



EVALUATION OF GERMPASM RESOURCES FOR THE RESISTANCE TO KIWIFRUIT VINE DECLINE SYNDROME (KVDS)

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PROBLEM AND INTRODUCTION



Kiwifruit: stands in top 10 cultivated fruit

Kiwifruit Vine Decline Syndrome (KVDS): complex disease, worldwide spread

Aetiology: soilborne pathogens activity enhanced in by waterlogging conditions



Actinidia orchard affected by KVDS,
In Italy, NE

Nowadays: no managing system, disease still being studied, confusing conditions

Possible solution: screening and using tolerant species



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METHODS



- Genotypes tested: *A. macrosperma*, accession number 176 (Ma176), number 183 (Ma183) and cv. 'Bounty71', *A. arguta* cv. 'Miss Green' (MG), *A. polygama* (Pol) and *A. deliciosa* cv. 'Hayward' (HW)
- 4 experimental sites in Italy, NE (Fig 1)
- Evaluation of root system
- Total aerial biomass produced
- Development of a statistical model for the fitness of *Actinidia* spp. radical system

Parameter	Site-1	Site-2	Site-3	Site-4
Sand (%)	5	14	32	32
Silt (%)	80	65	64	46
Clay (%)	15	21	4	22
Organic carbon (C)	1.69	1.17	1.44	1.66

Figure 1. Site features



RESULTS



Ma176, Ma183 and 'Bounty71': full capacity to survive in KVDS inducing soils (100%), while only the 16% of HW plants survived. At the end, no one *A. polygama* plant have been able to grow (0%). Different behavior in terms of the radical system indices (HW and Pol the worse) (Fig.2)



Genotype	Volume (mL)	Depth (cm)	Width (cm)	Total roots number (100 cm ²)
Ma176	407.33 c	31.34 b	47.65 B	18.64 a
Ma183	187.05 b	27.36 b	35.93 b	17.26 a
Bounty71	226.75 b	30.76 b	38.35 b	21.89 Aa
MG	389.33 c	29.80 b	36.8 b	22.93 Aa
HW	56 a	16.1 a	18.25 a	15,1 a

Figure 2. Root system indices. Within columns, values that are assigned by different letters are significantly different at $\alpha \leq 0.05$, 0.01, 0.001% and no significance (ns), respectively

Root systems of the tested genotypes. On the top: *A. macrosperma* 176, in the middle: *A. arguta* 'Miss Green', on the bottom: *A. deliciosa* 'Hayward'.



RESULTS



Dry weight: Ma176 along with Bounty71 had the greatest value, whilst HW the lowest. Statistical significance was found in each genotype.

Genotype	Dry weight (g)	Ø (cm) trunk
Ma176	23.53 c	1.01 a
Ma183	7.12 b	0.86 a
Bounty71	22.22 c	0.96 a
MG	10.22 Bb	1.22 aA
HW	2.80 a	1.09 a



Left: 'Bounty 71', right: *A. polygama*, after one vegetative season

Figure 3. Canopy indices after one growing season. Within columns, values that are assigned by different letters are significantly different at $\alpha \leq 0.05$, 0.01, 0.001% and no significance (ns), respectively



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RESULTS



Additive model and an Interactive one developing:

- the root volume was charged and fixed as the most important parameter for plant surviving
- volume influenced by the total root number and the canopy dry weight
- the two models produced data not significantly different (p value: 0.4117)

Additive Model	p value	Significance
Intercept - Root Volume	2,83E-07	***
Trunk Diameter	0,3251	
Total Roots Number	0,0101	*
Canopy Dry Weight	0,6954	

Interactive model	p value	Significance
Intercept - Root Volume	0,00175	**
Trunk Diameter	0,18054	
Total Roots Number	0,76072	
Canopy Dry Weight	0,09775	*
Trunk Diameter * Total Roots Number	0,56566	
Trunk Diameter * Canopy Dry Weight	0,11929	
Total Roots Number * Canopy Dry Weight *	0,14616	
Total Roots Number * Canopy Dry Weight * Trunk Diameter	0,18336	

ANOVA - Additive and Interactive 0,4117

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



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DISCUSSION AND CONCLUSION



- Several genotypes were able to survive in the tested KVDS inducing soil while 'Hayward' confirmed to decline rapidly. Indeed, *A. polygama* was the most sensitive
- Lots of differences among genotypes emerged for some traits related to root and canopy development in decline inducing soils
- The significant differences among *A. macrosperma* genotypes in the development of both root system and canopy suggest that the germplasm of this specie should be more carefully evaluated
- Both models, additive and interactive, demonstrated that root number and canopy dry weight seemed to be the most effective indices in determining the root volume.



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