Technical Note:  
Root-plowing effects on nutritional value of browse and mast in south Texas

DONALD C. RUTHVEN III AND ERIC C. HELLGREN

Abstract

Leaf and mast material was collected from mesquite (Prosopis glandulosa Torr.), huisache (Acacia smallii Isely), granjeno (Colubrina texana (T. & G.) Gray) on both root-plowed and untreated sites in south Texas. Forages were analyzed for nitrogen (N), neutral detergent fiber (NDF), and in vitro dry matter digestibility (IVDMD). Forages differed among species for N, NDF, and IVDMD. Leaf IVDMD of huisache and hog plum was higher on untreated sites. Huisache mast was highest in N and NDF concentrations, but not IVDMD, on untreated sites. Browsers on root-plowed sites may be forced to use forages of fewer digestible nutrients than on untreated sites. The cause of changes in browse quality following brush manipulation should be examined.

Key Words: Acacia smallii, Colubrina texana, digestibility, fiber, Prosopis glandulosa, nitrogen, white-tailed deer.

Root plowing is a common brush management method used to remove woody species that have invaded south Texas rangelands over the last 100-200 years. Following brush management, brush densities can rebound to levels similar to untreated brush sites in 20-25 years in the eastern Rio Grande Plains (Ruthven et al. 1993). Effects of decreased woody plant diversity and increased herbaceous cover (Ruthven et al. 1993) on nutrient content and digestibility of major browse species found on root-plowed sites are unknown. Short-term effects of shredding (Everitt 1983) and roller-chopping (Reynolds et al. 1992) on nutritional quality of browse have been variable. Browse is an important dietary constituent for wildlife species, especially during summer and fall (Arnold and Drawe 1979, Ruthven et al. 1994). Therefore, it is important that the effects listed above be determined, so that land managers can better estimate effects of changes in browse com-
through a 1-mm mesh screen in a Wiley Mill for laboratory analysis.

Nitrogen content of forages was determined by the micro-
Kjeldahl method (AOAC 1970). Neutral detergent fiber was esti-
mated by methods described by Van Soest and Wine (1967). In
vitro dry matter digestibility was determined by the methods of
Moore and Mott (1974, 1976), using rumen fluid from an adult
male white-tailed deer that was fed alfalfa hay and commercial
dereer pellets for 1 week before rumen fluid collection. Concen-
trated rumen fluid was collected by placing a tube into the
rumen via the esophagus and massaging the rumen. Filtered, con-
centrated rumen fluid (550 ml) was diluted to 750 ml with dis-
tilled water for addition to a McDougall saliva solution before
inoculation.

Leaf data were analyzed by 2-way analysis of variance (SAS
1987), with treatment and species as the main effects. Tukey's stu-
dentized range test was used to separate ($P < 0.05$) differences
for multiple comparison among species. Mast was analyzed by a
1-way analysis of variance with treatment as the main effect.

Results

Leaf material from untreated sites had higher digestibility
(IVDMD) than that from root-plowed sites ($P < 0.001$). A species-
treatment interaction ($P = 0.013$) indicated that treatment differ-
ences were greatest for huisache and hog plum (Table 1). Neutral
detergent fiber and N content did not vary by treatment.

Species effects were noted for N, fiber (NDF), and diges-
tibility (IVDMD) ($P < 0.0001$). Granjeno had higher N content
and IVDMD than the other 3 species. Huisache was also higher in N
than mesquite, and hog plum had higher IVDMD than huisache.
Mesquite and huisache had higher NDF values than granjeno
and hog plum, and hog plum was also higher in NDF than granjeno.

Huisache mast had greater N ($P = 0.003$) and fiber (NDF) ($P =
0.002$) concentrations on untreated than on treated sites. Total N
was 17% greater (2.96 ± 0.09 vs 2.47 ± 0.09%) and NDF was 22%
greater (29.6 ± 1.0 vs 23.1 ± 1.0%) on untreated areas than
on treated sites. Huisache mast digestibility (IVDMD) was simi-
lar ($P > 0.05$) between treatments (77.0 ± 1.0 untreated vs 79.6 ±
2.0% treated). Mesquite mast had similar N ($= 1.74\%$), NDF ($= 34.9\%$), and IVDMD ($= 70.7\%$) on untreated and treated sites.

Table 1. Percent nitrogen (N), neutral detergent fiber (NDF), and in vitro
dry matter digestibility (IVDMD) of leaves of huisache, mesquite,
granjeno, and hog plum for untreated (U) and root-plowed (RP) sites
at the Santa Gertrudis Division of the King Ranch, Kleberg and Jim

<table>
<thead>
<tr>
<th>Species</th>
<th>N</th>
<th>NDF</th>
<th>IVDMD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>U &amp; RP</td>
<td>U &amp; RP</td>
<td>U &amp; RP</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>SE</td>
<td>SE</td>
</tr>
<tr>
<td>Huisache</td>
<td>4.28</td>
<td>0.11</td>
<td>37.4a</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td></td>
<td>67.2c</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>59.3d</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.6</td>
</tr>
<tr>
<td>Mesquite</td>
<td>3.82</td>
<td>0.08</td>
<td>38.2a</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td></td>
<td>66.1c</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>64.6e</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>Granjeno</td>
<td>5.00</td>
<td>0.09</td>
<td>26.7a</td>
</tr>
<tr>
<td></td>
<td>0.3</td>
<td></td>
<td>89.1a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>88.0a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>Hog Plum</td>
<td>3.96</td>
<td>0.08</td>
<td>29.0b</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td></td>
<td>71.8b</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>63.8c</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.7</td>
</tr>
</tbody>
</table>

1Means in a column followed by the same letter are similar ($P > 0.05$). Mean separation by species is by Tukey's studentized range test.

Discussion

Our estimates of N concentration and digestibility (IVDMD)
were consistently higher than those previously recorded (Everitt
and Gonzales 1981; Meyer et al. 1984, Varner and Blankenship
1987). Several factors could be responsible for the higher concen-
tration relative to those previously reported. First, all study sites
received an average of approximately 9.8 cm of precipitation dur-
ing a 45-day period before sample collection (Unpublished data,
P. S. Lieck). All forages, especially hog plum, showed lush, spring-like regrowth and resprouting. Varner and Blankenship
(1987) reported April concentrations of 5% N for granjeno and
May concentrations of 3.9% N for hog plum, which were similar
to our September values. Second, our samples contained only leaf
material, whereas earlier researchers included twigs (Varner et al.
1977, Everitt and Gonzales 1981), which are lower in N concen-
tration and digestibility than leaves. Third, samples were inocu-
lated with rumen fluid collected from a live animal within 30–60
minutes. Samples of Everitt and Gonzales (1981) and Varner et
al. (1977) were not inoculated until 1–2 hours after collection,
which may have resulted in increased microbial mortality leading
to lower digestion.

Treatment differences in leaf digestibility (IVDMD) were not
consistent across species, although IVDMD of leaf material of all
4 major woody species from root-plowed sites was lower than
from untreated areas. These data suggest that browsers on root-
plowed sites would be forced to utilize browse of few digestible
nutrients during periods when browse is a major constituent of
their diet. However, greater dietary reliance on more abundant
forbs on root-plowed sites (Ruthven et al. 1994), lack of treat-
ment effects for IVDMD of huisache mast (which comprised as
much as 50% of white-tailed deer diets during the fall on root-
plowed sites) (Ruthven et al. 1994), diet selection by deer, or sta-
tistical differences that were not of biological significance may
reduce the impacts of differences of browse quality.

Future research is warranted to examine differences in nutrient
quality in browse following brush management. Questions to be
asked include, can the differences that we observed be replicated?
Also, what causes differences in browse quality following brush
manipulation? Lastly, if differences occur, are they of a mag-
itude large enough to affect reproduction or survival of browsing
herbivores?

Literature Cited

Arnold, L. A., and D. L. Drew. 1979. Seasonal food habits of white-
tailed deer on the South Texas Plains. J. Range Manage. 32:175–178.

Everitt, J. H. 1983. Effects of plant shredding on nutrient content of four
major woody species from root-plowed sites (Ruthven et al. 1994), lack of treat-
ment effects for IVDMD of huisache mast (which comprised as
much as 50% of white-tailed deer diets during the fall on root-
plowed sites) (Ruthven et al. 1994), diet selection by deer, or sta-
tistical differences that were not of biological significance may
reduce the impacts of differences of browse quality.

Future research is warranted to examine differences in nutrient
quality in browse following brush management. Questions to be
asked include, can the differences that we observed be replicated?
Also, what causes differences in browse quality following brush
manipulation? Lastly, if differences occur, are they of a mag-
itude large enough to affect reproduction or survival of browsing
herbivores?

JOURNAL OF RANGE MANAGEMENT 48(6), November 1995 561

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.

Aclains in a column followed by the same letter are similar ($P > 0.05$). Mean separation
by species is by Tukey's studentized range test.