

Sustainable Dairy Cropping Systems Designed to Produce Forage, Feed and Fuel

Our goal is to sustainably produce the forage, feed and fuel for a 65 cow, 240-acre dairy farm in Pennsylvania and to minimize off-farm inputs. With funding from a NESARE USDA grant, our team of PSU and USDA-ARS scientists designed two cropping systems to: 1) minimize nutrient and soil loss, build soil organic matter and nutrient pools, and promote biological processes for nutrient acquisition, 2) enhance biological diversity and ecological interactions, and 3) be energetically efficient, productive, profitable, and sustainable.

We consulted with an Advisory panel to ensure that the cropping systems are relevant to farmers and researchers. Using farm-scale equipment and manure from a neighboring dairy, we initiated the cropping systems in spring 2010 at 1/20th scale on 12 acres of Penn State's Russell E Larson Agronomy Research Farm. The cropping system strategies include two six-year rotations with legumes, cover crops, perennials, no-till, integrated pest management, and manure injection. To reduce herbicide-use and herbicide resistance, we are evaluating a combination of weed management practices including a cover crop roller-crimper, herbicides applied over the crop row, a high-residue cultivator, tillage once in 6 years, and companion crops. Winter canola provides some of the fuel for a straight vegetable oil-powered tractor and meal for the dairy ration. We have also included a conventionally managed corn-soybean grain rotation for research comparison purposes, which adds another two acres to what we manage.

To evaluate the performance of the cropping system strategies, we are monitoring performance indicators such as crop yield and quality, soil health, nutrient conservation, greenhouse gas emissions, weed, insect, and mycorrhizal populations; energy use and production; and farm profitability. Twelve field "lysimeter" areas (90' x 50') were installed, to compare the impact of the manure management strategies on nitrogen, phosphorus and soil conservation, as well as atmospheric emissions (ammonia, greenhouse gases). Using the crop yields and feed and forage quality results, two dairy nutrition and production models are used to predict the performance of the virtual dairy herd.

Project Team:

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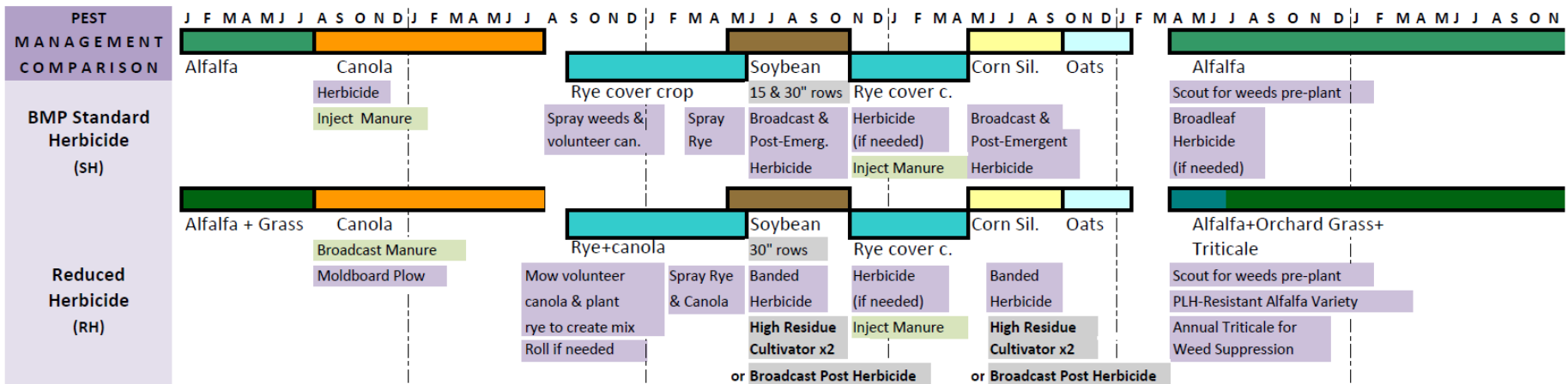
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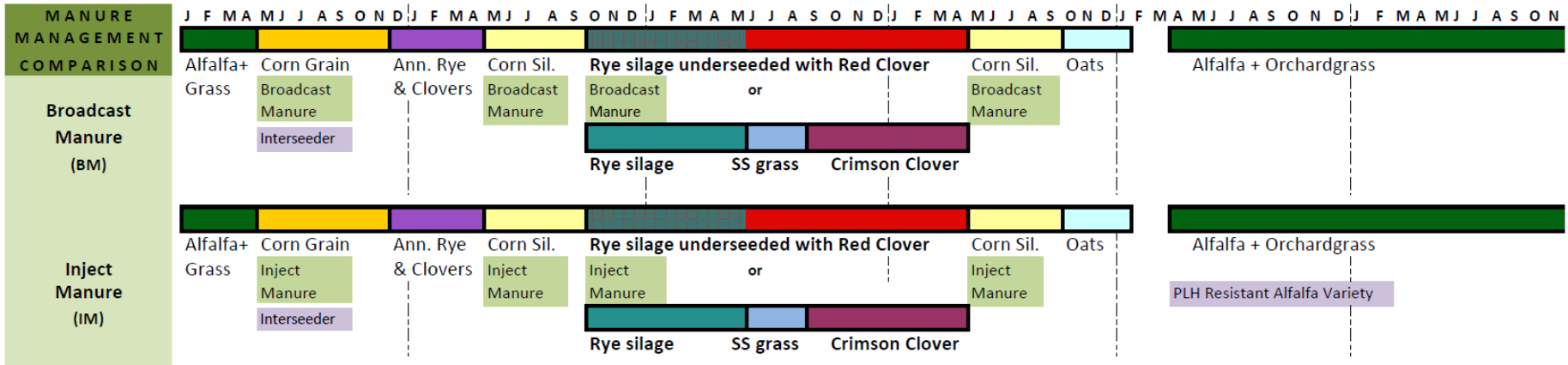
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Project webpage: <http://cropsoil.psu.edu/research/cropping-systems>

Pest Management Rotation: IPM for insect pests, multiple tactics for weed control (RH), inject manure for canola (SH) and rye cover crop before corn silage



Manure Management Rotation: injection vs. broadcast manure, green manure comparison, standard herbicides, IPM for insect pests, and non-Bt corn



Corn-Soy Conventional Grain Rotation: manure or fertilizer, standard herbicide regime, prophylactic insecticides, and Bt corn

