Development of a Harvesting System for Short Rotation Willow and Hybrid Poplar Biomass Crops

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Collaborators

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  – Aneshansley
  – Pellerin
  – Smart

◆ Greenwood Resources
  – Stanton

◆ Double A Willow
  – Rak
  – Blitz

◆ Mar-Allen Farms
  – Zimmerman
  – Hoover Brothers

◆ Agricultural Development Services
  – Wormuth
  – Kyle

◆ Mesa Engineering
  – McArdle
Willow Biomass Production Cycle

- **Site Preparation**
- **Planting**
- **Coppice**
- **First year growth**
- **Three-year old after coppice**
- **One-year old after coppice**
- **Early spring after coppicing**
Three Year Old Willow Biomass Crops

◆ Harvesting is the single largest cost of producing willow biomass crops

◆ Dormant season, single pass cut and chip harvesting system

  – Austroft (sugar cane harvester)
  – Claas forage harvester (Sweden)
  – Bender (Tractor mounted)

New CNH Short-Rotation Coppice header being tested on a FR series NH forage harvester in western NY in early 2009

Bought Bender Willow Harvester

Ordered (2000)  Received (2001)
Developing Willow Harvesting Systems:

Bender Willow Harvester 2001-2003

Did Not Work !!!! – produced unusable chips, very slow and constant repair

New Holland FX 45 forage harvester with Kemper style corn head on willow biomass crops – successful test harvest 12/2004

• CNH partnered with us in starting in 2004 to develop a single pass willow harvesting system with FX45 forage harvester and modified Kemper style corn head
  • The FX45 could effectively chip willow and produced consistent sized chips for end users.
  • Harvesting was successful, Kemper style corn head was not robust enough.

• CNH, SUNY-ESF and CRL in 2005-06 developed a hydraulically driven willow cutting head based on standard CRL cutting head
• Tested in 2006-2008 with both the NH FX series (06-07) harvester & new FR series (07-08) harvester.
  • Increased harvesting speed
  • Excellent in smaller diameter (< 3”) willow or less dense stands
  • Problems with larger diameter willow (< 3”) in the dense stands of older willow
  • Problems in snow over 3-4” deep

New Holland forage harvester with CRL willow cutting head harvesting willow biomass crops
CNH started development of the NH 130 FB coppice header for the new generation FR forage harvester in 2007 – 2008

- Harvest 1 or 2 rows
- Maximum capacity 3-5 A/hr
- Maximum stem diameter of six (6) inches
- No changes to feed rolls and chopper drum on base unit
- Chip length of .5 – 1.75 inch

- Tested in UK - 2008
- Tested in US - 2009-2010

New Holland FB 130 Coppice cutting head is now commercially available in US and Europe

2010 Harvesting video on our web site: www.esf.edu/willow
Header Drives & Components

- Sugar cane harvester technology
- 2 fast rotating saws (cut stems)
- 2 slow rotation feeding towers (center stems)
  - 1 paddle roll (lift stems)
- 2 grab/feed rollers (pull and feed stems)
- Hydrostatic drive (in cab speed setting)
$1.3 million dollar DOE grant to improve harvesting of SRWC based on the New Holland FR series forage harvester and the NH 130 FB coppice header:

- Willow energy crop harvesting in Northeast US (SUNY-ESF)
- Hybrid-poplar energy crop harvesting in the Northwest US (Greenwood Resources)
Getting the Chips From the Field: self-unloading forage wagons & forage blower
Getting the Chips From the Field: forage dump wagons
Getting the Chips to the End User:
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NYSTAR
USDOE

Willow website:

www.esf.edu/willow
Questions ?
New CNH Short-Rotation Coppice header being tested in Tully, NY in May 2010