“Incorporating annual forages into a grazing plan for sheep and goats”

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Overview:

- Annuals are part of a pasture renovation program
- Annuals as part of a cover crop grazing program
- Use of annuals as part of lamb finishing system

Sheep grazing programs with annual forages:

- **Annual forage rotations within a sheep/goat farm grazing program**
- **Cover crop grazing with a diversified sheep/goat and cash crop farm *or* as a partnership between a sheep/goat and crop farm.**

Challenge for forage production systems on sheep and goat farms:

Can we alter and optimize forage systems to:

- **Improve whole-farm forage utilization?**
- **Meet the nutritional needs of the highly productive animals?**
- **Lower cost of production?**
- **Improve soil and land carrying capacity?**
- **Improve animal health/welfare?**

How can forage base diversification with annual forages improve whole-farm forage utilization?

- **Fill in deficits in perennial pasture production**
  - ✓ extend the grazing season and **reduce stored forage use**
- **Improve forage quality at times of need**
  - ✓ **Improve energy** content of forage (soluble CHO and fiber digestibility)
    - ➢ Late pregnancy and lactation of prolific ewes
    - ➢ Growing lambs
- **Provide "safe" forages, low in parasite infectivity**
- **Improve productive capacity of the land**
  - ✓ Replacement of low productivity pastures
    - ➢ Addition of soil amendments (manure, lime, etc.)
    - ➢ Replace with more productive and/or palatable species
  - ✓ Rests perennials to improve productivity and resilience
  - ✓ Annuals can out-yield perennials if strategically planted
  - ✓ Allows an increase in total forage output including stored forage

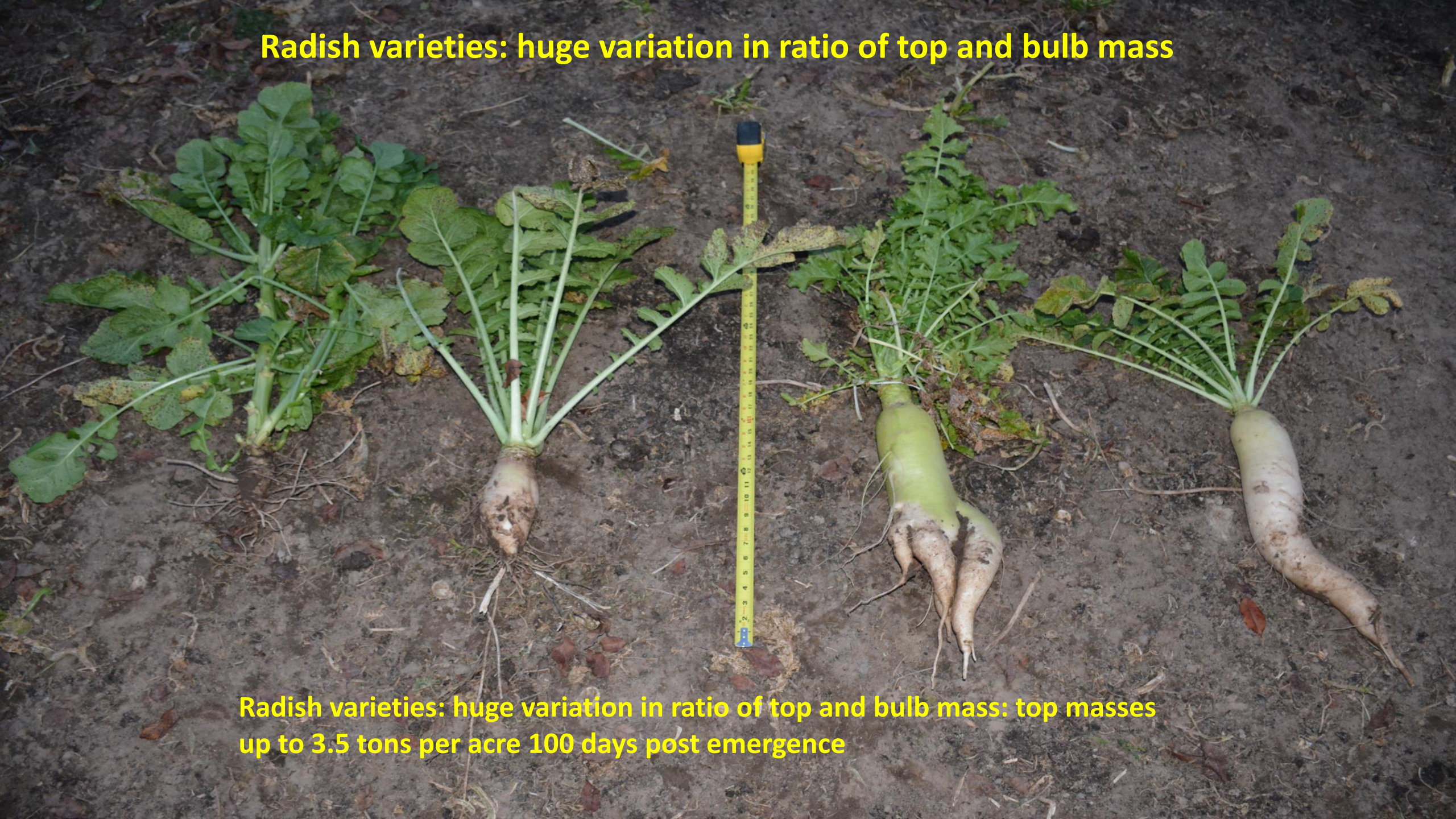
Case study of a complimentary forage rotation system :

- **Perennial pasture renovation targets:**
  - ✓**Pastures of poor yield and/or species composition**
  - ✓**Pasture birth paddocks**
- **Year 1-Brassica, warm season (C4) or brassica/C4 mixture planted into herbicide killed sod after approx. 50-60% of seasonal biomass production has been harvested by grazing or machine harvest**
- **Year 2-Red clover ,Italian ryegrass, chicory (biennial/short term perennial mixture) planted into brassica/C4 stubble from year 1.**
- **Year 3-Continued grazing of biennial/short term perennial mixture, then reestablishment of *perennial pasture in late summer/early fall***
- ***Years 4-8?-Perennial pasture***


Year 1
Year 2
Year 3

Year 1: "double-cropping of perennial pasture with annual forage"

- **Goal: Provide high quality, parasite free forage that will fill in the summer slump period *and* exceed yield of perennial pasture**
- **Annual forage crop planted in late June/early July after >60% perennial pasture annual yield.**
- **Soil amendments added (compost, manure, etc.)**
  - **Annual crops that germinate under limited soil moisture:**
    - ✓**Sudan hybrids (C4)**
    - ✓**Forage brassicas**
    - ✓**Brassica and warm season grass (C4) combinations**
  - **No-till seeding will limit moisture loss and minimize weeds**


Radish varieties: huge variation in ratio of top and bulb mass
Radish varieties: huge variation in ratio of top and bulb mass: top masses up to 3.5 tons per acre 100 days post emergence

Forage rape/kale hybrids

- Massive forage yields up to 5 tons per acre 100 day post emergence
- Nearly 45% is low quality, stalk fraction


BMR sudan grass and ‘Hunter’ (forage turnip x chinese cabbage) strips- day 25 after planting

Post weaning ewe lambs grazing a monoculture of ‘Hunter’ forage (turnip x chinese cabbage)

Year 2-3: High quality, short term perennial pasture

- **Goal: provide forage with outstanding quality and yield to maximize performance per unit land**
- **Additional soil amendments (manure, compost, lime, etc.) added and planting performed in early Spring.**
- **Legume, forb, grass mixture (Red clover, chicory, plantain, rye grass).**
- **Grazed for 2 years**


Short term perennial pasture of red clover/Italian ryegrass mixture in year 2

Cover crop grazing for small ruminants: a huge opportunity to improve production efficiency

- Use of annual forages within a cropping system
- Gigantic potential after primary crops of small grains, vegetables and corn harvested for silage
- *Fencing and water are barriers but easily overcome*
- *Opportunity for synergy between crop and livestock programs*
  - ✓ Within a farming program
  - ✓ *Partnership with neighboring farms*
- Crop farmers use cover crops for nutrient scavenging, soil protection, pest and weed control.
- Cover crops provide quality feed that can be *stockpiled* and can fill a deficit in a forage program

Management guidelines for cover crop grazing:

- Many opportunities with cropping programs
  - ✓ Silage corn-interseeded or flown-on
  - ✓ Corn grain-interseeded or flown-on
  - ✓ Sweet corn-drilled into stubble
  - ✓ **Winter wheat-frost seeding or drilled into stubble**

- Cover crop choices (annuals):
  - ✓ **Brassicas**
  - ✓ **Radishes**
  - ✓ **Cereal grains**
  - ✓ Legumes

- Mixtures offer complimentary nutrition, erosion control, better nutrient scavenging

Small ruminant cover crop grazing program 2010-present:

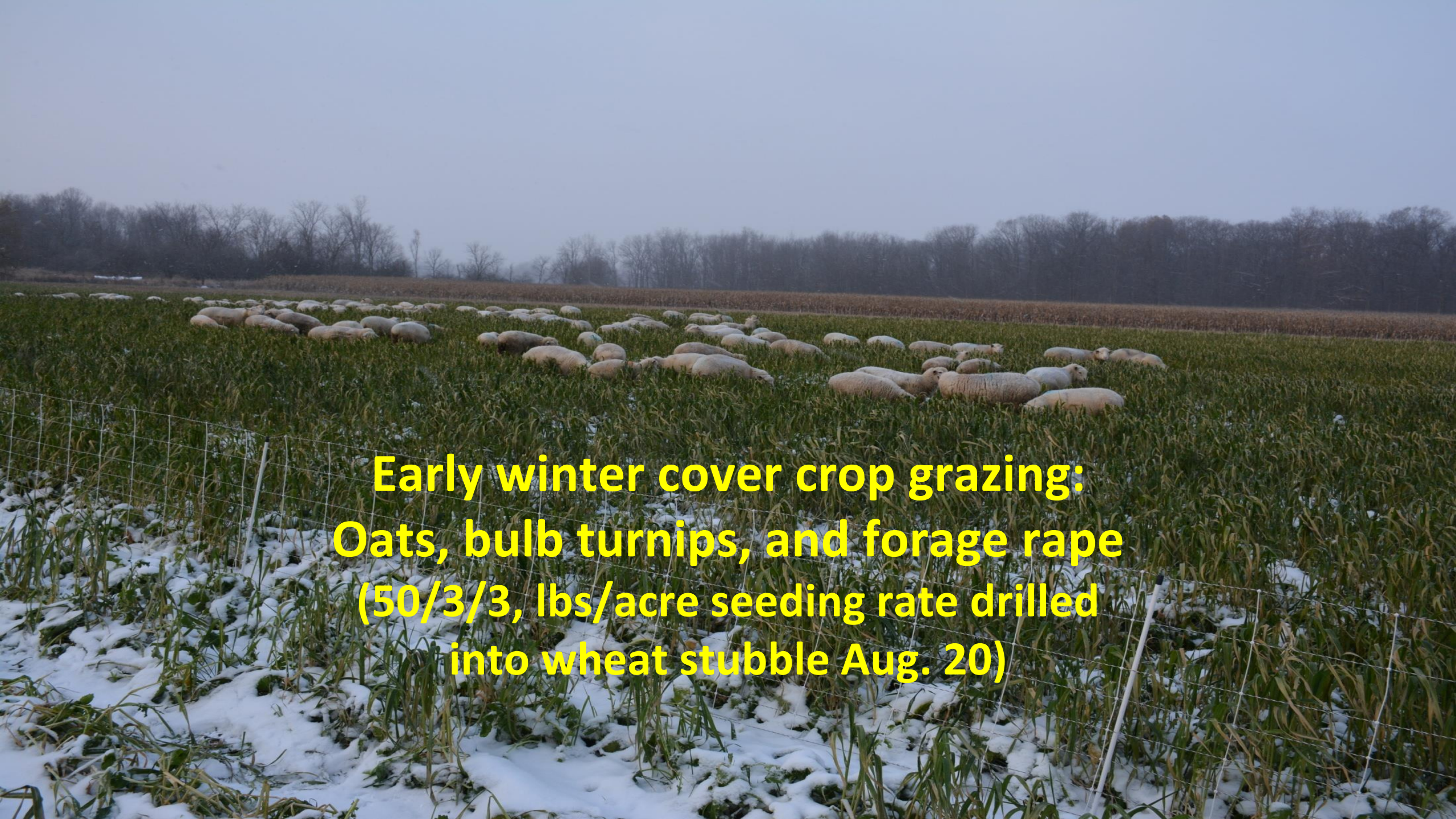
- Brassica, radish (4-9 lbs/acre) and oat (30-50 lbs/acre) combinations evaluated
- Planted into wheat stubble (July 25-Aug 20)
- Addition of 50 pounds N/ acre in early September
- Sheep introduced between October 1 and 25
- Sheep removed Jan 10-March 15
- Crop and sheep farm agreement:
  - ✓ Sheep farm: seed and fertilizer, manages grazing
  - ✓ Crop farm: plants seed

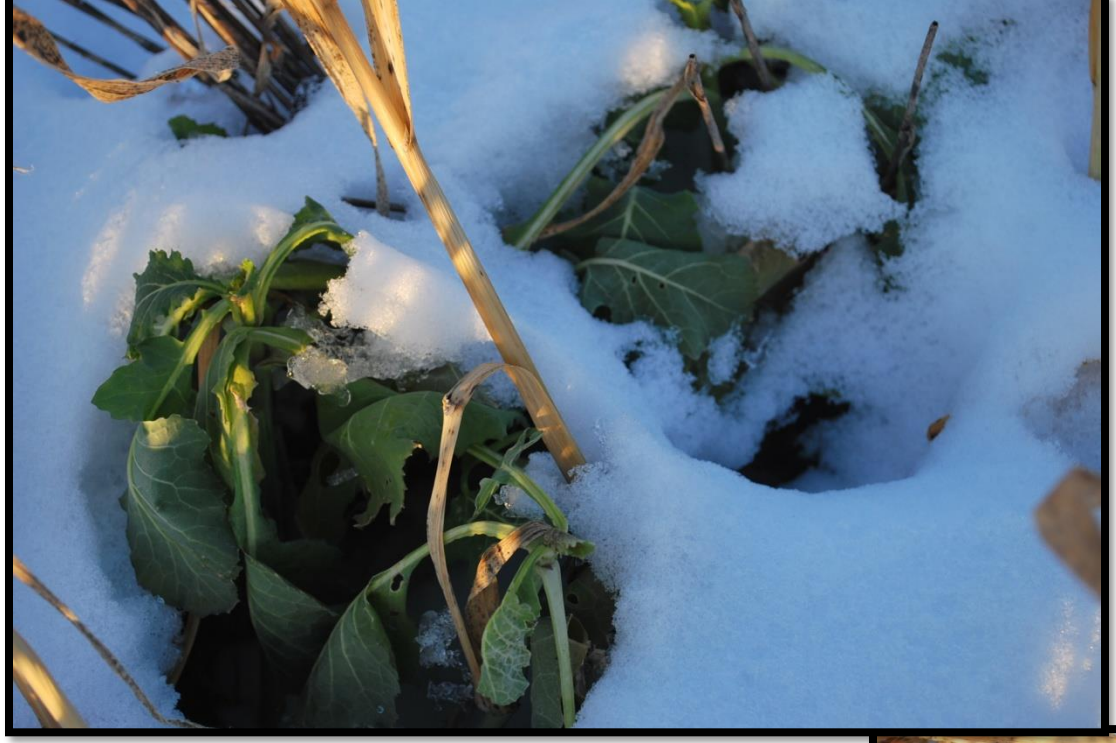
Cover crop combinations:

- **Brassicas, radish and small grains:**
  - ✓ Provide complementary (high soluble CHO plus digestible fiber)
  - ✓ Combination lowers risks of crop failure
  - ✓ Small grains help control mud issues during wet weather grazing
- **Brassica/radish choice:**
  - ✓ **Bulb turnips**
    - ➢ Bulbs stockpile well into february, tops are lost after extended cold <15 ° F
  - ✓ **Rape and Kale hybrids**
    - ➢ Tops hold quality longer than turnips, loose quality after extended cold at < 0 ° F
  - ✓ **Radishes**
    - ➢ Only top part of bulb available but tops hold quality longer than turnip bulbs but less than rape
    - ➢ Perhaps a good compromise between land and livestock benefits

Candidates for cover crops: Rape hybrids, Turnips, Radishes

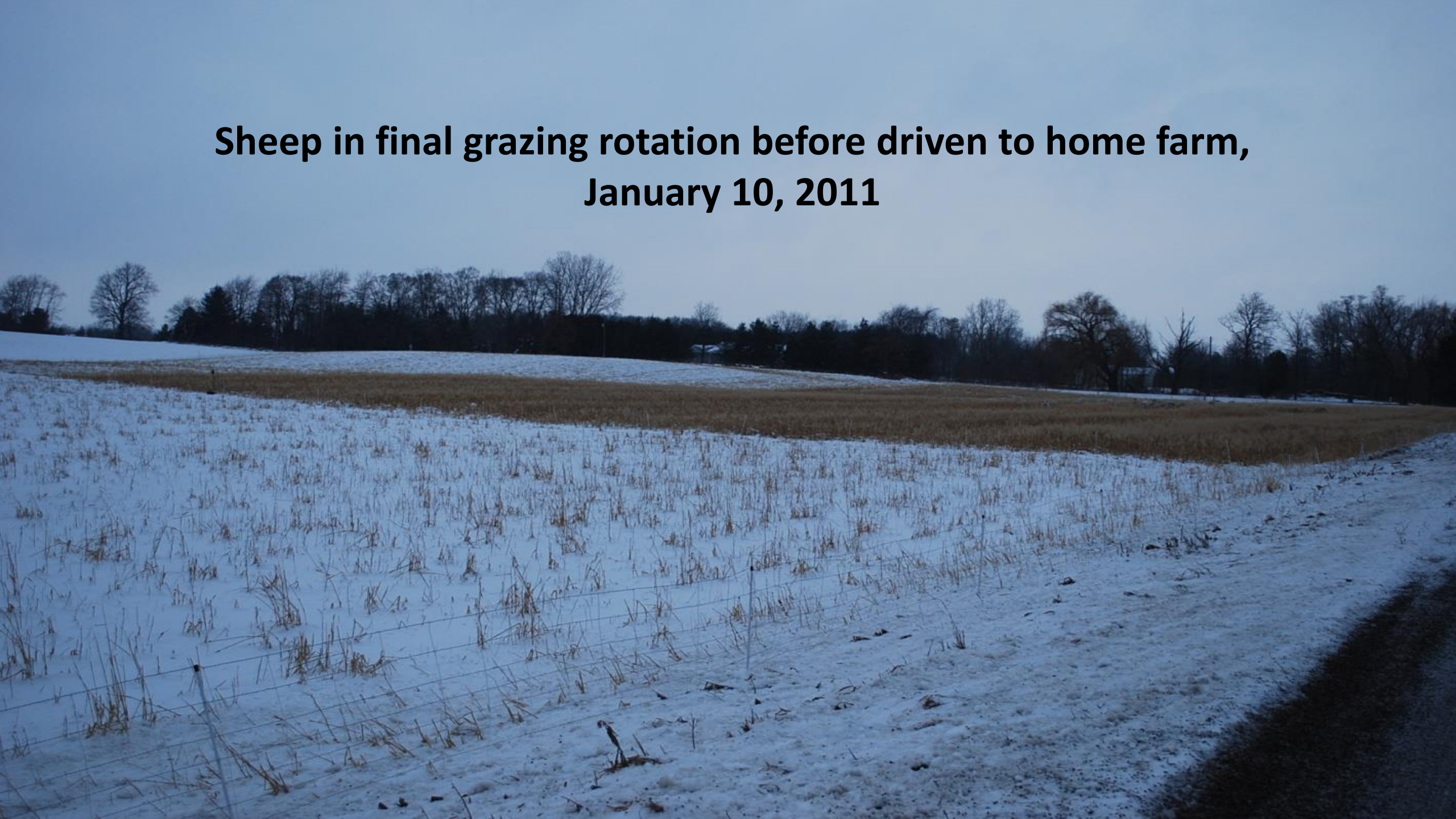
40 days post emergence, Sept. 28, 2012;
planted following break in 25 year drought


Early winter cover crop grazing:
Oats, bulb turnips, and forage rape
(50/3/3, lbs/acre seeding rate drilled
into wheat stubble Aug. 20)



“Winfred” forage rape hybrid
January 20, 2013

‘Hunter’ Chinese cabbage x forage turnip
January 20, 2013



Sheep in final grazing rotation before driven to home farm, January 10, 2011

Where does cover crop grazing fit best in sheep production systems?

Lamb backgrounding/finishing:

- Growth rates of 0.68 lb/day are possible on high quality brassica pasture however expect growth rates in the 0.45 lb/day range for most cover crop mixes and less intense grazing management
- Gains will drop off when mean daily temperature drops below freezing (late Nov/Dec in MI)

Ewe flock:

- High energy forage is perfect for flushing ewes and then maintaining them until late pregnancy. Ewes will easily gain a full body condition score on this feed if left on it for 60+ days (10-15 lb of tissue reserves for a 170 lb ewe)
- Replacement ewe lambs-gains of 0.35-0.45 lb/day- perfect plane of nutrition for breeding before 12 months of age

EVALUATION OF GROWTH PERFORMANCE, CARCASS AND MEAT QUALITY OF LAMBS REARED ON COVER CROP AND GRAIN FINISHING SYSTEMS.

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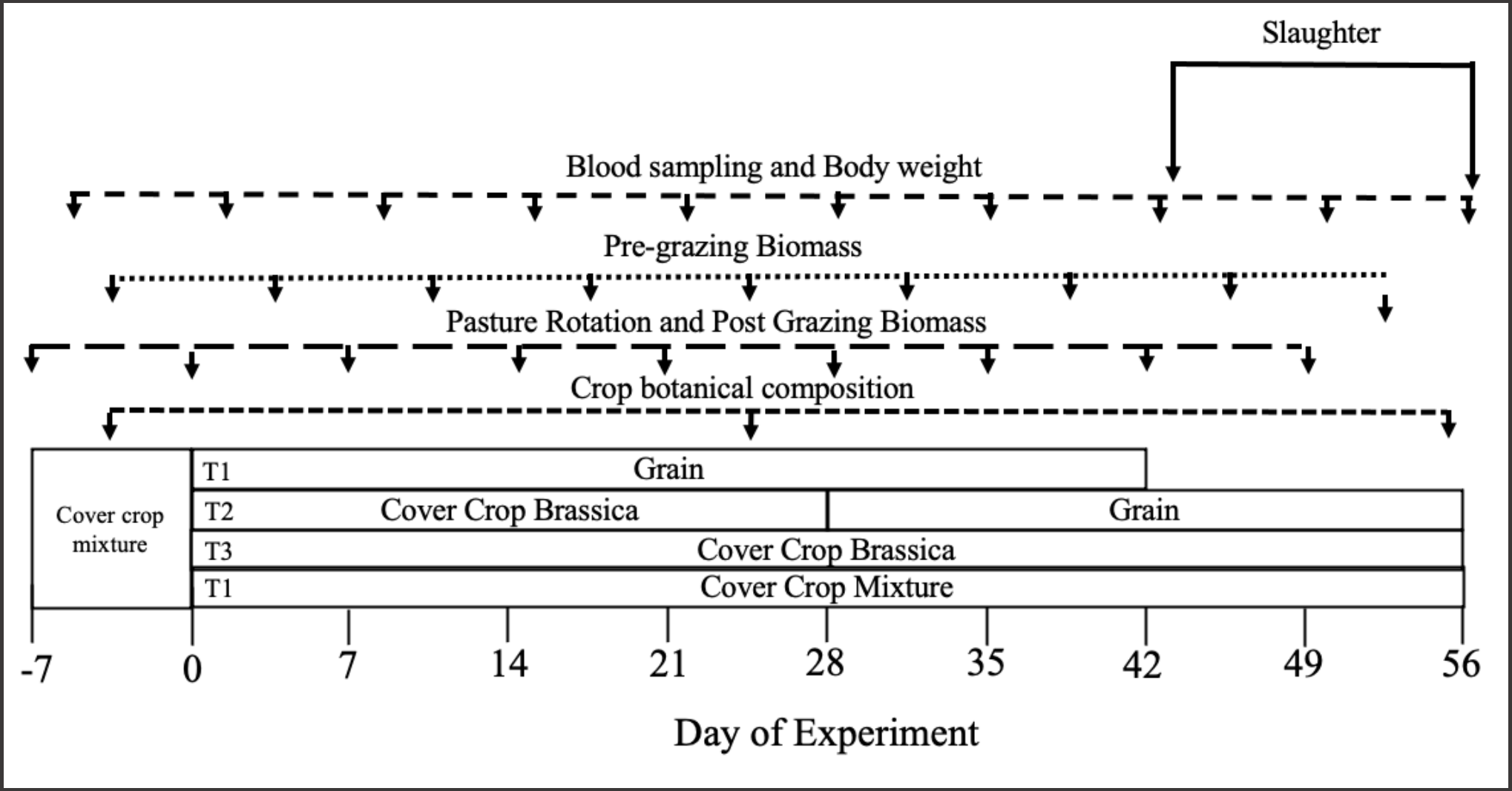
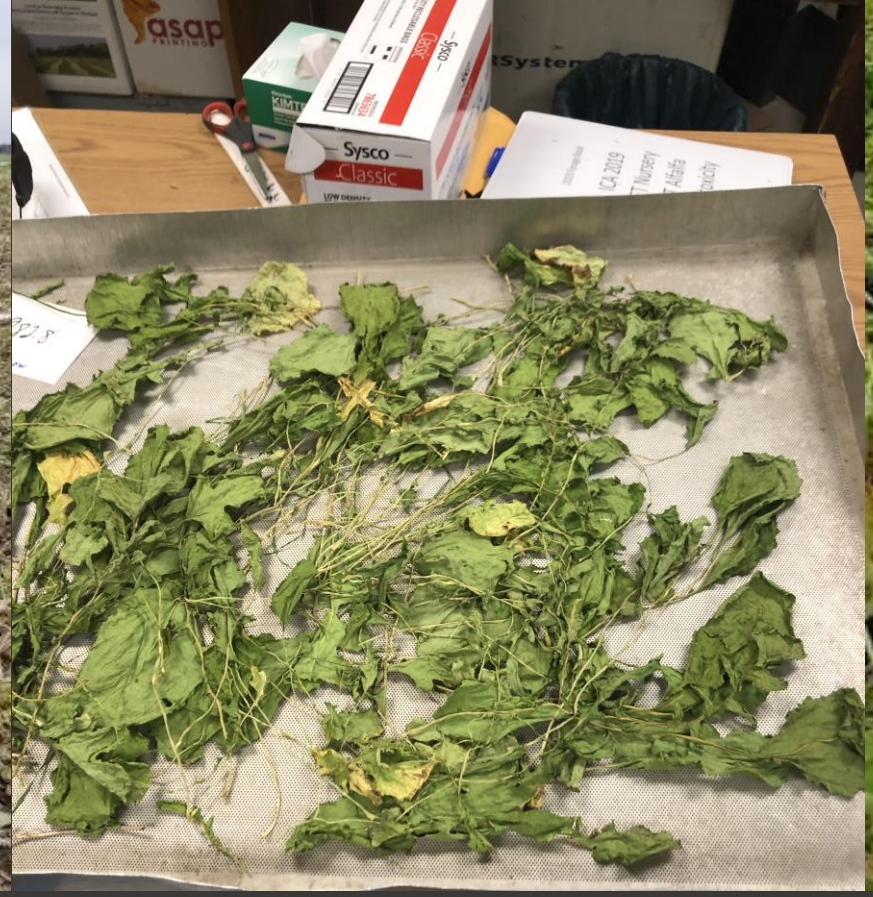
Design: Experimental Setup

- Randomized complete block with 3 replications of pen/pasture per treatment
- 5 Dorset x Polypay wether lambs per replication: 2019
- 4 Dorset x Polypay wether lambs and 1 ewe per replication: 2020
- Four treatments: N= 15 lambs per treatment
    - GRN - All grain feedlot control, 6 weeks
    - BKG – 4 week on brassica, then 4 week all grain feedlot
    - BRO - Brassica cover crop mix, 8 weeks
    - MIX - Diverse cover crop mix, 8 weeks

Timeline


Slaughter
Blood sampling and Body weight
Pre-grazing Biomass
Pasture Rotation and Post Grazing Biomass
Crop botanical composition
Cover crop mixture
T1
Grain
T2
Cover Crop Brassica
Grain
T3
Cover Crop Brassica
T1
Cover Crop Mixture
-7
0
7
14
21
28
35
42
49
56
Day of Experiment



Plant Sampling

Results: Botanical Composition

Brassica CC (BRO and BKG)

Diverse CC (MIX)

Feeding Management: Grazing

- Lambs grazed in 6-8 day period
- Paddock biomass was estimated weekly
- Allowance: paddock size was calculated weekly as the amount of pasture dry matter equal to 9-10% of the pen's bodyweight

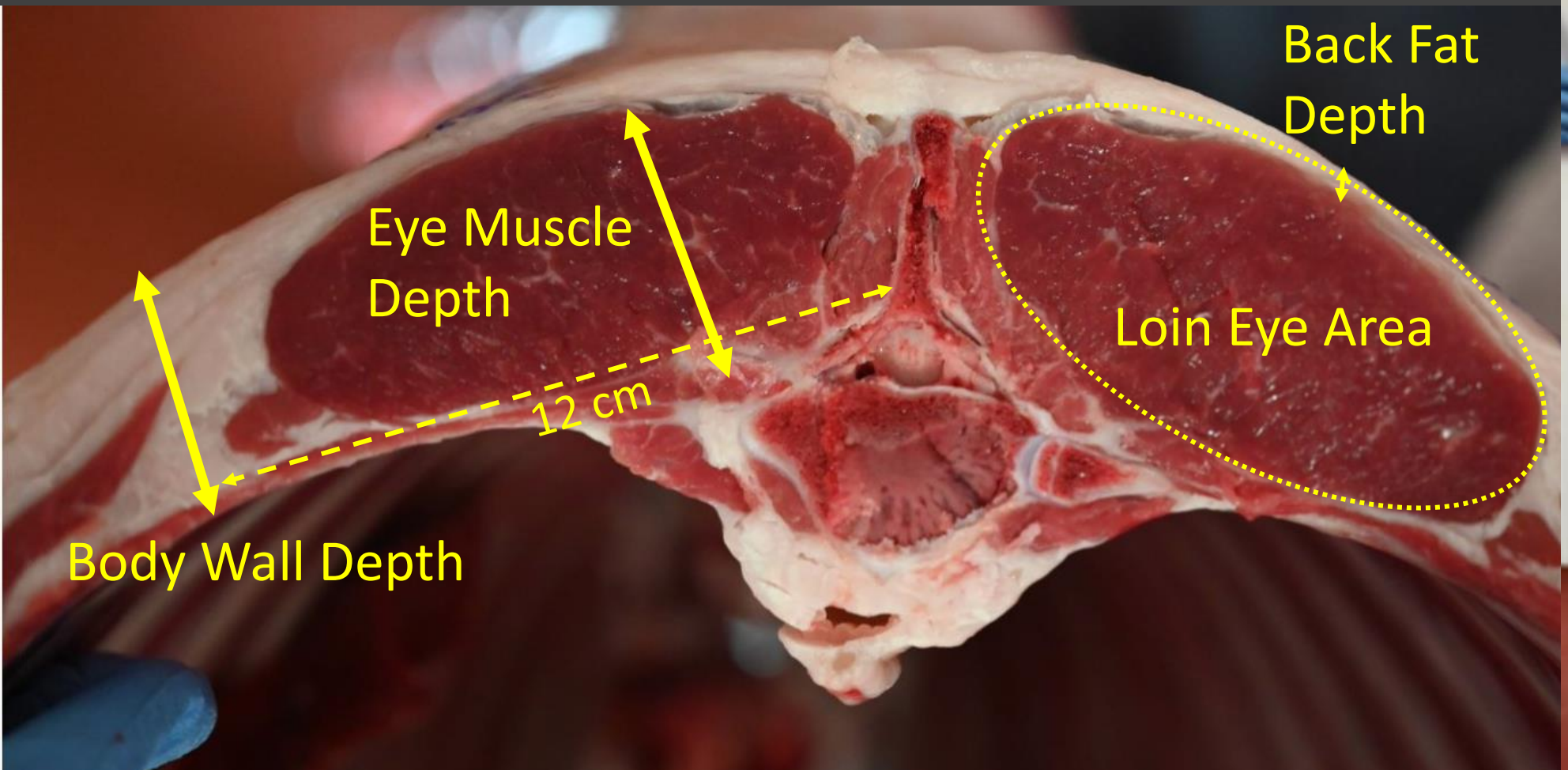
Feeding Management: Feedlot

- Lambs were fed a transition diet from pasture to grain
- Unlimited feed at minimum 20% refusal
- 6 weeks grain feeding for GRN
- 4 weeks grain feeding for BKG

Slaughter

- GRN slaughtered after 6-weeks of treatment
- BKG,BRO, MIX slaughtered after 8-weeks of treatment
- All carcass data was collected 24 h post slaughter

Carcass Measurements



Sensory Analysis:

- Loin chops subjected to sensory analysis by a consumer panel (Contract Testing, Grand Rapids, MI)
- 105 panelists, most consumed lamb every 2-4 wks
- Results recorded on a 100 point, continuous scale
- Attributes:
  - Juiciness
  - Overall acceptability/liking
  - Flavor
  - Tenderness

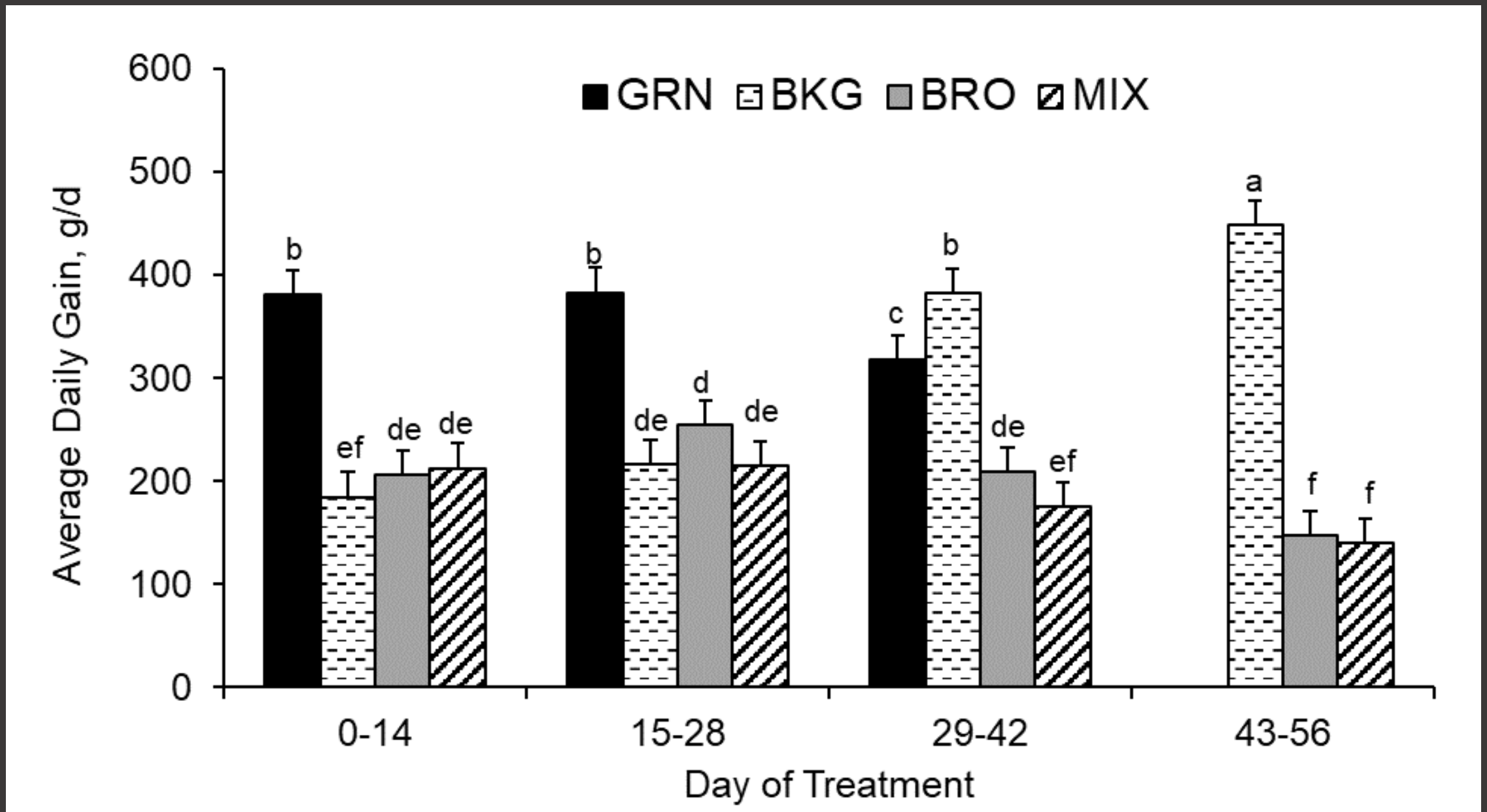

GRN
BKG
BRO
MIX
Average Daily Gain, g/d
600
500
400
300
200
100
0
b
ef
de
de
b
de
d
de
c
b
de
ef
a
f
f
0-14
15-28
29-42
43-56
Day of Treatment

Table 8: Carcass traits of lambs on reared on various treatments[1].

Carcass Trait	Treatments[1]				SE[4]
	GRN	BKG	BRO	MIX	
Hot Carcass Weight, kg	29.8[a]	30.2[a]	27.9[b]	27.3[b]	1.29
Back Fat Depth, cm	0.45[ab]	0.51[a]	0.40[bc]	0.38[c]	0.03
Body Wall Fat Depth, cm	2.28[a]	2.35[a]	1.95[b]	1.92[b]	0.14
Loin Eye Area, cm	20.6[a]	20.0[ab]	19.1[bc]	18.7[c]	1.09
Eye Muscle Depth, cm	3.77[a]	3.52[b]	3.40[c]	3.37[c]	0.04
Yield Grade[2]	2.16[ab]	2.37[a]	1.98[bc]	1.86[c]	0.10
Quality Grade[3]	3.00[a]	2.20	1.67	1.83	0.20
Dressing Percentage, %	51.5	50.6	51.8	51.5	1.29

[a–d] Within a row, least squares mean without a common superscript differ ($P < 0.05$)

The effect of dietary treatment[1] on consumer palatability traits of lamb loin chops (n=105).

	Treatments[1]				
Sensory Traits[3]	GRN	BKG	BRO	MIX	SE[2]
Liking	57.2	58.4	64.4	60.9	2.6
Flavor	52.1^{b}	55.7^{ab}	60.7^{a}	57.7^{ab}	2.8
Juiciness	50.4^{b}	51.4^{b}	60.4^{a}	49.5^{b}	2.7
Tenderness	56.4	54.0	63.2	57.3	2.9
Acceptability, % [4]	76.2	69.5	83.8	76.2	4.1

Summary:

- Annual forages can be used as part of a pasture renovation program to extend the grazing season, fill in gaps of production and improve carrying capacity of the farm.
- Annual forages can be use as cover crops in a partnership between a livestock and crop farmer for a win/win situation for both parties.
- Annual forages work great to support ewes/does but can also be used a backgrounding or even finishing system for lambs/kids
- Growth and carcass size will be lower on a grazing finishing system compared to grain however carcass and meat quality remain high.
- Use of cover crops as a background feeding system is a low risk endeavor as you can transition lambs to grain quickly if needed to avoid slow growth in cold weather and/or to create larger carcasses.

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Goiter

- Turnips and rape are goiterogenic
- Supplement I (iodine)

Trace minerialized salt with sufficient iodine (300 ppm)

Barriers for adoption of cover crop grazing (real or perceived)

- Fencing –need for security and portability
- Water-how can it be supplied during late fall and winter on crop land?

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Fencing Issues for cover crop grazing

Energizers:

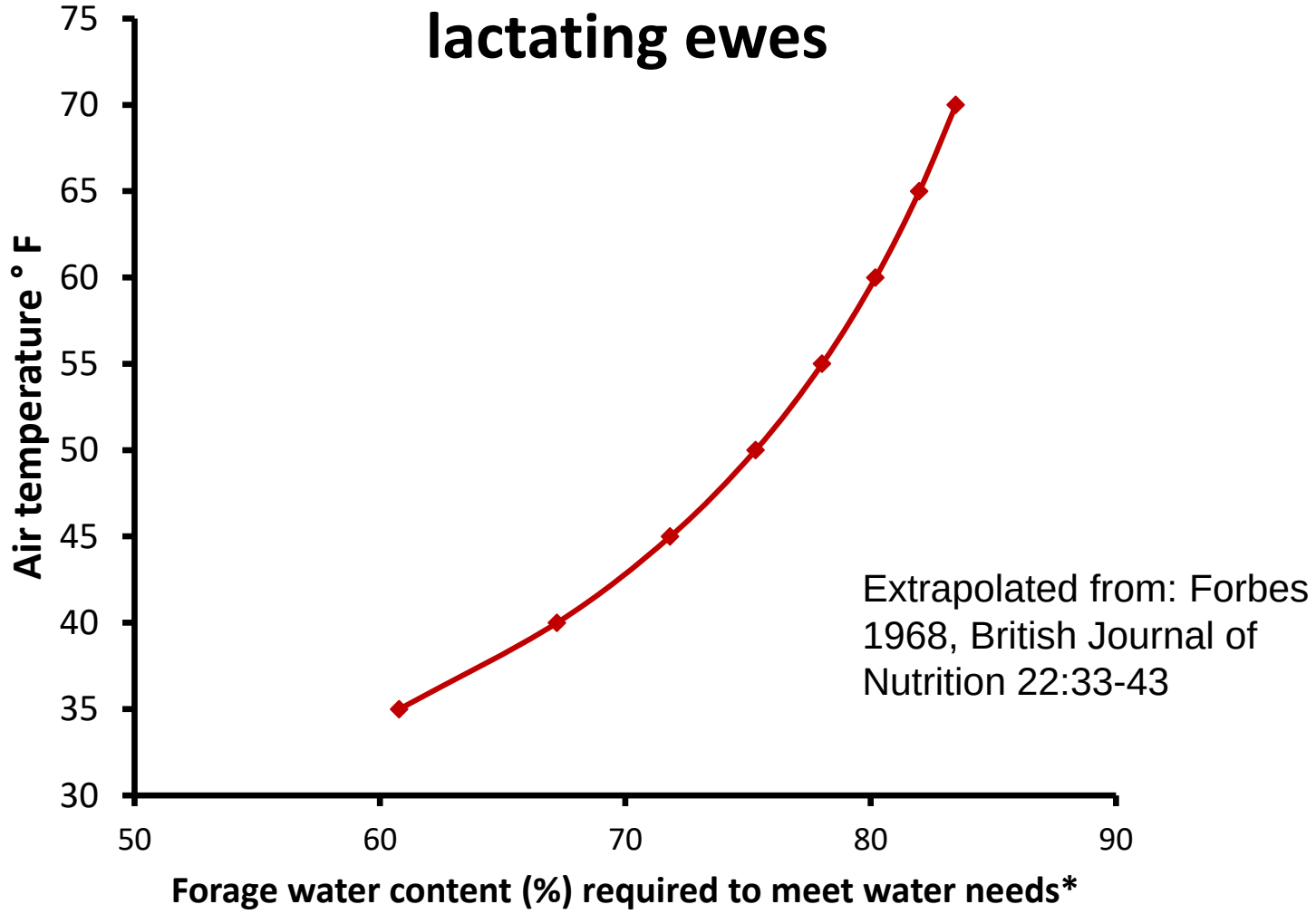
- Portable, 12 volt energizers are commonly used
- Choice of 12 volt energizer output is a balance between power (output measured in Joules) and rate of battery drain
- Target charge of >3000 volts
- Must be matched with portable grounding system
- Best to set up well-charged fence 1-2 weeks before bringing animals to allow wildlife contact


Crop may need to be trampled with truck or tractor with fence set-up in wheel tracks under heavy crop conditions

Factors to consider when assessing water needs of livestock during cover crop grazing

- Most cover crops are lush and with a water content (>80%) through mid fall which declines as the crop dies and is subject to freeze/thaw conditions
- Livestock water needs decrease by ~50% between 72° and 36° F
- Water needs are dependent on stage of production: (maintenance<growth<pregnancy<lactation)
- Snow is a major water source for winter grazing

Relationship between air temperature and forage water content required to meet water need of non-lactating ewes



*** Needs of non-lactating ewes before the last 30 days of pregnancy**

Forage water content required to meet water needs according to species and production state during cool weather (<55° F).

Species	Production State	Forage water %
Sheep	non-lactating, first 2/3 pregnancy	66
	last 30 days of pregnancy -singles	80
	last 30 days of pregnancy-twins	87
Cattle	non-lactating, first 2/3 pregnancy	74
	late pregnancy	85

Adapted from "Nutrient requirements of domesticated ruminants" CSIRO 2007

Forage water (oats plus radishes) in mid January = 76%


Brassica tubers are >90% water
Slide courtesy of J.S. Rook

Forage water content needs to be meets the need of most sheep classes except prolific ewes during late pregnancy

- Consumption of soft snow can make up deficit
- May need to move ewes off winter grazing during late pregnancy

Water needs summary:

- Forage water content meets the needs of most classes of sheep during cover crop grazing periods
- Consumption of soft snow contributes to water needs
- Dry matter intake can be limited by forage water content under certain conditions
  - ✓Brassica tuber grazing during late pregnancy
  - ✓Prolific ewes during late pregnancy
  - ✓Dry spells during mild weather (late fall or winter)
- Frozen snow/ice can limit grazing access
- Monitor body condition score

Windbreaks:

- Prevents pile up of ewes along permanent fence lines during winter storms
- May reduce feed requirements

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