WASHINGTON STATE UNIVERSITY

$200 million in possible revenue

WSU researcher finds new market for wheat growers

By Samantha M. Graf, IMPACT Communications

The four million tons of wheat straw produced annually in the Pacific Northwest may have a new market thanks to a researcher with the International Marketing Program for Agricultural Commodities & Trade (IMPACT) Center at Washington State University.

Dr. **Marie-Pierre Laborie** has designed a process to turn the otherwise wasted wheat straw into a cost-effective fiberboard product. Laborie found that by altering the components of the commonly used adhesive resins, she could produce a result that meets the American National Standards Institute (ANSI) requirements and reduce the cost of the current resins by three times.

“Many strawboard plants are expensive to run because of the cost of the resins, so I began looking for the most effective, low-cost adhesive resin,” said Laborie, an assistant professor for the WSU department of civil and environmental engineering.

An IMPACT Center call for proposals began Laborie’s quest to turn a large volume of agricultural byproduct, wheat straw residue, to a high value fiberboard composite.

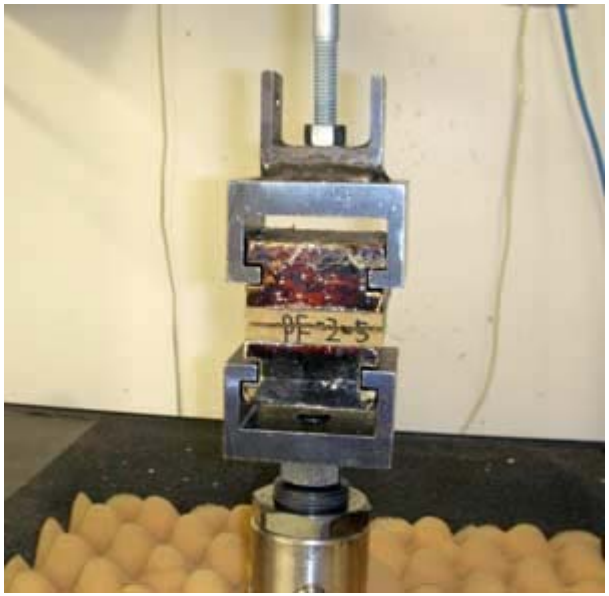
“I looked at agricultural products in the area that were wastes and started there,” said Laborie.

The 3-year project, funded solely by the IMPACT Center, started by gaining straw from Whitman County wheat growers and then moved on to the refining process. Laborie refined the wheat straw with a disc-refiner, applying friction and water to break down the straw to a uniform size and to disperse the waxy material from the straw pieces.

After the straw is refined the adhesive resin is applied. Three resin combinations were developed and tested. The resin and wax combinations were a melamine-urea-formaldehyde resin, which was tested with both a high and low wax content, and a phenol-formaldehyde resin with low wax content. The formaldehyde based resins were a necessity because wheat straw is covered with a waxy cuticle that inhibits bonding with a water-based adhesive resin.

To achieve a test board which meets the minimum requirements, the wheat straw is pretreated with acetylate to remove the waxy cuticle. The straw is then placed with the resin and wax into a rotary blender and mixed. The mixture is then hot pressed into shape and allowed to cool.

To assure the test panels meet the minimum requirements Laborie conducted several tests. Internal bond strength and thickness swell were two of those tests, and each showed promising results. Internal bond strength is a measure of how well the adhesive resin works.



A piece of straw fiberboard undergoes the internal bond strength test for Laborie's project.

"We place a piece of board onto the test machine and essentially pull it from the top and bottom until it comes apart," said Laborie. "When it breaks we mark that as the internal bond strength."

A challenge Laborie faced was meeting the ANSI requirements for water resistance. Many other researchers fell short in this area, said Laborie.

The test panels were soaked for 22 hours and allowed to swell. After the allotted time, Laborie compared the test pieces to the American national standard for fiberboard. Laborie also conducted an ANOVA test followed by a Tukey test. These tests resulted in significantly positive differences in the physical and mechanical properties of the fiberboard, Laborie said.

Straw fiberboard during a thickness swell test.

“Water resistance was a particular problem, especially swelling, but after a few adjustments to the process we improved this area a lot,” said Laborie.

The success of Laborie’s study could have far reaching economic impacts. She estimates that for each mid-sized strawboard plant in operation, revenue for farmers could increase by $5 million and provide approximately 100 jobs to boost the economy of the community. Washington state has sufficient resources to feed 40 strawboard plants and bolster the state economy by $200 million, said Laborie.

The ever increasing concern over the shortage of wood fibers is creating a strong pull from panel producers to find alternative resources, and the rich wheat producing Pacific Northwest is an excellent source of agricultural byproducts, in the form of wheat straw.

“I feel pretty happy about how the project turned out,” Laborie said.