

**The simultaneous production of sugar and biomass ethanol using high-biomass sugarcane derived from inter-specific and inter-generic cross in Japan.**

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Abstract

Sugarcane production area in Japan is limited to the Nansei Islands. During the 2003 - 2004 milling season, the total harvest area, total cane production and average cane yield were 23844 ha, 1,387,510 t, and 58 t / ha, respectively. Sugarcane harvest area and production continue to decrease because the annual average yield has been widely fluctuating, due to typhoon, drought and poor soil. However, sugarcane remains an important crop for sugar production to maintain food security in Japan. Sugarcane has only been used for sugar production in Japan, although the production costs are very high. To reduce the costs, effective utilization of by-products, such as molasses and bagasse are essential. To date, in Japan, utilization of by-products has been very limited, because the production area is small, the productivity of the sugarcane cultivars used for sugar production is not very high, the sugar content of molasses is low, and the unstable yield under difficult natural environment conditions. To overcome such problems, we have carried out inter-specific and

inter-generic cross with *Saccharum spontaneum*, *Sorghum bicolor*, *Miscanthus* spp. and *Erianthus* spp. to develop high-biomass sugarcane clones for multi purpose use. To date, we succeeded in selecting many high-biomass clones that offer high yield, about two-fold the yield of current commercial cultivars due to good tillering and ratooning abilities. Some clones have high adaptabilities to drought and poor soil conditions due to the deep spread of roots and some have adaptability to typhoons. Using these clones, there is a possibility that stable and high-yielding sugarcane production would become possible in Nansei Islands. At present, we have designed the simultaneous production of sugar and biomass ethanol from high-biomass sugarcane in cooperation with Asahi Breweries, LTD. The objectives of this project are 1; maintenance of sugar production at current levels, 2; production of an abundance of biomass ethanol by fermenting a large quantity of sugar-rich molasses, 3; production of total energy for sugar and ethanol production generated by a large quantity of bagasse. We ran productivity simulations using data from sugarcane cultivars for sugar production and high-biomass clones, and compared the performance of the new process with that of conventional method. Our findings confirmed that sugar production could be maintained at present levels and three-times more biomass ethanol could be generated compared with that in the conventional process. In addition, we demonstrated that a carbon-neutral process could be achieved using the new process.