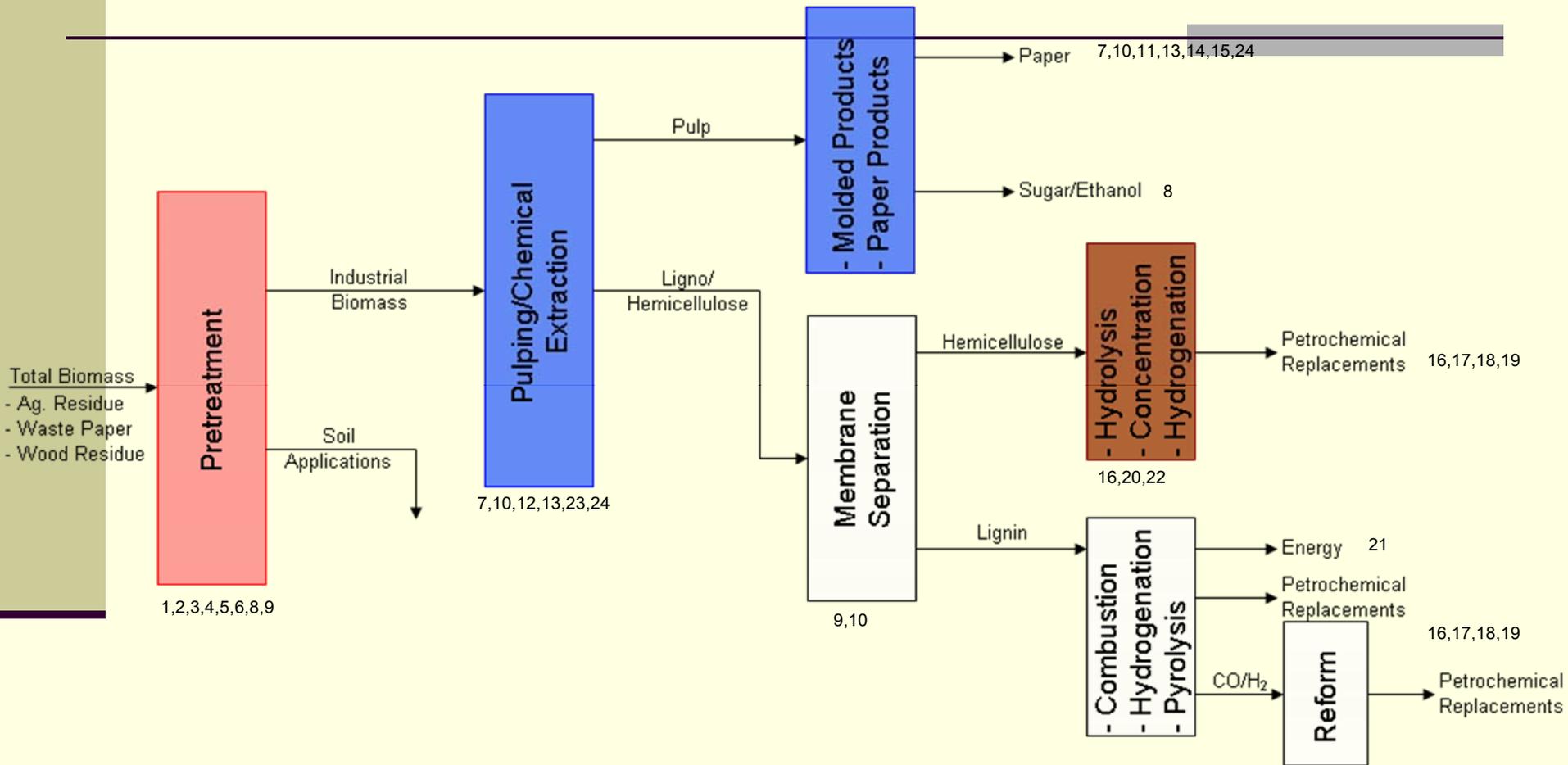


Research Report to DOE

Mark Lewis University of Washington
Bill McKean University of Washington
Bill Pan Washington State University
Bill Johnston Washington State University

Potential Washington Agro-Industry Manufacturing Configuration

Numbers refer to List of Current/Potential Stakeholders – see next page

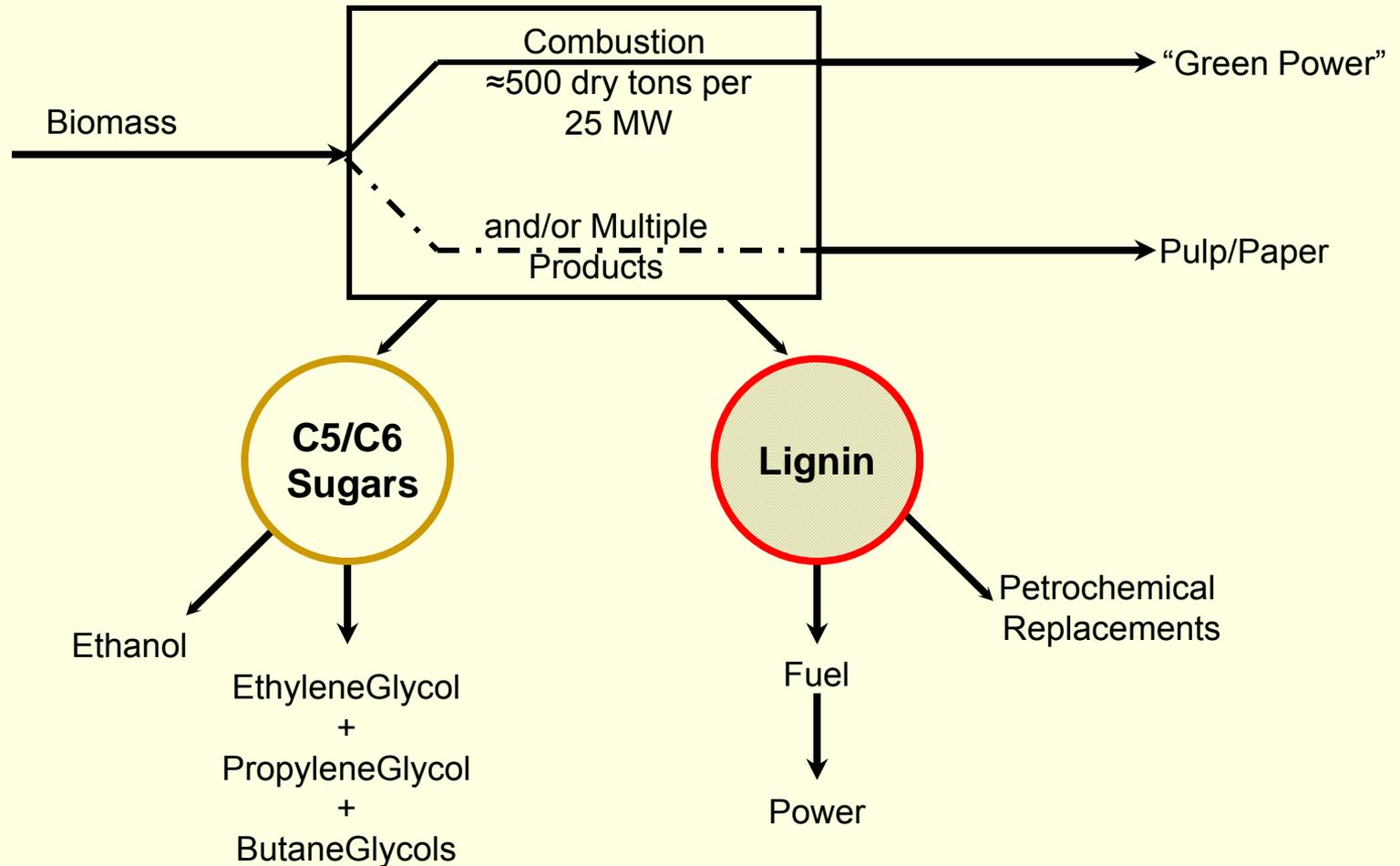


- █ – In development stage
- █ – Nearly commercial (2006), needs some optimization
- █ – Process presently commercial/needs R/D for bio-sugar feed and glycerin
- Research/Development

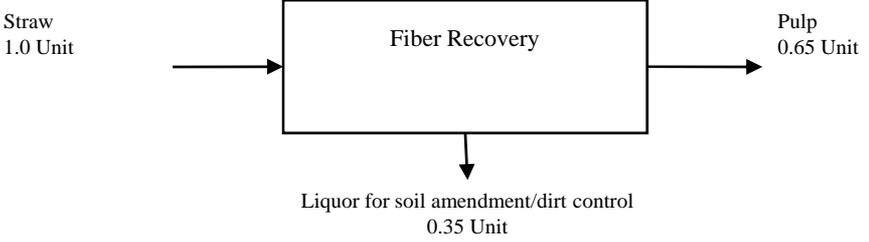
Molded Pulp Trials

- Final Trial held with wheat straw and alfalfa straw
- Exceeded strength properties of normal production runs
- 100% wheat straw far superior
- Drying is still an issue

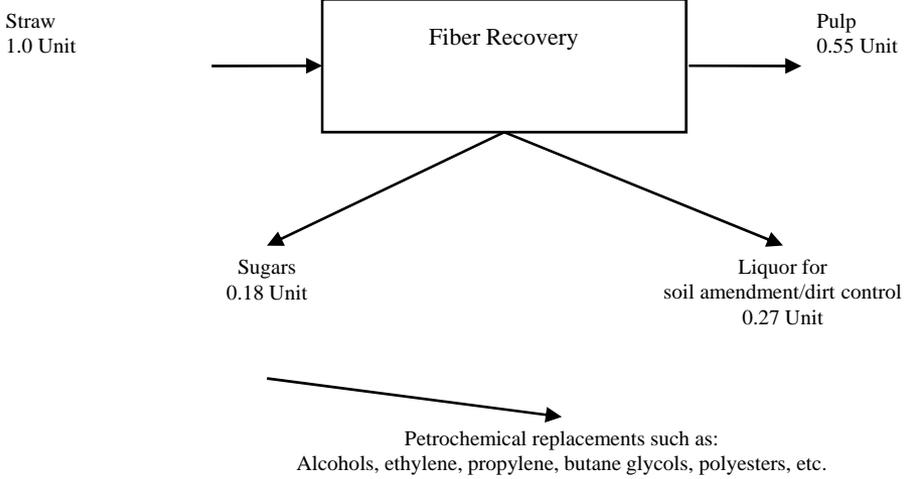
“Green Power” and/or Multiple Products from Biomass



a) No chemical recovery.



b) With chemical recovery.



Straw = 100 units

Cellulose	41
Hemicellulose	27
Total Lignin	23
Extractives	4
Ash	4

Extraction/
Pulping/W
ashing

Pulp 68 units

Cellulose	40
Hemicellulose	12
Lignin	7
Extractives	0
Ash	8

- 6 Na Salts
2 Si Salts

10 units NaOH

(After pulping the Na
is present as 13 units
of Na₂CO₃)
Total ash =16 units

Process Liquor 46 units total

In 1300 ml = 3.54% solids

Dissolved solids 37units

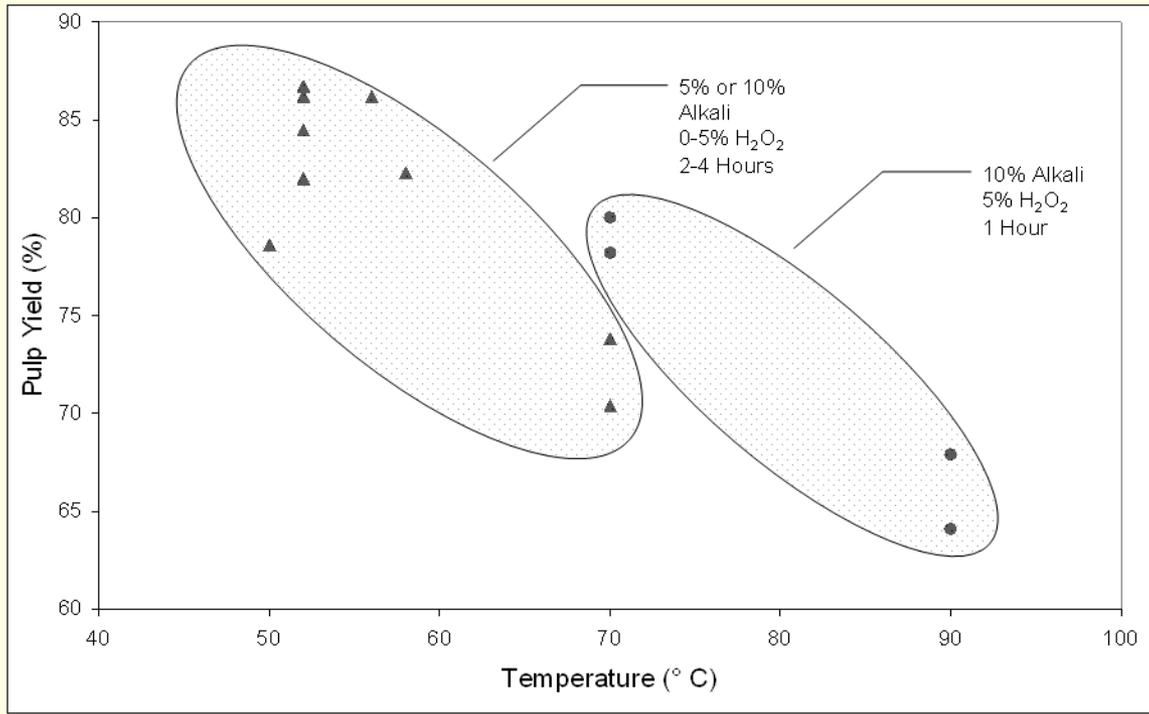
Cellulose	1.0
Hemicellulose	12
Lignin	11
Extractives	4
Ash	8

- 6 Na Salts
2 Si Salts

Suspended Solids(fines) 9 units

Hemicellulose	3
Lignin	5
Ash	1

- 1 Na Salts
1 Si Salts



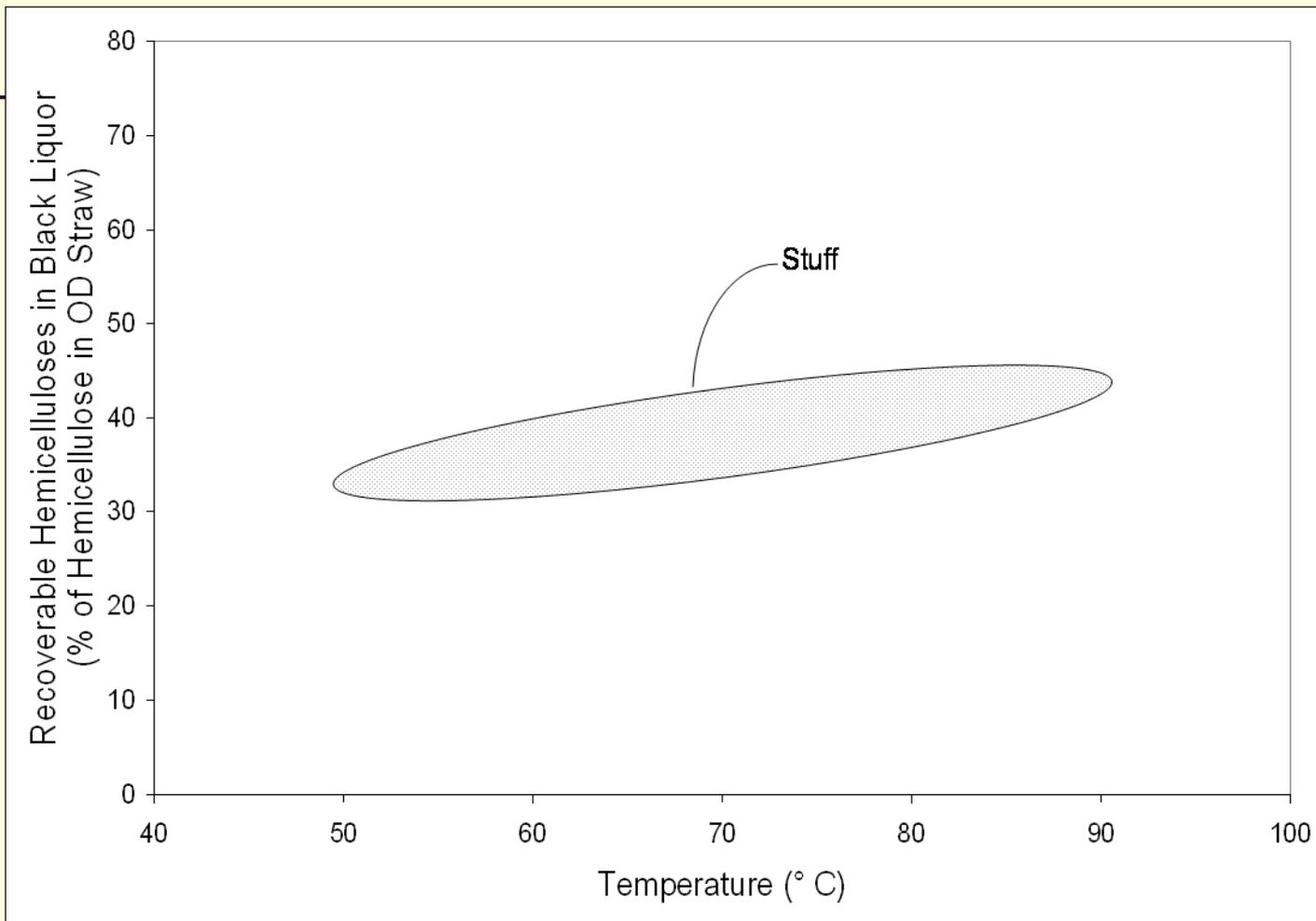


Table 4: Total sugar content

	Total sugar mass [g]	Percentage of total mass ws		Extracted mass (g)	Percentage of total mass ws
SE 1	0.98	9.8	SE 11	0.12	1.2
SE 2	0.70	7.0	SE 12	0.57	5.7
SE 3	0.30	3.0	SE 13	0.57	5.7
SE 4	1.23	12			
SE 5	1.51	15	AE 1	0.22	11
SE 6	0.96	9.6	AE 2	0.14	6.9
SE 7	0.43	4.3	AE 3	0.14	6.8
SE 8	0.49	4.9	AE 4	0.23	11
SE 9	0.90	8.9	AE 5	0.28	14
SE 10	0.36	3.6	AE 6	0.18	9.2
SE... Soxhlet Extraction AE ... Autoclave (large pressure Extraction)					











Highlights for 2008 (to date)

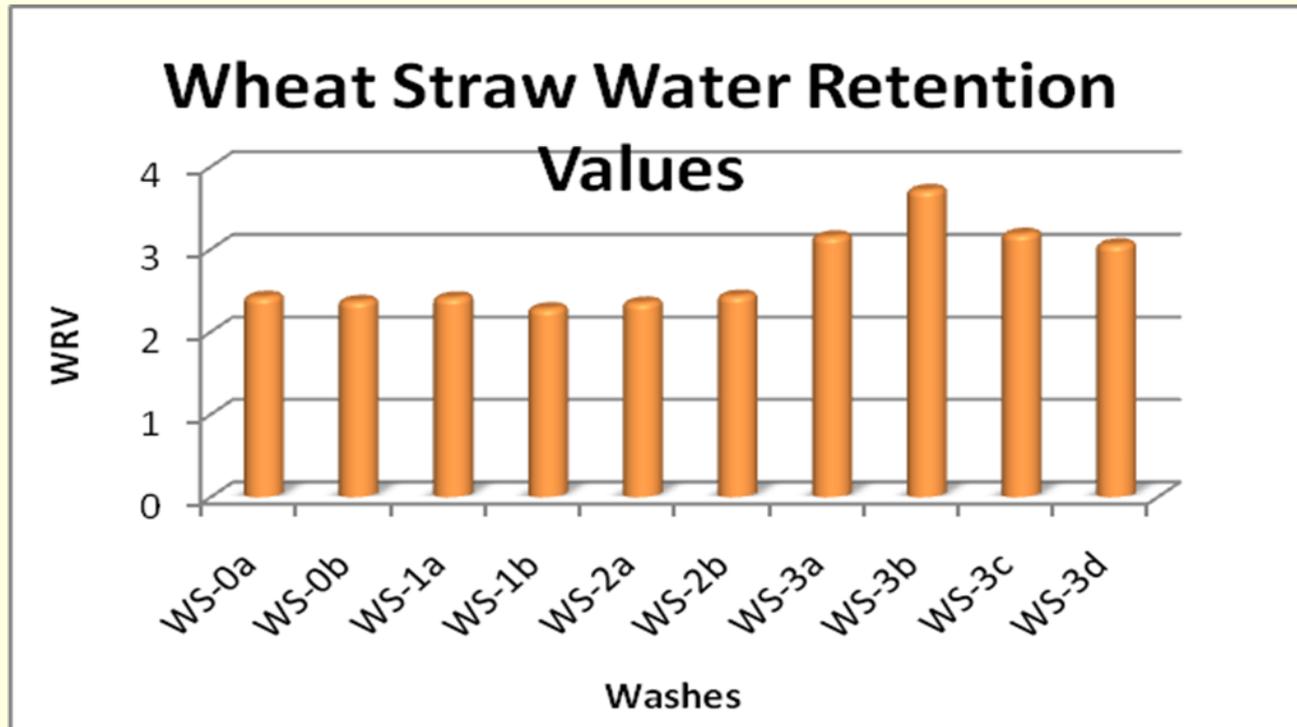
- 2008, first contract for the purchase of straw to be used in a straw pulping operation
- Pursuit of placing equipment from Ponderosa Fibers in the old Seneca plant in Dayton, WA



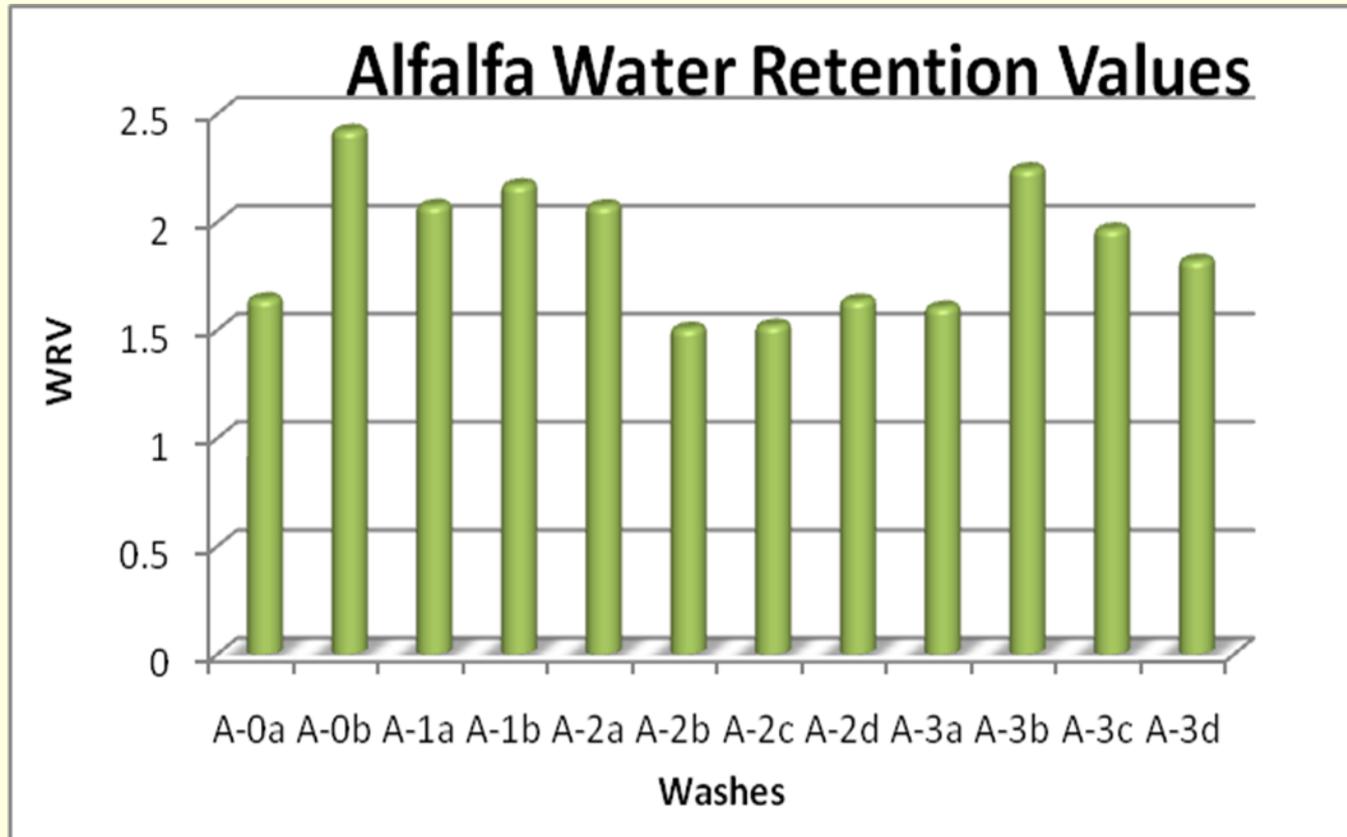
Research 08-09

- Water Retention Value Work
- Hydromulching
- Sugar Hydrolysis
- Mill Start up

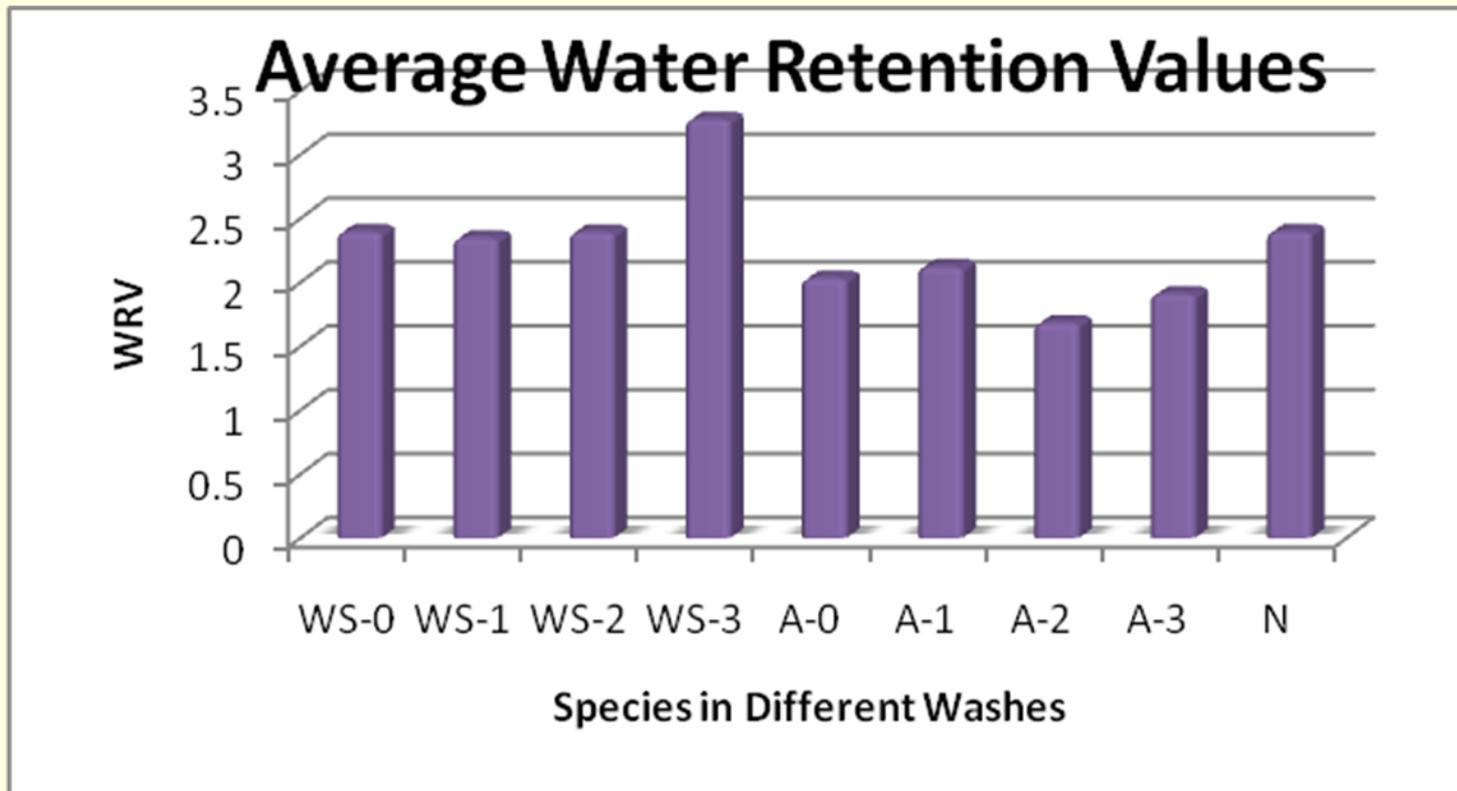
Water Retention Of Wheat Straw

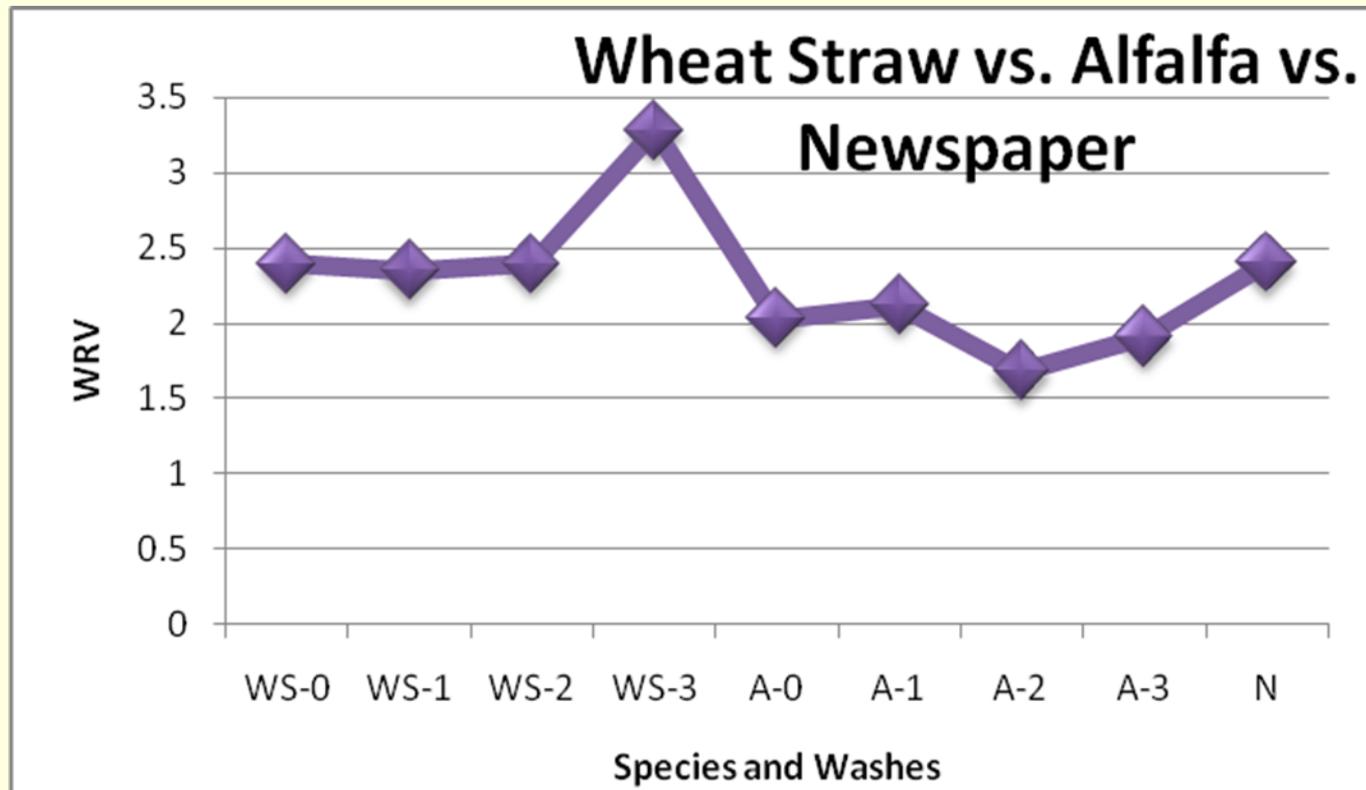


Water Retention of Seed Alfalfa Straw



Wheat and Alfalfa Straw





Market Pulp Production

- Produced bleached straw pulp for end user.
- End user completed critical testing

