Scanning report on pome fruits
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Source materials and methodology

Chemical strategies: increase the pre-harvest interval, use restriction, specific list, depending of the stage

Importance of reduction of pesticide residues on fruits increased during the last ten years. First approaches focused on scanning spray schedules and pesticide residues analyses to develop residue degrading protocols resulting in specific spray schedules "traffic lights table"(ESTEBURG project, ongoing). [*Spray schedules do also exist for stone and soft fruits*.]

Different pesticide treatments were compared in terms of pesticide residues as well as biological efficacy in a five years experiment (Holthusen, 2014).

Insecticide treatments before blossom to prevent dateable pesticide residues at the time of harvest (Holthusen et al., 2015; Lindstaedt et al., 2014).

Bio-control products

Organic PPP (Myco-Sin) was investigated in terms of pesticide residues as well as biological efficacy (storage scab and storage rots) in a five years experiment in comparison to a chemical standard (Holthusen, 2014).

Five years field experiment on long term effects of chemical vs. non chemical insecticide treatments on the sustainability of the apple production in Northern Germany (ESTEBURG experiment).

Testing of organic compounds against *Venturia inaequalis* (Apple scab), *Podosphaera leucotricha* (Powdery mildew of apples), storage rots (e.g. *Neofabraea* spp.), *Cydia pomonella* (Codling moth), *Adoxophyes orana* (Summer fruit tortrix), and *Lygocoris pabulinus* (Common green capsid) (ESTEBURG experiments, ongoing)

Mechanisation

Mowing the ditch vegetation to interrupt the generation cycle of *Lygocoris pabulinus* (Lindstaedt et al., 2014, ESTEBURG experiments, ongoing)

Survey of possible *Psylla pyri* antagonists in pear orchards (Appel et al., 2015) and impacted of modified alleyway treatment on development of antagonists (ESTEBURG project).

Alternatives to postharvest treatments, remove pesticides on fruits

Different post-harvest treatments were tested to remove pesticide residues after harvest (Holthusen, 2014).

Thermonebulisation of the pesticide pyrimethanil in the storage room to control storage rots (Holthusen, 2014).

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[1] Please see ec.europa.eu/eurostat/ramon/nomenclatures/ for details on NUTS regions, level 3

Development of a method and understanding the process of hot-water treatment to prevent storage rots in apple without the use of pesticides (Maxin et al., 2014; Maxin et al., 2012a; Maxin et al., 2012b).

Process integration of a hot-water treatment machine into the general post-harvest process. Focus on general grower's acceptance of hot-water treatment (ESTEBURG project, ongoing).

Best practice findings

Chemical strategies: increase the pre-harvest interval, use restriction, specific list, depending of the stage

Spray schedules ("traffic lights table") with information on degradation time of various pesticides in various fruit crops are widely used within the fruit industry in Northern Germany. Information is confidential and therefore cannot be disseminated. Spray schedules allow fruit growers to use various pesticides while at the same time preventing detectable residues at the time of harvest. Using those spray schedules in apple production made it more or less possible to keep integrated fruit production as well as fulfilling retailers demands in terms of pesticide residues. No exact data one the percentage of growers using "traffic lights tables" is available, but it can be estimated that at least 90% of the apple growers in Northern Germany work with this method. A five years experiment also revealed that a strategy using all available PPP against storage rots (anti-resistant strategy) was only slightly more efficient than the standard strategy recommended in Northern Germany (Fig. 2). However, the number of the detectable residues was doubled (from 3.4 to 6.8) in the anti-resistant compared to the standard strategy.

Insecticide treatments during the summer often result in detectable pesticide residues at the time of harvest. In terms of the woolly apple aphid (*Eriosoma lanigerum*) treatments with Pirimor Granulat before blossom can prevent detectable residues but also effectively control the pest. It could be demonstrated that the pest is not completely controlled by the insecticide but natural enemies retard population increase to a level that allows a further control, especially the parasitoid wasp *Aphelinus mali* (Fig. 1). An additional treatment with Movento 100 SC directly after blossom can increase the efficacy of this concept without producing dateable residues at the time of harvest, too. This new concept of wooly apple aphid control became widely accepted in Northern Germany's apple fruit industry and is now followed in almost every orchard which had problems with wooly apple aphid in the previous year.

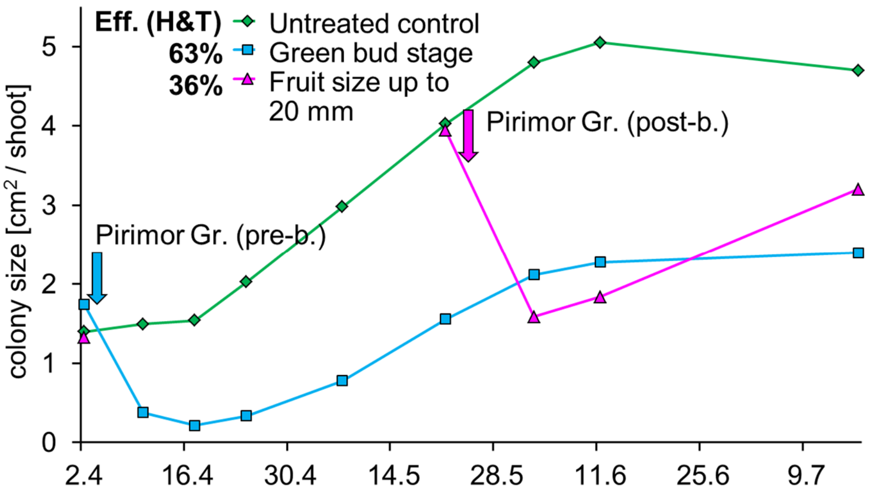

Fig. 1 Wooly apple aphid control with Pirimor Granulat – pre-blossom vs. post-blossom treatment

Bio-control products

Testing different pesticide treatments in a five years' field trial revealed that comparable fruit quality could be produced in terms of storage rots and storage scab when the ecological pesticide Myco-Sin was used instead of using chemical fungicides starting in July until harvest. Stopping any fungicide treatments at BBCH stage 74 resulted in storage rot losses up to 50% (Fig. 2). In terms of pesticide residues fruits treated with the Myco-Sin had less detectable pesticide residues at the time of harvest. However, Myco-Sin cannot be recommended for commercial fruit production since the use resulted in tremendous lenticel burns which reduce the marketability of the fruits.

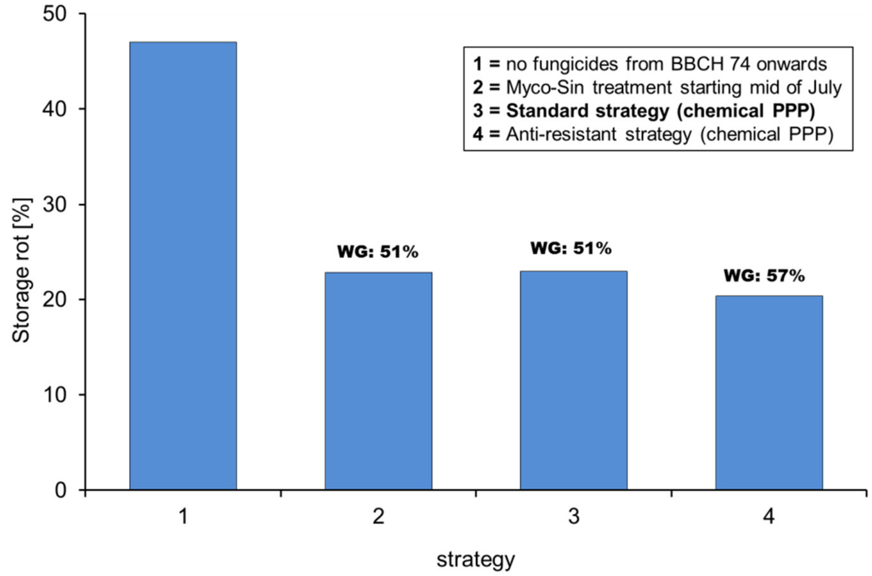

Fig. 2 Incidence of storage rots in cv. Elstar after storing for five month at 2°C [mean of 5 experimental years]

An experiment investigating the long-term effects of using organic vs. chemical insecticides was started two years ago and will proceed for another three years. First results indicate that *Cydia pomonella* and *Adoxophyes orana* control can be achieved to a comparable extent when 10-15 granulose virus application against codling moth as well as 6 organic applications against summer fruit totrix were done in the organic plots while only one application of Coragen was conducted in the chemical plots. None of the products used resulted in detectable residues. Furthermore rosy apple aphid (*Dysaphis plantaginea*) control was achieved to the same degree by using the organic insecticide NeemAzal T/S before blossom or the chemical insecticide Teppeki after blossom.

Mechanisation

Experiments on mowing the ditch vegetation were conducted for two years now and first results indicate that it is most likely to interrupt the lifecycle of *Lygocoris pabulinus* by mowing the ditch vegetation. However, only a reduction in the number of attacked fruits adjacent to mowed ditches was measured. Maybe an insecticide free control of *Lygocoris pabulinus* can be achieved in the future. However, this will be on the cost of reduced biological diversity within the ditches (plants and possible also insects).

Currently different projects with *Psylla pyri* in pears are ongoing to find solutions for a better integration between chemical/ alternative treatments and natural enemies.

Alternatives to postharvest treatments, remove pesticides on fruits

Reducing pesticide residues post-harvest by washing and brushing was effective only in the case of the fungicide captan. Concentration on fruits was reduced by 50% when fruits were dumped in water for 3 minutes. Additional or alternative brushing of fruits for 2 minutes could further reduce the concentration down to 20% of the initial concentration. However, it was not possible to reduce the concentration below the detection limit. The method is not specifically incorporated into commercial fruit production but since up to 90% of all apples in Northern Germany are at least treated with water once during the packing process, a significant reduction of captan between harvest and consumption can be estimated.

Thermonebulisation of pyrimethanil (0.04 l Xedathane A/ ton of fruit) was used to treat 100 tons of unsprayed fruits cv. Elstar postharvest in a storage room. The treatment was effective in reducing *Neofabrea perennans* losses by more than 60% after five month of storage at temperatures below 4°C. However, storage scab was only slightly reduced. Samples for pesticide residue analyses were taken at fifteen locations within the storage room. Residual levels ranged between 0.84 and 1.90 mg kg^{-1} with one exception (3.00 mg kg^{-1}). The MRL of pyrimethanil was never exceeded. Currently there is no practical use for this technology in Germany, since there is no registration in place.

Effect of hot water treatment was originally expected to be based on a direct and lethal effect of heat on fungal inoculum. However, Maxin et al. (2012b) were able to show that also an indirect effect may be present, which mediates a stress-induced physiological response in the fruit. This new understanding of the mode of action was the trigger for alternative treatment set ups. It is no longer necessary to treat fruits with 50 °C for 180 seconds to reduce storage rots by more than 70%. By treating fruits for much shorter periods, e.g. between 20 to 25 seconds at elevated temperatures, it is possible to obtain approximately similar results (Maxin et al., 2014). Currently a research project is carried out whit the aim to improve the integration of short hot water treatment into existing grading lines as well as developing specific short hot-water treatment recipes (time and temperature) for different apple varieties. In general, hot water treatments are used at a small extent in ecological fruit industry in Northern Germany. The share of the fruit industry (ecological and integrated production) which uses hot water technology is expected to strongly increase during the next few years since the technology is capable to protect the crop from storage rots as well as reducing the pesticide load of the fruits.

Literature

Appel, A., Mohr, D. & Weber, R. W. S. (2015). Birnenblattsauger und ihre Gegenspieler im ökologischen und Integrierten Obstbau an der Niederelbe. *Mitteilungen des Obstbauversuchsringes des Alten Landes* 70(12): 387–393.

Holthusen, H. H. F. (2014). Strategien zur Minimierung von Pflanzenschutzmittel-Rückständen im Kernobst. *Mitteilungen des Obstbauversuchsringes des Alten Landes* 69(5): 121–130.

Holthusen, H. H. F., Harms, F. & Palm, G. (2015). Bekämpfung der Blutlaus im Frühjahr. *Mitteilungen des Obstbauversuchsringes des Alten Landes* 70(4): 124–131.

Lindstaedt, J., Weber, R. W. S., Wichura, A. & von Kröcher, C. (2014). Hofseminare 2014 im Projekt „Demonstrationsbetriebe Integrierter Pflanzenschutz“. *Mitteilungen des Obstbauversuchsringes des Alten Landes* 69(10): 277–280.

Maxin, P., Weber, R. W. S., Lindhard Pedersen, H. & Williams, M. (2012a). Control of a wide range of storage rots in naturally infected apples by hot-water dipping and rinsing. *Postharvest Biology and Technology* 70: 25–31.

Maxin, P., Weber, R. W. S., Lindhard Pedersen, H. & Williams, M. (2012b). Hot-water dipping of apples to control *Penicillium expansum*, *Neonectria galligena* and *Botrytis cinerea*: Effects of temperature on spore germination and fruit rots. *European Journal of Horticultural Science* 77(1): 1–9.

Maxin, P., Williams, M. & Weber, R. W. S. (2014). Control of fungal storage rots of apples by hot-water treatments: a Northern European perspective. *Erwerbs-Obstbau* 56(1): 25–34.