



**OHIO STATE UNIVERSITY EXTENSION**

# **Sustainable Crop Rotations with Grass Cover Crops**

**James J. Hoorman**      [hoorman.1@osu.edu](mailto:hoorman.1@osu.edu)  
**Alan Sundermeier**      [sundermeier.5@osu.edu](mailto:sundermeier.5@osu.edu)  
**Dr. K. Rafiq Islam**      [islam.27@osu.edu](mailto:islam.27@osu.edu)  
[www.mccc.msu.edu](http://www.mccc.msu.edu)



**THE OHIO STATE UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

# Type of Cover Crops

**Legumes:** Make Nitrogen, low C:N ratio  
cowpeas, Austrian winter pea, hairy vetch,  
red clover, soybeans

**Grasses:** Accumulate nutrients (fine roots), C:N  
ratio depends on killing date: oats, cereal rye,  
annual ryegrass, barley, wheat, Sorghum-Sudan

**Brassicas:** Good for surface compaction and weed  
control: Daikon radish, turnips, kale, rape

# Grasses

- 1) Provide Carbon
- 2) Accumulate N & P
- 3) Provide P to legumes
- 4) Reduce horizontal soil compaction
- 5) Fibrous fine roots protect soil and provide habitat/food for microbes.
- 6) Promote good soil structure.



Cereal rye

Annual Ryegrass



**THE OHIO STATE UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

# Pearl Millet after Wheat



## Sorghum-Sudan grass



# Cowpea & Sudan Grass



# Winter Rye (Cereal Rye)

## Disadvantages

- May have allelopathic characteristics
- May “get away from you” in the spring and become difficult to kill



## Advantages

- Can be planted later than any cover crops with greatest opportunity to succeed
- Works well with aerial application
- Good rooting depth
- Excellent winterhardiness
- Scavenges N & P

# Winter Rye (Cereal Rye)



## Advantages

- Excellent for winter/spring grazing
- Excellent for spring haylage (4-6 ton/A)
- May have allelopathic characteristics (improved weed control)

# Suggested Planting Rates for Cereal Rye

- Air = 1.5 bushels/Acre
- Dry Spread w/ Fertilizer = 1.1 bushels/Acre
- Grain Drill = 1 bushel/Acre



## Strategically...

Do Soybeans  
need N ?  
...Sure, but  
they  
capture  
their own!



# Oats

## Disadvantages

- Bin run oats will have weed seed in them
- Winterkills

## Advantages

- Scavenges N
- Deep and fibrous root mass
- Works well with aerial application
- Excellent for forage
- Winterkills



# Oats- planted August 3 photo taken October 10



# Oats

- Provides erosion control
- Scavenges nitrogen
- Grows a deep and fibrous root mass
- Promotes mycorrhiza growth
- Quick to establish
- Relatively inexpensive
- Can be broadcast and lightly tilled in
- Can be added to other cover crops to add additional value
- Can spray with broadleaf herbicides if necessary to control weeds



Oats applied with highboy July 2012 on August 28, 2012.



**THE OHIO STATE UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

# Other cover crop options – Winter Barley

- Makes excellent feed or haylage
- Up to 2 weeks earlier harvest than wheat
- Less N needed for top crop
- Excellent scavenger of N
- More tolerant of low fertility
- Less winter hardy than rye



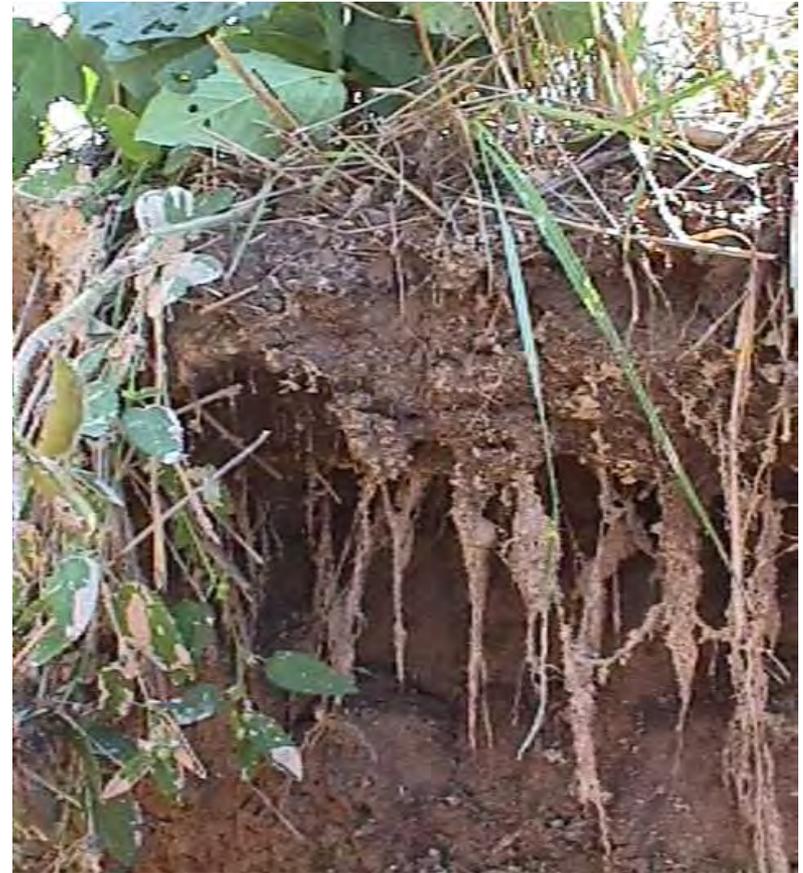
# Why Annual Ryegrass (ARG)?

- 1) Great Scavenger of N & P
- 2) Extensive Root System
- 3) ARG does not go dormant in Winter
- 4) Grows Well on Heavy Clay soils
- 5) Tolerates Flooding
- 6) Prevents Soil Erosion
- 7) Weed and Pest Suppression



# Characteristics of ARG

- 1) Extensive Root System  
in top 18-24" of soil.
- 2) Roots can penetrate down  
6 feet deep.
- 3) Fast Emergence, Little top  
growth.
- 4) Scavenges for N & P  
(300-700# N).
- 5) Elevates Nutrients from subsoil  
into the topsoil.
- 6) 80-90% of root growth by  
April 1<sup>st</sup>.



# Annual Ryegrass

## Disadvantages

- May be difficult to kill
- Many varieties rarely live through the winter



## Advantages

- New Winterhardy varieties are available
- Deep and fibrous root mass
- Excellent scavenger of N
- Works well with aerial application
- Excellent for forage
- Plant early Aug – early Sept.

# Planting ARG

- 1) Plant after wheat, corn silage, or soybeans.
- 2) Planting Date: 8/1-9/20
- 3) Seeding Rate: 15-25#/A.
- 4) Seeding depth: .25 to .75 inch
- 5) Needs 60 days of growth  
Or 6-9 inches before frozen soil.
- 6) Seeding Method: light tillage, drill.
- 7) Fertilizer: 25-50# Nitrogen



# Annual Ryegrass 45 Days 6,000 Gallons Swine Manure



# Nitrogen Uptake

ARG had 5-5.3% N in the tissue with maximum manure. With 4-4.5 tons of biomass (above and below ground), equals 400-450# of N being recycled.

Cereal ryegrass has 4-4.5% N in tissue or 350 to 400# of N.

Daikon radish-Highest uptake 5.3-5.5%N  
Also fastest release.

# Harvest/Kill Annual Ryegrass early



- Kill before jointing
- Be ready for 2<sup>nd</sup> spray
- Harvest before heads appear for best forage



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

# Root Density of Grass Cover Crops

Winter Rye-less dense  
1,500-2,600 #/A



Annual Ryegrass  
- greater root density  
- 2,600-4,500 #/A

Very little top growth does not mean very little root growth.

- Four inch tall Annual Ryegrass with 21" deep roots
- 15" deep radish roots that had 2" tall tops and a "pencil" sized tuber
- 12" deep crimson clover roots under 2" tall top growth (with many nodules)



# What fits after Corn and Soybeans?

- The tool box is not quite as full
- Aerial application works very well on most species
- Timing and moisture are critical for success
- Drilling provides best and most even stand...but efficiency problems



# What Species work best after Corn and Soybeans?

- Cereal Rye
- Oats
- Annual Ryegrass
- Crimson Clover
- Brassicas  
(Radish/Turnips  
/Kale/Rape)
- Mixes of the  
above



# What fits after WHEAT?

- The “tool box” is wide open!
  - For forage production
  - For nutrient sequestration
  - For nitrogen production
  - For building soil organic matter
  - Etc...etc...etc...
- **CAUTION**...DO NOT plant some of these too early
  - Early August works best (except with summer annuals)

# Drill in after wheat...

## Early Aug - Early Sept



# What about inter-seeding into Corn and Soybeans





Airplane

Helicopter



# Detassler for broadcasting seed into standing corn



# Highboy applicators





Van Tilburg Applicator Applied in August with growth by October, 2011



**THE OHIO STATE UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

# Need 50% Light Penetration in Corn



09 17 2010

# Yellowing Soybeans 25% Yellow Leaves



**THE OHIO STATE UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

# Cereal Rye Overseeded

## Residue from leaves hold moisture



**THE OHIO STATE UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

# Other popular combinations

- Oats and Radish
  - 1bu Oats + 2# Radish
  - Dies over winter
  - Very good cover
  - Great for controlling winter annuals
  - Great for holding/scavenging nutrients in the fall



# Planting Soybeans into Cereal Rye

- Need a thick, vigorous growth of cereal rye
- When to plant soybeans – maximize rye growth for SOM, water retention, weed control.
- How to kill rye – herbicide vs mechanical
- Managing soil moisture for soybean growth is a key to success. If dry conditions, kill early, if wet conditions, use cereal rye to dry out soil.

# SUMMARY

- Grasses (cereal rye, annual ryegrass) combined with Brassicas hold soil/nutrients.
- Grasses (oats, Sorghum Sudan) die with frost but loosen soil and may provide forage.
- Planting early maturing crops helps cover crops establish themselves early.
- All cover crops require 60-90 days of growth in fall to survive winter. Plant early maturing crops or plant early to maximize cover crop growth.



**OHIO STATE UNIVERSITY EXTENSION**

# **Sustainable Crop Rotations with Grass Cover Crops**

**James J. Hoorman**      [hoorman.1@osu.edu](mailto:hoorman.1@osu.edu)  
**Alan Sundermeier**      [sundermeier.5@osu.edu](mailto:sundermeier.5@osu.edu)  
**Dr. K. Rafiq Islam**      [islam.27@osu.edu](mailto:islam.27@osu.edu)  
[www.mccc.msu.edu](http://www.mccc.msu.edu)



**THE OHIO STATE UNIVERSITY**

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES