

Mix It Up

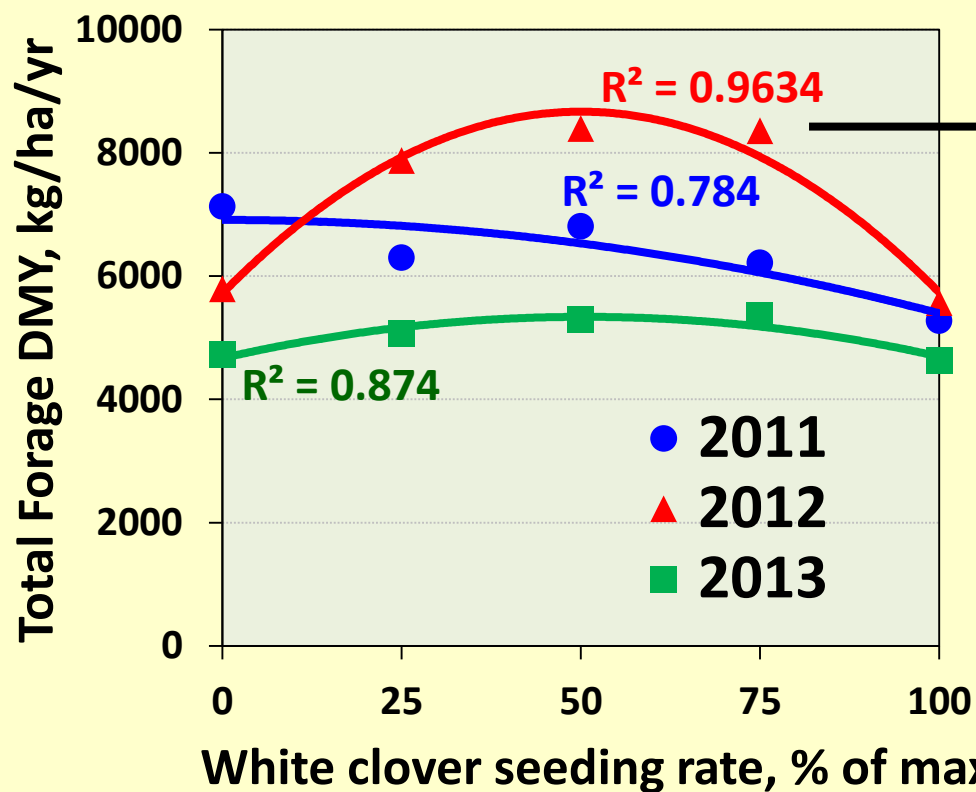
How Managing Forage Mixtures Can Help You

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Reason #1 - Improved yield



→ **OVERYIELDING** =
mixture yields
more than either
component by
itself

Total forage DM yield in tall fescue/white clover
mixtures (Lake City, MI)

Why does yield improve?



When plants have different growth habits and shoot/root structures, they can avoid competing directly with each other while more completely utilizing the local resources.

- **Example: fibrous-rooted grasses and taprooted legumes**

End result → greater annual biological productivity

Reason #2 - Nitrogen Fixation

Apparent biological N fixation (N harvested minus N applied) of alfalfa/orchardgrass (OG) and alfalfa/tall fescue (TF) mixtures

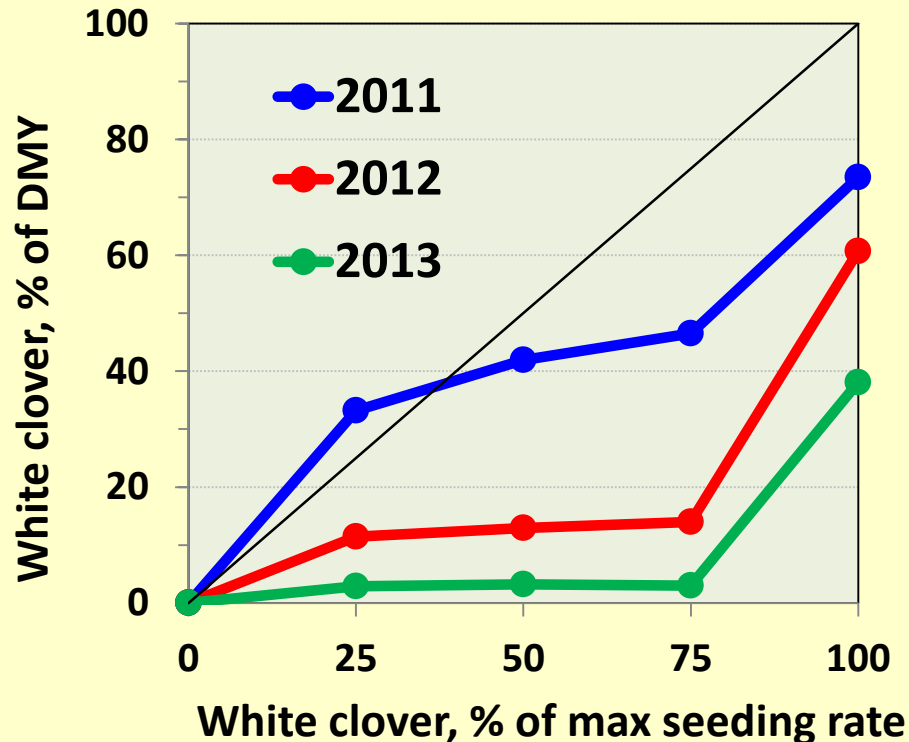
year	East Lansing			
	N (lb/A)	OG	TF	mean
2012	0	248	200	224a
	50	214	177	195b
	100	166	151	158c
	150	153	111	132c
	mean	195 ^A	160 ^B	
2013	0	277 ^a	276 ^a	276
	125	190 ^b	208 ^b	199
	250	110 ^d	157 ^c	133
	375	54 ^e	89 ^d	71
	mean	182	158	

^{AB} Values with different superscripts within rows for sites are different (LSD, $P < 0.05$).

^{BCDE} Values with different superscripts within columns for years are different (LSD, $P < 0.05$).

^{abcde} Values with different superscripts within sites are different (LSD, $P < 0.05$).

It doesn't take much!



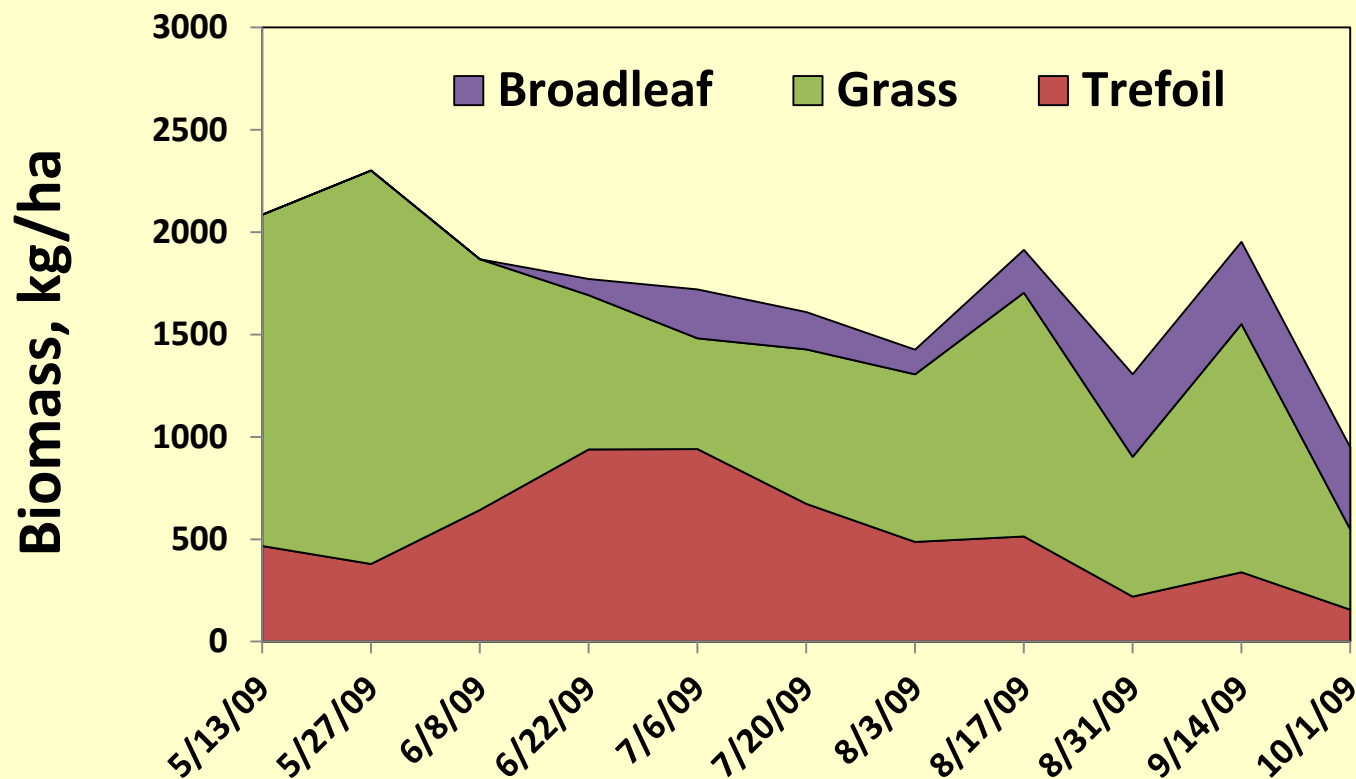
White clover proportion in tall fescue/white clover mixtures (Lake City)

- Benefits can be seen from very small proportions of legume
- Aim for 25-50% legume
- Legume N is slow release N

*Maximum seeding rate for WCL was 7 lb/acre

Reason #3

Improved seasonal forage distribution



Birdsfoot trefoil/prairiegrass pastures in WV

2014 (establishment year)



Pasture Research at UPREC

Each planted at 20% of single-species rate

Orchardgrass

Tall Fescue

Alfalfa

White Clover

Birdsfoot trefoil

2015



Mixtures change in time and space

Pasture Research at UPREC

8 pastures planted as 5-way mix:

Orchardgrass

Tall Fescue

Alfalfa

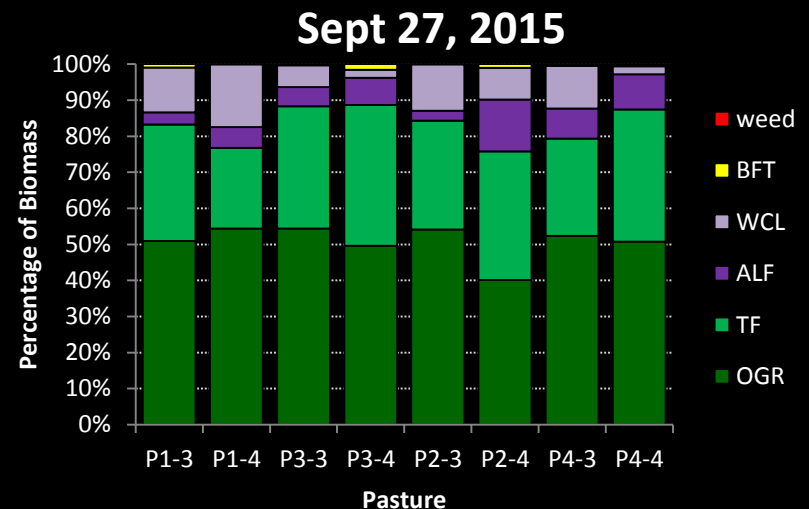
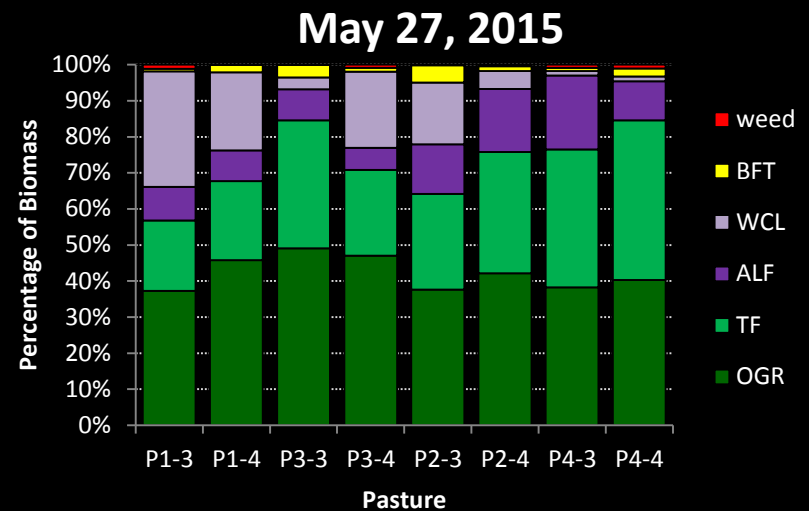
White Clover

Birdsfoot trefoil

Each planted in 2014 at 20% of its
single-species rate

By May 2015, mix proportion has
shifted to fit conditions in each pasture

Proportions shift again from May to
Sept.



Reason #4

Improved hay drying rate



Grass stems help fluff swath and windrow for better air circulation

Reason #5

Improved digestibility and feeding value

- Ruminants require effective fiber in their diets, but not too much!
- Grasses have more cell wall than alfalfa, but the cell wall is more digestible (more lignin) and is digested faster
- Therefore, grasses can provide BOTH effective fiber and energy when included in diets



- When grazing low-fiber forages like brassicas, including grass in the mix allows a more balanced diet selection in pastures

Reason #6 - Pest Control

- 1. The more vigorous the forage stand and the more complete its resource use, the less likely weeds can get a permanent foothold**
- 2. Alfalfa-grass mixtures are less attractive to potato leafhoppers**
- 3. A diverse plant community supports more beneficial insects**
- 4. Root diversity may reduce soil-borne pathogens of forages and rotated crops**

Reason #7 - Better erosion control

Mixtures provide good ground cover over greater number of days than single-species stands

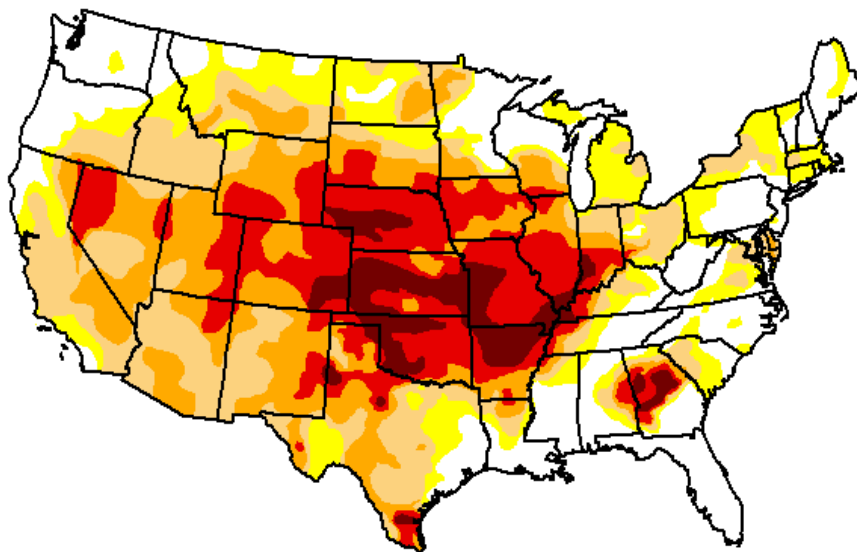
- Reduce raindrop impact
- Increase water infiltration
- Fibrous grass roots are concentrated near surface of ground



Reason #8 - Improved stand persistence

Mixtures buffer risk of catastrophic failure because they increase the chance that *something* will survive or thrive in all microenvironments and adverse conditions

US Drought Monitor, July 28, 2012



Reason #9

Reduced bloat risk if grazing

- Dilution of bloating legumes to less than 50% of pasture biomass helps prevent pasture bloat
- Birdsfoot trefoil is the only non-bloating legume common in the Upper Midwest

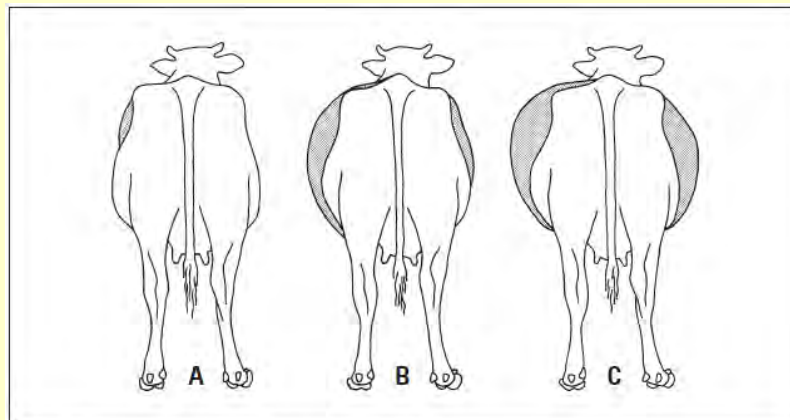


Figure 7 Three degrees of bloat: A - mild, B - moderate, C - severe



Reason #10

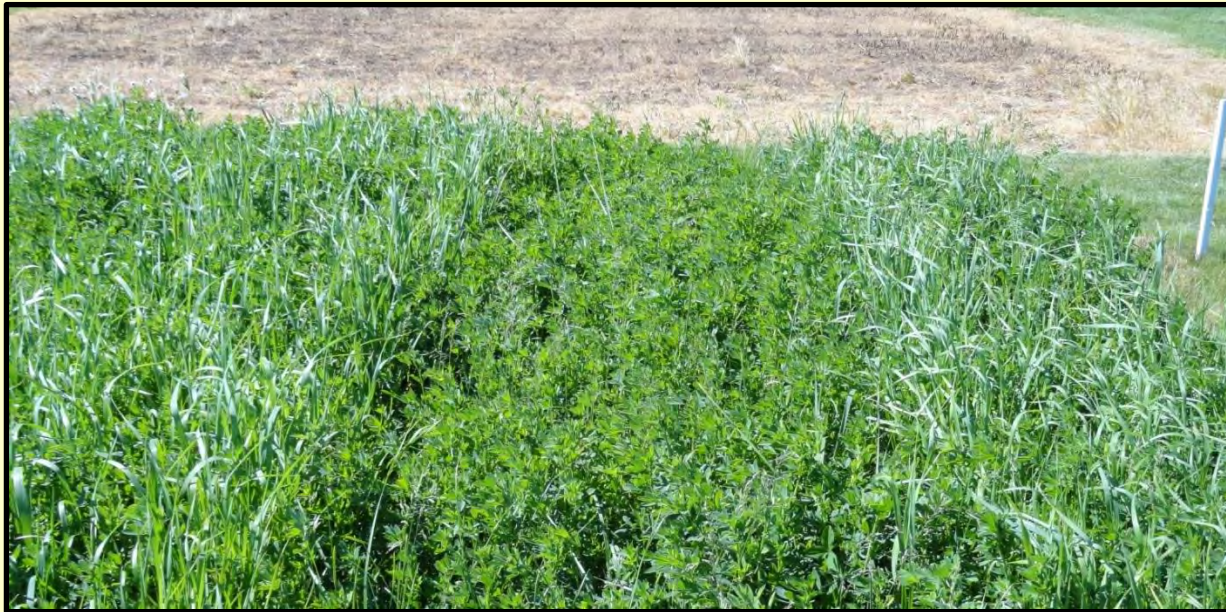
Improved soil health through root diversity

- **Different soil microbes and macrofauna are attracted to roots and residues of different forage species**
- **This diversity creates a more active soil food web that fills the entire soil horizon and helps improve all aspects of soil health**

Challenge #1 - Management

Management affects species proportions

- **Shade decreases most legumes**
- **N fertilizer decreases legumes**
- **Grazing can affect species proportion if livestock are allowed to graze selectively**



Challenge #2 – Weed Control

We have no herbicides to selectively remove weedy grass or broadleaf weeds from grass/legume mixes.

Other options:

- 1. Improved fertility**
- 2. Change harvest management**
- 3. For tall weeds, wicking can be effective**
- 4. Mowing or top-clipping (pastures)**
- 5. Mixed animal species grazing (pastures)**

Challenge #3 – Harvest Timing

Harvest decisions are more complex

- **Must consider timing and intensity for all components**
- **Components usually mature at different times**
- **Give greatest consideration to the most important component (usually the legume)**

Choose mixture components for compatible maturity

- **Alfalfa + late maturing orchardgrass**
- **Alfalfa + tall fescue**
- **Alfalfa + smooth brome**
- **Alfalfa + (early maturing) timothy**



Challenge #4 – Ration Balancing

Nutritive value shifts with species proportions

- Growing with a companion may change a component composition compared to monoculture
- Forage quality testing for harvested mixtures is **ESSENTIAL** before balancing rations
- “book values” are useless

It is biologically impossible to maintain a constant proportion of species at a constant maturity in a mixture at all times

Ameristand 403T Plus Alfalfa (10 lb/A)

+

Intensiv Orchardgrass (6 lb/A)

OR Bariane Tall Fescue (12 lb/A)

	First Cut (June)				Last cut (Sept)			
	Grass %	DMY (ton/A)	CP (%)	RFQ (%)	Grass %	DMY (ton/A)	CP (%)	RFQ (%)
<u>East Lansing 2012</u>								
OG	78	2.97	12.8	100	82	1.59	19.1	149
TF	78	2.05	15.6	112	84	1.33	19.9	151
P <	ns	**	**	**	ns	**	**	ns
<u>East Lansing 2013</u>								
OG	80	2.42	15.9	137	83	0.91	20.0	182
TF	70	2.10	19.0	147	84	0.98	19.8	200
P <	**	**	**	**	ns	*	ns	**

- P < 0.05, ** P < 0.01, *** P < 0.001, ns= not significant.
- Three cuts in 2012 (drought), five in 2013

Challenge #5 - Establishment

Option 1 - Mix and plant everything together. Don't worry about seed sorting in the planter.

Option 2 - Plant components separately. Go in different direction for each pass.

Option 3 - Add new components to established stands

- **Drill**
- **Frostseed or broadcast**

Planting Options for RR Alfalfa-Grass Mixtures

Best Option--Plant alfalfa and grass at same time.

- Not possible with RR alfalfa because the null spray kills the grass
- What to do?

1. Don't use RR alfalfa in alfalfa/grass mixes.
2. Don't use a null spray.
3. Drill grass into alfalfa immediately after the null spray.
4. Drill grass into alfalfa after first harvest (spring or fall?).
5. Drill or frostseed grass into alfalfa before spring dormancy break.
6. Wait to add grass until alfalfa stand declines (3-4 years)

Alfalfa Interseeded with Grass

Two separate MSU trials

- Sponsor: Monsanto
- Spring or late summer seeding

Treatments

1. Grass species
 - orchardgrass
 - tall fescue
 - meadow fescue
2. Planting method
 - Plant together, no herbicide
 - Plant together, buctryl at 4 wk
 - Drill grass after null spray, 4 wk
 - Drill grass after first spring cut



Alfalfa Interseeded with Grass Results

Spring Planting:

- Planted in 2011, 1st production year 2012
- No yield differences among grass treatments (~20% grass)
- Using any herbicide increased 1st yr DMY by 25% compared to planting alfalfa/grass with no herbicide treatment

Late Summer Planting:

- Planted in 2013, 1st production year 2014
- No yield differences among planting treatments
- <7% grass all treatments, establishment failure for grass

How to Make a Simple Seed Mix

- Seeding target is to place 75-100 live seeds/ft²
- Plant mixtures about 20% higher seeding rate than for pure components because direct competition is less (aim for 90-120 seeds/ft²)
- Split the single-species seeding rate as desired for each component, NOT the percentage of the mix!
- Remember to adjust for pure live seed if your seed source is not great

$$\% \text{ PLS} = \% \text{ purity} \times \% \text{ germination} / 100$$

Example: 2-way mix, 50:50 proportion by species

Species	Single species seeding rate (lb/A)	Mixture seeding rate (lb/A)	120% Rate (lb/A)	% of mix
Alfalfa	16	8.0	9.6	62
Orchardgrass	10	5.0	6.0	38
TOTAL		13.0	15.6	100

Example: four-way mix, 25% each species

Species	Single species seeding rate (lb/A)	Mixture seeding rate (lb/A)	120% Rate (lb/A)	% of mix
Alfalfa	16	4.0	4.8	37
Orchardgrass	10	2.5	3.0	23
White clover	2	0.5	0.6	5
Tall fescue	15	3.8	4.6	35
TOTAL		10.8	13.0	100

Forage Mixtures for the Upper Midwest

- Limit legumes (except trefoil) to 50% in pasture mixes due to bloat
- Use at least one species that spreads by rhizomes or stolons
 - Strong: white clover, smooth brome grass, Kentucky bluegrass, reed canarygrass
 - Moderate: tall fescue
- Use at least one species that establishes quickly
 - Alfalfa, orchardgrass, tall fescue, red clover, annual/Italian ryegrass
- If species is a slow starter, increase its proportion in mix
 - Birdsfoot trefoil, smooth brome grass, Kentucky bluegrass
- Effectiveness of warm-season grasses in hay mixtures is questionable. Possibly ok in pastures with long rest periods.

FORAGE CONNECTION

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Welcome to the MSU Forage Connection

This web site is the homepage for the MSU Forage Research Program and an information hub for forage production and use in Michigan and the Great Lakes region.

Forages are the third most valuable agronomic crop in Michigan, encompassing over 3.5 million acres dedicated to permanent hay and pasture, and a variable acreage devoted to annual forage and pasture crops. In addition to traditional use as stored or grazed livestock feed, forage crops improve soil health via use in crop rotations or as cover crops, are a vital link in preserving water quality, and provide biofuels. Forage crops thus have a direct or indirect connection to many facets of Michigan agriculture and to ecosystem services that affect all residents.

We hope you will enjoy exploring these connections through this website.

Recent Publications

- [2015 Forage Variety Test Report](#)
- [2016 MSU Weed Control Guide](#)
- [2016 Michigan Corn Varieties Compared \(grain and silage\)](#) **NEW!!**
- [Great Lakes Grazing Newsletter Volume 5 Issue 2 – May](#)

Helpful Links

- [MSUE Ag News](#)
- [Michigan Hay Sellers List](#)
- [MSU Weeds page](#)
- [MSU Soil Fertility page](#)
- [MSU Enviroweather](#)
- [MSU Soil and Plant Nutrient Testing Lab](#)
- [Michigan Forage Council](#)
- [Midwest Cover Crops Council](#)



Graze your cover crops!

Questions?
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