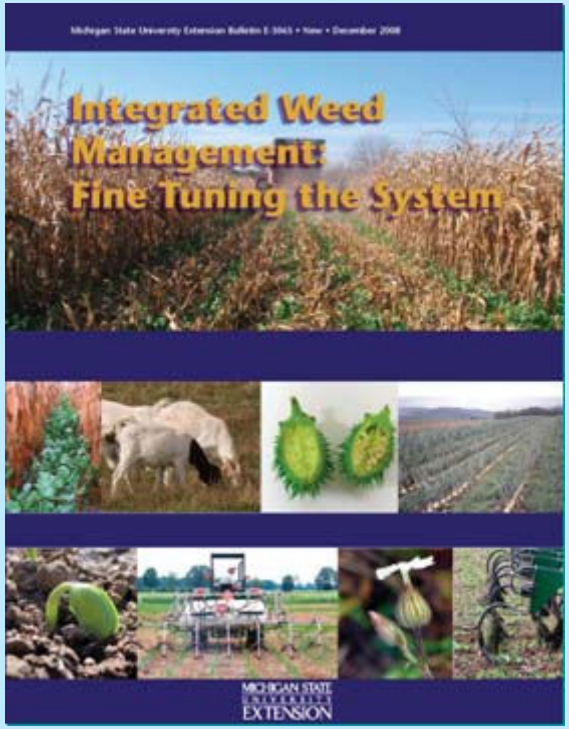
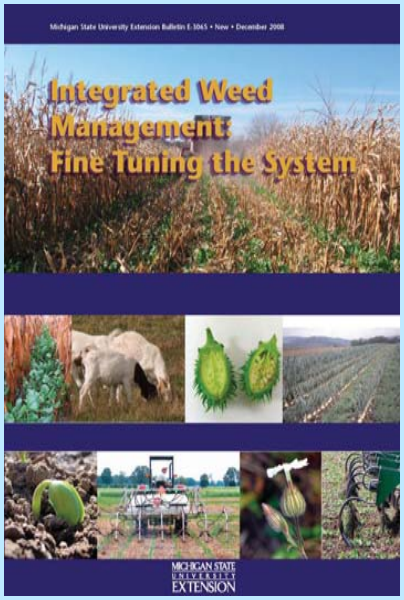
Integrated Weed Management: Tools of the Trade

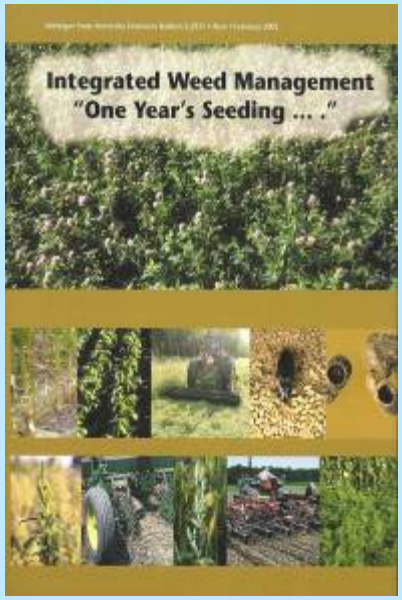


Erin Taylor, Karen Renner, Christy Sprague, and Dale Mutch



Integrated Weed Management: Fine Tuning the System





- Released December 2008/January 2009
- Complements 2005 bulletin
  Integrated Weed Management: One Year's Seeding





Integrated Weed Management: Fine Tuning the System

2006

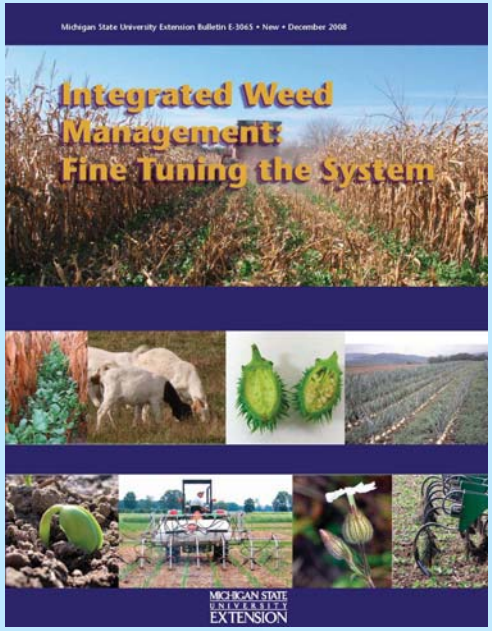
- Survey of "Integrated Weed Management: One Year's Seeding…"
- On-farm trials- SARE Grant

2007

- On-farm trials continued
- Flaming time of day

2008

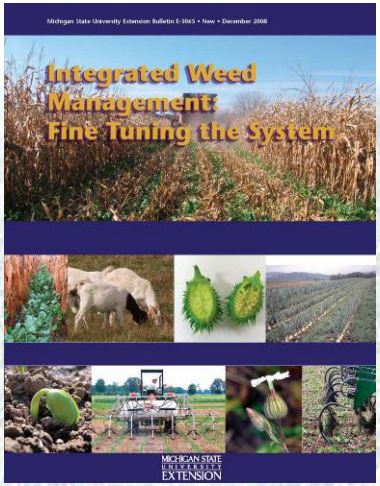
- Flaming time of day continued
- Grower interviews
- Grower rotation collection
- Bulletin writing and design



Fine Tuning the System

1. Diverse Crop Rotations
2. Cover Crop Systems
3. Manure and Compost
4. Flaming for Weed Management
5. Grazing and Other Biological Controls
6. Thresholds: How Many Weeds Are Too Many?
7. On-farm Weed Management Trials

Appendix. Weed Profile: The Second Dirty Dozen



Cover Crop Systems

"Using a cover crop is a learning experience: adjustments are usually necessary as conditions vary from year to year and from field to field."

-John Simmons (MI)

Benefits of cover crops

- Reduce light reaching the soil surface
- Some release chemicals that inhibit the germination and growth of weeds
- May act as a biofumigant
  - Releasing volatile chemicals that suppress diseases and pests
- Improve soil health and crop growth
- Scavenge or produce nitrogen

Table 1. Cost, growth rate, weed suppressive ability, seeding rate and nitrogen credits for popular cover crops grown in the Midwest.

Cost
A = least expensive
B = moderate
C = most expensive

Growth rate
A = fast
B = medium
C = slow

Weed suppression
A = highest
B = medium
C = lowest

	Cost	Growth rate	Weed suppression[2]	Drilled seeding rate (lb/A)[1]	N credit (lb/A)[1-3]
Red clover	A	C	A*	8 – 10	70 – 150
Crimson clover	B	B	B	15 – 20	70 – 130
Oats	A	A	A	80 – 110	—
Hairy vetch	C	B	B*	15 – 20	90 – 200
Sweet clover	A	C	B*	6 – 10	90 – 120
Cowpeas	B	A	B	30 – 90	100 – 150
Field peas‡	B	A	B	60 – 80	70 – 150
Turnips/ Forage rape	B	B	B	5 – 10	—
Oriental mustard	C	A	C	5 – 12	30 – 120[4]
Oilseed radish	C	A	A	8 – 13	50 – 200[4]
Buckwheat	B	A	A	48 – 70	—
Cereal rye	A	A	A	60 – 120	—
Winter wheat	A	B	A	60 – 120	—
Winter barley	A	B	A	50 – 100	—
Triticale	A	A	A	60 – 120	—
Annual ryegrass	B	B	B	10 – 20	—
White clover	B	C	A*	3 – 9	80 – 200
Sorghum-sudangrass	A	A	A	35	—

Kalamazoo County Field Crop Rotation

Year	Crop/cover crop
1	Corn
	Rye
2	Snap bean
3	Spelt
	Clover
4	Corn
	Rye
5	Soybean
6	Wheat
	Clover

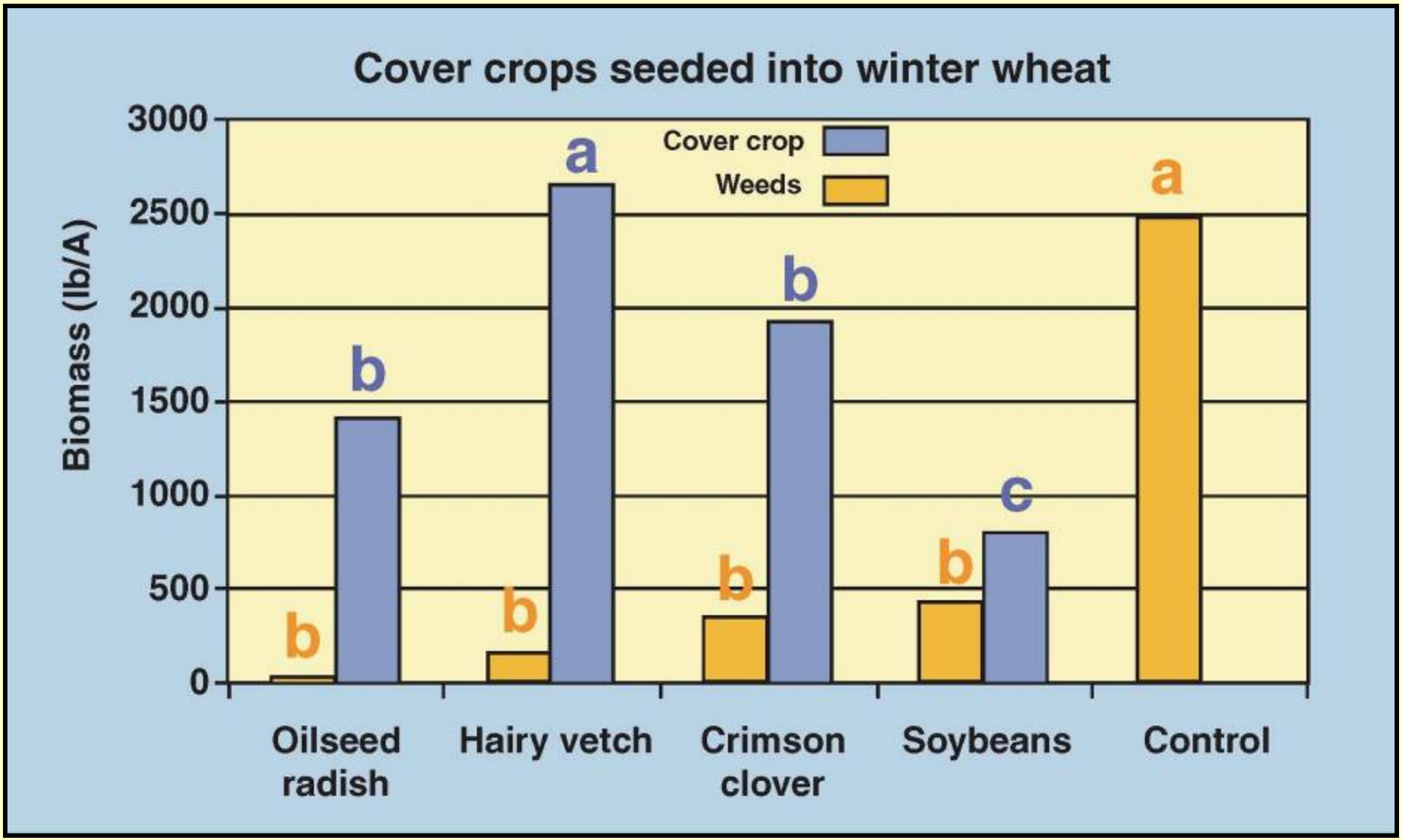
Vegetable Crop Rotation

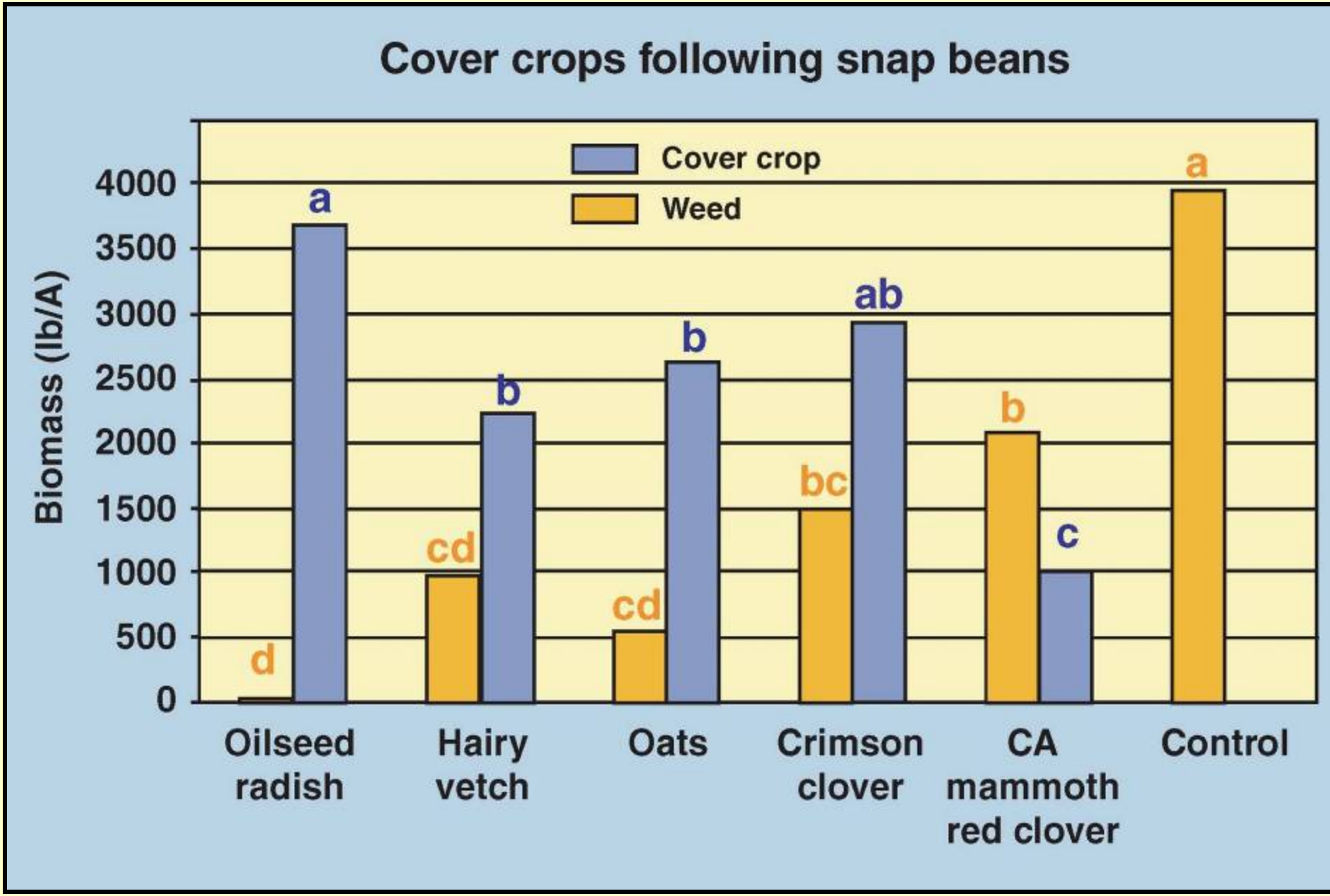
Year	Crop/cover crop
1	Oats **Winter Peas**
2	Tomato Peppers
3	**Field peas** Fall Veggies

"New" ideas for cover crop monocultures

Oilseed radish

- Belongs to Brassica family
- Relieves soil compaction
- Winter kills
- Produces large biomass in short time
- Good weed control
- Nitrogen scavenger


Cover crops seeded into winter wheat
Biomass (lb/A)
3000
2500
2000
1500
1000
500
0
Cover crop
Weeds
a
b
b
b
b
b
c
a
Oilseed radish
Hairy vetch
Crimson clover
Soybeans
Control


Cover crops following snap beans
Cover crop
Weed
Biomass (lb/A)
4000
3500
3000
2500
2000
1500
1000
500
0
a
d
b
cd
b
cd
ab
bc
b
c
a
Oilseed radish
Hairy vetch
Oats
Crimson clover
CA mammoth red clover
Control

"New" ideas for cover crop monocultures

Chickling vetch

- Germinates in cold soils
- Adds nitrogen through fixation
- Grows well in poor soils
  - Prefers alkaline pH
- Needs to be mowed/tilled prior to seed set to deter volunteers

"New" ideas for cover crop monocultures

Oriental mustard

- a.k.a. Brown or Indian mustard
- Belongs to Brassica family
  - Biofumigant
- Can be planted spring or fall
- Winter kills
- Needs to be managed to avoid seed production

“New” ideas for cover crop monocultures

Buckwheat

- Has a short lifecycle that can fit into small rotations windows
- Produces a large amount of biomass in a short amount of time
- Residues breakdown quickly
- Attracts beneficial organisms
- Can become a volunteer problem

“New” ideas for cover crop monocultures

Sorghum-sudangrass

- Surpasses other cover crops in biomass production
- Can be mowed to increase above and belowground biomass production
- Highly competitive with weeds
- Allelopathic
- Winter kills

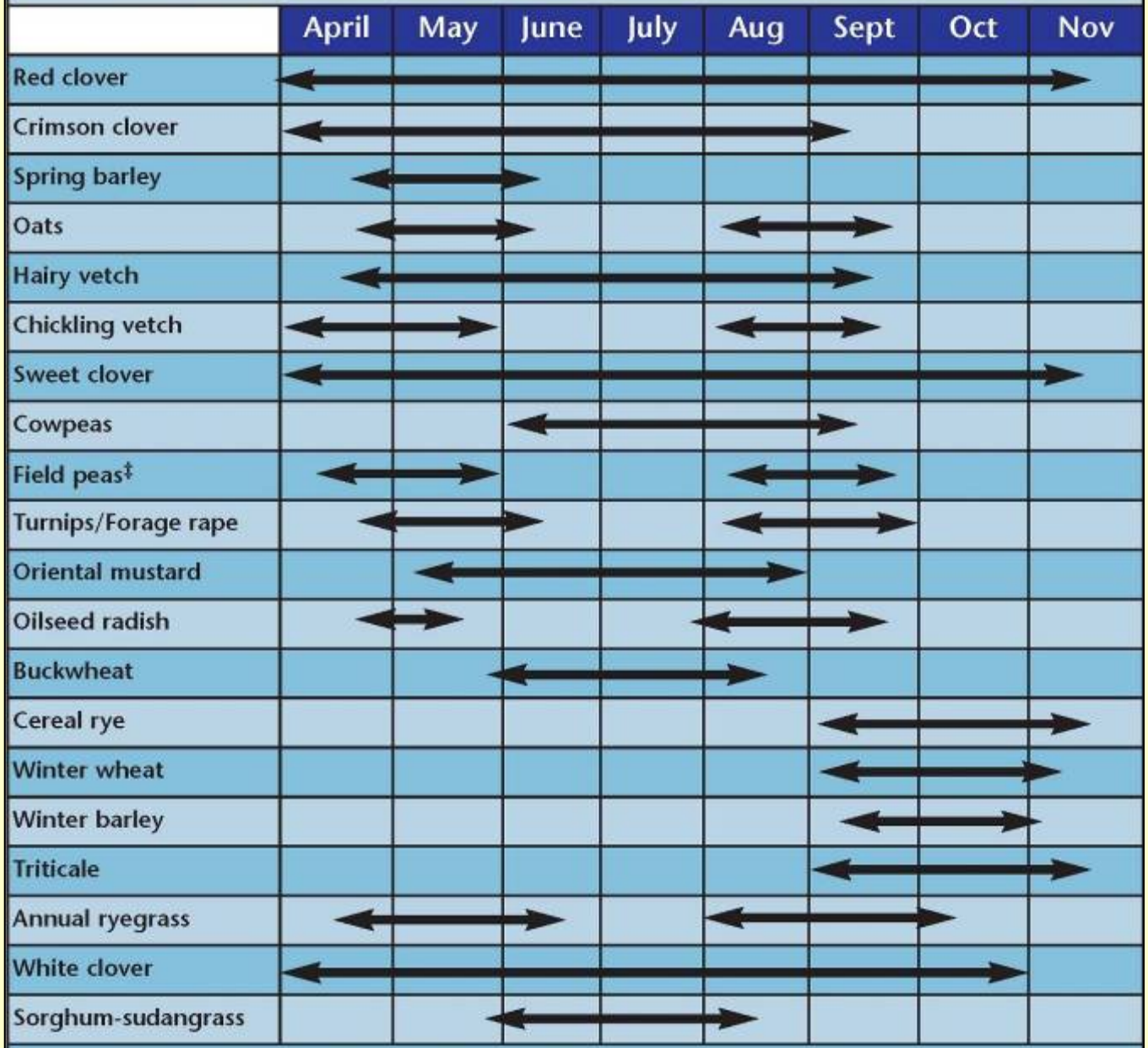
Promising cover crop mixtures

- Cowpea and Japanese millet
- Oats and field peas
- Rye and hairy vetch

Living mulches

- Two or more crops are grown together
- Works well when two crops have complementary growth patterns and nutrient needs
- Examples:
  - Clover frost seeded into wheat
  - Winter rye interseeded into broccoli
  - Onions interseeded with hairy vetch

Table 2. Seeding timing of various cover crops.



‡Also known as Austrian winter peas (black peas), Canadian field peas (spring peas).

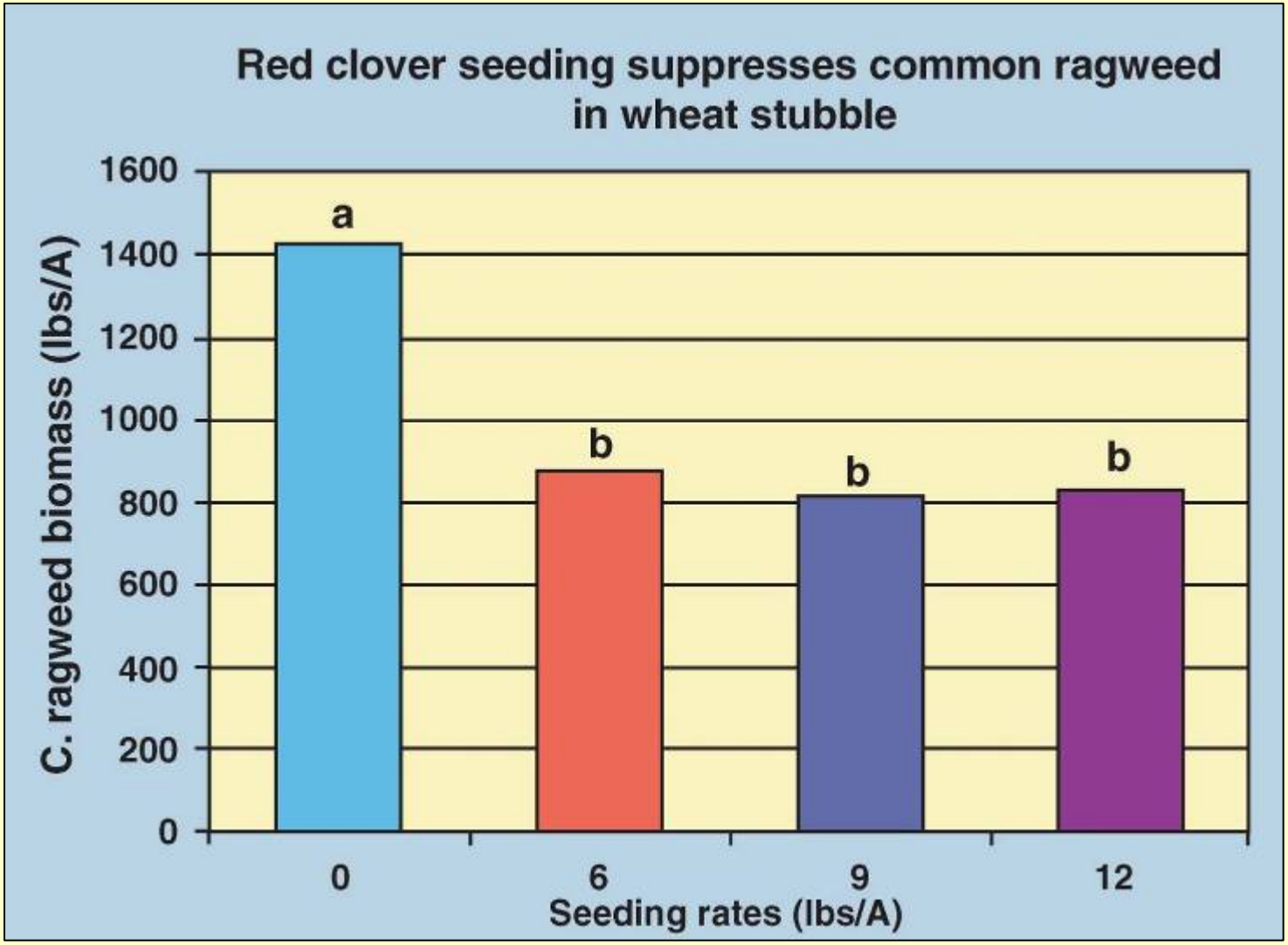


Figure 20. Seeding red clover at 6, 9, and 12 lbs. per acre suppressed common ragweed which is a common weed in wheat stubble in Michigan. The recommended seeding rate for red clover is 8 to 10 lbs. per acre; lower seeding rates in this year still provided ragweed suppression. Source: Mutch and Martin, Kellogg Biological Station, Michigan State University

Seeding cover crops with liquid manure

Manure slurry-enriched seeding combines low-disturbance aeration tillage, manure application, and the seeding of cover crops in one efficient operation.

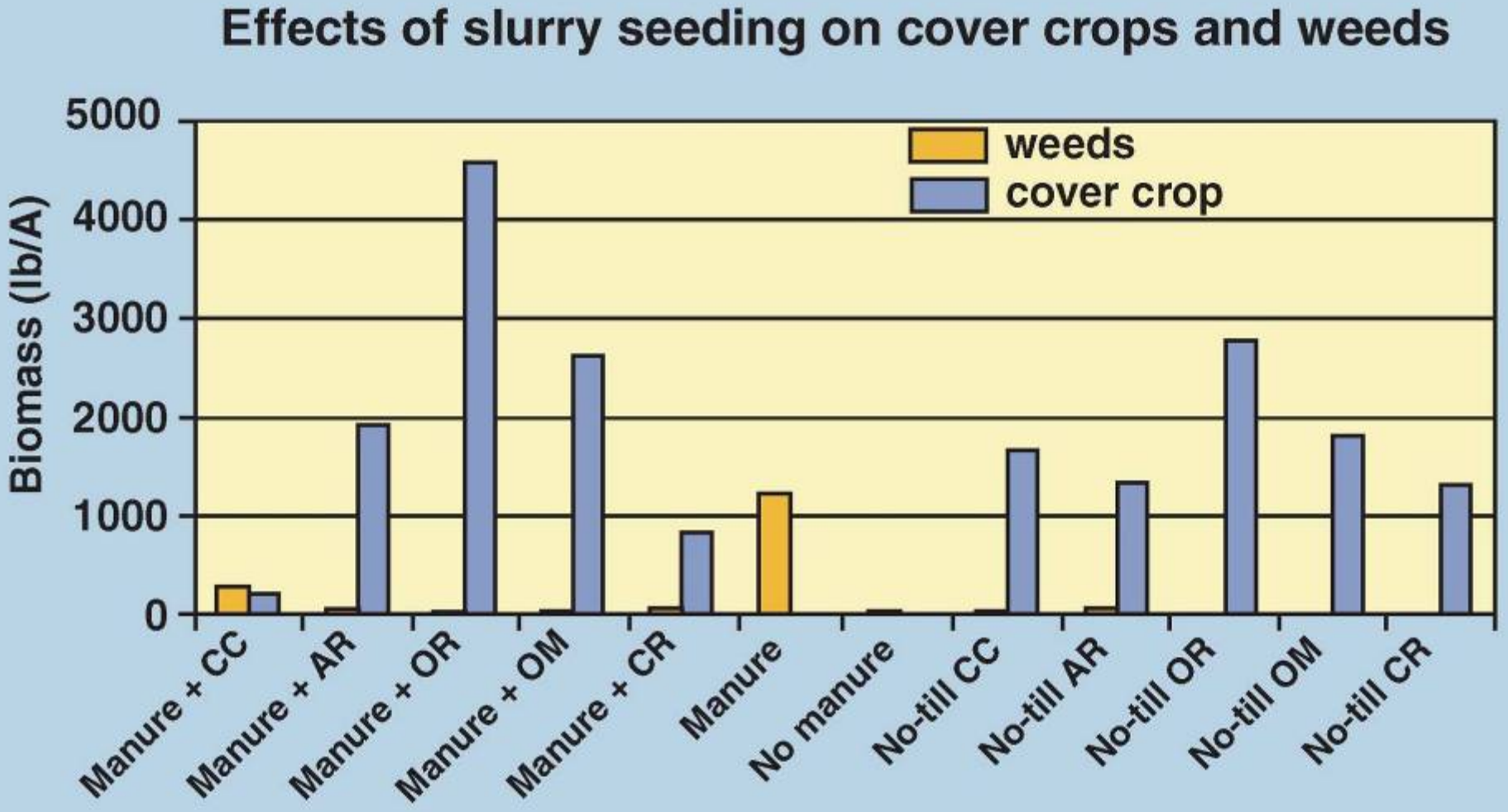


Figure 22. Effect of slurry seeding versus no-till seeding cover crops on biomass production and weed biomass. CC= Crimson clover, AR= Annual ryegrass, OR= Oilseed radish, OM= Oriental mustard, CR= Cereal rye. Mutch, Martin, Kellogg Biological Station, Michigan State University

Controlling cover crops

- More thoughts on managing rye
  - In a dry year, manage rye early in the spring as it can deplete the soil of moisture
  - Crimp rye at the soft dough stage
  - Apply herbicides when rye is 9 to 12 inches tall

Controlling cover crops

- More thoughts on managing red clover
  - Mowing
    - Under reasonable growing conditions, mowing will not reduce nitrogen production as growth is stimulated by mowing
    - If there is a weed problem, mow at 4 to 6 inches in mid to late August
    - If there is not a weed problem, no need to mow

Controlling cover crops

- More thoughts on managing red clover
  - Spraying
    - 2,4-D ester plus glyphosate provides excellent control in the spring
    - Glyphosate alone in the fall works better than spraying it along in the spring
  - Tillage
    - Moldboard plowing= 100% control
    - Chisel plowing may require multiple passes
    - Incorporate 8 to 10 inches in the soil
    - Allow at least 2 weeks between incorporation and planting if seed corn maggot is present

Controlling cover crops in no-till

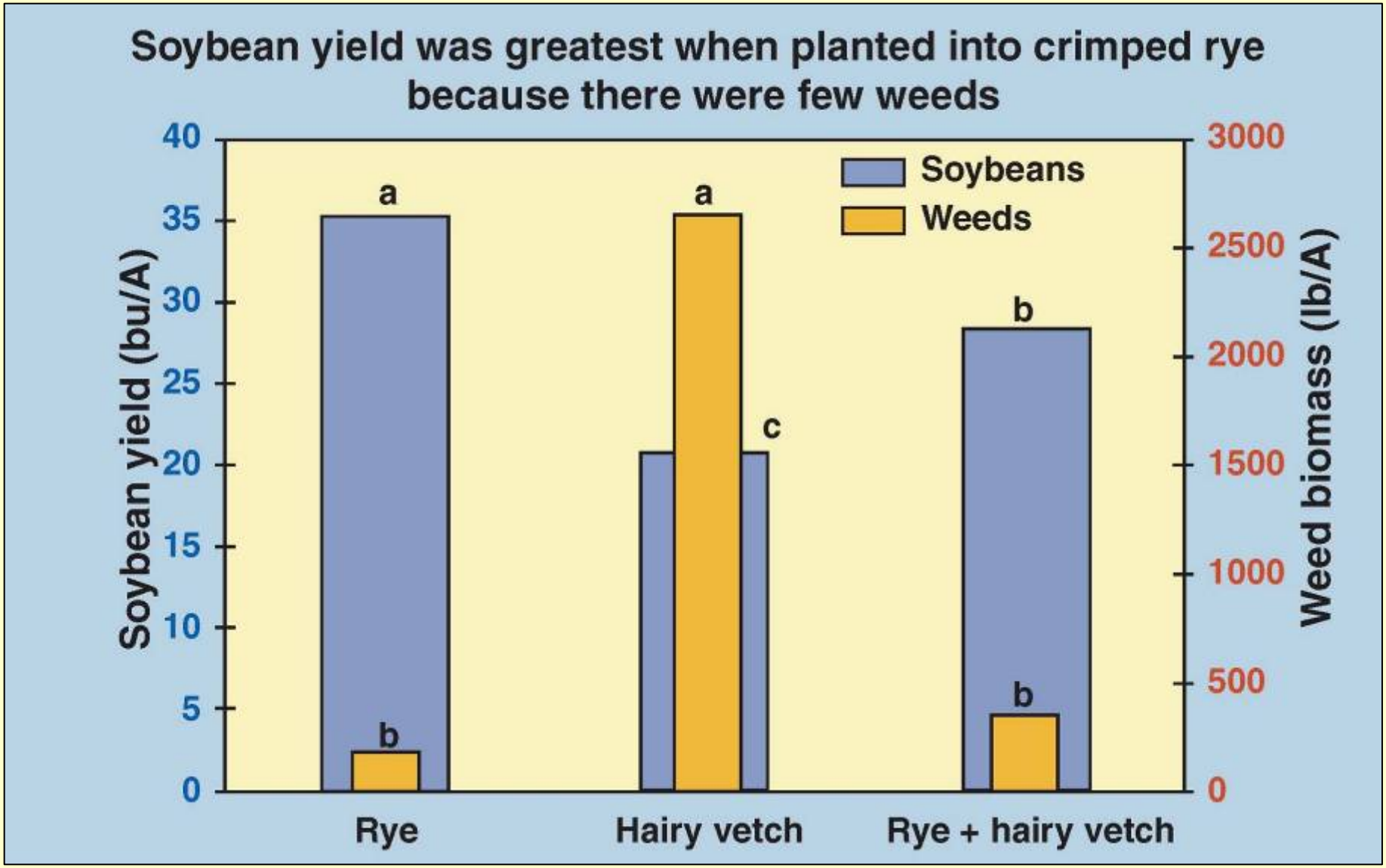


Figure 32. Yield and fall weed biomass for organic soybeans planted into crimped rye, hairy vetch, or a combination of the two cover crops. Different letters among yields or weed biomass indicate a significant difference among treatments. Mutch and Martin, Kellogg Biological Station, Michigan State University.

Table 3. Cover crop management strategies.				
Cover crop	**Winter kill**	**Tillage – timing or size of cover crop**	**Herbicide**	**Roller/crimper**
Red clover	No	2 to 4 weeks before planting	2,4-D ester + Glyphosate	Not recommended
Crimson clover	No	2 to 4 weeks before planting	2,4-D ester + Glyphosate	Not recommended
Alfalfa	No	2 to 4 weeks before planting	2,4-D ester + Glyphosate	Not recommended
Hairy vetch	No	2 to 4 weeks before planting	2,4-D ester + Glyphosate	Not recommended
Oilseed radish	Yes	—	—	—
Oriental mustard	Yes	—	—	—
Buckwheat	Yes	—	—	—
Field pea (Austrian pea)	Yes	—	—	—
Cereal rye	No	9 to 12 inches	Glyphosate	Soft dough stage
Wheat	No	9 to 12 inches	Glyphosate	Soft dough stage
Oats	Yes	—	—	—

Cover crop issues

- Possible detrimental effects on cash crop
- May increase beneficial or detrimental pest and plant diseases
- Volunteer cover crops
- Crop seed contamination