RESULTS OF THE DEMONSTRATION EXPERIMENTS ON CONTROLLING THE SOIL-BORNE PATHOGENS IN VEGETABLE CROPS, IN POLAND

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In 2011 and 2012 three demonstration experiments were conducted, in which different strategies for controlling the soil-borne pathogens in vegetable crops were compared

A. Experiment with bell pepper grown in unheated plastic greenhouses.

B. Experiment with greenhouse tomatoes in plastic tunnels.

C. Experiment with field-grown pickling-type cucumbers

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A tractor-mounted metam sodium applicator of 1.5 m working width, used for soil treatment in greenhouses

A compact metam sodium applicator of 2.5 m working width, suitable for greenhouse and field applications


Active steaming
SC600


Spreading the seed meal of *Brassica carinata*

Mean number of fruit sets on pepper plants (11.06.2011)

Treatment	In 1st and 2nd branching	Above 2nd branching	In total
Active steaming	1.65	2.45	4.1 cb
Dazomet 40 g/m²	0.9	2	2.9 cd
Dazomet + *T. asperellum*	1.95	4.1	6.05 a
Brassica carinata 150 g/m²	0.7	4	4.7 ab
B. carinata + *T. asperellum*	2.3	3.9	6.2 a
Control	1	0.5	1.5 d

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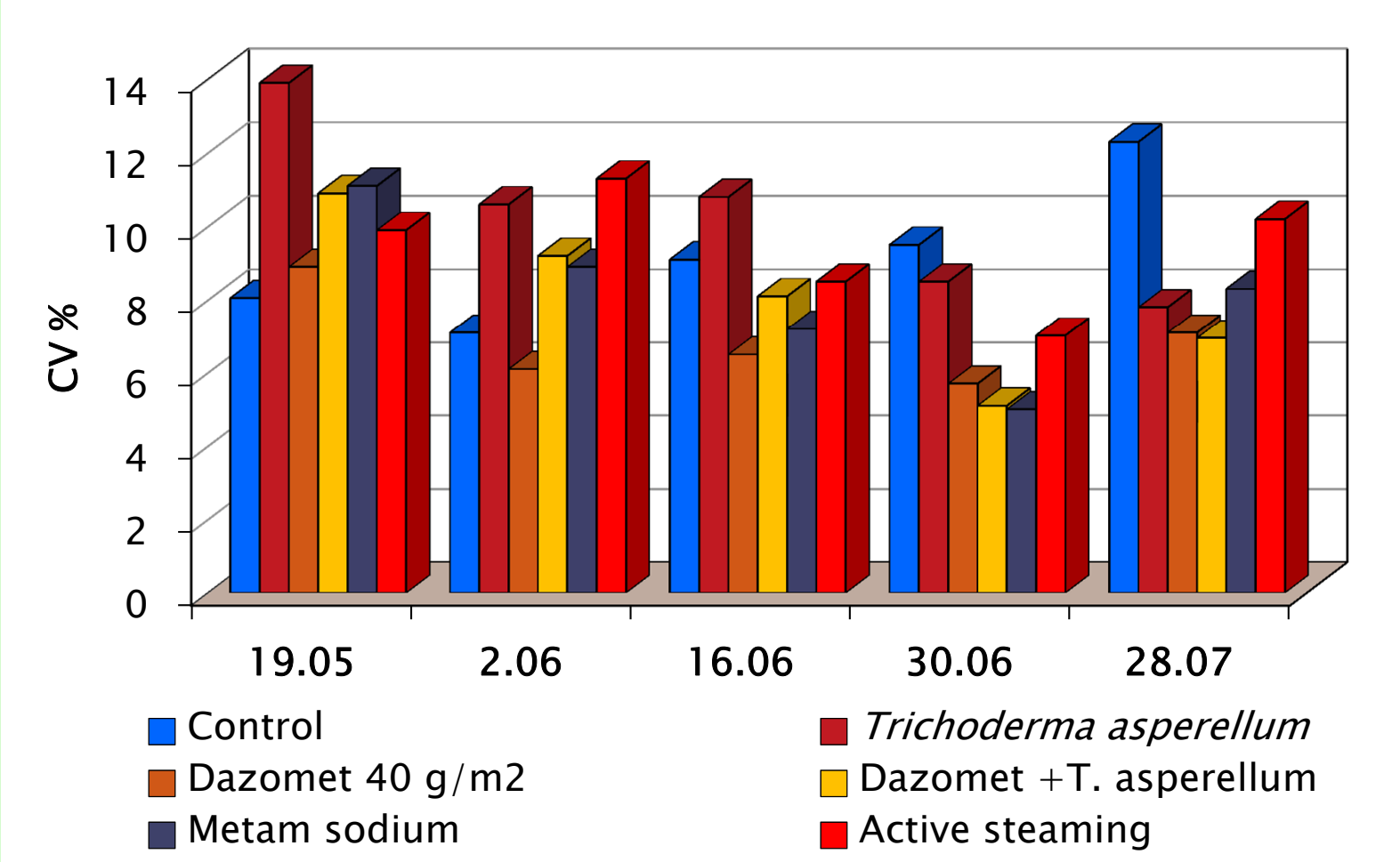
Uniformity of pepper plants, expressed as the coefficient of variation (CV) of the final plant height (2012)



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Early stage of *Verticillium* wilt of pepper

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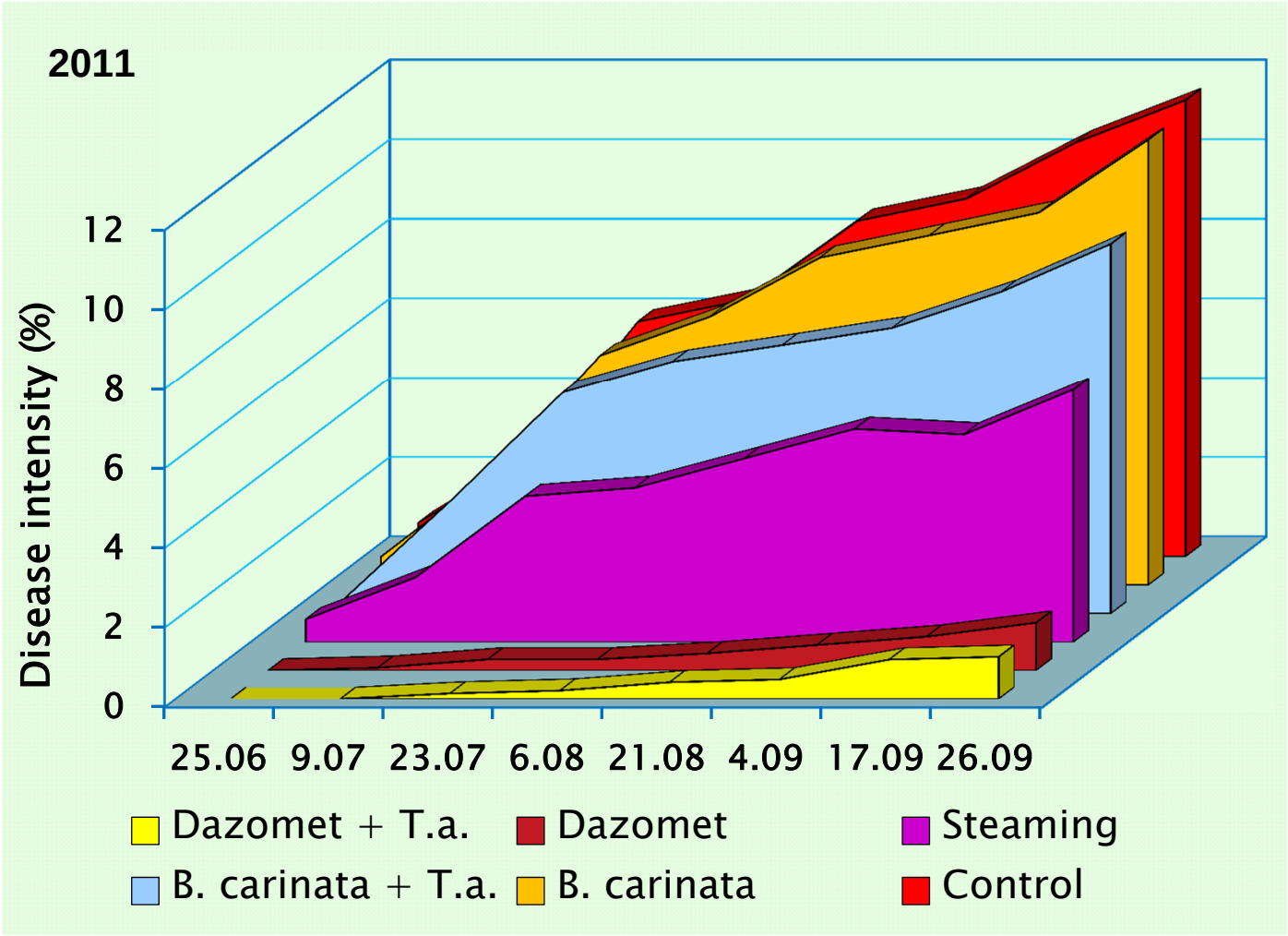
Progression of Verticillium wilt disease of bell pepper following different soil treatments. Disease intensity calculated according to the Townsend-Heuberger formula



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Effects of chemical, non-chemical and integrated soil treatments on the final incidence and intensity of Verticillium wilt disease of pepper (2011)

Treatment	Disease incidence (%)	Disease intensity according to Townsend-Heuberger's	Efficacy (%)	Area under the disease progress curve (AUDPC)
Active steaming	**9.9**	**6.36 b**	**44.6**	**358.9 b**
Dazomet 40 g/m^2	**1.8**	**1.20 c**	**89.5**	**38.6 c**
Dazomet +*T. asperellum*	**1.4**	**1.06 c**	**90.8**	**33.4 c**
B. carinata 150 g/m^2	**18.0**	**11.20 a**	**2.4**	**615.1 a**
B. carinata +*T. asperellum*	**14.8**	**9.30 ab**	**19.0**	**538.7 ab**
Control	**18.7**	**11.48 a**	**–**	**628.2 a**

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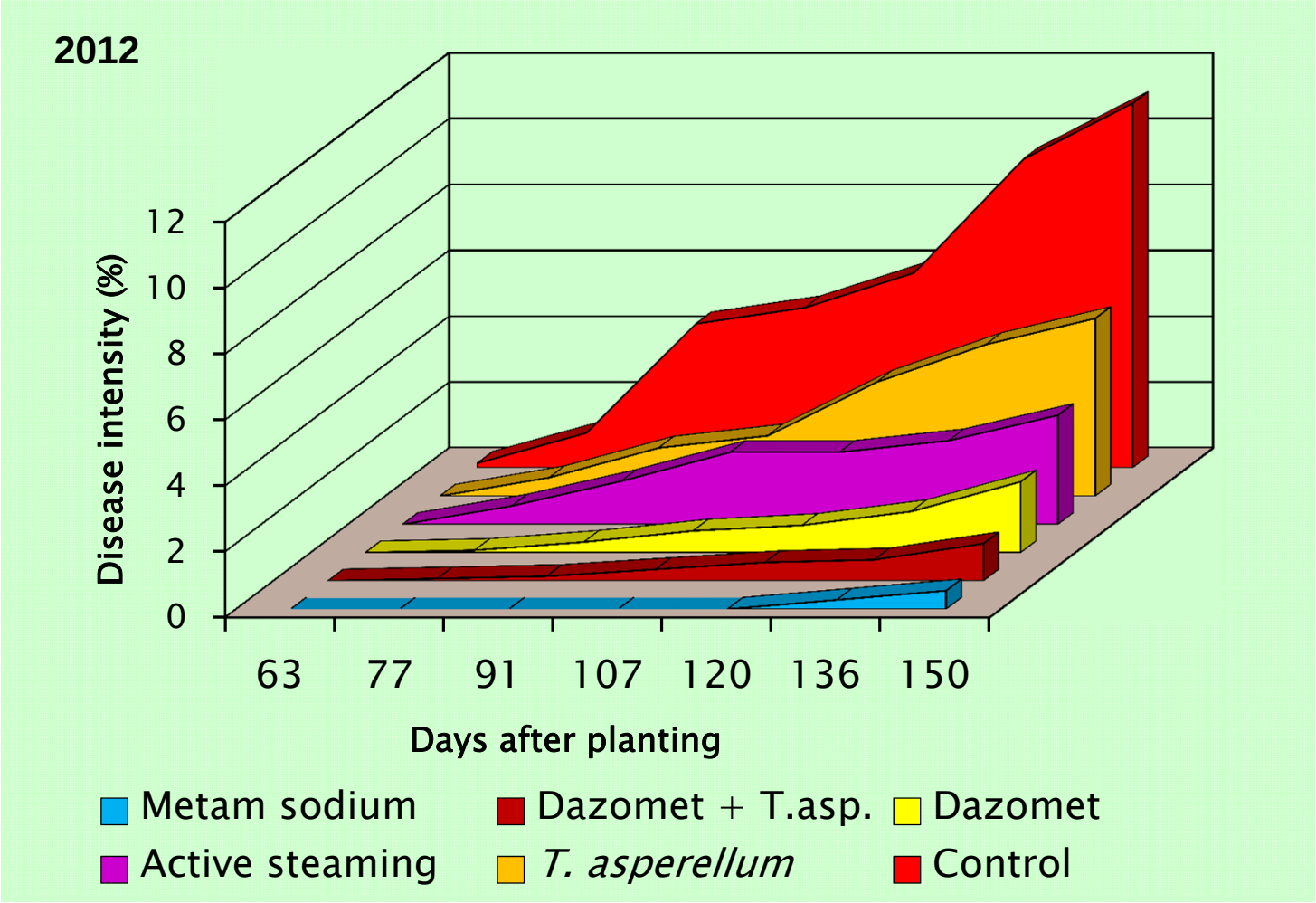
Progression of Verticillium wilt disease of bell pepper following different soil treatments. Disease intensity calculated according to the Townsend-Heuberger formula



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Effects of chemical, non-chemical and integrated soil treatments on the final incidence and intensity of Verticillium wilt disease of pepper (2012)

Treatment	Disease incidence (%)	Disease intensity according to Townsend-Heuberger's	Efficacy (%)	Area under the disease progress curve (AUDPC)
Active steaming	**7.1**	**3.31 bc**	**61.8**	**152.3 b**
Dazomet 40 g/m^2	**2.3**	**2.15 cd**	**87.6**	**61.2 c**
Dazomet +*T. asperellum*	**2.1**	**1.13 cd**	**88.7**	**33.8 c**
Metam sodium 70 ml/m^2	**1.4**	**0.56 d**	**92.5**	**8.1 c**
Trichoderma asperellum	**8.7**	**5.39 b**	**53.2**	**213.2 b**
Control	**18.6**	**11.06 a**	**–**	**455.7 a**

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Final severity of root rot of pepper, caused by a complex of soil-borne pathogens (2011)

Treatment	Disease severity index (0-5 scale)	Square-root transformed values of DSI (Freeman-Tukey)	Reduction of DSI (%)
Active steaming	2.23 b	3.29 ab	24.4
Dazomet 40 g/m^2	1.02 d	2.42 c	64.4
Dazomet +	0.91 d	2.34 c	69.2
B. carinata 150 g/m^2	1.82 bc	3.03 b	38.3
B. carinata +*T. asperellum*	1.47 cd	2.78 bc	50.2
Control	2.95 a	3.71 a	-

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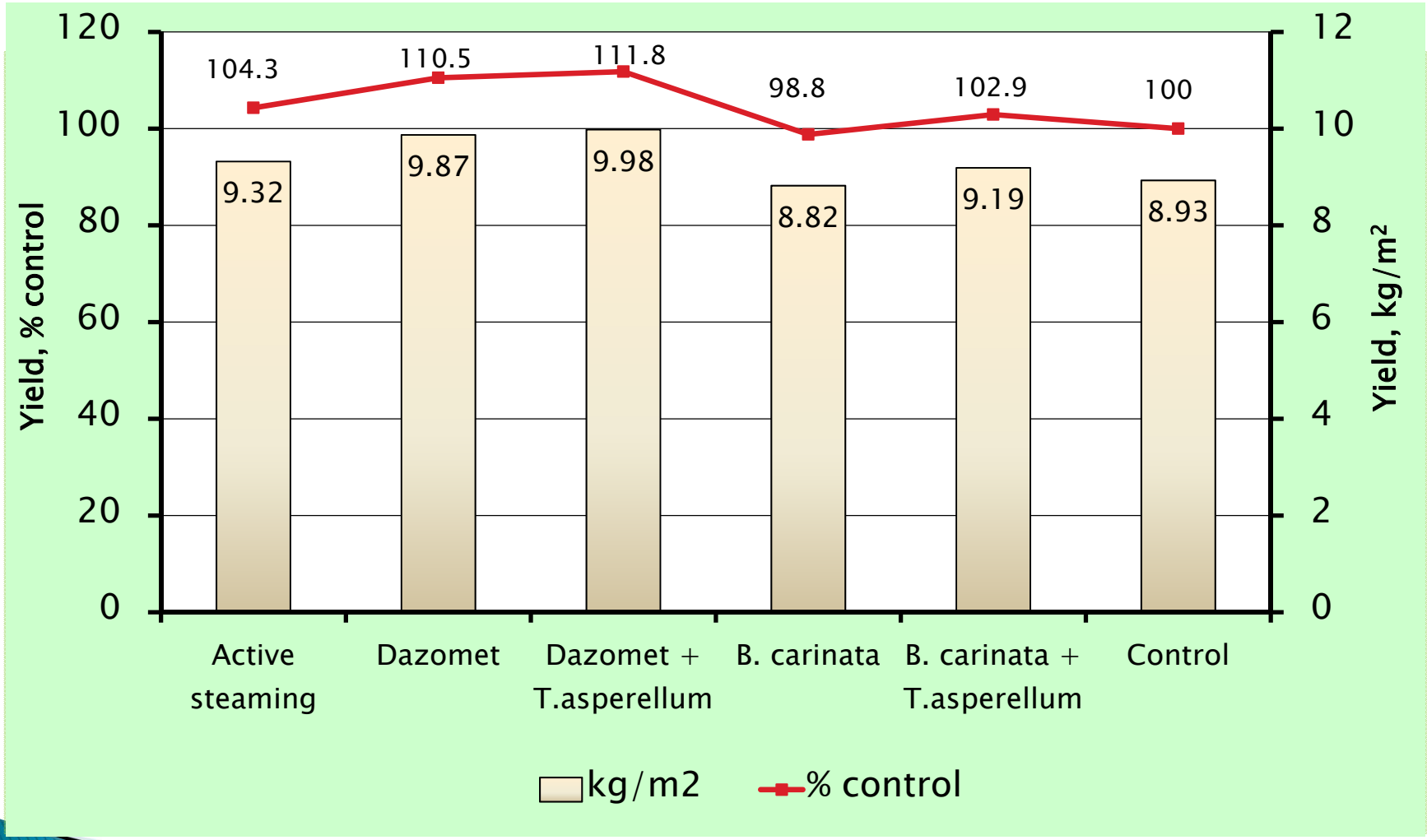
Pepper root health status following different soil treatments

Marketable yield of bell pepper following different soil treatments in plastic tunnels (2011)



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Mean number of fruit sets on cucumber plants, 40 (2011) and 47 (2012 days after sowing

Treatment	No of fruit sets		% control	
	2011	2012	2011	2012
Basamid 97 GR 40 g/m²	10.85 bc	11.7 b	108	150.0
Nemasol 510 SL 90 ml/m²	10.05 c	15.8 a	100	190.4
Nemasol 510 SL 60 ml/m²	10.0 c	15.0 a	99.5	180.7
Telopic C35 EC 35 ml/m²	15.05 a	13.8 a	149.8	166.3
Telopic C35 EC 50 ml/m²	13.45 ab	10.3 b	133.8	124.1
Brassica carinata 130 g/m²	-	8.9 c	-	107.2
Control	10.05 c	8.3 c	100	100

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Effect of different soil treatments on the vigour of field-grown cucumber plants. Assessment on a 0-5 scale

Treatment	Date of assessment		
	23.07.2011	6.08.2011	20.08.2011
Basamid 97 GR 40 g/m²	4.0	3.3	2.3
Nemasol 510 SL 90 ml/m²	4.3	3.5	2.5
Nemasol 510 SL 60 ml/m²	4.3	3.5	2.5
Telopic C35 EC 35 ml/m²	4.0	3,5	2,5
Telopic C35 EC 50 ml/m²	4.0	3.3	2.3
Control	3.0	2.0	1.0

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Effect of evaluated fumigants on weed control in cucumber culture (assessment on a 0–5 scale)

Treatment	Date of assessment		
	23.07.2011	6.08.2011	20.08.2011
Basamid 97 GR 40 g/m^2	0.5	0.75	1
Nemasol 510 SL 90 ml/m^2	0.25	0.5	0.75
Nemasol 510 SL 60 ml/m^2	0.0	0.25	0.25
Telopic C35 EC 35 ml/m^2	0.25	0.5	0.5
Telopic C35 EC 50 ml/m^2	0.5	1.25	1.25
Control	2.5	3.5	4

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Effect of soil fumigation on marketable yield of field cucumbers

Treatment	Marketable yield	
	t/ha	% control
Basamid 97 GR 40 g/m²	51.1	163.2
Nemasol 510 SL 90 ml/m²	38.1	121.8
Nemasol 510 SL 60 ml/m²	53.7	171.4
Telopic C35 EC 35 ml/m²	43.5	139.1
Telopic C35 EC 50 ml/m²	52.7	168.4
Control	31.3	100

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Grafted tomato plant

Even though modern tomato cultivars are resistant to numerous soil-borne fungi, grafted plants are being used on an increasing scale both in soil and soilless cultures.

This technique does not protect from infection with zoosporic pathogens (*Pythium* spp. *Phytophthora* spp. *Olpidium* spp.)

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Effect of soil fumigation and grafting of tomato plants on mean number of tomato fruits in the first and the second clusters

Soil treatment	Grafted plants		Non-grafted		Increase in fruit number caused by grafting (%)	
	I cluster	II cluster	I cluster	II cluster	I cluster	II cluster
Basamid 40 g/m²	**8.6**	**6.7**	**7.5**	**5.6**	**14.7**	**19.6**
Basamid 30 g/m²	**8.7**	**6.8**	**7.3**	**5.3**	**19.2**	**28,3**
Untreated	**8.8**	**6.8**	**6,4**	**5.0**	**37.5**	**36.0**

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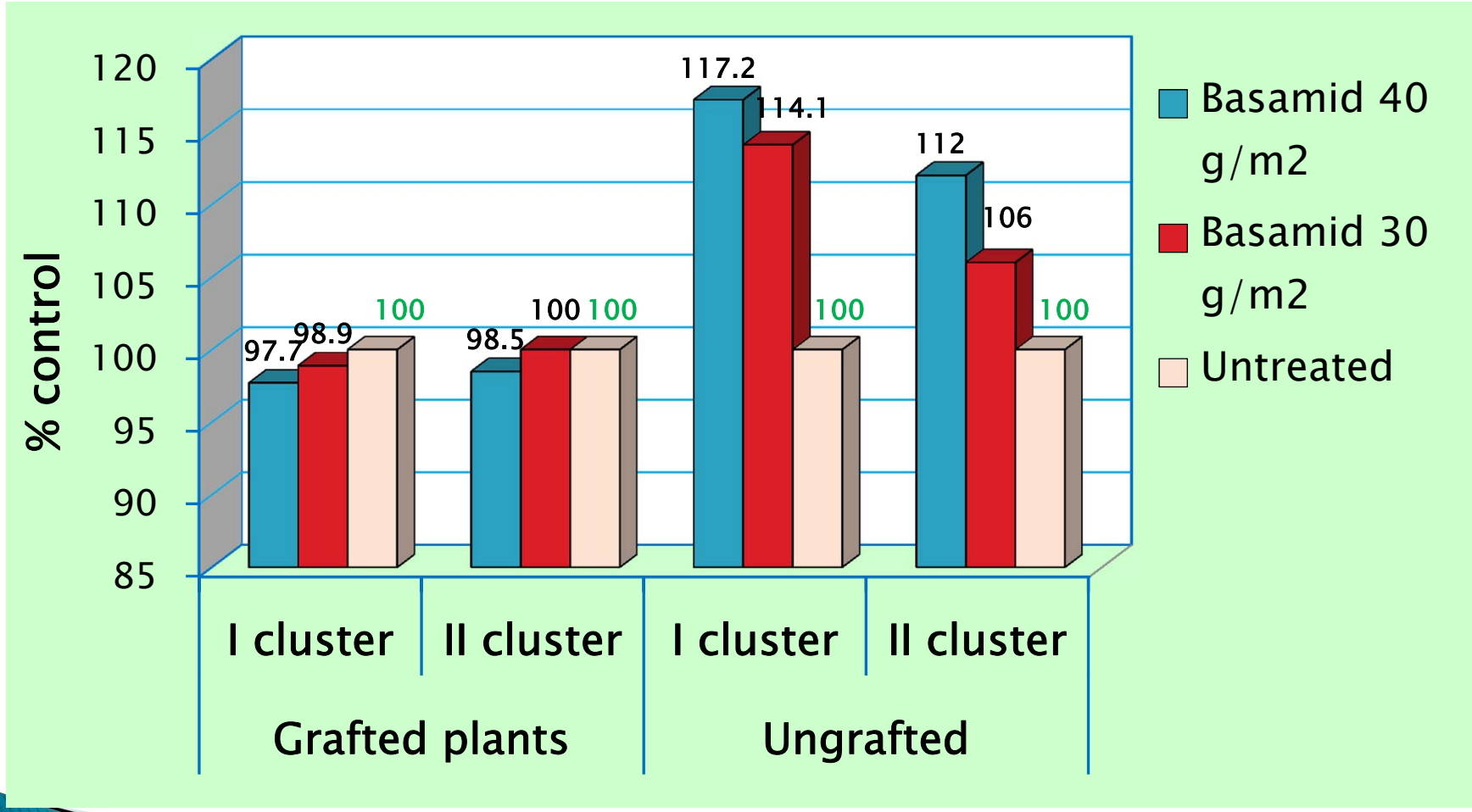
Effect of soil treatment with Basamid 97 GR (dazomet) on the number of tomato fruits on grafted and ungrafted plants, expressed as percentage of untreated soil



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Conclusions

- Combined application of dazomet and *Trichoderma asperellum* (Vital Plus) provided the best control of Verticillium wilt of pepper (89-91%), the best reduction of root rot severity and the highest pepper yield.

- The biocontrol performance of nonchemical treatments, such as *Brassica carinata* and *Trichoderma asperellum* alone or in combination, applied in pepper culture, was too low to be accepted by commercial growers.

- In the trials with field cuccumbers, the efficacy of lower application rates of metam sodium (Nemasol) and 1,3-D+CP (Telopic) in terms of biomertic parameters, weed control and yield was similar or better than the efficacy of higher rates.


Thank you for your attention