Scanning report (EIP format for practice abstracts)

***Project title (native language):** **EUFRUIT: Europäisches Obstnetzwerk**

***Project title (English):** **EUFRUIT: European Fruit Network**

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Section A. Summary for EIP dissemination

***Keywords:** Electroherb, flazasulfuron, flumioxazin, glyphosate, GrassKiller, mechanical weed management, pelargonic acid, pome fruit, root suckers, soil-active herbicide, total herbicide

***Main geographical location:** DE6 (Hamburg); DE9 (Niedersachsen)

Other geographical locations: DE8 (Mecklenburg-Vorpommern), DEF0 (Schleswig-Holstein), DEE0 (Sachsen-Anhalt), DEA (Nordrhein-Westfalen)

***Summary (native language):**

Der Report befasst sich mit Ergebnissen zur Unkrautbekämpfung im Kernobstanbau. Der Fokus liegt dabei insbesondere auf der Vermeidung bzw. Reduzierung von glyphosathaltigen Produkten durch die verstärkte Anwendung bodenwirksamer Herbizide und der Einbeziehung mechanischer Unkrautbekämpfung in die Herbizidstrategie auch im Integrierten Obstanbau.

Summary (english):

The report deals with results for weed control in pome fruit growing. In particular, the focus is on the avoidance or reduction of glyphosate-containing products through the increased use of soil-active herbicides and the inclusion of mechanical weed control in the herbicide strategy in integrated fruit production.

Section B. Project information

***Project coordinator:** Michelle H. Williams; Aarhus University, Department of Food, Kirstinebjergvej 10, 5792 Aarslev, Denmark; mw@food.au.dk; +45 25170049

***Project period:** 2016 - 2019

***Project status:** Ongoing

***Funded by:** Horizon 2020

***Total budget:** €1.8m

***Geographical regions:** DK011 Copenhagen, DK012 Copenhagen and its environs, DK013 North Zealand, DK014 Bornholm, DK021 East Zealand, DK022 West- and South Zealand, DK031 Funen, DK032 South Jutland, DK041 West Jutland, DK042 East Jutland, DK050 North Jutland, BE211 (Arrondissement. Antwerpen), BE212 (Mechelen), BE213 (Turnhout), BE221 (Hasselt), BE222 (Arr. Maaseik), BE223 (Tongeren), BE231 (Aalst), BE232 (Dendermonde), BE233 (Eeklo), BE234 (Gent), BE235 (Oudenaarde), BE236 (Sint-Niklaas), BE241 (Halle-Vilvoorde), BE242 (Leuven), BE251 (Brugge), BE253 (Ieper), BE254 (Kortrijk), BE255 (Arr. Oostende), BE256 (Arr. Roeselare), BE257 (Tielt), BE258 (Veurne), BE310 (Nivelles-Nijvel), BE331 (Huy-Hoei), BE332 (Liège- Luik), BE334 (Waremme-Borgworm), BE335 (Verviers), FR8 Méditerranée; FR81 Languedoc-Roussillon, FR6 SUD-OUEST, FR512 Maine et Loire, FR611 Dordogne, FR812 Gard, DE6 (Hamburg), DE8 (Mecklenburg-Vorpommern), DE9 (Niedersachsen), DEF0 (Schleswig-Holstein), DEE0 (Sachsen-Anhalt), DEA (Nordrhein-Westfalen), DE111, DE112, DE113, DE114, DE115, DE116, DE117, DE118, DE119, E11A, DE11B , DE11C, DE11D, DE121, DE122, DE123, DE124, DE125, DE126, DE127,DE 128, DE129, DE12A, DE12B, DE12C, DE131, DE132, DE133, DE134, DE135, DE136, DE137, DE138, DE139, DE13A, DE141, DE142, DE143, DE144, DE145, DE146, DE147, DE148, DE149, DE600 Hamburg, DE932 Cuxhaven, DE933 Harburg, DE939 Stade, DEF09 Pinneberg, NL1-NL4 + NLZ Holland; NL 224 zuidwest Gelderland, NL 226 Arnhem/Nijmegen,

NL230 Flevoland, NL310 Utrecht, NL321 Kop van Noord-Holland, Nl322 Alkmaar en omgeving, NL338 oost Zuid-Holland, NL33A zuidoost Zuid-Holland, NL341 Zeeuws-Vlaanderen, NL342 overig Zeeland, Nl411 west Noord-Brabant, NL413 noordoost Noord-Brabant, NL414 zuidoost Noord-Brabant, NL421 noord Limburg, NL422 Midden-Limburg, NL423 zuid Limburg, ES620 Murcia, UKG11 Herefordshire, UKG12, Worcestershire, UKH12 Cambridgeshire, UKH16 North and West Norfolk, UKH17 Breckland and South Norfolk, UKJ22 East Sussex, UKJ35 South Hampshire, UKJ36 Central Hampshire, UKJ37 North Hamphshire, UKJ41 Medway, UKJ42 Kent, UKJ43 Kent Thames Gateway, UKJ44 East Kent, UKJ45 Mid Kent, UKJ46 West Kent, ES618 Sevilla, ES511 Barcelona, ES512 Gerona, ES513 Lérida, ES514 Tarragona, CH0 Schweiz/Suisse/Svizzera, ITH51-59 Emilia Romagna region, ITH10 Bolzano-Bozen, HU101 Budapest, HU102 Pest, RO111, RO112, RO113, RO114, RO115, RO121, RO122, RO123, RO124, RO125, RO126, RO211, RO212, RO213, RO214, RO215, RO216, RO221, RO222, RO223, RO224, RO225, RO226, RO311, RO312, RO313, RO314, RO315, RO316, RO317, RO321, RO322 RO411, RO412, RO413, RO414, RO415, RO421, RO422, RO423, RO424. HU101, HU102, LT001 Alytaus apskritis, LT002 Kauno apskritis, LT003 Klaipėdos apskritis, LT004 Marijampolės apskritis, LT005 Panevėžio apskritis, LT006 Šiaulių apskritis, LT007 Tauragės apskritis, LT008 Telšių apskritis, LT009 Utenos apskritis, LT00A Vilniaus apskritis.

Project web page: http://www.eufrin.org/index.php?id=55

***Project Objectives (native language):**

1. Etablierung eines europäischen Netzwerks, das sich auf den Obstsektor konzentriert.
2. Entwicklung und Umsetzung eines systemischen Ansatzes zur Sichtung und Zusammenstellung bestehenden wissenschaftlichen und praxisnahen Wissens.
3. Etablierung eines laufenden Dialogs mit relevanten politischen Gremien auf regionaler, nationaler und EU Ebene.
4. Ermittlung und Unterstützung neuer Forschungsschwerpunkte durch kontinuierliches Monitoring und Auswertung bestehender und neu entstehender Forschungs- und Innovationsaktivitäten.

Project Objectives (English):

1. Establish a European network focused on the fruit sector.
2. Develop and implement a systematic approach for scanning and synthesizing existing scientific and practical knowledge.
3. Establish an ongoing dialogue with relevant EU, national and regional policy bodies.
4. Identify and support new priority areas of research by continually monitoring and analysing existing and upcoming research and innovation activities.

***Project partners:**

1. Aarhus University, Department of Food Science (Denmark) • AU
2. Research Station for Fruit npo (Belgium) • Pcfruit
3. Centre Technique Interprofessionnel des Fruits et Légumes (France) • CTIFL
4. Obstbauversuchsanstalt Jork (Germany) • OVA
5. Stichting Wageningen Research (Netherlands) • WR
6. ~~East Malling Research (United Kingdom) • EMR~~ (terminated 08-02-2016)
7. Institut de Recerca i Tecnologia Agroalimentàries (Spain) • IRTA
8. Federal Department of Economic Affairs, Education and Research (EAER), acting through Agroscope Institute of Plant Sciences (Switzerland) • Agroscope
9. Laimburg Research Centre for Agriculture and Forestry (Italy) • Laimburg
10. University of Agronomic Sciences and Veterinary Medicine of Bucharest (Romania) • USAMV
11. National Agricultural Research and Innovation Centre Fruitculture Research Institute (Hungary) • NARIC
12. Lithuanian Research Centre for Agriculture and Forestry (Lithuania) • LRCAF
13. Assemblée des Régions Européennes Fruitières, Légumières et Horticoles (France) • AREFHL
14. Variety Innovation Consortium South Tyrol (Italy) • SKST
15. Freshfel Europe (Belgium) • FRESHFEL
16. Elbe-Obst Erzeugerorganisation r.V. (Germany) • EO
17. Fruitconsult BV (Netherlands) • FC
18. University of Greenwich (United Kingdom) • UoG
19. University of Hohenheim (Germany) • UHOH

20. Università di Bologna (Italy) • UNIBO
21. Institut National de la Recherche Agronomique (France) • INRA
22. NIAB EMR (new 09-02-2016)

Section C. Annex: Scanning report[1]

Scanning report
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Country: Germany

NUTS 3 region(s)[2]: DE6 (Hamburg), DE8 (Mecklenburg-Vorpommern), DE9 (Niedersachsen), DEF0 (Schleswig-Holstein), DEE0 (Sachsen-Anhalt), DEA (Nordrhein-Westfalen)

WP no. and title: 3 – Reduction in pesticides residues

Date: 23-04-2018

Source materials and methodology

Reports on weed managements in orchards published in "Obstbau" 2017/2018 were scanned. Three articles were used for this report: "Alternatives in tree strip treatment" (Zimmer, 2017), "Solutions for weed control in pome and stone fruit orchards" (Scheuer, 2018), and "Herbicides in apple production – a status report" (Scheer & Hagl, 2018). The report was rounded off by data from a two years field experiment with soil-active herbicides in Northern Germany (Wiebusch et al., 2017) published in "Mitteilungen des Obstbauversuchsringes des Alten Landes". Both fruit grower magazines are published in German and were approached using ESTEBURG library.

Best practice findings

Due to favorable condition for weed growth in Northern Germany, especially on the loamy soils in the Elbe valley, repeated herbicide treatments are necessary to keep the tree strips in pome fruit orchards free of weeds. Standard weed control in Northern Germany depends on repeated treatments (2-4 times) of glyphosate herbicides (per treatment: max. 1,800 g glyphosate / ha tree strip) combined with a broadleaf herbicide (up to two times: 1,000 g MCPA / ha tree strip). In general, first application take place in spring around flowering, followed by at least one more application in summer, and a last application during autumn after harvest (without MCPA). In some cases, also a second summer application is needed. In all cases only the tree strip is treated which accounts roughly for one third of the whole orchard in Germany.

To reduce the use especially of glyphosate as well as the total number of herbicide applications (to save time and money), herbicide strategies with soil-active herbicides applied in winter and / or spring were tested. By applying 0.6 kg Vorox F / ha tree strip (300 g flumioxazin / ha tree strip) combined with 900 g glyphosate / ha tree strip short before flowering or 3 kg Chikara Duo / ha tree strip (20 g flazasulfuron plus 864 g glyphosate / ha tree strip) short after flowering an additional application of a glyphosate products during summer became unnecessary. Up to 2,700 g glyphosate / ha tree strip could be saved annually. Replacing the autumn application of glyphosate by a winter application of 6.25 l Kerb Flo / ha tree strip (2,500 g propyzamid / ha tree strip) followed by a solo application of 0.6 kg Vorox F / ha tree strip short before flowering showed the best long-lasting efficacy in 2017 and reduce the usage of glyphosate to zero. However, looking at the cost for chemical weed control the application of Kerb Flo in winter followed by Vorox F before blossom is the most expensive option, generating total costs of almost € 220 / ha orchard Compared to that the costs are only € 115 / ha orchard if glyphosate plus MCPA is applied once in spring or if the application is repeated in summer, € 175 / ha orchard. Both strategies also require a final after harvest application of glyphosate. In most cases the application of Chikara Duo in spring after blossom followed by glyphosate after harvest will be the cheapest option, costing € 130 / ha orchard. Vorox F plus glyphosate before blossom followed by glyphosate after harvest produces costs of € 195 / ha orchard (Wiebusch et al., 2017).

A field trial in western Germany also revealed the very good efficacy of glyphosate in combination with flumioxazin (Vorox F). Since *Echinochloa* spp. were present only to a low degree in the experimental field there was almost no effect of an additional

[1] Equivalent to 'final report' in EIP-AGRI format.
[2] Please see ec.europa.eu/eurostat/ramon/nomenclatures/ for details on NUTS regions, level 3

dimethenamid-P (Spectrum) treatment. Long time efficacy of Chikara Duo (flazasulfuron plus glyphosate) was almost similar to Vorox F plus glyphosate, but showed some weaknesses against *Echinochloa* spp. (Scheuer, 2018).

Root sucker removal from apple trees was originally done by summer or autumn application of glufosinate (Basta). Since glufosinate is banned in Germany since summer 2017 alternatives are needed. Pelargonic acid (8%) kills weeds as well as root suckers within hours, however, the effect will last for a maximum of three weeks only. The application of pelargonic acid in the summer to kill the root sucker, followed by a post-harvest glyphosate application, can prevent the possible uptake of glyphosate by the fruit trees and the resulting phytotoxic damage to the trees.In combination with soil-active herbicides like Vorox F (flumioxazin) or Katana (flazasulfuron) pelargonic acid showed a very good and long lasting herbicidal effect of at least three months Pelargonic acid can also be combined with mechanical weed management, treating only the selective weed growth around the trees while the rest of the tree strip is hoed five times a year. Another combination tested with good results was the application of glyphosate in spring followed by hoeing with the ”Krümler Ladurner Modell 7”. The use of hot water (98 °C) for weed control was also tested, however, the costs to heat the water still hinder the general usage (Scheer & Hagl, 2018).

Mechanical weed management gains increasing importance also in integrated orchard management. Different systems were demonstrated in 2017. A mechanical roll hoe can weed the tree strip excepted the tree interspace and thereby save much time compared to conventional mechanical weeding. Another machine NaturaGriff, developed in France, worked with rotating brushes also in the tree interspace and can be managed with a tractor speed of 8 km h^{-1}. The ”Krümler Ladurner Modell 7” is a commonly used machine for weed control in organic orchards in Germany. It is very flexible and works with two scanning arms to adjusted the working width to the row distance. The machine is also capable to handle massive weed infestation as well as wet conditions. For the similar purpose machines with nylon fibers were developed, which can chop off strong weeds as well as handle wet soil conditions. All machines are made to save treatment time as well as number of treatments per year. In future new machines like the ”GrassKiller” from Italy, working with high pressure (up to 1,250 bar) water, and the ”Electroherb” from Brasil, working with high-frequency alternating current, may change weed management in orchards a lot (Zimmer, 2017). However, first results with the “GrassKiller” revealed some weaknesses in terms of treatment speed and efficacy in the tree interspace. In comparison the ”Krümler Ladurner Modell 7” as well as a machine with nylon fibers showed better results (Scheer & Hagl, 2018).

Literature

Scheer, C. & Hagl, D. (2018). Herbizide im Apfelanbau - ein Sachstandsbericht. *Obstbau* 43(1): 20-22;47-49.

Scheuer, F.-J. (2018). Herbizidlösungen für den Kern- und Steinobstbau. *Obstbau* 43(3): 144–147.

Wiebusch, J.-H., Hilbers, J., Hahn, A., Holthusen, H. H. F. & Köpcke, D. (2017). Vorernteführungen 2017. *Mitteilungen des Obstbauversuchsringes des Alten Landes* 72(10): 288–293.

Zimmer, J. (2017). Alternativen in der Baumstreifenbehandlung. *Obstbau* 42(9): 532–535.