

Mushroom Substrate Feedstock Production On Degraded Mined Land Reclaimed with MC

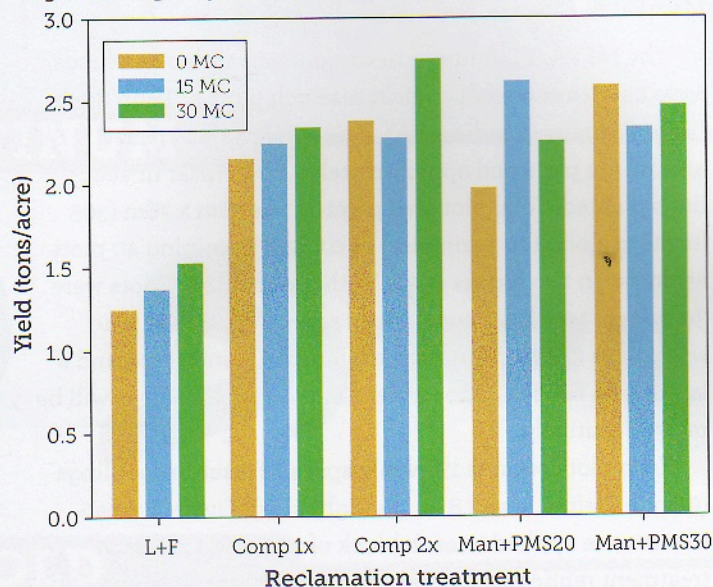
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Project Background

Seed grant funding provided by MFPA allowed us to begin a research project that addresses the need for additional grass straw and hay for mushroom substrate production and the need to find additional uses for MC. This project is investigating the potential to produce grass straw and hay on mined lands reclaimed and fertilized with mushroom compost. In eastern Pennsylvania there are thousands of acres degraded by mining that potentially could be used for production of perennial grass hay, use MC for crop nutrient needs and to build soil organic matter. Much of this land is 30 to 100 miles from intensive mushroom production areas, which would mean significantly shorter biomass hauls than many currently used sources. Transportation costs could be further reduced by establishing back-haul networks where trucks carry MC to the grass production sites and return with loads of grass straw or hay. Developing biomass production on these degraded lands would not compete with food, feed and biomass production on existing agricultural land. The system would establish a natural recycling of the carbon and nutrients in MC to produce new essential raw materials for mushroom production.

Funding was used primarily to establish two field experiments on mined land in Schuylkill County and to conduct initial soil sampling and one harvest. In the Blackwood site experiment, mined land was reclaimed using MC and then planted with three cool season grasses (timothy, orchardgrass and tall fescue) and two warm season grasses (switchgrass and miscanthus). In subsequent years of the experiment, the grasses will receive annual broadcast applications of MC at three rates (0, 15, and 30 tons/acre). In the Barry site experiment switchgrass was established in 2006 on abandoned mined land that was reclaimed in 2005 with lime and fertilizer, with poultry manure mixed with paper mill sludge or with composted poultry manure. No

Fig. 1: Switchgrass yield in Fall 2011 at the Barry site experiment.



additional fertilizer has been applied to the site since 2005. These switchgrass plots will also receive MC applications at 3 rates (0, 15 and 30 tons/acre). In both experiments soil is being sampled and analyzed to determine nutrient and organic matter content, and grass yield and nutrient removal will be measured. Warm season grasses are being tested as feedstock for mushroom substrate production.

Major Accomplishments

Blackwood site experiment

In Summer 2011 the experiment site was selected and was then cleared and graded. A reclamation rate of MC was applied and tilled in over the entire experiment area. In Fall 2011 the cool season grasses (timothy, orchardgrass and tall fescue) were planted and the first round of soil sampling was done. Warm season grasses were planted in the spring of 2012.

The cool season grasses established very well in the fall

and produced good growth this year. The plots have not yet been harvested. The warm season grasses did not establish well before hot dry summer weather arrived. Depending on survival these plots may need to be replanted next spring.

We also proposed to establish a 4-acre demonstration area at the Blackwood site that would be reclaimed using MC. Following the MC application, 1 acre each of timothy, orchardgrass, tall fescue and switchgrass would be planted. We had hoped to complete the planting in the spring of 2012 however the landowner did not complete site preparation early enough for spring planting. Site preparation will be completed this summer and a reclamation rate of MC will be applied and incorporated in the demonstration area. The cool season grasses will be planted this fall and switchgrass will be planted the following spring.

Barry Site Experiment

MC was broadcast applied to the switchgrass in spring of 2011 and plots were harvested in November 2011. Harvest data are shown in Fig. 1. Overall the effect of the first application of MC was not significant, but did show a trend toward increased yield with increased MC application. The effect of the MC was greatest on plots that were originally reclaimed with lime and fertilizer. This treatment had the poorest switchgrass growth in years prior to MC application. The second annual application of MC was made in Spring 2012. Soil samples will be collected in July and the switchgrass will be harvested in the fall. Photographs of the Blackwood and Barry site experiments are shown in Figs. 2-9.

Mushroom Substrate Production & Testing

Switchgrass is used on a regular basis at the Mushroom Research Center. The quantity used is about 15 percent of the total bulk ingredients, and it is pre-wet for four days before adding it to the straw bedded horse manure. Miscanthus straw was just used in a recent crop as a replacement for the switchgrass and seemed to compost about the same as the switchgrass. That crop was just spawned so no yields are available to report. **mn**



Fig. 2: Blackwood site experiment in Summer 2011 after site preparation and before MC application.



Fig. 3: Emergence of cool season grasses planted Fall 2011 at Blackwood site experiment



Fig. 4: Early Spring 2012 growth of cool season grasses at Blackwood experiment.



Fig. 5: Planting miscanthus in Spring 2012 at the Blackwood site experiment.



Fig. 6: Switchgrass establishment in early summer 2012 at the Blackwood site.



Fig. 7: Switchgrass stand late Summer 2011 at the Barry site experiment.



Fig. 8: Spreading MC at the Barry site experiment in Spring 2012. Piles of MC were subsequently raked out to uniformly cover the 7.5 x 30 foot plots.



Fig. 9: Switchgrass stand at the Barry site experiment