Northern NY Agricultural Development Program
2014 Project Report

Emergency Summer Annual Forage Crop Mixtures

Project Leader:

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Collaborators:

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- Mike Davis, Willsboro Research Farm, CUAES.

Background:
Farmers can use warm-season annual forage crops after a small grain harvest or in emergency situations when excessive rainfall prevents normal planting of corn or when perennial forage crops fail. Several warm-season forage crops are drought tolerant and can perform better than corn silage under dry conditions. Given projected changes in rainfall patterns in the region, warm-season annuals can increase cropping systems resilience against extreme weather events.

Methods:
Annual forage crop mixtures were compared in 2014 at the Willsboro Research Farm in ENNY as part of a larger project involving two additional research sites in central New York and Maryland. We seeded BMR sorghum sudangrass, hybrid pearl millet, sunn hemp, and cowpea in monocultures and in three and four species mixtures to test for complementarity between these crops. The first seeding date (late June) represented a scenario where corn silage failed and replanting corn is not an option. The second planting date (mid-July) represented a post small grain harvest scenario. We collected data on weed suppression, forage crop population, yield, and forage quality.

Results:
Crop performance. Crop biomass varied by year and was nearly double in 2013 compared to 2014, which was likely due to the cooler temperatures in the second year. The ANOVA results showed no interaction between the forage crop treatment and site-year at either sampling date. The grass monocultures and all intercrops produced similar amounts of biomass in both sampling dates, ranging from 7,800 (millet-sunn hemp-cowpea) to 9,600 kg ha^{-1} (millet-sorghum sudangrass-sunn hemp) (Figure 1). Legumes in monoculture produced the least amount of biomass of all forage species. At the first sampling date, cowpea produced two-thirds the amount of biomass as sunn hemp, 1,000

and 1,500 kg ha^{-1}, respectively. In the second sampling, cowpea produced slightly more than half the amount of biomass as sunn hemp, 2,500 and 4,800 kg ha^{-1}, respectively.

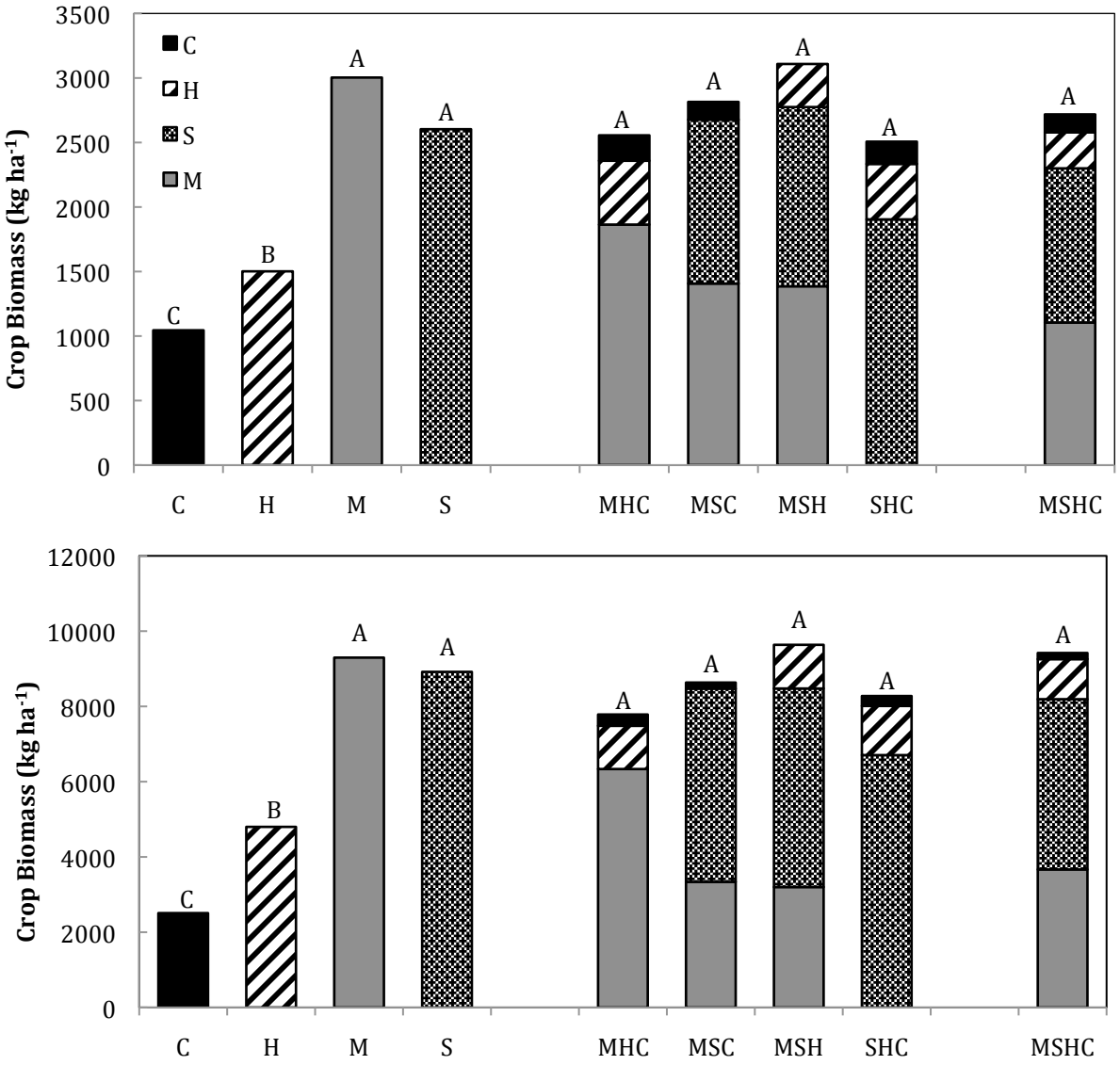

Figure 1: Crop biomass pooled across sites and years by species composition for the first (upper) and second sampling (lower). M, pearl millet; S, sorghum sudangrass; H, sunn hemp; C, cowpea. Similar letters above bars indicate no significant differences in total crop biomass at $P < 0.05$.

Seed costs. Pearl millet was the least expensive and most productive forage crop, resulting in the greatest production per cost (Table 1). As biomass production increased between the sampling dates, the production per cost also increased. Production per cost increased by a greater rate for the grasses than the legumes. The SHC intercrop was the most expensive treatment. Crop biomass was low in the SHC, making this intercrop the most expensive and least productive treatment. Although forage intercrops were more expensive than pearl millet, forage quality was likely greater in the intercrops.

Table 1: Calculated seeding cost per hectare and cost of biomass production for the first and second sampling dates. M, pearl millet; S, sorghum sudangrass; H, sunn hemp; C, cowpea.

Species	Cost per ha	1st sampling	2nd sampling
	($)	(kg dollar^{-1})	(kg dollar^{-1})
C	253.28	4.12	9.90
H	255.01	5.89	18.82
M	52.63	57.06	176.62
S	205.10	12.69	43.48
MHC	186.98	13.67	41.63
MSC	170.34	16.29	50.69
MSH	170.91	18.19	56.17
SHC	237.80	10.54	34.80
MSHC	191.51	14.19	49.19

Conclusions/Outcomes/Impacts:

Although pearl millet has not performed well in trials in Vermont, our research in NY suggest that this crop can produce a great deal of biomass very quickly at a reasonable cost. Forage quality will need to be considered before a recommendation can be made in regard to intercrop composition and management.

Outreach:

Our findings from this project have been presented in different venues including field days and farmer workshops. Project results are summarized on-line at our website [https://scslabcu.wordpress.com/portfolio/summer-annual-forage-crops/] and in a YouTube video [Low-input intercropping of summer annual crops in the Northeast. Ann Bybee-Finley, Graduate Field of Soil and Crop Sciences seminar series on November 13, 2014. https://www.youtube.com/watch?v=vfeuHkhPcZ4]

We also presented our results to farmers and the scientific community.

- Advances in cover cropping and rotations. Cornell Soil Health Train-The-Trainer Workshop. Ithaca, NY. Aug. 15, 2014.
- Advances in cover cropping. Musgrave Research Farm Field Day. Aurora, NY. July 18, 2014.
- Innovative cropping systems. NOFA NY 3rd Annual Organic Dairy & Field Crop Conference. Auburn, NY. Mar. 7, 2014
- Bybee-Finley, KA, MR Ryan, and SB Mirsky. 2014 Niche management with polycultures of summer annual forage crops. Proceedings of the Weed Science Society of America. 54:80.

Next steps:
We are applying for a USDA grant for a collaborative project with Heather Darby at the University of Vermont and Rich Smith at the University of New Hampshire.

Acknowledgments:
This research was also supported with funding from 2013-14-425: Expanding the role of cover crops in sustainable cropping systems.

Reports and/or articles in which results of this project have been published:
Ann Bybee-Finley reported on the results from this research in her MS thesis.

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