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## Commercial Harvest 2010

### Abstract

During the 2010 harvest in South Carolina White Technology was able to gather significant data on Arundo Donax as a commercial biomass crop. The research performed verifies arundo has a very high and superior yield, demonstrates the benefits of weed control, exhibits the crop success rate with and without management practices during establishment year, as well as exemplifies proof that arundo is a non-invasive low-input biomass crop.

### Test Plot Overview

The observed plot of Arundo Donax was planted in the summer of 2006 just south of Cayce, South Carolina. The four sub-plots, a total of 2.7 acres, of Arundo were planted using multiple techniques, but this article will primarily focus on only one of the aforementioned plots. The north east plot, Plot A, will be the emphasis of our summary. Plot A, .676 acres, was planted on three dates in the summer of 2006: May 12, June 9, and July 21. The June and July plantings were both planted using fresh cuttings from the Blossom Street Arundo stand, located near the University of South Carolina only 6 miles north of Plot A. The May 12<sup>th</sup> planting was planted using Knox over-wintered propagules.

Cayce, South Carolina is a very suitable location to grow Arundo Donax. Only 3 months of the year average temperatures less than 55°F with 5,696 growing degree days annually, and the average yearly precipitation is 47.9 inches. To further elaborate, the months averaging the most precipitation are during the planting season; the early spring and summer months.



Figure 1 Cayce, SC test plot. View looking south from the north side of Plot B

### History

The test plot south of Cayce was planted in the summer of 2006 by the University of South Carolina, and was left to grow with no field maintenance. The lack of proper crop upkeep led to poor establishment throughout the plot. Weeds overgrew much of the stand in the early months and the majority of planted arundo was choked out with no chance to succeed. No fertilizer, nitrogen, or other special treatment was given to the test plot. To clarify, a nearby grey-water irrigation system may have had an impact on the growth of the western most side of the test plot; this did not reach or affect Plot A. In 2008 the test plot was mowed down and then left alone until White Technology's commercial harvest demonstration on December 1, 2010.

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### Plot A Harvest Data

Using a Krone Big X 1000 chopper, White Technology began its harvest process on December 1<sup>st</sup>. Traveling at 1.4 mph and chopping with a 30ft wide head, the Krone Big X averaged 5 acres per hour. Employing the same logic, we can calculate 4 acres per hour using a 20ft head and traveling at the same ground speed.

Three truck-loads of chopped material were hauled to a nearby weigh station for a total of 8.52 tons of harvested material. The chopper was initially set to a particle size of 7/8 inch, but the vast majority of the test plot was chopped at 1/4 inch. Truck two and 80% of the material from truck three were harvested from Plot A for a total of 5 tons of arundo. 5 tons of harvested material from Plot A, .676 acres, is equivalent to 7.4 tons per acre. This number is significantly lower than projected White Technology yield estimates, yet the unmanaged plot yield still exceeds or is comparable to the average yields of switchgrass,



Figure 2 Krone Big X 1000 Harvesting alongside the truck in Cayce, SC 2010

sorghum, and corn stover.

Following the harvest process, researchers set to Plot A to count the arundo clump growths to better determine the survival rate from initial planting to the date of harvest. 3,400 arundo plants were initially planted in Plot A by the University of South Carolina, and only 592 arundo clumps were counted after harvest. This shows a survival rate of only 17.4% with no management practices after establishment. Along with this, each clump averaged 32 stalks of arundo for a total estimate of 18,944 arundo plants; a very significant increase in actual plants from inception to harvest (557.2% increase). To further this concept we can use our harvest weight of 5 tons to show each stalk averaged a weight of .528 pounds (assuming no material was lost), but using a digital scale White Technology gathered an average weight of .818 pounds per stalk. Using this number we can illustrate an estimated loss of 2.7 tons of material in Plot A, or an average loss of approximately 4 tons per acre. Adding the lost 4 tons per acre to our harvested quantity demonstrates a yield of 11.4 tons per acre with no management practices after establishment.

To calculate theoretical yield for Plot A with best management practices utilized, White Technology can use the data found from the harvest to compute a very high estimated yield. Assuming arundo success rate of 80% (Indiana test plot had a 100 percent success rate in 2010's arundo planting with weed management) using best management practices during the establishment year, and with the known average of 32 stalks per clump we know Plot A would have 2,720 clumps for a total of 87,040 plants in Plot A. Using an average of .818 pounds per stalk, a theoretical yield of Plot A can be calculated at 35.6

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tons of arundo. This is equivalent to 52.7 tons per acre or 48.7 tons after a 4 ton loss of material during the harvest process. This illustrates an increase of more than 700% by simply managing the arundo plot in the establishment year.

### Moisture Content

The moisture content of the chopped arundo was observed for 26 days, from December 1<sup>st</sup> until December 27<sup>th</sup> 2010. A moisture measurement was taken using a BM2 moisture reader immediately after the material was weighed and dumped from the truck. The three initial moisture readings for each truck were 29.5%, 33.5%, and 30% respectively for an average of 31%.

After the harvest process was completed, 24 vented onion/potato bags (36"x42"x58") were filled and



Figure 4 The vented onion/potato bags with chopped Arundo in storage Clinton, IN

hailed to Clinton, Indiana for further observations, while the remainder of the material was kept in two piles in Cayce, one compacted using a Kubota tractor and the other non-compacted. The 24 bags were stored inside a closed building without heat. Throughout the next 3 weeks a moisture measurement was taken from a designated bag to be a representative measure for the bagged material. The moisture content over the 3 weeks remained between 37% and 31.5%.

The percentages varied daily with no distinct trend line, but the lowest measurement since the bagging process was calculated on the final day observed; possibly beginning the dry down

process.

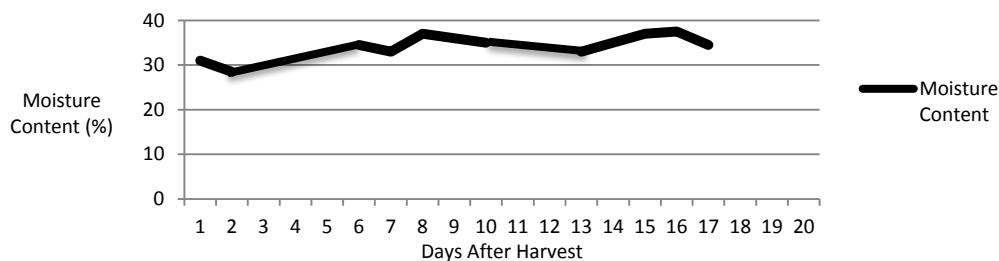


Figure 3 Moisture curve for the chopped arundo stored in the vented onion/potato bags

Along with the moisture content White Technology also observed the inner-temperature of the bags, as well as the compacted pile and non-compacted pile of harvested arundo left in Cayce, SC. The inner-temperatures were calculated by inserting loggers into the piles and 2 bags, then using an IntelliRock temperature and maturity reader to collect the data.

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The chopped arundo piles were in Cayce demonstrated almost identical temperature curves, but with the non-packed pile having two additional inflection points for an unknown reason. The compacted pile reached a maximum inner-temperature of 138.2°F, and the non-compacted pile had a maximum temperature of 145.4°F.

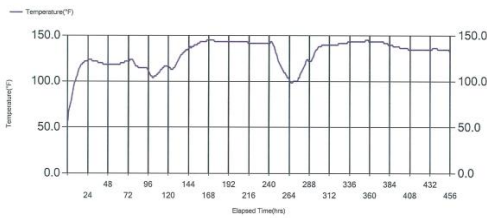


Figure 5 Temperature (F) curve for non-compact pile

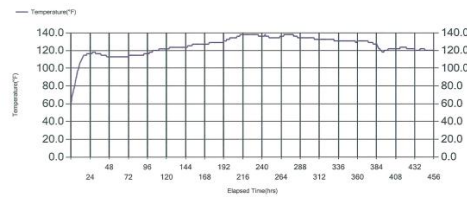


Figure 6 Temperature (F) curve for compacted pile

The temperature of the harvested material in the large vented bags was observed in the same manner. The maximum temperature of the bagged material was 140°F for both bags. The temperature curve for each bag was completely symmetrical to one another.

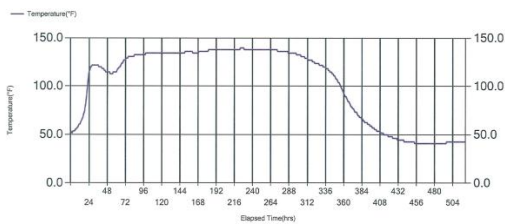


Figure 7 Temperature (F) curve for Bag 1

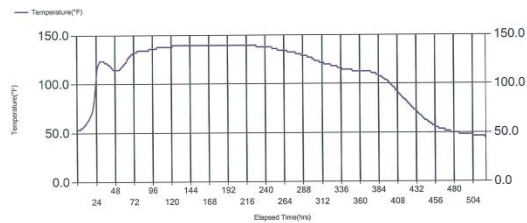


Figure 8 Temperature (F) curve for Bag 2

## Conclusion

The results of the 2010 commercial harvest demonstration have several very significant implications. To begin, the harvest process and results proved White Technology's assumptions to be correct about arundo being a low-input crop. Plot A was given no special treatment and was not treated for weed control, and the yield still exceeded that of other energy crops. To expand, the un-managed crop also showed no signs of encroachment or invasiveness over the past 4 years. Finally and most importantly, it is reasonable to state the success rate of Arundo depends significantly on the establishment year. Using best management practices during the first year of growth can increase the yield of arundo by over 700%.

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Figure 9 Krone Big X 1000 and truck during harvesting process in Cayce, SC 2010

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