Applied Research on Native Warm-season Grass Forages:
Where Do We Stand, Where Are We Headed?

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Center for Native Grasslands Management and UT Beef and Forage Center

11th Eastern Native Grass Symposium
Erie, PA – September 18, 2018
Native Grass Forage Research – Where We Have Been
### Animal Performance (Steers)

<table>
<thead>
<tr>
<th>Forage</th>
<th>ADG (lb/hd)</th>
<th>AUD (days/ac)</th>
<th>Gain (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchgrass</td>
<td>1.74</td>
<td>172</td>
<td>435</td>
</tr>
<tr>
<td>Big blue/Indian</td>
<td>2.11</td>
<td>121</td>
<td>368</td>
</tr>
<tr>
<td>Eastern gamagrass</td>
<td>1.06</td>
<td>171</td>
<td>247</td>
</tr>
</tbody>
</table>

93 – 115 days grazing per year; weaned steers (600 lb starting wt)

Backus et al., 2017 Journal of Animal Science 95:3143-3153
Production Curve for Three NWSG Forages
Season-long Grazing (Steers)

<table>
<thead>
<tr>
<th>Grazing Strategy</th>
<th>ADG* (lb/day)</th>
<th>Steer Days/ac</th>
<th>Beef (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>2.18</td>
<td>162</td>
<td>357</td>
</tr>
<tr>
<td>Heavy Early</td>
<td>1.92</td>
<td>141</td>
<td>276</td>
</tr>
</tbody>
</table>

* O N/ac applied since at least 2011

Aug 18, 2016 – 99 days continuous grazing

K. Brazil, Univ. TN, unpublished data
## Patch-burn vs. Rotational Grazing

<table>
<thead>
<tr>
<th>Location</th>
<th>Breed</th>
<th>Class</th>
<th>ADG (lb/day)</th>
<th>Grazing days</th>
<th>Total Beef (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>PBG</td>
<td>RG</td>
<td>PBG</td>
</tr>
<tr>
<td>BGAD</td>
<td>Angus X</td>
<td>Heifer</td>
<td>2.5</td>
<td>2.3</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steer</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DREC</td>
<td>Holstein</td>
<td>Heifer</td>
<td>1.61</td>
<td>1.64</td>
<td>109</td>
</tr>
<tr>
<td></td>
<td>Jersey</td>
<td>Heifer</td>
<td>1.36</td>
<td>1.41</td>
<td>-</td>
</tr>
<tr>
<td>QUICK</td>
<td>Angus X</td>
<td>Heifer</td>
<td>1.69</td>
<td>1.63</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steer</td>
<td>1.52</td>
<td>1.70</td>
<td>-</td>
</tr>
</tbody>
</table>

Keyser et al., Univ. TN, unpublished data
Dormant-Season Alternatives

Cereal rye overseeded into NWSG

“Starving Heifer” Study

<table>
<thead>
<tr>
<th>Grazing System</th>
<th>Pregnancy rate, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fescue</td>
<td>90</td>
</tr>
<tr>
<td>Big Bluestem</td>
<td>89</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>92</td>
</tr>
</tbody>
</table>

J. Richwine, Univ. TN, unpublished data

Courtesy, T. Mulliniks, Univ. TN
Exceptional Drought Tolerance

Dry Matter Yield (T/ac)

65% of 4-year average

2006 2007 2008 2009

Courtesy Dr. Don Tyler, Univ. TN
Long-lived Perennial...

- 21-year old stand of switchgrass
- managed with:
  - spring fire (every 1-3 yrs)
  - no fertilizers added
  - no spraying
  - rotational grazing
Cost of Gain ($ per lb) for Grazing Heifers

Heifer development:
- most expensive aspect of production
- mainly feed cost (75%) for 30+ months w/o any return

Net Returns for Five Summer Forages

C. Boyer, Univ. TN, unpublished data
Native Warm-season Grasses are a Viable Summer Forage Tool

Offer many benefits sought after in summer forage:

- Strong animal performance
- Strong carrying capacity
- Flexible management
- Exceptional drought resiliency
- Long stand life (perennials)
- Cost-effective production
Warm-season Grass Comparison: Grazing Days per Acre

Weaned heifers, 527 lb starting weight

K. Zechiel, MS thesis, 2017, Univ. TN, unpublished data
Season-long Gains: Bermuda vs Natives

Total Gain for Four WSG in NC Study

<table>
<thead>
<tr>
<th></th>
<th>Gain (lb/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bermuda</td>
<td></td>
</tr>
<tr>
<td>E. Gama</td>
<td></td>
</tr>
<tr>
<td>Switch</td>
<td></td>
</tr>
<tr>
<td>Big Blue</td>
<td></td>
</tr>
</tbody>
</table>

- **June 1 - September 4**
- **April - September 4**

Native Grass Forage Research –
Where We Need To Go
Four Critical Research Needs for Native Grasses Forages:

1. Putting it all together – systems research
2. Impact on calf production
3. Enhanced diversity in forage production settings
4. Improved establishment reliability
1. Systems Research

How much of the forage base should be converted to WSG?
- 10%, 20%, 30%, more?

Integrating NWSG into TF Forage Production

- Excess spring forage prodn converted to WSG acres
- How does this impact distribution & total grazing days?
- What about hay production?
Cow-calf Systems

- Growing animals do well on NWSG, but...
  - most are cow-calf producers
- How do NWSG impact calving rates, weaning weights?

![Weaning Weights](chart)

- E+E:
  - M&F: -31 lb/hd
  - M: -62 lb/hd*
  - F: -44 lb/hd*


UT annual pasture budgets, NWSG cost
~30% less than TF ($106 vs. $148/ac)

Widespread interest in enhanced plant diversity (forbs/legumes) in order to improve:
- pollinator habitat
- wildlife habitat
- soil health
In forage settings, what forbs/legumes can:
- establish (with grass planting or post-planting)
- persist under grazing
- still flower (pollinators)
- benefit and not harm forage quality/production
- not become pests
- be cost-effective
# 2. Increasing Diversity

<table>
<thead>
<tr>
<th>Common name</th>
<th>Latin name</th>
<th>Oz/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximilian Sunflower</td>
<td>Helianthus maximilian</td>
<td>8</td>
</tr>
<tr>
<td>Black Eyed Susan</td>
<td>Rudbeckia hirta</td>
<td>8</td>
</tr>
<tr>
<td>False Sunflower</td>
<td>Phoebanthus tenuifolius</td>
<td>4</td>
</tr>
<tr>
<td>Lance Leaf Coreopsis</td>
<td>Coreopsis lanceolata</td>
<td>16</td>
</tr>
<tr>
<td>Plains Coreopsis</td>
<td>Coreopsis tinctoria</td>
<td>8</td>
</tr>
<tr>
<td>Upright Prairie Coneflower</td>
<td>Ratibida columnifera</td>
<td>4</td>
</tr>
<tr>
<td>Purple Coneflower</td>
<td>Echinacea purpurea</td>
<td>10</td>
</tr>
<tr>
<td>Illinois Bundleflower</td>
<td>Desmanthus illinoensis</td>
<td>18</td>
</tr>
<tr>
<td>Partridge Pea</td>
<td>Chamaecrista fasciculata</td>
<td>8</td>
</tr>
<tr>
<td>Purple Prairie Clover</td>
<td>Dalea purpurea</td>
<td>8</td>
</tr>
<tr>
<td>Tickfoil</td>
<td>Desmodium</td>
<td>8</td>
</tr>
<tr>
<td>total lb/ac</td>
<td></td>
<td>6.25</td>
</tr>
</tbody>
</table>

J. Richwine, Univ. TN, Ph.D. project
2. Increasing Diversity

May 31, 2018 – pre-grazing

July 31, 2018 – ‘Late-rest’ treatment

July 31, 2018 – ‘No-rest’ treatment
2. Increasing Diversity

- “Variety trial” examining forage yield, quality, and persistence of 12 species
  - imazapic tolerant
  - potential for wildlife & pollinators
  - potential for forage prod’n
  - Mostly perennials (cheaper, less work)
- S. Duiker, Ernst Conservation Seed
- Planted 2018 at PSU and UT

<table>
<thead>
<tr>
<th>Species</th>
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<tbody>
<tr>
<td>Maximilian Sunflower</td>
</tr>
<tr>
<td>Black Eyed Susan</td>
</tr>
<tr>
<td>Oxeye Sunflower</td>
</tr>
<tr>
<td>Lance Leaf Coreopsis</td>
</tr>
<tr>
<td>Upright Prairie Coneflower</td>
</tr>
<tr>
<td>Purple Coneflower</td>
</tr>
<tr>
<td>Canada Goldenrod</td>
</tr>
<tr>
<td>Cup Plant</td>
</tr>
<tr>
<td>Illinois Bundleflower</td>
</tr>
<tr>
<td>Partridge Pea</td>
</tr>
<tr>
<td>Purple Prairie Clover</td>
</tr>
<tr>
<td>Showy Ticktrefoil</td>
</tr>
</tbody>
</table>
3. Improved Establishment

Step 1 – quit with the myths already!

- NWSG are NOT “almost impossible” to establish
  - 85-95% success to achieve production quality stands on 1st attempt

- It does NOT take 3-5 years to establish NWSG
  - grazable w/in 12 months (2nd year)
  - production in year 2 about same as for TF
  - but, in 2nd yr: 1 hay cutting only, rest after Aug 1, watch grazing ht.
But... Still need to improve. How to do that?

- Focus on good agronomy (weed control especially!)
  - ongoing studies to evaluate nurse crops (spring oats, browntop millet) – through mechanical harvest and through grazing
- Plant breeding – need material that germinates more quickly, high early seedling vigor
  - Miss State Univ (B. Baldwin) – has such material in increase for BB, IG, and LB + imazapic tolerant SG.
3. Improved Establishment

- Will always take time, attention to detail, risk, cost
  - good agronomy essential (weed control especially!)

**BMP idea?**
- winter annual ➔
  - sow improved seed ➔
  - summer nurse crop

- no lost forage, 1 year establishment

- Education (NRCS, SWCD, Extension + producers)
  - And... Lose the myths!
Native Grass Forages – Their Future Role
Q25. Pasture management practice

Respondents (%)

- Applied chemical fertilizer
- Applied poultry litter
- Applied lime
- Tested soil
- Sprayed to control weeds
- Irrigated pasture

Used | Didn't Use
--- | ---

Courtesy, C. Clark et al., Univ. TN, 2018
Q5. Rotate frequency (N=796)

Respondents (%)

- Less than once per month: 30%
- One or two times per month: 40%
- Three or four times per month: 28%
- More than once a week: 12%

Courtesy, C. Clark et al., Univ. TN, 2018
Producer Interest in Improving Summer Forage

Margin of error = 1.81%

P. Keyser, Univ. TN, unpublished data
Q13-22. Adoption and cost of planting warm-season grass

Cost of planting warm-season grass

Adoption Rate (%)

No

Yes

$35

$70

$105

$140

$175

Courtesy, C. Clark et al., Univ. TN, 2018
Q10. Livestock operation changed *after* grazing warm-season grass

Respondents (%)

- Pasture productivity during dry periods
- Pasture productivity overall
- Forage quality
- Livestock health & nutrition
- Stocking density
- Number of days on stored feed (hay, silage, etc.)
- Number of days on stored feed during winter
- Flexibility in managing pasture and grazing
- Frequency of rotating livestock among pastures
- Number of watering sources used
- Management burden
- Fertilizer applied to pasture
- Soil erosion
- Other

Increased | No Change | Decreased | Don't Know

Courtesy, C. Clark et al., Univ. TN, 2018
Recent research has documented many benefits - and practicality - of NWSG forages (all very positive)
- gain, yield/carrying capacity, profitability, drought resiliency, manageability

But, lacking data on integrating at systems level – and impact on cow-calf operations (critical to producer acceptance)

Need better data on managing for optimum ecosystem benefits
- pollinators, grassland birds (esp. quail), soil health

Must improve establishment reliability (and messaging)
Conclusions

- For widespread future adoption we must:
  - repeat message >7X
  - counter unfounded skepticism with SCIENCE (and objectivity)
  - re-brand NWSG as not “just for conservation” or “nearly impossible to establish” and will “take 3-5 years” to do so...
  - focus on innovators and early adopters (~25%)
- Maybe cost-share is less important than education and establishment reliability?
- Seeing is believing! Demonstrate
Questions?