# Exceptionally High Yields and Soil Carbon Sequestration Recorded for Giant Reed in Alabama

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## Introduction

Giant Reed (*Arundo donax* L.) has been extensively evaluated as a dedicated cellulosic energy crop in southern Europe, with very favorable results. Efforts to commercialize it are being stepped up in Italy, Greece, France, Spain and Portugal. However, the information on its potential for soil carbon sequestration and yield response to harvest frequency is lacking. Therefore, the aim of our research was to determine yield response of Giant Reed to harvest frequency and its potential for soil carbon sequestration.

## Procedure

Data from a replicated small-plot experiment with Giant Reed planted during the spring of 1999 in south central Alabama were analyzed. Plots were fertilized with ammonium nitrate at a rate of 112 kg N $ha^{-1}$ in 2000. broiler litter was applied during 2001 and 2003 at a rate of 112 kg N $ha^{-1}$. Four harvest frequency treatments (summer every year, winter every second year, winter every year, and summer & winter every year) were applied during 2006 and 2009. Plots were harvested to obtain dry biomass yield data for different treatments. Rhizome yield was collected in 2009. Above-ground biomass yield data and rhizome data were analyzed using the GLIMMIX procedure of SAS and the GLM procedure of SAS, respectively.

Table 1. Annual above-ground dry matter yield of Giant Reed under broiler litter treatments during 2001 and 2003

| Broiler litter treatments (Kg N $ha^{-1}$) | Above-ground dry matter yield (Mg $ha^{-1}$) | | |
|---|---|---|---|
| | Year | | |
| | 2001 | 2002 | 2003 |
| 0 | 29.08±5.35 [a] | 32.03±9.56 [a] | 32.82±5.30 [a] |
| 112 | 30.03±9.20 [a] | 26.55±7.53 [a] | 23.61±3.87 [b] |

[ab] means within the same column with different superscripts differ significantly (P<0.05)

## Results

Above-ground biomass yield of Giant Reed showed no positive responses to broiler litter treatments after established (Table 1). However, there was significant difference in above-ground biomass yield as well as rhizome yield among different harvest frequency treatments (Table 2). Carbon and N contents varied significantly among leaf, stem and rhizome components of Giant Reed (Figure 1). In addition, average above-ground dry matter yield of Giant Reed was higher than that of 'Alamo' switchgrass over the same 8-year period (Figure 2).

Table 2. Dry matter yield of Giant Reed under harvest frequency treatments during 2006 and 2009 (Mg $ha^{-1}$)

| Harvest frequency | Above-ground biomass yield | | | Rhizome yield |
|---|---|---|---|---|
| | Year | | | Year |
| | 2006 | 2007 | 2009 | 2009 |
| Summer every year | 20.30±5.70 [b] | 29.13±7.85 [b] | 11.97±1.63 [c] | 43.68±22.59 [b] |
| Winter every second year | ---------- | 55.29±17.03 [a] | 81.01±31.36 [a] | 117.10±12.25 [a] |
| Winter every year | 36.52±8.42 [ab] | 25.94±7.18 [b] | 38.93±10.78 [b] | 93.59±22.25 [a] |
| Summer & winter every year | 39.49±13.21 [a] | 20.89±6.79 [b] | 29.67±6.59 [b] | 46.95±13.28 [b] |

[abc] means within the same column with different superscripts differ significantly (P<0.05)

Harvest frequency : summer every year (left) VS winter every second year (right)

Harvest frequency : winter every second year (left) VS winter every year (right)

Harvest frequency : winter every year (left) VS summer &winter every year (right)

Rhizome distribution of Giant Reed in the 0-30 cm topsoil

Giant Reed rhizomes sampled from one square yard under the harvest frequency of winter every year

Plant height: 'Alamo' switchgrass VS Giant Reed

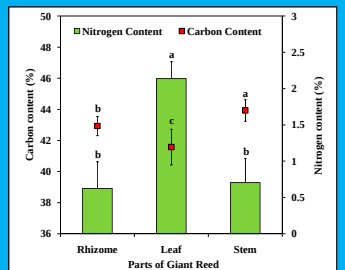

Figure 1. Carbon and nitrogen contents in different parts of Giant Reed in November 2009

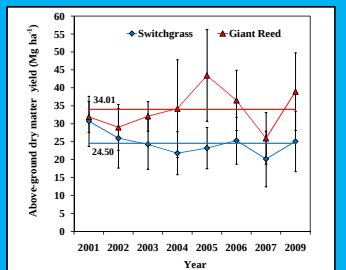

Figure 2. Annual above-ground biomass yield of Giant Reed and 'Alamo' switchgrass during the same period

## Conclusions

1) Annual above-ground dry matter yield for annual and biennial harvest in winter did not differ, but biennial harvest will likely result in lower cost $Mg^{-1}$.
2) Giant Reed sequestrated 40.18 Mg C $ha^{-1}$ over an 11-year period, approximately 4X that of switchgrass measured in another study.
3) Average above-ground biomass yield of Giant Reed over an 8-year period was 39% higher than that of switchgrass over the same period in this study.

## Acknowledgments

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