



Inštitut za hmeljarstvo
in pivovarstvo
Slovenije

LETNO POROČILO IHPS ZA LETO 2025

Žalec, 2026

Kazalo vsebine

1	UVOD.....	6
2	PREDSTAVITEV INŠTITUTA/ PRESENTATION OF THE INSTITUTE	7
2.1	ORGANIZIRANOST IN POSLOVANJE.....	7
2.1.1	Organizacijska shema javnega zavoda Inštituta za hmeljarstvo in pivovarstvo Slovenije	7
2.1.2	Pregled zaposlenih po organizacijskih enotah	7
2.2	ORGANI UPRAVLJANJA.....	7
2.2.1	Svet javnega zavoda Inštituta za hmeljarstvo in pivovarstvo Slovenije	7
2.2.2	Strokovni svet javnega zavoda Inštituta za hmeljarstvo in pivovarstvo Slovenije	8
3	RAZISKOVALNO DELO/ RESEARCH WORK	9
3.1	RAZISKOVALNI PROGRAMI IN PROJEKTNO RAZISKOVALNI CENTRI/ RESEARCH PROGRAM AND PROJECT RESEARCH CENTERS	9
3.1.1	Projektno raziskovalni center – kemija in struktura bioloških učinkovin / project research center – chemistry and structure of biological agents	9
3.1.2	Raziskovalni program Biokemijska in biofizikalna kemijska karakterizacija naravnih snovi / Research programme Biochemical and biophysical characterisation of natural substances	10
3.1.3	Projektno raziskovalni center - kmetijske rastline - genetika in sodobne tehnologije / Project research center - Agricultural plants - genetics and modern technology	10
3.1.4	Raziskovalni program – Ekonomika agroživilstva in naravnih virov / Research programme – Agro-food and natural resources economics.....	11
3.2	RAZISKOVALNO-RAZVOJNI IN APLIKATIVNO-RAZISKOVALNI PROJEKTI TER INFRASTRUKTURNI PROGRAMI	11
3.2.1	Preučevanje sinergizma med različnimi okoljsko sprejemljivimi načini zatiranja škodljivcev poljščin in vrtnin / Investigation of the synergism between different environmentally friendly control methods for field and vegetable crop pests.....	11
3.2.2	Razvoj in vpeljava Crispr/Cas diagnostike za terensko detekcijo viroida razpokanosti skorje agrumov (CBCVd) v hmelju (<i>Humulus lupulus</i> L.).....	12
3.2.3	SUSTEMICROP - Razvoj ekološko trajnostnih tehnologij in strategij za pomembne Sredozemske sisteme rastlinske pridelave, s poudarkom na podpori majhnih pridelovalcev in socialno-ekonomskega kmetovanja/ Development of eco-sustainable systemic technologies and strategies in key Mediterranean crops systems, contributing the small farming socio-economic resilience.....	13
3.2.4	Projekt ViroiDoc / Advanced Research on Viroid Pathogenesis and Control for Agricultural Sustainability (ViroiDoc).....	14
3.3	USPOSABLJANJE MLADIH RAZISKOVALCEV/ YOUNG RESEARCHERS PROGRAMME.....	15
3.3.1	Usposabljanje mlade raziskovalke Lucije Luskar pod mentorstvom izr. prof. dr. Andreje Čerenak / Young researchers programme (Lucija Luskar) under mentorship of izr. prof. dr. Andreje Čerenak	15
3.4	CILJNI RAZISKOVALNI PROJEKTI / TARGET RESEARCH PROJECTS	16
3.4.1	Vrednotenje genotipov in vzgoja družin križanj za proučevanje odpornosti hmelja <i>Humulus lupulus</i> L. na hudo viroidno zakrnelost hmelja.....	16
3.4.2	Ohranjanje in izboljšanje proizvodnega potenciala tal za trajnostno pridelavo oljk (GO S-OIL) / Preservation and improvement of the productive potential of soils for sustainable olive cultivation (GO-TO S-OIL) 17	
3.4.3	FD-GAMEPLAN - Ukrepi za preprečevanje nadaljnega širjenja zlate trsne rumenice (akronim: FD-GAMEPLAN) / Measures to prevent further spread of Grapevine flavescence dorée (acronym: FD-GAMEPLAN).....	18
3.4.4	Primerjava tehnologij in strategij namakanja in fertigacije na izbranih kulturah / Comparison of irrigation and fertigation technologies and strategies on selected crops.....	19
3.4.5	Preučevanje učinkovitosti, optimizacija in implementacija metod množičnega lovljenja in motenja parjenja izbranih gospodarsko pomembnih škodljivcev gojenih in samoniklih rastlin / Studying the effectiveness, optimization and implementation of methods of mass trapping and mating disruption of selected economically important pests of cultivated and wild plants	19
3.4.6	Uporaba brezpilotnih letalnikov za natančno nanašanje fitofarmaceutskih sredstev, sredstev z nizkim tveganjem in koristnih organizmov za trajnostno kmetijstvo – Fly4IPM / The use of unmanned	

aerial vehicles for precise application of pesticides, biostimulants and biocontrol agents for sustainable agriculture and integrated pest management – Fly4IPM (CRP - V4-2428)..... 20

3.5 ZNANSTVENO-TEHNOLOŠKO SODELOVANJE / SCIENTIFIC-TECHNICAL COOPERATION.21

3.5.1 Vpliv različnih faktorjev na diastatsko moč hmelja / The influence of various factors on the diastatic power of hops (Slovenija in ZDA v letih 2024-2026) 21

3.5.2 Razmnoževanje hmelja (*Humulus lupulus* L.) s potakjenci in vitro tehnikami (Slovenija in Bosna in Hercegovina v letu 2024-2025) / Propagation of hops (*Humulus lupulus* L.) by cuttings using in vitro techniques..... 22

3.5.3 Optimizacija sestave zdrobov pri uporabi pšenice hibridne (mešane) teksture endosperma za pripravo sladice in pivine za proizvodnjo piva (Slovenija in Hrvaška v letih 2025-2026) / optimizing the composition of the grits when using wheat of hybrid (mixed)endosperm texture for the preparation of mash and wort for beer production 22

4 JAVNE SLUŽBE, STROKOVNE NALOGE IN DRUGE NALOGE NA PODLAGI POOBLASTIL IN IMENOVANJ / PUBLIC SERVICES AND ACTIVITIES BASED ON PUBLIC AUTHORISATION 24

4.1 JAVNA SLUŽBA V HMELJARSTVU IN STROKOVNE NALOGE V KMETIJSTVU / PUBLIC SERVICE IN AGRICULTURE 24

4.1.1 Javna služba v hmeljarstvu / Public service in hop production 24

4.2 JAVNA SLUŽBA V VRTNARSTVU / PUBLIC SERVICE IN HORTICULTURE 28

4.3 STROKOVNE NALOGE S PODROČJA VARSTVA IN REGISTRACIJE SORT RASTLIN IN SEMENARSTVA ZA PODROČJE CERTIFICIRANJA SADILNEGA MATERIALA ZA HMELJARSTVO / THE PROGRAM FOR PROTECTION SEED MATERIALS AND REGISTRATION FOR DIFFERENT HOP VARIETIES AND CERTIFICATION HOP PANTING MATERIALS.....29

4.4 GENSKA BANKA HMELJA / THE HOP GENE BANK.....30

4.5 GENSKA BANKA ZDRAVILNIH IN AROMATIČNIH RASTLIN / THE GENE BANK OF MEDICINAL AND AROMATIC PLANTS (MAP) 31

4.6 STROKOVNE NALOGE S PODROČJA ZDRAVSTVENEGA VARSTVA RASTLIN / PLANT HEALTH PROGRAMS AND SERVICES.....31

4.6.1 Naloge zdravstvenega varstva po javnem pooblastilu 32

4.6.2 JAVNA SLUŽBA ZDRAVSTVENEGA VARSTVA RASTLIN / PUBLIC PLANT HEALTH SERVICE 36

4.7 OCENJEVANJE FITOFARMACEVTSKIH SREDSTEV (FFS) / PLANT PROTECTION PRODUCTS RISK ASSESSING.....38

4.7.1 Dodatna dela na področju škroplilne tehnike / Additional work in the field of spraying technology 39

4.8 UKREPI SODELOVANJA - PROGRAM RAZVOJA PODEŽELJA RS ZA OBDOBJE 2017-2020 / COOPERATIVE ACTIONS OF PROGRAM FOR COUNTYSIDE DEVELOPEMENT IN SLOVENIA IN 2017-2020.....40

4.8.1 IRP38..... 40

4.8.2 Projekti EIP 46

4.8.3 LAS projekti 49

5 DRUGE NALOGE PO NAROČILU IN POGODBAH S KMETIJSKIMI IN DRUGIMI PODJETJI TER POSLOVNIMI ZDRUŽENJI - TRŽNA DEJAVNOST, MEDNARODNI PROJEKTI / OTHER CONTRACTED TASKS WITH VARIOUS AGRIBUSINESS COMPANIES AND ASSOCIATIONS – MARKET ACTIVITIES – INTERNATIONAL PROJETS..... 50

5.1 DRUGE NALOGE PO NAROČILU / OTHER CONTRACTED TASKS.....50

5.1.1 Uradno biološko preizkušanje fitofarmaceutskih sredstev / Official biological testing of plant protection products 50

5.1.2 Poljski poskusi na področju gnojenja in prehrane rastlin / Field trials in the area of fertilisation and plant nutrition 50

5.1.3 Certificiranje pridelka hmelja / Certification of hops 51

5.1.4 Uradno potrjevanje semena poljščin in semenskega krompirja / Official certification of agriculture crops and seed of potato 51

5.1.5 Posodobitev pedoloških podatkov o kmetijskih tleh v Pedološki karti Slovenije 2024-2026 / Update of Soil Map of Slovenia 2024-2026 (mostly of agricultural land) 52

5.2 SERVISNA DEJAVNOST IN LASTNA PRIDELAVA / SERVICE ACTIVITIES AND OWN HOP PRODUCTION.....52

5.2.1	Analize hmelja in produktov iz hmelja, piva, pivine, pivovarskih surovin ter drugih prehranskih surovin / Analysis of hops and hop products, beer, wort, brewing raw materials and other foodstuffs	52
5.2.2	Analize tal s svetovanjem gnojenja in gnojilni načrti / Soil analyses with fertilisation advice and fertilisation plans	53
5.2.3	Usposabljanja o fitofarmacevtskih sredstvih / Training on Plant Protection Products	53
5.2.4	Redni pregledi naprav za nanašanje fitofarmacevtskih sredstev / Regular testing of PPP sprayers	54
5.2.5	Pridelava kmetijskih rastlin na poskusnih površinah / Cultivation of agricultural crops on experimental fields	54
5.2.6	Pridelava certificiranih sadik hmelja / Production of certified hop planting material.....	55
5.2.7	Pridelava navadne arnike / Cultivation of <i>Arnica montana</i>	55
5.2.8	Žlahtnjenje konoplje / Cannabis breeding	56
5.2.9	Zdravilne in aromatične rastline / Medicinal and aromatic plants.....	56
5.3	Evropski projekt ICAERUS - Preizkus uporabe brezпилotnih letalnikov (dronov) za odkrivanje nevarnih bolezni hmelja / European project ICAERUS - Testing drones for hop diseases detection	57
6	IZDAJANJE REVIJ IN DRUGIH PUBLIKACIJ / PUBLICATION OF JOURNALS AND OTHER PUBLICATIONS	58
6.1	Hmeljarski bilten / Hop Bulletin ISSN 0350-0756.....	58
6.2	Revija Hmeljar ISSN 1318-6183 / Journal Hmeljar ISSN 1318-6183	59
7	SODELOVANJE / COOPERATION.....	61
7.1	SODELOVANJE Z ZNANSTVENO-RAZISKOVALNIMI USTANOVAMI V SLOVENIJI / COOPERATION WITH SCIENTIFIC-RESEARCH INSTITUTIONS IN SLOVENIA	61
7.2	SODELOVANJE Z DRUGIMI ORGANIZACIJAMI IN PODJETJI V SLOVENIJI / COOPERATION WITH OTHERS IN SLOVENIA	61
7.3	MEDNARODNO SODELOVANJE / INTERNATIONAL COOPERATION	62
8	BIBLIOGRAFIJA / BIBLIOGRAPHY	64

Kazalo slik

Slika 1: Organigram javnega zavoda Inštituta za hmeljarstvo in pivovarstvo Slovenije / Diagram of institute's organizational structure	7
Slika 2: Zavrt razvoj kolonij glive <i>Verticillium nonalfalfae</i> (VNA) na gojišču ob prisotnosti koristnih bakterij (B1,2,3) (Foto: C.C. Peňa) / Inhibited colony development of <i>Verticillium nonalfalfae</i> (VNA) on agar medium in the presence of beneficial bacteria (B1,2,3). (Photo: C. C. Peňa)	13
Slika 3: Vnos BCA-obogatene komposta v testni del hmeljišča, okuženega s hmeljevo uvelostjo (Foto: S. Radišek) / Application of BCA-enriched compost in the experimental section of a hop yard infected with hop wilt. (Photo: S. Radišek)	14
Slika 4: Zaslonski posnetek objave na FB strani / A screenshot of a post from the Facebook page.....	17
Slika 5: Nasad prvoletnih rastlin na SN-6; namakan 5. 6. 2025 / SN-6 first-year plantation; irrigation performed on 5 June 2025	25
Slika 6: Utrinek s tehnološkega sestanka hmeljarjev; predavanje dr. Magde Rak Cizej / A snapshot from the hop growers' technical meeting; presentation by Magda rak Cizej, PhD	27
Slika 7: Divji hmelj na območju Zasavja / Wild hop plant in Zasavje	30
Slika 8: Oktobra smo se na IHPS v večernih urah na daljavo izobraževali o prenosnem merilnem sistemu LI-6800, ki smo ga nabavili za potrebe operacije PRIRAST. Strokovnjaki podjetja LI-COR iz ZDA so nam predstavili teoretično ozadje in delovanje naprave, ki na ravni lista omogoča merjenje izmenjave plinov in fluorescenco klorofila a pri fotosintezi. (Foto: J. Ferlin in M. Knapič) / In October, IHPS staff participated in evening remote training on the portable LI-6800 measurement system, which we purchased for the needs of the PRIRAST operation. Experts from the US-based company LI-COR presented the theoretical background and operation of the instrument, which enables measurements of leaf-level gas exchange and chlorophyll a fluorescence during photosynthesis. (Photo: J. Ferlin and M. Knapič)	44
Slika 9, levo: Destilacijski sistem za pridobivanje eteričnih olj in hidrolatov / Distillation system for extracting essential oils and hydrolates	45
Slika 10, desno: Sušilna omara z regulacijskim sistemom za sušenje zelišč / Drying cabinet with regulation systems for drying herbs.....	45
Slika 11: Pilotno preskušanje UV-C svetlobe v pridelavi sadik za preprečevanje bolezni hmelja (Foto: S. Radišek) / Pilot testing of UV-C light in hop plantlet production to prevent hop diseases. (Photo: S. Radišek)	46
Slika 12: V okviru EIP projekta BioBEL preučujemo vpeljavo novejših tehnologij pridelave - foliarno gnojenje visokega fižola glede na razvojno fazo in upoštevanjem vremenskih razmer, in sicer po smernicah ekološke pridelave. Na fotografiji sodelavka Monika Oset Luskar pri pregledu vzorčenih listov na prisotnost škodljivcev in koristnih organizmov. / Within the EIP project BioBEL, we are investigating the implementation of a modernised production technology—foliar fertilisation of runner bean according to growth stage and taking weather conditions into account, following organic farming guidelines. The photo shows our colleague Monika Oset Luskar inspecting sampled leaves for the presence of pests and beneficial organisms.	48
Slika 13: Naslovnica revije Hmeljarski bilten je izdelana v skladu s celotno grafično podobo inštituta / The cover of the journal Hmeljarski bilten is designed in accordance with the institute's corporate visual identity.	59
Slika 14: Utrinek iz revije Hmeljar 2025 / A snapshot from the magazine Hmeljar 2025	60

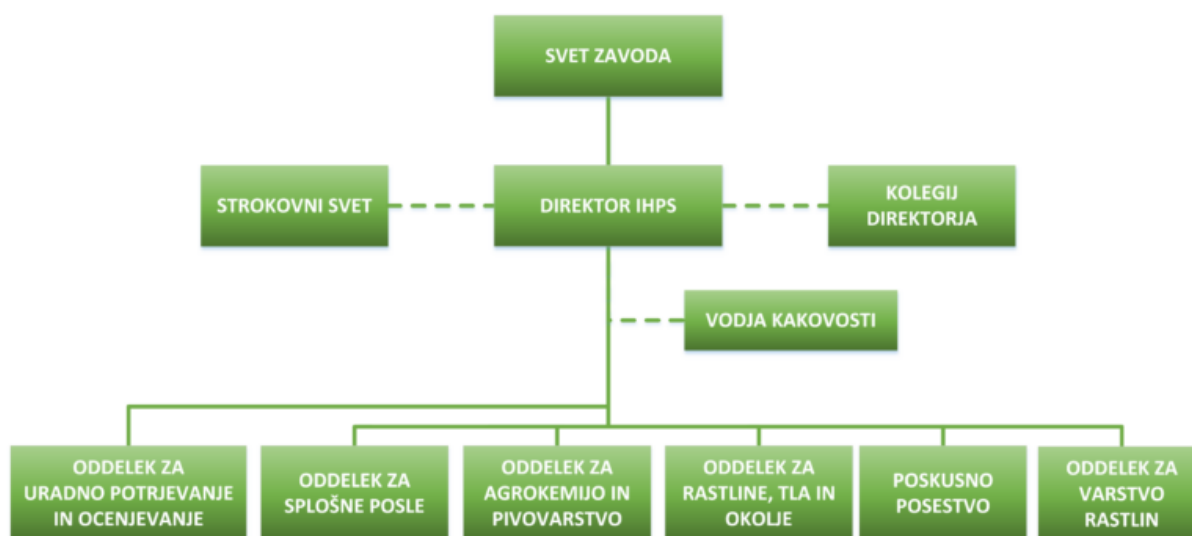
1 UVOD

Inštitut za hmeljarstvo in pivovarstvo Slovenije je javni zavod, katerega ustanovitelj je Republika Slovenija, ustanoviteljske pravice pa izvršuje Vlada Republike Slovenije. Sklep o preoblikovanju Inštituta za hmeljarstvo in pivovarstvo Žalec, p.o., v javni zavod Inštitut za hmeljarstvo in pivovarstvo Slovenije je Vlada Republike Slovenije sprejela dne 25. junija 2002 in objavila v Uradnem listu RS št. 71, dne 8. 8. 2002, medtem ko je Okrožno sodišče v Celju izdalo sklep o vpisu statusnega preoblikovanja v sodni register dne 16. 5. 2003. Dne 11. 1. 2007 je Vlada Republike Slovenije sprejela Sklep o spremembah in dopolnitvah Sklepa o preoblikovanju Inštituta za hmeljarstvo in pivovarstvo Žalec, p.o., v javni zavod Inštitut za hmeljarstvo in pivovarstvo Slovenije (Uradni list RS št. 5/2007), s katerim se spreminja sestava sveta zavoda. Dne 17. 3. 2011 je Vlada Republike Slovenije sprejela Sklep o spremembah in dopolnitvah Sklepa o preoblikovanju Inštituta za hmeljarstvo in pivovarstvo Žalec, p.o., v javni zavod Inštitut za hmeljarstvo in pivovarstvo Slovenije, s katerim se dopolnjujejo dejavnosti inštituta, pogoji za direktorja inštituta in obveznosti ustanovitelja (Uradni list RS št. 20/2011). V letu 2023 je Vlada Republike Slovenije sprejela dva sklepa o spremembah in dopolnitvah Sklepa o preoblikovanju Inštituta za hmeljarstvo in pivovarstvo Žalec, p. o., v javni zavod Inštitut za hmeljarstvo in pivovarstvo Slovenije (Uradni list RS, 79/23 in 132/23)

2 PREDSTAVITEV INŠTITUTA/ PRESENTATION OF THE INSTITUTE

2.1 ORGANIZIRANOST IN POSLOVANJE

2.1.1 Organizacijska shema javnega zavoda Inštituta za hmeljarstvo in pivovarstvo Slovenije



Slika 1: Organigram javnega zavoda Inštituta za hmeljarstvo in pivovarstvo Slovenije / Diagram of institute's organizational structure

2.1.2 Pregled zaposlenih po organizacijskih enotah

[Seznam zaposlenih](https://www.ihps.si/o-institutu/zaposleni/) se nahaja na spletni strani inštituta (<https://www.ihps.si/o-institutu/zaposleni/>).

2.2 ORGANI UPRAVLJANJA

2.2.1 Svet javnega zavoda Inštituta za hmeljarstvo in pivovarstvo Slovenije

Člani Sveta javnega zavoda Inštituta za hmeljarstvo in pivovarstvo Slovenije:

- Katarina Vasle, predsednica,
- Marta Hrustel Majcen, Ministrstvo za kmetijstvo, gozdarstvo in prehrano,
- mag. Teja Božovič Holc, Ministrstvo za okolje, podnebje in energijo,
- dr. Andrej Simončič, Ministrstvo za visoko šolstvo, znanost in inovacije,
- Domen Marovt, predstavnik pridelovalcev hmelja,
- Božo Kobold, predstavnik pridelovalcev hmelja,

- dr. Tanja Guček, Inštitut za hmeljarstvo in pivovarstvo Slovenije.

2.2.2 Strokovni svet javnega zavoda Inštituta za hmeljarstvo in pivovarstvo Slovenije

Člani strokovnega sveta Inštituta za hmeljarstvo in pivovarstvo Slovenije:

- Bojan Cizej,
- dr. Barbara Čeh,
- izr. prof. dr. Andreja Čerenak,
- dr. Tanja Guček
- mag. Matej Knapič
- izr. prof. dr. Iztok Jože Košir,
- dr. Boštjan Naglič,
- dr. Miha Ocvirk,
- prof. dr. Martin Pavlovič,
- dr. Sebastjan Radišek,
- dr. Magda Rak Cizej
- Davorin Vrhovnik.

3 RAZISKOVALNO DELO/ RESEARCH WORK

3.1 RAZISKOVALNI PROGRAMI IN PROJEKTNO RAZISKOVALNI CENTRI/ RESEARCH PROGRAM AND PROJECT RESEARCH CENTERS

3.1.1 Projektno raziskovalni center – kemija in struktura bioloških učinkovin / project research center – chemistry and structure of biological agents

Vodja / Leading by: prof. dr. Janez Plavec (KI), sodelujoči na IHPS: izr. prof. dr. Iztok Jože Košir

Pri delu se osredotočamo na identifikacijo in sestavo bioaktivnih snovi v zdravilnih in tujerodnih rastlinskih vrstah, kar omogoča nadaljnje študije v smeri iskanja njihovih naravnih virov in potencialne uporabe kot zdravilne surovine, prehranskih dopolnil in pesticidov naravnega izvora. Hkrati identifikacija spojin predstavlja izhodišče za nadaljnje raziskave o njihovi učinkovitosti in možni uporabi. Z vidika novega zelenega dogovora v EU naše delo na področju bioaktivnih spojin za medicinsko in kmetijsko uporabo naravnega izvora ponuja inovativen pristop pri iskanju novih rešitev, kako zmanjšati negativne vplive uporabe sintetičnih spojin. Tujerodne rastline lahko služijo kot potencialna surovina pri iskanju zatiranja rastlinskih bolezni in zatiranja škodljivcev z možnostmi ustvarjanja novih proizvodov in tehnoloških rešitev v kmetijstvu. Iskanje rastlinskih vrst, ki vsebujejo bioaktivne snovi s potencialom za medicinsko uporabo, bo spodbudilo kmetijski sektor, da začne gojiti takšne rastline, in prispevalo k diverzifikaciji kmetijskega sektorja ter možnosti ustvarjanja novih zelenih delovnih mest s pozitivnim vplivom na družbo.

In our work we focused on identification and composition of bioactive substances in medicinal and alien plant species that will enable their further studies towards finding their natural resources and potential use as medicinal raw materials, food supplements and pesticides of natural origin. At the same time, identification of compounds will give a starting point for further research on their effectiveness and possible use. In the view of a new green deal in EU our work in the field of bioactive compounds for medicinal and agricultural use of natural origin will offer an innovative approach in search of new solutions how to reduce negative impact of the use of synthetic compounds. Alien plants can serve as potential raw material in search for treatments of plant diseases and pests control with opportunities for creation of new products and technology solutions in agriculture. Finding the plant species that contain bioactive substances with potential for medicinal use will encourage agricultural sector to start growing such plants and contribute to diversification of agricultural sector and possibility of a creation of new green jobs with positive impact on the society.

3.1.2 Raziskovalni program Biokemijska in biofizikalna kemijska karakterizacija naravnih snovi / Research programme Biochemical and biophysical characterisation of natural substances

Vodja / Leading by: prof. dr. Nataša Poklar Ulrih (Biotehniška fakulteta Univerze v Ljubljani), sodelujoča na IHPS: dr. Barbara Čeh

Raziskovalni program poteka na področju raziskovanja polifenolov v rastlinskih tkivih. Mnoge fenolne spojine rastlinskega izvora imajo antimikrobni učinek, vplivajo na izražanje določenih genov, predvsem pa so dobri kelatorji kovinskih ionov in učinkoviti antioksidanti. V letu 2025 je dr. Čehova nadaljevala z izvajanjem poljskega poskusa z različnimi zelišči, katerim se je določil / izmeril pridelek, vsebnost eteričnega olja, vsebnost skupnih polifenolov ter sestava polifenolov. Delo se bo nadaljevalo na istem poskusu v prihodnjem letu, saj so v pokus vključene trajnice.

The research programme focuses on the study of polyphenols in plant tissues. Many phenolic compounds of plant origin exhibit antimicrobial activity, influence the expression of specific genes, and, most importantly, act as strong chelators of metal ions and effective antioxidants. In 2025, Dr. Barbara Čeh continued the field trial with various medicinal and aromatic plants, in which yield, essential oil content, total polyphenol content, and polyphenol composition were determined/measured. The work will continue on the same trial in the coming year, as the experiment includes perennial species.

3.1.3 Projektno raziskovalni center - kmetijske rastline - genetika in sodobne tehnologije / Project research center - Agricultural plants - genetics and modern technology

Vodja / Leading by: prof. dr. Jernej Jakše (Biotehniška fakulteta Univerze v Ljubljani), sodelujoča na IHPS: izr. prof. dr. Andreja Čerenak in dr. Sebastjan Radišek

Člani programske skupine smo aktivno sodelovali z raziskovalci v in izven Slovenije ter objavili izvirne znanstvene članke, ter z več prispevki bili prisotni na različnih znanstvenih konferencah z mednarodno udeležbo. Oddan in sprejet je bil znanstveni članek o genetski raznolikosti proučevanih genotipov navadne konoplje. Za namen določanja sortne čistosti hmelja smo z mikrosatelitnimi markerji analizirali večje število različnih hmeljnih mešanic ter vpeljevali različne ekstrakcijske mešanice DNA.

Na področju raziskav rastlinskih bolezni smo nadaljevali delo na določanju prisotnosti mikovirusov v izolatih gliv *Verticillium nonalfalfae* ter proučevanju njihovega vpliva na virulenco in razvoj kultur. Izvajali smo umetna okuževanja za namen proučevanja odziva (sekvenciranje degradoma) dveh sort hmelja na okužbe letalnega patotipa glive *V. nonalfalfae*. Pri proučevanju viroidov smo nadaljevali z epidemiološkimi raziskavami viroidov CBCVd in HLVd. Pri tem smo v se osredotočili na določanje gostiteljske specifičnosti CBCVd in raziskavo določanja variabilnosti CBCVd iz različnih žarišč. Razvijali smo tudi nove diagnostične tehnike določanja viroidov, ter preskušali nove pristope biotičnega zatiranja talnih gliv.

The members of the research group have collaborated with researchers from Slovenia and all over the world, the results have been published in journals with SCI, some contributions have been presented at various scientific conferences with international participation. A scientific article on the genetic diversity of the studied hemp genotypes was submitted and accepted in scientific journal. With focus on determination of varietal purity of different combinations of hop samples, microsatellite markers were applied in analyzing different hop mixtures. Different extraction methods were analysed as well.

In the field of plant disease research, we continued our work on detecting mycoviruses in isolates of the fungus *Verticillium nonalfalfae* and on studying their effects on virulence and culture development. We conducted artificial inoculations to investigate the response (degradome sequencing) of two hop cultivars to infection with the lethal pathotype of *V. nonalfalfae*. In viroid research, we continued epidemiological studies of CBCVd and HLVd. In this work, we focused on determining the host specificity of CBCVd and on investigating the variability of CBCVd from different outbreaks. We also continue with developing of new diagnostic techniques for viroid detection and tested new approaches for the biological control of soil-borne fungi.

3.1.4 Raziskovalni program – Ekonomika agroživilstva in naravnih virov / Research programme – Agro-food and natural resources economics

Vodja / Leading by: Prof. dr. Luka Juvančič (BF); sodelujoči na IHPS: prof. dr. Martin Pavlovič

Prispevek celotne ARRS programske skupine P4-0022 v letu 2025 je vključeval: (a) ekonomsko analizo indikatorjev konkurenčnosti agroživilstva, (b) izgradnjo empiričnih orodij ekonomskih modelov konkurenčnosti in (c) izdelavo instrumentov za krepitev gospodarske konkurenčnosti v agroživilstvu. V 2025 je sodeloval IHPS z raziskovalnimi prispevki na področjih (i) sistemske analize globalnih in lokalnih tržnih razmer v hmeljarstvu in pivovarstvu, (ii) aplikacije odločitvenih modelov za tehnološko-ekonomske analize v kmetijstvu (industrijske rastline) in (iii) trženjske analize trendov ponudbe kmetijskih pridelkov in nakupovalnih navad kupcev različnih živil v Sloveniji. Posamezni rezultati so objavljeni v raziskovalnih in strokovnih člankih domačih in mednarodnih publikacij (SICRIS).

The contribution of the entire ARRS program group P4-0022 in 2025 included (a) economic analysis of agri-food competitiveness indicators, (b) a construction of empirical tools of economic competitiveness models, and (c) a development of instruments for strengthening economic competitiveness in agri-food. In 2025, IHPS participated with research contributions in the areas of (i) system analysis of global and local market conditions in hop production and brewing industry, (ii) application of decision models for technological and economic analysis in agriculture (industrial plants) and (iii) marketing analysis of trends in the supply of agricultural products and shopping habits of customers of various foods in Slovenia. Individual results are published in research and professional articles in domestic and international publications (SICRIS).

3.2 RAZISKOVALNO-RAZVOJNI IN APLIKATIVNO-RAZISKOVALNI PROJEKTI TER INFRASTRUKTURNI PROGRAMI

3.2.1 Preučevanje sinergizma med različnimi okoljsko sprejemljivimi načini zatiranja škodljivcev poljščin in vrtnin / Investigation of the synergism between different environmentally friendly control methods for field and vegetable crop pests

Vodja / Leading by: prof. dr. Stanislav Trdan (BF), za/for IHPS: izr. prof. dr. Iztok Jože Košir

V sklopu projekta financiranega s strani ARIS smo sodelovali kot partnerska organizacija, z željo preučiti učinkovitost sočasnega delovanja okoljsko sprejemljivih načinov zatiranja izbranih

gospodarsko pomembnih škodljivih žuželk, katerih zatiranje je zaradi majhnega števila dovoljenih kemičnih pripravkov ali njihove odsotnosti, odpornosti škodljivcev na insekticide, podnebnih sprememb in drugih vzrokov vse bolj oteženo. V pričujočem projektu smo preučevali učinkovitost spremljevalnih (vmesni posevki in privabilni posevki) in prekrivnih rastlin, v kombinaciji z biotičnimi agensi (entomopatogene ogorčice in glive) oz. biotehniškimi metodami (barvne lepljive plošče in piramidne pasti z atraktanti), za zatiranje pomembnih škodljivcev krompirja, čebule in zelja. Tako je bil glavni namen raziskave projektne skupine, ki so jo sestavljali člani treh domačih raziskovalnih organizacij z bogatimi raziskovalnimi izkušnjami na področjih varstva rastlin, analize kemije in rastlinske ekologije, predvsem določitev najustrežnejših kombinacij različnih okoljsko sprejemljivih načinov zatiranja strun na krompirju, čebulne muhe in tobakovega resarja na čebuli ter kapusovih bolhačev, kapusovih stenic in tobakovega resarja na zelju. V vseh primerih gre za škodljive žuželke, katerih zatiranje predstavlja domačim pridelovalcem ob uporabi obstoječih načinov pridelave velik izziv, ki mu velikokrat niso kos.

As part of a project funded by ARIS, we participated as a partner organization we studied in four work packages the effectiveness of the simultaneous use of environmentally friendly methods of controlling selected economically important insect pests, which are increasingly difficult to control due to the small number of permitted synthetic insecticides or their absence, insecticide resistance, climate change and other causes. In the project we investigated the effectiveness of companion plants (intercrops and trap crops) and cover plants in combination with biological control agents (entomopathogenic nematodes and fungi) or biotechnical methods (coloured sticky boards and pyramidal traps with attractants) for controlling important pests of potato, onion and cabbage. Thus, the main purpose of the research of the project team consisting of members of three domestic research organizations with extensive research experience in the fields of plant protection, analytical chemistry and plant ecology, was to determine the most appropriate combinations of different environmentally acceptable methods for controlling wireworms in potato tubers, onion fly and onion thrips in onion and cabbage flea beetles, cabbage stink bugs and onion thrips on cabbage. In all cases, these are harmful insects, the control of which poses a great challenge to domestic producers using existing production methods, which they often cannot cope with.

3.2.2 Razvoj in vpeljava Crispr/Cas diagnostike za terensko detekcijo viroida razpokanosti skorje agrumov (CBCVd) v hmelju (*Humulus lupulus* L.)

Vodja / Leading by: dr. Tanja Guček

V letu 2025 smo z majem 2025 zaključili z aktivnostmi na projektu razvoja in vpeljave Crispr/Cas diagnostike za terensko detekcijo viroida CBCVd v hmelju. V okviru projekta smo v skladu s planom projekta izvedli optimizacijo RT-RPA metode in CRISPR/Cas metode ter testiranje hitrih testov. Testirali smo različne vzorce in primerjali različne načine homogenizacije, kot tudi različne hitre teste. V okviru testiranja smo dobili prve pozitivne rezultate in uspešno določili razliko med pozitivnimi in negativnimi vzorci. Svoje delo smo predstavili na mednarodnem kongresu na tematiko viroidov, ki je septembra 2025 potekal v Italiji. Projekt je zaključen, vendar bi radi v sodelovanju z raziskovalci iz Španije, ki razvijajo CRISPR diagnostiko v okviru projekta ViroiDoc, nadaljevali raziskave in metodo še dodatno optimizirali.

In 2025, by May 2025, we completed the activities of the project focused on the development and implementation of CRISPR/Cas diagnostics for field detection of the viroid CBCVd in hops. Within the project, and in accordance with the project plan, we carried out optimization of the RT-RPA method and the CRISPR/Cas method, as well as testing of rapid assays. We tested various samples and compared different homogenization approaches, as well as different rapid tests.

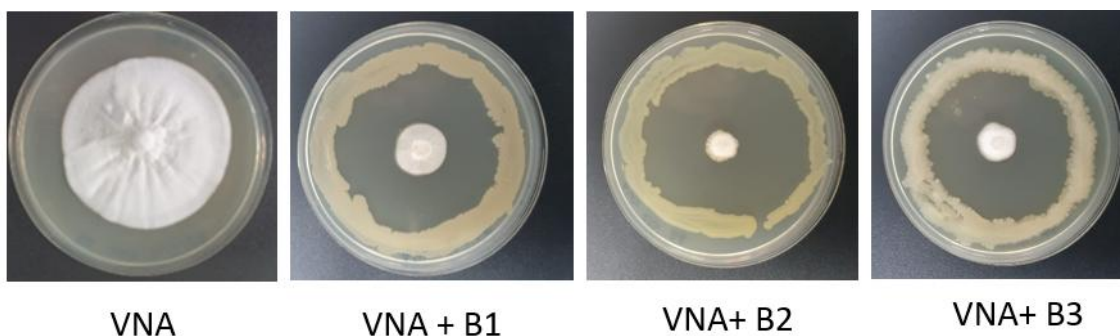
During the testing, we obtained the first positive results and successfully distinguished between positive and negative samples. We presented our work at an international congress on viroids, which took place in Italy in September 2025. The project has been completed; however, we would like to continue the research and further optimize the method in collaboration with researchers from Spain who are developing CRISPR diagnostics within the ViroiDoc project.

3.2.3 SUSTEMICROP - Razvoj ekološko trajnostnih tehnologij in strategij za pomembne Sredozemske sisteme rastlinske pridelave, s poudarkom na podpori majhnih pridelovalcev in socialno-ekonomskega kmetovanja/ Development of eco-sustainable systemic technologies and strategies in key Mediterranean crops systems, contributing the small farming socio-economic resilience

Koordinator: University of Leon, Dr. Juan José Rubio Coque, nosilec IHPS: dr. Sebastjan Radišek

V letu 2025 smo nadaljevali z izvajanjem poljskih poskusov, katerih cilj je bil oceniti učinkovitost s BCA (mikrobiološkimi biotičnimi agensi) obogatenega komposta pri preprečevanju okužb z verticilijsko uvelostjo hmelja. Poskus smo vrednotili na ravni spremljanja pojava obolelih rastlin na tretiranem in netretiranem delu hmeljišča. V času obiranja hmelja smo na reprezentativnih rastlinah določili pridelek in ocenili njegovo kakovost. Na ravni tal smo izvedli analizo mikrobioma ter analizo vsebnosti hranil. V drugem tehnološkem sklopu smo nadaljevali s preskušanjem učinkovitosti eteričnih olj pri preprečevanju okužb s hmeljevo peronosporo in hmeljevo pepelovko.

In 2025, we continued implementing field trials aimed at evaluating the effectiveness of compost enriched with BCAs (microbial biological control agents) in preventing infections of hop *Verticillium* wilt. The trial was assessed by monitoring the incidence of symptomatic plants in the treated and untreated sections of the hop yard. During hop harvest, yield was determined and quality was assessed on representative plants. At the soil level, we performed microbiome analysis and nutrient content analysis. In a second technological work package, we continued testing the efficacy of essential oils in preventing infections of hop downy mildew and hop powdery mildew.



Slika 2: Zavrt razvoj kolonij glive *Verticillium nonalfalfae* (VNA) na gojišču ob prisotnosti koristnih bakterij (B1,2,3) (Foto: C.C. Peña) / Inhibited colony development of *Verticillium nonalfalfae* (VNA) on agar medium in the presence of beneficial bacteria (B1,2,3). (Photo: C. C. Peña)



Slika 3: Vnos BCA-obogatenega komposta v testni del hmeljišča, okuženega s hmeljevo uvelostjo (Foto: S. Radišek) / Application of BCA-enriched compost in the experimental section of a hop yard infected with hop wilt. (Photo: S. Radišek)

3.2.4 Projekt ViroiDoc / Advanced Research on Viroid Pathogenesis and Control for Agricultural Sustainability (ViroiDoc)

Koordinator: Univerza v Ljubljani, dr. Sabina Berne, nosilca na IHPS: dr. Sebastjan Radišek, Octave Lacroix

HORIZON-MSCA-2023-DN-01-01; Obdobje financiranja 1.1.2025 - 31.12. 2028

ViroiDoc (<https://www.viroidoc.eu/>) je mednarodni raziskovalni projekt, financiran v okviru programa Horizon Europe Marie Skłodowska-Curie Actions (MSCA), katerega cilj je razumevanje in reševanje problematike viroidov z uporabo najnovejših znanstvenih orodij. Projekt povezuje 22 partnerjev, med katerimi so vodilne univerze, raziskovalni inštituti in industrijski partnerji iz 11 držav Evrope in obeh Amerik, vključno z Italijo, Španijo, Francijo, Grčijo, Nemčijo, Slovenijo, Švico, Češko, Poljsko, ZDA in Argentino. Projekt koordinira Univerza v Ljubljani, iz Slovenije pa v projektu sodelujeta še IHPS ter Kemijski Inštitut Slovenije. Projekt ViroiDoc vključuje deset doktorskih študentov, ki bodo skupaj z mentorji in partnerji razvijali in raziskovali ključne vidike biologije viroidov – od interakcij med gostiteljem in patogenom ter tehnologij zgodnjega odkrivanja do epidemiologije in inovativnih strategij obvladovanja, kot je uporaba antiviroidnih terapevtikov.

IHPS sodeluje v delovnem sklopu, ki se osredotoča na vpliv podnebnih sprememb na pojav in širjenje viroidov. Pri tem smo v letu 2025 pričeli raziskovati vpliv temperature, padavin in prehranskega stresa na nastanek okužb CBCVd ter razvoj bolezenskih znamenj na hmelju.

ViroiDoc (<https://www.viroidoc.eu/>) is an international research project funded under the Horizon Europe Marie Skłodowska-Curie Actions (MSCA) programme, aiming to understand and address viroid-related challenges using state-of-the-art scientific tools. The project brings together 22 partners, including leading universities, research institutes, and industrial partners from 11 countries across Europe and the Americas—Italy, Spain, France, Greece, Germany, Slovenia, Switzerland, the Czech Republic, Poland, the USA, and Argentina. The project is coordinated by the University of Ljubljana; in Slovenia, IHPS and the National Institute of Chemistry (Slovenia) also participate. ViroiDoc involves ten PhD students who, together with their supervisors and

project partners, will develop and investigate key aspects of viroid biology—from host–pathogen interactions and early detection technologies to epidemiology and innovative management strategies, such as the use of anti-viroid therapeutics. IHPS contributes to a work package focusing on the impact of climate change on the occurrence and spread of viroids. In 2025, we began investigating the effects of temperature, precipitation, and nutritional stress on the onset of CBCVd infections and the development of disease symptoms in hop.



ViroiDoc is funded by the European Union within the Horizon Europe MSCA Doctoral Networks, Reference Number HORIZON-MSCA-2023-DN-01-01, Marie Curie Grant Agreement Number: 101169421. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

3.3 USPOSABLJANJE MLADIH RAZISKOVALCEV/ YOUNG RESEARCHERS PROGRAMME

3.3.1 Usposabljanje mlade raziskovalke Lucije Luskar pod mentorstvom izr. prof. dr. Andreje Čerenak / Young researchers programme (Lucija Luskar) under mentorship of izr. prof. dr. Andreje Čerenak

Mlada raziskovalka Lucija Luskar je napredovala v 4. letnik podiplomskega študija biotehnologije na Biotehniški fakulteti Univerze v Ljubljani. Nadaljevala je z bioinformatiko analizo podatkov in pripravo napovednih modelov. Na podlagi pridobljenih rezultatov je pripravila znanstveni članek o odpornosti hmelja na glivo *Verticillium nonalfalfae*. Raziskovalno delo je predstavila na znanstveni konferenci v Riminiju (Italija, International Symposium on Biotechnological Tools in Horticulture), v Spaltu (Nemčija, IHGC STC) in Dnevu bioznanosti v Ljubljani.

Young researcher Lucija Luskar has progressed to the 4th year of her postgraduate studies in Biotechnology at the Biotechnical Faculty, University of Ljubljana. She continued with bioinformatic data analysis and the preparation of predictive models. Based on her results, she has prepared a scientific article on the resistance of hops to the fungus *Verticillium nonalfalfae*. She presented her research work at scientific conferences in Rimini (Italy, International Symposium on Biotechnological Tools in Horticulture), Spalt (Germany, IHGC STC), and at the Bioscience Day in Ljubljana.

3.4 CILJNI RAZISKOVALNI PROJEKTI / TARGET RESEARCH PROJECTS

3.4.1 Vrednotenje genotipov in vzgoja družin križanj za proučevanje odpornosti hmelja *Humulus lupulus* L. na hudo viroidno zakrnelost hmelja

Vodja / Leading by: izr. prof. dr. Andreja Čerenak

V projektnem predlogu smo vzpostavili prostorsko izoliran selekcijski nasad hmelja s posajenimi 49 genotipi, za izvajanje umetnih okuževanj in določanje tolerantnosti genskih virov na CBCVd. V postavljenem selekcijskem nasadu smo izvedli umetna okuževanja in fenotipsko ocenjevanje okuženih rastlin ter potrdili prisotnost CBCVd z ustreznimi diagnostičnimi tehnikami. V naboru različnih genskih virov hmelja na IHPS smo določili ženske in moške hmeljne rastline s toleranco na CBCVd. Genotipe z znano toleranco na CBCVd smo že vključili v prva ciljna križanja. Vzgojili smo nove družine križanja, ki bodo podlaga za nadaljnje genetske in molekulske raziskave.

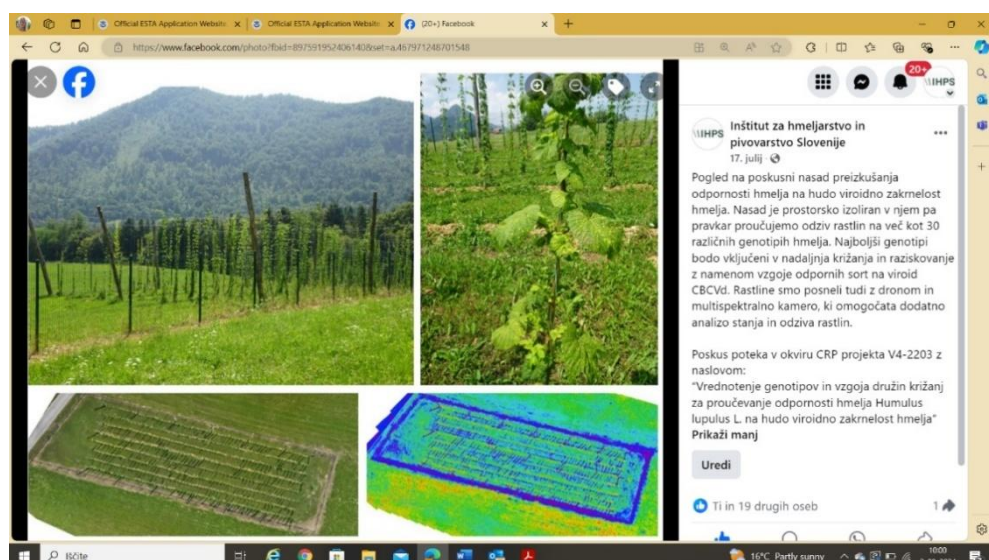
V okviru projekta smo analizirali diferencialno izražanje genov hmelja po okužbi z viroidi CBCVd, HLVd in HSVd. Z uporabo obstoječih transkriptomskih podatkov smo identificirali transkripte z izredno povečanim izražanjem v okuženih rastlinah, pri čemer sta se kot najbolj obetavna pokazala contig_1902 in contig_94445 in bi lahko služila kot potencialna biomarkerja za zgodnjo diagnostiko viroidnih okužb. Za eksperimentalno potrditev smo izvedli lončne poskuse s tremi sortami hmelja (Celeia, Styrian Cardinal, Styrian Wolf), okuženimi s CBCVd. Na izoliranem rastlinskem materialu smo z metodo RT-qPCR preverjali izražanje obeh transkriptov, vendar rezultatov močno povečanega izražanja, zaznanih v bioinformatični analizi, nismo uspeli potrditi.

Izvedli smo prenos znanja in rezultatov do ključnih deležnikov.

In the project proposal, we established a spatially isolated hop selection field with 49 planted genotypes to carry out artificial inoculations and assess the tolerance of genetic resources to CBCVd. In the established field, we performed artificial inoculations and phenotypic evaluation of infected plants, and confirmed the presence of CBCVd using appropriate diagnostic techniques. Within the IHPS hop germplasm collection, we identified female and male hop plants with tolerance to CBCVd. Genotypes with known CBCVd tolerance have already been included in the first targeted crosses. We developed new crossing families that will serve as a basis for further genetic and molecular research.

Within the project, we analysed differential gene expression in hop following infection with the viroids CBCVd, HLVd and HSVd. Using existing transcriptomic data, we identified transcripts with exceptionally increased expression in infected plants; contig_1902 and contig_94445 emerged as the most promising and could serve as potential biomarkers for early diagnosis of viroid infections. For experimental validation, we conducted pot trials with three hop cultivars (Celeia, Styrian Cardinal, Styrian Wolf) infected with CBCVd. In the isolated plant material, we monitored the expression of both transcripts using RT-qPCR; however, we were unable to confirm the strongly increased expression detected in the bioinformatic analysis.

We disseminated the knowledge and results to key stakeholders.



Slika 4: Zasloni posnetek objave na FB strani / A screenshot of a post from the Facebook page

3.4.2 Ohranjanje in izboljšanje proizvodnega potenciala tal za trajnostno pridelavo oljk (GO S-OIL) / Preservation and improvement of the productive potential of soils for sustainable olive cultivation (GO-TO S-OIL)

Vodja / Leading by: dr. Maja Podgornik (IO), za / for IHPS: izr. prof. dr. Iztok Jože Košir

V okviru Ciljnega raziskovalnega projekta »Ohranjanje in izboljšanje proizvodnega potenciala tal za trajnostno pridelavo oljk (GO-TO S-OIL)« so bila glavna področja dela:

- Preučevanje vpliva različnih načinov obdelave tal v oljčnih nasadih (negovana ozelenjena ledina/obdelana ledina) na fizikalne lastnosti tal in prehranjenost rastline,
- Izvajanje poljskih poskusov (nadgradnja poskusa zasnovanega v letu 2018)
- vpliv talnega gnojenja z organskimi in mineralnimi gnojili na rast in razvoj oljk ter lastnosti tal,
- Izvajanje poljskega poskusa za ovrednotenje vpliva uporabe oljčnih tropin na okolje,
- Proučevanje skladiščenja oljčnih tropin in rastlinske vode (pri skladiščenju) ter vplivov na okolje (na tla in na vodo v tleh),
- Izdelava tehnoloških navodil za gnojenje oljk in obdelavo tal.

In the framework of the Targeted Research Project "Maintaining and improving the productive potential of soil for sustainable olive cultivation (GO-TO S-OIL)", the main areas of work were:

- Examining the impact of different methods of soil treatment in olive plantations (cultivated green fallow land/cultivated fallow land) on the physical properties of the soil and plant nutrition,
- Conducting field experiments (upgrade of the experiment designed in 2018) - the influence of soil fertilization with organic and mineral fertilizers on the growth and development of olives and soil properties,
- Conducting a field experiment to evaluate the impact of the use of olive pomace on the environment",
- Studying the storage of olive pomace and plant water (during storage) and the effects on the environment (on the soil and water in the soil),
- Production of technological instructions for fertilizing olive trees and tillage.

3.4.3 FD-GAMEPLAN - Ukrepi za preprečevanje nadaljnega širjenja zlate trsne rumenice (akronim: FD-GAMEPLAN) / Measures to prevent further spread of Grapevine flavescence dorée (acronym: FD-GAMEPLAN)

Vodja / Leading by: doc. dr. Nataša Mehle (NIB), za / for IHPS dr. Magda Rak Cizej

Projekt FD-GamePlan se je zaključil leta 2025 in je bil usmerjen v preučevanje epidemiologije zlate trsne rumenice (Flavescence dorée, FD) v Sloveniji. V ospredju so bili vektorji (prenašalci), leske kot morebitni rezervoarji okužbe ter razvoj pristopov za zgodnje odkrivanje okužb z FD. Projektna hipoteza je izhajala iz predpostavke, da poleg glavnega prenašalca FD – ameriškega škržatka (*Scaphoideus titanus*) – k širjenju FD lahko prispevajo tudi drugi prenašalci, predvsem vzhodnjaški škržatek (*Orientus ishidae*). Sočasno smo preverjali, ali so leske (*Corylus avellana*) lahko rezervoarji fitoplazem iz skupine 16SrV, povezanih z FD, ter ocenili potencial naprednih molekularnih metod in daljinskega zaznavanja za pravočasno identifikacijo okužb v vinogradih.

Rezultati so pokazali, da je bila fitoplazma FD v preimaginalnih stadijih ameriškega škržatka potrjena le pri manjšem deležu vzorcev, zato ta pristop ni primeren za rutinsko zgodnje diagnosticiranje. Najpomembnejši prenašalec med trtami ostaja ameriški škržatek. Vzhodnjaški škržatek, ki je pogost v nasadih lesk in robni vegetaciji, bi lahko imel pomembno vlogo v epidemiologiji FD, vendar prenosa v poskusih (trta, leska–trta in med leskami) še nismo uspeli potrditi. V okviru projekta smo na IHPS podrobno proučili tudi bionomijo vzhodnjaškega škržatka.

Kar zadeva leske, rezultati ne potrjujejo, da so glavni vir težav z FD v slovenskem vinogradništvu, lahko pa predstavljajo rezervoar genetske raznolikosti fitoplazem. Za učinkovitejše obvladovanje vzhodnjaškega škržatka bi bila smiselna uporaba insekticidov, ki so učinkoviti proti ameriškemu škržatku, vendar bi bilo za uporabo v nasadih lesk potrebno ustrezno urediti dovoljenja v skladu z veljavno zakonodajo.

The FD-GamePlan project concluded in 2025 and focused on investigating the epidemiology of Flavescence dorée (FD) in Slovenia. The work concentrated on insect vectors (transmitters), hazel as a potential infection reservoir, and the development of approaches for the early detection of FD infections. The project hypothesis was based on the assumption that, in addition to the main FD vector—the American grapevine leafhopper (*Scaphoideus titanus*)—other vectors may also contribute to the spread of FD, particularly the mosaic leafhopper (*Orientus ishidae*). In parallel, we examined whether hazel (*Corylus avellana*) can serve as a reservoir of phytoplasmas belonging to the 16SrV group associated with FD, and we assessed the potential of advanced molecular methods and remote sensing for the timely identification of infections in vineyards.

The results showed that FD phytoplasma was confirmed in the preimaginal stages of the American grapevine leafhopper in only a small proportion of samples; therefore, this approach is not suitable for routine early diagnosis. The American grapevine leafhopper remains the most important vector between grapevines. The mosaic leafhopper, which is common in hazel orchards and in marginal vegetation, could play an important role in FD epidemiology; however, transmission in experiments (grapevine, hazel-to-grapevine, and between hazel plants) has not yet been confirmed. Within the project, we also studied in detail the bionomics of the mosaic leafhopper at IHPS.

With regard to hazel, the results do not confirm that hazel is the main source of FD problems in Slovenian viticulture, but it may represent a reservoir of the genetic diversity of these phytoplasmas. For more effective management of the mosaic leafhopper, the use of insecticides that are effective against the American grapevine leafhopper would be reasonable; however, for use in hazel orchards it would be necessary to appropriately regulate authorisations in accordance with applicable legislation.

3.4.4 Primerjava tehnologij in strategij namakanja in fertigacije na izbranih kulturah / Comparison of irrigation and fertigation technologies and strategies on selected crops

Vodja / Leading by: prof. dr. Martin Pavlovič

V letu 2025 so bile na lokacijah IHPS, KIS in ZRS KP uspešno izvedene vse načrtovane aktivnosti, ki so vključevale vzpostavitev poskusnih lokacij za hmelj, zelenjavnice in oljke z vgradnjo sistemov za fertigacijo ter merilnikov za kontinuirano spremljanje vsebnosti vode v tleh. Na podlagi podrobnih analiz vodozadrževalnih lastnosti tal in pedoloških analiz so bili pripravljeni natančni gnojilni načrti ter vzpostavljeni optimalni namakalni režimi, ki preko sistema napovedovanja omogočajo učinkovito porabo vode glede na dejanske potrebe rastlin. Tekom rastne sezone so bili izvedeni preizkusi različnih tehnologij, od kapljičnega namakanja po deficitnem pristopu do uporabe mikro-razpršilcev, pri čemer so prvi rezultati na hmelju že podali kvantitativne ocene pridelka, meritve na oljkah pa so pokazale jasne razlike v vodnem potencialu rastlin v času poletne suše. Projektna skupina je ob uspešni realizaciji programa dosegla tudi vidne bibliografske rezultate z objavo znanstvenega članka in aktivno promocijo znanja v širši javnosti preko radijskih in televizijskih prispevkov, celoten proces pa poteka v skladu z zastavljeno časovno dinamiko in strokovnimi cilji.

In 2025, all planned activities were successfully implemented at the IHPS, KIS, and ZRS KP locations, including the establishment of experimental sites for hops, vegetables, and olives, equipped with advanced fertigation systems and sensors for continuous soil moisture monitoring. Based on detailed soil water retention and pedological analyses, precise fertilization plans were prepared and optimal irrigation regimes were established, utilizing communication devices and forecasting systems to ensure efficient water use according to actual plant needs. During the growing season, tests of various technologies were conducted, ranging from deficit drip irrigation to the use of micro-sprinklers, with initial results for hops already providing quantitative yield assessments, while measurements on olives showed clear differences in plant water potential during the summer drought. Alongside the successful realization of the program, the project team achieved significant bibliographic results through the publication of a scientific article and active promotion of knowledge to the general public via radio and television features, with the entire process proceeding in line with the planned timeline and professional objectives.

3.4.5 Preučevanje učinkovitosti, optimizacija in implementacija metod množičnega lovljenja in motenja parjenja izbranih gospodarsko pomembnih škodljivcev gojenih in samoniklih rastlin / Studying the effectiveness, optimization and implementation of methods of mass trapping and mating disruption of selected economically important pests of cultivated and wild plants

Vodja / Leading by: prof. dr. Stanislav Trdan (BF), za / for IHPS: dr. Magda Rak Cizej

Št. pogodbe: V4-2414, obdobje financiranja 1. 9. 2024 do 31. 08. 2027

V okviru projekta smo leta 2025 sodelovali v DS2, kjer smo na lokaciji v Savinjski dolini preučevali učinkovitost metode množičnega lovljenja hroščev pokalic v ozimnem ječmenu, na območju, kjer se običajno pojavljajo velike težave s strunami (ličinkami pokalic). Za spremljanje pokalic smo preskušali učinkovitost dveh vrst pasti (Yatlorf in ESCOLITRAP® (Econex) ter negativno kontrolo brez pasti. V pasti smo namestili feromonski dispenzor za poljsko pokalico (*Agriotes lineatus*) proizvajalca Csalomon (Madžarska). Talne izkope smo izvajali mesečno od aprila do oktobra. Po žetvi ječmena (julij 2025) smo znotraj vsakega bloka polovico njive preorali in posejali z ajdo (setev ajde je bila 16. 7. 2025), druga polovica pa je ostala kot strnišče. Po setvi ajde smo talne izkope

nadaljevali ločeno na delu z ajdo in na strnišču ter z izkopi nadaljevali do zmrzali. Na lokaciji smo ulovili malo samcev pokalic, kar lahko nakazuje, da je ozimni ječmen manj ustrezen gostitelj za obravnavanega škodljivca kot ozimna pšenica. V pasteh Econex smo ujeli več hroščev kot v pasteh Yatlorf, vendar pri primerjavi povprečnega dnevnega ulova nismo potrdili statistično značilnih razlik.

Within the project, we participated in DS2 in 2025, where we assessed the effectiveness of mass trapping of click beetles in winter barley at a site in the Savinja Valley—an area that typically experiences severe problems with wireworms (click beetle larvae). To monitor click beetles, we tested the performance of two trap types (Yatlorf and ESCOLITRAP® (Econex)) and included a negative control without traps. The traps were equipped with a pheromone dispenser for *Agriotes lineatus*, produced by Csalomon (Hungary). Soil sampling by digging was carried out monthly from April to October. After the barley harvest (July 2025), within each block, half of the field was ploughed and sown with buckwheat (buckwheat was sown on 16 July 2025), while the other half remained as stubble. Following buckwheat sowing, soil excavations continued separately in the buckwheat section and in the stubble section, and sampling was continued until the first frost. Only a small number of male click beetles were captured at the site, which may indicate that winter barley is a less suitable host for the target pest than winter wheat. More beetles were caught in Econex traps than in Yatlorf traps; however, comparisons of the average daily catch did not reveal statistically significant differences.

3.4.6 Uporaba brezpilotnih letalnikov za natančno nanašanje fitofarmaceutskih sredstev, sredstev z nizkim tveganjem in koristnih organizmov za trajnostno kmetijstvo – Fly4IPM / The use of unmanned aerial vehicles for precise application of pesticides, biostimulants and biocontrol agents for sustainable agriculture and integrated pest management – Fly4IPM (CRP - V4-2428)

Vodja / Leading by: dr. Uroš Žibret (KIS), vodja na IHPS: dr. Magda Rak Cizej

V letu 2025 smo v okviru ciljno-raziskovalnega projekta Fly4IPM izvedli vse načrtovane aktivnosti. V sodelovanju s Kmetijskim inštitutom Slovenije ter Fakulteto za kmetijstvo in biosistemske vede Univerze v Mariboru smo izvajali poskuse z uporabo tako brezpilotnega letalnika kot klasičnih aplikacijskih tehnik. V prvi polovici leta smo se udeležili strokovnega usposabljanja, ki ga je organiziralo podjetje OneDrone v Jabljah. Nato smo dvakrat sodelovali pri izvedbi terenskih poskusov: v Požegi na Hrvaškem (nanos testne škropilne brozge na vinsko trto, glavno zelje in mnogocvetno ljuljko) ter v Slovenskih Konjicah (nanos testne škropilne brozge na vinsko trto). V obeh primerih smo primerjali zanos škropilne brozge med klasičnimi aplikacijskimi tehnikami (poljedelska škropilnica in pršilnik) ter nanosom s pomočjo brezpilotnega letalnika. Pri tretjem poskusu, ki smo ga organizirali v Savinjski dolini, smo testiranje zanos testne škropilne brozge izvedli v hmeljišču na lokaciji Šempeter v Savinjski dolini. Pri vseh treh poskusih nas je zanimal zanos testne škropilne brozge. V vseh terminih nanosa je brozga vsebovala rumeno barvilo tartrazin. Meritve zanosov smo izvajali s pomočjo sedimentacijskih kolektorjev, nameščenih na različnih razdaljah od roba njiv oziroma hmeljišča ter na različnih višinah na kolektorskih palicah. Poleg tega smo v času izvajanja poskusov na različnih višinah v neposredni bližini poskusa beležili tudi meteorološke podatke. Rezultate vseh poskusov smo zbrali v poročilih ter o ključnih ugotovitvah sproti obveščali zainteresirano javnost.

In 2025, within the framework of the research project Fly4IPM, we carried out all planned activities. In cooperation with the Agricultural Institute of Slovenia and the Faculty of Agriculture and Life Sciences of the University of Maribor, we conducted experiments using unmanned aerial vehicles and conventional application spraying techniques. In the first half of the year, we attended a

professional training course organized by the company OneDrone in Jablje. We then participated in two field trials: in Požega, Croatia (application of a test spray mixture on grapevine, head cabbage and perennial ryegrass) and in Slovenske Konjice (application of a test spray mixture on grapevine). In both cases, we compared spray drift between conventional application techniques (field sprayer and air-blast sprayer) and application using unmanned aerial vehicles. The third experiment, which we organized in the Savinja Valley, was conducted in a hop field located in Šempeter v Savinjski dolini. In all three experiments, our focus was on assessing the drift of the test spray mixture. During each application, the mixture contained the yellow dye tartrazine. Spray drift measurements were performed using sedimentation collectors placed at various distances from the edge of the field or hop yard, as well as at different heights on collector poles. In addition, during each experiment, we recorded meteorological data at different heights in the immediate vicinity of the trial area. The results of the experiments were reported in formal reports, and the interested public was informed about the findings.

3.5 ZNANSTVENO-TEHNOLOŠKO SODELOVANJE / SCIENTIFIC-TECHNICAL COOPERATION

3.5.1 Vpliv različnih faktorjev na diastatsko moč hmelja / The influence of various factors on the diastatic power of hops (Slovenija in ZDA v letih 2024-2026)

Vodja / Leading by: izr. prof. dr. Iztok Jože Košir

Proizvodnja piva temelji na sestavinah voda, kvas, ječmen in hmelj, pri čemer igra hmelj ključno vlogo pri aromi in okusu. Hladno hmeljenje, tehnika, kjer se hmelj doda med zorenjem, ustvarja bolj izrazite arome, vendar lahko povzroči težave, kot so prekomerna karbonizacija, previsoka vsebnost alkohola in spremenjeni okusi in arome. Te težave so posledica diastatske moči hmelja, ki omogoča razgradnjo kompleksnih sladkorjev v fermentabilne sladkorje, kar vodi v ponovno fermentacijo po končani primarni fermentaciji.

Cilj projekta je preučiti diastatsko moč hmelja, s poudarkom na tem, kako sorta hmelja, vsebnost polifenolov in osemenjenost vplivajo nanjo. Izbrali bomo metode za napovedovanje diastatske moči, kar bo pomagalo pivovarjem pri preprečevanju težav. Rezultati bodo izboljšali pivovarski postopek in nam podali podatke o slovenskih sortah hmelja.

Beer production relies on ingredients water, yeast, malt, and hops, with hops playing a key role in aroma and taste. Dry hopping, a technique where hops are added during maturation, creates more distinct aromas but can lead to problems like excessive carbonation, high alcohol content, and altered flavors. These issues are caused because of the diastatic power of hops, which allows them to break down complex sugars into fermentable ones, leading to re-fermentation after the primary fermentation.

This project aims to study the diastatic power of hops, focusing on how hop variety, polyphenol content, and seediness affect it. We will select test methods to predict diastatic power, helping brewers avoid related issues. The results will improve brewing processes and give the information about the Slovenian hop varieties.

3.5.2 Razmnoževanje hmelja (*Humulus lupulus* L.) s potakjenci in vitro tehnikami (Slovenija in Bosna in Hercegovina v letu 2024-2025) / Propagation of hops (*Humulus lupulus* L.) by cuttings using in vitro techniques

Vodja / Leading by: izr. prof. dr. Andreja Čerenak

V jesenskem času smo se sestali s partnerji sodelujoče države in dorekli zaključke našega raziskovalnega dela.

In the autumn, we had a meeting with partners from the participating country and agreed conclusions of for our research work.

3.5.3 Optimizacija sestave zdrobov pri uporabi pšenice hibridne (mešane) teksture endosperma za pripravo sladice in pивine za proizvodnjo piva (Slovenija in Hrvaška v letih 2025-2026) / optimizing the composition of the grits when using wheat of hybrid (mixed) endosperm texture for the preparation of mash and wort for beer production

Vodja / Leading by: izr. prof. dr. Iztok Jože Košir

Neslajena pšenica in pšenični slad sta verjetno prva žita, uporabljena v proizvodnji piva. V zadnjem času njun delež v pivovarski proizvodnji narašča, saj ima pšenica pomembne gospodarske in tehnološke prednosti pred drugimi žiti, vključno z ječmenom. Zato so žlahtnitelji že pridelali sorte, posebej prilagojene za potrebe pivovarske industrije, pri katerih so zmanjšane kvalitativne napake, kot je povečan delež beljakovin in/ali povečana viskoznost sladice in pивine. Sortiment pšenice na območju južne Panonske nižine (torej tudi na Hrvaškem in v Sloveniji) skoraj izključno pripada hibridnim "trdo rdečim ozimnim" sortam. Zanje je značilno, da imajo teksturo endosperma med trdo in mehko. Raziskave, ki jih opravljamo kažejo, da so v pregledanem sortimentu pšenice, ki dajejo slad in sladico zelo dobre kakovosti. Vse sorte, ki so se z vidika pivovarske kakovosti izkazale za dobre, spadajo v 2. sladarsko kakovostno skupino po nemški strokovni klasifikaciji. Za to skupino je značilen povišan delež skupnih beljakovin ter zadovoljive vrednosti deleža topnih beljakovin in viskoznosti sladice ali pивine. Razloge za to gre iskati v kombinaciji genotipskih in fenotipskih dejavnikov. Fenotipski dejavnik je zelo pogost učinek »prisilnega zorenja«, kjer se v zadnji fazi zorenja zrnja pojavi kombinacija visoke vlažnosti in visokih temperatur. Na podlagi navedenega raziskave obsegajo: poskusno mikroslajenje izbranih domačih sort, za katere že obstajajo znanstveni podatki o kakovosti slada in mikroslajenje kontrolnih tujih sort, analizo izhodne pšenice in pridobljenih sladov, njihovih sladice, pивine in piva.

Unmalted wheat and wheat malt are probably the first grains used in beer production. Recently, their share in brewing production has been increasing, as wheat has significant economic and technological advantages over other grains, including barley. Therefore, breeders have already produced varieties adapted to the needs of the brewing industry, in which qualitative defects as increased protein content and/or increased viscosity are reduced. The assortment of wheat in the area of the Pannonian (that is, also in Croatia and Slovenia) almost exclusively belongs to hybrid hard red winter varieties. They are characterized by having an endosperm texture between hard and soft. The research that we are carrying out shows that in the reviewed assortment there are wheats that produce wort of very good quality. All varieties, which have proved to be of high brewing quality, belong to the 2nd malting quality group according to the German classification.

This group is characterized by an elevated proportion of total proteins and satisfactory values of the proportion of soluble proteins and the viscosity of the wort. The reasons for this are to be found in a combination of genotypic and phenotypic factors. The phenotypic factor is a very common effect of "forced ripening", where a combination of high humidity and high temperatures occurs in the final stage of ripening. Based on the above, the research includes: experimental micromalting of selected domestic varieties for which there are already data on malt quality and of control foreign varieties, analysis of output wheat and obtained malts, their wort and beer.

4 JAVNE SLUŽBE, STROKOVNE NALOGE IN DRUGE NALOGE NA PODLAGI POOBLASTIL IN IMENOVANJ / PUBLIC SERVICES AND ACTIVITIES BASED ON PUBLIC AUTHORISATION

4.1 JAVNA SLUŽBA V HMELJARSTVU IN STROKOVNE NALOGE V KMETIJSTVU / PUBLIC SERVICE IN AGRICULTURE

4.1.1 Javna služba v hmeljarstvu / Public service in hop production

4.1.1.1 Žlahtnjenje hmelja / Hop breeding

Vodja / Leading by: izr. prof. dr. Andreja Čerenak

V okviru žlahtnjenja hmelja smo primerno oskrbovali 4,59 ha hmeljišč posajenih s križanci. V rastlinjaku smo izvedli umetno okuževanje s sporami hmeljeve peronospre in hmeljeve pepelovke na populaciji okrog 16.000 sejančkov; več kot 4.000 jih je prestalo obe selekciji in jih bo večina posajenih spomladi prihodnjega leta na njivo, po opravljeni molekularni določitvi spola. Umetno okuževanje 9 kandidatnih v primerjavi s 7 standardnimi sortami s sporami hmeljeve peronospre in hmeljeve pepelovke smo prav tako izvedli v rastlinjaku. Analizirali smo več deset rastlin za potrditev odsotnosti CBCVd pred načrtovanim sajenjem v hmeljišče v naslednjem letu. Na žlahtniteljskem polju s posajenimi dvoletnimi rastlinami smo zaradi ugodnih vremenskih pogojev opravili negativno selekcijo na hmeljevo peronospro. V poskus P30 smo posadili 11 križancev, v P5 smo posadili 9, v P2 pa 124 izbranih genotipov. V tkivni kulturi smo ohranjali 29 različnih genotipov hmelja. Opravili smo teste odpornosti na hmeljevo uvelost pri 5 križancih družine Wye Target x 2/1 ter 20 genotipov iz različnih družin križanj, vse smo okužili s PV1 V. nonalphanphae, ki v Sloveniji povzroča letalno obliko bolezni; 8 križancev je izkazalo odpornost in 2 srednjo odpornost. V testiranje odpornosti na CBCVd, ki povzroča hudo viroidno zakrnelost hmelja, smo vključili 10 genotipov hmelja in 4 standardne sorte; 2 izmed njih sta izkazala visoko občutljivost in sta bila izločena iz poskusa. V nasadu z nizko oporo smo opazovali pojav bolezni pri 12 križancih ter 8 sortah hmelja. Opravili smo 101 kombinacij križanj. V času tehnološke zrelosti hmelja smo označili nad 400 križancev, pri katerih smo opravili oceno habitusa rastline. Pri več kot 300 genotipih smo opravili kemijske analize določanja grenčičnih in aromatičnih spojin, storžke smo tudi senzorično ocenili. Za namen vzgoje izvornih matičnih rastlin smo vzgajali rastline iz meristema novih sort hmelja 90A263 in 109B27. Konec leta smo pripravili 30 različnih vzorcev piva petih sort z namenom določanja senzoričnih lastnosti v pivu.

In the hop breeding program 4.59 ha of hop fields, planted with hybrids, were properly cultivated. In the glasshouse, artificial infection with downy and powdery mildew spores was done on population of app. 16.000 seedlings; more than 4.000 of them passed both selections and the majority will be planted in the next year, after molecular sex determination. Artificial infection of 9 candidate varieties compared to 7 standard varieties with spores of downy and powdery mildew was done in the glasshouse as well. Before planting in the field in the next year, more than tens of hop genotypes in glasshouse were analysed to determine the absence of CBCVd. Because of the optimal weather conditions, we have done negative selection to the downy mildew, in the breeding field of 2 - years old plants. We planted 11 selected genotypes in P30 trial, 9 selected genotypes in P5 trial, 124 in P2 trial. 29 hop genotypes were maintained in in vitro culture. We carried out 25

tests of resistance to verticillium wilt, all of them were infected with PV1 pathotypes of *V. nonalfhalphae*, which causes lethal form of verticillium wilt in Slovenia; 8 genotypes shown resistance and 2 semi-resistance. We included 10 hop genotypes and 4 standard varieties in testing resistance to CBCVd which causes severe hop stunt disease; 2 were excluded from the trial because of their high susceptibility. In the hop yard with low trellis we observed appearance of diseases at 12 breeding lines and 8 varieties. 101 crossing combinations were done. In the time of technological ripeness 400 hop plants were marked in breeding plot, they were descriptively recorded while the others had less pronounced flavor. We have done more than 300 chemical analyses for determination of bitter compounds and essential oils; the plants were observed regarding the yield quality and quantity as well. For the needs of certification scheme plants from meristem of one new hop varieties were developed (90A263 and 109B27). In the beginning of the year, 30 beer samples were prepared using five varieties with the purpose to establish sensory evaluation in the beer.



Slika 5: Nasad prvoletnih rastlin na SN-6; namakan 5. 6. 2025 / SN-6 first-year plantation; irrigation performed on 5 June 2025

4.1.1.2 Ocena letnika hmelja / Annual hop harvest assessment

Vodja / Leading by: Joško Livk

Z nalogo smo določili letne reprezentativne vzorce pridelka hmelja po posameznih sortah ter analizirali vzorce hmelja na določene kakovostne parametre. Tako smo v času obiranja hmelja pobrali po terenu, analizirali in statistično obdelali skupno 120 vzorcev pridelka zračno suhega hmelja naslednjih sort: Aurora, Savinjski golding, Bobek, Celeia, Styrian gold, Styrian Cardinal, Styrian Dragon in Styrian Wolf. V vseh vzorcih smo določili vsebnost vlage in alfa-kislin (KVH – TE). Vrednosti alfa-kislin so bile v večini primerov višje ali v rangi povprečne vrednosti zadnjih desetih let. Vsebnost tujih snovi v hmelju (primesi in odpada) ter vsebnost semena smo določili v 30 vzorcih. V okviru naloge smo na spletni strani IHPS mesečno objavljali poročila o certificiranem pridelku slovenskega hmelja letnika 2024 in 2025.

We determined the annual representative samples of a hop yield for different hop varieties and analyzed them on certain quality parameters. During a hop harvest, we collected and statistically analyzed in total the 120 samples of air-dry hop cones for the following varieties: Aurora, Savinjski golding, Bobek, Celeia, Styrian gold, Styrian Cardinal, Styrian Dragon and Styrian Wolf. The moisture content and alpha-acids (KVH - TE) were determined for all the samples. Alpha-acid values were higher or similar to the rank of average ones in last ten years. The extraneous matter content (impurities and waste content) and the seed content were determined in 30 samples. In a context of this work, monthly reports about the certified Slovenian hops in years 2024 and 2025, were published on the IHPS website.

4.1.1.3 Tehnologije pridelave in predelave hmelja / Hop production and processing technologies

Vodja / Leading by: dr. Barbara Čeh

Strokovna naloga Tehnologije pridelave in predelave hmelja se izvaja na podlagi uredbe, ki ureja trg s hmeljem (UL RS 60/2010) in Pravilnika o izvajanju javne službe v hmeljarstvu (UL RS 45/2010) kot javna služba v hmeljarstvu iz proračunske postavke 7649. Izvajanje dela pridelovalci spremljajo preko Odbora za hmeljarstvo pri IHPS in tehnoloških sestankov. Strokovna naloga temelji na sedmih delovnih sklopih. Glavni poudarek je svetovanje in podpora hmeljarjem pri pridelavi hmelja, ki temelji na prognozah bolezni in škodljivcev hmelja, namakanja, gnojenja ter tehnološke zrelosti. Hkrati se glede na potrebe in zanimanje hmeljarjev ter stroke izvajajo tehnološki poskusi, ki služijo razvoju in dodelavi tehnologije pridelave hmelja. Obdelujejo se meteorološki podatki za namen spremljanja rasti in razvoja hmelja ter izdajanja navedenih napovedi. Na področju usmerjanja uporabe FFS v hmeljarstvu se izdela vsakoletni seznam dovoljenih FFS za varstvo hmelja v Sloveniji. V okviru naloge smo sodelavci IHPS na evropskem nivoju vključeni v skupino Commodity Expert Group (CEG) za Minor Uses – Hops. Izdelujemo sistemsko analizo konkurenčnosti in globalnih tržnih razmer v hmeljarstvu ter modelno analizo variabilnih stroškov pridelave hmelja v Sloveniji. Uporabnike izobražujemo in obveščamo preko tehnoloških sestankov hmeljarjev, Hmeljarskih informacij, vsako leto pa organiziramo in izvedemo Seminar o hmeljarstvu.

V letu 2025 smo na področju tehnoloških poskusov izvedli poskuse na tematike: presejalno preizkušanje učinkovitosti pripravkov iz skupine krepilcev odpornosti rastlin, biofungicidov, osnovnih snovi in biostimulatorjev za preprečevanje bolezni hmelja; uvajanje alternativnih metod zatiranja navadne (hmeljeve) pršice na hmelju, aplikacijska tehnika v hmeljarstvu; podsevki v hmeljiščih; foliarno gnojenje hmelja; gnojenje hmelja s sulfatom; testiranje napovedi kapljičnega namakanja hmelja z uporabo senzorjev za spremljanje vlažnosti tal in razporeditev vode v talnem profilu; analiza vpliva kapljičnega namakanja hmelja izvajanega po napovedi na razporeditev vode v tleh; določanje vpliva okužb storžkov na HSI; spremljanje HSI v času dozorevanja pri sorti Celeia.

The professional task Technologies for Hop Production and Processing is carried out based on the regulation governing the hop market (UL RS 60/2010) and the Ordinance on the Implementation of Public Service in Hop Production (UL RS 45/2010) as a public service in hop production funded by the budget item 7649. The work is monitored by hop growers through the Committee and technological meetings. The professional task is based on seven work modules. The main focus is on advising and supporting hop growers in hop production, based on forecasts for hop diseases and pests, irrigation, fertilization, and technological maturity. At the same time, technological trials are conducted according to the needs and interests of hop growers and the profession, which serve the development and refinement of hop production technology. Meteorological data are processed to monitor hop growth and development and issue the aforementioned forecasts. In the field of guiding the use of plant protection products (PPP) in hop production, an annual list of approved PPPs for hop protection in Slovenia is compiled. As part of the task, IHPS staff are involved at the European level in the Commodity Expert Group (CEG) for Minor Uses – Hops. We conduct a systematic analysis of competitiveness and global market conditions in hop production, as well as a model analysis of the variable costs of hop production in Slovenia. We educate and inform users through technological meetings for hop growers, Hop Information. Every year we organize and hold the Hop Growing Seminar.

In 2025, within the scope of technological trials, we carried out experiments on the following topics: screening the efficacy of products from the groups of plant resistance inducers, biofungicides, basic substances, and biostimulants for the prevention of hop diseases; introduction of alternative methods for controlling the common (hop) spider mite in hops; application technology in hop production; cover crops in hop fields; foliar fertilisation of hops; hop fertilisation with sulphate; testing drip irrigation scheduling forecasts for hops using sensors to monitor soil moisture and water distribution in the soil profile; analysis of the impact of drip irrigation performed according to

forecasts on water distribution in the soil; determining the influence of cone infections on HSI; and monitoring HSI during ripening in the variety Celeia.



Slika 6: Utrinek s tehnološkega sestanka hmeljarjev; predavanje dr. Magde Rak Cizej / A snapshot from the hop growers' technical meeting; presentation by Magda rak Cizej, PhD

4.1.1.4 Introdukcija novih in tujih sort hmelja / Introduction of new and foreign hop varieties

Vodja / Leading by: dr. Barbara Čeh

Strokovna naloga Introdukcija novih in tujih sort hmelja se je izvajala na podlagi Zakona o kmetijstvu (ZKme 1, UL RS, št. 45/2008), Uredbe o ureditvi trga s hmeljem (UL RS, št. 20/2009), Uredbe o spremembah in dopolnitvah Uredbe o ureditvi trga s hmeljem (UL RS, št. 60/2010) ter Uredbe o spremembah in dopolnitvah Uredbe o ureditvi trga s hmeljem (UL RS št. 50/2015). Cilji v letu 2025 so bili: določevanje načina gnojenja za sorto Styrian Wolf, sajenje poskusa z različno gostoto rastlina/ha pri sorti 31B26, določitev terminskega okna tehnološke zrelosti za nove sorte 90A263, 109B27 in 31B26 na dveh lokacijah, ugotavljanje morebitnega pojava fiziopatij pri novih sortah in iskanje njihovega vzroka, pridobivanje/zbiranje informacij o odzivu novih sort hmelja na škodljive organizme in dodatna opazovanja novih sort v poljskih razmerah na nizki opori s poudarkom na škodljivih organizmih.

Professional task Introduction of new and foreign hop varieties was carried out on the basis of the Agriculture Act (ZKme 1, Official Gazette of RS, no. 45/2008), Regulation on the organization of the hop market (Official Gazette of RS, no. 20/2009), Regulation on the amendments and supplements in the Regulation on the organization of the hop market (Official Gazette of RS, no. 60/2010) and Regulation on the amendments and supplements in the Regulation on the organization of the hop market (Official Gazette of RS, no. 50/2015). The goals for 2025 were: The objectives for 2025 were: to determine an appropriate fertilisation strategy for the cultivar Styrian Wolf; to establish a trial with different planting densities (plants per hectare) for the cultivar 31B26; to define the time window of technological maturity for the new cultivars 90A263, 109B27, and 31B26 at two locations; to identify any potential physiological disorders in the new cultivars and investigate their causes; to collect information on the response of new hop cultivars to pests and diseases; and to carry out additional field observations of the new cultivars under low-trellis conditions, with a particular focus on harmful organisms.

4.2 JAVNA SLUŽBA V VRTNARSTVU / PUBLIC SERVICE IN HORTICULTURE

Vodja / Leading by: Maja Dobrajc

Inštitut za hmeljarstvo in pivovarstvo Slovenije je del Javne službe v vrtnarstvu, kjer smo 2025 v okviru strokovnih nalog izvajali selekcijo zelišč, introdukcijo in ekološko rajonizacijo zelišč ter tehnologijo pridelave zelišč. Pri selekciji zelišč smo za sistematično vrednotenje genskega materiala obravnavali navadno dobro misel (*Origanum vulgare* L.), pri kateri smo v poljskem poskusu izvedli morfološko, kvantitativno in kemijsko vrednotenje. V sklopu introdukcije in ekološke rajonizacije smo kraški šetraj (*Satureja montana* L.), navadni rman (*Achillea millefolium* L.) in vrtni timijan (*Thymus vulgaris* L.) pridelovali na treh različnih lokacijah (Žalec, Doblatina, Fokovci). Proučevali smo vpliv agro-ekoloških razmer na pridelek, kjer smo primerjali kvalitativne podatke rastlin in njihov pridelek. Pri introdukciji smo tri sorte poprove mete (*Mentha x piperita* L.) zasadili na lokaciji Žalec, kjer smo spremljali količino in kakovost pridelka ter dovzetnost na bolezni in škodljivce. V sklopu tehnologije pridelave smo primerjali pridelavo poprove mete (*Mentha x piperita* L.) v zaščitenem prostoru in na prostem. Vrednotili smo spravilo pridelka, pri čemer smo rastline izmerili, svež pridelek stehali, ga posušili in nato analizirali odstotek vlage ter vsebnost eteričnega olja. Pri tehnologiji gnojenja smo proučevali različne odmerke dušika pri pridelavi melise (*Melissa officinalis* L.). Izmerili smo rastline, stehali svež pridelek in opravili analizo odstotka vlage ter vsebnosti eteričnega olja. Aktivnosti in rezultate strokovnih nalog smo podali v poročilih Javne službe v vrtnarstvu ter jih predstavili na Dnevih odprtih vrat v Vrtu zdravilnih in aromatičnih rastlin IHPS, kot tudi na spletni strani IHPS.

The Institute of Hop Research and Brewing (IHPS) operates within the framework of the Public Agricultural Advisory Service in Horticulture. In 2025, as part of our professional tasks, we conducted activities in herb selection, introduction and ecological regionalization of herbs, and herb production technology. Within the herb selection programme, systematic evaluation of genetic material was carried out on oregano (*Origanum vulgare* L.). A field trial was established in which morphological, quantitative, and chemical assessments were performed. As part of introduction and ecological regionalization, winter savory (*Satureja montana* L.), yarrow (*Achillea millefolium* L.), and common thyme (*Thymus vulgaris* L.) were cultivated at three different locations (Žalec, Doblatina, and Fokovci). We investigated the influence of agro-ecological conditions on yield, comparing plant qualitative parameters and total yield. Within the introduction trials, three cultivars of peppermint (*Mentha x piperita* L.) were established at the Žalec location. We monitored yield quantity and quality, as well as susceptibility to diseases and pests. Under production technology studies, we compared peppermint (*Mentha x piperita* L.) cultivation in protected cultivation and in the open field. Harvest evaluation included plant measurements, fresh biomass weighing, drying, and subsequent determination of moisture content and essential oil content. In the fertilization technology trial, different nitrogen application rates were studied in the cultivation of lemon balm (*Melissa officinalis* L.). Plants were measured, fresh yield was recorded, and analyses of moisture percentage and essential oil content were conducted. The activities and results of these professional tasks were documented in reports of the Public Agricultural Advisory Service in Horticulture and presented during Open Days at the IHPS Medicinal and Aromatic Plant Garden, as well as published on the IHPS website.

4.3 STROKOVNE NALOGE S PODROČJA VARSTVA IN REGISTRACIJE SORT RASTLIN IN SEMENARSTVA ZA PODROČJE CERTIFICIRANJA SADILNEGA MATERIALA ZA HMELJARSTVO / THE PROGRAM FOR PROTECTION SEED MATERIALS AND REGISTRATION FOR DIFFERENT HOP VARIETIES AND CERTIFICATION HOP PLANTING MATERIALS

Vodja / Leading by: dr. Magda Rak Cizej

V sklopu programa strokovnih nalog s področja varstva in registracije sort rastlin ter semenarstva smo na področju vrednotenja sort hmelja za uporabo in pridelavo (VPU) zadnje leto vrednotili serijo petih sort hmelja v preizkušanju. Izvedli pa smo ocenjevanje RIN pri okrasnih rastlinah in sicer na 12. sortah navadnega zvončka. Nudili smo strokovno podporo Upravi s pripravo protokolov za preverjanje RIN za *Ajuga genevensis* in dve vrsti zelišč.

IHPS izvaja nalogo hranjenja uradnih standardnih vzorcev sort hmelja, ki so v Republiki Sloveniji vpisane na sortno listo v skladu s področno zakonodajo. Sistem hranjenja standardnih vzorcev sort hmelja je prilagojen hmelju, ki spada med vegetativno množene rastline. Vzorce 26 sort v skladu s protokolom za hrambo standardnih vzorcev hmelja hranimo v *in vitro* in *in vivo* razmerah.

V skladu z odločbo o dodelitvi javnega pooblastila Inštitutu za hmeljarstvo in pivovarstvo Slovenije v Žalcu za vodenje postopka in za odločanje v postopku uradne potrditve semena žit, krmnih rastlin, pese, oljnic in predivnic, ter semenskega krompirja, smo izvajali postopke uradnega potrjevanja po predpisani zakonodaji.

V okviru strokovne naloge je potekalo laboratorijsko testiranje uradno odvzetih vzorcev izvirnega (IMR) in osnovnega genetskega materiala hmelja (OMR) na prisotnost določenih gospodarsko pomembnih škodljivih organizmov. IMR kot najvišja razmnoževalna stopnja hmelja, so bili testirani na 3 viruse (ApMV, HMV, ArMV) in 3 viroide (HLVd, HDVd in CBCVd). V letu 2025 smo opravili kontrolo pri 112 IMR. OMR, kjer smo izvedli kontrolo na viruse ApMV in HMV, pa smo testirali 1624 rastlin, hkrati so bile OMR laboratorijsko testirane na viroida HSVd in CBCVd.

As part of the programme of professional tasks in the protection and registration of plant varieties and seed production, and in the field of evaluating hop varieties for use and production, a series of five hop varieties was evaluated final year. We also carried out DUS testing in ornamental plants, specifically on 12 varieties of common snowdrop. In addition, we provided expert support to the Administration by preparing DUS testing protocols for *Ajuga genevensis* and two herb species.

In accordance with the protocol for the storage of standard samples of hop varieties, the plants of 26 varieties included in the list of varieties were maintained in tissue cultures and planted in the reference plantation. In accordance with the decision on the granting of public authority to the Institute for conducting the procedure and for deciding in the process of official certification of seed of cereals, fodder plants, beet, oil and fibre plants and seed potatoes, we conducted official certification procedures in accordance with the prescribed legislation.

As part of a professional task, laboratory testing of officially taken samples of nuclear genetic material (IMR) and basic genetic material of hops (OMR) for the presence of certain economically important pests was carried out. The IMR, the highest level of reproductive hop materials, were tested on three different viruses (ApMV, ArMV, and HMV) and on viroids (HLVd, HSVd, CBCVd). In 2025, 112 IMR plants were analysed, and 1624 plants were analysed for OMRs, which included the viruses ApMV and HMV, and two viroids, HSVd and CBCVd.

4.4 GENSKA BANKA HMELJA / THE HOP GENE BANK

Vodja / Leading by: izr. prof. dr. Andreja Čerenak

V okviru javne službe smo ohranjali 308 akcesij hmelja v nasadu ob IHPS in v rastlinjaku. V tkivni kulturi smo ohranjali 37 RGV hmelja. Opravili smo terensko delo in nabrali 16 novih genskih virov hmelja iz Zasavja, pri več izmed njih smo zbrali tudi semena. Vsa opažanja in podatke smo evidentirali v interno bazo in v podatkovno bazo SRGB. Pripravili smo podatke 200 genskih virov, ki so bili poslani na ECPGR in bodo vpisani v Eurisco bazo podatkov. Osnovno vrednotenje smo naredili pri 60 akcesijah. O rezultatih dela smo obveščali zainteresirano javnost. Pripravili smo dva članka o ohranitvi genskih virov hmelja na IHPS kot del diseminacije naloge.

In the context of a public service, we maintained 308 hop accessions in hop field at the IHPS and in glasshouse. We maintained 37 different genotypes in tissue culture. We collected 16 genetic resources in the area of Zasavje region, and gathered seed populations. All observations and data were recorded in internal database and in a database of SRGB. We prepared data for 200 genetic resources, which were submitted to ECPGR and will be entered into the EURISCO database. We carried out basic evaluation for 60 accessions. The results of the work were applied to stakeholders. Two articles as dissemination of the project results were presented about maintaining of genetic resources at IHPS.



Slika 7: Divji hmelj na območju Zasavja / Wild hop plant in Zasavje

4.5 GENSKA BANKA ZDRAVILNIH IN AROMATIČNIH RASTLIN / THE GENE BANK OF MEDICINAL AND AROMATIC PLANTS (MAP)

Vodja / Leading by: Maja Dobrajc

V okviru Javne službe rastlinske genske banke zdravilnih in aromatičnih rastlin IHPS sodeluje kot podizvajalec genske banke zdravilnih in aromatičnih rastlin na Biotehniški fakulteti. V letu 2025 smo ohranjali 134 avtohtonih akcesij zdravilnih in aromatičnih rastlin v obliki semena, sadik in tkivnih kultur. Izvedli smo kalilne poskuse za akcesije navadnega rmana (*Achillea millefolium* L.), šentjanževke (*Hypericum perforatum* L.), repika (*Agrimonia* sp.) in vzgojili ter posadili sadike akcesij navadnega čisteca (*Betonica officinalis* L.), šentjanževke (*Hypericum perforatum* L.), navadnega rmana (*Achillea millefolium* L.), ozkolistnega trpotca (*Plantago lanceolata* L.) in velikega trpotca (*Plantago major* L.). V rastni komori smo pod nadzorovanimi pogoji in vitro ohranjali tkivne kulture petih akcesij različnih zdravilnih in aromatičnih rastlin. V rastlinjaku smo pričeli z vzgojo štirih akcesij, ki bodo primerne za posaditev v prihodnjem letu. Rezultate poskusov smo podali v poročilih in zainteresiranost javnost obveščali o izsledkih.

Within the framework of the Public Service of the Plant Genetic Resources Bank for Medicinal and Aromatic Plants, IHPS participates as a subcontractor of the gene bank for medicinal and aromatic plants at the Biotechnical Faculty. In 2025, we conserved 134 autochthonous accessions of medicinal and aromatic plants in the form of seeds, seedlings, and tissue cultures. Germination tests were conducted for accessions of common yarrow (*Achillea millefolium* L.), St John's wort (*Hypericum perforatum* L.), agrimony (*Agrimonia* sp.), and seedlings of accessions of common betony (*Betonica officinalis* L.), St John's wort (*Hypericum perforatum* L.), common yarrow (*Achillea millefolium* L.), narrowleaf plantain (*Plantago lanceolata* L.), and broadleaf plantain (*Plantago major* L.) were propagated and planted. In a growth chamber, tissue cultures of five accessions of different medicinal and aromatic plant species were maintained in vitro under controlled conditions. In the greenhouse, propagation of four accessions suitable for planting in the following year was initiated. The results of the experiments were reported in formal reports, and the interested public was informed about the findings.

4.6 STROKOVNE NALOGE S PODROČJA ZDRAVSTVENEGA VARSTVA RASTLIN / PLANT HEALTH PROGRAMS AND SERVICES

Koordinator programa: dr. Magda Rak Cizej

Izvajanje nalog je organizirano v okviru Javne službe zdravstvenega varstva rastlin na območju Celjske in Koroške regije ter javnih pooblastil Uprave za varno hrano, veterinarstvo in varstvo rastlin RS (UVHVVR). V okviru programov strokovnih nalog smo v letu 2025 koordinirali in izvajali programe preiskav in spremljanj določenih škodljivih organizmov, izvajali laboratorijske preiskave, izvajali opazovalno-napovedovalno dejavnost in nudili strokovno podporo UVHVVR s področja dela. Vsebina nalog je predstavljena v posameznih poglavjih tega poročila.

The plant health activities are organized within the Public Plant Health Service in the Celje and Koroška regions by the public authorizations of the Food Safety, Veterinary and Plant Protection Administration of the Republic of Slovenia (UVHVVR). Programs in 2025 included coordination and performance of monitoring of certain harmful organisms, laboratory investigations, pest and

disease forecasting activities and constant professional support to the UVHVVR in the field of work. The content of the tasks is presented in individual chapters of this report.

4.6.1 Naloge zdravstvenega varstva po javnem pooblastilu

4.6.1.1 Izvajanje programov preiskav škodljivih organizmov v skladu s Fitosanitarnim programom EU/Plant health surveys in the frame of EU Phytosanitary Program

Koordinator naloge: Alenka Ferlež Rus

Namen programa

- Ugotavljanje prisotnosti novih in karantenskih škodljivih organizmov na območju EU.
- Spremljanje razširjenosti posebej nevarnih karantenskih škodljivih organizmov v Sloveniji.

V letu 2025 je bil IHPS vključen v pripravo in izvedbo programov preiskav naslednjih škodljivih organizmov:

Žuželke

- Paprikar (*Anthonomus eugenii*)
- Rdečevratni kozliček (*Aromia bungii*)
- Japonski hrošč (*Popillia japonica*)
- Jabolčna muha (*Rhagoletis pomonella*)
- Afriški plodov zavijač (*Thaumatotibia leucotreta*)
- Krompirjevi bolhači (*Epitrix spp.*)

Virusi

- Tomato leaf curl New Delhi virus (ToLCNDV)
- Virus češnje (Cherry rosette virus, Cherry rasp leaf virus)
- Blueberry leaf mottle virus
- Virusi vinske trte
- American plum line pattern virus

Bakterije

- Bakterijski ožig oljk (*Xylella fastidiosa*)
- Bakterijska uvelost koruze (*Pantoea stewartii* subsp. *stewartii*)
- *Clavibacter sepedonicus*
- *Ralstonia solanacearum* / *Ralstonia pseudosolanacearum*

Glive

- *Geosmithia morbida*
- Krompirjeva rjava gniloba (*Ralstonia pseudosolanacearum*) – bakterija/gliva (vključena v fitopatološke preiskave)

Fitoplazme

- Fitoplazme v rodovih: *Fragaria*, *Malus*, *Prunus*, *Pyrus*
- Zlata trsna rumenica (Grapevine flavescence dorée phytoplasma)

Begomovirusi

- Vključno s fitoplazmami pri *Solanum tuberosum*

Cilji posameznih preiskav

- Preprečevanje širjenja karantenskih škodljivih organizmov v EU.
- Spremljanje vnosov invazivnih vrst (npr. *Aromia bungii*, *Popillia japonica*).
- Ugotavljanje razširjenosti fitopatogenov, ki povzročajo hude ekonomske izgube (npr. *Xylella fastidiosa*, *Ralstonia pseudosolanacearum*, ToLCNDV).
- Zgodnje odkrivanje za hitro ukrepanje in zaščito kmetijskih pridelkov ter gozdov.

Podporne naloge

Programi preiskav so dodatno podprti z naslednjimi nalogami:

- Geografski informacijski sistem (GIS): Izvaja prostorske analize in izdeluje zemljevide za prikaz razširjenosti škodljivih organizmov in trendov.

Kontrola uvozov in analiza podatkov programov preiskav: Zagotavlja enotne postopke, dosledno vodenje podatkov in natančno analizo rezultatov preiskav.

Program Objectives

- To detect the presence of new and quarantine pests within the EU.
- To monitor the distribution of particularly harmful quarantine pests in Slovenia.

Pests Monitored by IHPS in 2025:

Insects

- Pepper weevil (*Anthonomus eugenii*)
- Red-necked longhorn beetle (*Aromia bungii*)
- Japanese beetle (*Popillia japonica*)
- Apple maggot (*Rhagoletis pomonella*)
- African fruit moth (*Thaumatotibia leucotreta*)
- Potato flea beetles (*Epitrix* spp.)

Viruses

- Tomato leaf curl New Delhi virus (ToLCNDV)
- Cherry viruses (Cherry rosette virus, Cherry rasp leaf virus)
- Blueberry leaf mottle virus
- Grapevine viruses
- American plum line pattern virus

Bacteria

- Olive quick decline syndrome (*Xylella fastidiosa*)
- Stewart's wilt of maize (*Pantoea stewartii* subsp. *stewartii*)
- *Clavibacter sepedonicus*
- *Ralstonia solanacearum* / *Ralstonia pseudosolanacearum*

Fungi

- *Geosmithia morbida*
- Potato brown rot – bacterial/fungus (*Ralstonia pseudosolanacearum*)

Phytoplasmas

- Phytoplasmas in the genera: *Fragaria*, *Malus*, *Prunus*, *Pyrus*
- Grapevine flavescence dorée phytoplasma

Begomoviruses

- Including phytoplasmas in *Solanum tuberosum*

Objectives of Individual Surveys

- Prevent the spread of quarantine pests within the EU.
- Monitor the introduction of invasive species (e.g., *Aromia bungii*, *Popillia japonica*).
- Determine the distribution of pathogens causing severe economic losses (e.g., *Xylella fastidiosa*, *Ralstonia pseudosolanacearum*, ToLCNDV).
- Enable early detection for rapid response and protection of agricultural crops and forests.

Supporting Tasks

The surveillance programs are further supported by:

- Geographic Information System (GIS): Conducts spatial analyses and cartography to visualize pest distribution and trends.
- Import Control and Data Analysis of Surveillance Programs: Ensures standardized procedures, consistent data management, and accurate analysis of surveillance results.

4.6.1.2 Uradni laboratorij (UL) in nacionalni referenčni laboratorij (NRL) za varstvo rastlin/Official laboratory and national reference laboratory for plant health

Vodja Diagnostičnega laboratorija za varstvo rastlin: dr. Sebastjan Radišek

Diagnostični laboratorij za varstvo rastlin IHPS (DL) je v Sloveniji s strani UVHVVR pooblaščen kot uradni laboratorij (UL) in nacionalni referenčni laboratorij (NRL) za: (i) določanje gliv in oomicet na hmelju, vinski trti, zeliščih in okrasnih rastlinah z molekularnimi metodami ter (ii) določanje virusov in viroidov na hmelju z molekularnimi metodami. Laboratorij deluje kot neodvisna organizacijska enota znotraj IHPS, kar zagotavlja neodvisnost postopkov in nepristranskost pri izvedbi analiz.

IHPS je akreditiran pri Slovenski akreditaciji (št. akreditacije LP-025) na področju preskušanja v skladu s standardom SIST EN ISO/IEC 17025. Laboratorij je hkrati imenovan kot karantenska postaja za izvajanje akreditiranih in neakreditiranih diagnostičnih metod za določanje škodljivih organizmov rastlin, za izvajanje nalog, povezanih z delovanjem UL in NRL, ter za podporo raziskovalnim projektom, ki lahko vključujejo delo s karantenskimi škodljivimi organizmi.

V letu 2025 je DL izvajal diagnostične analize vzorcev, odvzetih v okviru različnih programov spremljanja škodljivih organizmov, certifikacije sadilnega materiala hmelja, strokovnih nalog, projektov in tržnih poskusov. Kot podpora prognostični službi smo pregledovali vzorce iz spremljanja dinamike hmeljeve peronospore in jablanovega škrlupa, ki poteka s pomočjo lovilcev spor in drugih metod. Za potrebe žlahtnjenja hmelja smo izvajali umetne inokulacije za namene selekcije.

Izvajali smo tudi aktivnosti, povezane z vzdrževanjem referenčne zbirke škodljivih organizmov, v kateri hranimo več kot 100 različnih organizmov. V vlogi NRL smo nadgrajevali obstoječe diagnostične metode, se udeleževali strokovnih srečanj v organizaciji Evropskih referenčnih laboratorijev (EURL) ter sodelovali v več medlaboratorijskih primerjalnih testih, predvsem s področja diagnostike viroidov na hmelju in gliv iz rodu *Verticillium*.

The IHPS Plant Protection Diagnostic Laboratory (DL) is designated by the Administration of the Republic of Slovenia for Food Safety, Veterinary Sector and Plant Protection (UVHVVR) as an Official Laboratory (OL) and the National Reference Laboratory (NRL) for: (i) molecular detection of fungi and oomycetes on hop, grapevine, herbs, and ornamental plants, and (ii) molecular detection of viruses and viroids on hop. The laboratory operates as an independent organisational unit within IHPS, ensuring procedural independence and impartiality in the performance of analyses.

IHPS is accredited by the Slovenian Accreditation body (accreditation no. LP-025) for testing in accordance with SIST EN ISO/IEC 17025. The laboratory is also appointed as a quarantine station for carrying out accredited and non-accredited diagnostic methods for the detection of plant pests, for performing tasks required for the operation of the Official Laboratory and the National Reference Laboratory, and for supporting research projects that may involve work with quarantine pests.

In 2025, the DL performed diagnostic analyses of samples collected within various pest monitoring programmes, hop planting material certification, professional tasks, projects, and commercial trials. In support of the forecasting service, we examined samples from monitoring the dynamics of hop downy mildew and apple scab, which is conducted using spore traps and other methods. For hop breeding purposes, we carried out artificial inoculations to support selection activities.

We also conducted activities related to maintaining the reference collection of plant pests, which currently comprises more than 100 different organisms. In its role as the NRL, the laboratory further improved existing diagnostic methods, participated in several expert meetings organised by the European Union Reference Laboratories (EURLs), and took part in multiple inter-laboratory proficiency tests, primarily in the field of hop viroid diagnostics and fungi of the genus *Verticillium*.

4.6.1.3 Strokovna podpora UVHVVR/ Profesional support to UVHVVR

Nosilci nalog: Alenka Ferlež Rus, dr. Magda Rak Cizej, dr. Sebastjan Radišek, Silvo Žveplan, mag. Jolanda Persolja, Franček Poličnik, dr. Tanja Guček

Program je namenjen zagotavljanju stalne strokovne podpore UVHVVR pri spremljanju, zaznavanju in obvladovanju karantenskih in ostalih škodljivih organizmov (ŠO) rastlin. Pomembna naloga je tudi zagotavljanje sprotnega obveščanja UVHVVR o novih najdbah ali drugih nenavadnih/povečanih pojavih škodljivih organizmov na območju Slovenije. V ta sklop spada tudi sodelovanje v domačih in mednarodnih strokovnih telesih s področja diagnostike in obvladovanja ŠO rastlin. V okviru programa 2025 je IHPS izvajal naslednje naloge:

- Strokovno sodelovanje na EU in mednarodnem nivoju
- Sodelovanje v delovnih skupinah in delavnicah
- Spremljanje in evidentiranje okužb hude viroidne zakrnelosti hmelja (CBCVd) in določanje poti prenosa
- Spremljanje in evidentiranje pojava verticilijske uvelosti hmelja
- Marmorirana smrdljivka (*Halimorpha halys*)
- Virusne bolezni vinske trte
- Možnosti obvladovanja hmeljeve listne uši na hmelju
- Strokovna podpora za obvladovanje zlate trsne rumenice
- Druge strokovne naloge na področju zdravstvenega varstva rastlin.

The program is designed to provide ongoing expert support to the UVHVVR in the monitoring, detection and control of quarantine and other plant pests (PPOs). An important task is also to ensure that the UVHVVR is kept informed of new findings or other unusual/increased occurrences of pests in the territory of Slovenia. This also includes participation in national and international expert bodies in the field of diagnosis and control of plant pathogens. In the framework of the 2025 program, the IHPS carried out the following tasks:

- Expert cooperation at EU and international level
- Participation in working groups and workshops
- Introduction to the methodology of inspecting corn borer egg masses
- Monitoring and recording infections of severe hop stunt viroid (CBCVd) and determining transmission pathways
- Recording the occurrence of verticillium wilt of hops

- Recording the occurrence of severe viroid stunting of hops
- Marbled stink bug (*Haliomorpha halys*)
- Methods for management hop aphids on hops
- Expert support for the management of Grapevine flavescence doree
- Other expert tasks in the field of plant health.

4.6.2 JAVNA SLUŽBA ZDRAVSTVENEGA VARSTVA RASTLIN / PUBLIC PLANT HEALTH SERVICE

Nosilci nalog: Alenka Ferlež Rus, dr. Magda Rak Cizej, dr. Sebastjan Radišek, Silvo Žveplan, mag. Jolanda Persolja, Franček Poličnik

4.6.2.1 Opazovanje in napovedovanje škodljivih organizmov / Observation and forecasting of harmful organisms of plants

Na območju Celjske in Koroške regije smo spremljali pojav in razvoj škodljivih organizmov kmetijskih rastlin v hmeljarstvu, poljedelstvu, vrtnarstvu, sadjarstvu in vinogradništvu. Glede na prostorsko pokritost s kmetijskimi kulturami smo na opazovanih točkah beležili: vremenske podatke, fenološke faze, spremljali modele za napoved bolezni in beležili prisotnost bolezni ter posameznih škodljivcev. Na podlagi rezultatov opazovanj smo izdelali napovedi za varstvo rastlin pred škodljivimi organizmi in redno obveščali pridelovalce o pojavu in ustreznih ukrepih varstva rastlin.

In the Celje and Koroška regions, we monitored the occurrence and development of harmful organisms of agricultural plants in hop growing, agriculture, horticulture, fruit growing and viticulture. According to the spatial coverage with agricultural crops, we recorded at the observed points: weather data, phenological phases, running models for disease forecasting and recorded the presence of diseases and individual pests. Based on the results of observations, we made forecasts for plant protection against harmful organisms and regularly informed growers about the phenomenon and appropriate plant protection measures.

4.6.2.2 Ostale naloge javne službe / Other tasks of public plant health service

- Vzpostavitev sistema digitalizacije spremljanj fenologije rastlin in škodljivih organizmov
- Agrometeorološki informacijski sistem
- Svetovanje in usposabljanje pridelovalcev
- Sodelovanje s kmetijsko svetovalno službo
- Integrirano varstvo rastlin pred škodljivimi organizmi
- Reševanje nepričakovanih ali novih problemov varstva rastlin

-
- Establishment of a digital monitoring system for plant phenology and pest monitoring
 - Agrometeorological information system
 - Advice and training for growers
 - Cooperation with the agricultural advisory service
 - Integrated Pest Management
 - Dealing with unexpected or new plant protection problems.

4.6.2.3 Integrirano varstvo rastlin (IVR)/ Integrated Pest Management (IPM)

Nosilci nalog: dr. Magda Rak Cizej, Alenka Ferlež Rus, Franček Poličnik, Silvo Žveplan, dr. Sebastjan Radišek

V okviru nalog Integriranega varstva rastlin (IVR) so se izvajali naslednji poskusi:

- Zatiranje krvave uši (*Eriosoma lanigerum*) na koreninskem vratu jablan (*Malus domestica*)
- Obvladovanje jablanovega cvetožera
- Naravi prijazno obvladovanje pasastega grozdnega sukača (*Eupoecilia ambiguella*) in križastega grozdnega sukača (*Lobesia botrana*) z metodo konfuzije
- Obvladovanje populacije ameriškega škržatka (*Scaphoideus titanus*)
- Obvladovanje koruzne vešče (*Ostrinia nubilalis*) v koruzi
- Določanje odpornosti vrtnin in uvajanje metod nizkega tveganja za preprečevanje povzročiteljev talnih bolezni
- Zatiranje čebulne plesni (*Peronospora destructor*) na čebuli
- Uvajanje metodike pregleda spermatek koruzne vešče
- Zatiranje žitnega strgača na strnih žitih
- Okolju prijazne metode za obvladovanje črne žilavke na kapusnicah.

Within the tasks of Integrated Plant Management (IPM), the following experiments were conducted:

- Management of woolly apple aphid (*Eriosoma lanigerum*) on the root collar of apple trees (*Malus domestica*)
- Management of the apple blossom weevil
- Environmentally friendly control of the european grapevine moth (*Eupoecilia ambiguella*) and the European vine moth (*Lobesia botrana*) using the mating disruption method
- Management of the population of the American Leafhopper (*Scaphoideus titanus*)
- Control of the European Corn Borer (*Ostrinia nubilalis*) in Maize
- Determination of vegetable resistance and introduction of low-risk methods for the prevention of soil-borne pathogens
- Control of onion downy mildew (*Peronospora destructor*) on onions
- Introduction of a method for inspecting corn borer egg masses
- Control of the cereal leaf beetle in grains
- Environmentally friendly methods for controlling black rot in cabbage.

4.6.2.4 Prognoza v hmeljarstvu / Pest and diseases forecasting in hop production

Koordinator: dr. Magda Rak Cizej

Nosilci nalog: dr. Magda Rak Cizej, Franček Poličnik, dr. Sebastjan Radišek

Inštitut za hmeljarstvo in pivovarstvo Slovenije kot pooblaščen inštitucija izvaja razširjen program opazovalno- napovedovalne službe za področje varstva hmelja na vseh pridelovalnih območjih v Sloveniji. V okviru naloge smo spremljali pojav in razvoj vseh gospodarsko pomembnih škodljivcev hmelja ter izdajali navodila za varstvo hmelja. Prav tako smo redno beležili fenološke faze hmelja. Naloga se izvaja po pooblastilu UVHVVR in se financira v okviru "Javne službe v hmeljarstvu".

The Institute of Hop Growing and Brewing of Slovenia, as an authorized institution, implements an extended program of the observation and forecasting service for the field of hop protection in all production areas in Slovenia. As part of the task, we monitored the occurrence and development of all economically important hop pests and issued instructions for the protection of hops. We also

regularly recorded the phenological phases of hops. The task is carried out under the authority of the UVHVVR and is financed within the framework of the "Public Service in Hops".

4.7 OCENJEVANJE FITOFARMACEVTSKIH SREDSTEV (FFS) / PLANT PROTECTION PRODUCTS RISK ASSESSING

Vodja / Leading by: Primož Bukovec

Na podlagi Programa strokovnih nalog s področja ocenjevanja fitofarmacevtskih sredstev za leto 2025, smo v sklopu omenjene strokovne naloge sodelovali naslednji raziskovalci IHPS:

- Izr. prof. dr. Iztok Jože Košir, univ. dipl. kem: vodja oddelka za agrokemijo in pivovarstvo na Inštitutu za hmeljarstvo in pivovarstvo Slovenije v Žalcu; ocenjevanje fizikalno kemijskih lastnosti fitofarmacevtskih sredstev in analitskih metod za določanje njihovih ostankov.
- Mag. Simona Luskar, univ. dipl. inž. kmet.: raziskovalka za varstvo rastlin na Inštitutu za hmeljarstvo in pivovarstvo Slovenije v Žalcu; ocenjevanje uporabe in učinkovitosti fitofarmacevtskih sredstev.
- Primož Bukovec, univ. dipl. inž. kmet: vodja oddelka za uradno potrjevanje in ocenjevanje FFS, raziskovalec na področju pedologije in ekologije na Inštitutu za hmeljarstvo in pivovarstvo Slovenije v Žalcu; ocenjevanje usode in obnašanja fitofarmacevtskih sredstev v okolju.
- Marija Malovrh, univ. dipl. biol.: raziskovalka za varstvo rastlin pri Inštitutu za hmeljarstvo in pivovarstvo Slovenije v Žalcu; ocenjevanje ekotoksikologije FFS.
- dr. Miha Ocvirk, univ. dipl. inž. kem.: raziskovalec na Inštitutu za hmeljarstvo in pivovarstvo Slovenije; ocenjevanje usode in obnašanja fitofarmacevtskih sredstev v okolju

Na IHPS se opravlja ocenjevanje za fitofarmacevtska sredstva na podlagi naročila UVHVVR za sredstva, ki so v postopku registracije, podaljšanja registracije, razširitve uporabe, ponovnega pregleda registracije v skladu z Direktivo ES o vključitvi aktivne snovi za uporabo kot fitofarmacevtsko sredstvo (reregistracija), ter s sprejeto najnovejšo zakonodajo tudi ocenjevanje in komentiranje dokumentacije posameznih FFS znotraj posameznih EU con. Na IHPS smo v letu 2025 ocenjevali fitofarmacevtska sredstva za fizikalno-kemijske lastnosti in analitske metode za določanje FFS, uporabo in učinkovitost FFS, usodo in obnašanje FFS v okolju in ekotoksikologijo FFS in ocenjevanje ekvivalence proizvodnih virov aktivnih snovi. V okviru te naloge smo bili ocenjevalci FFS v največji meri usmerjeni predvsem na EU trg, kjer smo izvedli kar nekaj tako imenovanih conskih ocen FFS, ki veljajo ne samo v Sloveniji, ampak v celi EU srednji coni.

Izvajali smo podporo pri nemotenem delovanju evidence usposabljanj iz fitomedicine in spletnih pregledovalnikov za obveščanje javnosti in izvajali koordinacijo centrov usposabljanj. O poteku izvajanja programa strokovne naloge »Ocenjevanje fitofarmacevtskih sredstev, ter strokovne in informacijske podpore na področju usposabljanj iz fitomedicine« smo poročali med letom v štirih delnih poročilih kot tudi ob koncu leta v letnem poročilu. Vse strokovne ocene, ki smo jih izdelali se nahajajo v delnih poročilih in skupnem letnem poročilu danemu na MKGP, UVHVVR. Skozi vse leto so se vsi sodelavci na tej strokovni nalogi udeleževali rednih strokovnih srečanj in izobraževanj o okviru UVHVVR in drugih organizatorjev doma in v tujini.

V letu 2025 smo na različnih območjih Slovenije (Savinjska dolina, Dravsko polje, Mursko polje, Savska kotlina, Krška kotlina in druge lokacije) izvedli tudi tako imenovano usmerjeno vzorčenje podtalnih voda na pesticide. Izbrana mesta za vzorčenje podtalnice so bila natančno določena na podlagi hidrogeoloških in pedoloških značilnosti ter kmetijskih praks na posameznem območju. Ta mesta so predstavljala najbolj kritične točke za spiranje pesticidov v podzemno vodo, saj so izpolnjevala ključne kriterije, ki povečujejo tveganje za kontaminacijo voda. Poleg tega smo izbrali tudi nekaj mestnih in nekaj nultih lokacij, kjer se je pričakovalo manj pesticidov. Vsak vzorec podtalne vode, je bil analiziran na cca. 750 aktivnih snovi ali njihovih razgradnih produktov. Rezultati analiz so pokazali dobro kemijsko stanje naših podtalnih voda.

Based on the Program of the expert work in the assessing of the Plant Protection Products (PPP) for 2025 the following experts from the Slovenian Institute of Hop Research and Brewing (IHPS) cooperated in this group:

- Assoc. prof. dr., Iztok Jože Košir, B.Sc. Chem.: assessment of physical-chemical characteristics and analytical methods for determination of PPP.
- Simona Luskar, M. Sc.: researcher of plant protection on IHPS; efficacy evaluation of PPP.
- Primož Bukovec, B. Sc.: The leader of the department for official certification and PPP assessing, researcher for ecology and pedology on IHPS; Environmental Fate of pesticides.
- Marija Malovrh, B. Sc.: assessment of ecotoxicology for PPP
- dr. Miha Ocvirk, B. Sc.: Researcher, assessment of environmental fate and behaviour of PPP.

At the IHPS we worked in assessing and registration of PPP in the EU. This work is based on the UVHVVR contract and it consists of the expert work in the process of registration, renewal of registration, application extensions, review of the registration in accordance with the EU on the inclusion of the active substance for use as a plant protection product, and with the most recent legislation adopted within EU and EU zones. Authorisation of PPP at the zonal level represents, besides the coordination of evaluation and authorisation of PPP at national level, also coordination between interested Member States within the zone. Slovenia is classified in the central zone and has additional national requirements concerning national authorisation procedure for PPP. In year 2025, we evaluated plant protection products on the physical-chemical properties and analytical methods for determination of PPP, PPP-use and efficiency, the fate and behaviour of pesticides in the environment and ecotoxicology of PPP and equivalence assessment of new sources of active substances. In this task we had risk assessors largely focused primarily on the EU market, where we performed some Zonal estimates of PPP, which are applied not only in Slovenia but in the whole EU Central Zone.

A support for proper functioning of the register on training certificates (training program for phytomedicine), web browsers for informing of public and coordination of training centres was carried out in 2025. Our whole work done during the year 2025 was reported in four partial reports, as well as in the annual report at the end of the year. All expert reviews, risk assessments are available at Republic of Slovenia, Ministry of Agriculture and the Environment, The Administration for Food Safety, Veterinary and Plant Protection. Throughout the year, all colleges which participated on this professional assignment, attended on regular professional meetings and trainings on the framework of UVHVVR and other organizers at home and abroad.

In the year 2025 we also conducted so-called targeted sampling of groundwater for pesticides in different areas of Slovenia (Savinjska Valley, Dravsko Polje, Mursko Polje, Krška kotlina, Savska kotlina and other locations). The selected groundwater sampling sites were precisely determined based on hydrogeological and pedological characteristics, as well as agricultural practices in each area. These locations represented the most critical points for pesticide leaching into groundwater, as they met key criteria that increase the risk of water contamination. In addition, we also selected some urban and some zero-area locations where fewer pesticides were expected. Each groundwater sample was analyzed for approximately 750 active substances or their degradation products. The analysis results indicated a good chemical status of our groundwater.

4.7.1 Dodatna dela na področju škropilne tehnike / Additional work in the field of spraying technology

Na področju kmetijske tehnike smo pripravili seznam šob, ki so certificirane za zmanjšanje zanosa škropilne brozge. Na podlagi tega seznama bo UVHVVR pripravil šifrant šob, ki se bo z nadgradnjo sistema za izdajo Potrdil ob testiranju škropilne tehnike vnesel v sistem UVH-APL (šobe za poljedelstvo, sadjarstvo, hmeljarstvo, vinogradništvo). Šifrant se pripravlja v skladu s smernicami Julius Kuhn inštituta iz Nemčije in njihovimi odobritvami zmanjšanja zanašanja glede na napravo oz. šobo, ki je bila testirana.

In the field of agricultural technology, we prepared list of nozzles that are certified to reduce spray drift. Based on this list, Administration for Food Safety, Veterinary Sector and Plant Protection will prepare a code list of nozzles, which will be entered into the UVH-APL system (nozzles for agriculture, fruit growing, hop growing, viticulture) by upgrading the system for issuing Certificates when testing spraying technology. The code list is being prepared in accordance with the guidelines of the Julius Kuhn Institute from Germany and their approvals for reducing drift depending on the device or nozzle that was tested.

4.8 UKREPI SODELOVANJA - PROGRAM RAZVOJA PODEŽELJA RS ZA OBDOBJE 2017-2020 / COOPERATIVE ACTIONS OF PROGRAM FOR COUNTYSIDE DEVELOPEMENT IN SLOVENIA IN 2017-2020

4.8.1 IRP38

Instrument IRP38 predstavlja pomemben korak k sodobnejšemu, povezanemu in trajnostno usmerjenemu slovenskemu kmetijstvu. Vzpostavlja platformo, ki povezuje pridelovalce, raziskovalne, svetovalne, izobraževalne in podporne institucije ter bo omogočalo, da bo znanje hitreje in učinkoviteje prehajalo v prakso. Cilj je pospešiti prehod slovenskega kmetijstva v zeleno, digitalno in podnebno nevtralno prihodnost. Operacije IRP 38 razvijajo znanje, ki temelji na potrebah kmetov, krepijo sodelovanje v okviru sistema AKIS in nadgrajujejo poskusno-demonstracijsko infrastrukturo za uvajanje inovacij v slovensko kmetijstvo.

Operacije so se začele izvajati poleti 2025. IHPS je vodilni partner operacije Prilagajanje na podnebne spremembe v rastlinski proizvodnji (operacija CLIMAGROW) ter sodeluje kot raziskovalna organizacija še v treh drugih sklopih – Poljedelstvo in vrtnarstvo, vključno s semenarstvom (operacija PRIRAST), Digitalizacija in robotizacija v rastlinski proizvodnji (Robot4Plants) ter Ekološko kmetijstvo (operacija KEKS).



**Sofinancira
Evropska unija**



**SKUPNA
KMETIJSKA
POLITIKA**

The IRP38 instrument represents an important step towards a more modern, interconnected, and sustainability-oriented Slovenian agriculture. It establishes a platform that links farmers with research, advisory, educational, and support institutions, enabling knowledge to be transferred into practice more quickly and effectively. The aim is to accelerate the transition of Slovenian agriculture towards a green, digital, and climate-neutral future. IRP38 operations develop knowledge based on farmers' needs, strengthen cooperation within the AKIS system, and upgrade experimental and demonstration infrastructure to support the introduction of innovations into Slovenian agriculture.

The operations began in summer 2025. IHPS is the leading partner of the package Adaptation to Climate Change in Crop Production (operation CLIMAGROW) and is also involved as a research organization in three other packages: Arable Farming and Horticulture, including Seed Production (operation PRIRAST), Digitalisation and Robotics in Crop Production (Robot4Plants), and Organic Farming (operation KEKS).

4.8.1.1 IRP38 Celostne rešitve za rastlinsko pridelavo v času podnebnih izzivov: Nadgradnja znanja, kompetenc in infrastrukture (akronim CLIMAGROW)

Vodilni partner: IHPS, vodja na IHPS: dr. Boštjan Naglič

Leto 2025 je za konzorcij Climagrow predstavljalo ključno in strateško pomembno pripravljalno obdobje, namenjeno vzpostavitvi celovitih strokovnih, tehničnih in organizacijskih temeljev, ki so nujni za dolgoročno in kakovostno izvajanje programa v prihodnjih letih. Glavne aktivnosti so bile prednostno usmerjene v investicijsko fazo, ki je vključevala nabavo in operativno vzpostavitev sodobne laboratorijske, terenske ter digitalne infrastrukture, hkrati pa so bile izbrane ključne poskusno-demonstracijske lokacije, ki bodo služile kot osrednja prizorišča za prihodnje praktično delo. Z zbiranjem obsežnih izhodiščnih podatkov in pripravo natančnih metodoloških podlag je konzorcij zagotovil strokovno konsistentnost, kar bo v naslednjih fazah omogočilo nemoteno izvajanje praktičnih preizkusov in demonstracij na terenu. Kljub temu da določeni organizacijski procesi, kot sta formalna vzpostavitev koordinacijskega odbora in izvedba širšega nabora načrtovanih usposabljanj, v tem letu še niso bili v celoti realizirani, celotna dinamika dela ostaja tesno usklajena z zastavljeno časovnico programa in ne izkazuje nobenih vsebinskih odstopanj od zastavljenih ciljev konzorcija. Že izvedeno prvo praktično usposabljanje za člane konzorcija ter uspešno opravljena interna testiranja nove opreme so potrdila tehnično pripravljenost ekipe in postavila standarde za prihodnji prenos znanja na širši krog uporabnikov. Poseben poudarek konzorcija je bil v 2025 namenjen tudi mreženju, saj so bile vzpostavljene prve sistemske povezave z drugimi konzorciji, ostalimi projekti in javnimi službami, kar predstavlja trdno osnovo za prihodnjo souporabo visokotehnološke opreme, izvajanje skupnih terenskih aktivnosti ter usklajen prenos inovativnih rešitev in rezultatov v kmetijsko prakso od leta 2026 dalje. V prihodnjem obdobju bo konzorcij na teh temeljih še intenzivneje krepil praktične preizkuse in sodelovanje z javnimi službami, s čimer bo neposredno zasledoval svoj primarni cilj – razvoj in implementacijo naprednih prilagoditvenih rešitev, ki bodo ključno prispevale k večji odpornosti, trajnosti in podnebni prilagojenosti sodobne rastlinske pridelave v kmetijskem sektorju.

The year 2025 represented a key and strategically important preparatory period for the Climagrow consortium, dedicated to establishing comprehensive professional, technical and organisational foundations that are essential for the long-term and high-quality implementation of the programme in the coming years. The main activities were primarily focused on the investment phase, which included the purchase and operational deployment of modern laboratory, field and digital infrastructure, while at the same time key pilot and demonstration sites were selected to serve as central locations for future practical work. By collecting extensive baseline data and preparing precise methodological frameworks, the consortium ensured professional consistency, which in the next phases will enable the smooth implementation of practical trials and demonstrations in the field. Although certain organisational processes, such as the formal establishment of the coordination committee and the implementation of a broader range of planned trainings, were not fully completed in this year, the overall work dynamics remain closely aligned with the approved programme timeline and do not show any deviations from the consortium's set objectives. The first practical training already carried out for consortium members, as well as the successful internal testing of new equipment, confirmed the technical readiness of the team and set standards for the future transfer of knowledge to a wider group of users. In 2025, the consortium also placed particular emphasis on networking, as the first systematic links were established with other consortia, related projects and public services, which provides a solid basis for future shared use of high-tech equipment, the implementation of joint field activities and the coordinated transfer of innovative solutions and results into agricultural practice from 2026 onwards. In the coming period, the consortium will build on these foundations by further intensifying practical trials and cooperation with public services, thereby directly pursuing its primary goal – the development and implementation of advanced adaptation solutions that will make a key contribution to greater resilience, sustainability and climate adaptation of modern crop production in the agricultural sector.

4.8.1.2 IRP38 AKIS partnerstvo za uvedbo digitalnih in robotskih tehnologij v rastlinsko pridelavo (akronim Robot4plants)

Vodilni partner: KIS, vodja na IHPS: mag. Matej Knapič

Projektni sklop Robot4plants naslavlja reševanje izzivov slovenskega kmetijstva kot so razdrobljenost kmetij, staranje kmečkega prebivalstva, vplivi podnebnih sprememb in nizka stopnja digitalizacije z uvajanjem digitalnih in robotskih tehnologij.. Projektni konzorcij bo s povezovanjem znanstvenih institucij, svetovalnih služb in kmetov razvijal in uvajal digitalne ter trajnostne prakse, ki bodo krepile konkurenčnost in odpornost slovenskega kmetijstva. S postavitvijo poskusno-demonstracijskih lokacij po Sloveniji, vključevanjem novih tehnologij in ciljno usmerjenim izobraževanjem bo projekt omogočil prehod v zeleno, podnebno odporno in digitalno kmetijstvo.

Projekt se osredotoča na tri ključne vsebinske sklope:

- Aero kmetijstvo: Razvoj in implementacija metod foliarnega gnojenja, natančnega apliciranja sredstev za varstvo rastlin ter uporaba brezpilotnih letalnikov za izboljšanje učinkovitosti in zmanjšanje okoljskega odtisa.
- Robotika v kmetijstvu: Preizkušanje robotskih sistemov za pripravo tal, okopavanje, uporabo UV-C tehnologije v trajnih nasadih, precizno aplikacijo sredstev za varstvo rastlin ter nadzor in manipulacijo rastlin in sadežev.
- Digitalizacija v kmetijstvu: Digitalizacija tal, razvoj preskripcijskih map, testiranje platform za beleženje delovnih procesov in vzpostavitev centralizirane ITC platforme za izmenjavo znanja.

V okviru projekta smo pridobili raziskovalno opremo in sicer georadar za ugotavljanje in kartiranje nekaterih talnih lastnosti kot so globina tal, heterogenost in skeletnost tal ter štrikolesnik z vzorčevalnikom tal.

The Robot4plants project addresses key challenges facing Slovenian agriculture, such as farm fragmentation, the ageing farming population, the impacts of climate change, and the low level of digitalisation, through the introduction of digital and robotic technologies. By connecting scientific institutions, advisory services, and farmers, the project consortium will develop and implement digital and sustainable practices aimed at strengthening the competitiveness and resilience of Slovenian agriculture. Through the establishment of pilot-demonstration sites across Slovenia, the integration of new technologies, and targeted training activities, the project will facilitate the transition toward green, climate-resilient, and digital agriculture.

The project focuses on three key thematic areas:

- Aerial agriculture: Development and implementation of foliar fertilisation methods, precision application of plant protection products, and the use of unmanned aerial vehicles to improve efficiency and reduce environmental impact.
- Robotics in agriculture: Testing of robotic systems for soil preparation, mechanical weeding, the use of UV-C technology in perennial crops, precision application of plant protection products, and monitoring and manipulation of plants and fruits.
- Digitalisation in agriculture: Soil digitalisation, development of prescription maps, testing of platforms for recording work processes, and the establishment of a centralised ICT platform for knowledge exchange.

Within the project, we have acquired research equipment, including a ground-penetrating radar for determining and mapping selected soil properties such as soil depth, heterogeneity, and stoniness, as well as an all-terrain vehicle equipped with a soil sampler.

4.8.1.3 IRP38 Uvajanje trajnostnih in naravi prijaznih tehnologij pridelave in sodobnih pristopov v žlahtnjenju poljščin in vrtnin ter semenarstvu za blaženje učinkov podnebnih sprememb (akronim PRIRAST) / Introduction of sustainable and nature-friendly production technologies and modern approaches in the breeding of field crops and vegetables, and in seed production, to mitigate the effects of climate change (acronym PRIRAST)

Vodilni partner: KIS, vodja na IHPS: dr. Barbara Čeh

Z operacijo PRIRAST želimo odgovoriti na sistemske in okoljske izzive, ki vplivajo na trajnost kmetijske pridelave ter konkurenčnost in privlačnost kmetijstva za mlade prevzemnike. Glavni cilj programa konzorcija, katerega vodilni partner je Kmetijski inštitut Slovenije, IHPS pa sodeluje kot raziskovalni partner, je vzpostavitev tesnega sodelovanja med raziskovalnimi institucijami, svetovalno službo in kmetijami z namenom razvoja, testiranja in prenosa inovativnih tehnologij v prakso.

Na IHPS osredotočamo predvsem na dva ključna cilja:

- vzpostavitev in nadgradnjo poskusno-demonstracijske infrastrukture, ki bo podpirala uvajanje inovativnih tehnologij ter omogočala boljši dostop k znanju za kmete,
- razvoj in uvajanje novih tehnologij za izboljšanje sort hmelja, odpornih na podnebne spremembe.

Zasnovali in izvedli bomo poljski poskus na partnerski kmetiji, v katerem bomo z uporabo opreme za fiziološke meritve LI-COR primerjali odziv dveh standardnih sort hmelja z dvema sortama v preizkušanju. Ta prenosni sistem za merjenje fotosinteze in sorodnih parametrov omogoča ne-invazivne meritve ključnih fizioloških lastnosti, ki odražajo učinkovitost fotosinteze, vodno bilanco, obnašanje listnih rež, ter splošno vitalnost rastline v realnem času. To bo v nadaljevanju dela omogočilo pridobivanje pomembnih informacij za izboljšanje sort hmelja s ciljem prilagoditve na podnebne spremembe in abiotske strese.

With the PRIRAST operation, we aim to address systemic and environmental challenges that affect the sustainability of agricultural production as well as the competitiveness and attractiveness of agriculture for young farm successors. The main objective of the consortium programme—led by the Agricultural Institute of Slovenia, with IHPS participating as a research partner—is to establish close cooperation between research institutions, advisory services, and farms in order to develop, test, and transfer innovative technologies into practice.

At IHPS, we focus primarily on two key objectives:

the establishment and upgrading of experimental and demonstration infrastructure that will support the introduction of innovative technologies and enable better access to knowledge for farmers,

the development and implementation of new technologies to improve hop cultivars that are resilient to climate change.

We will design and carry out a field trial on a partner farm, in which we will use LI-COR physiological measurement equipment to compare the responses of two standard hop cultivars with two cultivars under evaluation. This portable system for measuring photosynthesis and related parameters enables non-invasive measurements of key physiological traits that reflect photosynthetic efficiency, water balance, stomatal behaviour, and overall plant vitality in real time. This will subsequently provide valuable information for improving hop cultivars with the aim of enhancing adaptation to climate change and abiotic stresses.



Slika 8: Oktobra smo se na IHPS v večernih urah na daljavo izobraževali o prenosnem merilnem sistemu LI-6800, ki smo ga nabavili za potrebe operacije PRIRAST. Strokovnjaki podjetja LI-COR iz ZDA so nam predstavili teoretično ozadje in delovanje naprave, ki na ravni lista omogoča merjenje izmenjave plinov in fluorescenco klorofila a pri fotosintezi. (Foto: J. Ferlin in M. Knapič) / In October, IHPS staff participated in evening remote training on the portable LI-6800 measurement system, which we purchased for the needs of the PRIRAST operation. Experts from the US-based company LI-COR presented the theoretical background and operation of the instrument, which enables measurements of leaf-level gas exchange and chlorophyll a fluorescence during photosynthesis. (Photo: J. Ferlin and M. Knapič)

4.8.1.4 IRP38 Konzorcij znanja za ekološko kmetijstvo Slovenije (KEKS)

Vodilni partner: FKBV, **vodja na IHPS:** Maja Dobrajc

V delovnem sklopu KEKS želimo vse izsledke, inovacije, nove rešitve, dognanja, ki so primerna in dovoljena v ekološkem kmetijstvu, uporabiti tudi v vseh drugih kmetijskih pridelovalnih sistemih. Nujne so izboljšave različnih tehnologij za potrebe ekološkega kmetijstva, zlasti s področja oskrbe in nege rastlin, varstva rastlin, uvedbe namakanja in zastiranja tal, izboljšanja razpoložljivosti ustreznih sort ter ekološko pridelanih semen in sadilnega materiala ter nabave ustrezne opreme, ki je primerna za specifičnosti in razmere KMG v Sloveniji. To so tudi potrebe kmetov, ki smo jih partnerji zaznali in identificirali ob spremljanju in soustvarjanju ekološkega kmetijstva v Sloveniji v preteklih letih. Glavni cilj programa konzorcija, katerega vodilni partner je Fakulteta za kmetijstvo in biosistemske vede, IHPS pa sodeluje kot raziskovalni partner, je prispevati k zmanjšanju razlik v pridelkih med ekološko in konvencionalno pridelavo in s tem povečati interes za preusmeritve KMG v ekološko kmetijstvo. To bi nam omogočilo doseganje ciljev Strateškega načrta RS in Skupne kmetije politike EU. Na IHPS bomo intenzivno delali na izbranih genotipih navadne arnike (*Arnica montana* L.), naboru preizkušenih materialov za zastiranje tal ter navodilih za dodelavo zelišč (sušenje, destilacija). Za namen predelave zelišč smo pridobili sušilnico z regulacijskim sistemom uravnavanja temperature in pretoka zraka, kar je ključno za kakovostno sušenje zelišč ter destilacijski sistem, s katerim bomo pridobivali eterična olja, hidrolate in nam bo omogočil preskušanje kakovosti različnih vrst in sort zelišč glede na vsebnost posameznih kemijskih komponent. Izvedli bomo tudi prenos znanja v prakso, kot je zastavljeno v letnem delovnem načrtu operacije.



Slika 9, levo: Destilacijski sistem za pridobivanje eteričnih olj in hidrolatov / Distillation system for extracting essential oils and hydrolates



Slika 10, desno: Sušilna omara z regulacijskim sistemom za sušenje zelišč / Drying cabinet with regulation systems for drying herbs

In KEKS we aim to apply all findings, innovations, new solutions, and knowledge that are suitable and permitted in organic farming to other agricultural production systems as well. Technological advancements are essential to address the specific requirements of organic agriculture, particularly in the fields of crop nutrition and management, plant protection, implementation of irrigation and soil mulching practices, improved availability of suitable varieties, organically produced seed and planting material, and the acquisition of equipment adapted to the specific characteristics and operational conditions of agricultural holdings (KMG) in Slovenia. These also represent the needs of farmers, which project partners have identified through long-term monitoring and co-development of organic agriculture in Slovenia in recent years. The main objective of the consortium programme, led by the Faculty of Agriculture and Life Sciences, with IHPS participating as a research partner, is to contribute to reducing yield gaps between organic and conventional production and thereby increase interest among agricultural holdings in converting to organic farming. This would support the achievement of the objectives set out in the Strategic Plan of the Republic of Slovenia and the EU Common Agricultural Policy. At IHPS, we will intensively work on selected genotypes of mountain arnica (*Arnica montana* L.), a set of tested mulching materials, and guidelines for post-harvest processing of herbs (drying, distillation). For the purpose of herb processing, we have acquired drying facilities equipped with control systems for regulating temperature and airflow, which are crucial for high-quality herb drying, as well as a distillation system for the production of essential oils and hydrolates. This system will also enable the evaluation of the quality of different herb species and varieties with regard to the content of individual chemical components. Knowledge transfer into practice will also be carried out, as defined in the annual work plan of the operation.

4.8.2 Projekti EIP

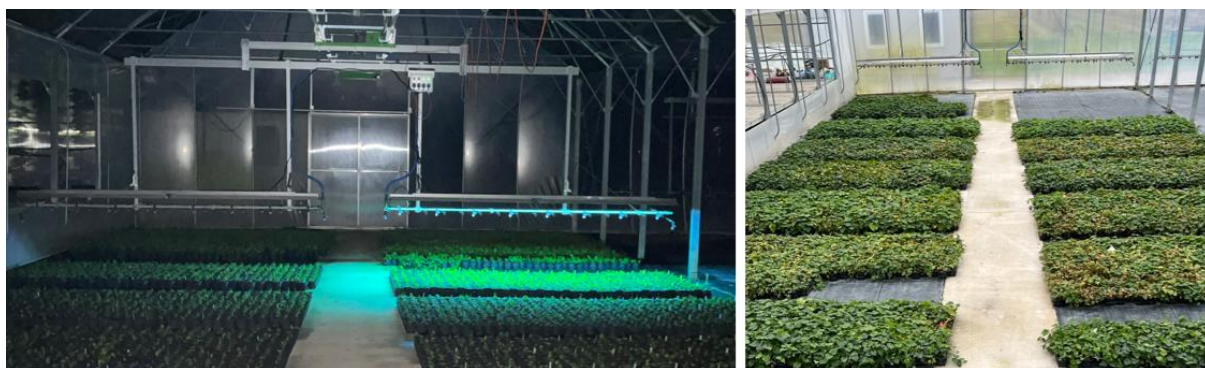
4.8.2.1 Trajnostno varstvo rastlin z uvajanjem UV osvetljevanja - UV4PLANTS / Sustainable plant protection through the introduction of UV lighting

Vodilni partner: Zavod Slokva, SO.P., vodja na IHPS: dr. Sebastjan Radišek

Obdobje trajanja projekta: 18. 05. 2022 – 19. 05. 2025

Ultravijolična (UV-C) svetloba je kratkovalovno elektromagnetno sevanje z izrazitim protimikrobnim učinkom. Zaradi tega se že več kot stoletje uporablja kot učinkovita fizikalna metoda za zmanjševanje prisotnosti škodljivih mikroorganizmov v medicini in živilski industriji, zlasti za razkuževanje vode, zraka in prostorov. V zadnjem desetletju se je uporaba UV-C razširila tudi na področje varstva rastlin, kjer se kot alternativni pristop fitofarmacevtskim sredstvom (FFS) uveljavlja predvsem pri omejevanju pepelastih plesni in sive plesni na različnih gojenih rastlinah. V okviru EIP projekta UV4PLANTS smo v letu 2025 izvedli namestitev sistema UV-C in njegovo testiranje za preprečevanje hmeljeve pepelovke (*Podosphaera macularis*) pri pridelavi sadik hmelja skozi celotno vegetacijsko obdobje. Rezultati so potrdili predhodna laboratorijska opažanja: z UV-C obsevanjem smo dosegli skoraj 100-odstotno učinkovitost pri preprečevanju pojava navedene bolezni. V letu 2025 smo s partnerji izdelali smernice in tehnološka navodila s priporočili za uporabo uporabe UV-C svetlobe v kmetijstvu. Dosežki projekta so bili predstavljeni v oddajah [Tv Idea](#) in [AgriFuture Generations](#).

Ultraviolet (UV-C) light is short-wavelength electromagnetic radiation with a pronounced antimicrobial effect. For this reason, it has been used for more than a century as an effective physical method to reduce harmful microorganisms in medicine and the food industry, particularly for the disinfection of water, air, and premises. Over the past decade, the use of UV-C has also expanded into plant protection, where it is increasingly applied as an alternative approach to plant protection products (PPPs), mainly to suppress powdery mildews and grey mould on various cultivated plants. Within the EIP project UV4PLANTS, we installed and tested a UV-C system in 2025 to prevent hop powdery mildew (*Podosphaera macularis*) during hop plantlet production throughout the entire growing season. The results confirmed earlier laboratory observations: UV-C irradiation achieved nearly 100% effectiveness in preventing the occurrence of this disease. In 2025, together with project partners, we prepared guidelines and technical instructions with recommendations for the use of UV-C light in agriculture. The project outcomes were presented in the TV programmes *TV Idea* and *AgriFuture Generations*.



Slika 11: Pilotno preskušanje UV-C svetlobe v pridelavi sadik za preprečevanje bolezni hmelja (Foto: S. Radišek) / Pilot testing of UV-C light in hop plantlet production to prevent hop diseases. (Photo: S. Radišek)

4.8.2.2 Z naprednimi digitalnimi tehnologijami do kakovostne hrane FRESH@FOOD

Vodilni partner: Zavod Slokva, SO.P., vodja na IHPS: dr. Sebastjan Radišek

Obdobje trajanja projekta: 12. 05. 2023 – 11. 05. 2025

V okviru EIP projekta smo s partnerji izdali priročnik **Pametno skladiščenje za svež pridelek: Digitalna komora in dobre prakse za podaljševanje obstojnosti na kmetiji**. Priročnik ponuja celovit in praktično uporaben vir znanja za vse, ki želijo na kmetijah ali v raziskovalnih okoljih preizkušati ali vpeljati inovativne rešitve za podaljševanje obstojnosti živil. Priročnik združuje znanstvena spoznanja, inženirske pristope in praktične izkušnje, pridobljene v okviru projekta FRESH@FOOD, in jih pretvori v konkretna navodila, priporočila in sistemske rešitve, ki so izvedljive tudi v skromnejših okoljih.

Within the EIP project, together with our partners, we published the handbook **Smart Storage for Fresh Produce: A Digital Chamber and Good Practices for Extending On-Farm Shelf Life**. The handbook provides a comprehensive and practically applicable knowledge resource for anyone who wants to test or implement innovative solutions for extending the shelf life of food on farms or in research settings. It brings together scientific insights, engineering approaches, and practical experience gained within the FRESH@FOOD project, translating them into concrete instructions, recommendations, and system solutions that are feasible even in more modest settings.

4.8.2.3 Trajnostna pridelava in predelava manj razširjenih beljakovinskih rastlin kot rastlinske alternativne živalskim beljakovinam / Sustainable production and processing of less widely grown protein crops as plant-based alternatives to animal proteins

Vodja / Leading by: FKBV, vodja na IHPS: dr. Barbara Čeh

EIP projekt Trajnostna pridelava in predelava manj razširjenih beljakovinskih rastlin kot rastlinske alternativne živalskim beljakovinam se osredotoča na pridelavo in uporabo manj razširjenih beljakovinskih rastlin, ki pomembno prispevajo k trajnostnemu kmetijstvu, izboljšanju tal in razvoju alternativ rastlinskih beljakovin. Kljub številnim prednostim jih v Sloveniji pridelujemo na zanemarljivih površinah, predvsem zaradi pomanjkanja ustreznih sort, tehnološkega znanja in povezovanja med pridelovalci in predelovalci. Projekt vodi Fakulteta za kmetijstvo in biosistemske vede Univerze v Mariboru. Delo je zastavljeno tako, da se na kmetijah v različnih regijah izvajajo poljski poskusi za preverjanje primernosti sort in razvoj agrotehničnih rešitev za setev, zatiranje plevela in spravilo. Poseben poudarek je na praksah, prilagojenih podnebnim spremembam, kot je vključevanje beljakovinskih rastlin v kolobar, kar izboljšuje talne razmere in povečuje biotsko raznovrstnost. Projekt bo raziskoval tudi možnosti razvoja inovativnih prehranskih produktov (npr. fermentirani izdelki) iz lokalnih surovin, s ciljem zmanjšanja uvoza in krepitev lokalne prehranske varnosti. Z razvojem novih tehnologij in osveščanjem javnosti želimo omogočiti širšo uporabo teh rastlin in oblikovati konkretne rešitve za večjo prehransko in okoljsko trajnost. IHPS v okviru projekta vodi in izvaja poljski poskus z visokim fižolom v žičnici partnerske kmetije, sicer primerjamo pridelek in kakovost pridelka fižola sorte Sivček med klasično tehnologijo pridelave na kmetiji in posodobljeno tehnologijo s foliarnimi pripravki, ki zmanjšujejo stresne vplive in pomagajo pri prehrani rastlin. V letu 2025 je bil poskus izveden prvič, v letu 2026 pa se nadaljuje.

The EIP project Sustainable Production and Processing of Less Widely Grown Protein Crops as Plant-Based Alternatives to Animal Proteins focuses on the cultivation and use of underutilised protein crops that can make a significant contribution to sustainable agriculture, soil improvement, and the development of plant-based protein alternatives. Despite their many advantages, these crops are cultivated in Slovenia only on negligible areas, mainly due to a lack of suitable varieties,

insufficient technical knowledge, and limited cooperation between producers and processors. The project is led by the Faculty of Agriculture and Life Sciences of the University of Maribor.

The work is designed so that field trials are carried out on farms in different regions to assess variety suitability and to develop agronomic solutions for sowing, weed control, and harvesting. Particular emphasis is placed on climate change–adapted practices, such as integrating protein crops into crop rotations, which improves soil conditions and enhances biodiversity. The project will also explore opportunities to develop innovative food products (e.g., fermented products) from local raw materials, with the aim of reducing imports and strengthening local food security. Through the development of new technologies and increased public awareness, we aim to enable wider use of these crops and to formulate practical solutions for improved food and environmental sustainability.

Within the project, IHPS leads and carries out a field trial with runner bean on a trellis system at a partner farm. We compare the yield and yield quality of the bean variety Sivček between the farm's conventional production technology and an improved technology incorporating foliar products that reduce stress effects and support plant nutrition. The trial was conducted for the first time in 2025 and will continue in 2026.



Slika 12: V okviru EIP projekta BioBEL preučujemo vpeljavo novejših tehnologij pridelave - foliarno gnojenje visokega fižola glede na razvojno fazo in upoštevanjem vremenskih razmer, in sicer po smernicah ekološke pridelave. Na fotografiji sodelavka Monika Oset Luskar pri pregledu vzorčenih listov na prisotnost škodljivcev in koristnih organizmov. / Within the EIP project BioBEL, we are investigating the implementation of a modernised production technology—foliar fertilisation of runner bean according to growth stage and taking weather conditions into account, following organic farming guidelines. The photo shows our colleague Monika Oset Luskar inspecting sampled leaves for the presence of pests and beneficial organisms.

4.8.3 LAS projekti

4.8.3.1 Vzpostavitev infrastrukture za senzorično vrednotenje agroživilskih proizvodov z namenom povečanja prepoznavnosti in ugotavljanja vplivov podnebnih sprememb na kvaliteto / Establishing an infrastructure for sensory evaluation of agri-food products with the aim of increasing their visibility and determining the impacts of climate change on quality

Vodja / Leading by: izr. prof. dr. Iztok Jože Košir

Cilj projekta je bil vzpostavitev infrastrukture za senzorično vrednotenje agroživilskih produktov primarne proizvodnje (hmelj) in predelovalnih podjetij na področju SSD (predelan hmelj, pivo, izdelki dopolnilnih dejavnosti na kmetijah - mesni, mlečni, sadni izdelki). Na nivoju primarne pridelave smo želeli postaviti pogoje za proučevanje novih kultivarjev hmelja in ugotavljati negativne posledice podnebnih sprememb in na ta način podati informacije hmeljarjev katere kultivarje gojite in katere agrotehnične ukrepe uporabljati za blažitev podnebnih sprememb. Predelovalcem in proizvajalcem živilskih izdelkov smo želeli ponuditi orodje za vrednotenje kakovosti njihovih produktov s ciljem dviga kvalitete, diverzifikacije proizvodnje in vzpostavljanja partnerstev znotraj dejavnosti in s potencialnimi potrošniki.

The aim of the project was to establish an infrastructure for sensory evaluation of agri-food products of primary production (hops) and processing companies in the field of SSD (processed hops, beer, products of complementary activities on farms - meat, dairy, fruit products). At the level of primary production, we wanted to set the conditions for studying new hop cultivars and determining the negative consequences of climate change and in this way provide information to hop growers on which cultivars they grow and which agrotechnical measures to use to mitigate climate change. We wanted to offer processors and producers of food products a tool for evaluating the quality of their products with the aim of improving quality, diversifying production and establishing partnerships within the industry and with potential consumers.

5 DRUGE NALOGE PO NAROČILU IN POGODBAH S KMETIJSKIMI IN DRUGIMI PODJETJI TER POSLOVNIMI ZDRUŽENJI - TRŽNA DEJAVNOST, MEDNARODNI PROJEKTI / OTHER CONTRACTED TASKS WITH VARIOUS AGRIBUSINESS COMPANIES AND ASSOCIATIONS – MARKET ACTIVITIES – INTERNATIONAL PROJECTS

5.1 DRUGE NALOGE PO NAROČILU / OTHER CONTRACTED TASKS

5.1.1 Uradno biološko preizkušanje fitofarmacevtskih sredstev / Officinal biological testing of plant protection products

Vodja / Leading by: dr. Magda Rak Cizej

V skladu s certifikatom dobre poskusne prakse (GEP) smo v letu 2025 izvedli 2 uradna biološka preizkušanja FFS, biostimulantov in sicer fungicidih (2) in sicer na hmelju (1) in jagodah (1). Uradna preizkušanja FFS so vsebovala oceno učinkovitosti in fitotoksičnost na gojenih rastlinah ter v 1 poskusu tudi vpliv FFS na količino in kakovost pridelka. Vsa poročila uradnih preizkušanj FFS so bila izvedena v skladu z EPPO smernicami in večina od njih vnesena v mednarodno uveljavljenem programu ARM 2025.

In accordance with the Good Experimental Practice (GEP) certificate, we conducted two official biological trials in 2025 involving plant protection products (PPPs) and biostimulants—specifically two fungicide trials—carried out on hops (one trial) and strawberries (one trial). The official PPP trials included assessments of efficacy and phytotoxicity on the cultivated crops, and in one trial we also evaluated the effects of the PPP on yield quantity and quality. All official PPP trial reports were prepared in accordance with EPPO guidelines, and most of them were entered into the internationally recognised ARM 2025 software.

5.1.2 Poljski poskusi na področju gnojenja in prehrane rastlin / Field trials in the area of fertilisation and plant nutrition

Vodja / Leading by: dr. Barbara Čeh

V letu 2025 smo na področju gnojenja, prehrane rastlin in rodovitnosti tal izvedli en tržni poskus, in sicer vključevanje zeolita v pridelavo žit in izdelali elaborat Priprava načrta pridelave hmelja za kmetijo s tehnologijo pridelave, ki zmanjšuje izgubo dušika iz tal v podzemno vodo.

In 2025, in the area of fertilisation, plant nutrition, and soil fertility, we conducted one commercial trial focused on integrating zeolite into cereal production, and prepared the report Preparation of a Hop Production Plan for a Farm Using a Cultivation Technology that Reduces Nitrogen Loss from Soil into Groundwater.

5.1.3 Certificiranje pridelka hmelja / Certification of hops

Vodja / Leading by: Joško Livk

Delo na področju certificiranja pridelka hmelja je potekalo v skladu z veljavno zakonodajo. Ves pridelek hmelja letnika 2025 je bilo potrebno priglasiti do 30. oktobra 2025. Glavna dejavnost je bila izvedba certificiranja pridelka hmelja in kontrola dela izvajalcev certificiranja na terenu, ter kontrola centrov za certificiranje. V tem letu je delovalo 12 centrov za certificiranje pridelka hmelja in 20 izvajalcev certificiranja. Skupno se je pridelka hmelja letnika 2025 certificiralo 2.346.690,63 kg.

Glede hmeljskih površin je bilo stanje v tem letu sledeče: Aurora – 620 ha, Savinjski golding – 135 ha, Bobek – 170 ha, Celeia – 547 ha, Hallertauer Magnum – 14 ha, Dana – 3 ha, Styrian gold – 47 ha, Styrian Eureka – 1 ha, Styrian Cardinal – 4 ha, Styrian Wolf – 32 ha, Cascade – 4 ha, Styrian Kolibri – 1 ha, Styrian Dragon – 6 ha, Styrian Fox – 3 ha, Styrian Eagle – 1 ha, Akoya – 3 ha, Eureka! – 2 ha, drugo – 3 ha in sorte v preizkušanju – 5 ha. Premen je bilo prijavljenih 312 ha.

The work on a hop certification the yield was conducted according to current valid regulations. All the hops harvested in year 2025 had to be declared by the 30th of October 2025. The main activity was to carry out certification of a product and harvest control of providers of certification on the terrain and controlling of certification centres. In that year, there were 12 centres for the certification of a hops and 20 performers of certification. Overall, there was a crop of 2,346,690.63 kg of hops certified in year 2025.

Regarding the area covered by the hops, the state in this year was as follows: Aurora – 620 ha, Savinjski golding – 135 ha, Bobek – 170 ha, Celeia – 547 ha, Hallertauer Magnum – 14 ha, Dana – 3 ha, Styrian gold – 47 ha, Styrian Eureka – 1 ha, Styrian Cardinal – 4 ha, Styrian Wolf – 32 ha, Cascade – 4 ha, Styrian Kolibri – 1 ha, Styrian Dragon – 6 ha, Styrian Fox – 3 ha, Styrian Eagle – 1 ha, Akoya – 3 ha, Eureka! – 2 ha, other – 3 ha and varieties in testing – 5 ha. 312 ha was registered under temporary resting.

5.1.4 Uradno potrjevanje semena poljščin in semenskega krompirja / Official certification of agriculture crops and seed of potato

Vodja / Leading by: Joško Livk

V letu 2025 smo pregledali in uradno potrdili 147,41 ha poljščin (pšenica, oves, ajda, proso, oljna ogrščica, trave in detelje) ter 9,24 ha semenskega krompirja. Izvedli smo predpisane poljske preglede in uradna vzorčenja. Pred pakiranjem in trženjem semena poljščin in semenskega krompirja smo izvedli uradne preglede in vzorčenja. Semena poljščin in gomoljev semenskega krompirja, ki so izpolnjevali predpisane zahteve po pravilniku, smo potrdili v ustrezno kategorijo.

In 2025, we carried out an official visual inspection and officially certificated 147,41 ha fields with different agriculture plants (wheat, oats, buckwheat, millet, oilseed rape, grass and alfalfa) and 9,24 ha of seed potato. We made official assess on fields and took official samples for testing. The seeds of different agriculture crops and potato tubers were visually inspected before marketing. If they satisfied the requirements laid down in the rules, they were confirmed in the appropriate category.

5.1.5 Posodobitev pedoloških podatkov o kmetijskih tleh v Pedološki karti Slovenije 2024-2026 / Update of Soil Map of Slovenia 2024-2026 (mostly of agricultural land)

Vodilni partner: Kmetijski inštitut Slovenije, vodja na IHPS: mag. Matej Knapič

Sredi leta 2024 se je pričel projekt posodobitve Pedološke karte 2024-2026, ki bo trajal do konca marca 2026. Posodobitve za naročnika (MKGP) izvajamo v okviru konzorcija, ki ga koordinira Kmetijski inštitut Slovenije, kjer so poleg našega inštituta vključeni obe fakulteti (Oddelek za agronomijo BF ter FKVB Maribor), Gozdarski inštitut Slovenije, Inštitut za oljkarstvo ZRS Koper ter podjetje Agrarius.

V letu 2025 smo dokončali izkop vseh predvidenih pedoloških profilov (skupaj 25) ter nadaljevali s terenskim in kabinetnim delom rekartiranja Pedološke karte Slovenije in Pedološke karte kmetijskih zemljišč (PKKZ) za območje Slovenije, ki je bilo v popravke dodeljeno IHPS.

O opravljenem delu smo ob dveh mejnikih koordinatorju projekta oddali poročila.

In mid-2024, the Soil Map Update Project 2024–2026 was launched and will run until the end of March 2026. The updates for the client (MKGP) are being carried out within a consortium coordinated by the Agricultural Institute of Slovenia. In addition to our institute, the consortium includes both faculties (the Department of Agronomy at the Biotechnical Faculty and the Faculty of Agriculture and Life Sciences in Maribor), the Slovenian Forestry Institute, the Institute of Olive Growing of ZRS Koper, and the company Agrarius.

In 2025, we completed the excavation of all planned soil profiles (a total of 25) and continued with fieldwork and office-based work related to the revision of the Soil Map of Slovenia and the Soil Map of Agricultural Land (PKKZ) for the area of Slovenia assigned to IHPS for corrections.

Reports on the completed work were submitted to the project coordinator at two project milestones.

5.2 SERVISNA DEJAVNOST IN LASTNA PRIDELAVA / SERVICE ACTIVITIES AND OWN HOP PRODUCTION

5.2.1 Analize hmelja in produktov iz hmelja, piva, pivine, pivovarskih surovin ter drugih prehranskih surovin / Analysis of hops and hop products, beer, wort, brewing raw materials and other foodstuffs

Vodja / Leading by: izr. prof. dr. Iztok Jože Košir

V preteklem letu smo v laboratorij prejeli skoraj 3.500 vzorcev različnih matrikov s področja tal, hmelja, pivovarstva in rastlinskih tkiv, katerim smo skupno določili več kot 19.000 različnih fizikalno kemijskih parametrov. Čeprav je akreditiranih preskusnih metod po standardu ISO EN 17025 omejeno število, so bile vse analize opravljene v skladu s standardom in Poslovníkom kakovosti po omenjenem standardu. Med letom smo tudi sodelovali v 46 mednarodnih medlaboratorijskih preskušanjih na področju pivovarstva, hmeljarstva in tal.

In the past year, the laboratory received almost 3,500 different samples of various matrices from the fields of soil, hops, brewing and plant tissues, for which we determined more than 19,000 different physical and chemical parameters. Although the accredited test methods in accordance with ISO EN 17025 are limited, all analyzes have been carried out in accordance with the standard

and the corresponding quality rules. During the year, we also participated in 46 international inter-laboratory trials in the field of brewing, hop production and soil.

5.2.2 Analize tal s svetovanjem gnojenja in gnojilni načrti / Soil analyses with fertilisation advice and fertilisation plans

Vodja / Leading by: dr. Barbara Čeh

V letu 2025 smo na IHPS naredili 474 osnovnih analiz, 356 analiz vzorcev tal na N-min ter 10 analiz na nitrat v listih (hitri test), ki jih oddamo naročnikom zapisane v ustrezni preglednici z navedbo preskrbljenosti tal z določenim hranilom ter dopišemo nasvet za gnojenje glede na analizo, lastnosti tal in namen rabe tal (sadovnjak, travnik, njiva, vrt ali vinograd). Če je potrebno, zapišemo tudi nasvet za apnjenje. Približno petina pridelovalcev vsakoletno potrebuje tudi usten nasvet bodisi za pravilno preračunavanje bodisi glede gnojenja in dognojevanja ter glede izbire gnojil (sestanek na IHPS ali po telefonu). Poleg tega smo svetovali na področju gnojenja vseh kmetijskih rastlin preko telefona, na tehnoloških sestankih hmeljarjev in drugih strokovnih srečanjih. Nadaljevali smo z izdelovanjem gnojilnih načrtov s programom Kegn; izdelali smo okrog 500 letnih gnojilnih načrtov.

In 2025, IHPS carried out 474 basic soil analyses, 356 N-min soil sample analyses, and 10 nitrate-in-leaf analyses (rapid test). The results are delivered to clients in a standardised table indicating the soil supply status for individual nutrients, together with fertilisation recommendations based on the analytical results, soil characteristics, and intended land use (orchard, grassland, arable field, garden, or vineyard). When necessary, we also provide liming recommendations.

Approximately one fifth of growers additionally require annual verbal advice, either regarding correct calculation methods or regarding fertilisation and supplementary fertilisation, as well as fertiliser selection (in-person consultation at IHPS or by phone). In addition, we provided fertilisation advice for all agricultural crops by phone, at hop growers' technical meetings, and at other professional events. We continued preparing fertilisation plans using the Kegn programme and produced around 500 annual fertilisation plans.

5.2.3 Usposabljanja o fitofarmacevtskih sredstvih / Training on Plant Protection Products

Vodja / Head of Training: Alenka Ferlež Rus

V letu 2025 so bila izvedena tri osnovna usposabljanja o fitofarmacevtskih sredstvih za svetovalce, prodajalce in poklicne uporabnike, v skladu z Zakonom o fitofarmacevtskih sredstvih (ZFfS-1) ter 3. členom Uredbe (ES) št. 1107/2009. Usposabljanja in postopki certificiranja so bili izvedeni skladno z zahtevami 5. člena Direktive 2009/128/ES in veljavnimi podzakonskimi predpisi Republike Slovenije. Na podlagi uspešno opravljenih predpisanih izpitov je bilo izdanih 21 potrdil za svetovalce, 17 potrdil za prodajalce in 28 potrdil za poklicne uporabnike.

Poleg tega je bilo organiziranih šest obnovitvenih usposabljanj. V okviru obnovitvenih usposabljanj je bila v skladu z ZFfS-1, 5. členom Direktive 2009/128/ES in nacionalnimi izvedbenimi predpisi podaljšana veljavnost 72 potrdil za svetovalce, 82 potrdil za prodajalce in 65 potrdil za poklicne uporabnike.

Prav tako je bilo izdanih 15 dvojnikov potrdil. Poleg tega je bilo osebam, ki izpolnjujejo pogoje za poklicne uporabnike v skladu z ZFfS-1 in 3. členom Uredbe (ES) št. 1107/2009 ter imajo opravljeno usposabljanje za svetovalca ali prodajalca fitofarmacevtskih sredstev, izdano 124 izkaznic za poklicne uporabnike, skladno z nacionalno zakonodajo.

In 2025, three basic training programmes on plant protection products were implemented for professional advisers, distributors, and professional users, as defined in Article 3 of Regulation (EC) No 1107/2009. The training and certification activities were carried out in accordance with the requirements set out in Article 5 of Directive 2009/128/EC. Following the successful completion of the prescribed examinations, a total of 21 certificates were issued to professional advisers, 17 certificates to distributors, and 28 certificates to professional users.

In addition, six refresher training programmes were organised. As part of these programmes, the validity of 72 certificates for professional advisers, 82 certificates for distributors, and 65 certificates for professional users was renewed, in line with Article 5 of Directive 2009/128/EC.

Furthermore, 15 duplicate certificates were issued. Moreover, 124 professional user identification cards were issued to persons who meet the requirements for professional users in accordance with Article 3 of Regulation (EC) No 1107/2009 and who have previously obtained certification as professional advisers or distributors, as provided for under Article 5 of Directive 2009/128/EC.

5.2.4 Redni pregledi naprav za nanašanje fitofarmacevtskih sredstev / Regular testing of PPP sprayers

Vodja / Leading by: Joško Livk

Na osnovi Zakona o fitofarmacevtskih sredstvih ter Pravilnika o pogojih in postopkih, ki jih morajo izpolnjevati pooblaščen nadzorni organi za redno pregledovanje naprav za nanašanje fitofarmacevtskih sredstev, smo na Inštitutu za hmeljarstvo in pivovarstvo Slovenije v letu 2025 opravljali redne preglede naprav za nanašanje FFS. Skupno smo pregledali 252 naprav.

Based on the Law on Plant Protection Products, the Slovenian Institute for Hop Research and Brewing (IHPS) carried out in 2025 its regular checks of the application equipment. We inspected a total of 252 devices.

5.2.5 Pridelava kmetijskih rastlin na poskusnih površinah / Cultivation of agricultural crops on experimental fields

Vodja / Leading by: Davorin Vrhovnik

V letu 2025 smo na poskusnem posestvu pridelovali hmelj na 19,3 hektara površin. Na dislociranem hmeljišču izven Savinjske doline smo oskrbovali 0,20 ha moških rastlin za potrebe žlahtnjenja. Posadili smo tudi 1,0 hektara križancev. Na Rojah smo pridelovali 1,05 hektara ekološke industrijske konoplje v skladu z GACP standardom. Izvedli smo veliko poskusov na področju žlahtnjenja, gnojenja, varstva rastlin in zdravilnih zelišč. Vse hmeljarske površine so vključene v integrirano pridelavo hmelja in biotično varstvo rastlin.

In 2025, we cultivated hops on 19.3 hectares of land on the experimental estate. On a dislocated hop field outside the Savinja Valley, we have grown 0.20 ha of male plants for breeding purposes. We also planted 1.0 ha of hybrids. In Roje, we cultivated 1.05 hectares of organic industrial hemp in accordance with the GACP standard. We conducted many experiments in the field of breeding, fertilization, plant protection and medicinal herbs. All hop growing areas are included in integrated hop production and biotic plant protection.

5.2.6 Pridelava certificiranih sadik hmelja / Production of certified hop planting material

Vodja / Leading by: Monika Oset Luskar

Inštitut za hmeljarstvo in pivovarstvo Slovenije (IHPS) je v sortni listi registriran kot žlahtnitelj in vzdrževalec sort hmelja. V skladu z zakonodajo s področja zdravstvenega varstva rastlin in semenskega materiala kmetijskih rastlin ima IHPS vzpostavljeno certifikacijsko shemo za sadilni material hmelja. V skladu s to shemo vzgaja izvirne in osnovne matične rastline, iz katerih prideluje certificiran sadilni material – certificirane sadike A (CSA). Cilj certifikacijske sheme je zagotoviti sortno in kakovostno ustrezen sadilni material, ki je prost vseh bolezni hmelja, ki jih ni mogoče obvladovati s fitofarmacevtskimi sredstvi (npr. virusi, viroidi, verticilijska uvelost), saj lahko te bolezni v pridelovalnih nasadih povzročijo znatno gospodarsko škodo. Preprečevanje drugih škodljivih organizmov v okviru certifikacijske sheme poteka skladno z dobro agronomsko prakso in dodatnimi smernicami za vzgojo sadilnega materiala v zavarovanih prostorih (ZAP).

V letu 2025 smo vzgojili 100.000 certificiranih sadik hmelja A (CSA) različnih sort.

The Slovenian Institute of Hop Research and Brewing (IHPS) is registered in the variety list as a breeder and maintainer of hop varieties. In compliance with legislation related to plant health and seed material of agricultural plants, IHPS has implemented a certification scheme for hop planting material. According to this scheme, IHPS cultivates original and basic mother plants, from which it produces certified planting material: Certified Seedlings A (CSA). The certification scheme's primary objective is to ensure the production of varietally pure and high-quality planting material that is free from all hop diseases that cannot be controlled with plant protection products (e.g., viruses, viroids, Verticillium wilt), as these diseases can cause significant economic damage in plantations. The prevention of other harmful organisms within the certification scheme follows good agronomic practices and additional guidelines for growing planting material in protected environments (ZAP).

In 2025, we cultivated 100,000 certified hop plants A (CSA) of various varieties.

5.2.7 Pridelava navadne arnike / Cultivation of *Arnica montana*

Vodja / Leading by: Maja Dobrajc

V drugo letnem nasadu navadne arnike (*Arnica montana* L.) smo leta 2025 spremljali cvetenje rastlin na dveh lokacijah v Žalcu. S selekcijo dveh izvorno različnih sadik smo preverjali uspešnost pridelave v povezavi s tehnologijo pridelave (z agrotekstilom, na grobovih in brez grobov). Zaradi intenzivnega razvoja koreninske gnilobe smo uvedli nekatere ukrepe pri gojenju sadik in pridelavi rastlin. Kljub izvedenim ukrepom je zaradi koreninske gnilobe propadlo 25–50 % rastlin ne glede na izvor sadilnega materiala in tehnologije pridelave.

In 2025, flowering of plants in a second-year plantation of *Arnica montana* L. was monitored at two locations in Žalec. By selecting two seedlings of different origins, we evaluated cultivation performance in relation to production technology (with agrofabric, on raised beds, and without raised beds). Due to the intensive development of root rot, several measures were introduced in seedling cultivation and plant production. Despite the implemented measures, 25–50% of plants were lost due to root rot, regardless of the origin of the planting material or the production technology used.

5.2.8 Žlahtnjenje konoplje / Cannabis breeding

Vodja / Leading by: izr. prof. dr. Andreja Čerenak

Za tujega naročnika smo v varovanem zaprtem območju opravljali raziskavo z namenom razvoja lastne sorte konoplje.

For a foreign client, we conducted research in a protected closed area with the aim of developing our own cannabis variety.

5.2.9 Zdravilne in aromatične rastline / Medicinal and aromatic plants

5.2.9.1 Sadike zelišč, pridelane na ekološki način / Seedlings of medicinal and aromatic plants, produced according to the guidelines of organic production

Vodja / Leading by: Maja Dobrajc

V skladu s smernicami ekološke pridelave (SI-EKO-01) smo v letu 2025 pridelali 5000 sadik, ki so bile namenjene prodaji, vključitvi v poskusne nasade, sajenju v Vrt zdravilnih in aromatičnih rastlin na IHPS ter donacijam.

In 2025, a total of 5,000 seedlings were produced in compliance with organic production standards (SI-EKO-01). The seedlings were intended for commercial sale, establishment of experimental plantations, planting in the Medicinal and Aromatic Plants Garden at IHPS, and for donation purposes.

5.2.9.2 Vrt zdravilnih in aromatičnih rastlin (VZAR) / Medicinal and Aromatic Plant Garden (MAP)

Vodja in kuratorka / Leader and curator: Maja Dobrajc

Vrt zdravilnih in aromatičnih rastlin IHPS je bil ustanovljen leta 1976. V njem se izvaja raziskovalna, svetovalna in izobraževalna dejavnost. V VZAR proučujemo rast in razvoj zdravilnih in aromatičnih rastlin, količino pridelka, dovzetnost posameznih rastlin na bolezni in škodljivce. Del VZAR predstavlja gensko banko zdravilnih in aromatičnih rastlin in poskuse na področju zelišč. Dejavnosti potekajo v skladu z ekološkimi smernicami, pridelek VZAR je ekološko seme, ki je namenjen za vzgojo ekoloških sadik zelišč za prodajo.

The IHPS Medicinal and Aromatic Plants Garden was established in 1976. It serves as a site for research, advisory, and educational activities. Within the MAP, we investigate the growth and development of medicinal and aromatic plants, yield levels, and the susceptibility of individual species to diseases and pests. A section of the MAP comprises a gene bank of medicinal and aromatic plants as well as experimental trials in the field of herbs. All activities are conducted in accordance with organic production guidelines. The output of the MAP includes organically produced seed intended for the propagation of organic herb seedlings for commercial sale.

5.3 Evropski projekt ICAERUS - Preizkus uporabe brezpilotnih letalnikov (dronov) za odkrivanje nevarnih bolezni hmelja / European project ICAERUS - Testing drones for hop diseases detection

Vodja / Leading by: Agricultural University of Athens, vodja na IHPS: mag. Matej Knapič

V začetku leta 2024 smo pripravili prijavo na razpis v okviru HORIZON projekta ICAERUS. Skupaj z glavnim nosilcem projekta Hmezad exim d.o.o. smo uspešno pridobili sredstva za enoletni projekt s kratico DAEPHC na temo uporabe brezpilotnih letalnikov (v nadaljevanju dronov) v kmetijstvu za zgodnje odkrivanje verticilijske uvelosti hmelja in viroida razpokanosti skorje agrumov (CBCVd).

Rezultati prvih obdelav snemanja kažejo, da je predvsem pri verticilijski uvelosti hmelja velika stopnja zanesljivosti ugotavljanja obolelih rastlin na nivoju rastrske celice (več kot 80% zanesljivost detektiranja), nekoliko slabša je pri detekciji CBCVd (75%). Pri analizah podatkov je bilo veliko šuma, tako zaradi senčenja kot tudi različne višine rastlin. S podatki snemanja 2025 smo v drugi fazi, s spremembami metodologije obdelave podatkov z uvajanjem obdelave v 4x4 m velikih prostorskih celicah hmeljišča, zmanjšali šum v podatkih in s tem zanesljivost detekcije okuženih rastlin, tako se je zanesljivost detekcije hmeljeve uvelosti izboljšala na 86%, medtem ko je zanesljivost detekcije CBCVd ostala na okoli 75% neglede na datum snemanja oziroma se je izboljšala tudi zanesljivost detekcije zdravih rastlin. Rezultati detekcije hmeljeve uvelosti so povsem dosegli operativen nivo uvajanja tehnologije daljinskega zaznavanja v izvajanja nadzora te bolezni. Pri nadzoru CBCVd lahko ta tehnologija prav tako pripomore k bolj usmerjenem terenskem pregledovanju prisotnosti CBCVd v hmeljiščih.

At the beginning of 2024, we prepared an application for a call within the HORIZON project ICAERUS. Together with the lead partner, Hmezad exim d.o.o., we successfully obtained funding for a one-year project entitled DAEPHC, focusing on the use of unmanned aerial vehicles (hereinafter: drones) in agriculture for the early detection of hop *Verticillium* wilt and Citrus Bark Cracking Viroid (CBCVd).

The results of the initial image processing indicate a high level of reliability in detecting infected plants at the raster cell level for hop *Verticillium* wilt (over 80% detection reliability), while the detection rate for CBCVd was somewhat lower (75%). The data analyses revealed a considerable amount of noise, caused both by shading and by variations in plant height. Using the 2025 imaging data, we entered the second phase, where modifications to the data processing methodology were introduced, including analysis within 4 × 4 m spatial grid cells of the hop yard. This reduced data noise and improved the reliability of detecting infected plants. The detection reliability for hop wilt increased to 86%, while the detection reliability for CBCVd remained around 75% regardless of the imaging date; however, the reliability of detecting healthy plants also improved. The results for hop wilt detection have fully reached an operational level, enabling the implementation of remote sensing technology in disease monitoring. In the case of CBCVd, this technology can also contribute to more targeted field inspections for the presence of the viroid in hop yards.

6 IZDAJANJE REVIJ IN DRUGIH PUBLIKACIJ / PUBLICATION OF JOURNALS AND OTHER PUBLICATIONS

6.1 Hmeljarski bilten / Hop Bulletin ISSN 0350-0756

Urednika / Editors: dr. Barbara Čeh and dr. Boštjan Naglič

Revija Hmeljarski bilten / Hop Bulletin je domača znanstvena publikacija, ki jo izdaja IHPS od leta 1994. V njej objavljamo prispevke slovenskih avtorjev in avtorjev iz tujine s področja agronomije, živilstva, ekologije in razvoja podeželja, s tem da težimo k temu, da je večina prispevkov na tematiko s področja hmeljarstva in pivovarstva oziroma vsebin, s katerimi se raziskovalno ukvarjamo sodelavci IHPS. Vsi prispevki imajo dvojezičen (slovenski in angleški) izvleček, naslov, ključne besede ter naslove preglednic in slik, prispevki pa so napisani v slovenskem ali angleškem jeziku.

Prispevke zbira urednica dr. Barbara Čeh (barbara.cek@ihps.si) in so dvojno, po potrebi trojno recenzirani. Recenzenti prispevkov so člani uredniškega odbora revije, ki so navedeni na začetku revije in na spletni strani. Če pa je tematika z bolj specifičnega področja, prispevek pošljemo v recenzijo ustreznemu strokovnjaku izven uredniškega odbora. Revija izhaja enkrat letno, in sicer v decembru. Vključena je v relevantno mednarodno bazo EBSCO Publishing (ZDA) in CABI Publishing (VB), vpisana je v COBISS. **V letu 2025 je bila revija vpisana tudi v Directory of Open Access Journals (DOAJ) – to je mednarodni spletni imenik (baza) znanstvenih revij z odprtim dostopom.**

[Revija je objavljena v celoti na spletni strani IHPS](http://www.ihps.si/raziskave-in-razvoj/publikacije/hmeljarski-bilten/) (<http://www.ihps.si/raziskave-in-razvoj/publikacije/hmeljarski-bilten/>) in v [Digitalna knjižnica Slovenije - dLib.si](http://dlib.si). Na ta način je dostopna najširši zainteresirani javnosti. Objava celotnih kontaktnih podatkov vseh vključenih avtorjev dovoljuje vzpostavljanje neposrednih stikov med raziskovalci in strokovnjaki ter študenti in drugimi zainteresiranimi za več informacij in dialog ter omogoča multidisciplinarne povezave. Glede na soavtorstvo prispevkov revija dokazuje sodelovanje strokovnjakov in raziskovalcev z različnih področij in institucij.

V letošnji številki revije Hmeljarski bilten je zajetih 13 znanstvenih in strokovnih prispevkov s širšega področja raziskovalnega in strokovnega dela sodelavcev IHPS. Kot vedno smo se tudi tokrat potrudili pridobiti prispevke z novostmi na tem ožjem raziskovalnem področju sodelavcev IHPS in izven.

The Hop Bulletin / Hmeljarski bilten is a domestic scientific publication issued by IHPS since 1994. It publishes contributions from Slovenian authors and authors from abroad in the fields of agronomy, food science, ecology, and rural development, with an emphasis on ensuring that the majority of contributions focus on topics related to hop cultivation and brewing, or subjects that IHPS collaborators are researching. All contributions have bilingual (Slovenian and English) abstracts, titles, keywords, and titles of tables and figures, and the articles are written in either Slovenian or English. Contributions are collected by editor Barbara Čeh PhD (barbara.cek@ihps.si) and are double, if necessary, triple, peer-reviewed. Reviewers are members of the journal's editorial board, listed at the beginning of the journal and on the website. If the topic is from a more specific field, the contribution is sent for review to a suitable expert outside the editorial board. The journal is published annually in December. It is included in the relevant international databases EBSCO Publishing (USA) and CABI Publishing (UK), registered in COBISS. In 2025, the journal was also included in the Directory of Open Access Journals (DOAJ), an international online directory (database) of open-access scientific journals.

[Hmeljarski bilten](http://www.ihps.si/raziskave-in-razvoj/publikacije/hmeljarski-bilten/) is fully available on the website (<http://www.ihps.si/raziskave-in-razvoj/publikacije/hmeljarski-bilten/>) and [Digitalna knjižnica Slovenije - dLib.si](http://www.dlib.si). In this way, it is accessible to the widest interested public. Publishing the full contact details of all included authors allows for direct contacts between researchers, experts, students, and others interested in more information and dialogue, and facilitates multidisciplinary connections. Given the co-authorship of contributions, the journal demonstrates the collaboration of experts and researchers from various fields and institutions.

In this year's issue of the journal Hmeljarski bilten, 13 scientific and professional articles are included, covering a broad range of research and technical work carried out by the staff of IHPS. As always, we have also made an effort to collect contributions presenting new developments in this narrower research area, both from IHPS colleagues and from external contributors.



Slika 13: Naslovnica revije Hmeljarski bilten je izdelana v skladu s celotno grafično podobo inštituta / The cover of the journal Hmeljarski bilten is designed in accordance with the institute's corporate visual identity.

6.2 Revija Hmeljar ISSN 1318-6183 / Journal Hmeljar ISSN 1318-6183

Urednica / Editor-in-Chief: dr. Barbara Čeh

V letu 2025 je Inštitut za hmeljarstvo in pivovarstvo Slovenije izdal eno številko strokovne revije Hmeljar ISSN 1318-6183 letnik 87. Izdali smo tiskano verzijo (300 izvodov) in revijo objavili na spletni strani, kjer so dosegljive vse številke revije od leta 2008 (www.ihps.si) oziroma je dostopna v spletni knjižnici.

The Slovenian Institute of Hop Research and Brewing (IHPS) publishes one or two issues per year of the popular/scientific and professional magazine Hmeljar (ISSN 1318-6183), the oldest professional agricultural magazine in Slovenia, which has been published since 1935. Since 2008, individual issues have also been available online and archived on our website.

The magazine covers events in the field of hop production during the current year, professional articles, cultivation advice for hops and medicinal and aromatic plants, photo chronicles, and feature reports related to hop production. The authors are mainly IHPS staff, while several

contributions from external authors are also published in each issue. The editorial board consists of experts employed at IHPS, as well as an advisory specialist for hop production from the Chamber of Agriculture and Forestry of Slovenia (KGZS).

In 2025, the Slovenian Institute of Hop Research and Brewing published one issue of the professional journal Hmeljar (ISSN 1318-6183), volume 87. We produced a printed version (300 copies) and published the journal on our website, where all issues since 2008 are available (www.ihips.si), or it can be accessed in the online library.

V generaciji 2025/26 dr. Košir izbran v Fulbrightov program kot predstavnik Slovenije s projektom Primerjava slovenske in ameriške hmeljarske industrije – od polja do piva

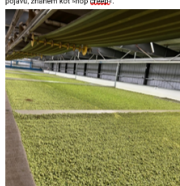
Dr. Irena Jula Košir
Inštitut za hmeljarstvo in pivovarstvo Slovenije

Fulbrightov program je vodilni in najbolj raziskovalni mednarodni program izobraževanja znanj, ki ga sponzorira vlada ZDA, in je zasnovan za poveljavno medsebojnega razumevanja med prebivalci ZDA in Slovenije. Program je bil ustanovljen leta 1946 in ga sponzorira Urad za izobraževanje in kulturne zadeve ameriškega zunanjega ministrstva. Trenutno program deluje v več kot 160 državah po vsem svetu.



Dr. Irena Jula Košir, ki bo v letu 2025/26 izšla v Ameriko, na sliki s sodelavci in gostitelji v Ameriki. (Foto: T. Tavlcar)

V generaciji 2025/26 sem bil avtor prispevka izbran kot predstavnik Slovenije s projektom "Primerjava slovenske in ameriške hmeljarske industrije – od polja do piva". Projekt se je izvajal tri mesece v laboratoriju prof. Tima Sheehana na Oregon State University, ki je bil ustanovljen leta 1946 in ga sponzorira Urad za izobraževanje in kulturne zadeve ameriškega zunanjega ministrstva. Trenutno program deluje v več kot 160 državah po vsem svetu.



Slika prikazuje hmelj na hmeljarskem posestvu. Hmelj je ključna surovina za proizvodnjo piva. (Foto: T. Tavlcar)

Drugo raziskovalno področje je bilo **diagnostika** moči hmelja. Ki se nanaša na enotno iz hmelja, sposobno razgrajevanje polihidrofenov v fermentabilne sladkorje. Ti encimi, še posebej pomenljivi pri hmelju, hmeljarju, lahko povzročijo pojav **hop crush** – nezabojno rakadno fermentacijo, napramno aromo, viljo vsebnosti alkohola in ostrega CO₂ v pivu.



Slika prikazuje hmelj na hmeljarskem posestvu. Hmelj je ključna surovina za proizvodnjo piva. (Foto: T. Tavlcar)

Projektna skupina fontane piva Zeleno zlato nagajena z značko Občine Žalec

Na slovenski seji Občinskega sveta Občine Žalec, ki je potekala v soboto, 6. septembra 2025 v Domu št. 1 slovenskega tabornega župana, so podali občinska proročja. Značko Občine Žalec so prejeli tudi štiri projektne skupine, ki so znanstveno in umetniško odpravi turistični produkt – Fontana piva Zeleno zlato (**Beer Fountain of Green Gold**). Med projektnimi je tudi direktor Inštituta za hmeljarstvo in pivovarstvo Slovenije Bujan Čadež, ki je z ostalimi član projektna skupine pripravil k uspešni realizaciji



Projektni priraj Občine Žalec (značka, plakati in gital) v letu 2025 (Foto: T. Tavlcar)

Operacije v okviru instrumenta IRP38 – okrepljena infrastruktura in prenos znanja v prakso s ciljem podpore prehodu kmetijstva v zeleno, digitalno in podnebno nevtralno

Dr. Božjan Naglič, mag. Metka Knapčič, dr. Barbara Čuh, Maja Dobner in Maja Matavž
Inštitut za hmeljarstvo in pivovarstvo Slovenije



Instrument IRP predstavlja pomemben korak k sodobnejšemu, povezanemu in trajnostno usmerjenemu slovenskemu kmetijstvu. Vzpostavlja platformo, ki povezuje pridelavce, raziskovalce, inovatorje, izobraževalce in podporne institucije ter bo omogočala, da bo znanje hitreje in učinkoviteje prešlo v prakso. Cilj je povečati prehod slovenskega kmetijstva v zeleno, digitalno in podnebno nevtralno prihodnost. Operacija IRP38 razvijajo znanje, ki temelji na potrebah kmetov, kmetijsko sodelovanje v okviru sistema AKIS in razpisujejo poskuse-demonstracije.

Češotne rešitve za rastlinsko pridelavo v času podnebnih izzivov: Nadgradnja znanja, kompetenc in infrastrukture (akronim: CLIMAGROW)

Slovenija ima enega najvišjih deležev namakanj kmetijskih površin v Evropi, sistem znanja in podpore na tem področju pa ostaja šibek in neuporaben. Za doseg ciljev Strategije razvoja slovenskega kmetijstva in Skladnega načrta SRP 2023-2027 je nujno okrepiti prenos znanja o namakanju in drugih ukrepih prilagajanja podnebnim spremembam – od izbire odpornih sort in uporabe biostimulansov do naprednih tehnologij upravljanja z vodo in talnimi viri. Tu predstavljamo glavni cilj operacije CLIMAGROW.



Prilagoditve operacije CLIMAGROW na vodnem ostanku v septembru 2025. (Foto: arho HPS)

Konzorcij, ki ga vodi Inštitut za hmeljarstvo in pivovarstvo Slovenije (IHPS), združuje 18 partnerjev iz raziskovalnih inštitutov, svetovalnih služb in pridelavcev. Z vzpostavitvijo sodelovanja in usklajevanjem med deskriptorji operacije ustvarja celovit okvir za oblikovanje in uveljavljanje trajnostnih rešitev, ki prispevajo k višji odpornosti kmetijstva na podnebne izzive, zmanjšanju okoljskih tveganj ter dolgoročno razvoju trajnostnega konkurenčnega in podnebno odpornega kmetijstva. Povezovalno se predstavljajo raziskovalne institucije in drugi ključni deležniki z namenom razvoja trajnostnih rešitev, učinkovite rabe vodnih virov ter upravljanja naprednih praks v kmetijstvu. Cilj je povečati odpornost kmetijske pridelave na podnebne spremembe, zagotoviti dolgoročno trajnostni razvoj sektorja ter obratni konkurenčnost in višja stopnja podjetnosti.

Slika 14: Utrinek iz revije Hmeljar 2025 / A snapshot from the magazine Hmeljar 2025

7 SODELOVANJE / COOPERATION

7.1 SODELOVANJE Z ZNANSTVENO-RAZISKOVALNIMI USTANOVAMI V SLOVENIJI / COOPERATION WITH SCIENTIFIC-RESEARCH INSTITUTIONS IN SLOVENIA

- Institut Jožef Stefan
- Inštitut za nutricionistiko
- Kemijski inštitut
- Kmetijski inštitut Slovenije
- Nacionalni inštitut za biologijo
- TECOS, Celje
- Univerza v Ljubljani, Biotehniška fakulteta
- Univerza v Ljubljani, Fakulteta za farmacijo
- Univerza v Ljubljani, Fakulteta za kemijo in kemijsko tehnologijo
- Univerza v Ljubljani, Veterinarska fakulteta
- Univerza v Mariboru, Fakulteta za kemijo in kemijsko tehnologijo
- Univerza v Mariboru, Fakulteta za kmetijstvo in biosistemske vede
- Univerza v Mariboru, Fakulteta za strojništvo

7.2 SODELOVANJE Z DRUGIMI ORGANIZACIJAMI IN PODJETJI V SLOVENIJI / COOPERATION WITH OTHERS IN SLOVENIA

- Agropoagro, Podlehnik
- Arnika, Društvo pridelovalcev in predelovalcev zdravilnih rastlin
- ARSO, Agencija RS za okolje
- Center za poklicno izobraževanje RS
- Čebelarska zveza Slovenije
- Gospodarska zbornica Slovenije – Zbornica kmetijskih in živilskih podjetij
- HMEZAD Exim d.o.o.
- Inbarco, d.o.o. (od nov. 2025 - Hopsteiner SI)
- Izvršni odbor Slovenskega agronomskega društva
- Karsia, kmetijska proizvodnja, proizvodnja vin, trgovina, Izvoz-Uvoz, Dutovlje, d.o.o.
- Kmetijsko gozdarske zbornice Slovenija
- Kmetijsko gozdarski zavod Celje
- Kmetijsko gozdarski zavod Maribor
- Kmetijsko gozdarski zavod Nova Gorica
- Kmetijsko gozdarski zavod Novo Mesto
- LEK d.d.
- Marovt sistemi d.o.o.
- Meko d.o.o.
- Metrob d.o.o.
- Montana
- Občina Celje
- Pivovarna Laško -Union, d.d.
- Razvojna agencija Savinja
- Sadjarstvo Mirozan d.d.

- Syngenta Agro d.o.o., Ljubljana
- Šola za hortikulturo in vizualne umetnosti Celje
- Šolski center Slov. Konjice - Zreče
- Šolski center Šentjur, Višja strokovna šola
- Zavod za zdravstveno varstvo Celje
- Združenje hmeljarjev Slovenije

7.3 MEDNARODNO SODELOVANJE / INTERNATIONAL COOPERATION

- AHA - Delovna skupina za analitiko hmelja, Nemčija
- ALBAUGH EUROPE SÀRL, World Trade Center Lausanne, Switzerland
- Bayerische Landesanstalt für Bodenkultur und Pflanzenbau, Hüll, Nemčija
- Bayerische Landesanstalt für Landwirtschaft, Institute für Pflanzenbau und Pflanzenzüchtung, Hopfenforschungszentrum Hüll
- Belchim Crop Protection NV
- BMS Micro-Nutrients, Italija
- Central Science Laboratory, Sand Huton, Velika Britanija
- CPVO
- Cybele Agrocare, Levallois-Perret, Francija
- East Malling Research (EMR), New Road, East Malling, Kent ME19 6BJ, UK
- EBC analizna komisija
- EFSA (člani PRAPeR odborov)
- Fertilizers Europe
- Hop Head Farms, Ltd., Michigan
- Hop Research Institute Co., Ltd, Žatec, Češka
- International Fertilizer Society Labor Veritas, Zürich, Švica
- [International Hop Growers' Convention - Svetovna hmeljarska organizacija](http://www.ihgc.org) IHGC / IHB / CICH (www.ihgc.org)
- Lankhorst Yarns, Portugalska
- Mednarodna harmonizacijska skupina Commodity Expert Group (CEG) Minor Uses – Hop za uporabo FFS v hmelju (Magda Rak Cizej, Sebastjan Radišek)
- Mednarodna skupina za rodovitnost tal IOSDV
- Oregon State University, Corvallis, Oregon, Združene države Amerike
- Plant Protection Institute, Budapest
- Plant Protection Service, Mycology Department, P.O. Box 9102, 6700 HC Wageningen, The Netherlands
- Priprava projektnih vlog v okviru različnih mednarodnih konzorcijev INTERREG IIIB in IVC
- Research Institute for Brewing and malting, Praga, Češka
- Russel IPM, Integrated Pest Management, Velika Britanija
- SAGEA Centro di Saggio s.r.l., Italija
- Sveučilište Josipa Jurja Strossmayera u Osijeku, Osijek, Hrvaška
- State General Laboratory, Ministry of Health, Nikozija, Ciper
- SUMI AGRO Europe
- Tecnopackaging, Španija,
- The China National Research Institute of Food and Fermentation Industries Corporation Limited, Peking, Kitajska
- TRIDAS, Češka
- University of Tasmania, Tasmanian Institute of Agricultural Research, P.O. Box 3523, Burnie, Tasmania 7320 Australia
- Univerzitet Crne Gore, Biotehnički fakultet, Centar za zaščito bilja

- Univerza v Beogradu, Beograd, Srbija
- Univerza v Novem Sadu, Novi Sad, Srbija
- Veleučilište u Karlovcu, Karlovac, Hrvaška
- Zelfo Technology, Nemčija

8 BIBLIOGRAFIJA / BIBLIOGRAPHY

Bibliografija članov Raziskovalne skupine za rastline, tla in okolje je na voljo na strežniku [Sicris](#).