IPM Decisions

D4.6 Dataset for DSS validation from partners collated and organized in a standard structure (weeds)

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Version number	Implemented by	Reason
1.0	Jonathan Storkey	Deliverable 4.2 – Dataset for DSS validation from partners collated and organized in a standard structure (weeds)

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Contents

1 Public Summary

Weed data has been collated from Greece and the IWPraise project, to be used to validate weed DSS outputs.

2 Executive Summary

This report gives an overview of the data collated on weeds. These data will be used in WP4 activities in 2021 and 2022 to evaluate the predictions of changes in weed densities using data from across Europe (Deliverable 4.7), and evaluate the value of prediction in terms of economics and environment for DSSs related to weeds (D4.15)

Main messages:

- A data set on herbicide x weed species combination including dose response curves has been made available from Greece.
- A data set from weed trials in 2021 as part of the EU funded IWPraise project has also been made available, and further data will be provided in future years.

Horizon 2020

3 Introduction

Decision support systems (DSS) that aim to inform the more judicious and efficient use of herbicides differ from their counter parts for disease and pest control in two important respects. Firstly, the impact of weeds in terms of potential yield loss in a season will be a function of multiple factors in addition to the density of weed species, including crop competitiveness and growing conditions (Storkey J *et al*, 2021). Any decision to reduce herbicide doses or to use an alternative, more environmentally benign product, therefore, needs to take account of this *contextual* information. The second defining feature of weeds that presents a major challenge to the implementation of DSS, compared to (for example) threshold-based models for pests and diseases, is the problem of weed seed return. A weed infestation may be reduced sufficiently to protect yield in season t_1, based on a single year economic threshold, but if surviving plant go on to produce seed the problem may worsen in seasons t_{1+n}. The potential for reducing herbicide dose, therefore needs to be quantified based on the population dynamics of the target weed species over multiple years. This potential, in a single season, will be greater where the cropping system is inherently resilient to the build up of dominant weed species through use diversification of management practices (Storkey J & Neve P, 2018).

The two models that will be validated in IPMDecisions are 'IPMwise' (the fourth generation tool of the Danish Crop Protection Online-Weeds (Montull JM *et al*, 2020)) and Weed Manager, a DSS for advising on weed control over multiple seasons developed in the UK (Parson DJ *et al,* 2009). In both cases, a first requirement is the parameterization of dose response curves of specific active ingredient x weed species combinations that reflect the different environmental conditions in countries around Europe. As part of IPM Decisions, these data have been compiled across a range of European countries: Greece, Denmark, Norway, Germany, and Spain. The meta-data for Greece are presented in Section 2. These parameters for herbicide efficacy need to be implemented in the agronomic context of contrasting cropping systems to quantify the risk of reduced herbicide applications in the short and long term. Any validation datasets, therefore, need to also contain this contextual information. We have collated and organized data from the H2020 project, IWMPraise (Kudsk P *et al,* 2020) on the response of weeds and yield to a range of herbicides and doses for 26 field experiments in UK, Denmark, France, Slovenia, and Italy (Section 3). This dataset also includes information on crop competitiveness and additional weed management operations including cultivation and mechanical control that will be used to validate IWMwise and Weed Manager under alternative scenarios.

4 Dose response curve data from Greece

A new dataset has been collated to parameterise dose response curves of range of herbicide x weed species combinations under growing conditions in Greece. The combinations of herbicides x weeds used in the experiments are presented in Table 1 and the doses used to parameterise the curves in Table 2.

	Pacifica plus	Cossack Star	Broadway	Axial	Primus perfect
Alopecurus myosuroides	✓	✓	✓	✓	
Avena sterilis	✓	✓	✓	✓	
Lolium rigidum	✓	✓	✓	✓	
Phalaris sp.	✓	✓	✓	✓	
Galium aparine	✓	✓	✓		✓
Papaver rhoeas	✓	✓	✓		✓
Sinapis arvensis	✓	✓	✓		✓
Veronica hederofolia	✓	✓	✓		
Stellaria media	✓	✓	✓		✓
Matricaria chamomilla	✓	✓	✓		✓

Table 1. Herbicide x weed species combination included in the dataset of dose response curves from Greece.

PACIFICA PLUS	amidosulfuron 5% w/w + iodosulfuron-methyl-sodium 1% w/w + mesosulfuron-methyl 3% w/w + mefenpyr-diethyl 9% w/w		
Treatments' description	Rate		Note
2X	1000	g of product /ha	Double the recommended rate
X	500	g of product /ha	Maximum recommended rate
X/2	250	g of product /ha	1/2 recommended rate
X/4	125	g of product /ha	1/4 recommended rate
X/8	62.5	g of product /ha	1/8 recommended rate
Untreated	0		
COSSACK STAR	iodosulfuron-methyl-sodium 45 g/kg + thiencarbazone-methyl 37,5 g/kg + mefenpyr-diethyl 135 g/kg		
Treatments' description	Rate		Note
2X	400	g of product /ha	Double the recommended rate
X	200	g of product /ha	Maximum recommended rate
X/2	100	g of product /ha	1/2 recommended rate
X/4	50	g of product /ha	1/4 recommended rate
X/8	25	g of product /ha	1/8 recommended rate
Untreated	0		
PRIMUS PERFECT	florasulam 2,5% w/v + clopyralid 30% w/v		
Treatments' description	Rate		Note
2X	300	g of product /ha	Double the recommended rate
X	150	g of product /ha	Maximum recommended rate
X/2	75	g of product /ha	1/2 recommended rate
X/4	37.5	g of product /ha	1/4 recommended rate
X/8	18.75	g of product /ha	1/8 recommended rate
Untreated	0		

AXIAL	cloquintocet mexyl 1,55% w/w + pinoxaden 6% w/w		
Treatments' description	Rate		Note
2X	1500	g of product /ha	Double the recommended rate
X	750	g of product /ha	Maximum recommended rate
X/2	375	g of product /ha	1/2 recommended rate
X/4	187.5	g of product /ha	1/4 recommended rate
X/8	93.75	g of product /ha	1/8 recommended rate
Untreated	0		
BROADWAY	cloquintocet mexyl 7,1% w/w + florasulam 1,4% w/w + pyroxsulam 7,1% w/w		
Treatments' description	Rate		Note
2X	530	g of product /ha	Double the recommended rate
X	265	g of product /ha	Maximum recommended rate
X/2	132.5	g of product /ha	1/2 recommended rate
X/4	66.25	g of product /ha	1/4 recommended rate
X/8	33.13	g of product /ha	1/8 recommended rate
Untreated	0		

Table 2. Summary of experimental treatments used to parameterize dose response curves for weeds under Greek condition.

Data for Denmark, Norway, Germany, and Spain will be added when available, expected to be August 2021.

5 IWPraise data

Integrated Weed Management: PRActical Implementation and Solutions for Europe (IWPraise) is an EU funded project (H2020 grant agreement 727321) supporting and promoting the implementation of IWM in Europe. Data were available at the time of writing for experiments completed as part of this project in 2019; these were arranged by active ingredient, crops and season of application. Each record has associated data on weed response, yield and additional weed control events to validate the models (Table 1). Data from additional years will also be collated.

Herbicide x crop x season	Number of occasions in data
Chlorotuluron x winter wheat x autumn	8
Clodinafop x winter wheat x spring	1
Diflufenican x spring barley x spring	12
Diflufenican x spring oats x spring	3
Diflufenican x winter wheat x autumn	16
Flufenacet x spring barley x spring	15
Flufenacet x winter triticale x autumn	6
Flufenacet x winter wheat x autumn	14
Glyphosate x none x autumn	22
Glyphosate x none x spring	7
Iodosulfuron-methyl-sodium x winter barley x spring	3
Iodosulfuron-methyl-sodium x winter wheat x spring	12
Meso-sulfuron-methyl x winter wheat x spring	12
Pendimethalin x spring barley x spring	6
Pendimethalin x winter triticale x autumn	6
Pendimethalin x winter wheat x autumn	6
Picolinafen x winter wheat x autumn	2
Prosulfocarb x winter barley x autumn	1
Prosulfocarb x winter triticale x autumn	12
Prosulfocarb x winter wheat x autumn	6
Pyroxsulam x winter wheat x spring	2
Tribenuron x winter wheat x spring	2

Table 3. Data from field experiments from UK, Denmark, France, Italy and Slovenia that finished in 2019.

Data from IWPraise field experiments in 2020 and 2021 will be added when available, expected to be August 2021.

6 References

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