Rice production in the United States is approximately 10 million tons annually with about 1.4 million tons in Louisiana. With an approximately equal rice-to-straw weight ratio, an equivalent amount of dry rice straw is produced per year. Rice straw consists of more than 60 percent lignocellulosic fibers. In current rice farming practice, most straw is left in the field to decompose after rice harvesting. Thus, the use of the straw fiber resources for value-added applications is so far limited. Transforming the straw fiber resources into high quality panel products provides a prospective solution to the straw disposal problem. Straw-based composites offer potential as materials for subfloors, cabinets, shelving and building products. Technical information on strength and dimensional stability of the product is critical for such an application.

LSU AgCenter researchers conducted studies to develop technical data for manufacturing straw-based particleboard. The objectives were 1) to evaluate straw strength properties in comparison with wood, and 2) to investigate effects of panel density, resin content and wax level on dimensional stability and mechanical properties of the straw particleboard.

Straw Properties
Rice straw has a tensile strength four times higher than southern pine wood. Thus, the high tensile strength properties of the straw can be used to improve strength properties of particle-
board. Sampling locations from a straw stem had significant influences on the tensile properties of rice straw. Generally, middle nodes of rice straw had the highest average tensile strength, which was followed by the bottom and top parts.

**Straw Panel Properties**

Panel density and resin level played a significant role in controlling mechanical performances of straw particleboard. For panels with densities higher than 0.70 g/cm³, bending modulus of elasticity, modulus of rupture and internal bond strength met the minimum values specified in the ANSI 208.1 standard for the corresponding wood particleboard. Thus, these products can compete directly with wood particleboard in terms of their strength properties in the market place. In general, bending strength of the straw particleboard was higher than its corresponding tensile strength. This was due to the density profile across sample thickness formed during hot-pressing of the panel, which helps increase the bending properties. There was no significant influence of wax on mechanical properties of the particleboard.

Dimensional stability of straw particleboard was also strongly affected by density and resin content. The dimensional instability of the particleboard under water was significantly improved by wax sizing. High-density boards had relatively low short-term (24 to 48 hours) linear expansion and thickness swelling values, but these boards had higher deformation potentials. By increasing resin and wax content (wax sizing), both linear expansion and thickness swell were reduced. In general, linear expansion and thickness swelling were reduced. In general, linear expansion met the specifications for the corresponding wood-based particleboards in ANSI 208.1. Thickness swelling was also in the range of values specified in the standard.

This study shows that it is technically possible to make rice straw particleboard with pMDI resin as a bonding agent and wax as a dimensional stabilizer. The particleboard developed had mechanical properties that well exceeded the standard requirement for wood particleboards. Panel dimensional stability properties were also in the range of the values for wood particleboards. The study demonstrated an effective way of transforming rice straw into high quality industrial panel products, providing a prospective solution for value-added straw use.

Further development of the technology includes bonding the straw with formaldehyde-based resins at reduced cost. Successful commercialization of straw-based panel products depends on development of a cost-effective manufacturing process on a commercial scale and establishment of a market base for the products. With increasing wood fiber costs and environmental pressure for using agricultural residues, the industry is developing manufacturing facilities for using valuable straw fibers. Current technology includes straw particleboard, whole-straw-based building blocks, and extruded plastic composites reinforced with straw fibers.