Exceptional Plant

Isoenzyme replacement leads not only to enhanced stress tolerance, but also to increased harvest yield, higher biomass production, improved seed quality and higher energy density

Invention

Biotic and abiotic stresses represent the most limiting factors for agricultural productivity worldwide. This often goes along with a loss in harvest yield, because induction of a wide array of stress responses involves massive redistribution of the plant's energy resources towards the stress response. Hence, several strategies have been explored in the past decades to improve stress tolerance of higher plants.

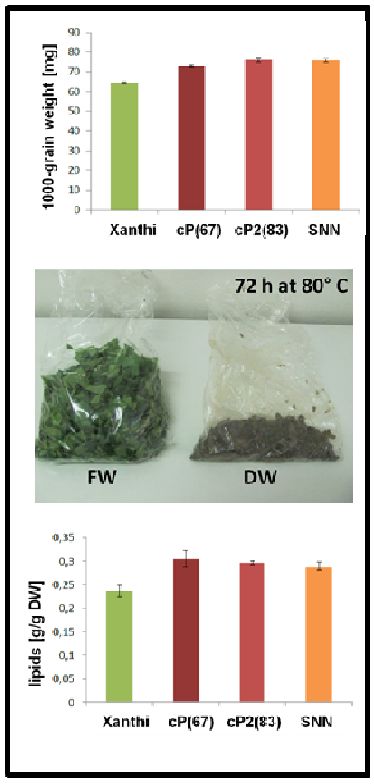

Fig.: Improved energy content and above-ground biomass by isoenzyme replacement

Scientists of the University of Muenster succeeded in turning a stress susceptible tobacco variety (Xanthi) into an exceptionally stress-tolerant plant using replacement of glucose-6-phosphate dehydrogenase (G6PDH), the rate-limiting step of the oxidative pentose-phosphate pathway (OPPP) in the cytosol by a specially suited plastidic isoform.

This strategy led to tobacco lines (cP (67,83) with higher fructose-2,6-bis-phosphate levels, an effector molecule crucial for the regulation of a key reaction in primary carbohydrate (CHO) metabolism, and resulted in accumulation of soluble sugars, especially glucose.

The isoenzyme-replaced plants produce more biomass [dry weights of above-ground tissues], . The 1000-grain weight ,which is an important seed quality criterion, raised by 15%. and oil levels increased by ~5% in *source* leaves and by 20% in seeds (see Figure).. The latter was accompanied by a higher energy density (lipid-to-CHO ratio). As one consequence, seed germination under stress conditions (salt) markedly improved.

The G6PDH isoenzyme-replacement technology is a promising tool to improve not only stress tolerance in general, but also biomass production, seed quality and energy density of agronomically important plants. Metabolic engineering of tobacco (a non-food species) with increased biomass could serve as an alternative energy source (e.g. for the production of biofuels).

Commercial Opportunities

The present invention yielded exceptionally performing tobacco plant lines, which can generate a large amount of inexpensive biomass more efficiently than almost any other non-food agricultural crop. On behalf of the University of Muenster, PROvendis offers access to rights for commercial use as well as the opportunity for further co-development.

Further Reading

Scharte, J. et al. (2009) Isoenzyme replacement of glucose-6-phosphate dehydro-genase in the cytosol improves stress tolerance in plants. PNAS 12; 106 (19): 8061-6.

Current Status

In case of interest we are pleased to inform you about the current patent status.

An invention of the Westfaelische Wilhelms-University of Muenster (WWU Münster).

Competitive Advantages

- **Fast & easy production of plants with enhanced general stress resistance**
- **Increased biomass**
- **Improved energy content**
- **Higher energy density**
- **Improved seed quality**
- **Increased harvest yield**
- **Cost-effective improvement of elite lines**

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