Higher Yield and Fruit Quality of *Solanum pennellii* Introgression Line

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Abstract

Cultivated tomato (*Solanum lycopersicum* L.) is an important source of antioxidants, such as ascorbic acid, carotenoids and phenolic compounds. Epidemiological results confirm that these antioxidant molecules are associated with a reduced risk of cancer, inflammation and cardiovascular diseases. Recently, one Introgression Line population deriving from *Solanum pennellii* has been exploited to identify favorable alleles that can improve fruit quality traits in commercial varieties, including antioxidants content. The aim of this work was to evaluate growth, final yield and content of nutraceutical compounds at the ripe red fruit stage in one subline coded R182 which carries only a small region (448 Kbp) of wild genome in the cultivated genetic background (M82). Analyses carried out on R182 and on the parental line M82, demonstrated that the subline showed better performances in terms of yield and fruit qualitative traits most considered for tomato processing. Indeed, higher yield (+28.96%), content of soluble sugars (+34.64%) and titratable acidity (+78.94%) were demonstrated for R182 compared to M82. Also, for the nutritional traits analyzed, an increase in the content of phenols (+ 69.96%), ascorbic acid (+ 48.55%), carotenoids (+ 29.66%), lycopene (+ 31.22%) and β-carotene (+31.67%) was observed. Therefore, it is possible to assert that the subline R182 may be considered as a good candidate to be used as parental genotype in breeding programs.

Results and Discussion

Genotype	Height (cm)	Fresh weight (g)	Yield (Kg/pt)
M82	64.20 ± 7.07	316.00 ± 57.97	0.37 ± 0.06
R182	71.80 ± 5.96 *	314.00 ± 65.35	0.48 ± 0.02 *

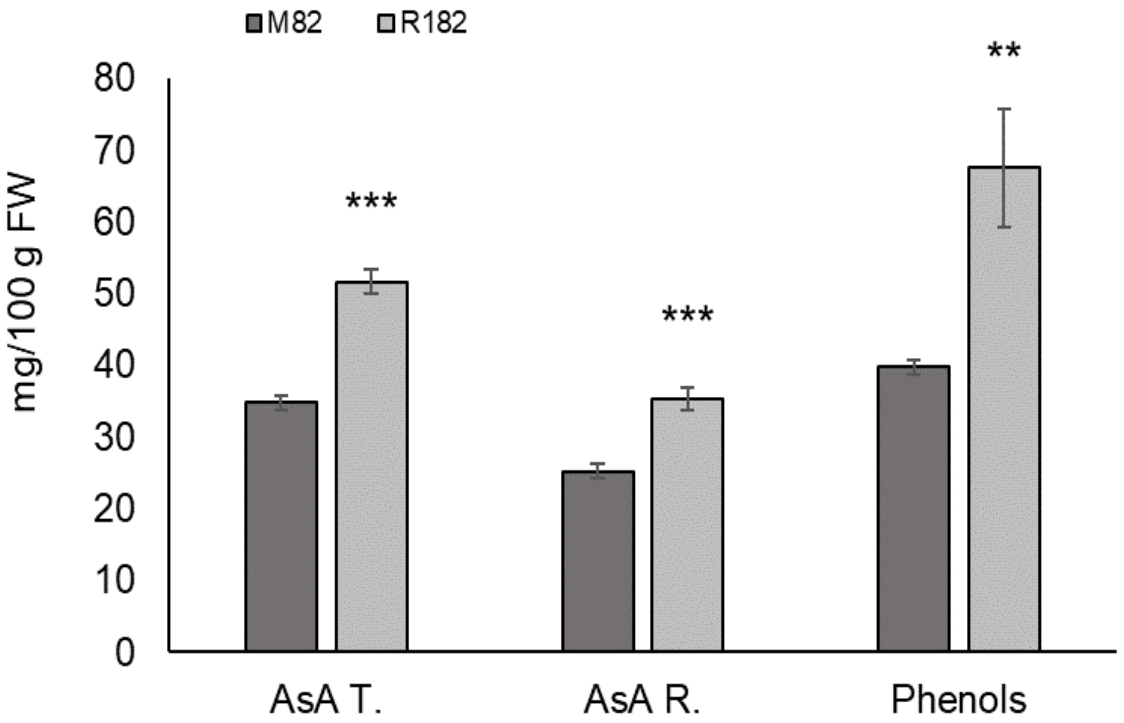
The values are means ±SD (n = 9). Asterisks indicate statistically differences of R182 compared to M82 by Student's t-test (*P < 0.005; **P < 0.01; ***P < 0.001)

Genotype	Soluble solids (°Brix)	Titratable acidity (g/100 g FW)	Firmness (Kg/cm^2)	Total carotenoids (mg/100g FW)	Lycopene (mg/100g FW)	β-carotene (mg/100g FW
M82	5.60 ± 0.39	0.33 ± 0.01	5.73 ± 0.68	16.44 ± 1.83	1.01 ± 0.13	0.14 ± 0.01
R182	7.54 ± 0.38 ***	0.59 ± 0.06 ***	6.15 ± 0.59	21.32 ± 1.94 ***	1.32 ± 0.13 ***	0.18 ± 0.01 **

Yield per plant and height were higher in R182 compared to M82, increasing respectively by 28.96% and 11.84%. On the other hand, no differences were evidenced in the fresh weight of the biomass between the two genotypes. For all the qualitative traits analyzed R182 showed a better performance compared to M82. An increase in °Brix of 34.64% was evidenced, and also titratable acidity increased by 78.94% in R182 compared to the cultivated genotype. No differences in terms of fruit firmness were instead evidenced herein.

Assessing the content of lipophilic antioxidant, the R182 genotype showed a 30% increase in the content of carotenoids, lycopene and β-carotene compared to the M82.

Results and Discussion



The content of hydrophilic antioxidants was higher in the subline R182 compared to the cultivated line M82. Genotype R182 showed an increase of 48.55% in total ascorbic acid content and 40.09% in reduced ascorbic acid content compared to M82 plants. The average of total phenolic compounds of M82 was 39.71 mg GAE/100g FW. The subline R182 showed an increase of 70% compared to the cultivated line.

The values are means ±SD (n = 9). Asterisks indicate statistically differences of R182 compared to M82 by Student's t-test (*P < 0.005; **P < 0.01; ***P < 0.001)

Conclusion

Tomato fruit is one major source of antioxidants for the benefit of nutrition and human health, so it is very useful to select genotypes with high content of antioxidant molecules. From an agronomic point of view, it is important that these genotypes also have a good productivity. The results of this study demonstrated a better performance of one *S.pennellii* subline named R182 compared to that of the control line M82. Our results suggested that it could be possible to use this introgression line as breeding material to obtain new varieties. Now, additional studies are necessary to identify the genes controlling the quality traits evidenced in this line.