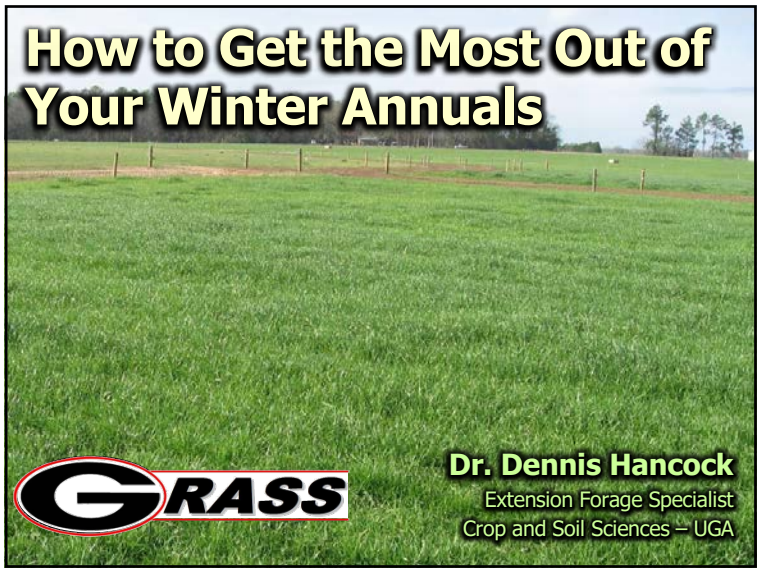
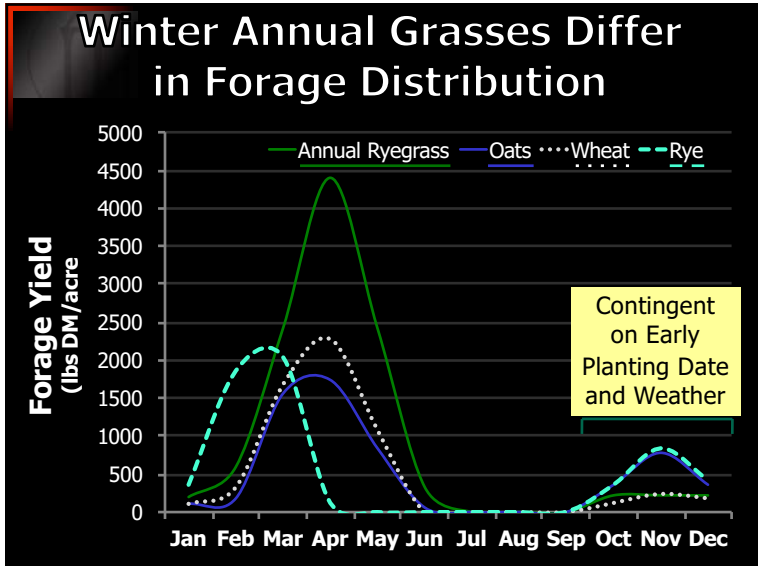


Winter Annual Forage Quality

Species	Crude Protein	Total Digestible Nutrients	Annual Yield*
	------- % -------		lbs DM/acre
Ryegrass	10-20	56-74	10,630
Oats	8-14	55-70	7,100
Wheat	8-14	52-70	7,110
Rye	8-14	50-70	4,850
Arrowleaf	14-17	56-75	3,470
Crimson	14-16	57-75	3,570

Quality ranges are approximate and are highly dependant upon forage maturity at grazing/harvest. Yields are 3-yr averages from GA and AL.



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Oats

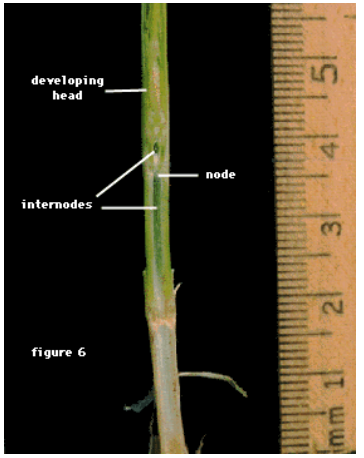
Adaptation	South and central GA. Soil pH should be kept above 6.0 for best results.
Maturity	Early (if planted early); Late (if grown for hay)
Cold Tolerance	Poor
Problems	Oat can be winterkilled in some years. If grazed early, later growth is very poor.
Varieties	Horizon 201, SS76-40, and RAM LA99016.

Rye (cereal rye)

Adaptation	Entire state. More tolerant of soil acidity than oat or wheat.
Maturity	Early to very early
Cold Tolerance	Excellent
Problems	Rye will mature quickly and quality may decline fast. Timely grazing or harvest management will be required.
Varieties	AGS104, Bates, Wrens Abruzzi **Early:** FL 401 (CP)

Wheat

Adaptation	Entire state. Not tolerant of soil acidity.
Maturity	Medium late
Cold Tolerance	Good
Problems	Late as ryegrass, but not as high yielding.
Varieties	AGS 2038, Oglethorpe (P,M), Roberts (P,M), and SS8641



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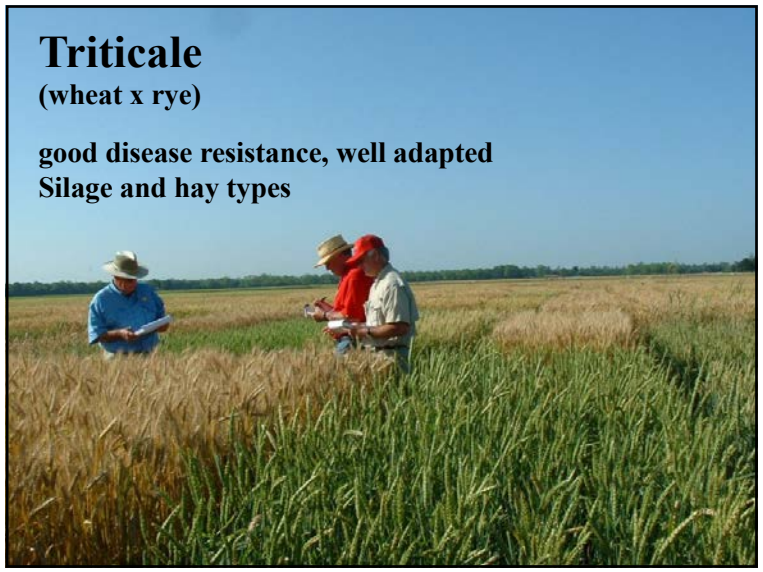

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Annual Ryegrass

Adaptation	Entire state. Tolerates poor drainage and close grazing. Soil pH should be kept above 6.0 for best results.
Maturity	Late
Cold Tolerance	Good
Problems	Interferes with bermudagrass emergence mechanism: (?) competition, luxury K uptake, allelopathy

Annual Ryegrass

Varieties	Attain, Big Boss, Diamond T (CP), Early Ploid (CP), Fria (M), Jackson (CP), Marshall**, Nelson, Prine, TAMTBO, and Winterhawk (P, M)

** Highly susceptible to crown rust.

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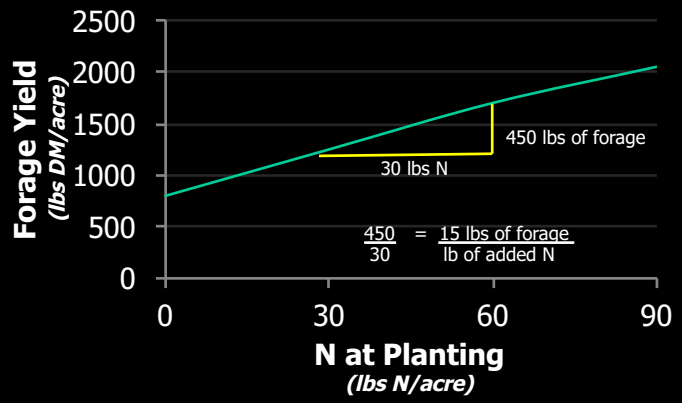
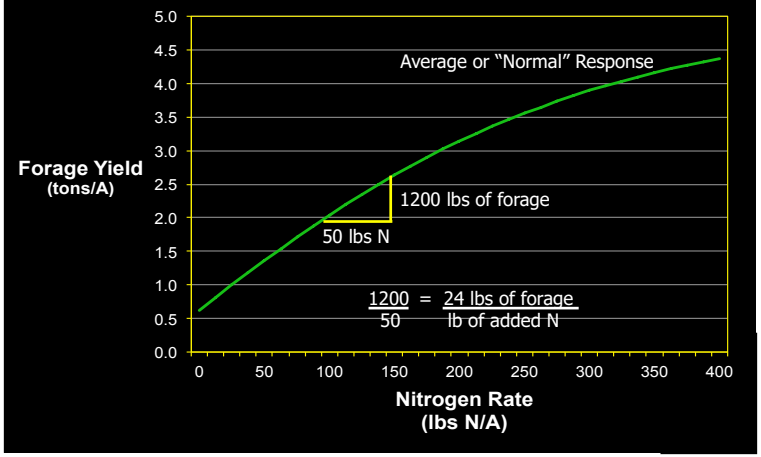
Annual Ryegrass Yield Response to N Rate at Planting



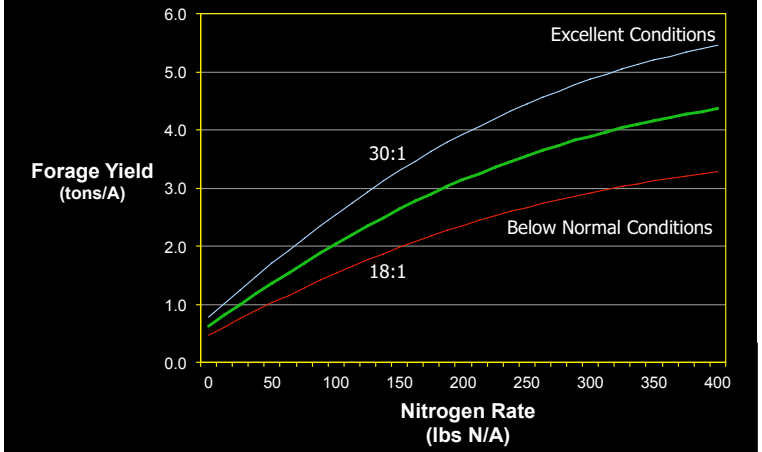
Cost Implications of Different Nitrogen Response Rates

	Cost of N, $/lb of N			
	$0.50	$0.60	$0.75	$1.00
Nitrogen Response	N Cost of Additional Production			
lbs of DM/lb of N	*$/lb of DM*			
5				
10				
15				
20				
25				
30				
35				
40				
45				
50				
55				

Annual Ryegrass Yield Response to N Rate Over the Whole Season



Annual Ryegrass Yield Response to N Rate Over the Whole Season



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Nitrogen Response: Rules of Thumb

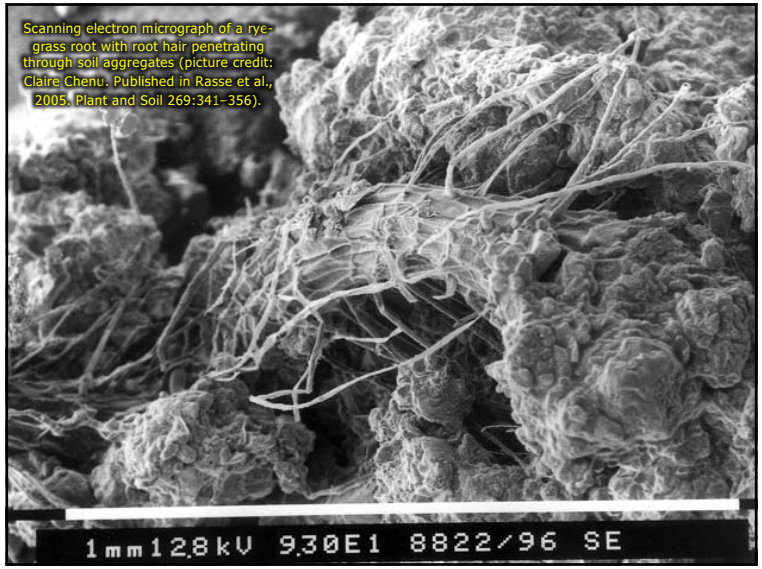
Forage Type	N Response Above Critical Level*		
	Early Season	Mid-Season	Late-Season
	------- lb of DM/lb of N added -------		

* N fertilization above an annual ~40, 50, or 25 lbs of N/acre for Coastal, Tifton 85, and ryegrass, respectively.

Improvement in soil OM in 3 paddocks located in a pasture-based dairy in Wrens, GA. (2007-2009)

Paddock	Initial	1 year	2 years	3 years
	------ *Soil Organic Matter, %* ------			
P4	1.08			
P8	1.01			
P14	1.14			
Avg.	**1.07**			

3 years after grazing system started, averaging an inc. in soil OM of 0.35 percentage points per year!!!



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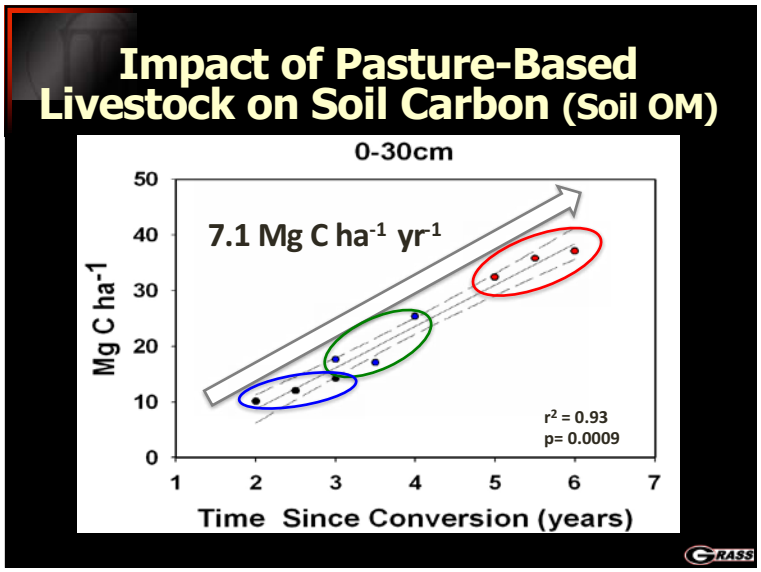

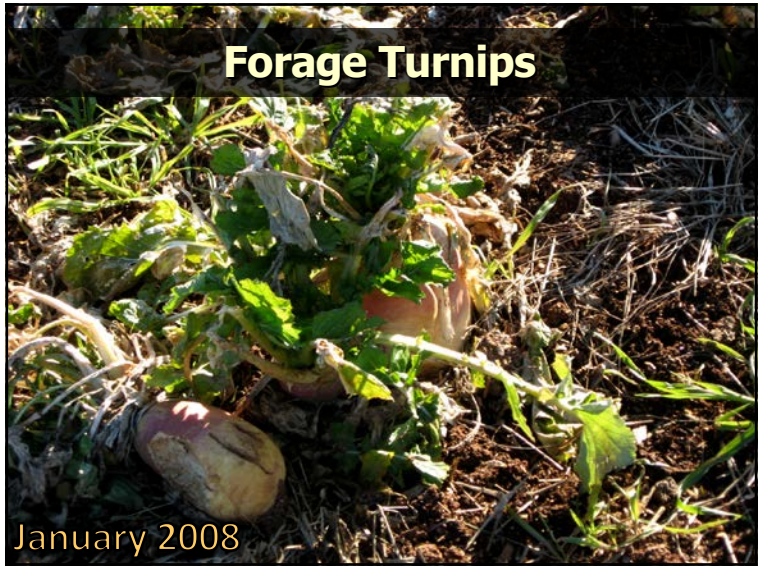

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Turnips (*Brassica rapa*)

- Bushy tops and large roots (bulbs)
  - High in carbohydrates
- Seeding rate = 1-3 lbs/ac
- Vary in partitioning of tops to bulbs
  - 90:10 – 15:85
- Quick to grazing:
  - 60-90 DAP
- Usually grazed 1-2 times for tops and once for bulbs

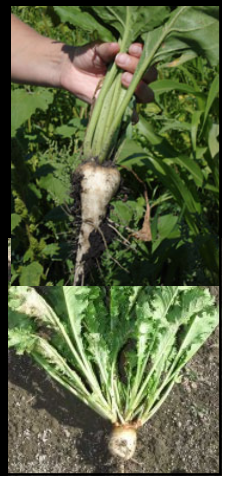
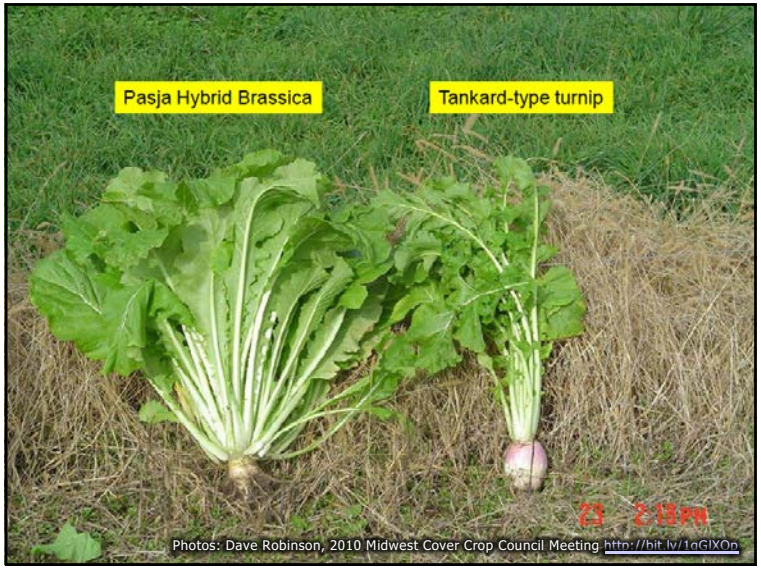


Photo credit: http://www.agassizseed.com/ (top)
http://www.ampacseed.com/ (bottom)

Leafy Turnips and Hybrids (*Brassica campestris* spp.)

- Usually crosses of turnips and oriental vegetables.
- Grazing begins earlier than forage rape
  - 45-75 DAP
- Seeding rate, 1-3 lbs/ac

Photo credit: http://www.brightseeds.co.uk/



Photos: Dave Robinson, 2010 Midwest Cover Crop Council Meeting http://bit.ly/1qGIXOn

Forage rape (*Brassica napus*)

- Ready to graze after 60-120 d.
  - At least 60 d before first grazing
  - 30 d before 2nd grazing.
- 3-4 lbs seed/ac
- Two types:
  - Leafy and upright
  - Dwarf that is short and branched.
- Develop reddish top when ready to graze.

Photo credit: http://www.brightseeds.co.uk/

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Kale (*Brassica oleracea*)

- Excellent winter hardiness
  - Down to 10° F
  - Excellent grazing into winter
- 3-4 lbs seed/ac
- Two types:
  - Narrow stem (up to 60" tall, 2" stem)
  - Stemless (up to 25")
- Later maturing
  - First grazing may be 90-120 DAP
- Can be conserved as baleage ("kaleage")

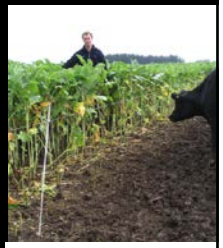

Photo credit: http://www.auswestseeds.com.au/ (top)
http://www.limagrain.co.uk/ (bottom)

Swede (*Brassica napus*)

- More commonly grown where winters are cold and summers are wet.
- 1-3 lbs seed/ac
- Larger bulbs than turnips
- Slower to mature (20-24 wk)
- Usually only grazed after reaching maturity.
- Not recommended in Georgia

Photo credit: http://gleadell.breezegroup.net/ (top)
http://www.scri.ac.uk/ (bottom)

Forage or "Tillage" Radish (*Raphanus sativus*)

- Partitions more energy to root than shoots
- Impressive root, but…
  - questionable as to impact on and practicality in forage systems.

Photos: Dave Robinson, 2010 Midwest Cover Crop Council Meeting http://bit.ly/1qGIXOp

Tillage radish may or may not breakthrough the compacted zone

Photo: Dave Robinson, 2010 Midwest Cover Crop Council Meeting http://bit.ly/1qGIXOp

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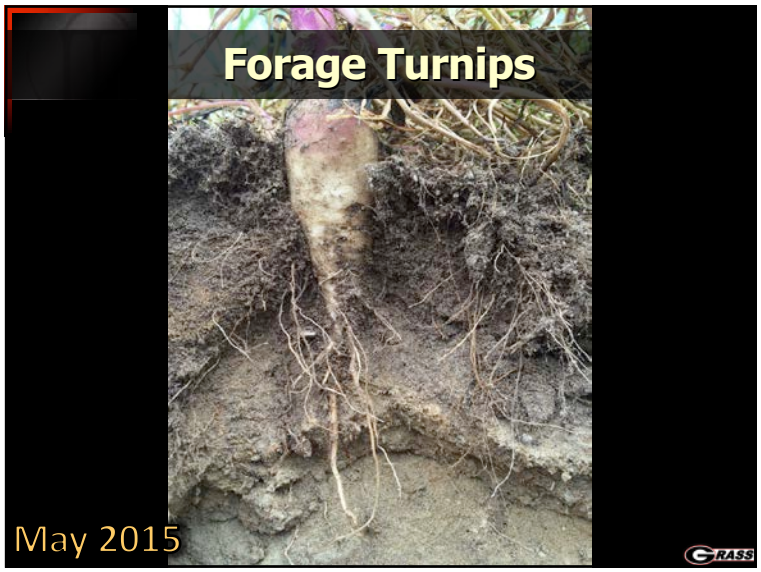
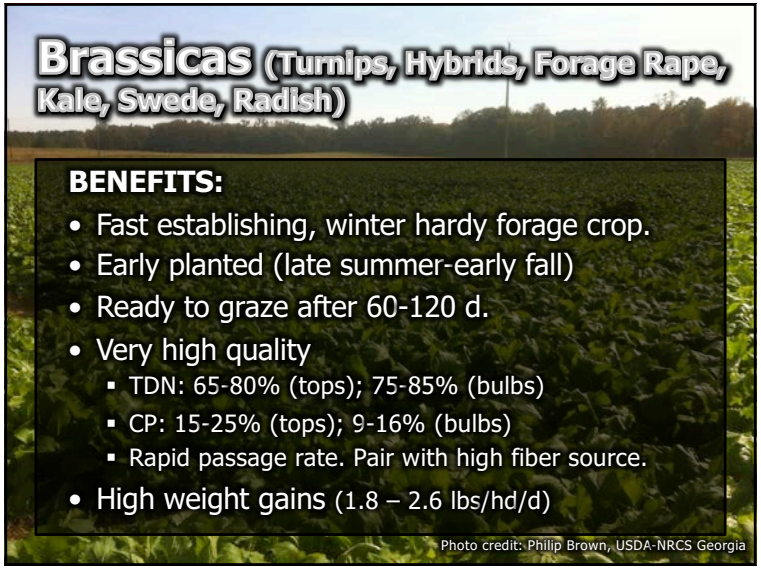


Brassicas

Type[1]	November 21	January 24	March 26	Total
	lb/ac			
Rape				
Barnapoli	812	2898	4257	7968
Bonar	924	2630	4222	7776
Dwarf Essex	1232	3121	4855	9209
T-Raptor	1799	4112	6211	12123
Turnips				
Appin	1571	2657	3928	8256
Barabas	1402	1746	1957	5105
Barkant	1241	1902	2434	5577
FL Broadleaf	1512	2505	3473	7491
Pasja	1420	3661	5761	10842
Purpletop	2375	2201	3389	7965
$LSD_{0.05}$[2]	560	445	532	866

[1]Planted at 5 lb/ac and fertilized with 400 lb of 15-5-10 at planting and after each harvest.
[2]LSD = Least Significant Difference. LSD for comparison of varieties within each column.
Source: Lang et al., 2007. Brassicas as Alternative Winter Forage for Mississippi. Mississippi State Univ.



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Brassicas (Turnips, Hybrids, Forage Rape, Kale, Swede, Radish)

BENEFITS:

- Aggressive growth competitive with weeds
- Tap root of some brassicas can help break through compaction or pans
- Naturally contain glucosinolates
  - Wards off many insect pests
  - Inhibits take-all disease (*Gaeumannomyces graminis var. tritici*)
  - Natural nematicide ("biofumigant")
  - Nitrification inhibitor
- Great renovation tool!

Photo credit: Philip Brown, USDA-NRCS Georgia

Brassicas (Turnips, Hybrids, Forage Rape, Kale, Swede, Radish)

CHALLENGES:

- Requires pH of 6.0-6.8 and well-drained soil.
- Not for overseeding! Does not tolerate much residue and tolerates NO competition from sod.

Photo credit: Philip Brown, USDA-NRCS Georgia

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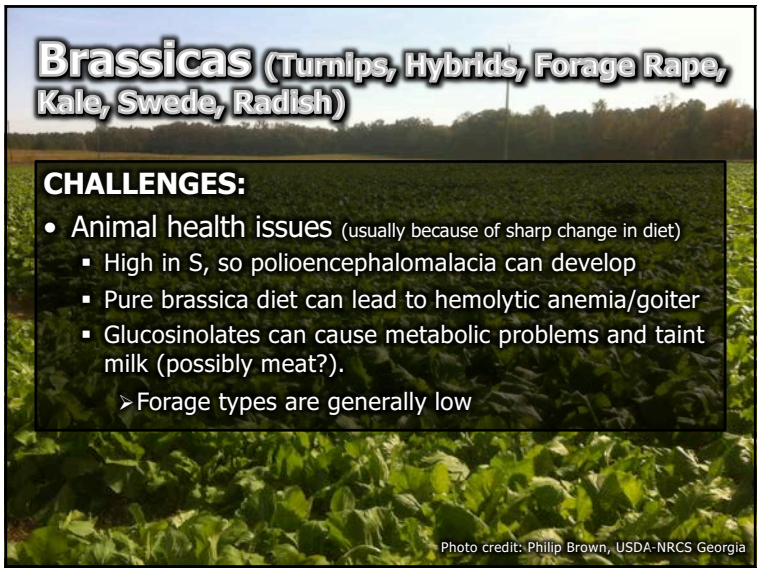

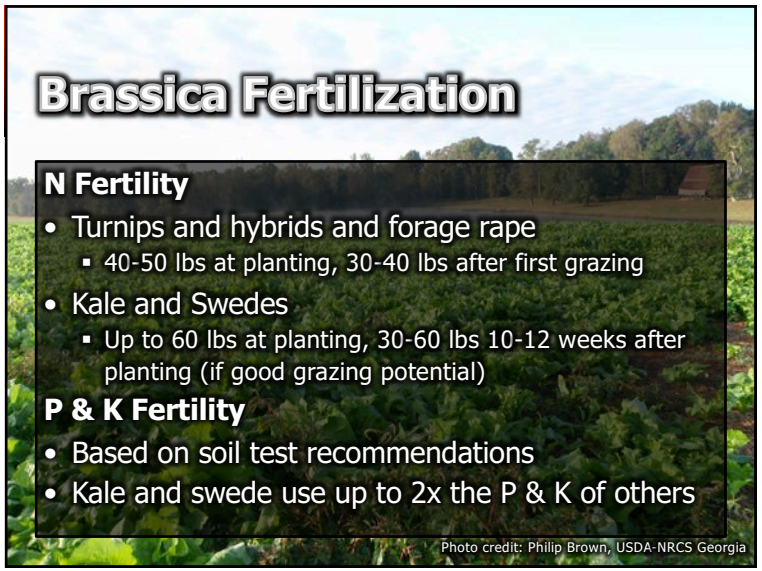

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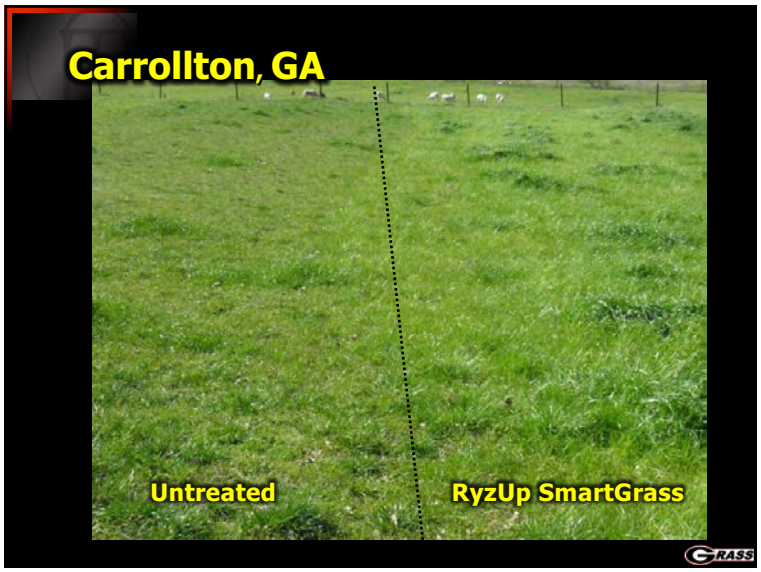

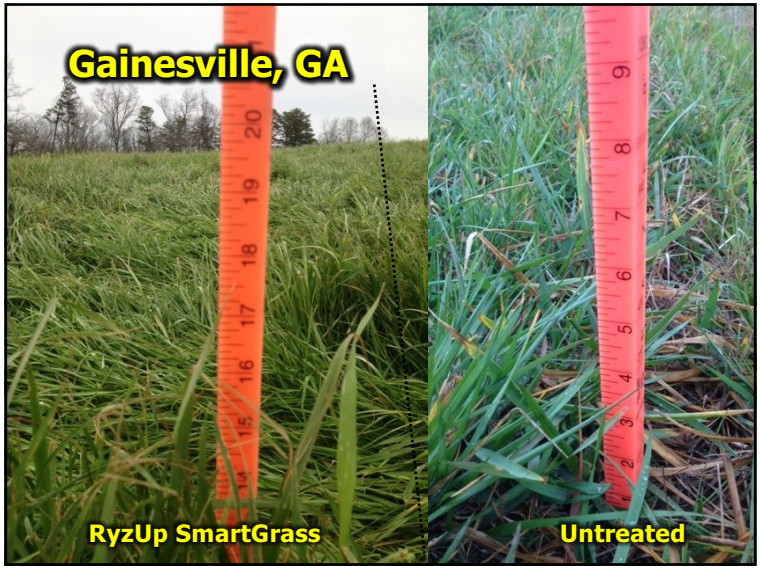

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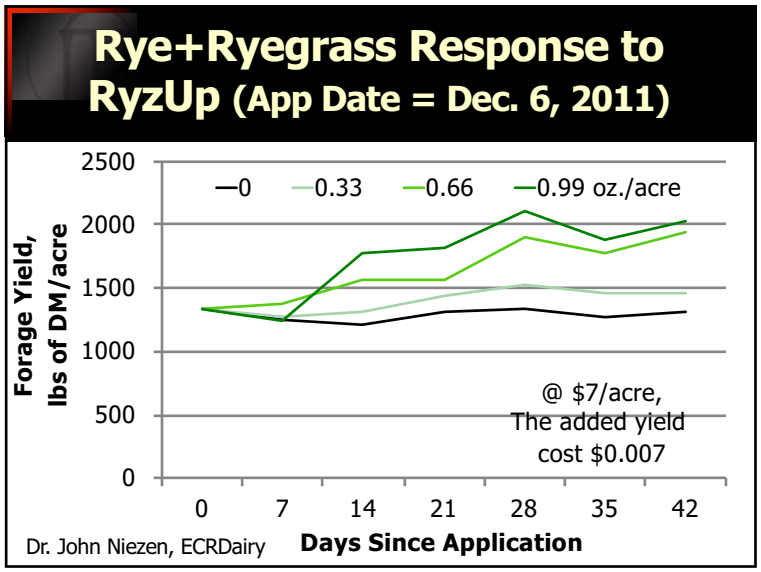

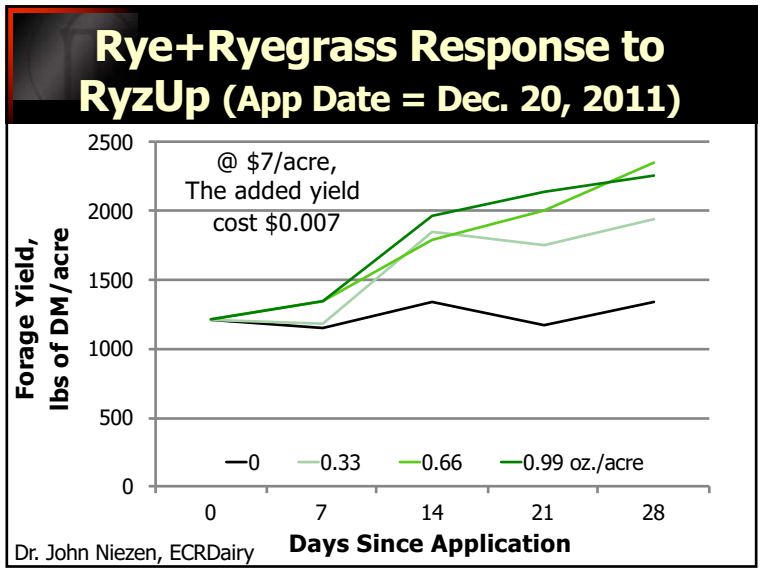

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