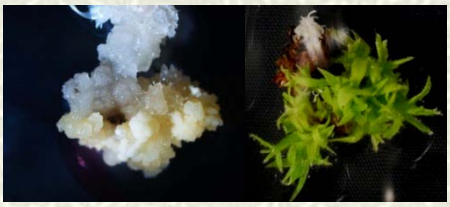
Genetic improvement through a transgenic approach in *Miscanthus* ssp., a new bioenergy crop

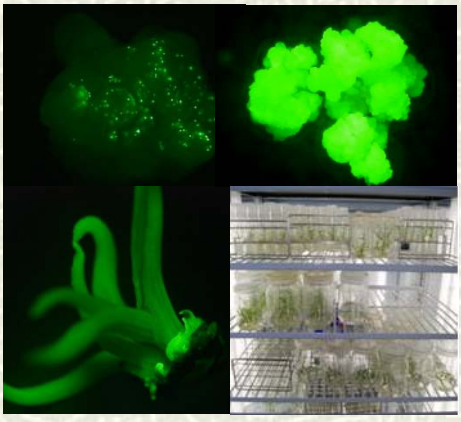
Toshihiko Yamada[1], Xun Wang [2], Akira Kanazawa[3], TetsuyaYamada[3], Yoichiro Hoshino [1] and Norifumi Ukaji[1]

[1] Field Science Center for Northern Biosphere, Hokkaido University, Japan.
[2]Graduate School of Environmental Science, Hokkaido University, Japan.
[3] Research Faculty of Agriculture, Hokkaido University, Japan.
E-mail: yamada@fsc.hokudai.ac.jp

Perennial C4 grasses are candidates as energy crops because they have a low demand for nutrient inputs and show higher biomass yields on relatively poor quality land sites and longer persistency and have the merit of increasing the soil carbon sequestration as well as an effect on the stability and cover value for wildlife. One of the most intensively investigated potential new energy crops is *Miscanthus* spp. that is native to Asian countries. Genetic improvement through a transgenic approach has a great impact on the development of novel biofuel crops. An *in vitro* culture system in *M. sinensis* has been established. Embryogenic callus was induced from mature seeds in MS medium supplemented with 30 g/L sucrose, 5 mg/L 2,4-D and 0.01 mg/L BA. Embryogenic callus was regenerated in MS basal medium supplemented with 30 g/L sucrose, 1 mg/L TDZ and 0.5 mg/L IAA. Transformation by a particle bombardment technique has been established using embryogenic callus of *M. sinensis*. Transgenic plants containing *gpf* gene and *hpt* gene were successfully obtained. We have two strategies for improvement of fermentation efficiency through a transgenic approach. One of them is obtaining fructan-accumulating transgenic *Miscanthus* plants by the introduction of fructosyltransferase (FT) genes isolated from C3 grass, perennial ryegrass. Transgenic plants of *M. sinensis* containing FT gene from perennial ryegrass were obtained. Another strategy is transgenic down-regulation of enzymes involved lignin biosynthesis. Research on RNAi, gene silencing approach is progressing.



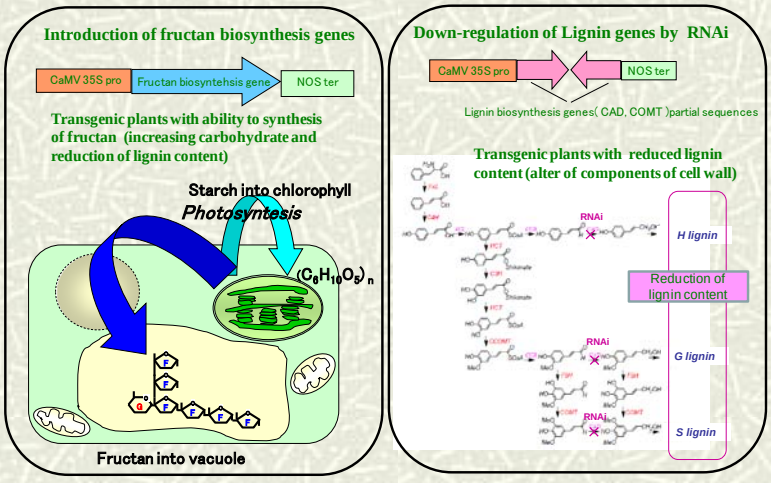
In vitro culture of *Miscanthus sinensis*

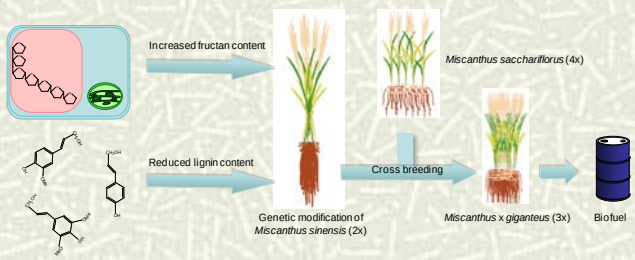


Transgenic plants containing *gpf* gene and *hpt* gene

Transgenic plants containing FT (*prft1*) gene (Hisano et al. New Phytologist 178: 766-780 (2008))

Altering the content of components of cell wall by transgenic approach (carbohydrates and lignin)





Research flow to produce novel Giant Miscanthus

This work was supported by the program from New Energy and Industrial Technology Development Organization , Japan (NEDO) and Grants-in-Aid for Scientific Research from the Ministry of Education, Science, Sports and Culture, Japan