

Breeding for improved responsiveness to arbuscular mycorrhizal fungi in onion

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Onion (*Allium cepa* L.) is one of the leading vegetable crops worldwide. Due to its superficial root system that is rarely branched and lacks root hairs, onion is very inefficient in the uptake of water and nutrients. As a result, large amounts of fertilizer are used in onion cultivation. In low-input systems crops need to be nutrient scavengers. To improve nutrient uptake in onions it is possible to breed for larger root systems using *A. fistulosum*. A complementary approach is to use arbuscular mycorrhizal fungi (AMF), which associate with onion and improve plant growth and the uptake of nutrients and water from soils. Previous research showed high responsiveness of *A. fistulosum* to AMF. The aim of the present research was to study possibilities to improve onions for mycorrhizal responsiveness by breeding.

A tri-hybrid population of *A. cepa* x (*A. roylei* x *A. fistulosum*) called CCxRF was obtained (Khrustaleva and Kik, 2000). Seventy-seven genotypes, vegetatively multiplied, were tested for responsiveness in a greenhouse (day/night 22/17 °C). AMF species *G. intraradices* was kindly provided by Dr. Kapulnik, Volcani Centre, Israel. Responsiveness was calculated as the increase in plant height/weight compared to the non-mycorrhiza treatment: $(W_{AMF} - W_{NM})/W_{NM} * 100\%$. Responsiveness was considered significant when the AMF and control treatment were statistically different ($p < 0.05$).

AMF had a significant effect on plant height and fresh weight of genotypes of the population. The frequency distribution for height responsiveness demonstrated genetic variation between genotypes that varied from hardly or no response to genotypes with up to 100% increase in plant height and up to 500% for weight. Analysis of the genetic basis of AMF responsiveness will be done by QTL mapping in this population. We expect not only to find traits to improve the rooting system but also to improve the mycorrhizal responsiveness. The results support our hypothesis that using *A. fistulosum* is an interesting option to improve onions by breeding to obtain cultivars better adapted to low input farming because of their improved rooting system and mycorrhizal responsiveness.

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