



# NEW WAYS TO HARVEST AND PROCESS FORAGES



Vita-Plus Custom Harvesters Meeting

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## FRACTIONAL HARVEST RATIONALE

- Traditional WPCS co-mingles highly digestible and more difficult to digest fractions.
  - Approaches to overcome this issue:
    - High-cut Silage (HCS)
    - Snaplage
    - HMSC or Dry Grain
- Stover Harvest**



# HIGH-CUT SILAGE



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# SNAPPLAGE



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## FRACTIONAL CORN HARVEST



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## FRACTIONAL TWO-STAGE CORN-SILAGE HARVEST

- Create a “new” silage intermediate between HCS and Snaplage plus a better quality 2<sup>nd</sup> harvest :
  - **Toplage** – ear + some of the top plant to produce better starch, energy and fiber-digestibility than HCS but greater fiber content than snaplage.
  - **Stalklage** – manage 1<sup>st</sup> operation to produce good quality maintenance feed.

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## POTENTIAL BENEFITS OF TOPLAGE

- Corn-header adjusted for optimized nutritional goals:
  - Adjust header to yield as much top stalk and leaf as desired.
- Potentially improved kernel processing.
- Most digestible portion of plant harvested.

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## POTENTIAL BENEFITS OF STALKLAGE

- Total yield per acre close to WPCS.
- High-fiber; low-starch “filler feed” available from 2<sup>nd</sup> harvest of same field.
- Potentially better quality than baled stover.
- New lime treatments could improve digestibility.

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# FRACTIONAL HARVEST APPROACH



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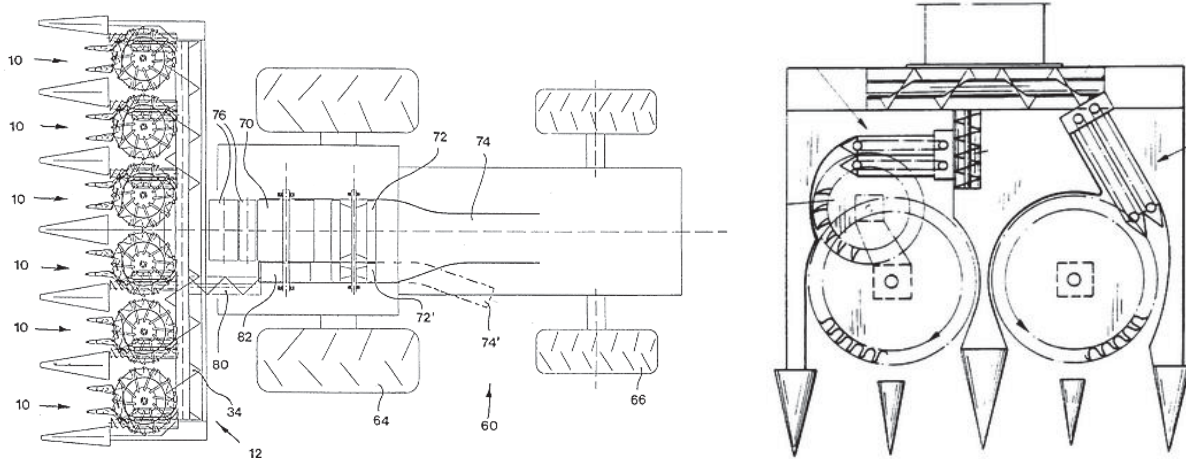
# FRACTIONAL HARVEST APPROACH



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# FRACTIONAL HARVEST APPROACH



From Patent No. 6119443



# CORN HEADER MODIFICATIONS

- Stalk Cutoff Knives :





## FRACTIONAL HARVEST APPROACH

- SPFH configured with narrow tires and wheel spacers so rows would not be run over.



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## FRACTIONAL HARVEST APPROACH



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# FRACTIONAL HARVEST APPROACH



Forward Disks



Rearward Disks



No Disks



# FRACTIONAL HARVEST APPROACH







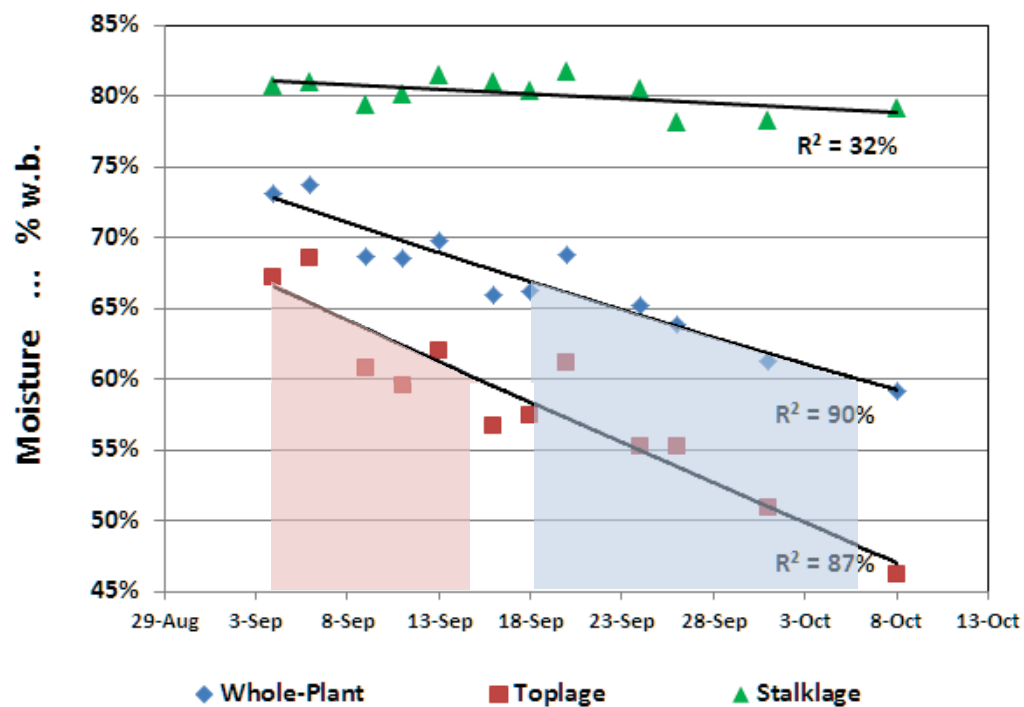
# FRACTIONAL HARVEST CHALLENGES

- Managing yield split:
  - Grain is 50% of mass, so not much left after 1<sup>st</sup> pass.
- Managing moisture of both fractions.
- First-pass field traffic.
- Potential yield loss.

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# FRACTIONAL HARVEST CHALLENGES



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## FRACTIONAL HARVEST APPROACH

- Direct-cut:
  - **Benefits:** 1 additional pass; clean product.
  - **Challenges:** 1<sup>st</sup>-pass traffic; wet stalks; slow dry-down; poor leaf yield.



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## FRACTIONAL HARVEST APPROACH

- Alternative direct cut:
  - **Benefits:** Improved leaf yield, but not common.



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# FRACTIONAL HARVEST APPROACH

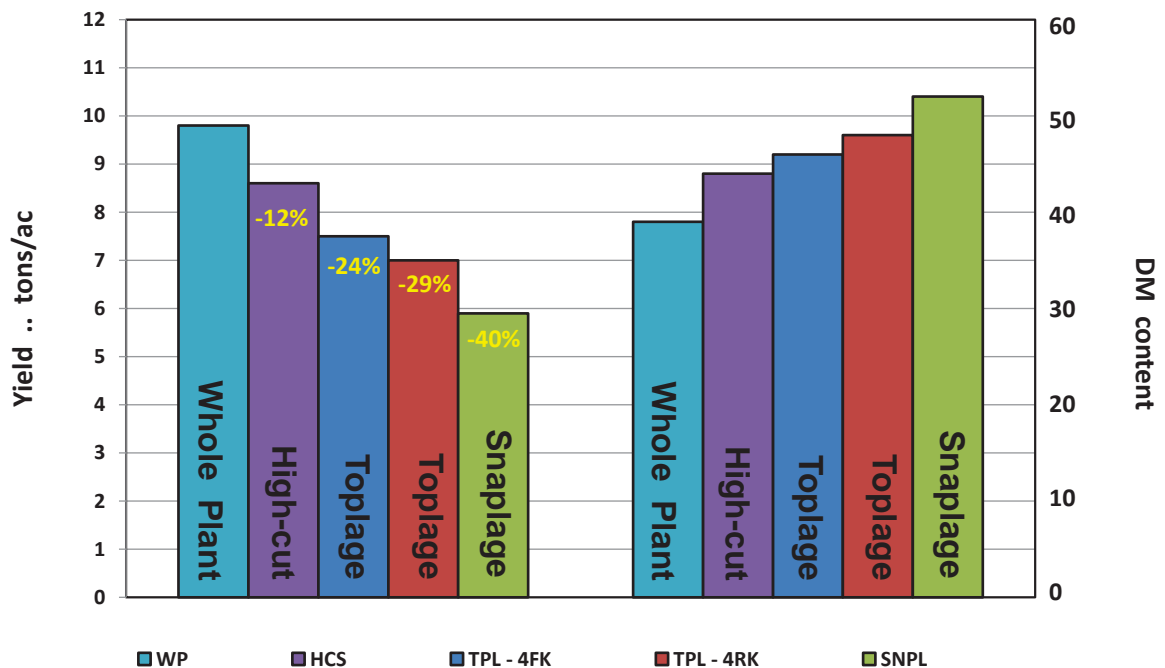
- Windrow then chop:
  - **Benefits:** dry-down; merge to match SPFH capacity
  - **Challenges:** Added operation; soil and rocks



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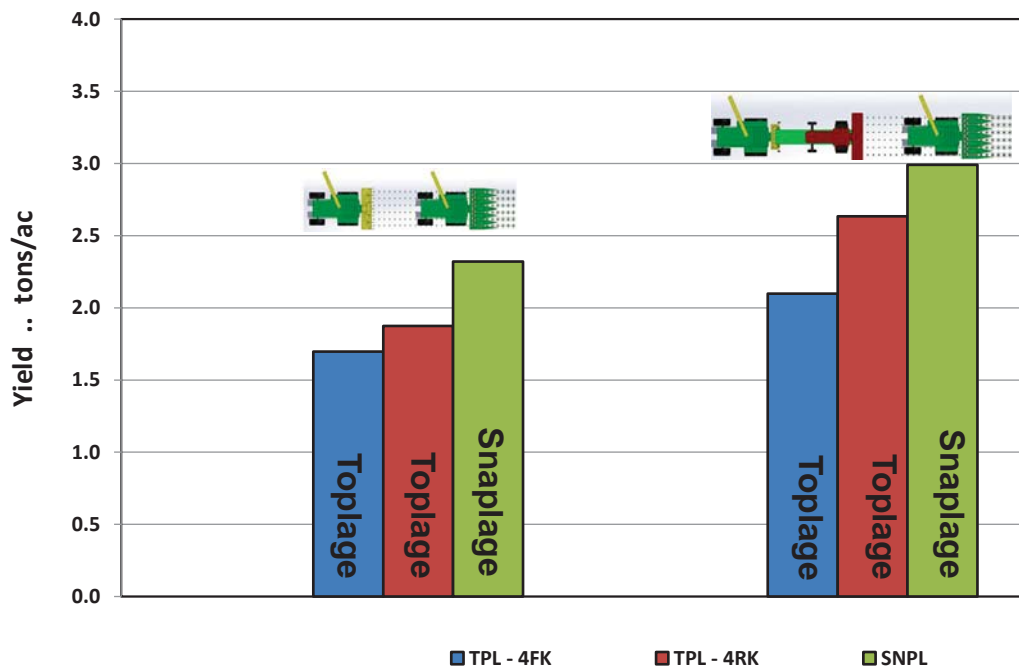
## TOPLAGE YIELD



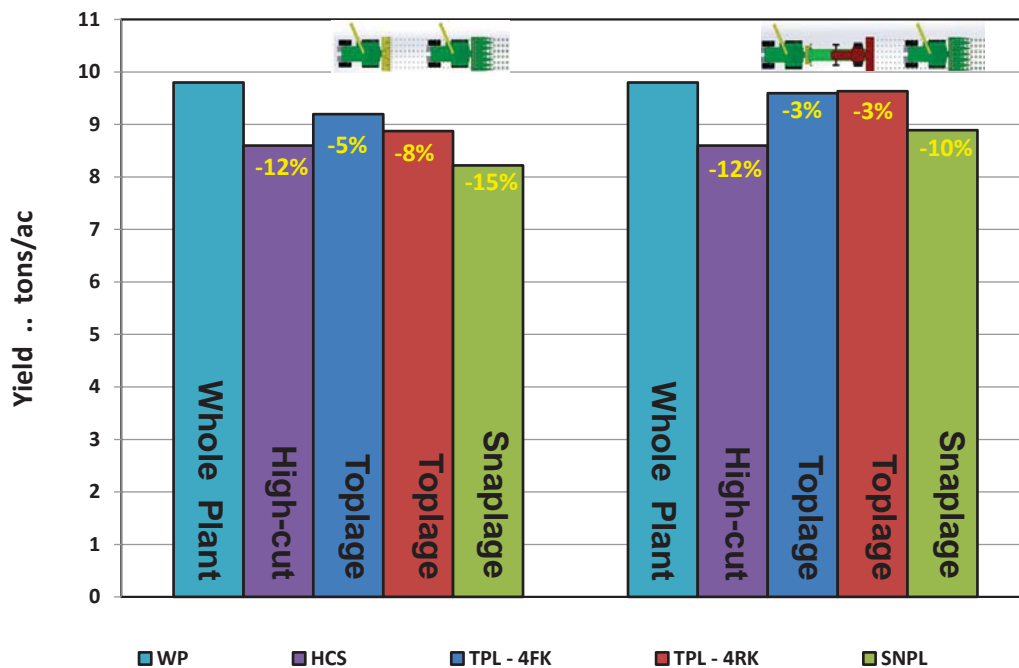
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# STALKLAGE YIELD



# TOTAL YIELD





## TOPLAGE COMPOSITION

Configuration	CP	NDF	Starch
	% of DM	% of DM	% of DM
<b>Snaplage</b>	8.8	19.5	58.6
<b>Toplage</b>	8.9	32.1	43.1
<b>Whole-plant</b>	8.2	40.3	33.9

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## STALKLAGE COMPOSITION

Configuration	CP	NDF	tNDFD – 48 h
	% of DM	% of DM	% of NDF
<u>Direct-cut</u> After Toplage	3.6	72.1	53.9
<u>Windrowed</u> After Toplage	4.3	70.2	53.1
<u>Windrowed</u> After Snaplage	5.3	68.5	55.5
<u>“Typical Stover”</u>	4 - 5	75 - 85	50 - 60

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## CONVENTIONAL CORN STOVER



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## TWO-PASS CORN STOVER



(<http://poet-dsm.com/biomass>)

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## TWO-PASS CORN STOVER



<http://www.newhollandrochester.com/cornrower.php>

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## SINGLE-PASS CORN STOVER



<http://www.hillcotechnologies.com/jb510-media.html>

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# COMPARING STOVER HARVEST SYSTEMS

	3 – 4 Pass	2 Pass	1 Pass
Yield (dry ton/ac)	<b>1 – 3</b>	<b>1 – 2</b>	<b>&lt; 1</b>
Least impact to grain harvest	<b>1</b>	<b>2</b>	<b>3</b>
Field drying	<b>1</b>	<b>2</b>	<b>3</b>
Fewest operations	<b>3</b>	<b>2</b>	<b>1</b>
Best nutrient composition	<b>3</b>	<b>2</b>	<b>1</b>
Cleanest product	<b>3</b>	<b>2</b>	<b>1</b>

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# STOVER BALE COMPOSITION

	Ash	NDF <sup>[1]</sup>	NDFd <sup>[1]</sup>	IVDMD <sup>[1]</sup>	Starch <sup>[1]</sup>
	“Dirt”	Fiber	Fiber Digestibility	Overall Digestibility	From Grain
	% of DM	% of DM	% of NDF	% of DM	% of DM
1 Pass	4.8	78.1	56.6	65.9	5.3
3 Pass	12.7	83.3	36.0	55.5	0.4

Source: Hillco Technologies

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# ENHANCING STALKLAGE DIGESTIBILITY



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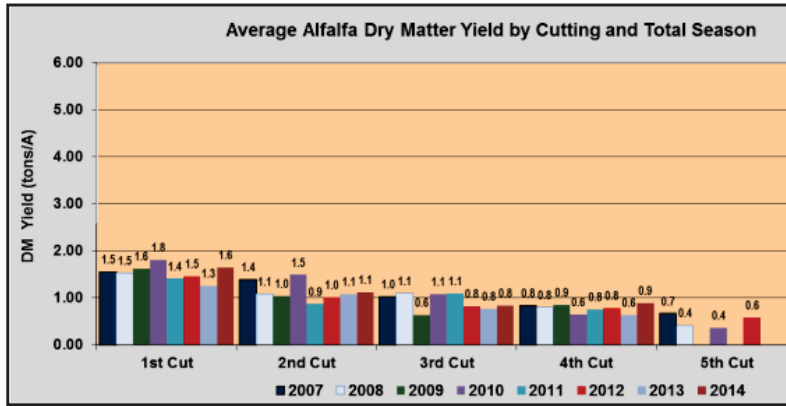
# LIME TREATED STALKLAGE

- Positive Attributes:
  - No additional water application.
  - No bale grinding.
- Challenging Issues:
  - Need much better application techniques.
  - Managing pH and aerobic stability.

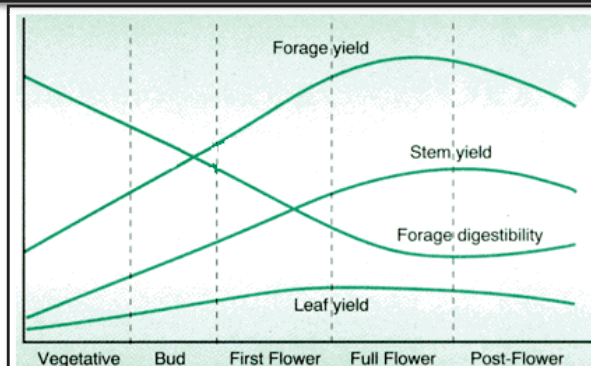
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# FRACTIONAL ALFALFA HARVEST

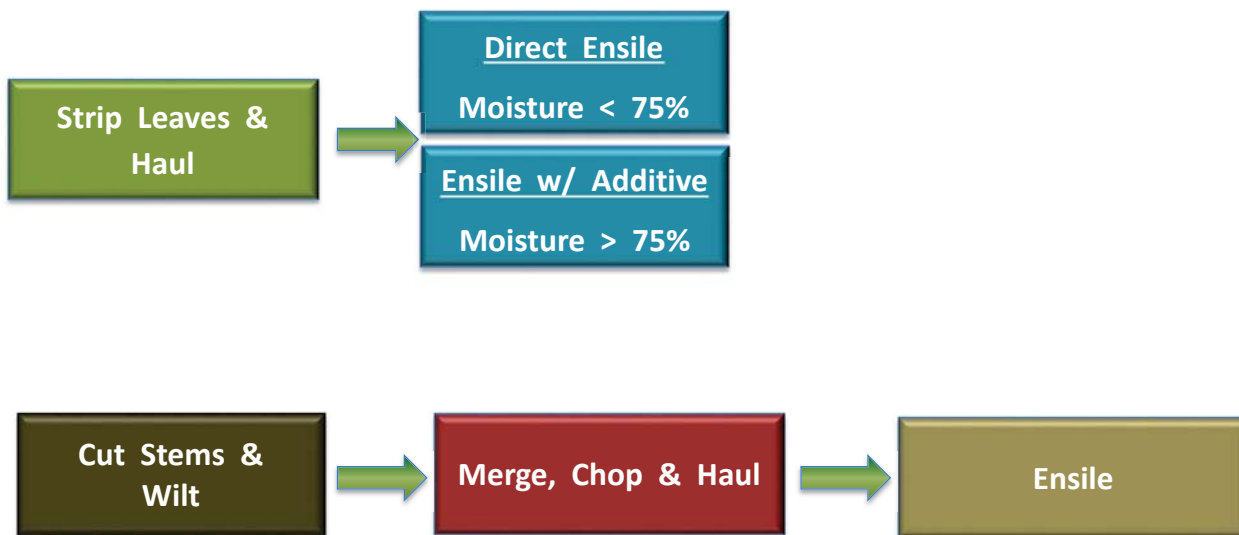


# FRACTIONAL ALFALFA HARVEST





# FRACTIONAL ALFALFA HARVEST

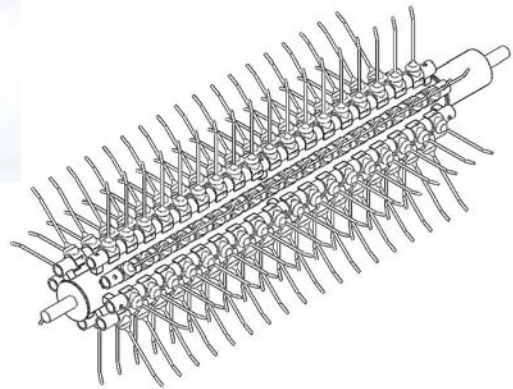
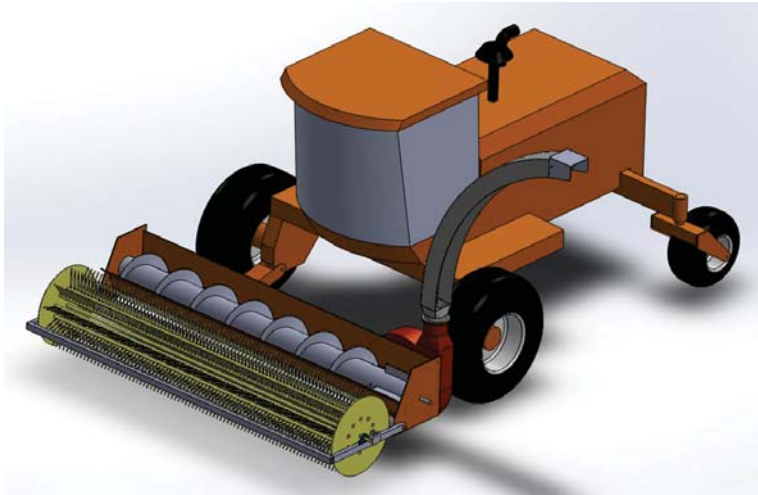


# FRACTIONAL ALFALFA HARVEST





## FRACTIONAL ALFALFA HARVEST



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## FRACTIONAL ALFALFA HARVEST

- Positive Attributes:
  - Quality not so tied to cutting schedule.
  - Maximum of 3 cutting per year.
  - Single-day harvest possible:
    - Stems dry very quickly after cutting.
    - Fewer weather related losses.

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# FRACTIONAL ALFALFA HARVEST



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# FRACTIONAL ALFALFA HARVEST



## Stripped Fraction

- Leaf Purity: 85 – 90%
- CP 23 – 32%
- NDF 22 – 35%
- WSC 9 – 12%



## Cut Fraction

- Stem Purity: 85 – 90%
- CP 10 – 12%
- NDF 55 – 66%
- WSC 7 – 9%

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## ALFALFA LEAF SILAGE

Moisture	pH	Lactic	Acetic	Butyric	Ethanol
%		% of DM	% of DM	% of DM	% of DM
77.0	4.4	7.8	2.7	0.0	0.5
83.2	5.9	1.6	4.9	5.1	0.9

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## FRACTIONAL ALFALFA HARVEST

- Challenging Issues:
  - Achieving > 25% DM needed for ensiling leaves.
  - Capturing effluent from leaf silages.
  - New feeding schemes needed.

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# FRACTIONAL ALFALFA HARVEST

- Alternatives for Leaves:
  - Post stripping “wet fractionation”:
    - Protein supplement for animal or human use.

