Successfully Integrating Grass Cover Crops into Potato-Alfalfa Rotations

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Introduction

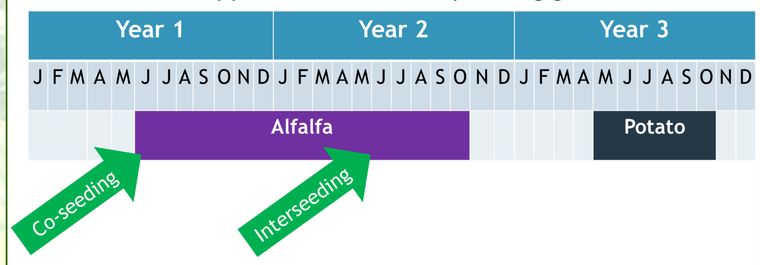
- Intensive management practices in Michigan potato production systems have led to degradation in the forms of mineral withdrawal, poor soil structure and soil microbial community disruption.
- Increasing cropping system diversity could lead to improved soil productivity and crop yields (Tiemann et al., 2015; van Elsas et al., 2002), with several studies showing that the combination of grasses and legumes could result in synergistic improvements (Garbeva et al., 2004; Sainju et al., 2005; Altieri et al., 1999; Wagger et al., 1998).
- Grass species, such as pearl millet, have been shown to potentially decrease the pathogens responsible for Potato Early Die (*Verticillium dahliae* and *Pratylenchus penetrans*).

Objective

- Determine how to best incorporate a grass species into a potato-alfalfa-alfalfa rotation

Materials & Methods

- 2016 Location- Kitchen Farms (Elmira, MI)
- Rotation and opportunities for incorporating grasses



  - Co-seeded (Plot 1)- Planted at the time of alfalfa seeding in Year 1, June 17th
  - Interseeded (Plot 2)- Planted at the first cutting of alfalfa in Year 2- June 17th

Table 1. Cover crop treatments and seeding rates

Grass	Variety	Co-seeded	Interseeded
		—Seeding rate (lbs/A) —	
Pearl millet	CFPM101 Millex32 Tifleaf3	7.5	15
Sorghum-sudangrass	Sweetbites	10	20
Teff	Dessie	2.5	5
Annual ryegrass	Centurion	10	12.5
Cereal rye	Guardian	30	60
Alfalfa alone	Roundup Ready	12.5	12.5

- Both plots were under irrigation and alfalfa was not removed upon cutting (4” height)
- Aboveground biomass was sampled at each cutting date; at the frost/termination above- and belowground biomass were sampled (0.25 m^2, depth = 18”)
- Randomized complete block (4 replications)

Results: Co-seeding (Plot 1)

- Loose seed bed and planting difficulties resulted in poor alfalfa stands
- Plot was cut once- August 29
- Final “frost” sampling- October 21
- Weeds were problematic, with no herbicide options for control
- Biomass production ranges (Figure 1)
  - Grasses- 4,700 to 10,000 lbs/A
  - Alfalfa- 300 to 1,400 lbs/A
  - Weeds- 600 to 4,600 lbs/A
- Grasses will either winter kill or be terminated with glyphosate. In 2018 Plot 1 will be alfalfa and in 2019 it will be planted to potatoes
- Future management considerations:
  - Increase alfalfa seeding rates
  - Reduce grass seeding rates
  - Plant grass later, after glyphosate application to alfalfa, to reduce weed pressure

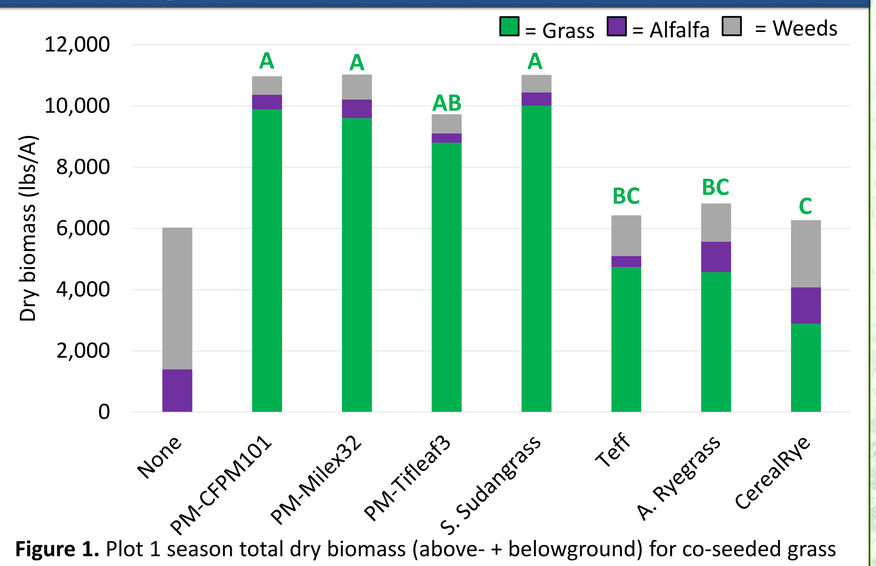


Figure 1. Plot 1 season total dry biomass (above- + belowground) for co-seeded grass species, alfalfa, and weeds. Differing letters indicate differences among grass biomass (p≤0.05).

Figure 2. Sorghum sudangrass, teff, and alfalfa alone (left to right) at the time of cutting August 29

Results: Interseeding (Plot 2)

- Cuttings- June 15, July 15, and August 9
- Plot terminated- August 30
- Weed pressure was low due to 2015 glyphosate applications to Year 1 alfalfa (no grasses planted yet)
- Season total grass biomass production ranged from 16 to 775 lbs/A, with pearl millet ‘Tifleaf3’ producing the most (Figure 3)
- Average alfalfa biomass for the season was 3,025 and 1,775 lbs/A for the above- and belowground portions, respectively
- In 2018 Plot 2 will be planted to potatoes, with a focus on microbial community, soil nutrient, and Potato Early Die pathogen assessments, in addition to potato quality and yield
- Future management considerations:
  - Increase grass seeding rates
  - Alter cutting times to the advantage of the grass species to reduce early shading and increase total biomass production

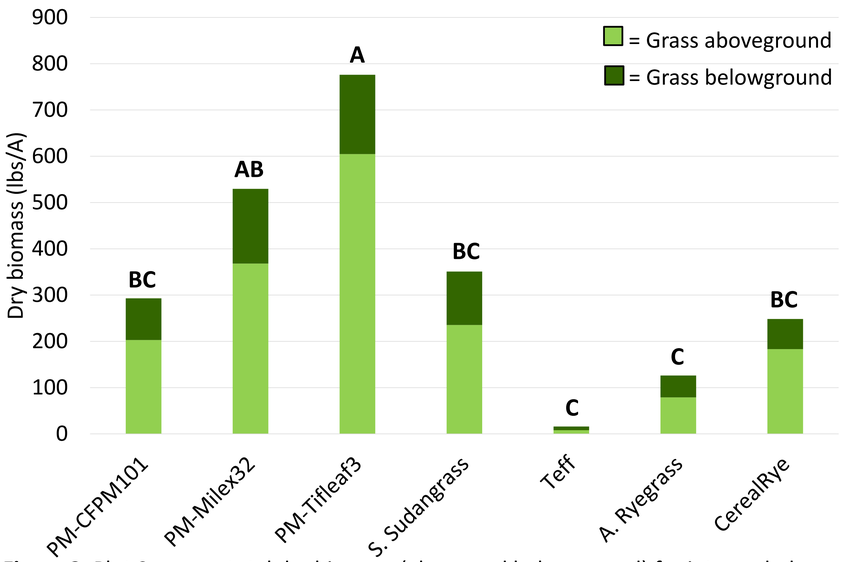


Figure 3. Plot 2 season total dry biomass (above and belowground) for inteseeded grass species. Differing letters indicate differences among total grass biomass (p≤0.05).

Figure 4. Pearl millet ‘Tifleaf’, teff, and annual ryegrass (left to right) next to alfalfa at the third cutting time on August 9

Conclusions

- Grasses were successfully grown when co-seeded with alfalfa or interseeded into 2nd year alfalfa
- Pearl millet varieties differed in their performance under these two planting scenarios, with ‘Tifleaf3’ out producing ‘CFPM101’ and ‘Millex32’ under intense competition from alfalfa (Plot 2- interseeded) and producing slightly lower biomass relative to those same varieties under reduced competition (Plot 1- co-seeded)
- Continued research will lead to recommendations for increasing crop diversity in potato-alfalfa rotations

Funding provided by:

Project GREEEN

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