Artificial Mineral Licks: Longevity, Use and Attitudes

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Abstract: We studied longevity, depletion rate, and peak periods of use by white-tailed deer (*Odocoileus virginianus*) of minerals at artificial lick sites on a clay soil in the Georgia Piedmont in 1990 and 1991. We also surveyed attitudes among southeastern state wildlife agencies about providing mineral supplementation for deer. Results indicated a rapid loss of sodium (Na) to leaching. Leaching rates for calcium (Ca), iron (Fe), magnesium (Mg), manganese (Mn), phosphorus (P), potassium (K), and zinc (Zn) were low. Pure salt (NaCl), rather than a more expensive mineral mixture, can be applied in alternate years since other important minerals are still present at lick sites. Peak deer use occurred during April and May, with moderate to low use during June to November, and no use during December and January. Deer use was low the second year after establishment indicating a need for annual replenishment. Most wildlife agencies did not apply mineral supplements to public lands nor encourage application on private lands, and the agencies differed in their opinions on the role of mineral supplements in deer management. Until that role is determined, biologists should be cautious in recommending mineral supplements in a deer management program. Otherwise, non-professionals looking for quick-fix management solutions may choose mineral supplements over proven management techniques.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 46:188–194

White-tailed deer have minimum nutritional requirements necessary for reproduction, body growth, antler growth, and maintenance (French et al. 1956, Short 1969). Eroded uplands of the Piedmont Physiographic Province often have relatively infertile soils which produce deer browse that can be seasonally deficient in protein, P, and other macro and micro elements (Wood 1986). Habitat improvements and the provision of mineral supplements are 2 techniques which have been suggested as ways to increase nutrition for deer (Short 1969).

There has been a proliferation in recent years in the availability and use of commercial mineral supplements. Many of these products are advertised as being specifically for deer and are available in the form of blocks, granulated mixtures, and suckers. Mineral supplements often are promoted as a means of enhancing antler growth, body size, and improving nutritional condition. However, the value of mineral licks for free ranging deer has yet to be determined.

Deer occupying inland habitats use both natural and artificial licks. This use is due to the intake of K and water which leads to excessive Na loss (Weeks and Kirkpatrick 1976). Wiles and Weeks (1986) found that 16 of 17 radio-collared deer in South Central Indiana used mineral licks and 12 deer sallied from their home ranges to use licks. Deer in South Central Indiana utilized licks heavily during April and May with moderate use in summer through fall and no use during January and February (Weeks and Kirkpatrick 1976). Peak periods of use of mineral licks in the Piedmont of the Southeast have not been determined.

This study was designed to determine longevity, depletion rate, and peak periods of use of minerals provided at artificial lick sites for white-tailed deer. We also surveyed professional attitudes with respect to the use of mineral licks for deer. We gratefully acknowledge F. Granitz, D. Danner, and L. Ross for their assistance in data collection and K. Grahl for assistance with graphics and manuscript review.

Methods

Rum Creek Wildlife Management Area is in the lower Piedmont Physiographic Province, approximately 11.3 km east of Forsyth, Monroe County, Georgia. The study was conducted on a 405 ha portion of the wildlife management area and adjacent lands owned by Georgia Power Company. The terrain is gently rolling. The average annual rainfall is 114.3 cm.

Major vegetation types on the study area are loblolly pine (*Pinus taeda*)—shortleaf pine (*P. echinata*), white oak (*Quercus alba*)—red oak (*Q. rubra*)—hickory (*Carya spp.*), mixed pine hardwood, and old fields. Soils are of the order Ultisol (Perkins et al. 1973), are acidic with pH ranging between 4.7 and 5.8, have a low base saturation, and are typically low in Ca and P. Farming practices during the 1800s and early 1900s severely eroded the soils. The deer population was recently estimated at 15 km^2 (Thackston, unpubl. data).

In January 1990, 10 1 m^2-sites were randomly chosen for the application of a commercially prepared mineral mixture often used as a supplement for white-tailed deer. Five of the sites were randomly selected and fenced with 1.8-m hogwire and metal fence posts to exclude deer.

Soil samples were collected along the periphery of each site on 30 January 1990 prior to mineral application. Samples were taken to a depth of 15.2 cm using a 2.5-cm diameter sampling tube. Five core soil samples were taken per site. Samples were separated equally into upper (strata 1) and lower (strata 2) 7.6-cm strata. Stratification was necessary to monitor downward movement of minerals due to leaching. All samples were analyzed by the Soil Testing Lab at the University of

Georgia (STLUGA). The analysis determined ppm values of Ca, Fe, Mg, Mn, Na, P, K, and Zn.

On 7 February 1990, 22.7 kg of mineral mixture was applied at each site. This mixture had a guaranteed analysis of: NaCl (minimum) 50%; Ca (14%–16%); P (minimum) 8%; Mn (minimum) 0.2%; Zn (minimum) 0.4%, and Fe (minimum) 0.1%. A sample tested by STLUGA yielded the following ppm concentrations of selected elements: Na-271,500; Ca-119,800; P-55,100; Mg-5,600; Mn-3,500; Fe-5,600; and K-1,400.

Post-treatment soil samples were taken in March 1990 (month 1), July 1990 (month 5), January 1991 (month 11), and June 1991 (month 16). Five sample cores were taken on a grid pattern across each site. Sample core locations were recorded for each site to avoid duplicate core removal during future sampling periods.

Use was recorded bi-weekly during February through September 1990 and monthly during October 1990 through June 1991. Utilization was rated on each of the unexcluded sites as follows: 0—no use, 1—tracks only, 2—light gnawing/digging, 3—heavy gnawing/digging. Two consecutive days without rain were a prerequisite for use observations.

A 1-sided *t*-Test was used to test for significant ($P \leq 0.1$) differences in mean concentrations of minerals between baseline and post-treatment sampling periods. Differences in concentrations between excluded and unexcluded sites were tested in an attempt to determine the contribution of deer use to mineral depletion. Because there were no significant differences in mineral concentration for any element ($P \leq 0.1$) between excluded and unexcluded sites, they were combined for statistical analysis.

A mail survey was sent to the chiefs of the 16 southeastern state wildlife agencies to determine if artificial mineral licks were established on public lands or were recommended for use on private lands.

Results and Discussion

At all post-treatment sampling periods (months 1, 5, 11, and 16) concentrations of Ca, Mn, Na, P, and Zn in strata 1 were greater ($P \leq 0.1$) than baseline values (Table 1). At month 1, only Na concentrations in strata 2 were greater ($P \leq 0.1$) than baseline values. At month 5, Na, Mn, and Zn concentrations in strata 2 were greater ($P \leq 0.1$) than baseline values. At months 11 and 16 ppm concentrations of Ca, Mn, Na, P, and Zn in strata 2 were greater ($P \leq 0.1$) than baseline values.

Sodium leached rapidly from lick sites while P, Ca, Mn, Mg, Fe, and Zn remained at the soil surface longer, leaching at a much slower rate. Since much of the leaching occurred after peak deer use, applying 22.7 kg of minerals to a single site at 1 point in time resulted in a loss of minerals. One of the primary objectives often stated for providing mineral supplements to deer is to increase their intake of Ca and P. Elevated concentrations of Ca and P persisted at the surface of lick sites through the second spring following establishment. However, the results suggest that due to the loss of Na, very little use of lick sites occurred in the second year.

Table 1. Mean concentrations ppm in strata 1 (0–7.6 cm) and strata 2 (7.6–15.2 cm) soil depth levels for pre-treatment and post-treatment sampling periods.[a]

Element	Baseline	Month 1	Month 5	Month 11	Month 16
Calcium					
strata 1	314±154	*3465±499[b]	*3550±1049	*2631±1303	*2411±1046
strata 2	254±140	383±127	1072±507	*325±136	*398±332
Iron					
strata 1	37±18	22±7	24±4	20±6	19±5
strata 2	24±9	21±4	22±3	16±4	15±4
Magnesium					
strata 1	87±51	104±20	149±47	119±37	156±72
strata 2	111±69	59±40	68±38	46±30	37±22
Manganese					
strata 1	70±24	*307±59	*299±72	*171±96	*137±57
strata 2	57±25	128±48	*152±60	*62±16	*75±2
Phosphorus					
strata 1	3±0.4	*1264±221	*1253±407	*916±507	*778±367
strata 2	2±0.5	71±42	327±208	63±45	85±119
Potassium					
strata 1	51±13	46±8	44±17	38±12	51±10
strata 2	40±12	59±16	47±15	41±14	47±18
Sodium					
strata 1	33±5	*1528±482	*1515±523	*627±164	582±202
strata 2	31±4	*1829±542	*1527±697	*534±168	*489±229
Zinc					
strata 1	2±1	*193±2	*219±64	*179±73	*211±91
strata 2	1±0.3	24±7	*57±30	*20±8	*18±17

[a]Baseline—January 1990, Month 1—March 1990, Month 5—July 1990, Month 11—January 1991, Month 16—June 1991.
[b]Values preceded by an asterisk indicate they are significantly ($P \leq 0.1$) greater than baseline values.

In 1990, deer used mineral lick sites most during April and May with moderate to low use during June through November and no use in December. In 1991, no use occurred in January and February, very low use occurred in March through May, and no use occurred in June (Fig. 1). These data indicate that in 1 year Na levels had declined to the point deer were no longer attracted to lick sites. The mean concentrations of Na in strata 1 at lick sites were 627 ± 164 ppm in months 11 and 582 ± 202 ppm in month 16. In Indiana, Wiles and Weeks (1986) documented intensive deer use of natural lick sites with a mean Na concentration of 382 ppm. However, their lick sites had a tradition of deer use, which they suggested was a determinant factor in the frequency of lick site use.

No significant differences ($P \leq 0.1$) in mineral concentrations were determined between excluded and unexcluded sites. This does not imply that the amount of minerals being consumed by deer was insignificant. Deer may have removed soil volumes sufficient to prevent mineral concentrations at the lick side from decreasing even though mineral quantities decreased.

Of 16 southeastern state wildlife agencies, 6 used mineral supplements on public lands. Of these, 1 used NaCl, 4 used trace minerals, and 1 used trace minerals with a 2:1 P/Ca ratio. Four replenished licks annually, 1 replenished licks bi-

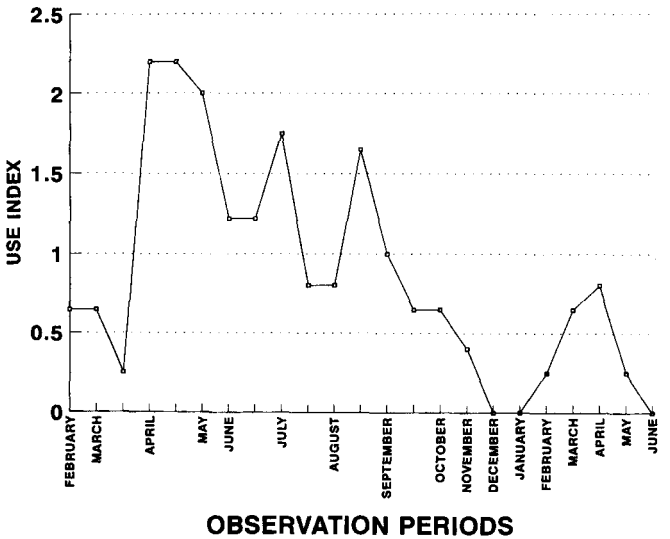

Figure 1. Use of artificial mineral licks by white-tailed deer on Rum Creek WMA during February 1990–June 1991.

monthly from April through July and monthly during August through March, and 1 relied on the discretion of the manager. Four states that used minerals on public lands also encouraged use of private lands and 2 states neither encouraged nor discouraged use on private lands.

There is apparent disagreement, or at least a lack of understanding, among professional wildlife biologists as to the importance of mineral licks in deer management. Schultz and Johnson (unpubl. data) working with both captive and free-ranging deer in Louisiana found mineral licks to have no effect on growth, antler development, and tissue mineral content. If mineral supplements improve deer health, they do so in ways typically not measured.

There is a need for additional research to determine the true role of mineral supplements in deer management and their importance relative to other management practices. It is especially important to determine public perception of mineral supplements since this activity may be substituted for other management practices.

A survey of 30 Georgia Piedmont deer clubs indicated that 70% established salt or mineral licks on their club lands (Thackston 1991). Clubs averaged one mineral lick per 48 ha. Eighty five percent believed mineral supplements would increase antler size. When asked which was most important in producing large antlered bucks: 50% felt mineral licks were more important than adequate doe harvests; 43% felt mineral licks were more important than food plots; and 37% felt mineral licks were more important than passing up young bucks. Until the role is determined, biologists should be cautious in recommending mineral supplements in a deer management program. Otherwise, non-professionals looking for quick-fix management solutions will continue to elevate the relative value of mineral supplements beyond that of proven deer management techniques.

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