Mixtures of legume and grass summer cover crops for integrated weed and soil management

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Introduction

- Legume cover crop tradeoffs
  - Reduce off-farm purchases of fertilizer and improve soil health
  - Often expensive seed
  - Often poor weed suppression

- Grass-legume mixtures may provide advantages…

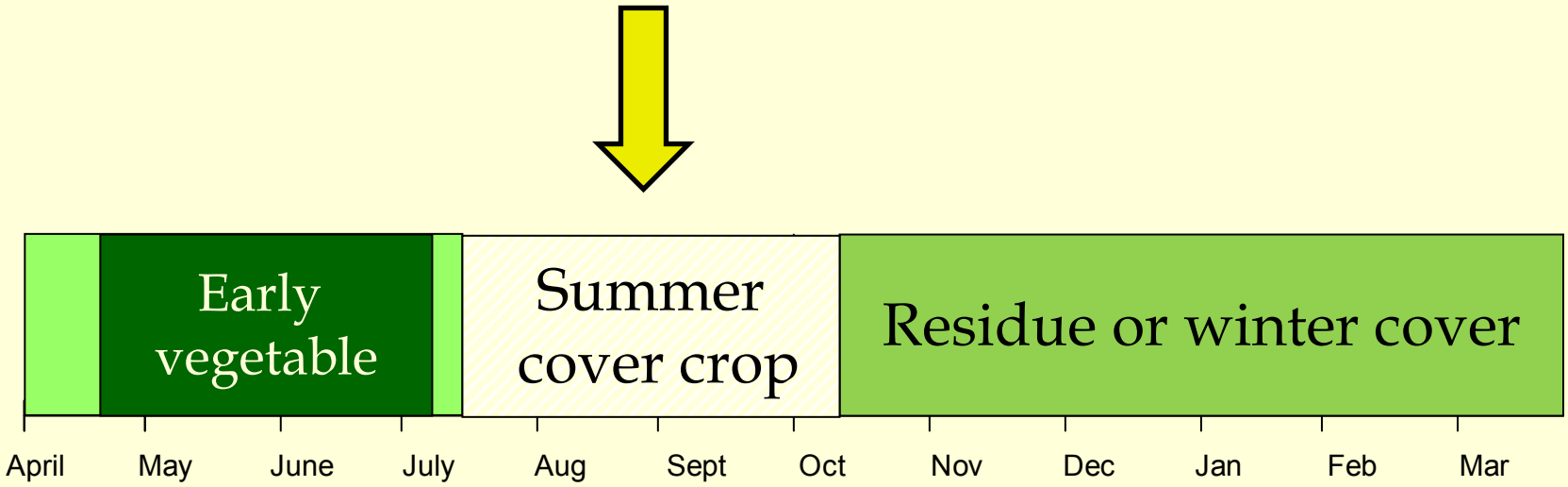
Why grass-legume mixtures?

- Improved weed suppression
- Lower seed costs
- More efficient N fixation
- Improved C:N ratio

Objectives

- Evaluate effects of grass-legume cover crop mixtures on:
  - Weed suppression
  - N-fixation
- Identify potentially valuable cover crop species or mixtures for use following early harvested vegetables

Niche for summer cover crops in vegetable systems



Methods

- Cover crops evaluated
  - Sorghum sudangrass (Sweetleaf II; 50 lb/A)
  - Japanese millet (12 lb/A)—one yr only
  - Cowpea (Red Ripper; 150 lb/A)
  - Soybean (Tyrone; 150 lb/A)
  - No cover crop
- Alone and in 50:50 mixtures
- Drilled in mid July
- Evaluated in mid September (60 days later)


Sorghum-sudangrass

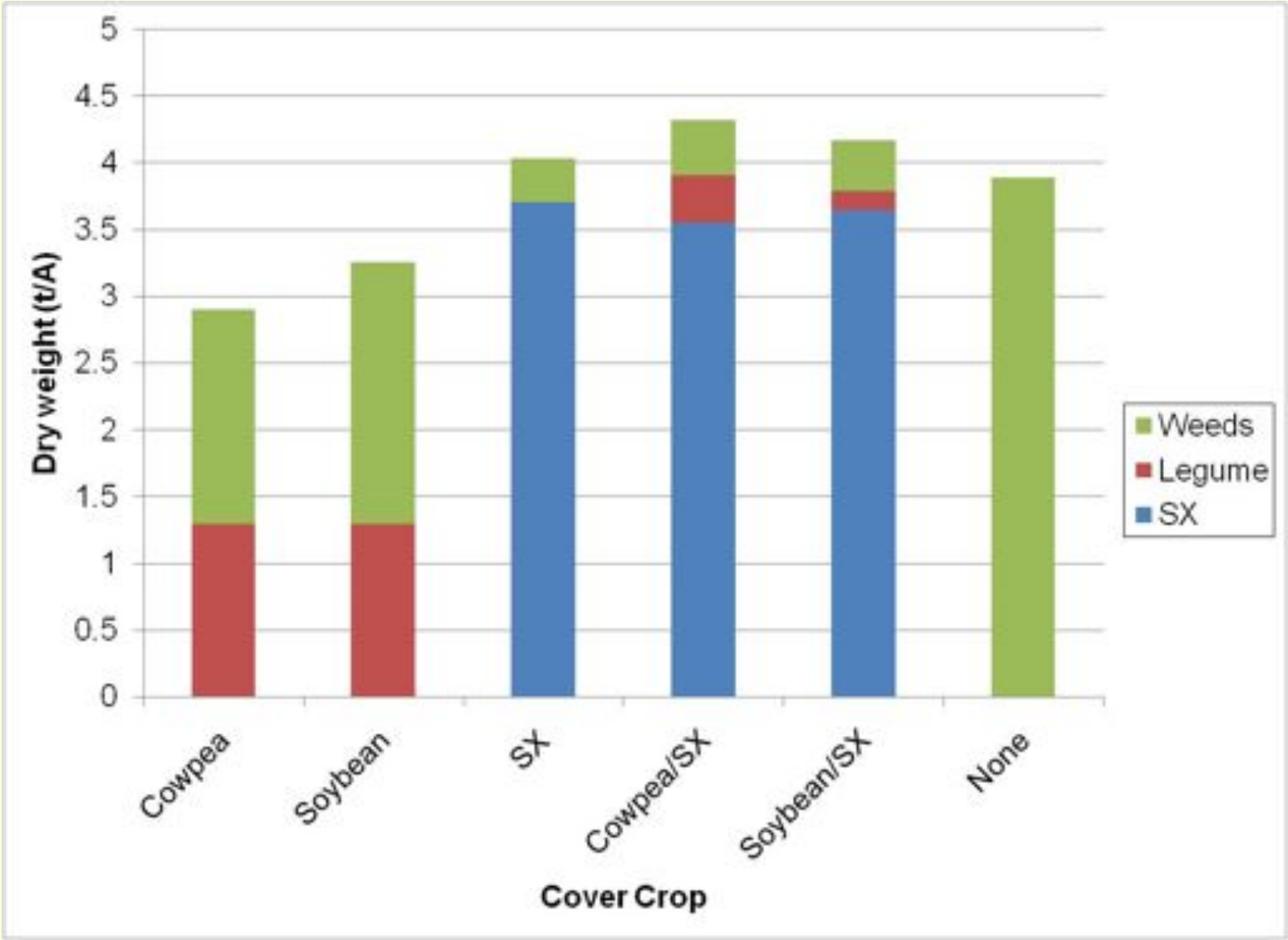

Japanese millet


Soybean

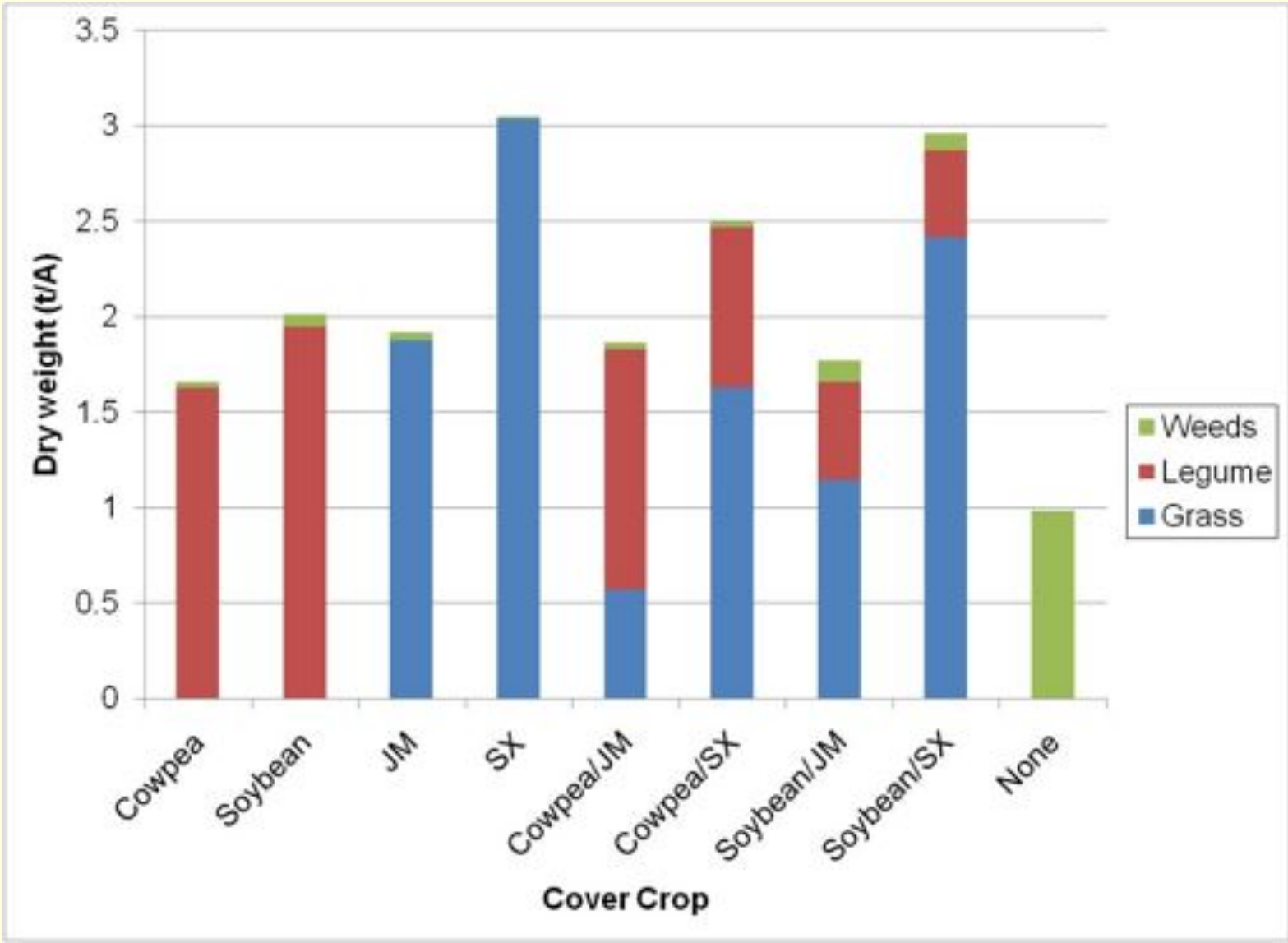

Cowpea

Grass-legume mixtures

Results: Biomass 2005



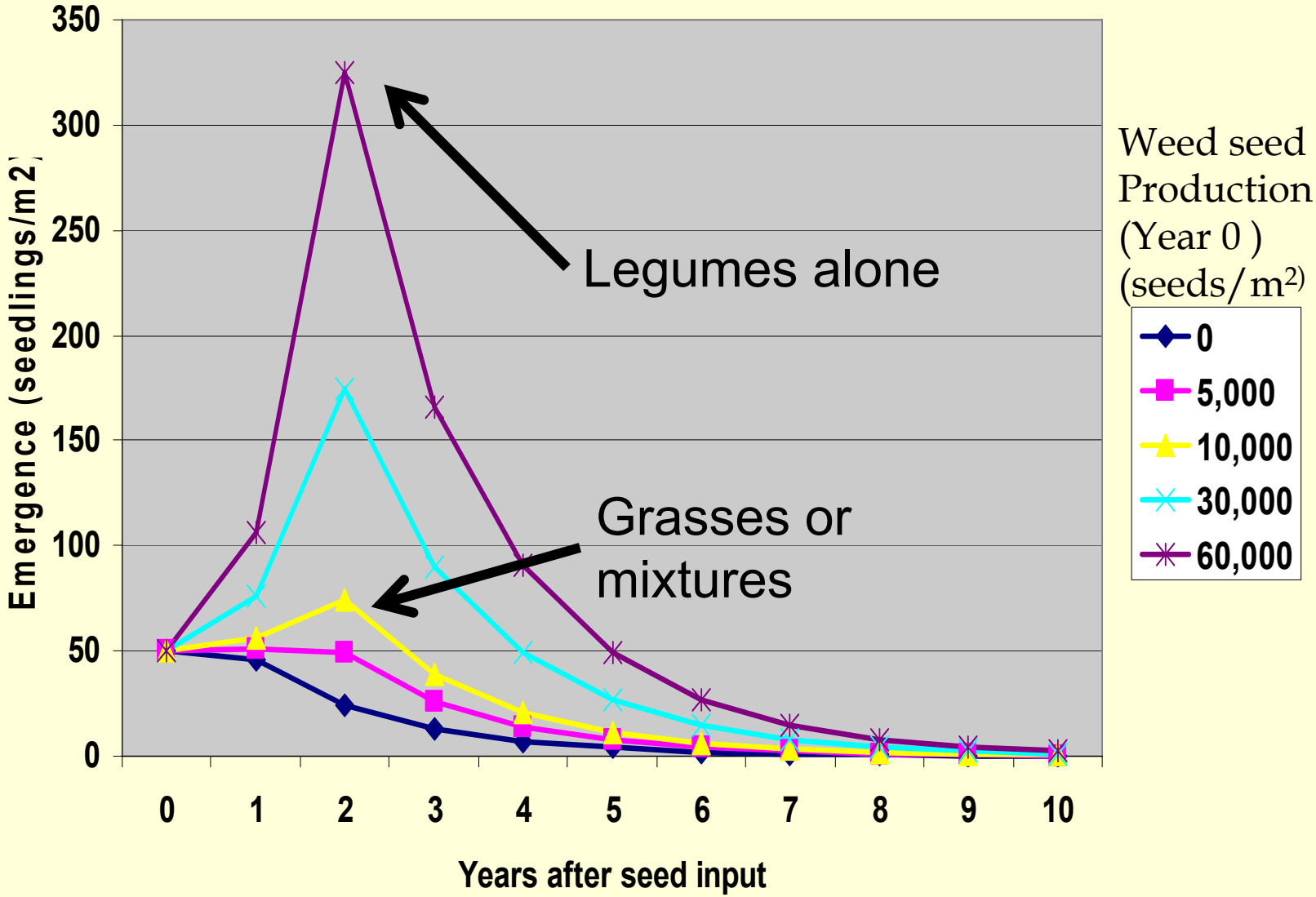
Results: Biomass 2006



Results: Weed seed production
Amaranthus powellii

Cover crop(s)	2005	2006
	------000 seeds/m^2-------	
Cowpea	130 b	0.6 b
Soybean	166 b	1.3 b
Japanese millet (JM)	NA	0.7 b
Sorghum-sudangrass (SX)	20 c	0.2 b
Cowpea/JM	NA	0.6 b
Cowpea/SX	27 c	0.3 b
Soybean/JM	NA	3.4 b
Soybean/SX	24 c	2.0 b
None	386 a	48.7 a

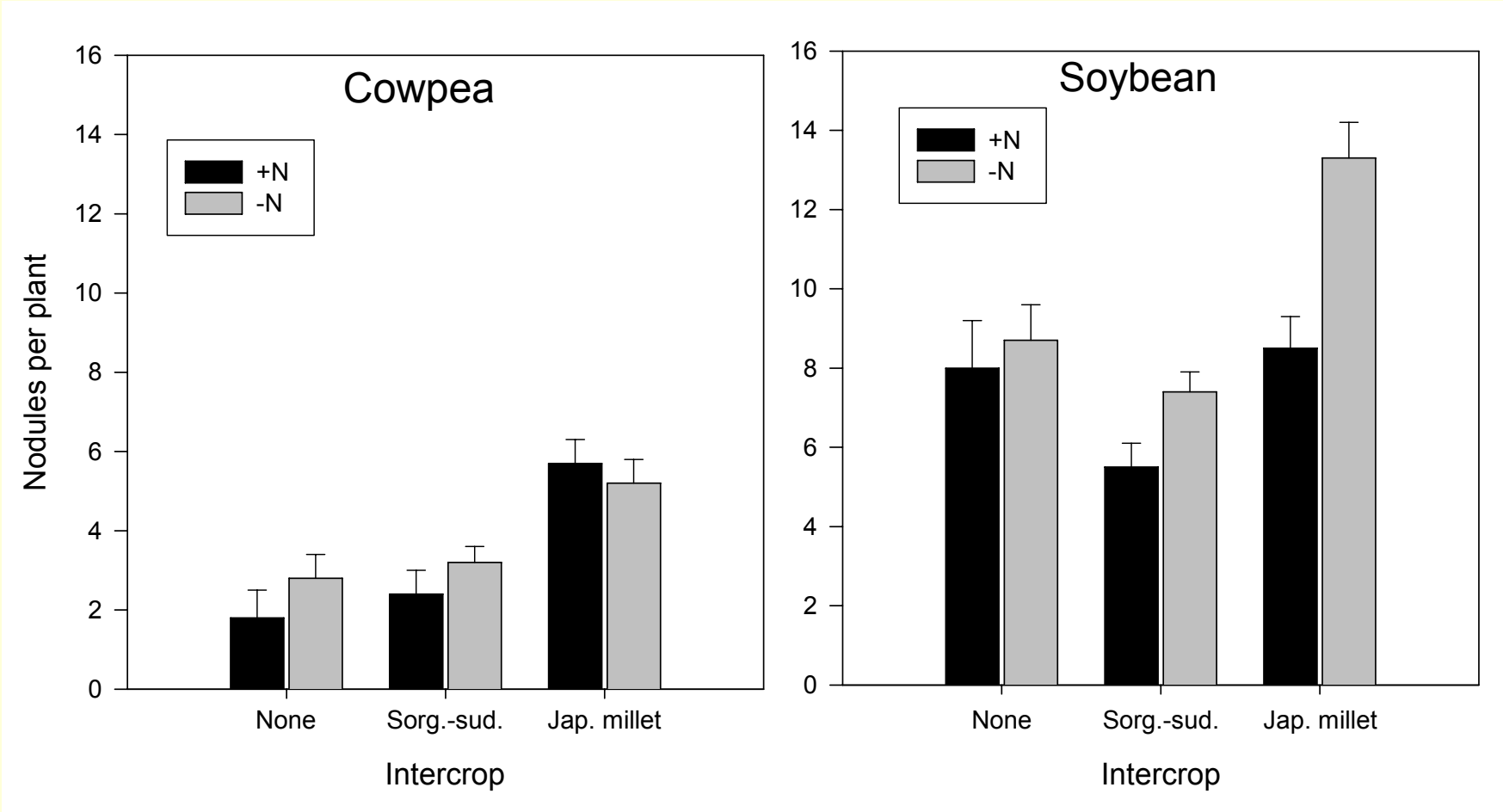
Impact of weed seed production on future Weed density



Brainard 2002


Results: Nitrogen fixation

Results: Legume nodulation, 2006



Results: Nitrogen benefits, 2006
(preliminary data)

	Cowpea	Soybean
	---------lbs/A-------	
Alone	45.0	105.0
With Japanese Millet	71.8	41.8
With Sorghum-sudangrass	31.1	33.2

	Cowpea	Soybean
	---------$/lbN-------	
Alone	1.56	0.38
With Japanese Millet	0.63	0.72
With Sorghum-sudangrass	1.45	0.90

Drinkwater and Brainard, unpublished

Summary

- Mixtures of legumes with Sorghum-sudangrass
  - Reduced risk of weed seed production
  - Reduced legume N fixation

    ⟶ not recommended
- Mixtures of legumes with Japanese millet
  - Provided adequate weed suppression
  - Improved N fixation of cowpea
  - Reduced N fixation of soybean

    ⟶ JM/cowpea potentially good

Take-home messages

- Tradeoffs often occur between soil and weed management objectives.
- Mixtures can be helpful in reducing tradeoffs, but…. not always. Effects vary with species and environmental conditions.
- More research is needed to identify compatible grass-legume cover crop mixtures and optimize their use in agroecosystems.

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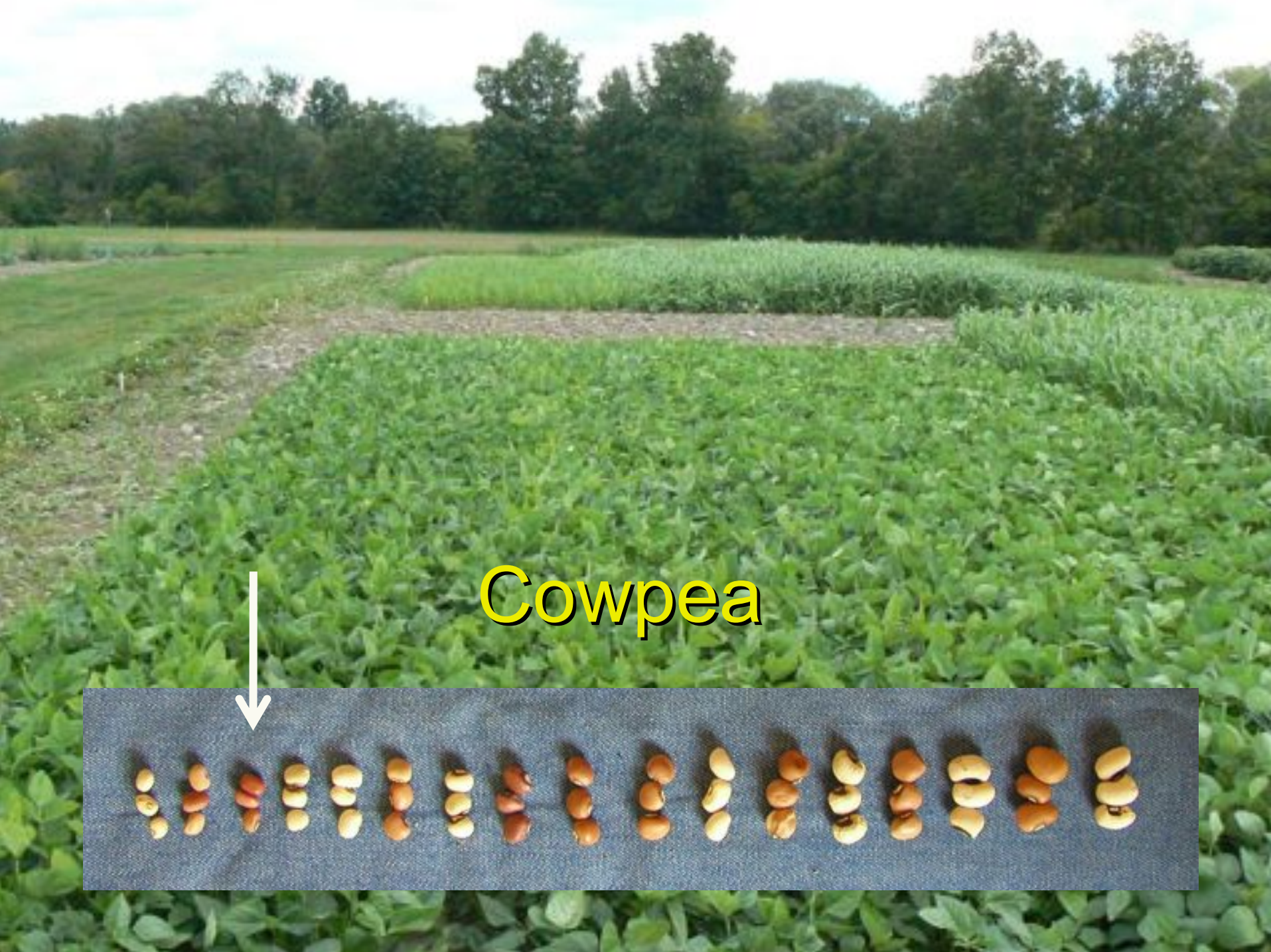
Cowpea

Seedling mortality

Seed production

Seed Germination

Seed mortality

Allelochemicals

Mulch effects

Nutrient effects

Seed predation

Seed decay

Should we care about 20,000 seeds/m^2?

Avoiding seed production

- Draw down weed seed bank
  - Crop rotation
  - Stale seed bed
- Mow before weeds set seed.
- Increase seeding rate

Seeding rates

Seed rate (lbs/A)	100	200	300
Cost ($/A)	30	60	90
Weed seeds (#/m2)	20,000	4,260	1,522