



UNIVERSITÀ DEGLI STUDI DI PALERMO
Department of Agricultural and Forest Sciences

Soilless table grape cultivation

Di Lorenzo R.¹, Scafidi P.³, Coffaro G.¹, Gambino C.²
rosario.dilorenzo@unipa.it

¹Department of Agricultural and Forest Sciences., Palermo University

² Agrosoilless - Soilless specialist

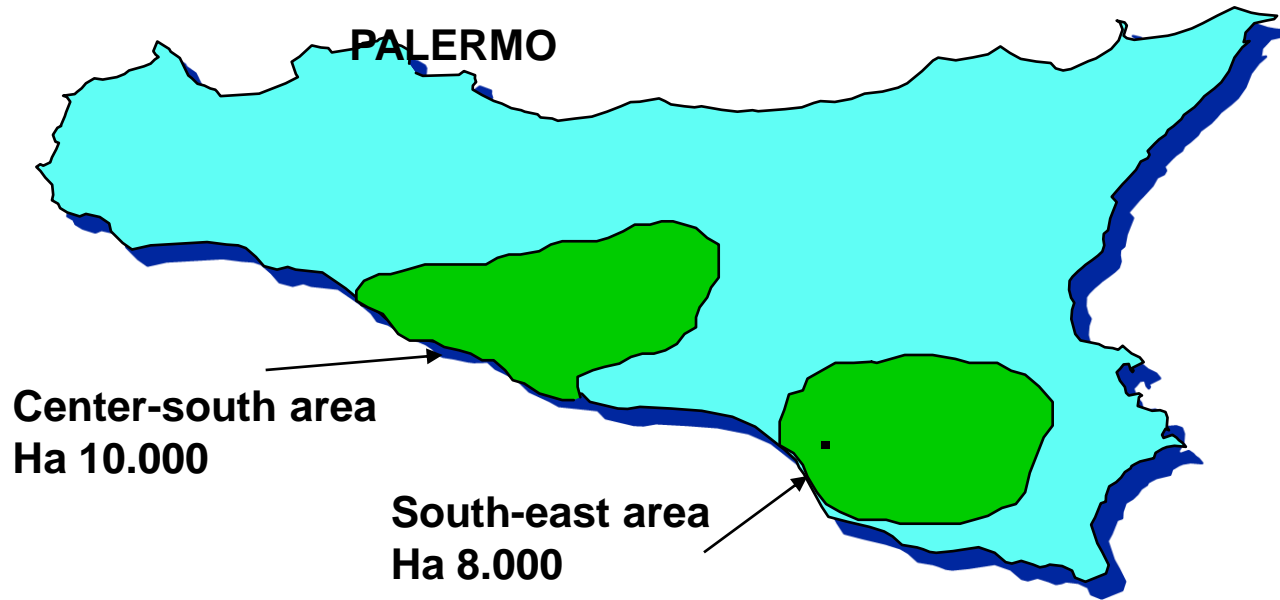
³Grape & Grape



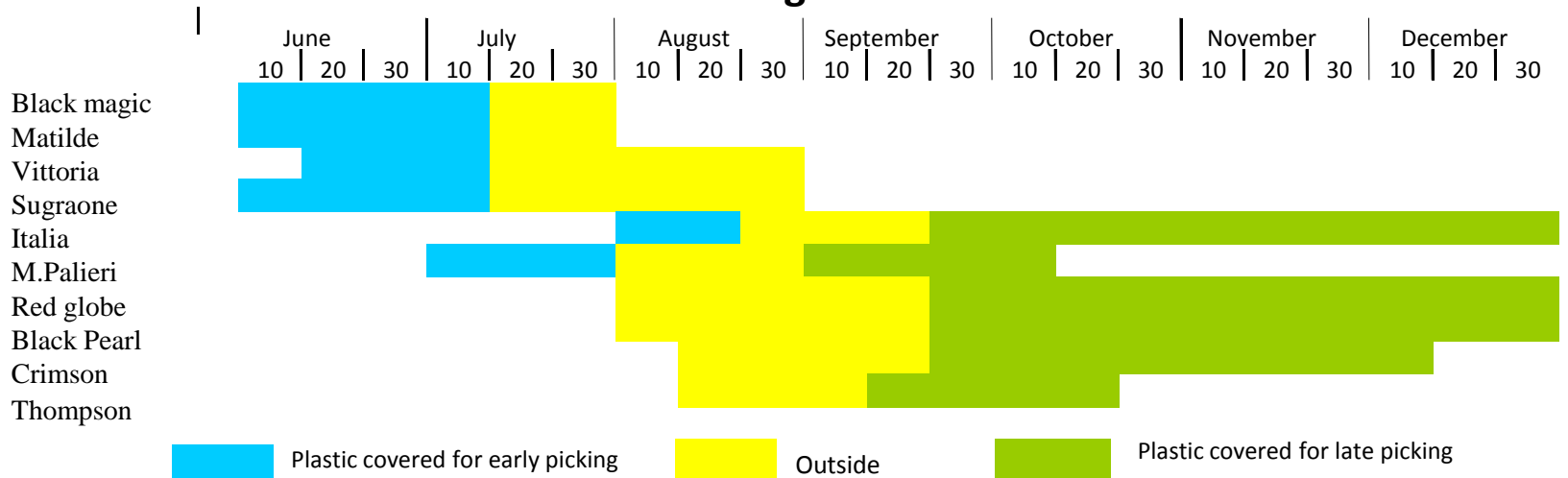
Sicily is in the middle of the Mediterranean sea



Table grape cultivation area



Marketing Schedule



SOILLESS TABLE GRAPE CULTIVATION : WHY?



RESEARCH ACTIVITIES AND ACHIEVEMENTS

The aim of this presentation is to describe the technique of soilless table grape cultivation and in the same time show its difficulties and potentials.

From 1999, the Department SAF started research activities about table grape soilless cultivation.



MANY RESULTS HAVE BEEN PUBLISHED



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e-mail: info@world-food.net

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Soilless greenhouse production of table grape under Mediterranean conditions

Donato Buttaro¹, Francesco Serio^{2*} and Pietro Santamaria¹

¹Dipartimento di Scienze Agro-Ambientali e Territoriali, University of Bari 'Aldo Moro', Via Amendola 165/A, 70126 Bari, Italy.

²Institute of Sciences of Food Production, CNR – National Research Council of Italy, Via Amendola 122/O, 70126 Bari, Italy.

*e-mail: francesco.serio@ispa.cnr.it

Process innovation in the table grapes sector: two production in the same year with the soilless technique

Rosario Di Lorenzo¹, Biagio Dimauro², Carlo Gambino³, Gabriele Coffaro¹

¹Dipartimento Scienze Agrarie e Forestali, Università degli Studi di Palermo

²UOS Comiso (RG) – Assessorato Risorse Agricole e Alimentari - Regione Sicilia

³Agronomo specialista in coltivazioni in fuori suolo



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V Viticulture National Congress – CONAVI 2014
FOGGIA 1-3 Luglio 2014

From soil to soil-less in horticulture: quality and typicity

Rosario Di Lorenzo,¹ Antonino Pisciotta,¹ Pietro Santamaria,² Valentina Scariot³

¹Dipartimento Scienze Agrarie e Forestali, Università di Palermo;

²Dipartimento di Scienze Agro-Ambientali e Territoriali, Università di Bari;

³Dipartimento di Scienze Agrarie, Forestali e Ambientali, Università di Torino, Italy



ISHS Acta Horticulturae 614

VI International Symposium on Protected Cultivation in Mild Winter Climate: Product and Process Innovation

Cultivation of Table Grapes in “Soilless” in Sicily

R. Di Lorenzo, M.G. Barbagallo,
P. Costanza and E. Gugliotta.
Dipartimento di Colture Arboree
Università degli Studi di Palermo.
Viale delle Scienze, 11 – 90128
Palermo, Italy

R. Mafrica
Dipartimento di Agrochimica ed Agrobiologia
Università degli Studi di Reggio Calabria.
Piazza S. Francesco. Gallina di Reggio
Calabria, Italy

G. Palermo
Direttore tecnico Agrimed 2000
Acate (RG), Italy

B. Di Mauro
SOAT Regione Siciliana
S. Croce Camerina (RG, Italy)

Ricerca SPECIALE UVA DA TAVOLA

Comportamento vegeto-produttivo ed ecofisiologico di viti allevate fuori suolo in serra

CARLO GAMBINO¹ - BIAGIO DIMAURO² - ROSARIO DI LORENZO¹

¹Dipartimento di Colture Arboree - Università di Palermo

²U.O.S. 36 - Assessorato Agricoltura e Foreste - Regione Sicilia

Research Article

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Postharvest evaluation of soilless-grown table grape during storage in modified atmosphere

Maria Cefola,^a Bernardo Pace,^{a*} Donato Buttaro,^b Pietro Santamaria^b
and Francesco Serio^a

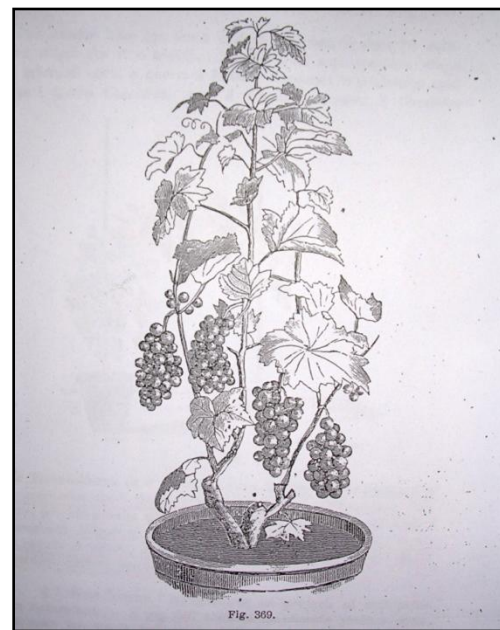


THE HYPOTHESIS OF TABLE GRAPE PRODUCTION IN POTS HAS AN OLD HISTORY

- Foex G. 1891 – “Cours complet de viticulture”;
- Ottavi O. 1893 – “Viticultura Teorico-Pratica”.

“...the cultivation of vines in pots, as well as provide pleasure and satisfaction, may be able to give a gain because it often gives amazing results for quantity, quality and beauty of the product...

(Longo, 1926)



- Ravetti F., Ridray G. INRA di Alenya from '87 to '90;
- Vidaud J., Landry P. CTIFL di Balandran from 91 to 94;
- Kingston C., Van Epenuijsen K. dell'Horticultural Research Centre Private Bag di Levin in '95.

Greenhouses



“capannina” greenhouse



“tunnel” greenhouse traditional



“italian Pergola”



“tunnel” greenhouse with automated management of climate

Equipment

Fertigation unit



Climate unit



Sterilization system



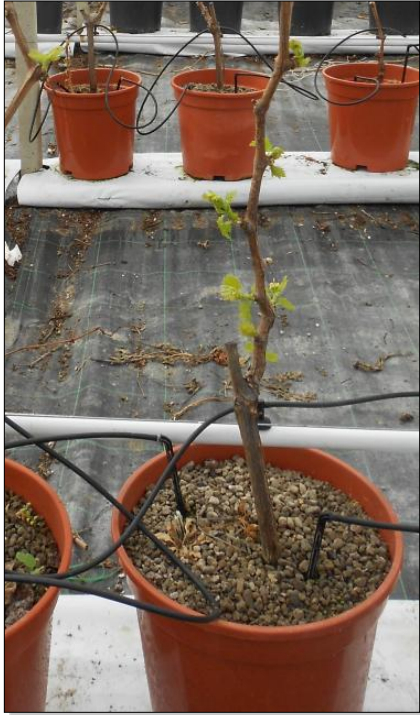
Nebulization and sublimation systems



Reverse osmosis system



Container



Pot



Logline



Grow bag



Plastic bag

Substrates



Perlite



Coconut fiber



Pumice



Perlite/coconut fiber mixture(70:30)



**Coconut fiber mixture
(75% coconut peat- 25% coconut chips)**

Trellis systems



VSP: 1,60 x 0,40 m
(15600 plants/ha)

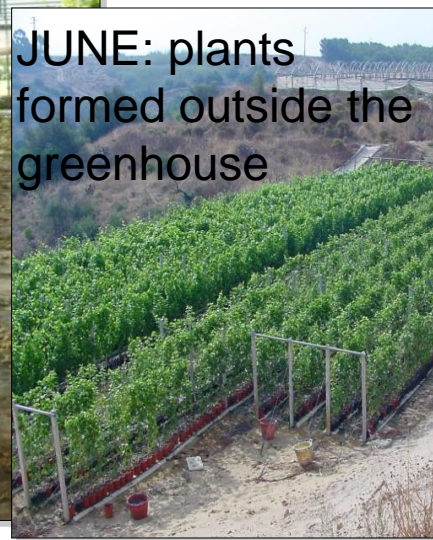


Tendone: 2,0 x 0,40 m
(12500 plants/ha)



V trellis: 2,0 x 0,35 m
(14300 plants/ha)

1st YEAR: PLANTS FORMATION



Vineyard management during training period

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1 st Year. Training period												
Rooting cuttings												
Container plantation												
Suckering and shoot selection												
Lateral shoot removal												
topping												

Irrigation plan

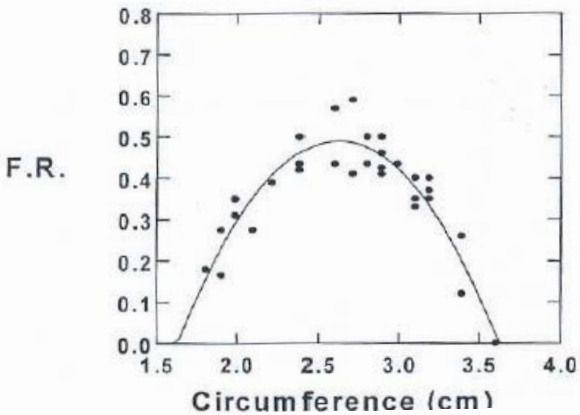
Period	Water supplied amount/turn	N. of irrigation/day	Water supplied amount(cc)/plant/day	30% draining	Lt/plant
Vegetative cycle	220	7	1540	462	370

Quantity of water (Lt) and mineral elements (g) for each plant during the formation of plants

Water	N	P	K	Mg
526	21.3	3.8	18	12.3

TRAINING PROBLEMS

Plant type for cycle start



Quadratic regression between fertility and cane circumference

Differences (%) of some productive variables between classes.

Cane circumference	Weight of cluster	Weight of berry
< 20 mm	-39 %	-0.9 %
20-30 mm	-16 %	-1.1 %
> 30 mm	-	-



2nd year: *PRODUCTION*



Vineyard management during production cycle

	DEC	JAN	FEB	MAR	APR	MAY	JUN
IInd Year: Production cycle							
Pruning							
Cane positioning							
Sukering and bunch removal							
Leaf removal							
Lateral shoot removal							
Harvest							

Water and mineral nutrients

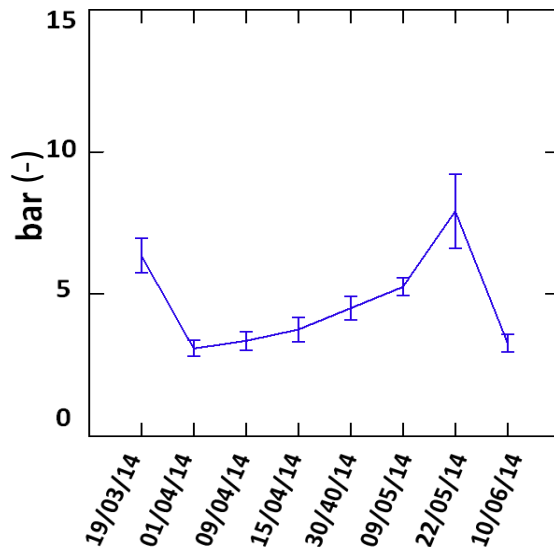
Phenological fase	water supplied (mL)/turn	N. of irrigation/day	water supplied (Lt)/plant/day	30% draining	pH	EC (mS/cm)
BUD BREAK–BLOOM	220 - 280	4 - 5	1,12 – 1,40	0,33 – 0,42	5,8 – 5,9	3,23 - 4,09
BLOOM – VERAISON	233 - 333	7 - 8	1,80 – 2,66	0,70 – 0,94	5,8 – 5,9	3,05 – 3,98
VERAISON – HARVEST	333	10 - 15	3,33 – 4,99	0,99 – 1,49	5,8 – 5,9	3,30 – 4,18

Phenological stage	Total amount (g)					
	Water (Lt)	N	P	K	Ca	Mg
BUD BREAK – BLOOM	57,2 – 72,8	8,72 – 9,09	2,65 – 5,79	16,97 – 21,36	11,18 – 19,58	3,60 – 7,27
BLOOM – VERAISON	65,2 – 93,2	6,42 – 9,78	1,41 – 4,22	13,41 - 17,32	13,02 – 25,06	3,47 – 9,95
VERAISON – HARVEST	139,9 – 209,6	13,22 – 20,68	4,76 – 6,51	35,36 – 66,26	30,72 – 46,03	12,69 – 16,41
BUD BREAK - HARVEST	262,3 – 375,6	28,36 – 39,55	8,82 – 16,52	65,74 – 104,94	54,92 – 90,67	19,76 – 33,63

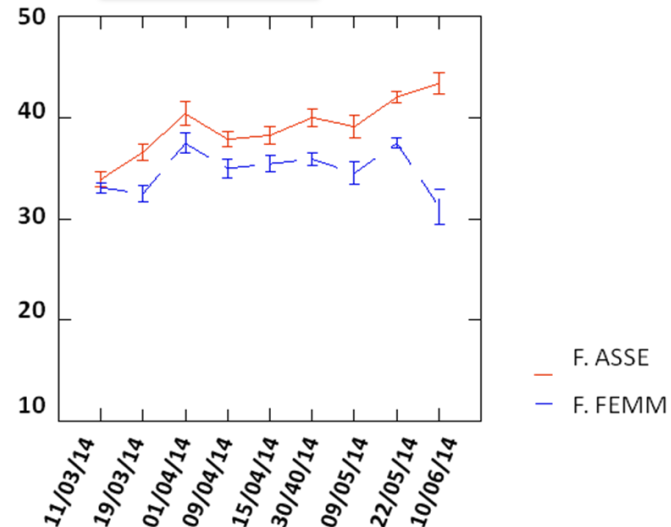
Eco-physiological behaviour of plants

	PHOTOSYNTHESIS	STOMATAL CONDUCTANCE	TRASPIRATION
Phenological fase	($\mu\text{mol m}^{-2} \text{sec}^{-1}$)	($\text{mmol m}^{-2} \text{sec}^{-1}$)	($\text{mmol m}^{-2} \text{sec}^{-1}$)
Bud break – bloom	5,1	1078,3	5,4
Bloom – veraison	5,8	407,7	5,0
Veraison – harvest	2,6	188,1	3,5

Stem Water Potential



Spad Index



***Efficiency index per plant at veraison and harvest:
leaf area (mq)/grape yield (kg)***

	VERAISON		HARVEST
m^2/kg	2,0	m^2/kg	1,5



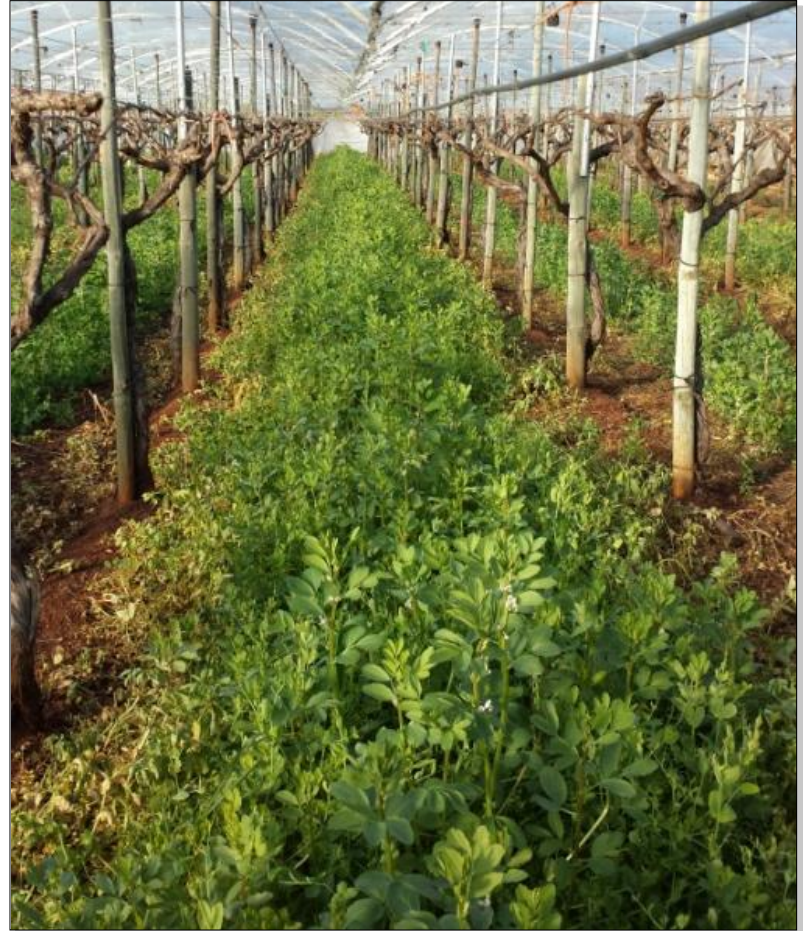
SOILLESS CULTIVATION PROBLEMS:

- Cultivar choice
- Water and mineral nutrition
- Substrate and container choice (pot or bag)
- Climate management in relation to the greenhouse

SOILLESS CULTIVATION POTENTIAL

- 1. Overcoming the problems associated with "soil-wood diseases", and "soil tiredness"*
- 2. Quick varietal change;*
- 3. Enlargement of the marketing calendar and seasonal adjustment of the productions;*
- 4. High productivity.*

1. *Overcoming the problems associated with "soil-wood diseases", and "soil tiredness"*



2. *Quick varietal change*



CV DORIA SEEDLESS

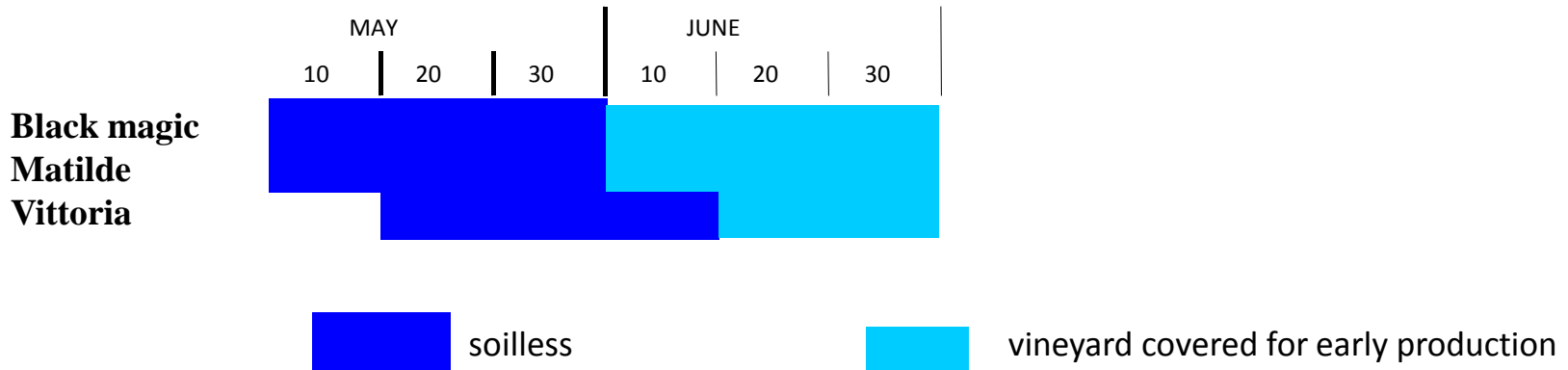


CV REGAL SEEDLESS

3. Enlargement of the marketing calendar



Marketing calendar



3. *Outseasonal productions*

Black Magic
October



Vittoria
October



Red Globe
July

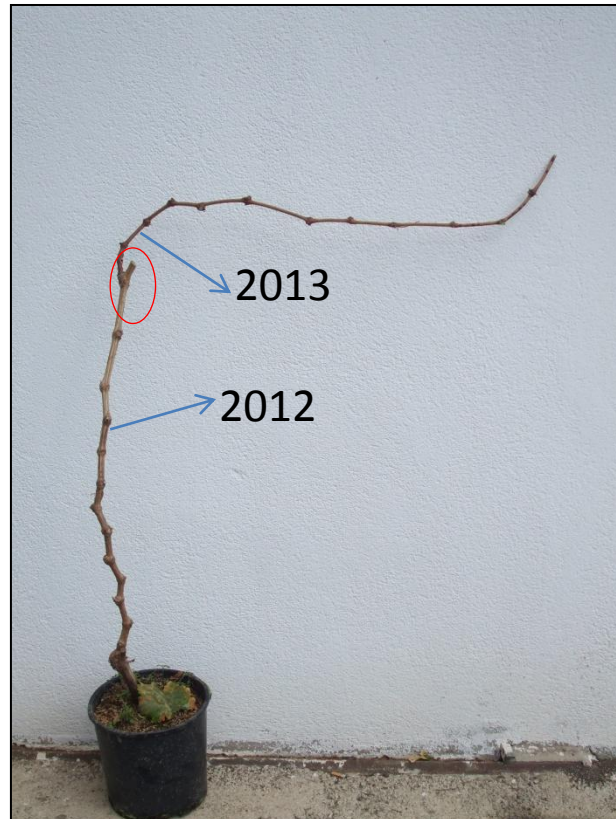
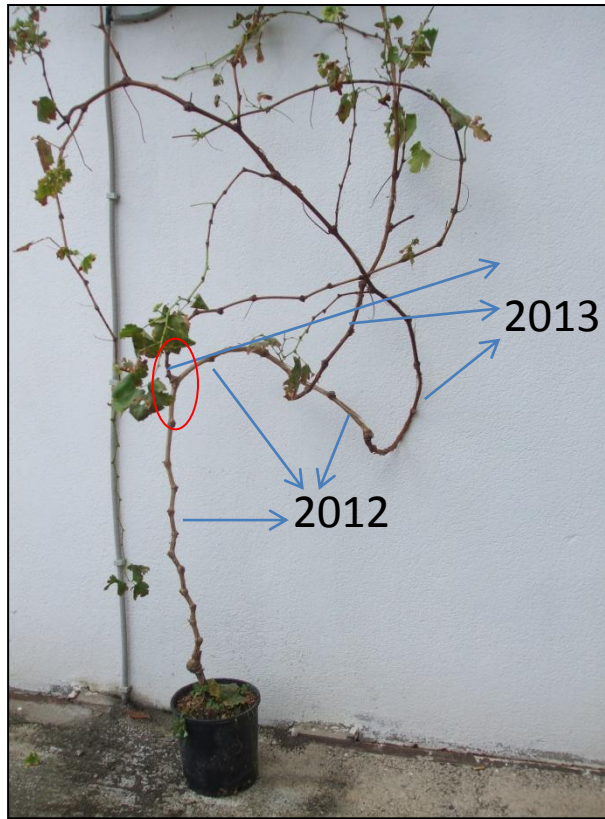


Regal seedless
July

Possibility to have two production cycles in the same year and greenhouse:

- *1st cycle* “ *January-June*” ;
- *2nd cycle* “ *July-October*”

Types of plants used in the second cycle

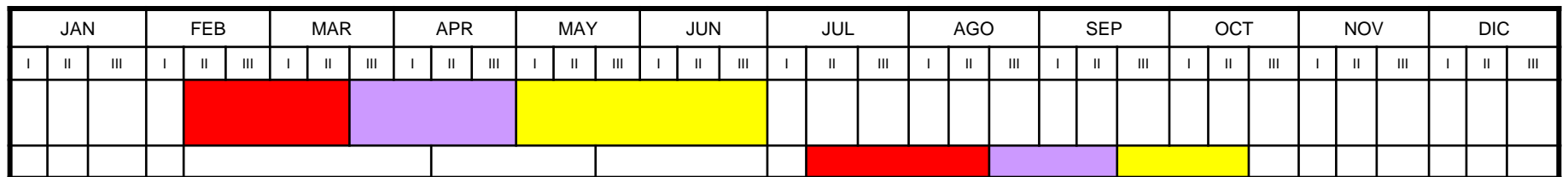


Plants that produced in the 1st cycle

Refrigerated vines

Phenology in the two production cycles

	Pruning	Bud break	Bloom	Veraison	Harvest
I st CYCLE	1 JAN	11 FEB	25 MAR	29 APR	10 JUN
II nd CYCLE	9 JUL	15 JUL	10 AUG	16 SEP	16 OCT
	Bud break - bloom	Bloom - veraison	Veraison - harvest	Bud break - harvest	
I st CYCLE	52	35	42	129	
II nd CYCLE	26	37	30	93	



Second vs first cycle

	Bud break – bloom		Bloom - veraison		Veraison – harvest	
	I st cycle	II nd cycle	I st cycle	II nd cycle	I st cycle	II nd cycle
Air Temperature (° C)		+ 9,7		+ 3,5		+ 2
Relative Humidity (%)	- 1,7		- 12			+ 11,4
Global radiation accumulation (W/mq)*		+ 1272	- 28		- 916	
VPD (kPa)		+ 0,65		+ 12,68	- 0,20	

Vegetative parameters

<u>Black magic</u>	I st CYCLE		II nd CYCLE			
			Refrigerated plants		Plants that produced in the I st cycle	
	media	e.s.	media	e.s.	media	e.s.
"Active" bud (n.)	9,3	0,68	7,5	0,41	6,6	0,36
% blind bud	37,1	-	21,0	-	35,7	-
% bud break	70,4	-	100,6	-	74,7	-

<u>Vittoria</u>	I st CYCLE		II nd CYCLE			
			Refrigerated plants		Plants that produced in the I st cycle	
	media	e.s.	media	e.s.	media	e.s.
"Active" bud (n.)	8.9	0.4	7.2	0.3	7.4	0.3
% blind bud	27.1	-	15.7	-	37.1	-
% bud break	87.6	-	108.3	-	72.9	-

4. High productivity

	Soilless	Open field
PLANT (Kg)	2,5 - 3,5	20-40
HECTARE (tons)	39 - 54	25 - 50

Yield per plant (kg) and per hectare (tons)

cv Black magic

I st CYCLE	2,9		45,2	
II nd CYCLE	Refrigerated plants		Plants that produced in the I st cycle	
	1,9	29,6	1,4	21,8
Total yield	4,8	74,8	4,3	67

cv Vittoria

I st CYCLE	3,1		48	
II nd CYCLE	Refrigerated plants		Plants that produced in the I st cycle	
	1,4	23	2,5	39
Total yield	4,5	71	5,6	87

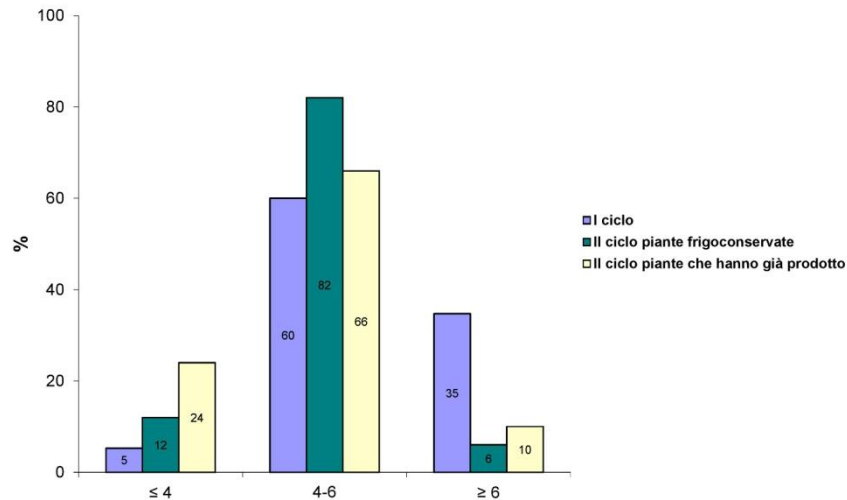
Quantitative parameters

<u>cv Black magic</u>	I st Cycle	II nd Cycle	
		Refrigerated plants	Plants that produced in the I st CYCLE
Shoot fertility	2.3	1.2	0.6
Bunch per vine	4	4,5	2,5
Bunch weight (g)	727	422	562
Berry weight(g)	5,8	4,8	4,9
Bunch compactness	1,4	1,5	3,3
Td/Tl	1,51	1,67	1,54

<u>cv Vittoria</u>	I st Cycle	II nd Cycle	
		Refrigerated plants	Plants that produced in the I st CYCLE
Shoot fertility	1.7	0.6	0.9
Bunch per vine	4	3.5	4
Bunch weight (g)	620	408	632
Berry weight(g)	7.2	8.6	9
Bunch compactness	2.1	3.02	2.8
Td/Tl	1.3	1.17	1.14

QUALITATIVE PARAMETERS

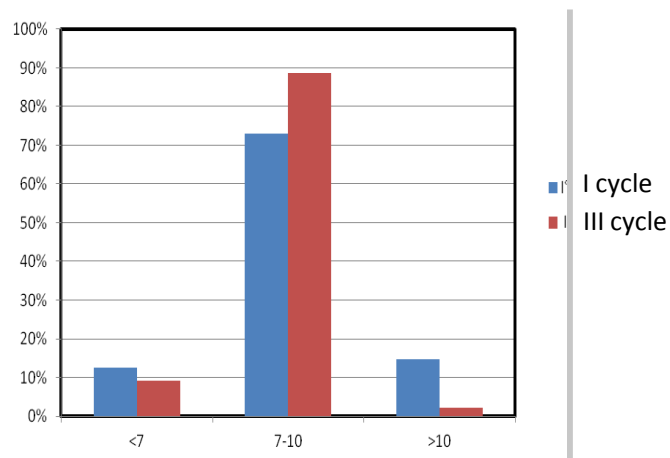
	1 st CYCLE		2 nd CYCLE Refrigerated plants		2 nd CYCLE Plants that produced in the 1 st CYCLE	
	Vittoria	Black magic	Vittoria	Black magic	Vittoria	Black magic
Total Soluble Solids (Brix)	12,9	15,2	13,1	13,6	13,2	12,3
TSS/TA (>20:1)	20	39	20	26,4	21	19,6



Productive capacity: effect of vine age (cv. Vittoria)

	I st cycle	III rd cycle
Shoot Fertility	1,15	1,17
Bunch per vine	5.9	5.3
Yield per vine (kg)	3.3	3.0
Yield per hectare(tons)	51	47
Bunch weight (g)	559	565
Berry weight(g)	8.6	8.5
Td/Ld	1.31	1.32

Berry weight: frequency classes



QUALITATIVE PARAMETERS	I st cycle	III rd cycle
Soluble Sugar (°BRIX)	12,7	11,6
TSS/TA	30,2	29

CONCLUSIONS

A close-up photograph of a grapevine with several clusters of green grapes. The leaves are vibrant green and the branches are brown and woody.

Soilless cultivation of table grapes is innovative process, ready for the definitive transfer into real production system.



The table grape growers will define, with exactness, the best areas of utilization and application of this new type of production





I want to thank all the working group:

Prof. M.G. Barbagallo
Dr. Antonino Pisciotta
Dr. Rocco Mafrica
Dr. Carlo Gambino

Dr. Biagio Dimauro
Dr. Gabriele Coffaro
Dr. Pietro Scafidi

and all students who have done the thesis and
the companies that hosted the research in the various years:

- Agrimed
- Fiorilla
- Salerno
- Vita
- Minio
- Lo Giudice
- Sorace

7 1:06 PM

THANKS FOR YOUR

ATTENTION



Financial statement per square meter for soilless table grapes cultivation

Voce	Riferimento	
PROFIT	€/Kg	€/m ²
Gross Profit (1.56 p/m ² x 2,85 Kg/pianta)	€ 1.50	€ 6,67
COSTS		
Amortization charge for the purchase of plant (duration 2 years)		€ 1.05
Amortization charge for the purchase of plastic covers (duration 2 years)		€ 0.30
Labour (98 gg/ha x €47,00/gg)		€ 0,47
Technical advice		€ 0,37
Materials for production		€ 1.50
unexpected expenses		€ 0,20
TOTAL		€ 3.89
Net Profit		€ 2.78