Development of application technics of invasive plant eradication

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Outlook

- Reasons of usage chemical control methods in management
- Field trials – control practices
- Application technics
- Economic approach
- Result of chemical control - post treatment activities – restoration of project areas
- Development of application technics
- Conclusions and recommendations

Most important invasive alien species of nature conservation importance in Hungary	
Acer negundo	*Heracleum mantegazzianum*
Ailanthus altissima	*Humulus scandens*
Ambrosia artemisiifolia	*Impatiens glandulifera*
Amorpha fruticosa	*Impatiens parvifolra*
Asclepias syriaca	*Parthenocissus inserta*
Aster novi-belgii agg.	*Phytolacca americana*
Bidens frondosa	***Prunus serotina***
Celtis occidentalis	*Ribes aureum*
Echinocystis lobata	***Robinia pseudoacacia***
Elaeagnus angustifolia	*Rudbeckia laciniata*
Elodea canadensis	***Solidago canadensis***
Fallopia × bohemica	***Solidago gigantea***
Fraxinus pennsylvanica	*Vitis riparia*
Heilanthus tuberosus s. l.	*Xanthium* spp.

Reasons of usage chemical control methods – effect of mechanical control

- Vigorous resprouting characteristic from cut stumps and root fragments, (which proliferate the species)

Field trials – application techniques tested

- Spot spraying
- Overall spraying
- Leaf painting
- Bark painting
- Bark ringing and painting
- Cut stem painting
- Leaf wiping by hand
- Leaf wiping by light tractor
- Tree injection
- Foam placing






Field trials – main active ingredients tested

(at different species in different combinations, timing, formulation etc.)

2,4 D	klomazon
aminopiralid	klopiralid
dikamba	MCPA
dimetenamid-p	metalochlor
flazaszulam	metszulfuron-metil
flazaszulfuron	mezotrion
floraszulam	nikoszulfuron
fluroxipir - meptil	proszulfuron
glyfosate - IPA	rimszulfuron
glyfosate-diammonium	terbutilazin
kletodim	tribenuron-metil
klomazon	triklopyr

Main expectation using chemical control methods

- Kill the entire root-system of target plant ideally by one treatment
- Be not harmful for the environment / neighbouring plants (selective ingredients or application technics with minimal drift and no or moderate soil-effect after leaching)
- Be not toxic to application labour
- Be cheaper than other methods
- Be controllable application technics (for instance visible) whilst applied
- Be decomposable after treatment

Main expectation using chemical control methods

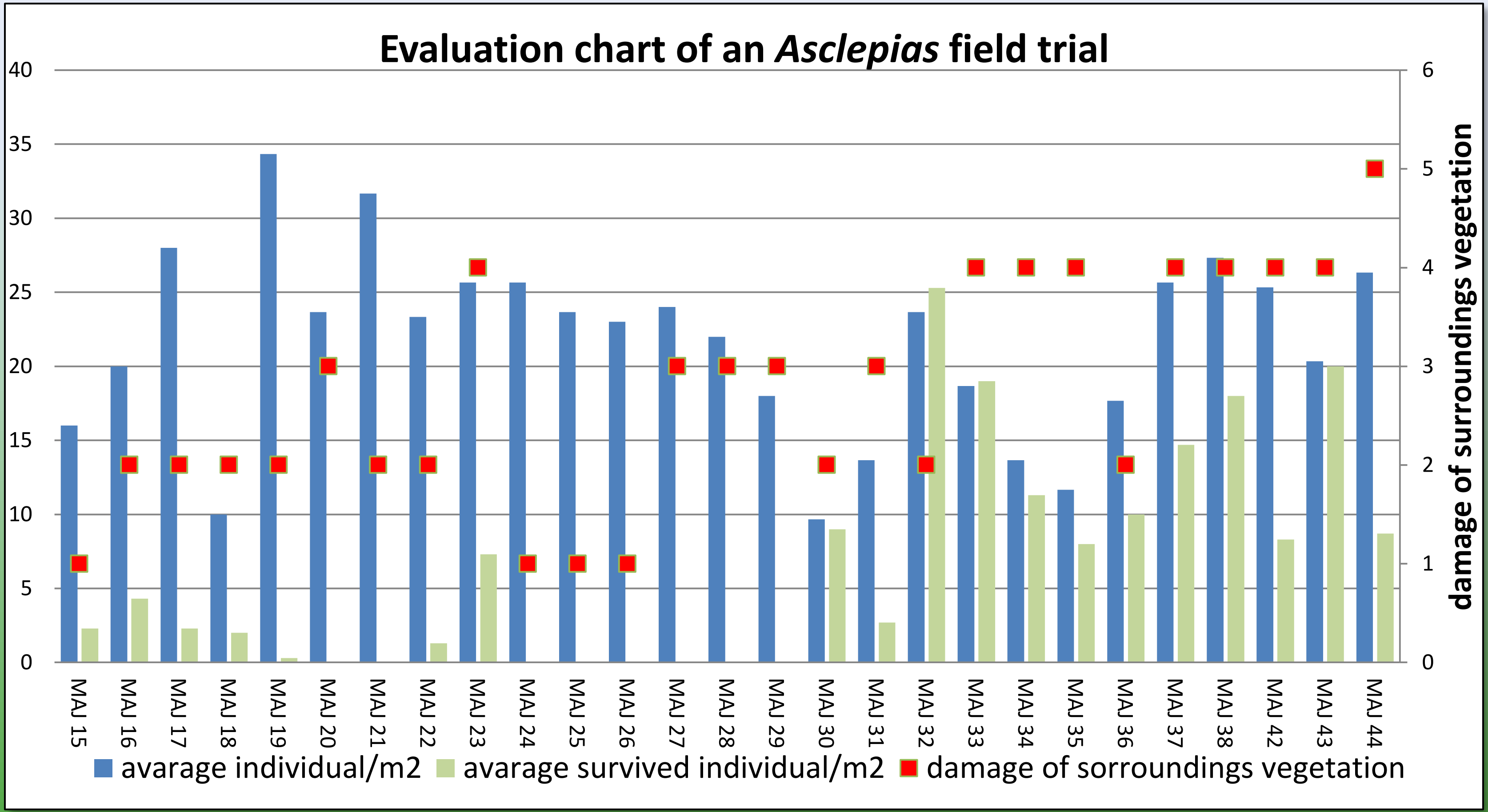
Monitoring after chemical application 0-1 year

- All trial quadrats 3 pcs 1X1 quadrat
- 1 month and one year after the treatments
- Data:
  - Survived individual
  - Damage of neighbouring flora (ranked 1-5)

No.MAJ22 – June 19.2013.

No. MAJ22 – June 17 2014.

Monitoring after chemical application



Szidonya, Takács, Korda & Csiszár (2015)

Monitoring after chemical application 2-5 years

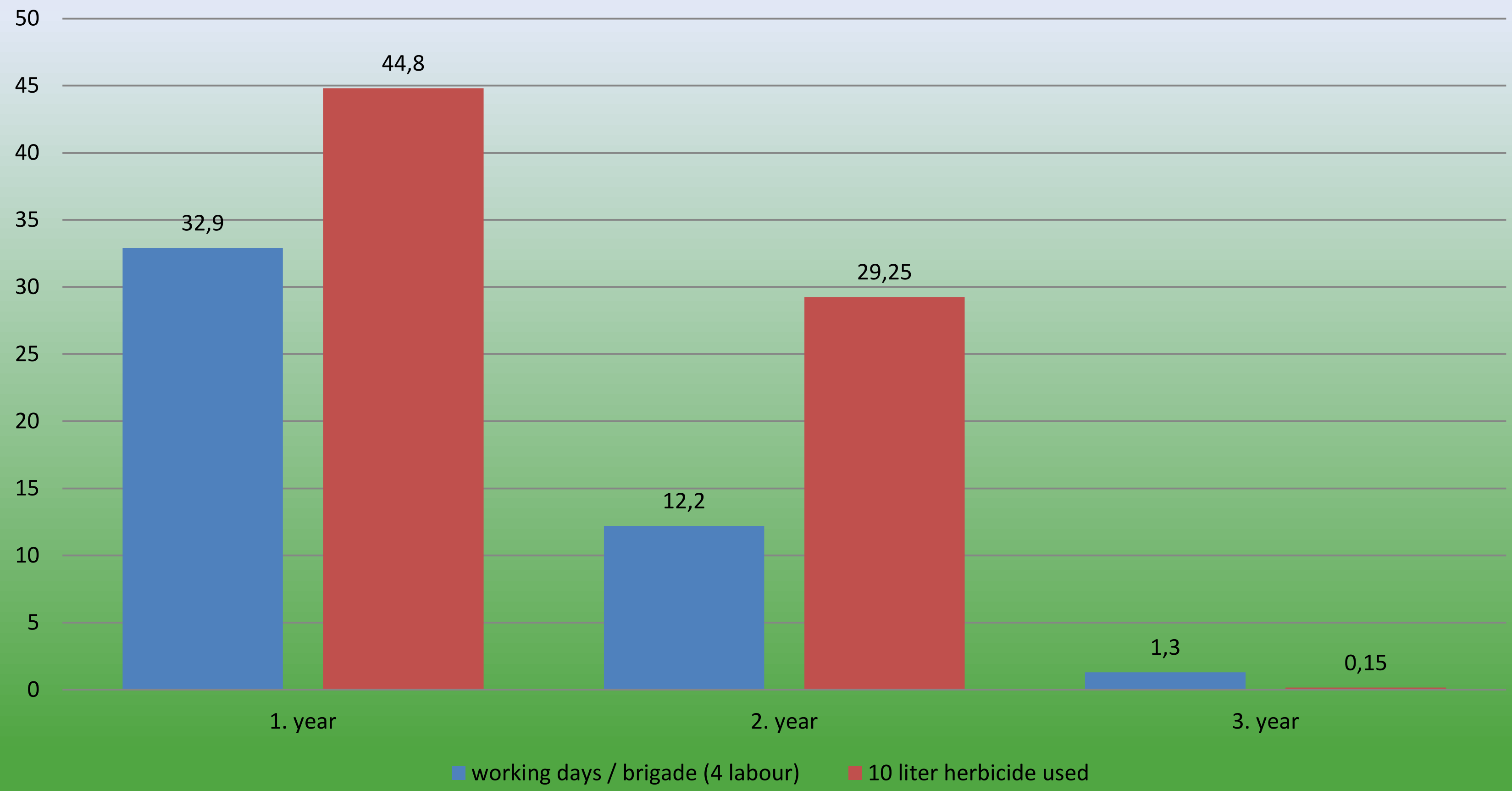
- Data:
  - Resprouting activity (survived trunks)
  - Revive of natural vegetation

Sept 11 2012

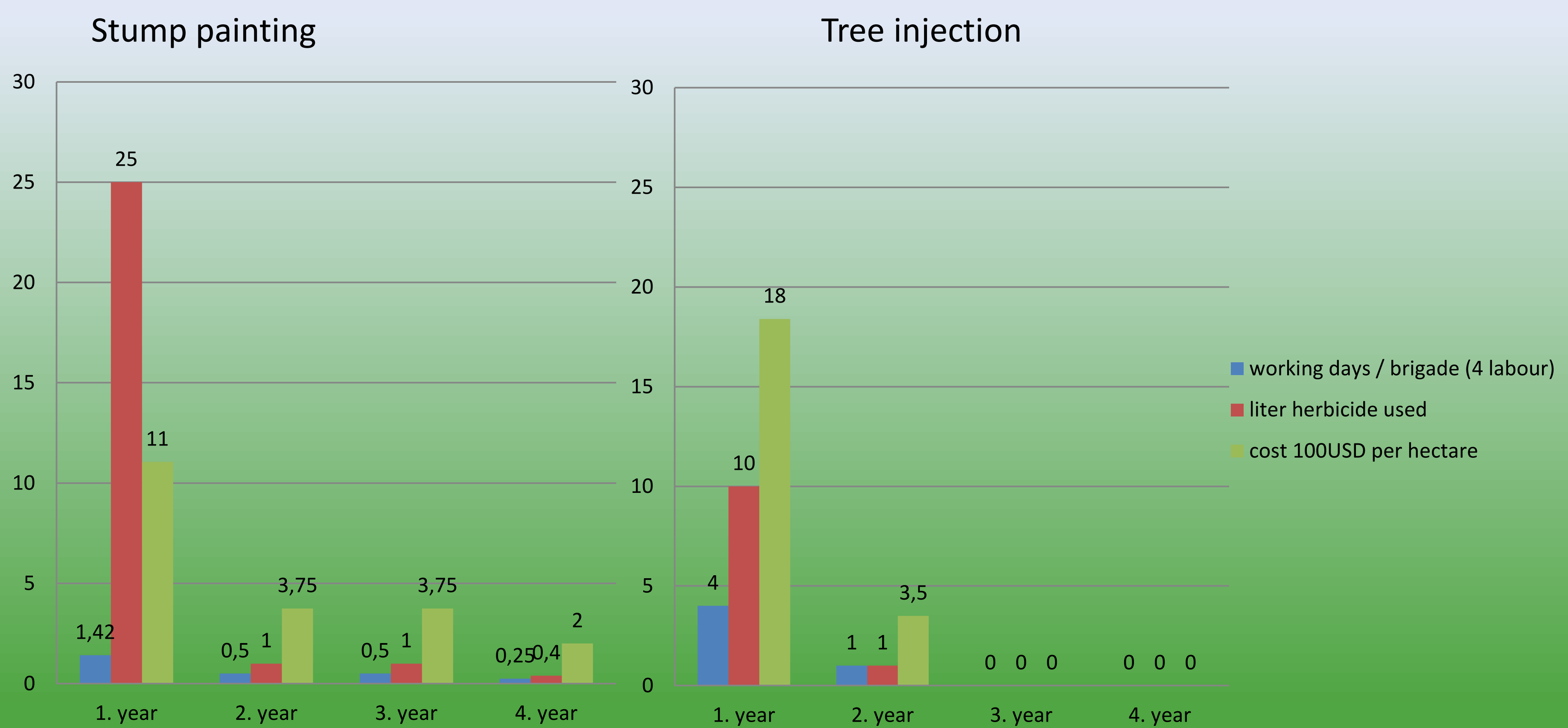
June 30 2015

Economic approach (used herbice quantity and workforce for 3 years of tree of heaven eradication from young oak forest renewal -1

2012-2014 (Gyermely No67)

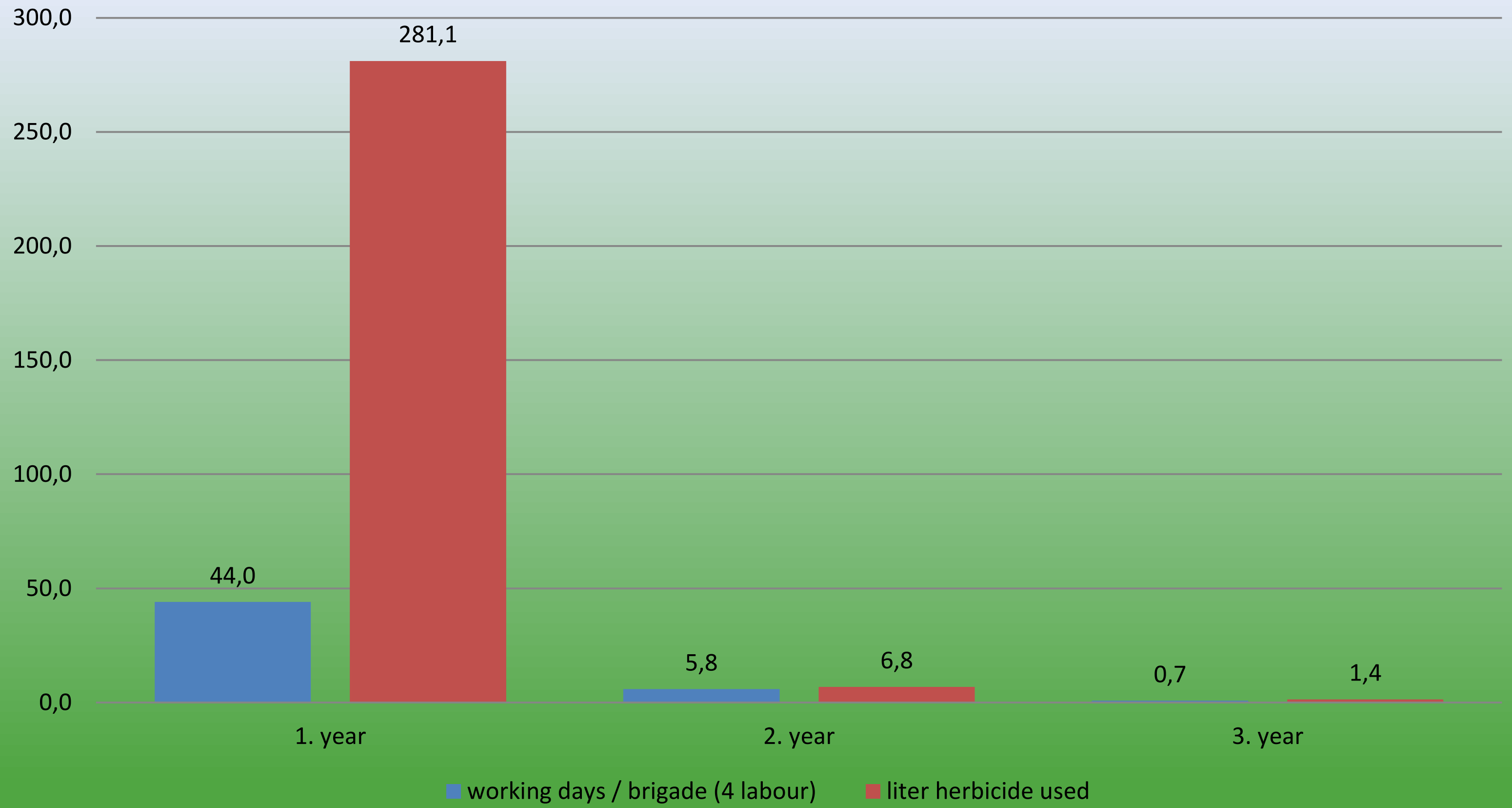


Economic approach used workforce, herbicide quantity and cost – 2 comparison of tree injection and stump painting technologies against black locust (summarized data from different projects average)



Economic approach (used herbicide and workforce for 3 years common milkweed eradication projects - 3 (3 phase starting in subsequent years - average)

Táborfalva grassland military training field LIFE+ project



Development of application technics

(as there is limited number of physiologically selective active ingredients)

- Aim: minimize the target and out of target herbicide quantity by
- Endotherapic treatments
- Wiping/painting to target
- Increase the herbicide intake
- Increase the efficiency of application
- Combination with mechanic control

Selective formulations/active ingredients

Mashinery development

Endotherapic treatments - trunk injection

Efficiency of chemical intake is 10 times higher that painting/spraying method
High inverstment cost – high labour cost – low chemical usage
Applicable: Ailanthus, Robinia, Prunus, Celtis, Acer, Fraxinus , Fallopia
Weak result: Elaeagnus, Syringa, Amorpha
Developed formulation – glyfosate-ammonium – metsulfuron-metil – used by emegency use permit by plant protection authority
Developments: to improve the physical charcteristic: solvent agent, surface tension



Tree injection

Tree/stem injection

Wiping / painting onto the target
Painting onto target leaves

Chemical intake is effective – minimal drift

Deterioration on leaves/stems is slow, so leaching is possible

Low investment – high labour – high chemical intake -

The quality of application in vast areas is weak can be improved by pigments

Applicable: Asclepia, low Fallopia Ailanthuns and other sprouts

Decrease the chamical usage – surfactant, oil, sun protection agent, timing

Painting methods – Asclepias syriaca

Next year resprouting is minimal – Asclepias syriaca

Painting onto bark

Chemical intake medium – drift minimal

Low investment cost – low labour cost comparing to tree-injection or bark removal – high herbicide usage – relatively high performance

Quality is excellent (coloured liquid)

Garlon (triklopyr used in the past but no longer permitted – evaporous – weak translocation towards the root system

Glyfosate base suspo-emulsion (BFA+ result of 7 years development)

Applicable: Ailanthus Prunus – Amorpha – Celtis <5 cm diameter withour resprouting. In case of larger diamater resprouting from the root.

Applied by emergency use permit of the plant protection authority

Application for EU funds to make final formulation to improve stability, and pesticide registration has been done

Bark painting by intermediate formulation (2013)

Bark painting

Bark painting

Increase the chemical intake

Continous work balancing the

Timing / phenological phase of the target plant

/ temperature

Physical characteristic of formulation surface tension,

Solvent agent – soluability of active ingredients

Decrease the water hardness

Assisting the cohesivity of the liquid by lipophyl additives (oil)

Increase the target plant metabolism by fertilizer or plant hormones

Agent to free atomic oxigen to help the intake through the cuticula

Sun protection to decrase the decomposition by UV light

Combination with mechanical control

To provide the height difference for wiper (spring cutting of Asclepias and grass)

Cutting Ailanthus dominated forests than no seedling planted for 1 year – 3 times spraying

Amorpha/Prunus cutting and spot spraying of small sprouts

etc.

In case of too thick manifestation mechanical control – sump painting – sport spraying

Selective formulation/active ingredients

(physiological selectivity)

Target	Active ingredients	Selectivity on
Robinia	chlopyralid	oak seedlings, grass
Ailanthus seedlings	aminopyralid	oak seedlings
Ailanthus seeds	metsulfuron methyl	oak seeds / other planted seedlings
Asclepias	*tryklopyr*	*monocotyledonous plants*
Amorpha	*aminopyralid*	*monocotyledonous plants*

Mashinery development

Wiping mashines – Asclepias, Ailanthus and other arboreal seedlings

- spinning roller
- gravity spounge-based
- both with recirculation

Problems

Height difference needed

Sticking onto waxed leaves is problematic

Leaching rain soon after treatment

Treadding damage by tyres

Injecting mashine

Herbicide foam making

Minimize the drifting of chemical

Application development – light wiper

Wiping Ailanthus sprouts from young oak renewal

Recirculation sprayer

Bycicle

Granule

Application development – herbicide foam

Increase the efficiency of application

- Labour logistic improvement
- Colouring the spraying liquid
- Determine the exact dosage
- Lower the dosage by combination of active ingredients

Combination of active ingredients

Conclusion

- Chemical control is the only way to eradicate effectively some of the aggressively resprouting species
- Tree injection is the most effective method - herbicide utilization 10 times higher (estimated) than any other method (spraying or painting) therefore environmental strain is less
- For thin bark arboreal and non-arboreal species leaf painting <1m, bark painting >1m had the best results
- The plant protection authority realized the importance providing „permit for emergency use" EU conform registration

Conclusion II.

- In general glyphosate-ammonium (Medallon) and metsulfuron-methil (Mezzo, Savvy) combination produced the highest translocation into root systems at all samples (much better results than tryklopir (Garlon), but other herbicides are used for different applications, as well
- The ideal timing is necessary
- With 7 component a visible suspo-emulsion fluid was developed for bark painting to provide the proper intake and effect
- After eradication (moderate) effort is needed to prevent the new colonization of emerging seedling

Recommendations for developing technology for new species using chemical control methods

- Try mechanical methods - if does not work:
- Make studies before the treatments
- Apply in optimal phenological phase of the target plant
- Integrate non-chemical interventions into technology, if possible
- Be aware on the environmental behaviour and ecotoxicological characteristic of herbicides
- Be aware on the secondary ecological influence on the treatment

Recommendations for developing technology for new species using chemical control methods II.

- Deal with formulation (visible colour, surface tension, viscosity of mix, stability of emulsion, hardness of water
- Make tests to decrease the dosage of herbicides
- Integrate the herbicide treatment into middle and long term habitat restoration projects
- Deal with the invasion pressure from neighbourhood
- Deal with the area after the restoration project

Thank you for attention !

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