

# Apple Root Systems for Organic Orchards

What might be the contribution of  
the rootstock?

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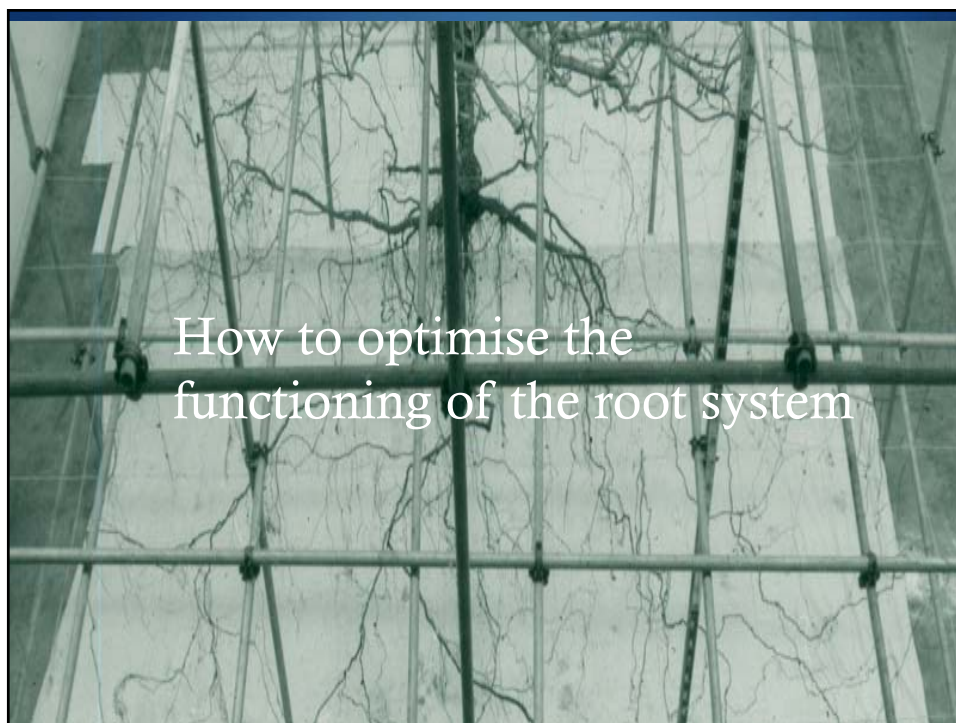


## How to optimise nutrient supply in organic production



## So how does organic differ from “conventional”?

- No mineral fertilisers so lower soil nutrient concentrations particularly in early season
- Nutrient supply from organic sources so availability more closely geared to soil temperature
- Greater reliance on soil microbes including mycorrhizal fungi
- Potentially more competition from ground cover vegetation



## What root system features are important in organic production ? Can rootstocks help?

- Long duration of root length production geared to soil temperature
- Significant partitioning to root system and root length
- Good distribution through soil volume
- Ability to cope with varied nutrient speciation and concentrations

## What do rootstocks do?

- Control tree size
- Influence the partitioning of assimilates giving differences in yield to tree size
- Influence fruit quality indirectly via effects on canopy density
- Can they influence the root system?

## An experiment to assess the impact of rootstock on the root system and its interaction with soil management

- ◆ Trees (Cox) on M27, M9, M26, MM106, MM111 at common 4x4M spacing
- ◆ Initially grown with bare soil then after 5 years 10 of 25 blocks grassed
- ◆ New growth assessed with a mini-rhizotrons (yr. 5/6), root activity through soil water depletion and uptake of 32P
- ◆ Root length assessed using soil monoliths in yr. 11

## The effect of rootstock on growth

	M27	M9	M26	MM106	MM111
Annual Shoot Production (m)	5	29	81	141	167
Estimated Total root Length (km)	19	29	21	33	49

## Effect of rootstock on root system function

	M27	M9	M26	MM106	MM111
32P Uptake nr. Tree cpm./g leaf		4391	1724		2779
Mean soil water deficit for season (cm)	2.6	3.3	3.0	3.8	4.5

## Effects and Interactions

Rootstock	Soil Management	Soil Depth	Distance from Trunk
***	*	***	***
Stock/Management	Stock/Depth	Stock /Distance	Management/Distance Depth
ns	ns	ns	***

## Effect of rootstock and soil management on root length density cm/cm<sup>2</sup>

manage	position	M27	M9	M26	MM106	MM111
Grass	Near	31	33	31	49	56
	Away	6	11	11	13	17
Bare	Near	14	15	17	23	30
	Away	11	20	12	23	31

## Effect of rootstock and soil management on distribution with depth cm/cm<sup>2</sup>

		M2712	M9	M26	MM106	MM111
Grass	0-10	3	15	17	25	29
	10-30	6	13	11	19	22
	30-50	7	5	3	6	5
Bare	0-10	6	6	7	8	12
	10-30	7	7	8	13	14
	30-5015	1	1	2	2	3



## The future root system: Interactions for total weight

Management	Rootstock	Depth	Distance from trunk
*	***	***	***
Stock /distance	Stock/depth	Stock/Management	Stock /distance/depth
**	**	ns	*

