

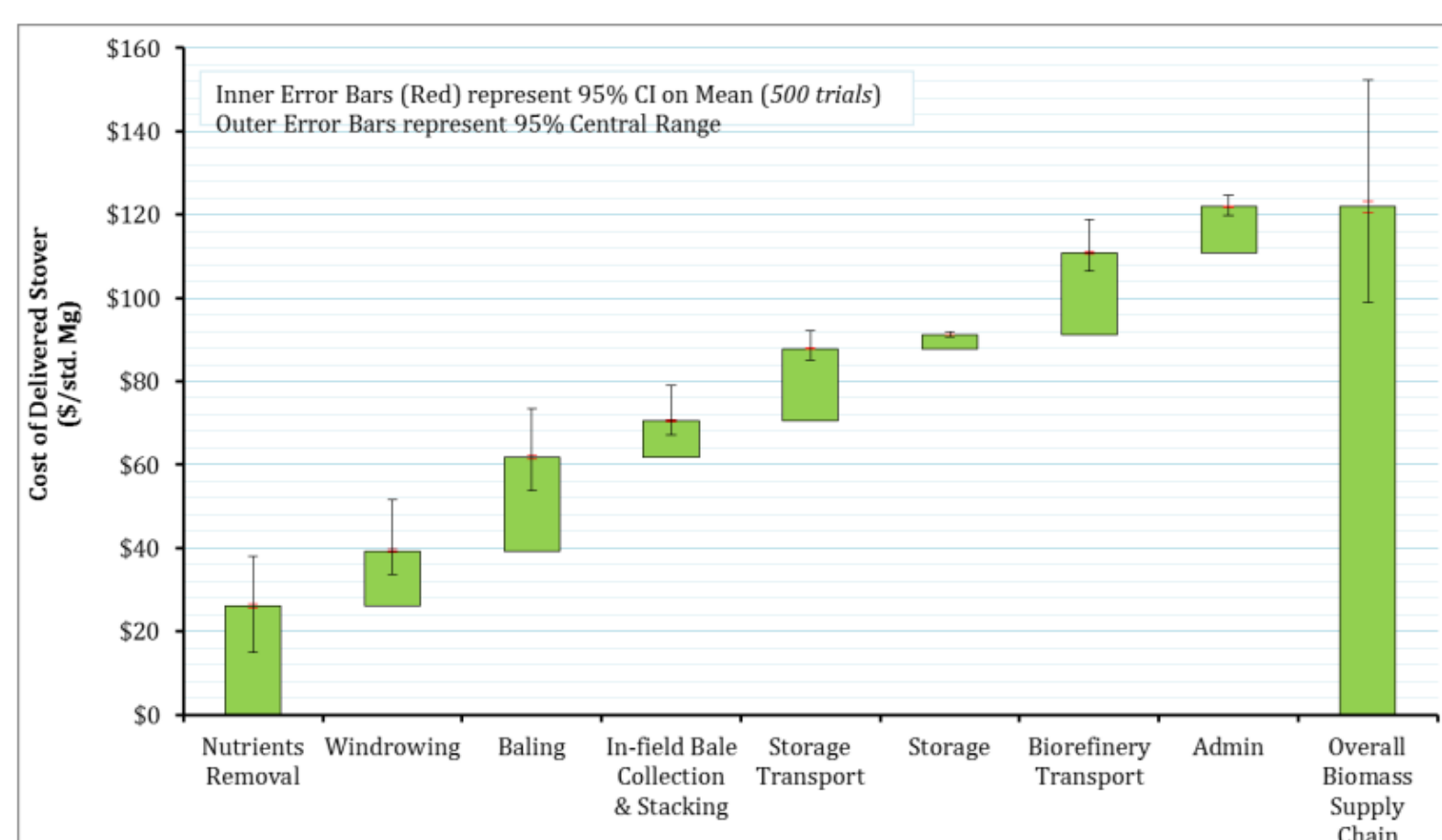
Independent Biomass Collection and Transportation

Introduction

- Dupont is opening a cellulosic ethanol plant in Nevada, IA.
- Currently they collect all of the corn stover by hiring custom harvesters and also coordinate the transportation of the biomass.
- This requires a shredder and baler for each pass through the field for collection.
- A crew then also comes to stack the bales for storage until they are needed.

Background Information

- Current research estimates that it costs about \$120/ton to harvest/transport corn stover. (Figure 1)
- Stover can be collected during harvest using a pull-behind baler.
- This allows for less passes across the field increasing the efficiency of the operation.



Cost breakdown for multi-pass corn stover collection Figure 1

Constraints

- If producers are collecting and transporting their own bales this requires them to have all the necessary equipment.

Machine	Approximate Cost
Baler	\$ 22,690.00
Shredder	\$ 32,650.00
Stacker	\$ 79,320.00
Flatbed Trailer	\$ 10,000.00
Shed for Storage	\$ 5,000.00
Total	\$ 149,660.00

This is the approximate initial investment that would need to be made by private farmers (figures according to International Harvester Co.) Figure 2

- This is a high investment as seen in Figure 2.
- A pull-behind baler would take the place of the shredder as well as the baler in this system of harvesting stover at a cost of \$75,000.
- The initial investment would then be more than \$150,000 which is higher but has several advantages, particularly in the long term.
- Due to the high initial investment required by the grower, multiple growers may consider making the investment together.

Opportunities

- Using a single pass system results in a lower ash content because the stover isn't on the ground before it is collected as seen in Figure 3

Parameters	Multi-pass corn stover (inside)	Single-pass corn stover (inside)
Moisture content (wt.%)	4.1 (0.0) ^a	2.8 (0.1) ^d
Ash content (wt.%)	15.1 (1.8) ^a	5.0 (0.1) ^b
Total volatiles (wt.%)	41.7 (1.3) ^c	60.3 (0.7) ^a
Fixed carbon (wt.%)	43.2 (0.4) ^b	34.7 (0.5) ^d

Ash content differences between harvest systems Figure 3

- Single pass reduces soil compaction by reducing the number of times equipment goes through a field.
- Removing those equipment needs also reduces needed labor and repair costs while increasing the harvest time window.



Figure 4

- This is an image demonstrating the effectiveness of single pass stover harvesting when compared to multi-pass harvesting. Note the efficiency of the process. (Figure 4)

Potential Solutions

- According to research done by Keith Webster, harvesting corn stover with a pull-behind baler costs 10-35 dollars per ton, depending on the amount of stover baled.
- This compares to approximately \$30 a ton using a multi-pass system.
- Typically single pass harvesting will provide a less expensive alternative to multi-pass harvesting done by Dupont.
- Producers would need to purchase a baler individually but could share the equipment needed for stacking, storage, and transport.

References

- Shah, Ajay, Ohio State University, Techno-economic analysis and life cycle assessment of the corn stover biomass feedstock supply chain system for a Midwest-based first-generation cellulosic biorefinery, 2014, et al.
- Webster, Keith Edward. Iowa State University, **Single-pass corn stover harvest system productivity and cost** Brue, Jeremy, Corn Stover Production Ppt. and in-class discussion, 2015analysisProQuest Dissertations Publishing, 2011.
- Farmshow, https://www.farmshow.com/a_article.php?aid=23780
- Shah, Ajay, Ohio State University, Physicochemical properties of bio-oil and biochar produced by fast pyrolysis of stored single-pass corn stover and cobs, 2014, et. all
- Case, International Harvester Co. 2015 Machinery <http://www.caseih.com/northamerica/en-us>