# サトウキビとススキ属植物との属間雑種は低温条件下での光合成特性が優れる

## Sugarcane and *Miscanthus* intergeneric hybrids: New sugarcane breeding materials with high photosynthetic activity in a low-temperature environment

サトウキビ（*Saccharum* spp hybrid）は、世界の食料・エネルギー生産等にとって重要な作物であるが、低温がサトウキビ生産上の課題となる地域が多く存在する。そこで、サトウキビ近縁遺伝資源の中で最も低温環境への適応性が優れるススキ属植物（*Miscanthus* spp.）との属間交雑に取り組み、属間雑種を作出した（図1）。サトウキビとススキ属植物との属間雑種は、サトウキビより低温条件下での光合成速度が高く、低温条件から温暖条件に戻した場合の光合成速度の回復程度がサトウキビ系統より優れる（図1、表1）。また、寒冷地（札幌市）の圃場で栽培した場合に、サトウキビよりバイオマス生産性が優れる系統（JM14-09）がある（図2）。本研究で作出した属間雑種は、サトウキビの低温環境への適応性改良に向けた新しい育種素材として利用できる。

Sugarcane (*Saccharum* spp. hybrid) is an essential crop for food and energy production in the world. However, cold stress is a major constraint in production. To improve sugarcane's cold tolerance, we developed sugarcane and *Miscanthus* intergeneric hybrids (Fig. 1). The hybrids exhibited higher photosynthetic rates in the chilling treatment (Fig. 1, Table 1), and JM14-09 showed higher biomass productivity than sugarcane in a cold-climate region (Sapporo City) (Fig. 2). The hybrids can be utilized for improving the biomass productivity and photosynthetic characteristics of sugarcane at low-temperature environments.

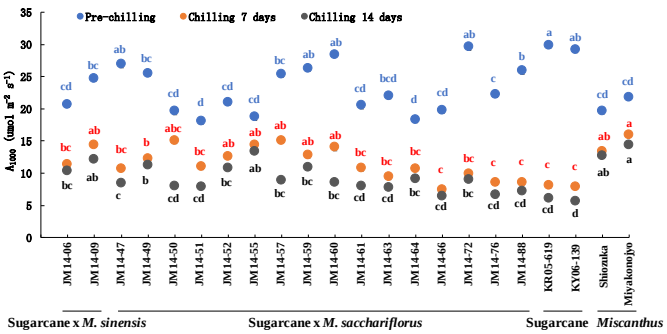


図1　属間雑種の低温条件下での光合成速度

Fig. 1. Photosynthetic rates in the chilling treatment

The experimental materials were planted in plastic pots with three replications. Photosynthetic rates were measured pre-chilling (22–25° C day/13–15° C night) and after 7 and 14 days of chilling (12–13° C day/7–9° C night). A different letter indicates significant difference ($p<0.05$).

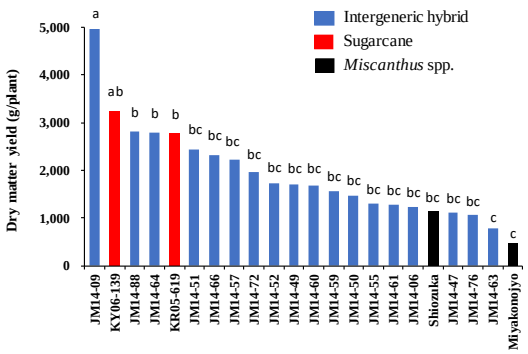


図2　寒冷地（札幌市）での年間乾物収量

Fig. 2. Dry matter yield per year in the cold climate region

The experiments were conducted for two years, in 2017 and 2018, at the fields in Hokkaido University (Sapporo, Japan; 43° 07′N, 141° 33′E). The average temperature and precipitation in the experimental period were 17–18° C and 700–800mm, respectively. A different letter indicates significant difference ($p<0.05$).

表1　低温処理後に温暖処理した場合の光合成速度

Table 1. Recovery of the photosynthetic rate after chilling treatment

| Clone | $A_{1500}$ (μmol $m^{-2}$ $s^{-1}$)[1] | | |
|---|---|---|---|
| | Pre-chilling[2] | Chilling 4 days[3] | Recovery 7 days[4] |
| JM14-09 | 28.8 b[5] | 17.1 (59) ab | 29.9 (104) a |
| JM14-72 | 33.2 a | 14.8 (45) b | 25.4 ( 77) b |
| JM14-88 | 23.4 c | 13.2 (56) b | 24.0 (103) b |
| KR05-619 | 28.3 b | 9.3 (33) c | 20.5 ( 72) c |
| KY06-139 | 29.3 b | 9.5 (32) c | 20.3 ( 69) c |
| Shiozuka | 24.2 c | 16.0 (66) b | 24.9 (103) b |
| Miyakonojo | 29.9 b | 19.7 (66) a | 28.9 ( 97) a |

1) The photosynthetic rate at a photosynthetic photon flux density of 1,500 μmol $m^{-2}$ $s^{-1}$. 2) Photosynthetic rates were measured five weeks after planting (26° C/18° C day/night). 3) Photosynthetic rates were measured after 4 days of chilling treatment (12° C day/7° C night). 4) Photosynthetic rates were measured after 7 days of recovery treatment (26° C day/18° C night). 5) A different letter indicates significant difference among the treatments ($p<0.05$). The values in parentheses in the table indicate the ratio to the photosynthetic rate of pre-chilling.

国立研究開発法人 国際農林水産業研究センター
〒305-8686 茨城県つくば市大わし1-1
Japan International Research Center for Agricultural Sciences
1-1 Ohwashi, Tsukuba, Ibaraki, 305-8686 https://www.jircas.go.jp/