Introduction of rolA,B,C genes in Rootstocks of Roses Enhances production

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Introduction

The aim of the research was to improve the performance of a combination plants of rose by genetic modification of its rootstocks. The strategy followed is based on the idea that an altered hormonal status of rol gene transformed roots may result in a larger root system and consequently, an increased production of cytokinin. These processes would support the growth of the scion grafted on the rootstock, especially by enhanced release of basal shoots. Since the number of basal shoots are correlated with the successive lower production, it was expected that the rol A, B, C transformed rootstock would provide an opportunity for growers to produce more efficiently, especially at lower energy input where basal shoot production is limited.

MATERIALS AND METHODS

Application of rol genes

the rol A, B and C genes originate from the plant pathogen Agrobacterium rhizogenes. These genes are well-known or their phenotypical effects in the hairy-root disease of various woody plants. The rol B gene is responsible for an auxin-like activity, such as enhanced adventitious root formation, where as the rol C gene product has a cytokinin like action, resulting in diminished apical dominance. The role of the rol A gene is largely unknown.

Plant transformation

Transgenic plants of the rootstock Rosa hybrida L. 'Moneyway' were produced via a two step procedure. First, kanamycin resistant roots were generated on stem slices from micropropagated shoots, which were cocultivated with A. tumefaciens containing the PTII gene or conferring kanamycin resistance together with the rol A, B and C genes. In the second step these roots were used to regenerate transgenic plants via somatic embryogenesis.

RESULTS

Rol A, B, C genes enhance rooting capacity

Adventitious root formation was measured on cuttings of greenhouse grown transgenic plants. After one week, the number of roots counted on the rol A, B, C transformed cuttings was three times higher than the nontransgenic controls. Root systems of the transformed rootstocks developed faster. they were

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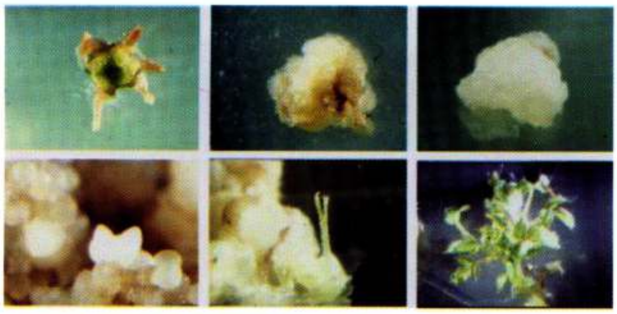
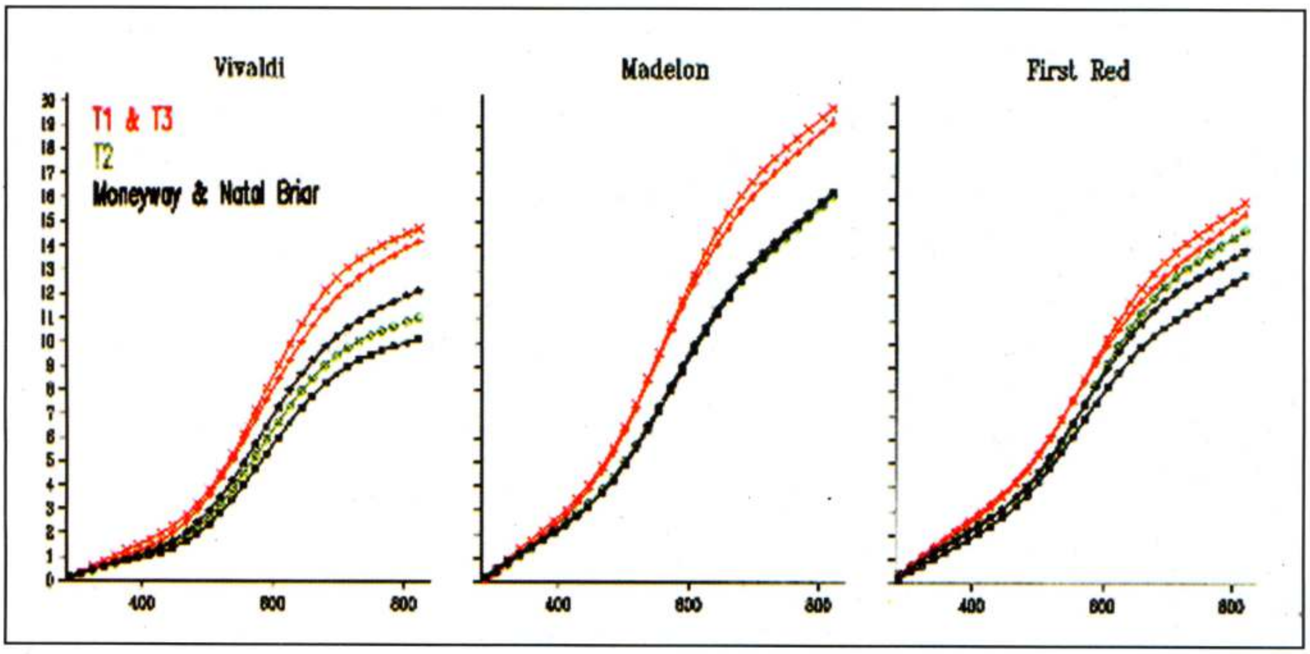


Regeneration of transformed roots via somatic embryogenesis

shorter but much more branched. The dry weight of their root system measured after 9 weeks was significantly higher than those of the control plants.

Effect on rose production

transformed scions from cultivars Vivaldi, Madelon and First Red were grafted on the transgenic rootstocks. In 1998, a greenhouse trial was initiated to measure the effect of the transgenes on rose production. After 18 months of harvest, the transgenic rootstocks out produced -in number of lowering shoots - the untransformed controls by 23% calculated as the average over the three cultivars. This production increase is mainly explained by an increase of the number of new axillary buds at the base of the stem after cutting. The total fresh weight increased by 8% only, resulting in a decrease in weight per stem by 15%. As shown in the figure below, the effect of the rol genes on production varies per scion cultivar. To comply with the aim of energy-efficiency the greenhouse was kept at a low temperature in winter. The increase in yield was, however, also observed in summer when the temperature in the greenhouse is high. So far, there are no indications of untimely exhaustion of the rootstocks.



CONCLUSION

Rose combination plants consisting of an untransformed scion grafted on a rol A, B, C transformed rootstock improve the yield of cut roses significantly.