Biomass and Grain Harvesting Advances

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BIOMASS AND GRAIN HARVESTING ADVANCES

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SUMMARY OF PRESENTATION

Part A. Corn Stover Harvesting Developments

Five different approaches to whole plant harvesting of corn - with the aim of simultaneous collection of the stover - have been tested. Many of the principles are relevant to other crops. This work has advanced the frontiers of biomass harvesting and handling. The different approaches to corn stover harvesting have been shown publicly:

* A two-tier two-row corn head and stover collection system on a research plot harvester. The heads having stalk chopping capability (Geringhoff design)
* A whole plant combine harvester-mounted stover collecting system, specifically making use of the row crop head that takes in the whole plant.
* The row crop head on the combine harvesting the whole plant and discharging the stover into a semi-mounted stover caddy at the rear of the combine. A particular focus of this test will be to see how much the combine’s grain harvesting capacity is affected.
* A conventional corn head on a corn combine with stover caddy at the rear.
* Another two-tier head of different design, row-independent, that uses an 8-foot reel for corn and provides the intact ears along with the chopped stover for higher load densities.

Each of these systems or approaches are being compared with baling for econometric analyses.

In Summary, single-pass, two-stream harvest of grain and stover has been publicly demonstrated and collection costs have been reduced considerably lower than $30/ton. By contrast with traditional baling which can cost $30/ton and up, at no stage was the stover allowed to touch the ground. Furthermore the cobs are captured in the stover - and the cobs have value. A clean sample is assured by these methods of whole plant harvesting. These approaches allow safe harvest at higher moisture levels than were possible with traditional baling, provided that the appropriate steps are taken by the processor at the biorefinery for longer-term material storage – as for example by ensiling.

Part B. Combine Performance: The Combine “Sweet Spot”

Tests have been conducted on eleven different combines, ranging from an old but highly-equipped and valuable Deere 4420, an STS 9750 (donated to the University courtesy Deere Harvester works), to the very latest market models (some whose identity cannot be revealed just now). When the performance of combines is measured in terms of machine harvested yield versus forward speed and throughput, the performance graph is found to have a parabolic shape. That is to say, for a given crop and field conditions there is a certain peak harvested...
yield or 'sweet spot' where the combine will collect the optimal harvested yield of grain. Note that a distinction is made between machine harvested yield and theoretical crop yield, the actual harvested yield being lower to the extent of field and machine losses. Yield reductions at higher speed due to combine separating and threshing ('processor') losses are well known. But harvested yield reductions caused by the machine at lower forward speeds have not been well reported. The hypothesis that is tested here is that when a combine is lightly loaded, grain damage increases and that damage results in harvested yield losses, for example powdered grain blown over the shoe and out the back. That loss is not accounted in routine loss measurements – the traditional method of reporting on combine performance is to plot loss measured by grain over the back versus crop throughput. Furthermore, yield monitors register whole grain signals at best and are not sensitive enough to be able to accurately account for the subtle loss-effects of particulate material.

The conclusions are (1) that measuring harvested yield is valuable way to assess combine operation, insofar that it integrates combine performance factors, and is readily turned into harvest gross income figures. (2) Grain damage constitutes a loss just as much as whole grain on the ground behind the combine is a loss. By reducing grain damage, there will be a corresponding gain in harvested yield and in farmer profitability at harvest.