The Times They Are a-Changin':
Development of plant protection
in German hop cultivation in the 2020's

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Hop Production for the Wisconsin Craft Brew Industry
11th Annual Hop Seminar
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Outline

1 Who’s that guy?

2 Plant protection policy in the EU

3 Public demand for biodiversity issues and organic agriculture

4 Some examples from organic research work in Huell:
   Downy mildew – Powdery mildew – Damson hop-aphid –
   Two-spotted spidder mite – Hop-flea beetle –
   Rosy rustic moth – Weed control

5 Outlook: Changes in European agriculture and a vision of plant protection in hops 2030 in the EU
Meet the Huell Hop Research Center
Who's that guy?

1992  Certified biologist (University of Munich), entomologist

1993  Beginning to work at Hop Research Center Hüll Plant Protection Dept, biological pest control

2001  Beginning with pest & disease control in organic hops

2003  Ph.D. (Technical University Munich): Development of a control threshold for spider mites in hop cultivation

2003  Deputy head of work group 'Plant protection in hop'

2016  Head of work group 'Ecological issues of hop cultivation'

2017  Chairman of the Scientific-Technical Commission (STC) of the International Hop Growers' Convention, I.H.G.C
### Official IGHC list of hop cultivars, regularly updated in November:

https://www.lfl.bayern.de/ipz/hopfen/024299/index.php
Who's that guy? Work for STC
Who`s that guy?

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2018  Chairman of the EU Commodity Expert Group (CEG) `Minor Uses in Hops`
Approval of active substances

A plant protection product usually contains more than one component. The active component against pests/plant diseases is called “active substance”. The Commission evaluates every active substance for safety before it reaches the market in a product. Substances must be proven safe for people's health, including their residues in food and effects on animal health and the environment.

Procedure

1. Application to an EU country called Rapporteur Member State (RMS);
2. RMS verifies if the application is admissible;
3. RMS prepares a draft assessment report;
4. EFSA issues its conclusions;
5. Standing Committee for Food Chain and Animal Health votes on approval or non-approval;
6. Adoption by the Commission;
7. Publication of a Regulation in the EU Official Journal.

Under the new EU rules, it takes 2.5 to 3.5 years from the date of admissibility of the application to the publication of a Regulation approving a new active substance.

This time varies greatly depending on how complex and complete the dossier is.
Introducing the
EU Plant Protection Products Application Management System (PPPAMS)

The application procedure for the authorisation of Plant Protection Products (PPPs), within the EU, is changing. New legislation will enforce the use of a new online application system that will simplify the management of applications and the sharing of information by relevant stakeholders across the EU. Information on authorised products will be made available through a publicly available EU Database.

**Benefits of the System for Industry**

- PPPs authorised in one Member State can be mutually recognised in other Member States with greater ease due to the electronic sharing of information.
- Duplication of work avoided.
- Easier monitoring of applications.
- An automatic notification system informs users when action is required and enables tracking of applications through the authorisation process.
- A single application can be submitted to multiple Member States at the same time.

**APPLICATION PROCEDURE**

1. Create a product
2. Create a draft application
3. Application status changes to “pre-submitted”
4. Submit your application to National Competent Authority*
5. Decision by Member State
6. Check authorisation in database

*Documents are not submitted via the PPPAMS. The system does not replace other manual processes in Member States; it serves as a system to host workflows.

Find out more at: [http://ec.europa.eu/pppams](http://ec.europa.eu/pppams)

Here you can find:
- Video tutorials on how to create your account
Pesticides: Experts endorse new EU list of candidates for substitution

A Commission proposal to establish an EU list of 77 candidates for substitution was today endorsed by EU Member State experts. Candidates for substitution (CIS) are pesticides for which national authorities need to carry out an assessment to establish whether more favourable alternatives to using the plant protection product exist, including non-chemical methods. The aim is to encourage more sustainable crop protection.
Plant protection policy in the EU

To: Mr. Vytenis Andriukaitis
European Commissioner for Health and Consumer Policy
European Commission
B-1049 Brussels.
Vytenis.Andriukaitis@ec.europa.eu

Concerning: The policy of your DG on the (interim) criteria for endocrine disrupting pesticides.

Dear Commissioner Andriukaitis,

It must be no news for you to hear that the incidences of endocrine-related diseases such as breast and prostate cancer keep on rising in all EU member states. You will also be aware that many pesticides are linked to endocrine adverse effects. Just to mention an example for only one endocrine target: 69 of the EU approved pesticides cause a decrease of thyroid hormone levels; a further 56 cause an increase of relative thyroid weight. Given the urgency to act, it is a surprise to us that your DG did not propose to put an end to the market access of endocrine disrupting pesticides yet. Regulation 1107/2009 has been in place for 6 years now and we are very disappointed about the implementation by your DG, not only on endocrine disrupting pesticides but on other issues as well. Nothing has changed so far to start banning harmful pesticides and to start introducing sustainable practices (IPM, integrated pest management) while the use of pesticides is increasing in most member states and the number of approved pesticides has more than doubled since 2009.

We ask for your intervention and for a radical change of policy.

DG SANTE’s decisions on endocrines and pesticides.
Contact: Hans Muilerman
hans@pan-europe.info
tel. 0031655807255.
Plant protection policy in the EU

This is changed in the new pesticide Regulation 1107/2009. While not quite ideal (EU decisions are by nature a compromise), for the first time we have strict criteria for pesticides, the so-called “cut-off” criteria in Annex II, points 3.6.2 to 3.6.5 about classified mutagens, carcinogens, reproductive and endocrine disrupting pesticides. Point 3.7 is about PBT and POP's. The "cut-off" procedure will likely only be operational in 2016, also because Commission and member states are still discussing two types of derogations ("negligible exposure' and "serious danger for plant health’) that might open ways to partly keep the harmful pesticides on the market.

Hazard-based cut-off criteria in the EU for active substances under Regulation (EC) No 1107/2009:
- Carcinogens
- Mutagens
- Reproductive toxicants (CMR)
- Endocrine disruptors (ED)
- Persistent, bioaccumulative, toxic substances (PBT)
- Persistent organic pollutant (POP)
This report seeks to broadly identify the universe of worldwide agricultural exports to the European Union (EU) that could be affected by EU hazard-based cut-offs for crop protection active substances.

In 2009, the European Union revised its regulation of crop protection products, adopting a “hazard-based” approach to the approval of active substances under Regulation 1107/2009. This Regulation establishes hazard-based “cut-offs” for certain categories of substances, including carcinogens, mutagens, or reproductive toxicants (“CMR”), as well as substances that are persistent in the environment. In addition, active substances deemed to have endocrine disrupting properties are subject to a hazard-based cut-off, although EU criteria for identifying substances as endocrine disruptors have not yet been adopted. Under Regulation 1107/2009, active substances meeting the criteria for any of these categories will be cut off from the European market based solely on the health or environment hazard they pose, without a risk assessment that considers levels of exposure.

Regulation 1107/2009 provides that active substances used in crop protection products be assessed for potential hazard each time the substance is subject to an approval or renewal of approval at the EU level. If deemed to belong to one of the cut-off categories, the EU Maximum Residue Levels (MRLs) can be revoked and the substance can be withdrawn from the market. The application of the criteria under regular EU reviews creates the potential for numerous plant protection products to be withdrawn from usage in EU member states and tolerances for residues on imported goods to fall to the default level of 0.01 ppm. Revocation of MRLs would patently have an impact upon worldwide exporters of agricultural products to the European Union, and such trade flow impacts could be substantial.

There are 58 active substances that may be subject to hazard-based evaluation, almost all within the next four years (see Appendix A).
Plant protection policy in the EU

EU - Pesticides database

**ACTIVE SUBSTANCES**
Regulation (EC) No 1107/2009

- Non-approval of Vitis vinifera canker, Regulation (EU) 2020/29 of 14 January 2020
- Non-renewal of the approval of the active substance chlorpyrifos-methyl, Regulation (EU) 2020/17 of 10 January 2020
- Non-renewal of the approval of the active substance chlorpyrifos, Regulation (EU) 2020/18 of 10 January 2020
- Update of reference values for Alpha-Cypermethrin (aka alphamethrin)

**PESTICIDES EU-MRLs**
Regulation (EC) No 396/2005


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> > 26 active substances relevant for hop growing lost since 2018
2019: Referendum for biodiversity

1,745 MILLIONEN FÜR DIE ARTENVIelfALT

31.01. - 13.02.19
Unsere historische Chance!
Wir retten die Artenvielfalt.

Nur noch 5 Tage bis zum Termin!

Volksbegehren Artenvielfalt

Eintragen Volksbegehren Artenvielfalt

Volksbegehren Artenvielfalt in Bayern
wir wollen abstimmen!

Eintragungszeit 31.1. - 13.2.2019
Biodiversity – what’s important?
Public demand for more organic agriculture

Bericht aus der Kabinettsitzung vom 30. Juli 2019

30. Juli 2019

1. Kabinett tagt mit Forschern des Bayerischen Klimarats / Ministerrat wird im Herbst über bayerische Klimastrategie entscheiden / Klimapolitik muss langfristig angelegt, wirkungsvoll und konjunkturfest sein / Bayern soll erstes klimaneutrales Bundesland werden

2. Bayern richtet die Bewirtschaftung des Staatswaldes auf den Klimaschutz aus / In den nächsten fünf Jahren werden 30 Millionen Bäume im Staatswald gepflanzt / Privat- und Körperschaftswälder erhalten mehr Hilfen für den Aufbau stabiler Wälder

3. Regierung will weniger Einwegplastik und leichtere Wiederverwendung / Kabinett gibt Plastikverordnung Initiative

4. Bayern will das Bio-Netzwerk weiter ausbauen / Bis zum Jahr 2030 sollen 30 Prozent der landwirtschaftlichen Fläche nachhaltig bewirtschaftet werden / Das neue Landesprogramm „BioRegio 2030“ soll den Absatz und Nachfrage, um Marktverwerfungen zu vermeiden

> overall 30 % organic agricultural area till 2030 in Bavaria
Outlook: Even if demand for organic hops increases strongly, the organic hop area in Germany will not surpass 1,000 ha (5% of total hop area) until 2030.
Primary infection with *Pseudoperonospora humuli* problem #1 in organic hops: Currently only manual separating of spikes! Spikes are source of secondary infection (leaves, flowers, cones)
Downy mildew

Trials with biologicals to reduce use of copper fungicides

Control of primary infection with biologicals, e.g. Polyversum – a biofungicide from CZ (oospores of *Pythium oligandrum*, a parasitic soil fungus)

Liquorice extract

New plant extract R2-D2 (FiBL)

Chitosan

Hop extract
Downy mildew trial 2019

1.5 ha (3.7 acres), cv. Herkules
24 rows, >120 crowns
> 28 plots (500 m²) possible
> 14 variants with 2x2 sub-plots
Cone infection in the field
Cone infection at harvest

control
Cone infection at harvest

1b: control, 0 kg Cu
2a: Funguran progress, 3 kg Cu
4a: Fung prog & Flavonin, 2 kg Cu
8b: CuCaps & HopCaps, 2 kg Cu
10b: Fung prog & FiBL-R2D2, 1 kg Cu
11b: Polyversum, 0 kg Cu
13b: Chitosan, 0 kg Cu
14a: Fung prog & & Chitosan, 1 kg Cu
Powdery mildew

PM not a problem in organic hops in Germany

Waiving of highly susceptible cvs (e.g. HMG, HKS, HTU)

Wider spacing of plants, manual stripping in June

Hilling up of rows 2-4 times/year – no flag shoots!

www.plantmanagementnetwork.org
Damson-hop aphid *Phorodon humuli*

Migration of winged morphs in May from *Prunus* spp. (sloe, plum trees)

Extremely small aphid, on summer host hop 10-12 generations (clones)

Eggs overwinter on *Prunus*
Damson-hop aphid

Release of mass-reared beneficials to control *Phorodon humuli* in the field not purposeful

Quassia extract (a.i. quassin) currently best control method

Registration as pesticide is problematic – currently efforts to list quassin as a basic substance within the EU (DG Sanco)
Quassia, an Effective \textit{...} \\

Key words: Hop, \textit{Humulus lupulus} \\

Abstract \\

In the first three decades of the 20th century, quassia was growing as a chemical agent to control pests and diseases. In the first years of the 21st century this attitude changed among growers. In several efficacy trials on commercial hop-growing plants quassia products proved to be effective control agents for several pest species, including the hop aphid. A systemic variant of the quassia extract is currently being used in hop-growing. In the period of 2000-2003, the yield of hops was the best method to determine the efficacy of quassia products. Quassia was effective, but was also best from an economic point of view. An application rate was determined which can be used in a trial to generate the data necessary for the approval of the quassia extract as an organic crop protection agent. The results of the trial were then used to establish the necessary data for the approval of the quassia extract as an organic crop protection agent for hop-growing. \\

\textbf{Figure 1:} The influence of various quassin applications on hop yield and alpha acids in an organic hop garden. Haushausen, Hallertau, 29 viii 2007, cv. HT \\

Bars with the same letters are not significantly different by ANOVA, at $P<0.05$. 

F. Weihrauch, IPZ5e
Two-spotted spider mite

Organic farmers spray with sulphur and whey

Release and management of predatory mites:

*Typhlodromus pyri, Amblyseius andersoni* (native); *Phytoseiulus persimilis, Neoseiulus californicus* (allochthonous)
Two-spotted spider mite
Two-spotted spider mite: Microclimate!

Organic Citra crop in Toppenish (Yakima, WA), without severe spider mite problems due to irrigated cover crop in the lanes – effect of microclimatic conditions
Two-spotted spider mite

- TSSM (predatory mite release)
- TSSM (control)
- Predatory mites (predatory mite release)
- Predatory mites (control)

Release of predatory mites:
01 June, 13 June 2007

Graph showing population changes from 01 June to 23 August 2007.
Two-spotted spider mite

Release of predatory mites on felt strips, with 5-10 gravid females per strip on every 4th training
Two-spotted spider mite

Raubmilbenversuch Oberulrain 2017; Sorte: PE
Spinnmilbenentwicklung in den Versuchsparzellen

Raubmilben-Einsatz: 08.06.
Praxis: blieb unbehandelt

Boniturdatum

Spinmilben bzw. -eier pro Blatt
(MW aus 4 Wiederholungen à 30 Blättern)
Two-spotted spider mite

Tall fescue, *Festuca arundinacea*, and strawberries as an undersown crop in the lanes for hibernation of predatory mites
Two-spotted spider mite

Transfer of grapevine cuttings from pruning of vineyards to hops in spring, with ca 10 predatory mites per cutting
Hop-flea beetle: Know the biology!

- March-April
- July-August
Life cycle of *Psylliodes attenuatus*

Hop-flea beetle has only one annual generation!

Adult beetles hibernate

Copulation and egg-laying into soil

Maturation feeding on shoots

Larval stage in the soil

New generation of adult beetles feeding on flowers and cones

February

March

April

May

June

July

August

September

vegetative growth
trellis height
flowering
cone formation
mature cones

F. Weihrauch IPZ5e
No lure effect hitherto in:
β-caryophyllene, cis-3-hexenyl-acetat, ocimene,
R+-limonene, (1S)-β-pinene…
Positive results with linalool
All efforts to detect pheromone so far not successful
Metarhizium trials, Hersbruck 2017-2018
Metarhizium trials, Hersbruck 2017-2018
Metarhizium trials, Hersbruck 2017-2018

Tentative projection: 2,000 beetles /m² x 0.3 ha = 6,000,000 beetles /ha!
Rosy rustic moth, *Hydraecia micacea*

Caterpillars hatch from egg in early spring (April)

The highly mobile young caterpillars are mining briefly superficially on couch grass and then are migrating to the actual host plant

Infestation typically strongest on marginal rows, especially close to waterbodies

Boring of the shoot and larval feeding in the shoot leads to „hanging tips“
Rosy rustic moth: damage in April / May
Rosy rustic moth: damage in June/ (July)

Older L4 caterpillars (length 4-5 cm, become whitish) cease mining and feed on the rootstock and on the base of the stem.

Feeding damage can lead to wilting symptoms up to complete dieback of the bines.

Only solution: consequent weed control (Elymus repens, Echinochloa crus-galli)!
Organic weed control
Low input farming – the future?

Over-use of pesticides with main objective of increasing yields will be reduced – the better approach is to optimize overall farm profitability.

Plant protection will be done increasingly not by synthetic pesticides, but by the use of:
- basic substances
- plant strengtheners (biostimulants)
- biologicals (plant extracts)

Primary focus on healthy soils and plant health; low or no input farming is objective.
Plant protection in hops 2030 – a vision

Further breeding of robust varieties with tolerances to pests and diseases will facilitate low-input farming.

Additional focus will be on climate change: ’Allrounder’ cvs tolerant to drought and heat will be next breeding challenge.

Hop growing will be done anticipatorily, not reactively. Upcoming problems are detected early or are prevented.

Overall yields will slightly decrease but will become more stable.

The definition of quality hops will change. The appearance will lose importance, while metabolites important for brewing and an environmentally sound production will stand for quality hops.

„The selection of hops is not a beauty contest!“ (David Grinnell)
Changing agriculture in the EU

'Carrying on as usual' can't be the approach for the future!

**Conventional system**
Low-priced foods, high yields, food security

**Organic system**
Ecosystem services, sustainability, conservation, biodiversity

Outlook: With the slogan, "Best of both worlds", most farms will develop an individual strategy and find their own place between 'conventional' and 'organic'.
Acknowledgements

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