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Low-residue apple production compared to common integrated and organic production

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Introduction

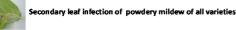
In a field trial with Golden Delicious and the scab resistant varieties Topaz, Otava and Ariane, common crop protection strategies for integrated and organic apple production were compared to a low-residue strategy with reduced use of synthetic fungicides. Pest and weed control was identical to the integrated strategy. In all strategies, insecticides were used only if damage thresholds were exceeded and alternative measures were applied, being mating disruption against codling moth, mulching of leafs to reduce scab inoculum and exclosure netting to prevent pest invasion.



Results

Scab infection of Golden Delicious

			Infection incidences											
Time		Plant part	IP I	LR	Bio	Control								
2009	Summer	leaves	0.0%	0.0%	22.0%	37.5%								
	At harvest	fruits	1.5%	33.0%	30.0%	97.5%								
2009	Summer	leaves	0.3%	0.0%	0.8%	26.5%								
	At harvest	fruits	0.0%	0.8%	3.0%	65.3%								
2010	Summer	leaves	0.25%	0.5%	24.5%	46.0%								
	At harvest	fruits	1.25%	0.25%	11.75%	96.5%								
2011	Summer	leaves	0%	0.5%	14.3%	27.8%								
	At harvest	fruits	0%	0.3%	10.3%	54.5%								
2012	Summer	leaves	0%	0%	20.5%	39.0%								



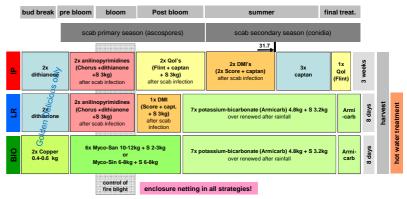
				Infection	incidences	
Time		Variety	IP	LR	Bio	Control
2008	Summer	Golden Del.	5.0%	6.5%	17.5%	33.0%
		Ariane	14.5%	15.5%	22.0%	41.5%
		Otava	9.0%	8.0%	13.5%	44.5%
		Topaz	10.0%	11.0%	17.5%	33.5%
2009	Summer	Golden Del.	4.5%	2.3%	15.5%	54.2%
		Ariane	5.5%	4.5%	21.0%	52.8%
		Otava	6.0%	6.0%	22.0%	37.3%
		Topaz	4.3%	5.0%	16.8%	29.3%
2010	2010 Summer	Golden Del.	1.3%	6%	8.8%	39.8%
		Arlane	3.0%	4.0%	8.8%	17.5%
		Otava	2.8%	2.8%	19.8%	42.0%
		Topaz	3.5%	1.3%	10.3%	15.0%
2011	Summer	Golden Del.	5.8%	4.8%	13.3%	21.8%
		Ariane	16.5%	8.3%	17.8%	29.5%
		Otava	11.3%	9.3%	12.5%	32.0%
		Topaz	14.3%	6.5%	6.8%	17.8%
2012	Summer	Golden Del.	9.5 %	1.8%	5.8%	9.5%
		Arlane	1.8 %	1.5%	5.3%	13.8%
		Otava	2.5 %	5.0%	6.8%	14.0%
		Topaz	1.8%	3.0%	8.8%	7.3%

Crop protection strategies



integrated pest management according to ACW recommendations low pesticide residue production of high quality fruits organic pest management according to Swiss BIO-guidelines

Disease Control



Pest & Weed Control, Thinning

	aphids	codling moth	smaller fruit tortix	weed control	thinning			
IP	1x triazamate (Aztec)		1x fenoxycarb (Insegar)	herbicides	Chemical			
LR	ahead of boom	and the suffragment of	end of May	nerbicides	Chemical			
BIO	1x azadichratin A (Neem Azal) ahead of boom	mating disruption	1x spinosad (Audienz) end of May	mechanical weeding	Mechanical (Darwin)			



Damages after 5 month of storage at 4°C

(LR: low residue; HW: post harvest hot water treatment for low-residue and Bio)

	Variety	Storage scab						Bull's eye rot					other						total damage						
Time			LR	LR W	Bio	Bio HW	С	IP	LR	LR HW	Bio	Bio HW	с		LR	LR HW	Bio	Bio HW	С		LR	LR HW	Bio	Bio HW	С
2009	Golden Del	0.0	0.3	228	1.3	220	58.1	0.2	2.7	2 <u>11</u> 2	10.0	122	2.3	3.0	4.0	225	6.0	220	5.0	3,4	6.8	-22	17.1	1022	60.9
	Ariane	0.0	0.0		0.0	-	0.0	0.1	0.4	-	0.6	1.00	2.8	23.6	16.2		13.7		11.4	23.7	16.6		14.3	-	14.2
	Otava	0.0	0.0	223	0.0	-	0.0	0.3	6.3	-	7.1	312	24.8	4.0	2.7	243	3.1	-	7.6	4.3	9.0	1222	10.2	<u></u>	32.4
	Topaz	0.0	0.0	0.0	0.0	0.0	0.0	1.6	13.3	1.5	26.5	1.5	34.3	1.4	0.7	7.5	1.8	2.2	3.3	3.0	14.0	9.0	28.3	3.7	37.6
2010	Golden Del.	0.3	4.0	1.2	4.3	3.2		1.3	9.1	0.0	9.6	0.2	-	3.7	7.3	5.3	21.0	28.1		5.2	20.4	6.5	35.0	31.4	
	Ariane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.9	0.0	1.9	14.2	6.4	8.9	5.0	5.3	19.6	14.2	7.0	8.9	5.8	5.3	21.5
	Otava	0.0	0.0	0.0	0.0	0.0	0.0	12.0	65.5	5.3	37.7	3.1	61.3	4.1	4.0	82.1	6.4	96.2	7.5	16.1	69.5	87.4	44.0	99.3	68.8
	Topaz	0.0	0.0	0.0	0.0	0.0	0.0	3.1	52.1	4.1	40.0	1.0	58.0	2.4	1.1	4.0	0.7	6.8	3.7	5.5	53.2	8.1	40.7	7.8	61.7
2011	Golden Del.	0.0	8.5	4.5	54.0	46.9	81.9	0.2	4.5	0.4	2.5	0.7	3.4	6.9	2.9	5.3	6.9	11.5	0.3	7.1	15.9	10.3	61.8	59.1	85.7
	Ariane	0.0	0.0		0.0		0.0	1.7	6.3	-	2.4		3.8	19.8	12.0	-	5.5	1.00	16.3	21.4	18.4	-	7.8	-	20.0
	Otava	0.0	0.0	-	0.0	-	0.0	4.7	29.1	-	32.7	2	27.1	6.1	6.1	-	8.4	-	11.3	10.7	35.2	-	41.1	-	38.4
	Topaz	0.0	0.0	0.0	0.0	0.0	0.0	12.3	60.8	6.4	73.7	5.9	59.9	3.0	2.1	2.9	3.0	8.5	9.4	15.4	62.9	9.2	76.7	14.4	69.3

Summary

In the first year, fungicide application was interrupted in summer in the low-residue strategy. Compared to the integrated strategy, this resulted in increased incidence of fruit scab on Golden Delicious and bull's eye rot on Golden Delicious and Topaz. From the second year on, synthetic fungicides were used in Low-Residue until end of bloom. After bloom, control of diseases was done with potassium bicarbonate and sulphur. No pesticide residues could be detected with this strategy and good control was achieved for scab on Golden Delicious and powdery mildew on all varieties. Ariane was the most robust variety. Bull's eye rot at storage on Golden Delicious and Topaz remained the weakness of the low-input strategy. Hot water treatments after harvest reduced the incidence of this disease. No relevant losses due to pests were observed in any strategy during four years. The trial will be continued to collect further information on crop protection efficacy and profitability, aiming at recommendations for farmers.



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