooth maple).....	10	4	3	10	9	6	28	10
<i>Purshia tridentata</i> (Bitterbrush).....	2	8	8	10	6	16	14	10
<i>Vaccinium membranaceum</i> (Big whortleberry).....	—	—	8	—	13	8	2	9
<i>Clematis ligusticifolia</i> (Virgin bower).....	—	20	12	8	7	5	—	9
<i>Sambucus microbotrys</i> (Red elderberry).....	—	—	8	10	10	—	—	7
<i>Symphoricarpos spp.</i> (Snowberry).....	5	6	9	9	6	5	0	6
<i>Eriogonum spp.</i> (Indian tobacco).....	0	9	7	3	8	1	—	6
<i>Ribes spp.</i> (Currant).....	3	2	6	4	6	1	2	5
<i>Mahonia repens</i> (Oregon grape).....	—	1	2	0	17	—	—	5

* The indexes were derived by dividing the average consumption of any species during a period by the average daily forage intake during the corresponding period.

† Dash indicates none fed.

forbs, mule ear dock, alfalfa, storks-bill, sweet clover, and locoweed were especially attractive. Mule ear dock was the most important single plant in periods one and two and continued to be important until well into August, a result which was not anticipated. The high consumption of dogbane was surprising, particularly during period three. Although geranium was never high in level of con-

sumption, it was important during all periods except period one, and throughout later periods remained one of the most important of the native forbs. Dandelion, aster, Chinese lettuce, skunk flower, and black medic all were consumed in moderate quantities during mid-summer.

Three species of willows fed regularly were eaten in considerable quantities. It would appear that collectively they

TABLE 3
Preference indexes* of northern range forage for mule deer during summer

SPECIES	PERIOD							AVERAGE FOR SUMMER
	1	2	3	4	5	6	7	
Forbs								
<i>Apocynum</i> spp. (Dogbane).....	—†	—	44	21	32	—	—	27
<i>Wyethia amplexicaulis</i> (Mule ear dock).....	46	28	19	18	14	9	—	20
<i>Medicago sativa</i> (Alfalfa).....	37	—	—	—	—	—	—	20
<i>Erodium cicutarium</i> (Storksbill).....	39	4	—	—	—	—	—	15
<i>Taraxacum officinalis</i> (Dandelion).....	29	9	20	22	14	12	—	14
<i>Lactuca serriola</i> (Chinese lettuce).....	21	13	16	13	10	7	—	12
<i>Geranium</i> spp. (Geranium).....	—	17	10	12	12	10	8	11
<i>Aster</i> spp. (Aster).....	—	23	7	12	8	6	0	11
<i>Polemonium albiflorum</i> (Skunk flower).....	—	16	11	13	11	7	0	11
<i>Medicago lupulina</i> (Black medic).....	—	6	10	17	9	—	—	9
<i>Pedicularis racemosus</i> (Elephant head).....	—	—	—	—	8	19	7	9
<i>Potentilla</i> spp. (Cinquefoil).....	—	10	7	9	11	10	—	9
<i>Smilacina</i> spp. (False solomonseal).....	—	5	12	13	—	—	—	9
<i>Melilotus</i> spp. (Sweet clover).....	43	—	7	—	—	—	11	8
<i>Solidago</i> spp. (Goldenrod).....	—	4	15	11	4	8	5	8
<i>Thalictrum fendleri</i> (Meadow rue).....	—	7	8	12	11	4	—	8
<i>Roripa nasturtium-aquatica</i> (Water cress).....	—	14	7	9	7	7	10	8
<i>Aquilegia</i> spp. (Columbine).....	—	—	6	0	7	2	—	7
<i>Astragalus cibarius</i> (Loco weed).....	23	1	6	—	3	—	—	7
<i>Lithospermum ruderales</i> (Stoneseed).....	1	7	5	15	3	—	—	7
<i>Ranunculus orthorhynchus</i> (Buttercup).....	—	6	9	6	0	—	—	7
<i>Rumex</i> spp. (Sourdock).....	4	16	11	1	1	1	0	7
<i>Scrophularia occidentalis</i> (Figwort).....	6	6	10	7	7	7	—	7
<i>Agastache urticifolia</i> (Horsemint).....	3	7	7	6	6	8	—	6
<i>Balsamorhiza sagittata</i> (Balsamroot).....	10	7	7	11	—	—	—	6
<i>Pteridium aquilinum</i> (Brackenfern).....	—	—	—	7	—	—	—	6
<i>Lupinus</i> spp. (Lupine).....	—	1	3	4	9	7	9	6
<i>Nepeta cataria</i> (Catnip).....	—	7	0	6	4	—	4	6
<i>Senecio</i> spp. (Groundsel).....	1	2	11	1	2	—	—	6
<i>Agoseris glauca</i> (Mountain dandelion).....	4	8	—	—	—	—	—	5
<i>Arnica</i> spp. (Arnica).....	3	7	6	4	—	—	—	5
<i>Descurainia</i> sp. (Tansy mustard).....	—	5	7	—	—	—	—	5
<i>Penstemon</i> spp. (Penstemon).....	—	6	11	2	—	—	—	5
<i>Sidalcea oregana</i> (Mallow).....	—	—	7	7	4	2	—	5
<i>Vicia americana</i> (Vetch).....	—	4	3	—	2	11	—	5

* The indexes were derived by dividing the average consumption of any species during a period by the average daily forage intake during the corresponding period.

† Dash indicates none fed.

form an important part of the diet of deer on the range. Contrary to expectation, serviceberry did not rate high at all periods, although it appeared to increase in desirability as the season advanced. Snowbrush and curleaf mahogany, although not generally considered as plants

which produce summer forage, were eaten in considerable quantities through the summer. Curleaf mahogany rated higher in these tests than did birchleaf mahogany, which is considered to be a superior forage plant. A partial explanation for this may be found in the fact that a leaf

rust was prominent on birchleaf mahogany during the later periods which appeared materially to reduce its palatability. This rust was not present during the early season. A similar cause may have been operative in the case of serviceberry, since it was affected in like manner.

Bitterbrush was not eaten in large quantities in these tests. During the last two periods, however, it increased in importance. By contrast, cliffrose, a similar plant which also is important as winter forage, was taken more readily during mid-summer than it was toward the end of the summer. Bigtooth maple, while not eaten readily during mid-summer, was nevertheless eaten with some relish at later periods. This resulted in its being higher on the list than species commonly believed to be better forage plants, among them bitterbrush and snowberry.

In addition to the species listed in Table 2, there were seven browse species which were included in the tests but which were uneaten or so lightly touched that they were not considered to be important summer forages for deer. These included alder (*Alnus tenuifolia*), yellow brush (*Chrysothamnus viscidiflorus*), big rabbitbrush (*C. nauseosus*), buffalo berry (*Lepargyrea canadensis*), ocean spray (*Sericotheca discolor*) sagebrush (*Artemisia* spp.) and juniper (*Juniper* spp.).

Twenty-seven herbs were included in addition to those shown in the tables. Several of those were eaten to some extent. Hawksbeard (*Crepis acuminata*), scarlet gilia (*Gilia aggregata*), evening primrose (*Oenothera* sp.), monkshood (*Aconitum columbianum*), and bluebells (*Mertensia leonardi*) all show an average consumption of four percent of the daily average. The reaction to bluebells is especially interesting in this connection since the plant is regarded as an important forage for sheep. In spite of the low

consumption of these plants individually, it is probable that in the aggregate they contribute an appreciable amount to the diet of deer on the range. Butterweed (*Senecio serra*), another particularly good sheep forage was eaten very lightly in these tests.

Of the several grasses offered, only cultivated rye (*Secale*) and smooth brome (*Bromus inermis*) were found to be eaten and these but lightly. Neither of these was eaten after it matured beyond the boot stage.

The two deer exhibited some rather well defined differences throughout the summer in respect to their apparent liking for certain plants. Deer 85 consumed considerably less oak than did deer 84. Similarly, deer 84 ate on the average about a quarter of a pound of balsamroot each time it was fed, while it was largely left untouched by the other animal. Throughout, deer 84 appeared to be less particular in his forage preferences, utilizing forbs more heavily and eating of more individual species than did deer 85.

It is interesting to note that stems of the herbaceous plants and the leaf petioles of those plants with large leaves were eaten but slightly. Even in the case of plants which were eaten readily such as geranium, mule ear dock and skunk flower, the leaf blades were severed from the stems of petioles, which seems the more remarkable in view of the fact that the plants were not attached, making leaf removal more difficult than it is in nature. This behavior forms an interesting contrast to that observed during the winter when woody stems are eaten back even beyond the point marking the current growth.

Table 1 contains data showing the pounds of forage consumed per hundred pounds body weight. The mean value for the two deer throughout both seasons was 3.49 pounds daily. During indi-

vidual periods, the consumption was as low as 2.65 pounds per hundred weight, and as high as 4.71 pounds. The highest periodic consumption in 1948 occurred in late June and early July. This was not true in 1947, although in both years the level of consumption throughout this period was greater than during the two periods following. With the onset of cooler weather in late summer, the consumption of forage increased from hot summer months.

Throughout the tests, great differences in daily consumption were evident. On individual days less than a pound of air dry material was consumed. At other times, and particularly toward the close of the feeding period, daily intakes of 5 pounds and more were not uncommon. This variation was not explainable by the particular plants which were offered, for on individual days the same species would be eaten now heavily, now moderately.

COMPARATIVE FORAGE PREFERENCES OF SHEEP AND MULE DEER

During the summer of 1949, deer and sheep were held in pens and fed for one-day periods. Four feeding dates were selected: mid-July, early August, early September, and late September. In 1950 feeding was conducted on only the first and last of these feeding dates. Two of each kind of animal were used in the feeding trials each year. The results are summarized in Table 4.

It may be noted that the results secured from deer in these tests show the same general trend throughout the season as was found in the earlier feeding tests (See Fig. 1). However, comparable percentage consumptions of browse and herbs were not attained at the same season, browse being less important and herbs correspondingly more important during mid-season than in the earlier tests.

TABLE 4

Comparative consumption by forage class of deer and sheep in percent of total daily consumption throughout the season

	Mid-July		Early August		Early September		Late September	
	Sheep	Deer	Sheep	Deer	Sheep	Deer	Sheep	Deer
	<i>Percent</i>							
Browse...	2	44	15	42	49	73	68	87
Forbs...	92	55	85	58	49	27	30	13
Grass...	6	1	0	0	2	0	2	0

There is a marked difference between the two kinds of animals in the importance of the forage classes. Browse proved considerably more important in the diet of the deer than in that of the sheep, especially during the earlier periods. Grass was generally more important to sheep than to deer, and this difference may have been even greater had the tests been begun earlier. Sheep, like deer, displayed a definite tendency to shift from forbs to browse as the season progressed.

SUMMARY

Forage preference studies were conducted near Logan, Utah with captive mule deer. Deer were confined to pens and fed fresh forage collected from the range in the vicinity. The feeding period extended from May to October during the summers of 1947 and 1948. In 1949 and 1950 two deer and two sheep were fed for one-day periods in order to compare their forage preferences.

Until late in May, deer consumed a greater amount of herbaceous material than of browse. Thereafter, browse became more important in the diet, until at the end of the season less than 10 percent of the daily consumption was of herbs.

The average consumption of air dry material was 3.49 pounds per hundred weight of deer. Individual deer con-

sumed as little as 2.65 and as much as 4.71 pounds per hundred weight during specific periods.

As measured by the volume consumed, Scouler's willow, dogwood, gambel oak, sandbar willow and aspen were the most important browse plants. Bitterbrush stood relatively low in the scale as compared to other browse plants, especially during early periods.

Few forbs attained the average consumption figures found in the case of browse plants, only dogbane exceeding 20 percent of the average daily forage intake. Of the most common forage plants,

mule ear dock, dandelion, geranium, and skunk flower were most important.

Two important sheep forages, groundsel and bluebells, were eaten very lightly by deer in these tests.

Comparative feeding tests using mule deer and sheep showed that forbs were more important in the diet of sheep than of deer. During mid-July browse made up but 2 percent of the forage consumed by the sheep, while at the same time it constituted 44 percent of that of mule deer. By late September browse made up 68 and 87 percent of the consumption of sheep and deer, respectively.



SOMETHING SPECIAL

A man wrapped up in himself makes a very small bundle.

If you would have a faithful servant, and one that you like, serve yourself.

Some are weather-wise, some are otherwise.—*Benjamin Franklin.*



The winds and waves are always on the side of the ablest navigator.—*Gibbon.*



Sit loosely in the saddle of life.—*Robert L. Stevenson.*