In maize, co-expression of GAT and GR79-EPSPS provides high glyphosate resistance, along with low glyphosate residues

September 12 2023

This is the result of spraying glyphosate on transgenic maize GG2 and non-transgenic maize interplanting. The green color is transgenic maize GG2 which grew up healthily after glyphosate treatment. Credit: Beijing Zhongke Journal Publising Co. Ltd.

In a paper published on *aBIOTECH*, a new bio-breeding resource designated GG2 for glyphosate-resistant (GR) maize has been developed. The co-expression of GAT and GR79-EPSPS confers GG2 with high GR and a low risk of herbicide residue accumulation, making this germplasm a valuable GR event in herbicide-tolerant maize breeding.

This study is led by Dr. Zhihong Lang (Biotechnology Research Institute, Chinese Academy of Agricultural Sciences).

To develop a new bio-breeding resource for glyphosate-resistant maize, a large transgenic maize population was generated with introducing a codon-optimized glyphosate N-acetyltransferase gene, gat, and the enolpyruvyl-shikimate-3-phosphate synthase gene, gr79-epsps, into maize and a transgenic event, designated GG2, was highly resistant to glyphosate in consecutive generations of glyphosate screening.

"This result is very encouraging," Dr. Lang says.

The team performed Southern blot analysis, RT-PCR and enzyme-linked immunosorbent assay (ELISA) to determine the copy number, transcription and protein stability of the foreign genes in GG2, and found that the gat and gr79-epsps genes are stably integrated into the maize genome as single copy insertions, and these genes could be correctly transcribed and translated in transgenic maize.

The researchers also investigated the glyphosate resistance level and agronomic traits of transgenic maize event GG2 in the field, and detected the glyphosate residues. This observation indicated that the transgenic maize event GG2 could tolerate 10 times the recommended glyphosate dose with no negative effect on yield, and compared to single EPSPS transgenic maize, the glyphosate residues in GG2 leaves could be reduced by 90% in a short time.

Professor Chunming Liu (School of Advanced Agricultural Sciences, Peking University) commented, "By introducing two microbial genes gat and gr79-epsps, which cloned from resistant microorganisms in glyphosate-contaminated soil, maize was able to obtain stronger herbicide capability and lower herbicide residue. This research achievement targets the maize development needs and the transgenic maize GG2 with high glyphosate tolerance and low glyphosate residues has application prospects."

More information: Shengyan Li et al, In maize, co-expression of GAT and GR79-EPSPS provides high glyphosate resistance, along with low glyphosate residues, *aBIOTECH* (2023). DOI: 10.1007/s42994-023-00114-8

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