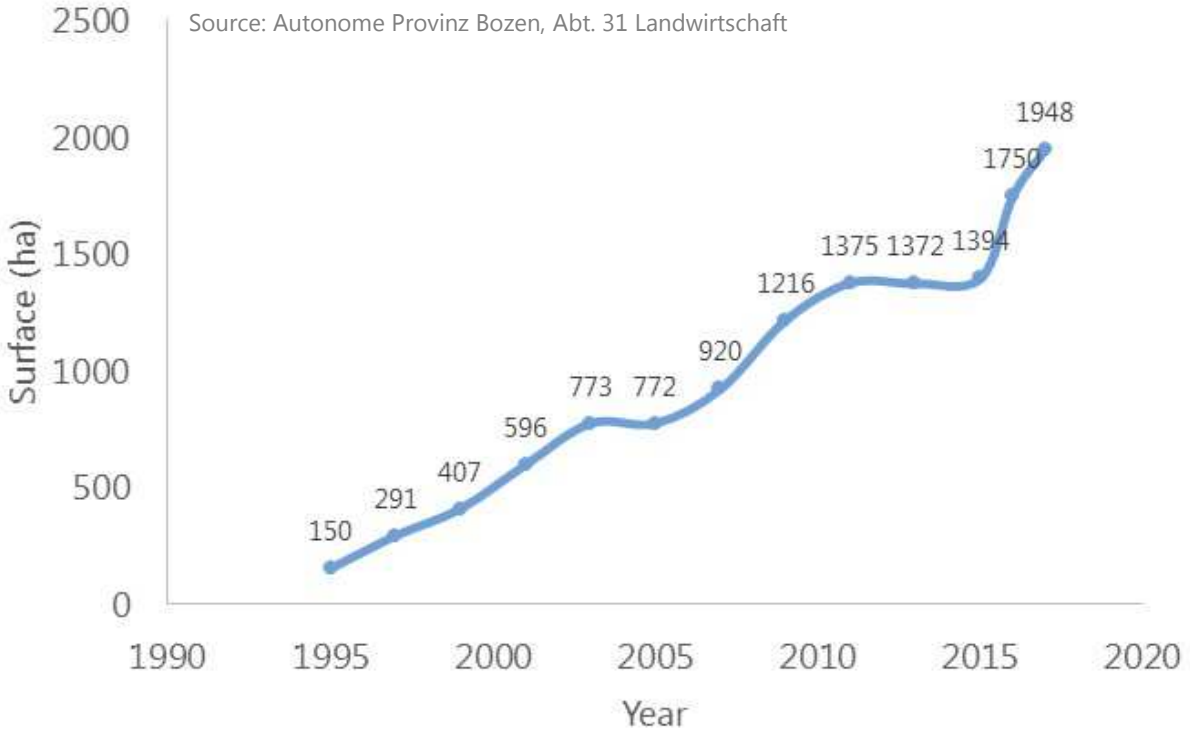
Versuchszentrum
Centro di Sperimentazione
Research Centre
LAIMBURG
NATURE & SCIENCE: HAND IN HAND

Research activity 2017

Kelderer, Strobl & organic fruit team

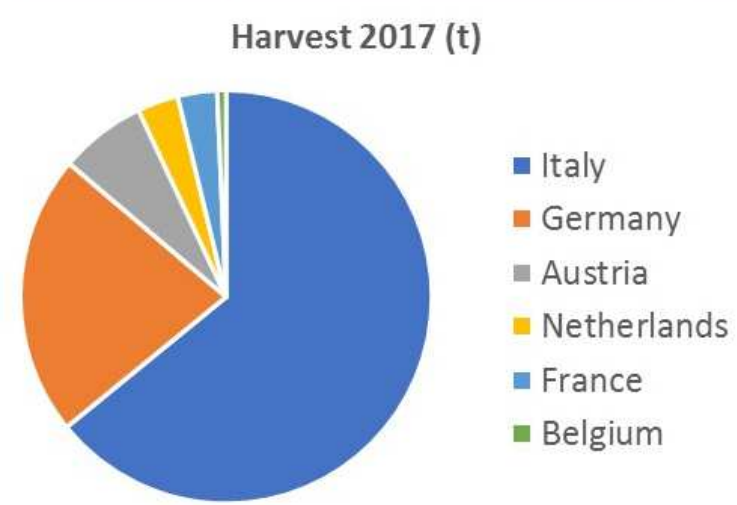
Increase of the surface of organic apple cultivations in South Tyrol



31.12.2016: 639 organic apple growers

Organic apple production per country (2015 – 2017)

Country	Harvest 2015 (t)	Portion of the EU-organic-production 2015 (%)	Harvest 2016 (t)	Portion of the EU-organic-production 2016 (%)	Harvest 2017 (t)	Portion of the EU-organic-production 2017 (%)
Italy	64.230	47	78.495	52	75.685	**64**
Germany	39.613	29	54.702	36	26.001	**22**
Austria	19.567	15	5.443	4	8.021	**7**
Netherlands	5.745	4	5.657	4	3.811	**3**
France	4.621	3	3.831	2	3.654	**3**
Belgium	2.443	2	2.721	2	819	**1**
Total	**136.219**	**100**	**152.865**	**100**	**117.991**	**100**



Presentation of the working Group for Organic Farming

Active at Laimburg Research Centre since 1993

Head of the working group:
- Markus Kelderer

FOTO

Permanent employees:
- Claudio Casera
- Ewald Lardschneider

Interns

Projekt staff:
- Anne Topp (part-time)
- Josef Telfser
- Thomas Holtz

EcoOrchard

LOGO DOMINO?

Research activities 2017

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Topic	treatments	locations	Lb/private	Execution
Functional biodiversity (botanic)	3	3	Lb/Private	Josef Telfser
Functional biodiversity (entomology)	2	2	Lb	Josef Telfser
Functional biodiversity (network)	4	1	Private	Josef Telfser
Residues K3PO4 apple + vineyard	10, 8	2	Lb	Claudio Casera
Residues paraffin oil, aminoalcole, Cu	5, 4, 2	2	Lb	Claudio Casera
Anti drift nozzles	3, 2	2	Lb	Ewald Lardschneider
Thinning Lime sulfur	5	5	Lb	Ewald Lardschneider
Thinning Oil	6	2	Lb	Ewald Lardschneider
Primary scab treatment	12	2	Lb	Claudio Casera
Primary scab cover	2	2	Lb	Claudio Casera
Secondary scab	12	4	Lb	Claudio Casera
Soy lecithin	2	2	Lb	Claudio Casera
Sooty blotch or mold (field)	10	2	Lb	Claudio Casera
Sooty blotch (post harvest)	23	2	Lb	Claudio Casera
Gleosporium (field)	5	1	Lb	Claudio Casera
Gloeosporium (post harvest)	5	2	Lb	Claudio Casera
Sprinkler test for lime sulfur	7	2	Lb	Claudio Casera
Rosy apple aphid	4	1	Lb	Claudio Casera
Woolly aphid pruning	2, 10	2	Lb	Ewald Lardschneider
Woolly aphid - plant protection products	5	1	Lb	Ewald Lardschneider

Research activities 2017

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Topic	treatments	locations	Lb/private	Execution
Woolly aphid (varieties and rootstock)	3	1	Lb	Ewald Lardschneider
Summer fruit tortrix	6	1	Lb	Ewald Lardschneider
Codling moth – netting systems	14	4	Lb	Claudio Casera
Cockchafer Neem	2	1	Private	Ewald Lardschneider
Apple Proliferation netting systems	5	1	Lb	Ewald Lardschneider
Apple Proliferation – plant proteccion	4	2	Private	Ewald Lardschneider
Apple varieties under organic cond.	6, 10, 18	3	Private/LB	Ewald Lardschneider
Apple varieties Org - IP	22, 34	2	Lb	Ewald Lardschneider
Natyra rootstocks	2	2	Lb	Ewald Lardschneider
fertilization tests	15	2	Lb/Latsch	Anne Topp
Apple replant desease	12, 12	2	Lb/Latsch	Anne Topp
Stop treatments Plasmopora	15	1	Lb	Claudio Casera
Viticulture brush	4, 3, 2, 15	7	Private/LB	Ewald Lardschneider
Viniculture varieties	25	1	Lb	Ewald Lardschneider
Plant-strengtheners strawberries	8	1	Lb	Sebastian Soppelza
Plant-strengtheners apple	8	2	Lb	Sebastian Soppelza
Sick Soil Syndrome strawberries	4	1	Lb	Andreas Rossi
Nutrient balance IP - Org			Lb	Simon& Tobias
fertilization tests	8	1	Lb	René Schütz

Research activities 2017

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Residues paraffin oil, aminoalcole, Cu	5, 4, 2	2	Lb	Claudio Casera
Anti drift nozzles	3, 2	2	Lb	Ewald Lardschneider
Thinning Lime sulfur	5	5	Lb	Ewald Lardschneider
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Rosy apple aphid	4	1	Lb	Claudio Casera
Woolly aphid pruning	2, 10	2	Lb	Ewald Lardschneider
Woolly aphid - plant protection products	5	1	Lb	Ewald Lardschneider

Research activities 2017

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Sick Soil Syndrome strawberries	4	1	Lb	Andreas Rossi
Nutrient balance IP - Org			Lb	Simon& Tobias
fertilization tests	8	1	Lb	René Schütz

http:// coreorganicplus.org/research-projects/ecoorchard

Goal: Promotion of the functional Biodiversity in ecological Apple Orchards through the seeding of flowering plants in the middle of the tramline

Trials:
Botanic trial in Block 1 and 12 Laimburg:
Comparison of the Performance of two different seed mixtures (simple and cheaper, partially cultivated vs complex compositions, wild exemplars).

Entomologic trial in Block 25 and 27 Laimburg:
What impact deos the sowed flower strip in the centre of the tramline (ca. 50 cm) have regarding the infestation of the rosy apple aphid and codling moth?

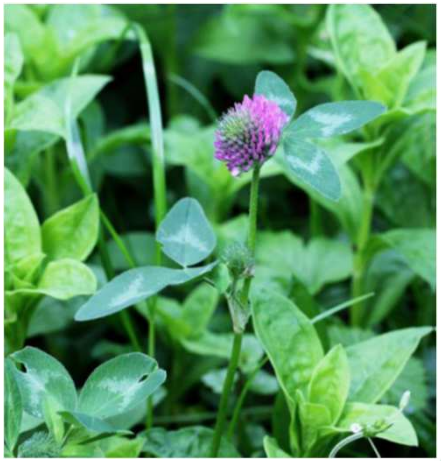
Trial orchards: Block 1, Block 12, Block 25, Block 27 at the Laimburg Research Centre

Plant protection: normal organic strategy against fungi (application of cupper and sulphur products), complete abdication of treatments against pests

FAB Plants

Vicia sepium

Carum carvi



Trifolium pratense

Centaurea pratensis

Lotus corniculatus

Daucus carota

Cardamine pratensis

Flower strips promote natural enemies

Natural enemies were significantly more abundant on trees in the flower strip plots than in the control plots

Throughout the season, the average number of generalist predators was higher in the flower strip plots than in the control plots.

The average number of Coccinellidae in 2016 (AF) in the flower strip plots was almost twice as high as in the control plots.

Similarly, the average number of Forficulidae in 2016 was about one third (AF) and two thirds (FD) higher in the flower strip plots than in the control plots.

The average number of Syrphidae in 2017 was about one third (PF, AF) and two thirds (FD) higher in the flower strip plots than in the control plots.

Flower strips for pest control

Fruit damage caused by D. plantaginea after the second fruit drop was significantly reduced from an average of 7.2 % in the control plots to 5.9 % in the flower strip plots.

The number of larvae, cocoons and pupae of codling moth dropped more from 2016 to 2017 in the flower strip plots compared to the control plots, indicating a positive control effect of the flower strips.

Due to the low fruit yield in 2017 (frost), however, the resulting relative fruit damage in 2017 was higher than in 2016. But the increase in fruit damage caused by codling moth from 2016 to 2017 was lower in the flower strip plots compared to the control plots.

DOMINO PROJECT

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http://

Goal: Improve the long term sustainability and ecological footprint of intensive organic fruit orchards by a) introducing new organic fertilizer (local available and derived from organic waste), b) using transitory overhead covering for crop protection against pests, c) introducing a second cash crop in the rows.

Trials:
Incubations of organic fertilizers in order to determine the Nmin and N dynamics.
Screening and test of wild and cultivated plants as secondary cash crops to be grown in the orchard
Evaluation of different covering systems against insects and desease

Laimburg is partecipating as european partner of the consortium in collaboration with:

FiBL

InHort SKIERNIEWICE

UNIVERSITY OF HOHENHEIM

UNIVERSITÀ POLITECNICA DELLE MARCHE

Landwirtschaftliches Technologiezentrum Augustenberg

Description of the experimental orchards where the covering systems were tested

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Plot	Years	Variety / Rootstock	Plant. year	Plant. distance	Orchard management	Covering system	Topic
1	2011 - 2017	Fuji / M9	2003	3,4 x 1	certified organic	single row[1]	codling moth
110	2010 - 2017	Nicoter / M9	2006	3,0 x 0,8	IPM	plot system[2]	codling moth
53	2011 - 2017	Braeburn / M9	2006	3,2 x 0,8	IPM	single row/plot system	codling moth
103	2015	Fuji / M9	1998	3,2 x 0,9	IPM	Keep in touch®[3]	disease
41	2016 - 2017	Fuji / M9	2003	3,0 x 0,8	IPM	Keep in touch®	disease
82	2015	Cripps Pink / M9	2001	3,0 x 0,9	IPM	Keep in touch®	disease
93	2016 - 2017	Cripps Pink / M9	2012	3,0 x 0,9	IPM	Keep in touch®	disease
1	2010	Gold Rush / M9	2010	3,4 x 1,2	certified organic	single row	crop regulation
64	2011	Golden Reinders / M9	2011	3,2 x 0,9	IPM	single row	crop regulation
1	2014	Pinova / M9	2014	3,4 x 1	certified organic	single row	crop regulation

[1]**single row:** the single row was covered with a hail net (3x8mm)

[2]**plot system:** a plot was covered with a hailnet on the top and on the border (3x8mm)

[3] **Keep in touch®:** www.keepintouchsystem.eu

Kelderer, M., Casera, C., Lardschneider, E., Telfser, J. (2018). Field trials in apple orchards with different covering methods to reduce plant protection treatments and yield losses due to pest and diseases. . Proceeding of 18th International Conference on Organic Fruit-Growing, 19–21 February 2018, Hohenheim, Germany. Fördergemeinschaft Ökologischer Obstbau E.V. (Ed.), Weinsberg, Germany, pp. 64-17.

Codling moth control trial 2008-2017

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Roof cover system vs. Single row cover system

Kelderer, M., Casera, C., Lardschneider, E., Ranier, A. (2010). Controlling codling moth with different netting structures and their influence on crop yield and quality. Proceeding of 14th International Conference on Organic Fruit-Growing, 22–24 February 2010, Hohenheim, Germany. Fördergemeinschaft Ökologischer Obstbau E.V. (Ed.), Weinsberg, Germany, pp. 183-190.

Percentage of fruits affected by codling moth at harvest

Treatment	Variety	*Cydia pomonella* -% affected fruits at harvest							
		2010	2011	2012	2013	2014	2015	2016	2017
Hail net - roof system	Braeburn	4,9	5,4	5,7	3,7	6,0	7,9	22,8	38,7
Hail net - single row, downside open	Braeburn	2,3	2,8	3,4	2,2	5,6	3,6	8,5	4,0
Hail - net single row, downside closed	Braeburn	1,4	1,6	1,2	1,5	0,8	2,6	17,3	15,4
Untreated control	Braeburn	27,4	25,9	29,4	27,8	33,8	30,1	65,6	72,5
Hail net - roof system	Nicoter	1,5	12,5	18,3	-	1,4	2,3	2,0	2,6
Untreated control	Nicoter	2,1	13,4	32,9	-	2,9	10,0	13,0	12,9
Hail net - single row	Fuji	0,6	2,5	3,4	2,7	13,4	4,6	35,6	1,1
Control (CpGV)*	Fuji	1,7	14,8	2,9	9,4	50,6	9,8	72,0	1,9

**Cydia pomonella* Granulosis Virus

Keep in Touch®: The future of fruit growing in Südtirol?

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Different trials on apples, grapes, apricots and cherries since 2015

Geipel K., Kreckl W. (2006).Ökologischer Anbau von Äpfeln ohne den Einsatz von Pflanzenschutzmitteln. 12th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing from 31st January to 2nd February 2006, Fördergemeinschaft Ökologischer Obstbau e. V. Weinsberg, Weinsberg, Deutschland, 133-137.

Keep In Touch®

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- **Net cover system that gives a combined protective effect against rain and insects**

  Produced by the firm Boscato Reti – Malo (VI)

- Reference person: Mario Tonioni

  - **Upper part of the net (Rainproof):**

    Rain net made of two sewn nets, sewn with an acid and UV-resistant yarn (Ø 0.22 mm), weight 480 g / m^2, rip resistance of 18t / m^2, and mesh size of circa 3 x 3 micron

  - **Lateral part of the net (Insect protection):**

    Anti-insect net made of a white yarn (Ø 0.31 mm) acid and UV-resistant , weight 0.70 gr/ m^2 , and mesh size of 4 mm x 2.3 mm.

- **Cost per ha incl. supporting frame:** Rain net 180 cm + Anti-insect net 300cm + 300cm; Concrete pillars 9 X 9 cm, 7 m in the row; Row spacing: 3.20 m; Height 2.80 m; = Costs / lm 18 €; Cost / ha 55.800 € (material costs incl. Nets, posts, wires, etc.)
- **Costs / LM without posts (180 + 300 + 300): 11,0 Euro**

Keep In Touch® effect against scab and *Marssonina* leaf blotch

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Year	Fuji / M9	scab % affected leaves in June	scab % affected fruits in June	*Marssonina* % affected leaves in June	pred. mites per leaf in June	russetting % affected fruits at harvest
2015	Polt. disperss, 75 g Cu / ha / treatment	1,0 a	0,3 a	-	0,5 a	17,1 a
	Keep In Touch® opened 05.04	2,4 a	0,3 a	-	1,1 a	17,4 a
	Untreated control	12,0 b	3,6 a	-	0,8 a	20,5 a
2016	Keep In Touch® opened 31.03	0,0 a	0,6 a	0,8 a	0,4 b	1,3 a
	Untreated control	1,6 a	16,7 b	1,0 a	0,2 a	0,2 a
2017	Keep In Touch® opened 10.04	0,0 a	0,0 a	0,0 a	-	-
	Untreated control	0,0 a	0,0 a	0,0 a	-	-

Note: Results refer to the end of the primary infection period

% Apple of fruits and/or leaves affected by several diseases and phytotoxicity at harvest

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Year	Variety	Treatments	scab % affected leaves	scab % affected fruits	Marssonina % affected leaves	sooty mold % affected fruits	alternaria % affected leaves	alternaria % affected fruits	phytotoxicity % affected fruits
2015	Cripps Pink	Polt. disperss (150 g Cu /ha / treatment)	21,5 a	8,2 a	-	-	97,0 b	0,7 a	40,0 a
		Keep In Touch® opened 05.08.	8,8 a	21,3 ab	-	-	76,3 a	0,3 a	0,6 a
		untreated control	23,3 a	33,6 b	-	-	100,0 b	1,5 a	0,9 a
2016	Fuji	Keep In Touch® opened 05.04.	8,4 a	0,9 a	-	0,6 a	-	-	-
		untreated control	67,6 b	12,4 b	-	4,7 a	-	-	-
2017	Fuji	Keep In Touch® opened 10.04.	2,4 a	0,0 a	1,4 a	0,8 a	-	-	-
		untreated control	25,5 b	0,5 a	9,1 b	11,4 b	-	-	-

% of fruits affected by *Gleosporium* fruit rot after different storage regimes

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Year	% of fruits affected by Gleosporium rot						
	Variety	End of Storage	End of Shelf life	Treatments	after Storage	after Shelf life	Total
2015	Pinova	08/03/2016	21/03/2016	Ulmasud (2 treatments)	12,8 a	10,2 a	23,1 a
				Keep in touch® opend at 05/08/2016	11,9 a	12,9 a	24,8 a
				untreated control	18,6 a	11,6 a	30,3 a
2016	Pinova	06/02/2017	24/02/2017	Ulmasud (8 treatments)	15,7 ab	28,8 ab	44,5 ab
				Keep in touch® opend at 07/07/2016	6,6 a	13,0 a	19,6 a
				untreated control	24,2 b	37,7 b	61,9 b
2016	Rosy Glow	01/03/2017	16/03/2017	Keep in touch® opend at 02/08/2016	2,2 a	1,5 a	3,7 a
				untreated control	21,3 b	6,4 a	27,8 b

Goeosporium on Pinova

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Nr. V.	Varianten	Dosis / hl	Dosis / 50 l	Hersteller
1	Boni protect®	100 g /hl	50 g	Manica
2	Keep in touch®	-	-	Keep in touch
3	Poltiglia disp. + Laminarin	50 g /hl (10 g Cu) + 70 ml	25 g + 35 ml	UPT + Vacciplant
4	Ulmasud	1 kg /hl	500 g	Geofin
5	Kontrolle	-	-	-

Nr.	Varianten	Dosis / hl
1	Kontrolle	-
2	H2O 52°C x 3'	-
3	Boni protect	1
4	Ulmasud	1 kg
5	Elektrolytisches Wasser - Verdenora	5 l
6	KHC - Vitikappa	1%

Thinning effect of diverse netting and cover systems in different apple varieties

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Year	Variety	Type of net/ opening time	Thinning eff. in %	fr / 100 f.c.	g / fruit
2010	GoldRush	hailnet / before flowering	46,5	63,4 a	-
		hailnet / during flowering	25,1	88,9 b	-
		control	-	118,6 c	-
2011	Golden D.	hailnet / before flowering	35,4	84,7 a	181,3
		hailnet / during flowering	21,4	103,0 b	178,9
		control	-	131,0 c	146,7
2014	Kanzi	hailnet / before flowering	29,9	66,5 a	211,8
		hailnet / during flowering	5,0	90,2 b	194,9
		control	-	94,9 b	173,7
2015	Fuji	Keep in Touch® / before flowering	65,0	-	-
2016	Fuji	Keep in Touch® / during flowering	~ 60*	-	-
* Estimation					

Methodology: CF of pest treatments

GALA

1ha, 2016

Total treatments: 20

Product	GALA	Main target pathogens
Copper sulphate (kg/ha)	8.33	Scab
Sulfur (kg/ha)	11.16	Powdery mildew, scab
Calcium polysulfide (l/ha)	106.76	Scab
Paraffin oil (l/ha)	17.89	San José scale
Azadirachtin (l/ha)	2.15	Aphids
Granulovirus (l/ha)	0.07	Codling moth
Bacillus Thuringensis (kg/ha)	1.33	Tortrix

Mating disruption

900 plastic pheromon dispensers;
6h of platform use

Results

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Carbon footprint: $kgCO_{2eq}/ha/year$		Nets	Pest treatments	Sum
Traditional hail net + pest treatments		679.8	304.6	**984.4**
Mono-block net		717.9	**???**	**717.9**
Single row net		932.1	**???**	**932.1**
Keep In Touch®		1513.4	**???**	**1513.4**

Boschiero M.,Kelderer, M., Casera, (2018). Carbon foot print of innovative plastic covers used as insect and pest control system in organic apple orchards . Proceeding of 18th International Conference on Organic Fruit-Growing, 19–21 February 2018, Hohenheim, Germany. Fördergemeinschaft Ökologischer Obstbau E.V. (Ed.), Weinsberg, Germany, pp. 71-77.

Conclusions

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(+)

- Reduction of plant protection inputs
- Crop load regulation
- Additional beneficial effects (russetting, sunburn, drift etc.)

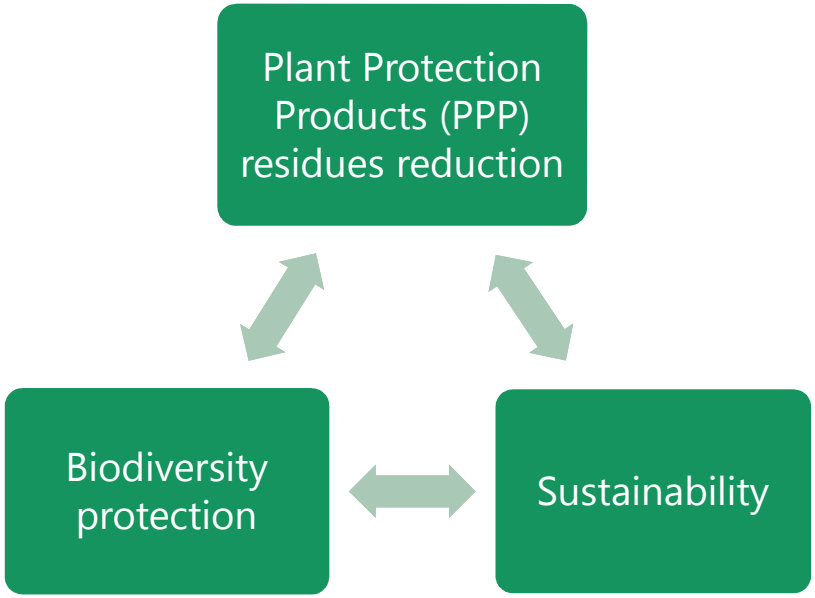
(-)

- Negative effects (wooly aphids, coloring…)
- tendency negativ influence on sugar, firmness
- High initial cost
- Complicate meccanization and labor
- LCA (Carbon Footprint)

(?)

- Economic feasibility
- Landscape in South Tyrol!

Organic agriculture goals



Organic agriculture aims to stay pesticides free, in line with what organic fruit/vegetable consumers are looking for: to buy and eat residual-free products.

The possible presence of residues in organic products is caused by wrong agronomic practices and natural factors (e.g. wind), that are unintentionally diffusing pesticides on organic fields.
Only the implementation of cultivation techniques and a major awareness of farmers could lead to a sensible reduction of chemical residues.