

Effect of Kiwifruit Vine Decline Inducing Soils on Growth, Mineral uptake, and Protein Content in Different *Actinidia* Genotypes radical systems

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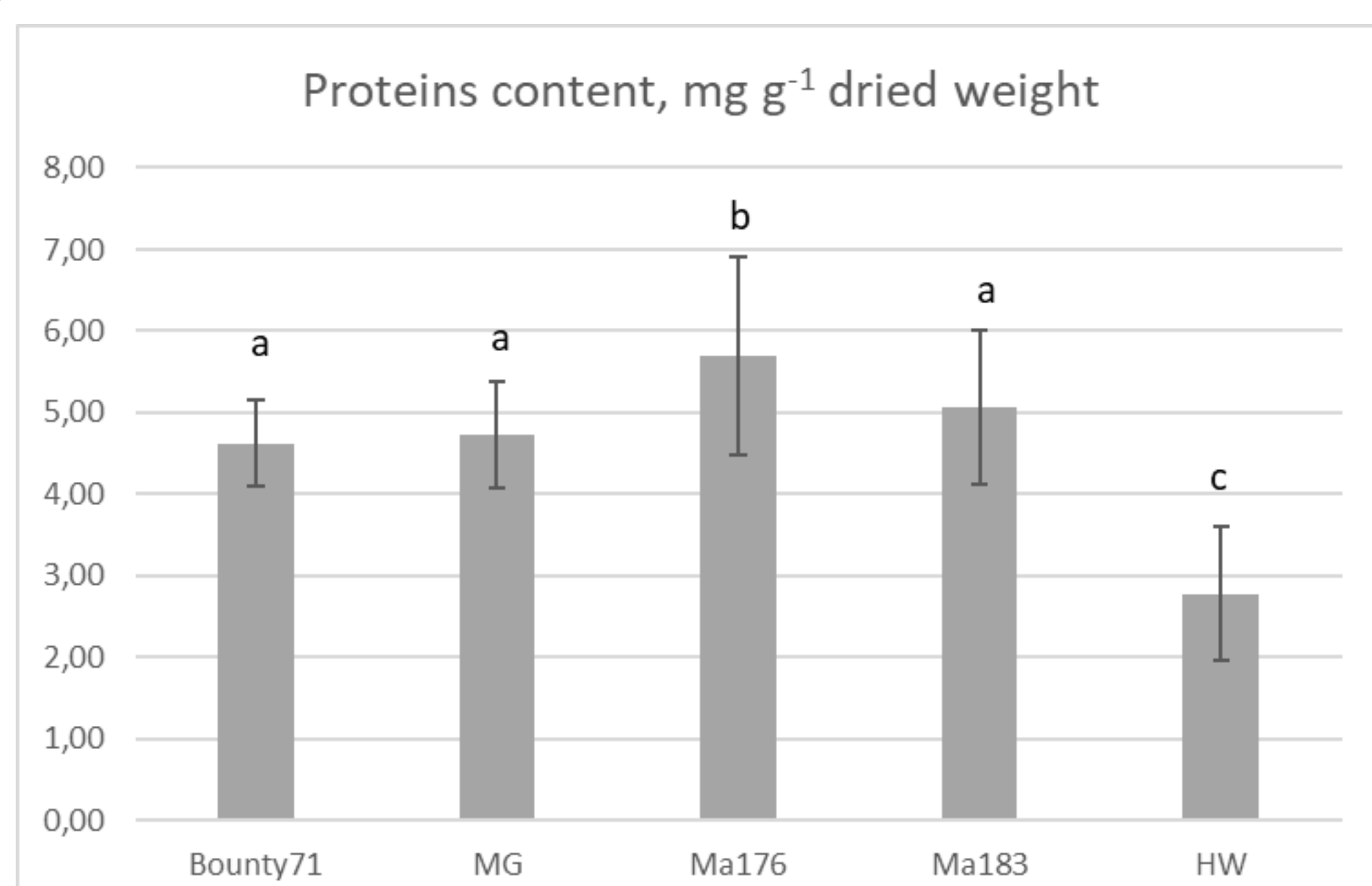
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Kiwifruit Vine Decline Syndrome (KVDS) is a severe and complex disease, caused by both biotic and abiotic factors, without any effective managing strategy. The availability of a large *Actinidia* germplasm collection offered the possibility of screening different species in order to find traits to contrast KVDS. Thus, 5 accessions of *Actinidia* planted in 4 KVDS inducing soils were tested: *A. macrosperma* (accessions Ma176 and Ma183), *A. deliciosa* cv. 'Hayward' (HW), *A. arguta* cv. 'Miss Green' (MG) and 'Bounty71' cv. We evaluated the growth of roots determining their volume and the total number of roots. Yet, the capability of mineral up-taking was also evaluated along with the protein degradation, since abiotic and biotic stresses induce numerous biochemical and physiological responses in plants. Specifically, the concentration of mineral elements in the radical system was measured by using the Inductively Coupled Plasma-Atomic Emission Spectrometry. The total protein content was measured through the Bradford assay. Discontinuous sodium dodecyl-sulfate polyacrylamide gel electrophoresis (SDS-PAGE) was performed in order to separate proteins and determine their patterns. Results are the mean of a pool of samples concerning each genotype from the different KVDS soils. In the graphs, different letters (e.g., a, b, c,) are significantly different at $\alpha \leq 0.05, 0.01, 0.001 \%$ and no significance (ns), respectively.

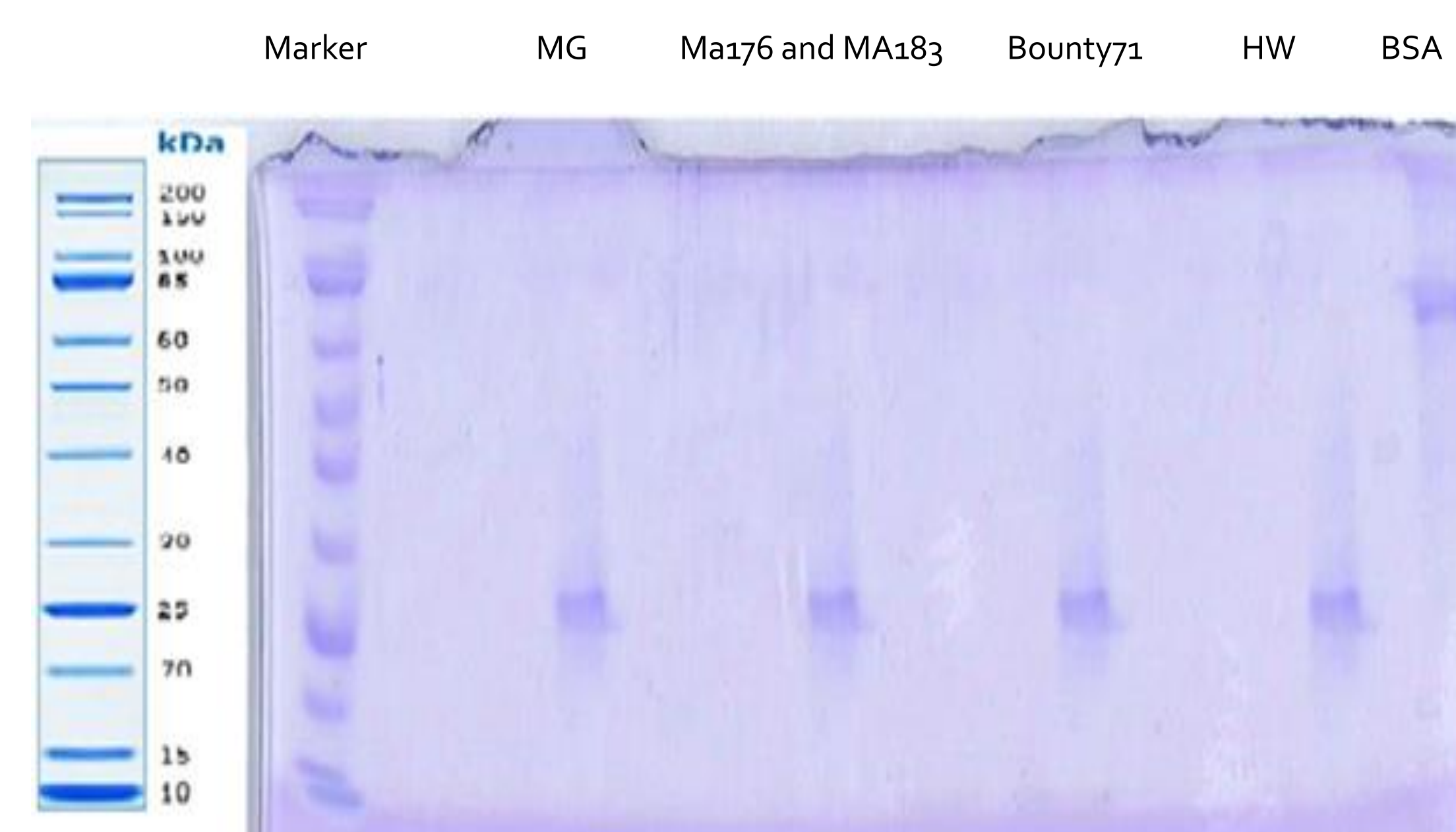
Genotype	Volume (ml)	Total roots number (100 cm ²)
Ma176	407.33 c	18.64 a
Ma183	187.05 b	17.26 a
Bounty71	226.75 b	21.89 Aa
MG	389.33 c	22.93 Aa
HW	56 a	15,1 a

Results of root volume showed as follows: Ma176 an MG had the greatest volume and HW the lowest, while Bounty71 and Ma183 were similar. Indeed, for the total root number, only few differences were found.

After SDS PAGE analysis, no different patterns of proteins were found (Bovin Siero Albumin, BSA, as positive control). The proteins identified were located between 25 and 30 kDa



Regarding the protein content, applying the Bradford assay, Ma176 had the greatest value. Bounty71, MG and Ma183 were comparable but with a minor content if compared to Ma176. The lowest value was recorded for HW.



	Bounty71	MG	Ma176	Ma183	HW
N	1,96	2,14	1,78	1,80	1,74
P	45,12 *	39,97	32,28	43,17 *	1,47 ***
K	101,76	96,09	110,89	102,15	1,42 ***
C	617,10	583,40	649,53 *	632,95	37,59 ***
S	28,145	27,66	25,92	24,725	2,41 ***
Ca	4,81	6,29	7,69 *	6,7325	2,69 **
Mg	10,745	14,64 *	12,69	13,10	0,38 ***

Data: mg g⁻¹ dry weight

Significant codes : 0 '***', 0.001 '**', '**' 0.01, '*' 0.05, '.' 0,1

Differences were found in the mineral content of the roots. Firstly, HW showed the lowest values of each element taken into consideration, apart from N. Secondly, each tested genotype had a different capability of nutrient up taking in KVDS inducing soils. Thirdly, Bounty71 and Ma183 had the greatest capability of P up taking, , MA176 for C and MG for the Mg. Finally, MA176 showed the greatest capability of Ca uptake.

Conclusions

The lowest values of all parameters related to root growth were obtained for the "Hayward" variety, while the two *A. macrosperma* showed significant differences in the root volume. "Bounty71" was not significantly different from *A. macrosperma* 183 since the root volume was only slightly higher than that of *A. macrosperma* 183. *A. arguta* "Miss Green" did not perform differently compared to all *A. macrosperma*. The root number was not particularly different. For the protein content, Ma176 had the highest value while HW the lowest. The other genotypes showed similar patterns. We assume that the infected conditions promoted the protein degradation in the Hayward cv., whilst the other genotypes were not influenced. Surprisingly, no different protein patterns were found. Regarding the capability of mineral up taking, Hayward cv. was not able to grow and not even to supply the mineral demand for the plant nutrition. The other genotypes had a similar behavior with only some specificities. Finally, these evidences demonstrated how the tolerant genotypes had a better performance of the radical system compared to the sensitive ones (e.g., Hayward cv.).