Interseeding Legumes in Hay and Pasture

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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

<table>
<thead>
<tr>
<th>Gain (lb/acre) grazed on interseeded pasture</th>
<th>Calves</th>
<th>Yearling steers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>ND (1978-85)</td>
<td>SD (1977-79)</td>
</tr>
<tr>
<td>Check (no alfalfa)</td>
<td>33</td>
<td>53</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>61</td>
<td>85</td>
</tr>
</tbody>
</table>

*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
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
4. **Grazing or clipping:**

- Close grazing or clipping is recommended to reduce vegetative growth before seeding.
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
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*
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)

<table>
<thead>
<tr>
<th>1. Alfalfa</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Sweet clover</td>
<td>8</td>
</tr>
<tr>
<td>3. Birdsfoot trefoil</td>
<td>6</td>
</tr>
<tr>
<td>4. Alfalfa + Red clover</td>
<td>6+3</td>
</tr>
<tr>
<td>5. B. trefoil + Red clover</td>
<td>3+3</td>
</tr>
<tr>
<td>6. Red clover + Orchardgrass</td>
<td>5+3</td>
</tr>
<tr>
<td>7. B. trefoil + Orchardgrass</td>
<td>4+2</td>
</tr>
<tr>
<td>8. Alfalfa + Orchardgrass</td>
<td>6+3</td>
</tr>
<tr>
<td>9. Alfalfa + Bromegrass</td>
<td>6+8</td>
</tr>
<tr>
<td>10. Alf. + Brome + Orchard.</td>
<td>6+6+2</td>
</tr>
</tbody>
</table>

*Source: Barnhart 2004*
8. *Seeding with drill*:

- use of appropriate drill, designed for sod
- calibration of drill
- checking of seeding depth (not > \(\frac{3}{4}\) inch)
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
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
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 \( \text{N}_2 \) 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;

![Diagram of 160-acre tract, 12 paddocks, 13.3 acres each]
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.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Dry matter concentration</th>
<th>Removal per ton of hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>2.0 % N</td>
<td>40 lb N</td>
</tr>
<tr>
<td>Potassium</td>
<td>3.0 % K₂O</td>
<td>60 lb K₂O</td>
</tr>
<tr>
<td>Phosphate</td>
<td>0.65 % P₂O₅</td>
<td>13 lb P₂O₅</td>
</tr>
<tr>
<td>Sulfur</td>
<td>0.25 % S</td>
<td>5 lb S</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Stand composition</th>
<th>Yield potential of the site</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-2 tons/acre</td>
</tr>
<tr>
<td>100% grass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
</tr>
<tr>
<td>75% grass, 25% legume</td>
<td>25</td>
</tr>
<tr>
<td>50% grass, 50% legume</td>
<td>0</td>
</tr>
<tr>
<td>25% grass, 75% legume</td>
<td>0</td>
</tr>
</tbody>
</table>

¹ nitrogen recommendation (lbs/acre)
Fertilizing grass-legume stands

- Nitrogen for grass hay & pasture:
  - Best: UAN applied with spoke-wheel injector;
  - Urea: must apply \( \geq \frac{1}{4} \) 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/acre liquid or 10 t/acre 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?