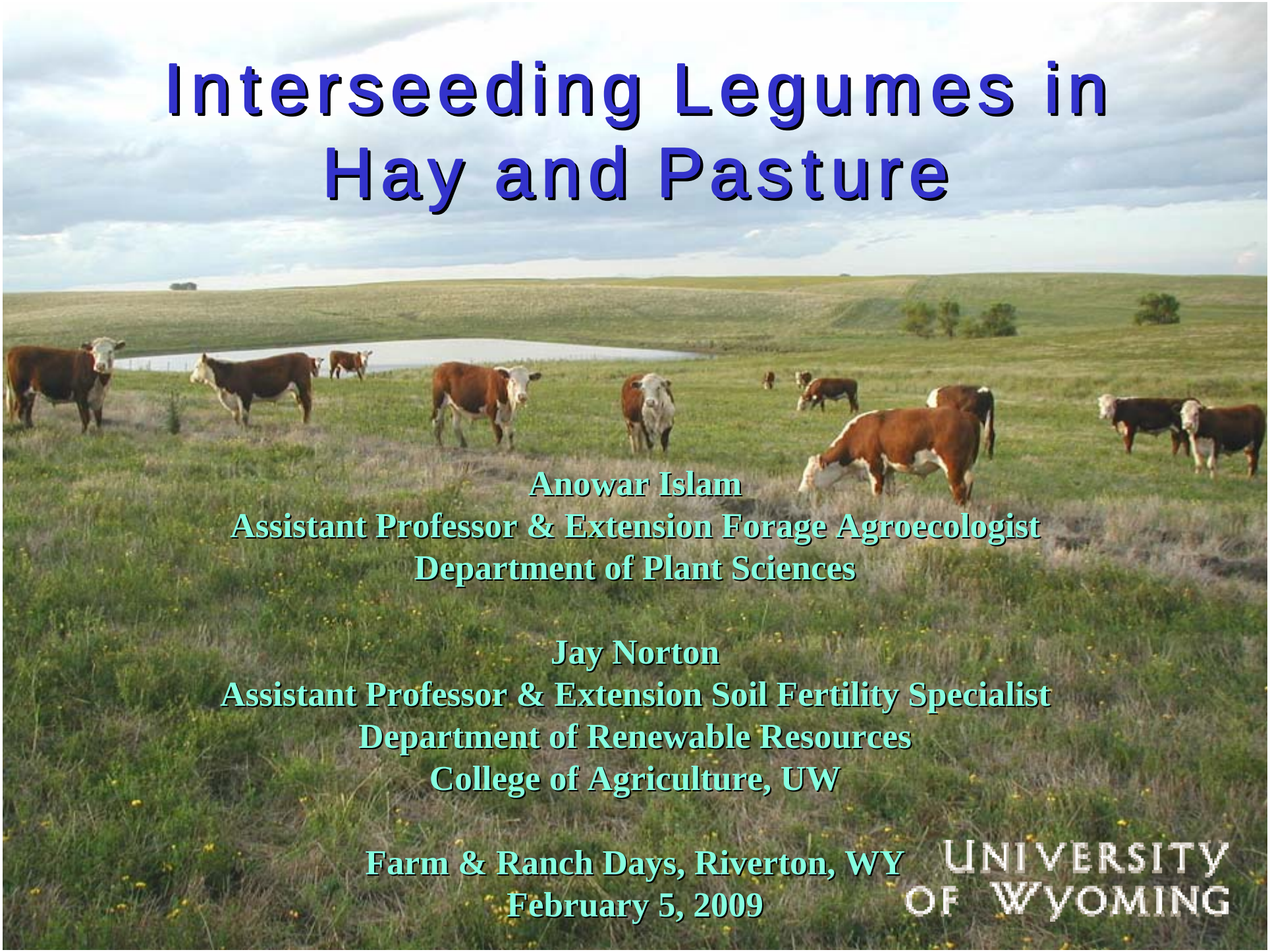
Interseeding Legumes in Hay and Pasture



Anowar Islam
Assistant Professor & Extension Forage Agroecologist
Department of Plant Sciences

Jay Norton
Assistant Professor & Extension Soil Fertility Specialist
Department of Renewable Resources
College of Agriculture, UW

Farm & Ranch Days, Riverton, WY
February 5, 2009

UNIVERSITY OF WYOMING

Interseeding

Problems/Concerns

Difficult to maintain yields of grass pastures and hayfields, especially in irrigated areas:

- N is number one limiting nutrient
- High price of N fertilizers
- Manures and composts are alternative sources but high rates and transportation limit the use

Interseeding legumes into pastures might be a good option!

Outline of the talk

- What is interseeding?
- Advantages of interseeding
- Steps to be followed
- Summary/Recommendation

Interseeding

What is Interseeding?

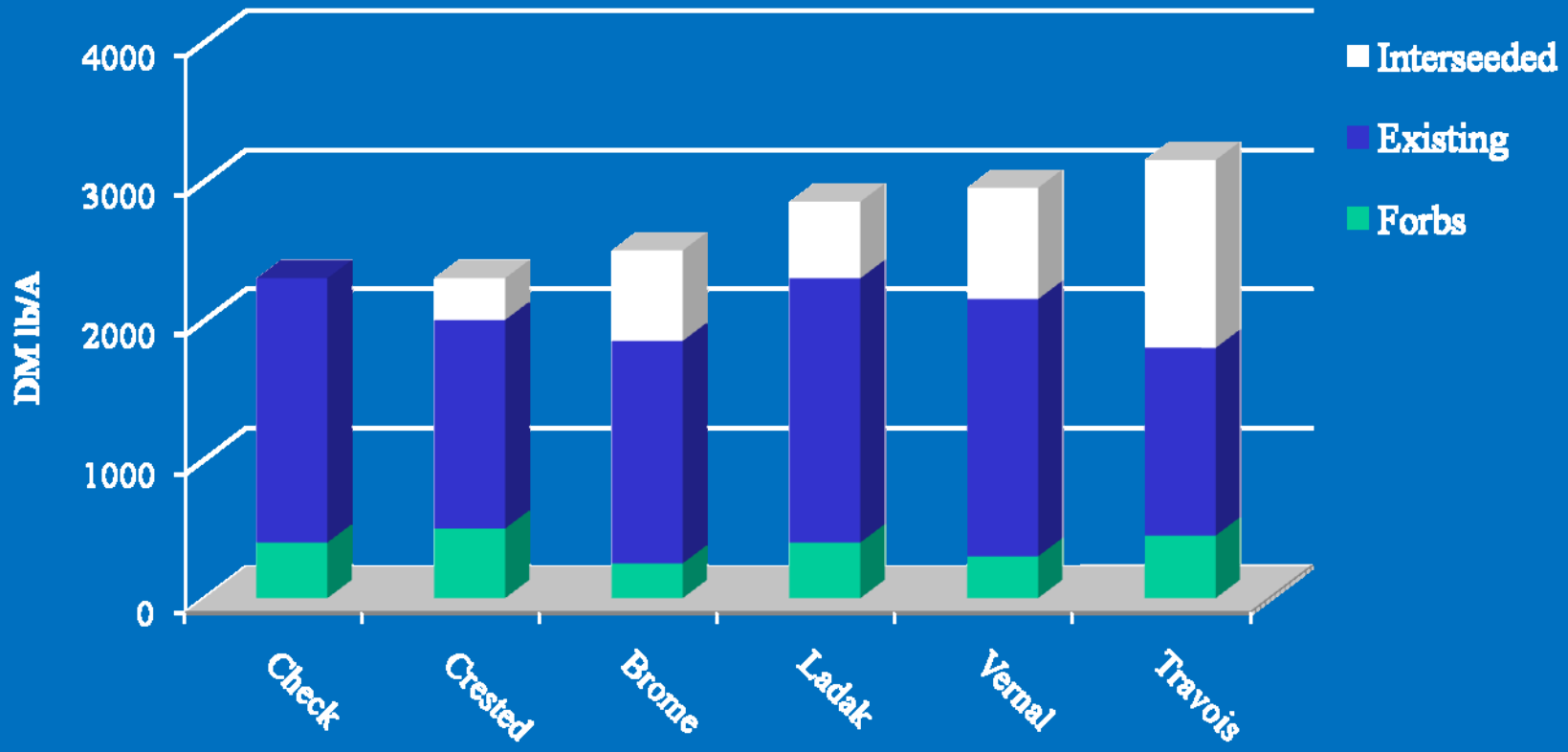
- *Introduction of a legume or a more productive grass into an existing pasture*

Advantages of Interseeding

- Increase forage production
- Increase forage quality
- Increase palatability and intake
- Decrease N Fertilizer needs
- Increase grazing capacity and animal gain
- Increase more coverage, decrease soil erosion
- Longer stand life
- Easier curing of hay

Interseeding

Benefits from Interseeding: grass vs. legume



Source: Dodds and Manske, 1987

Interseeding

Benefits from Interseeding: animal performance

Gain (lb/acre) grazed on interseeded pasture		
	Calves	Yearling steers
Treatment	ND (1978-85)	SD (1977-79)
Check (no alfalfa)	33	53
Alfalfa	**61**	**85**

Source: Dodds and Manske, 1987

Interseeding

The questions are:

where
what
when
how

--- should this be done?

Interseeding

Important steps need to be followed for successful interseeding:

1. Site selection:

- most effective in low-production area (e.g. Kentucky bluegrass sod)
- smooth bromegrass and other tall grasses are not suitable unless they are very thin
- alfalfa and red clover best for tall grass sods

Interseeding

2. Soil test:

- Especially for lime, P and K

3. Application of lime and fertilizer:

-pH at least 6.5 is recommended for grass, clovers, birdsfoot trefoil; 6.8-7.0 for alfalfa

-lime can be applied (pH < 6.5) at least a year before seeding

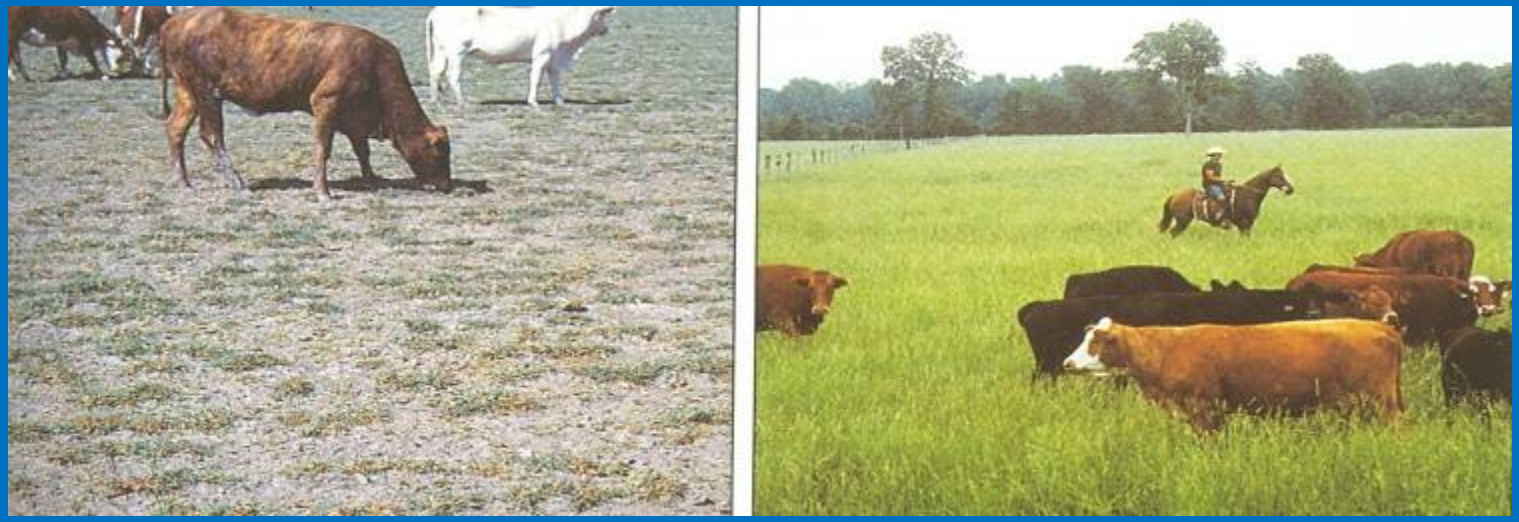
-optimum P and K can be top dressed ahead of interseeding

-N usually is not required before legume or legume-grass seeding

Interseeding

4. Grazing or clipping:

-close grazing or clipping is recommended to reduce vegetative growth before seeding



Interseeding

5. Herbicide application (e.g., 2, 4-D):

Once legumes established, weeds are more difficult to control

- apply before seeding (preceding year)
- for spring renovation: apply late May or early June
- additional application in Sep or Oct – if needed

Interseeding

6. Control of existing plants to reduce competition:

Extra growth should be reduced, especially in spring by clipping, grazing, or nonselective herbicides

-A few inches growth is necessary for effectiveness of herbicide

-Contact herbicide (e.g. *Gramoxone Extra (paraquat)*) for spring seedings can be applied for grass suppression:

-few days before seeding

-at the time of seeding

-no later than 3 days after seeding

Interseeding

7. Seeding rates and mixtures:

- legumes alone, if desirable grass species good
- mixture of legumes are advantageous but management is a concern
- matching of right legumes with right grass
- grass-legume mixture will be the best in situations where:
  - -grass stand is thin
  - -more desirable grass species is required
  - -change in proportion grass species is expected

Interseeding

7. Seeding rates and mixtures:

Minimum interseeding rates (lb/acre)

1. Alfalfa	8
2. Sweet clover	8
3. Birdsfoot trefoil	6
4. Alfalfa + Red clover	6+3
5. B. trefoil + Red clover	3+3
6. Red clover + Orchardgrass	5+3
7. B. trefoil + Orchardgrass	4+2
8. Alfalfa + Orchardgrass	6+3
9. Alfalfa + Bromegrass	6+8
10. Alf. + Brome + Orchard.	6+6+2

Source: Barnhart 2004

Interseeding

8. Seeding with drill:

-use of appropriate drill, designed for sod

-calibration of drill

-checking of seeding depth (not > ¾ inch)

Interseeding

9. Management of new seeding:

-*patience is necessary!*
-there may be no grazing (also grazing restriction) up to 5-6 wks
-rotational grazing may be used
-avoid close grazing of newly established seedlings
-avoid grazing/clipping of warm-season, native grass seedlings
-If necessary, 8-10 inches high clipping can be done

Interseeding

10. After seeding care:

-after 2 wks, check progress and pest (insect) attack, act quickly

-after 5 wks, grazing is possible if growth is good (3-5 inches), however care should be taken not to close graze

-livestock removal may be necessary after a week

-summer clipping/light grazing may be necessary depending on the growth

Interseeding

10. After seeding care: contd.

-fall rest starting from early September

-after 4-6 wks, late grazing is possible

-leave *at least 3 inches* residue for winter survival

-*for late summer interseeding*, grazing is not advisable for first year of establishment

Establishment Summary

- Pasture improvement depends on successful stand establishment and management
  - *The #1 challenge is the establishment!*
- Interseeding offers unique opportunities for improving pasture and hay productivity, quality and profitability
  - it's essential to know the key factors responsible for successful establishment
  - *site selection*, *species & variety selection*, *planting method*, *fertilization*, and *weed management* are among the most important factors to be considered

Managing established grass-legume stands

- Not for everyone: Requires commitment to intensive management for longevity;
- Too often legume component is short-lived;
- Two major issues:
  - Nitrogen fertilizer favors grasses;
  - Poor grazing management.

Using legumes to supplement fertility

- Symbiotic relationship with bacteria that infect roots and fix N_2 gas from soil air for conversion to organic N in plant tissue;
- N becomes available to other plants upon decomposition or animal excretion;
- 80 to 90 percent passes through livestock.

Fertilizing to maintain grass-legume stands

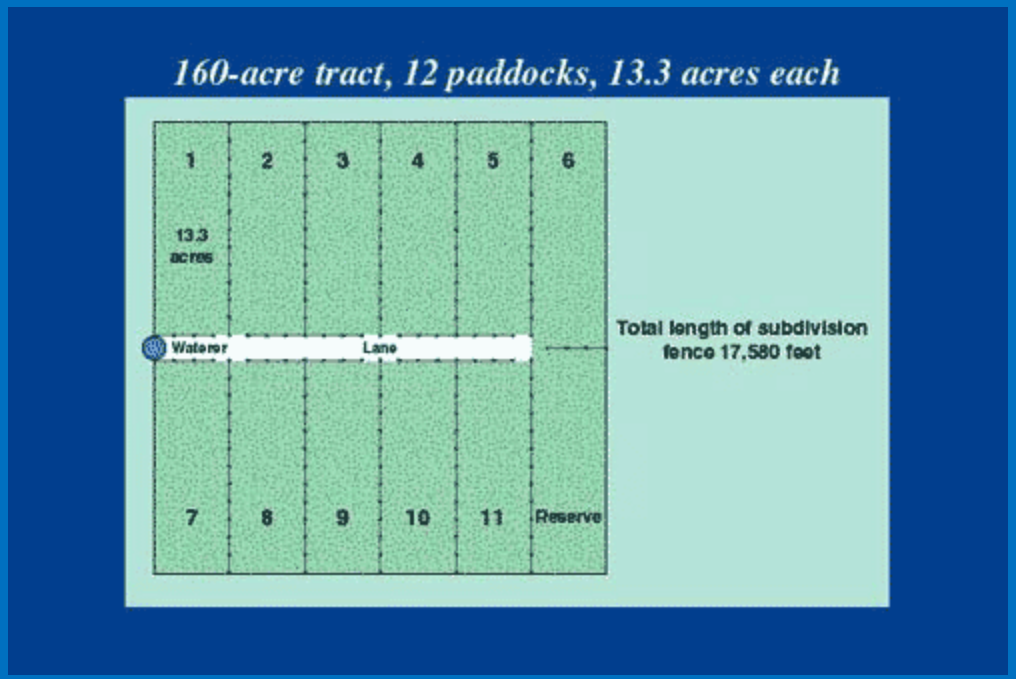
- >50% legume stand supplies all the N needed;
- N fertilizer favors grasses and reduces legume component;
- P fertilization important for maintaining legume component;
- Large amounts of nutrients are removed as hay and must be replaced to maintain yield and quality;
- BUT, in pastures 80-90% of nutrients grazed return to the soil as urine or manure.

Grazing management to maintain grass-legume stands

- Continuous grazing eliminates legumes;
- Rotational grazing can increase legumes;
  - Close grazing followed by removing livestock and deep irrigation;
  - Keep grass in vegetative stage to avoid selective grazing of legumes.

Grazing management to maintain grass-legume stands

- Good distribution is necessary for best recycling:
  - < 600-800 feet from water;
  - May have to fence out shady areas;
- Remove livestock about September for ~30 days regrowth before killing frost; graze after killing frost if desired;



Maintaining grass-legume stands for hay production

- Need to test soil annually to properly fertilize;
- P fertilization especially important in mixed stands;
- Low rates of N required for < 50% legume stands; high rates suppress N fixation and will eliminate legumes.
- Important to fertilize based on potential yield of particular site;
- Don't harvest after Sept. 1.

Nutrients removed with grass hay

Nutrient	Dry matter concentration	Removal per ton of hay
Nitrogen	2.0 % N	40 lb N
Potassium	3.0 % K_2O	60 lb K_2O
Phosphate	0.65 % P_2O_5	13 lb P_2O_5
Sulfur	0.25 % S	5 lb S

Maintaining grass-legume stands for hay production

N required to maintain very high yields, but will eliminate legume component;

- Better to manage to increase legumes to provide N.

	Yield potential of the site			
Stand composition	**1-2 tons/acre**	**2-4 tons/acre**	**4-6 tons/acre**	**6-8 tons/acre**
	---------- nitrogen recommendation (lbs/acre) ----------			
100% grass	50	75[1]	100-150[1]	150-200[1]
75% grass, 25% legume	25	50	75-100	100-150[1]
50% grass, 50% legume	0	25	50	75
25% grass, 75% legume	0	0	25	50

Fertilizing grass-legume stands

- Nitrogen for grass hay & pasture:
  - Best: UAN applied with spoke-wheel injector;
  - Urea: must apply >= ¼ inch of water from sprinkler within 3 days;
  - Ammonium sulfate: expensive, but stable dry product, problems suspected in Laramie;
- For pasture, test soil every 2-3 years;
  - If N called for, split into two or three separate applications;
  - Apply 1/3 to 1/2 in early spring, 1/3 to 1/2 in June, and the remainder in late August.
  - Schedule mid- and late-season nitrogen applications to coincide with irrigation or rainfall events.
  - For hay-pasture systems, apply 2/3 of the nitrogen in early spring and 1/3 after the hay crop is removed to stimulate regrowth for grazing.

Phosphorus

- Most often deficient, especially in high-yield management;
- Stimulates nodule production and N fixation;
- Soil test crucial; symptoms difficult to detect;
  - Sample >6 months prior to planting: takes time;
  - Test soil at least every 2 or 3 years (see UW ext pub on sampling);
- Apply P to total about 10 lbs/ac/ton of expected yield;
- We recommend annual applications, but UNeb and USU claim best results from applications every other year on calcareous soils;

Phosphorus, cont.

- Preplant applications should be banded for better root access; but broadcast just as effective on established stands: lots of near surface roots;
- On established stands apply in fall or early spring, but avoid soft soils;
  - Fall best for furrow irrigated stands;
- Source does not matter: choose by availability, ease of application, and **price per unit P_2O_5**;
  - Liquid can be easier to apply but costs more;
  - No yield difference between spraying and applying with irrigation;
- Split application beneficial only for high-yield, long growing season (not Wyoming).

Potassium

- Can be deficient on sandy soils, irrigation with clean water low in K, and long-term, high yield production;
  - If need is determined, annual applications are necessary since alfalfa and other forages will luxury consume and end up with very high K concentrations;
  - Several sources available; choose same as P.

Sulfur

- Occasionally deficient on sandy low OM soils with clean, low-S irrigation water;
  - Sulfate-sulfur soil test < 8 ppm indicate need;
  - Utah State recommends: 50 lbs SO_4-S as ammonium sulfate, potassium sulfate, or gypsum plus 100 lbs/ac of elemental S to correct deficiencies for two to three years.

Micronutrients

- Deficiencies sometimes occur: apply according to soil test recommendations;
- Liquid forms work well;
- Fe chlorosis can occur in early spring but often disappears with warmer temperatures.

Other fertilizer considerations

- Fertilize right after harvest, before regrowth, avoid fertilizer contact with wet foliage;
- Topdress after first cutting to improve regrowth; after last cutting to improve winter hardiness;
- Avoid soft soils, like in early spring, due to compaction and physical damage to root crowns;
- Split application if using > 500 lb/a to avoid salt damage;
- Base source choice on price per unit; they don't perform differently;
- Don't use foliar spray for mod-high rates of macro nutrients: causes salt damage and uptake is no better than soil application. Great for micronutrients though.

Applying manure to irrigated alfalfa & grass

- Excellent source of P, K and micronutrients if applied to avoid salt damage, but N favors grass & weeds, reduces fixation, and shortens stand life;
- Rates should not exceed 3000 to 5000 gal/ac liquid or 10 t/ac dry in any one application;
- Apply uniformly and break up large chunks;
- Three timing considerations:
  - Before Establishment: >6 months prior; avoid seed contact;
  - On established stands: ASAP after harvest, before regrowth to avoid salt damage, and on dry soil to avoid compaction and crown damage;
  - Before plow down for next crop: Recommend light application because, combined with N fixed by alfalfa, will create excess.
- Best to apply to grass stands or mixed grass-alfalfa because grass will respond dramatically; again, ASAP after harvest to avoid salt damage;
- Avoid ammonia losses by avoiding warm, windy days to apply;


Questions?