Abstract

Development of a Bulk-Format System to Harvest, Handle, Store, and Deliver High-Tonnage Low-Moisture Switchgrass Feedstock

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A high-tonnage feedstock supply system was developed using agricultural, transportation, and industrial technologies to provide year-round supply of low-moisture chopped switchgrass. Project handles switchgrass from field-to-factory, and includes the following steps: switchgrass is dry chopped into bulk format on the farm, hauled to storage, stored in a protective facility, and bulk compacted into an ejector trailer.

Switchgrass is produced using Genera Energy-producer contacts. Field harvest equipment was acquired and staged. A forage harvester chops field-dried, stable switchgrass mowed with a mower conditioner. The chopped switchgrass is collected in high-tip wagons to allow rapid off-load into an over-the-road (OTR) trailer, all selected to minimize cycle times and to accommodate safe transport. The OTR trailer uses a built-in off-load feature to empty it into the storage receiving pit. System-wide capacity analyses (Mg/h) was conducted and indicated multiple trailers to service one forage chopper. Bulk storage is planned, and it uses Laidig Equipment (OEM manufacturer) systems for receiving, storing, and reclaiming bulk-format switchgrass in a protective, automated system. The storage system reclaims bulk-format switchgrass with a positive-driven, sweeping auger located underneath the feedstock to aide switchgrass handling. Design of a pneumatic conveyance system, with dust control was completed so as to perform fill-, empty-, and blend-tasks from storage structures. Marathon Equipment (OEM manufacturer) specifies a transfer-type compaction system to directly load the bulk stream from storage into an OTR ejector trailer. The transfer compaction system uses a large plunger to pack the OTR trailer with bulk switchgrass. An alpha-compaction test was completed and used to determine specifications for the ordered compactor and ejector trailer. These results are highlighted in the presentation. The OTR ejector trailer has a large ram to push off packed switchgrass directly into a receiving pit. Bulk-format quality is compared to baseline bales, and sampling of bales was started. Quality of bulk-format feedstock for motor-fuel ethanol (EtOH) production, potential, and inhibitors will be determined by Dupont-Danisco Cellulosic Ethanol. National Laboratories (Idaho, Oak Ridge) assist with issues associated with biomass properties, bulk handling, and handling efficiency determination. Project identifies "switchgrass memory," which is stored energy expressed as resistive confining stresses and elastic rebound after compression, and "costs" as the top potential challenges. Both compaction into the ejector trailer and storage having compressive overburden involve elements of "switchgrass memory" from an operational and capacity standpoint.