Harvested Forage

Hay

Silage

Crop Residue

Hay Production

What to raise

Rules of establishment

Harvest timing

Yield vs quality

Renovating fields

Hay cost and market

Making good hay

Hay Crop Selection - perennial

Species	Seeding rate	CGREC DM yield
Meadow brome	12	2.71
Smooth brome	8	3.25
Intermediate wheatgrass	10	2.39
Crested wheatgrass	8	2.61
Green wheatgrass	8	2.12
Creeping foxtail	7	2.18
Reed canarygrass	5	2.05
Alfalfa	8	2.79
Sanfoin	20-30	2.44

Alfalfa or Alfalfa-Grass mix

- Alfalfa
  - Multiple cuttings
  - High Yield potential
  - Highest protein
  - Potentially high energy
  - Weevils and aphid pests
  - Winter kill susceptibility
- Grass Mix
  - Faster curing
  - Less damaged by rain
  - Longer harvest window
  - Better nutrient balance for cows
  - 35% + alfalfa included to fix N
  - Mix: alfalfa 3, meadow brome 8, intermediate wheat grass 6

Alfalfa Pests

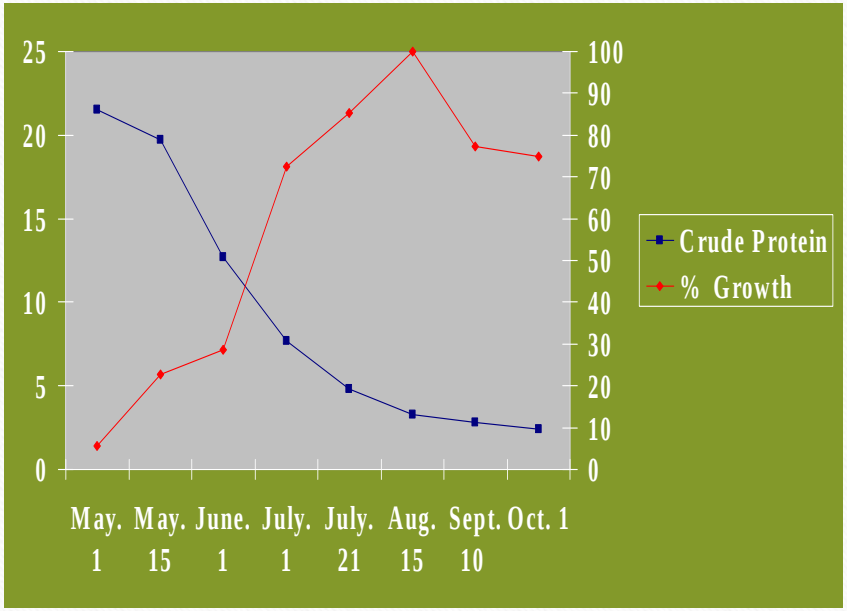
What about Sanfoin

- Non bloating very palatable legume
- Slow to establish and recover after cutting
- Less persistence over time
- Higher seeding rate and usually seeded as monoculture
- Prefers higher ph coarser soil
- Matures quicker than alfalfa but holds leaves better
- Some resistance to glyphosate

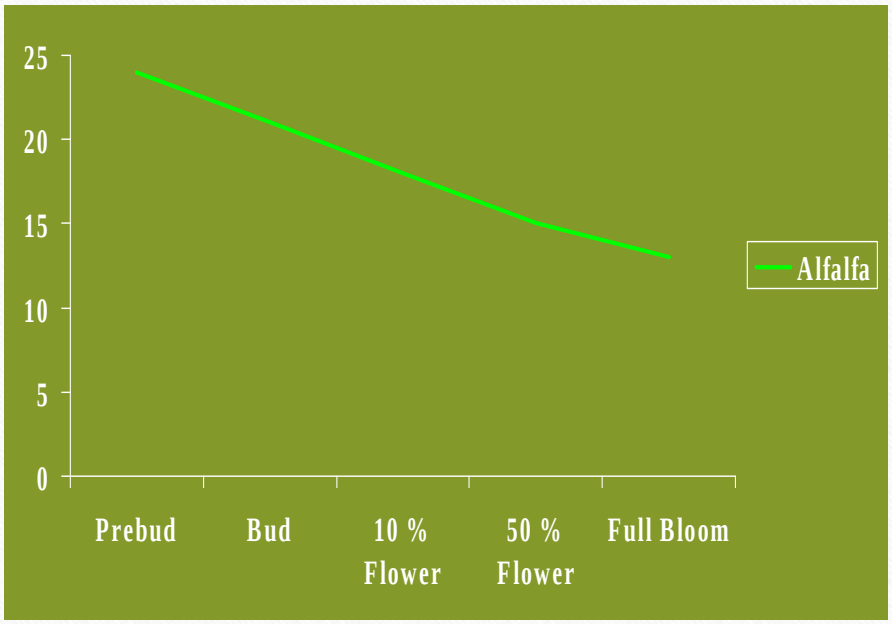
How about saline sites

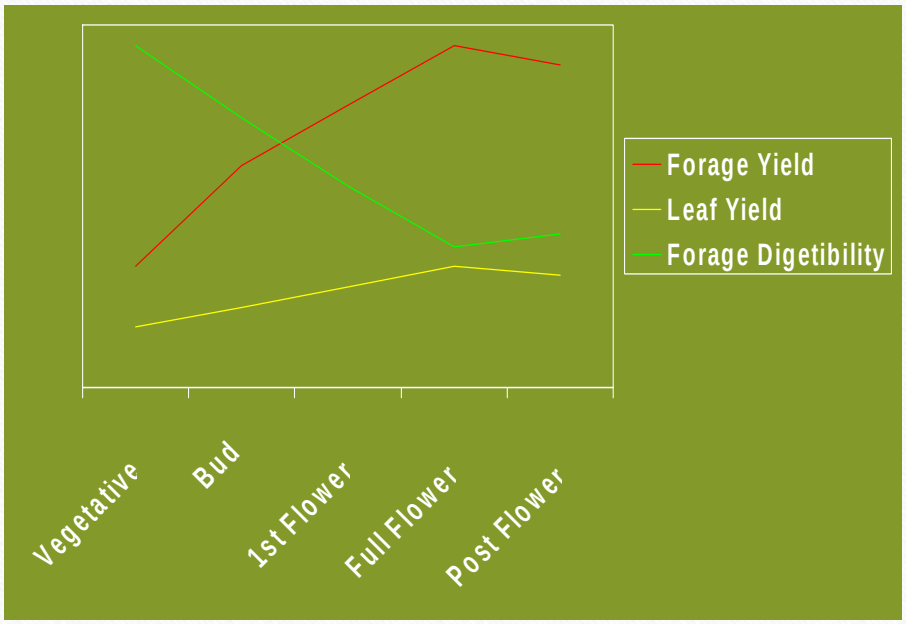
- Green or Tall wheatgrass are most tolerant species
- AC Saltlander has good feed value
- "salt tolerant" alfalfa is only marginally so (ec < 10)
- Reed canary grass can withstand extended wet or flooding
- Glyphosate foxtail barley prior to establishment

Harvest Timing - brome and wheat grass yield vs quality



Alfalfa cutting strategy: 1st cut bud to early bloom 2nd cut 50% bloom to 18 " final cut by 8/15 or frost





Rules of establishment

- Pick right crop and variety
  - Alfalfa winter hardiness rating
- Quality seed
  - Purity, germination, PLS
  - Inoculation
- Firm shallow seeding
  - .5 inch
- Weed control
  - Clean field, mowing, companion crop

Renovation - Rejuvenation

- Evaluation
  - Yield relative to potential
  - Desired vs undesired plants species
- Termination- re establishment
  - Late season glyphosate
- Over seeding Legume
  - Broadcast and harrow
  - Notill drill
- Fertilizing
  - Nutrient removal per ton
  - N-35, P-10, K-50, S-5, Boron
  - Early spring when soil moist, temps are cool, and rain is likely
  - Economics depend on hay value and fertilization cost
- Herbicides
  - Invasive weeds

Hay Crop Selection – cool season annuals

Species	rate	stage	Carrington Yield 2015		Streeter Yield 2011
Oats	100	milk	2.30	10.3	2.57
Forage oats	100	milk	2.71	10.1	3.67
barley	90	early dough			2.48
Hay barley	90	early dough	2.56	10.1	2.68
Forage Winter Wheat			1.73	9.2	
Triticale	120	flowering	2.52	10.6	2.53
Forage field peas	160	flat pod	1.03	18.5	2.33
Oat pea			2.60	14.3	
Barley pea			2.21	12.1	

Hay Crop Selection – warm season annuals

Species	rate	stage	Carrington Yield 2015		Streeter Yield 2011
German millet	12-15	heading	2.37	9.4	2.39
Siberian millet	12-15	heading	2.13	10.8	2.76
Pearl millet	12-15		3.53	11.6	2.75
Sudan grass	20-25		4.19	9.5	3.2
Sorghum x sudan	20	heading	3.65	10.2	3.43
Forage sorghum	15				
Soybean	80	50% pod			2.14
Cowpea	80				2.23

German Millet – swath graze

- Spray roundup
- Seed June 15-25
- Fertilize 60-20-0
- Swath September 10-25
- Graze Nov-Dec
- 85 grazing days per acre
- Ration acres or stock to use in 40 days

Minimize Harvest Losses

- The quality can be no better than the stage and quality at cutting
- But can be diminished greatly by weather, harvest and storage losses
- Quality losses are related to leaf shattering and deterioration
- Harvest technique is critical in maintaining quality

Minimize time in field – fast curing

- Dry from 80% to less than 20% moisture
- Cut early in day maximizes drying and leaf retention but lowers NS – CHO
- Mechanical conditioning reduces drying time
- Raking or tedding enhances uniform drying

Raking ?

- In sunny conditions alfalfa will dry to 30-40% in one day
- Leaf loss will be high if moved under 30%
- Raking in early morning preferred
- Raking enhances rate and uniformity of drying by spreading cut windrow and turning
- Raked windrows feeds baler more uniformly

Wide Swath Haymaking

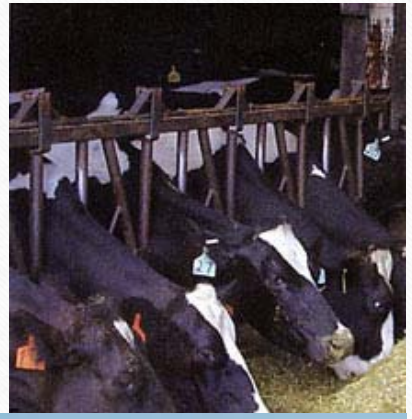
- Maximize drying in small harvest windows
- Faster dry down lessens respiration loss and minimizes chance for rain damage
- Merge windrows at optimum moisture
- Mowing provides full cut to swath width
- Conditioning provides 80-50% swath width to cut width

Rain damage

- Typical losses, 1” rain
  - DM loss 8-17%
  - CP decrease 1.7%
  - TDN decrease 7%

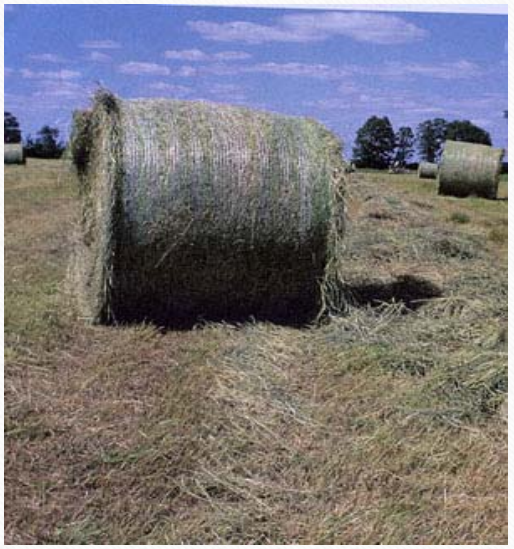
Bale at correct hay moisture

- Optimum moisture depends on baler type and if "green" hay or "dew"
- For hard core large round and large rectangular 16% is about the limit
- By time stems dry, leaves are too dry and shatter so bale on dew (<20%)
- Heating and mold growth in wet hay reduces protein and dry matter digestibility



Net Wrap?

- Faster wrapping
  - **Greater baling productivity**
  - **Lower leaf loss**
- Lower storage loss
  - **Shed water**
- Cost - ????



Use Preservatives when Needed

- Buffered propionic acid is effective in preventing mold and preserving high moisture hay
- Application rate depends on hay moisture .5 to 1.5 % from 20-30%
- Must be uniformly applied during baling
- Generally economical when reduce losses that would be incurred from weather/rain damage

Bacterial innoculant products are also used. They are cheaper but less consistent.

Cost to raise hay – ND farm management

- Alfalfa
  - Yield/acre 2.44
  - Direct Costs 80
    - Fertilizer, fuel, repairs, chemical seed, operating interest
  - Land 27
  - Overhead Costs 32
    - Machinery depre and lease, utilities, insurance hired labor
  - Cost per Ton $57
- Alfalfa/Grass Mix
  - Yield/acre 1.4
  - Direct Costs 23
    - Fertilizer, fuel, repairs, chemical seed, operating interest
  - Land 25
  - Overhead Costs 23
    - Machinery depre and lease, utilities, insurance hired labor
  - Cost per Ton $51

Cost to raise hay – ND farm management

- Grass
  - Yield/acre .80
  - Direct Costs 24
    - Fertilizer, fuel, repairs, chemical seed, operating interest
  - Land 11
  - Overhead Costs 20
    - Machinery depre and lease, utilities, insurance hired labor
  - Cost per Ton $68
- Oat
  - Yield/acre 2.5
  - Direct Costs 80
    - Fertilizer, fuel, repairs, chemical seed, operating interest
  - Land 35
  - Overhead Costs 32
    - Machinery depre and lease, utilities, insurance hired labor
  - Cost per Ton $59

Hay Price

- Feed Value
  - Cost per Lb TDN
    - $2.75 corn = $.05
  - Cost per lb Crude Protein
    - $120 DDGs = $.22
  - Hay 85% DM, 8% CP, 55% TDN
    - $75/Ton
- Market Value
  - Ag Stats ND monthly hay Survey
    - Alfalfa - $80
    - Other - $58
  - Regional Auction (ag week - Iowa)
    - Large rounds, fair alfalfa $110
    - Large rounds, utility grass $70
  - Local Pricing
    - www.hayexchage.com/ndphp
    - NDSU feedlist

Many aspects of haying have to do with Equipment may account for 40% of production costs

- Custom Rate
  - Mowing 12
  - Raking 6.5
  - Mow Conditioning 14.25
  - Swathing 13
  - Large round bale 11.25
  - Large Round bale Wrap 12.75
  - Silage Chopping (per hr/row) 65

Crop Residue

- Calculated cost
  - ISU Spreadsheet
  - Market Value

		CP	TDN	Tons
Wheat straw		3.6	43	.7
Corn stalks		4.8	45	1.4
Pea straw		8.5	46	.5
Oat straw		4.5	47	.8

Feed value and nutrient costs for corn stover			Nutrient removal rates, lb. / ton of dry matter	
Hay price for medium quality mixed grass/legume hay, $ per ton	$	70	Nitrogen, lb.	4.0
Price of dried distillers grains (DDGS), $ per ton	$	120	Phosphorus, lb.	3.0
Price of anhydrous ammonia, $ per ton	$	580	Potassium, lb.	19.0
Price of DAP (18-46-0), $ per ton	$	500	*Estimated bales harvested per acre (optional)*	
Price of potash (0-0-60), $ per ton	$	480	Corn yield, bu./acre	110
Corn stover harvested			% of stover harvested	50%
Estimated moisture percent of stover, %		20%	Est. bales harvested per acre	2.5
Estimated weight of a large bale of corn stover		1,300	*Estimated weight of a large round bale (optional)*	
Bales harvested per acre		4.0	Bale diameter, inches	66
Harvesting costs for corn stover			Bale width, inches	60
Chopping stalks, $ per acre	$	12.00	Estimated bale wet weight, lb.	1,336
Raking, $ per acre			*Estimated weight of a large square bale (optional)*	
Baling, $ per bale	$	13.00	Bale height, feet	3
Moving bales to storage, $ per bale	$	2.00	Bale width, feet	4
Cost for plastic wrap (if used), $ per bale			Bale length, feet	8
Transporting bales to point of sale, $ per bale	$	6.25	Estimated bale wet weight, lb.	1,320

See current Iowa Farm Custom Rate Survey

Value for large round bales of corn stover						
Value based on costs to seller (minimum price to accept)		Per Bale		Per Wet Ton		Per Acre
Pounds of nitrogen removed		2.1		3.2		8.3
Pounds of phosphate removed		1.6		2.4		6.2
Pounds of potash removed		9.9		15.2		39.5
Cost to replace nitrogen	$	0.74	$	1.13	$	2.94
Cost to replace phosphate	$	0.63	$	0.97	$	2.53
Cost to replace potash	$	3.95	$	6.08	$	15.81
Total harvesting costs	$	24.25	$	37.31	$	97.00
Equals cost of corn stover (at point of sale)	$	29.57	$	45.49	$	118.28
Value based on the cost of alternative feed sources (maximum price to offer)						
Market value of 1.16 tons of hay minus .22 ton of DDGS	$	35.62	$	54.80	$	142.48

Forage Toxicities

- Nitrates
  - % nitrate =
  - ppm nitrate/100000
- Prussic Acid
  - Warm season annual grass
- Mold
- Poisonous Plants
- Ergot

Table 3. Guidelines for Nitrate in Feedstuffs (Express on 100% Dry Matter Basis in the Total Diet)

Nitrate Content %	Comment
0.0- 0.44	This level is considered safe to feed under all conditions.
0.44-0.66	This level should be safe to feed to nonpregnant animals under all conditions. It may be best to limit its use for pregnant animals to 50% of the total dry matter in the ration.
0.66-0.88	Feeds safely fed if limited to 50% of the total dry matter in the ration.
0.88-1.54	Feeds should be limited to about 35-40% of the total dry matter in the ration. Feeds containing over 0.88% nitrate should not be used for pregnant animals.
1.54-1.76	Feeds should be limited to 25% of total dry matter in ration. Do not use for pregnant animals.
over 1.76	These feeds are potentially toxic. Do not feed.

Silage sample should be taken after fermentation is complete (3 weeks), because proper fermentation will decrease the nitrate content by 40-60%.