Department of Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

Protect
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Strategies to reduce herbicide damage after strategic deep tillage

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GRDC DPIRD project DAW1901_006RTX *Increasing farming system profitability and longevity of benefits following soil amelioration*

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Take Home Messages

Mouldboarding and spading can increase the risk of pre-emergent herbicide damage

Difficult to generalise but can identify factors that increase risk:

1) **Soil composition change post-tillage**
   - ↑ Risk, 90% of cases
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2) **Environmental conditions conducive to damage**
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3) **Herbicide**
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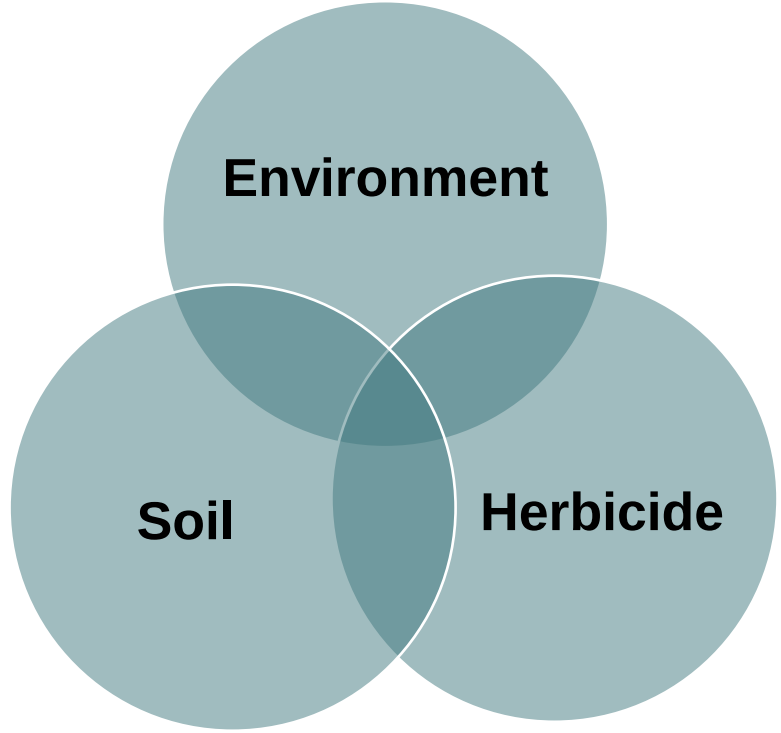
   - Sensitivity to change in soil composition ↑ Risk
   - High concentration required to achieve weed control ↑ Risk



Deep soil mixing with **Spader**

Soil inversion with **Mouldboard plough**

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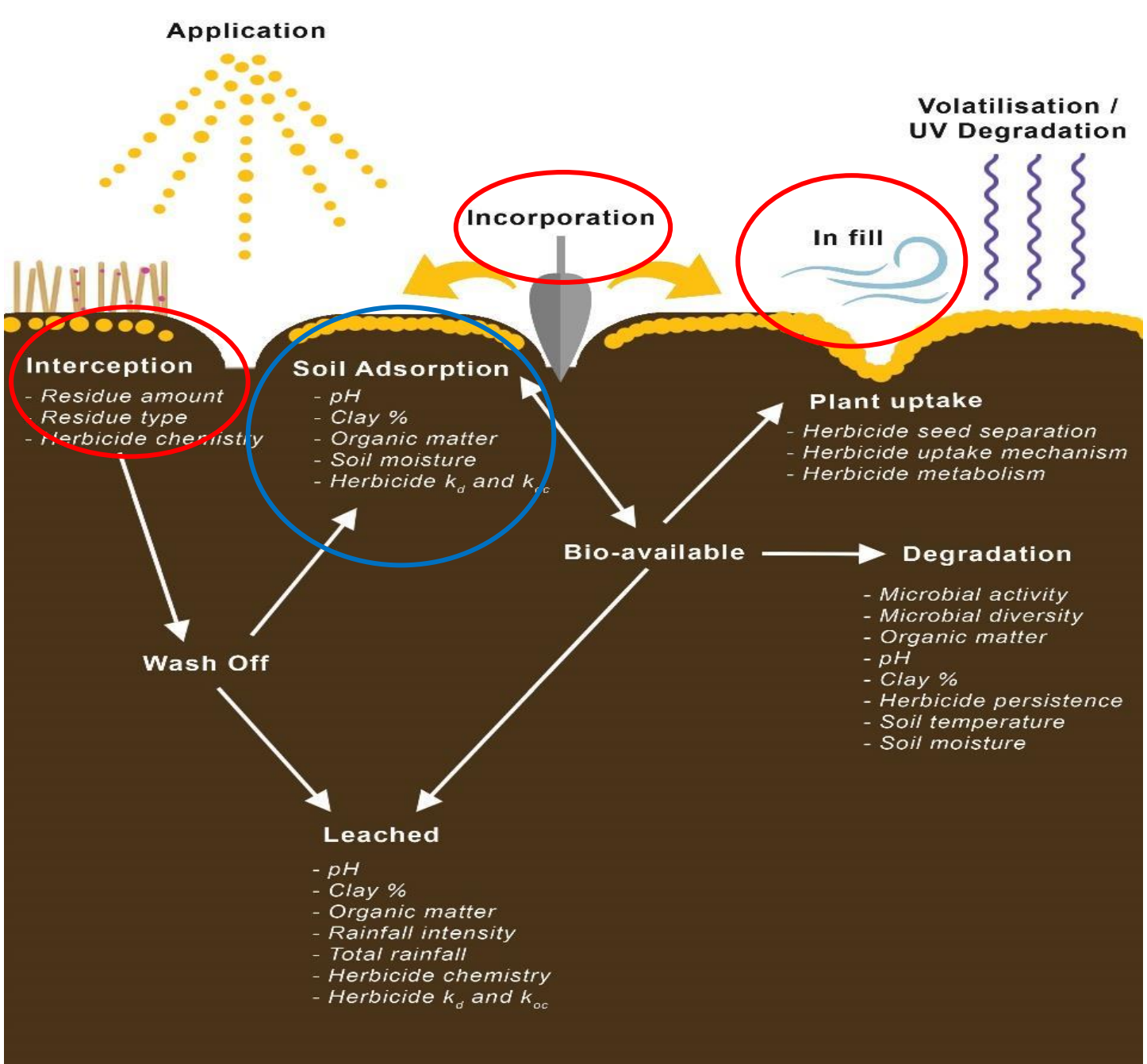

Soil inversion with **Mouldboard plough**

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Survey of 214 growers	Inversion Ploughing	Deep Mixing
Adoption 2019-2020	0.31m ha	0.65m ha
Observed **herbicide damage** post amelioration	26%	23%
Will change herbicide strategy post amelioration	67%	78%

Soil inversion with **Mouldboard plough**

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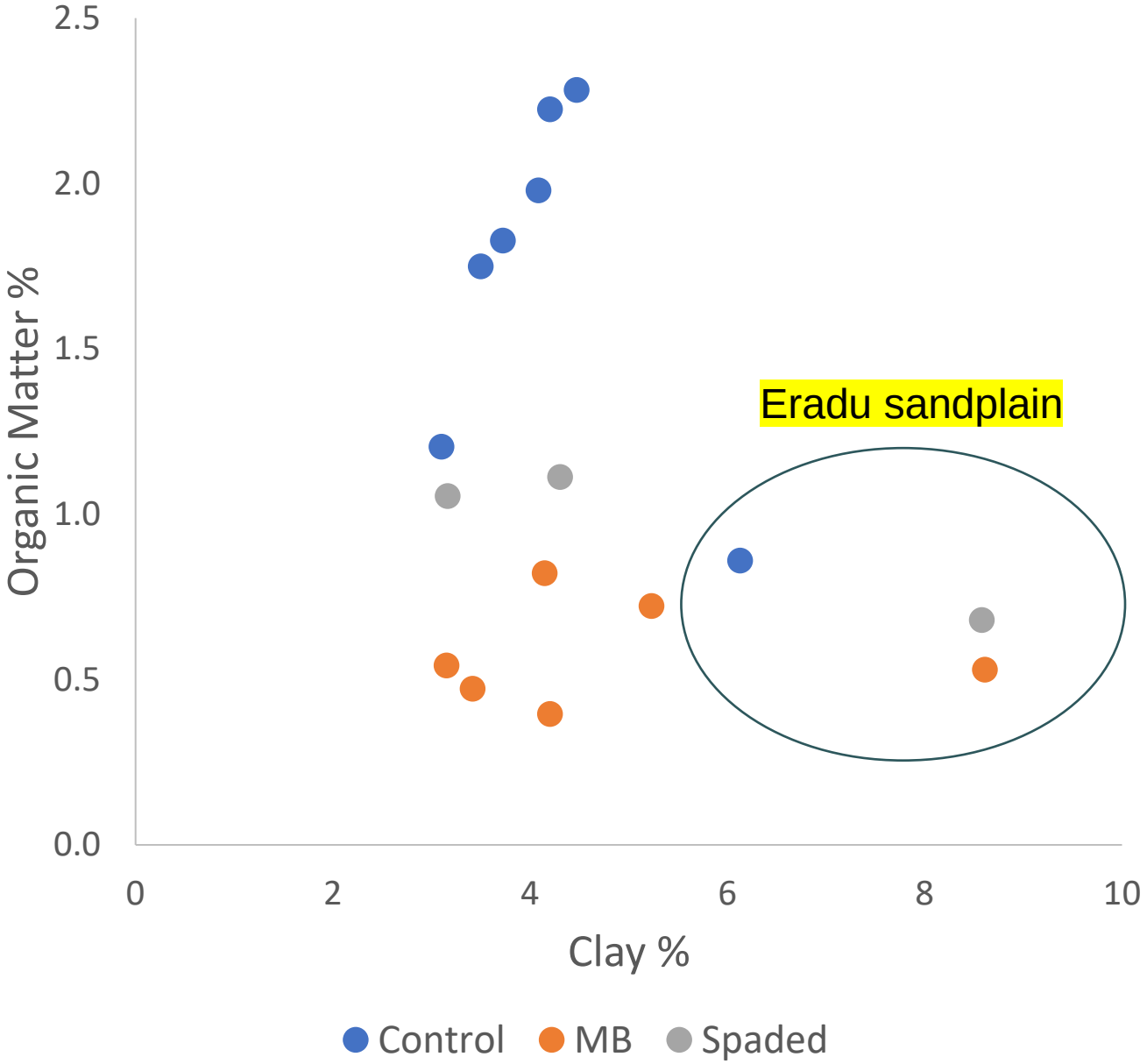
Soil changes from strategic deep tillage

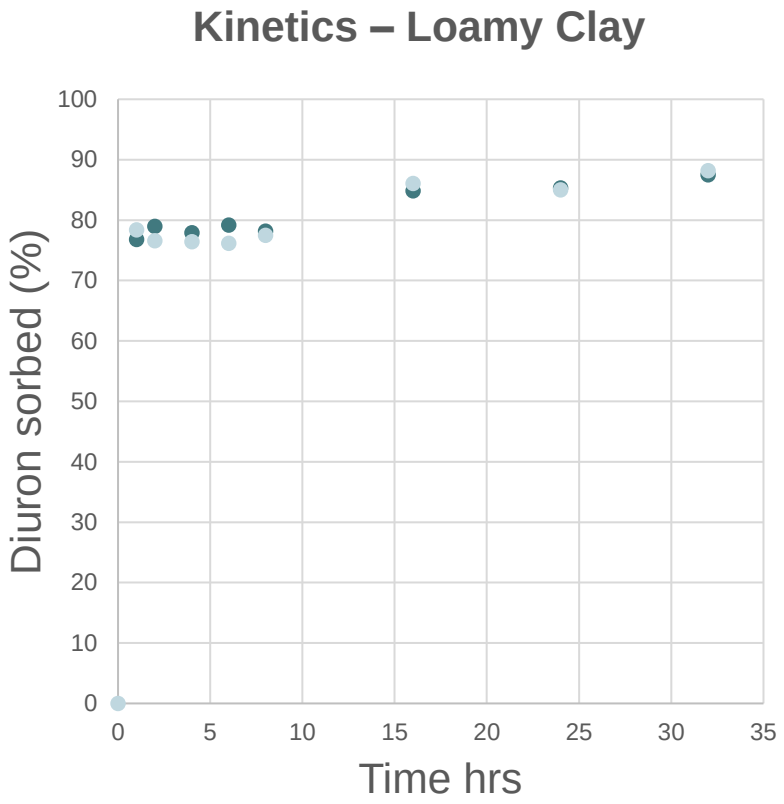


Site	Strategic deep tillage method	Percent Change		
		O.M	CEC	Clay %
TJM	Spaded	-53	-69	-25
TJM	Mouldboard	-76	-73	-25
E1	Mouldboard	-74	-84	-8
Spaded	Spaded	-44	-34	5
PrickleFarm	Mouldboard	-59	-74	49
Schutz	Mouldboard	-64	-76	-7
Corrigin	Mouldboard	-67	-82	35
Geraldton	Spaded	-21	-34	40
Geraldton	Mouldboard	-38	-56	40

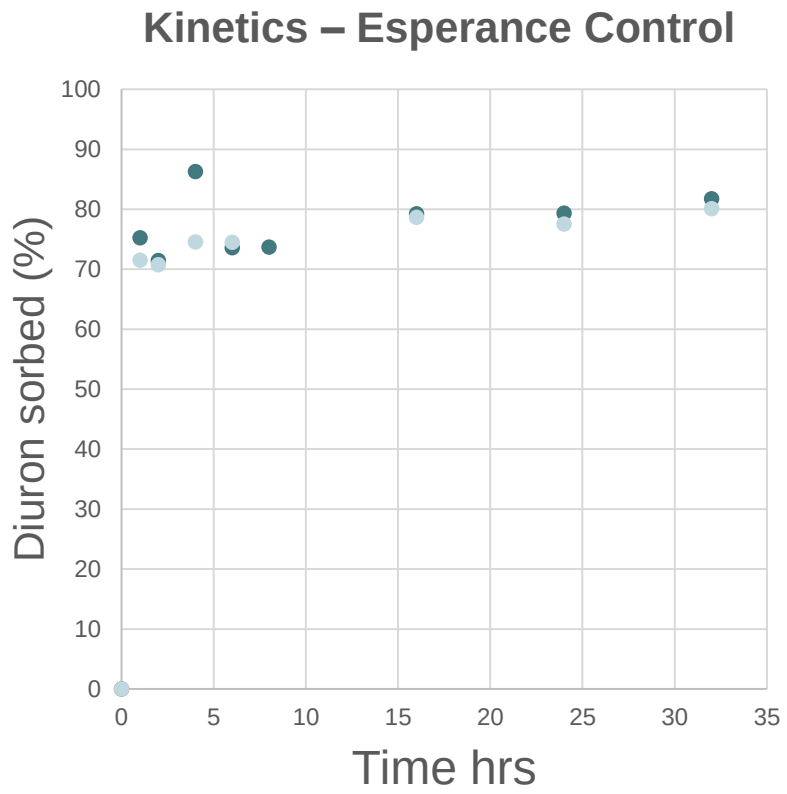
Big reductions in O.M, Clay % and CEC ↑ Risk

Soil – Diuron Kinetics

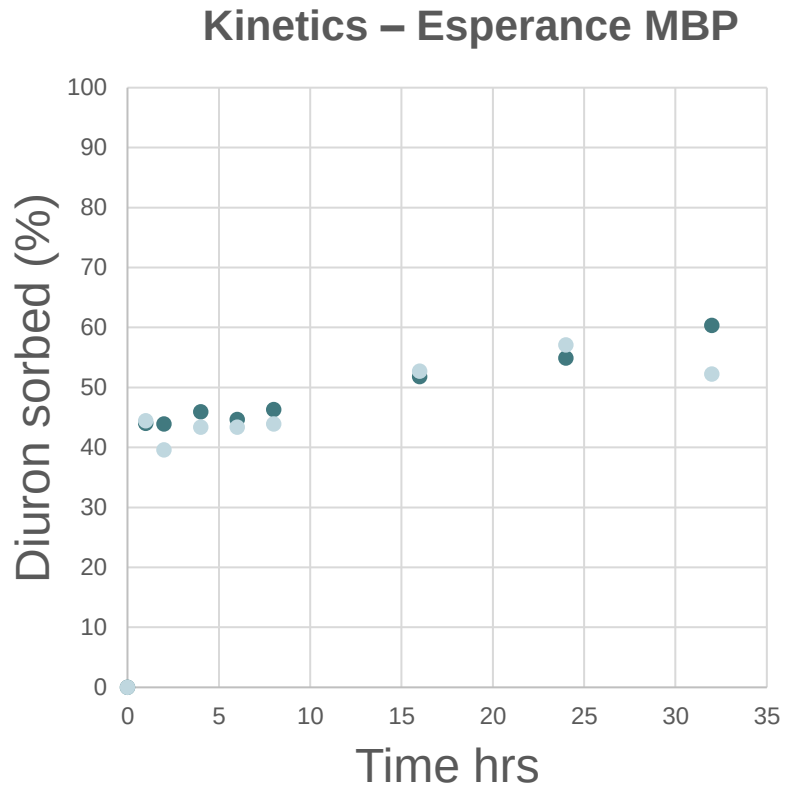
660ng a.i./g soil = 550 g a.i. of Diuron product top 5cm at BD 1.3



After 30 hours 12% of Diuron remains in solution,
11% Clay, **1.32%O.C**

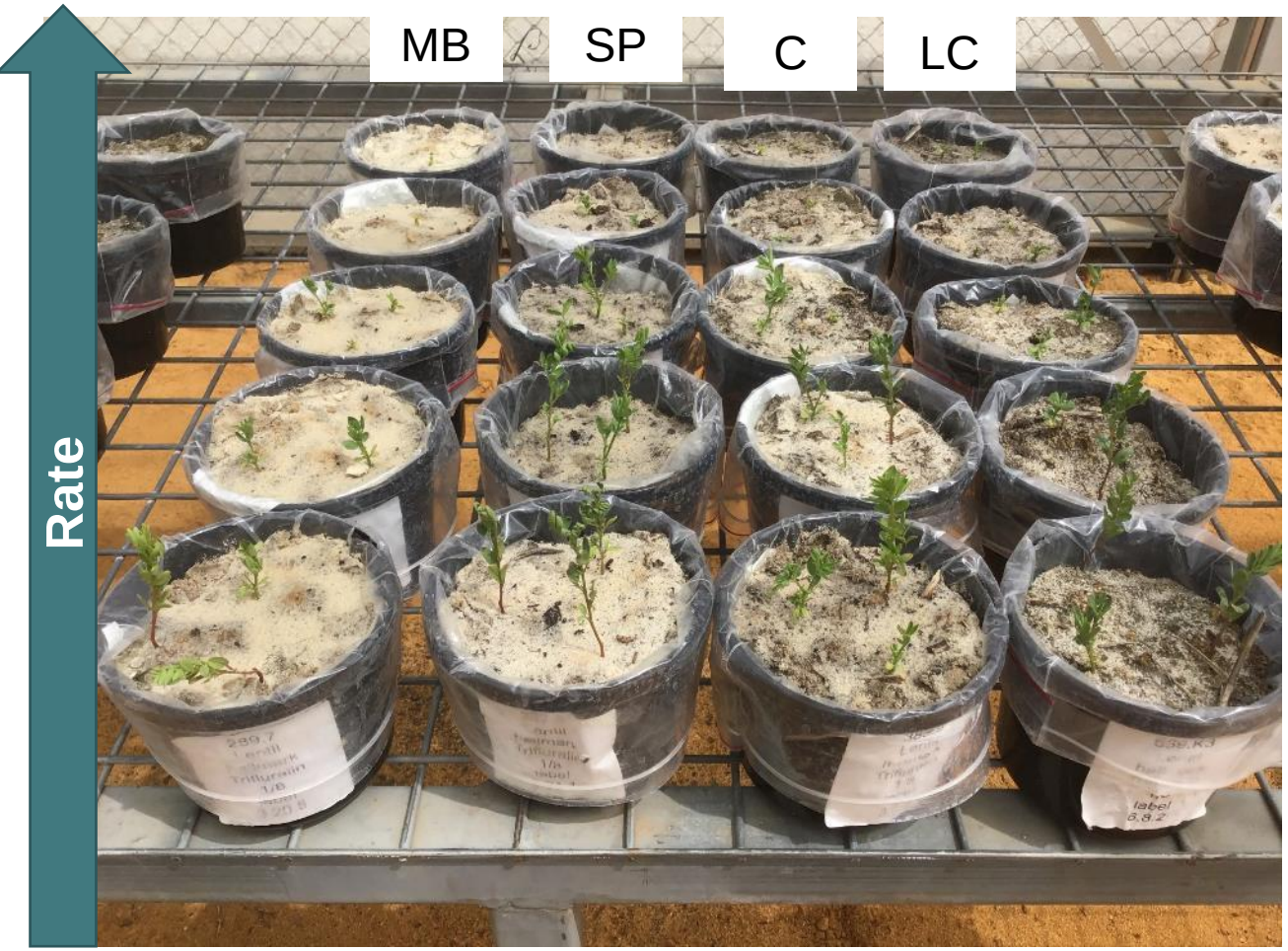


After 30 hours 20% of Diuron remains in solution
4% Clay, **0.96%O.C**



After 30 hours 40% of Diuron remains in solution
3% Clay, **0.27%O.C**

Deep tillage can increase herbicide toxicity



Screenhouse Bioassay
Intact cores from each soil treatment- Spray with a range of herbicide concentrations and sow a sensitive easy to measure species (Lentil cv Bolt)

Trifluralin applied at 5 rates to Lentils in soil cores from
MB – Mouldboard, SP – Spaded, C – Control, LC – Loamy clay

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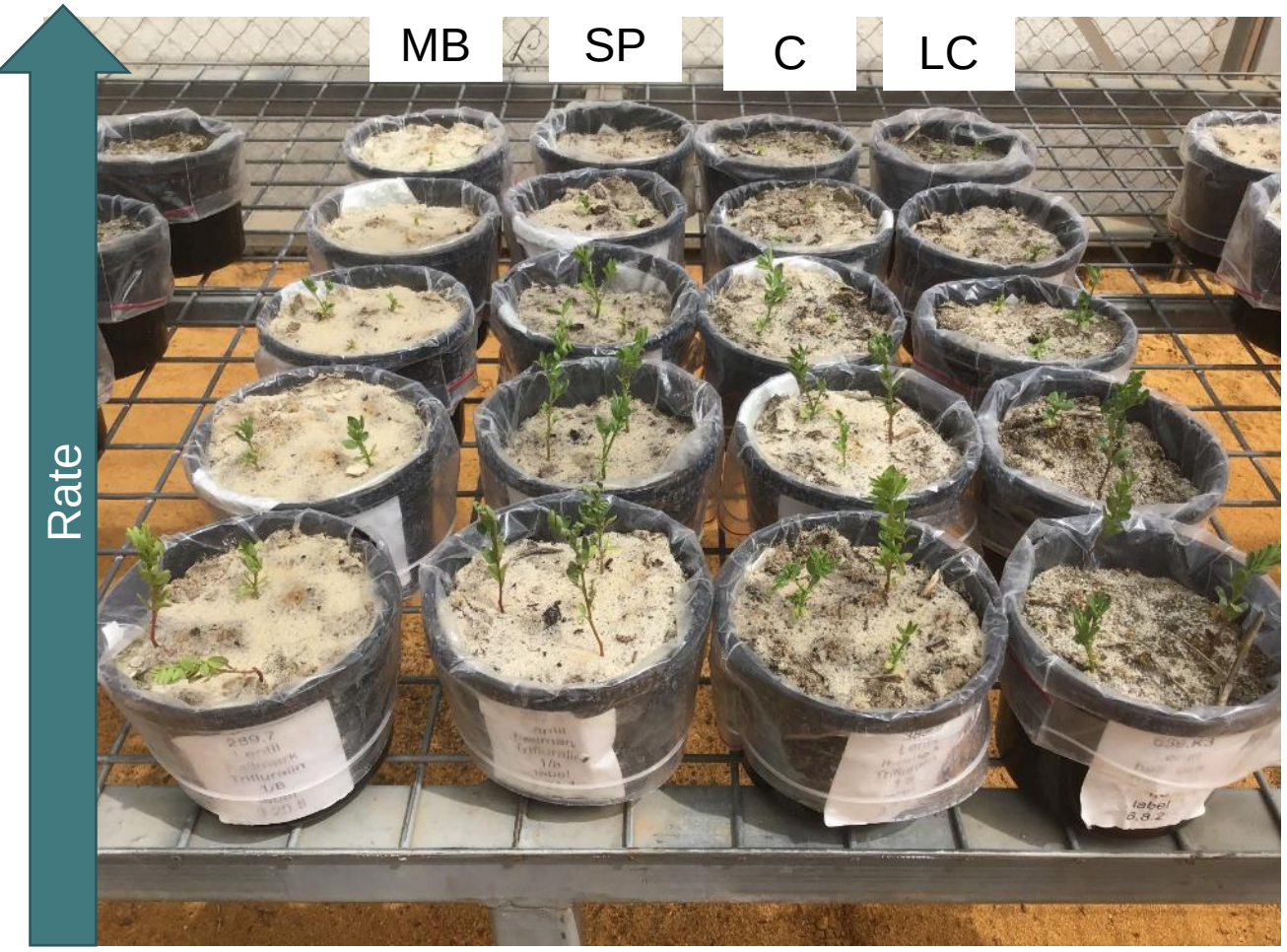

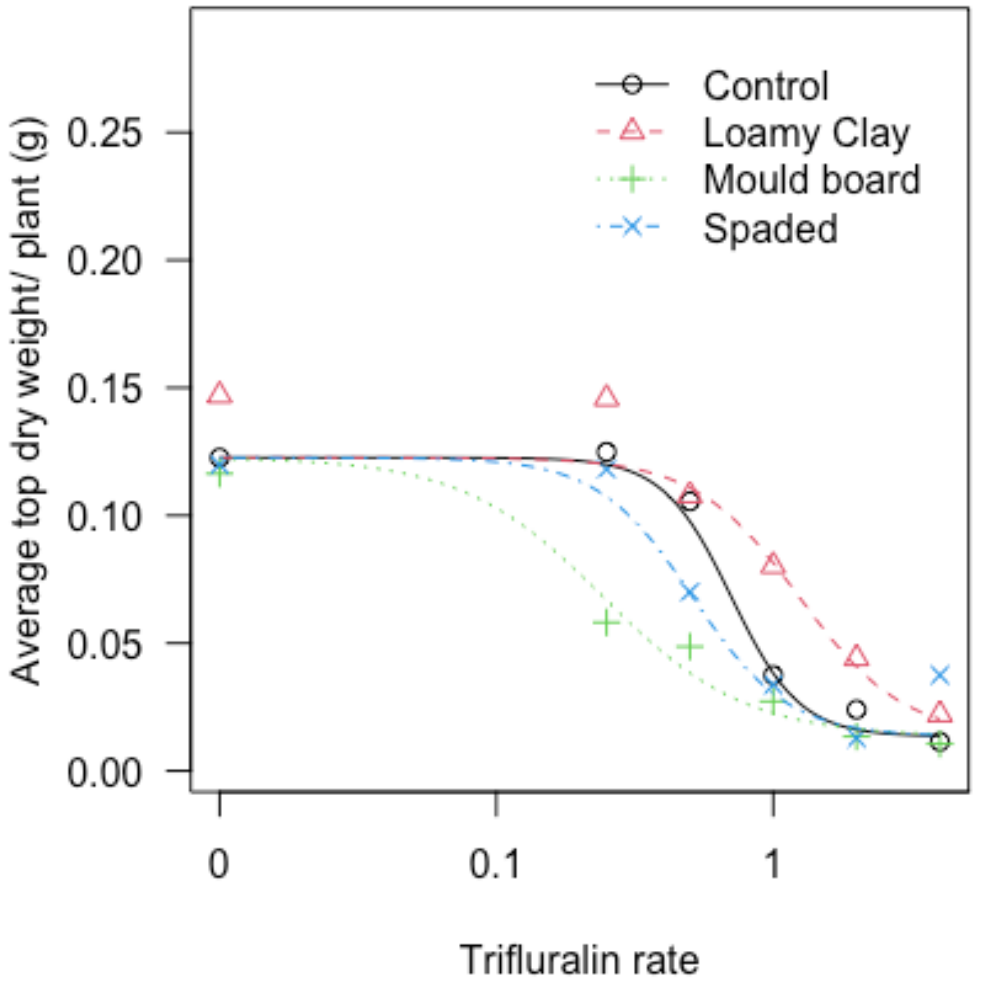

Trifluralin applied at 5 rates to Lentils in soil cores from MB- Mouldboard, SP- Spaded, C- Control, LC – Loamy clay

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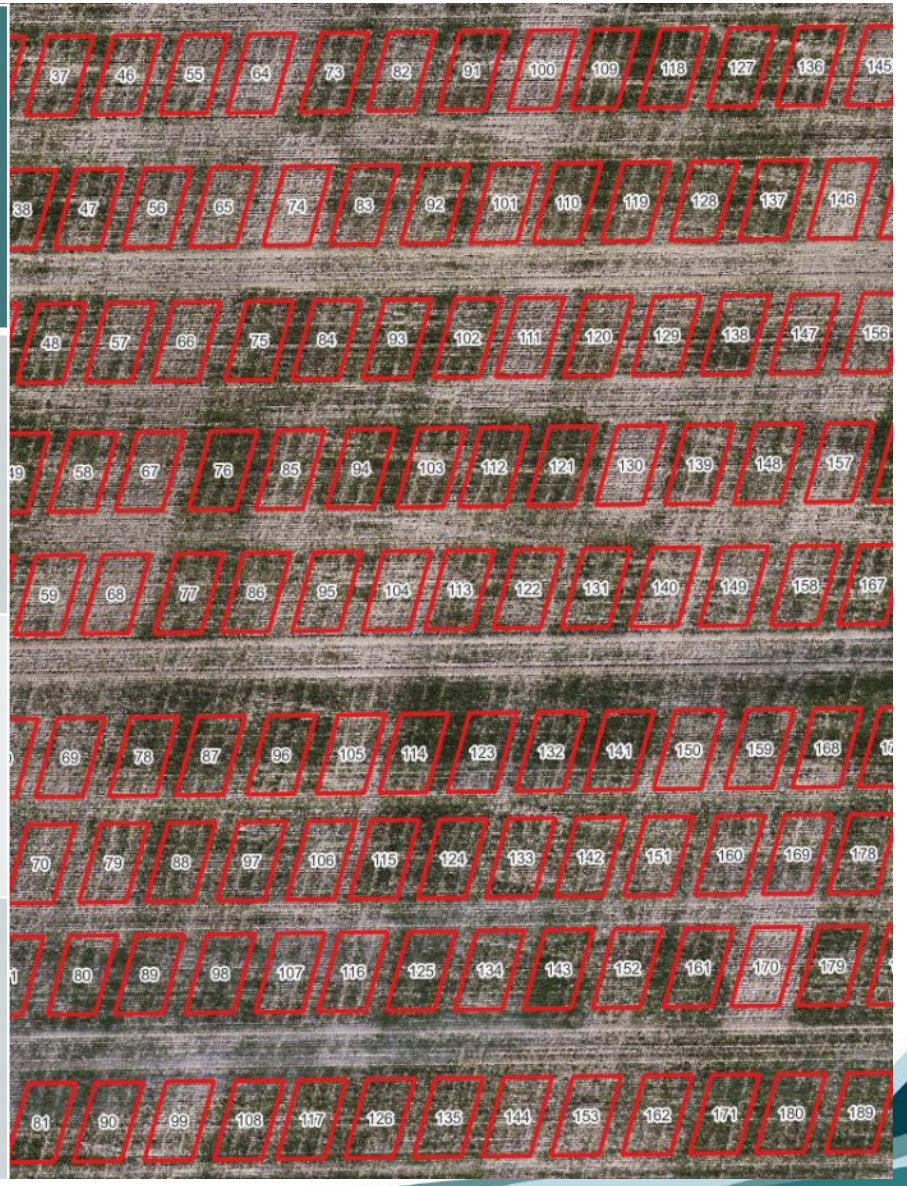
Field trials – impacted by environmental conditions

Crop	Number of trials	Growing seasons after amelioration	Significant soil change	Responsive environment
Wheat	7	1-4	80%	28%
Barley	3	1-4	100%	33%
Canola	3	1-4	66%	0%



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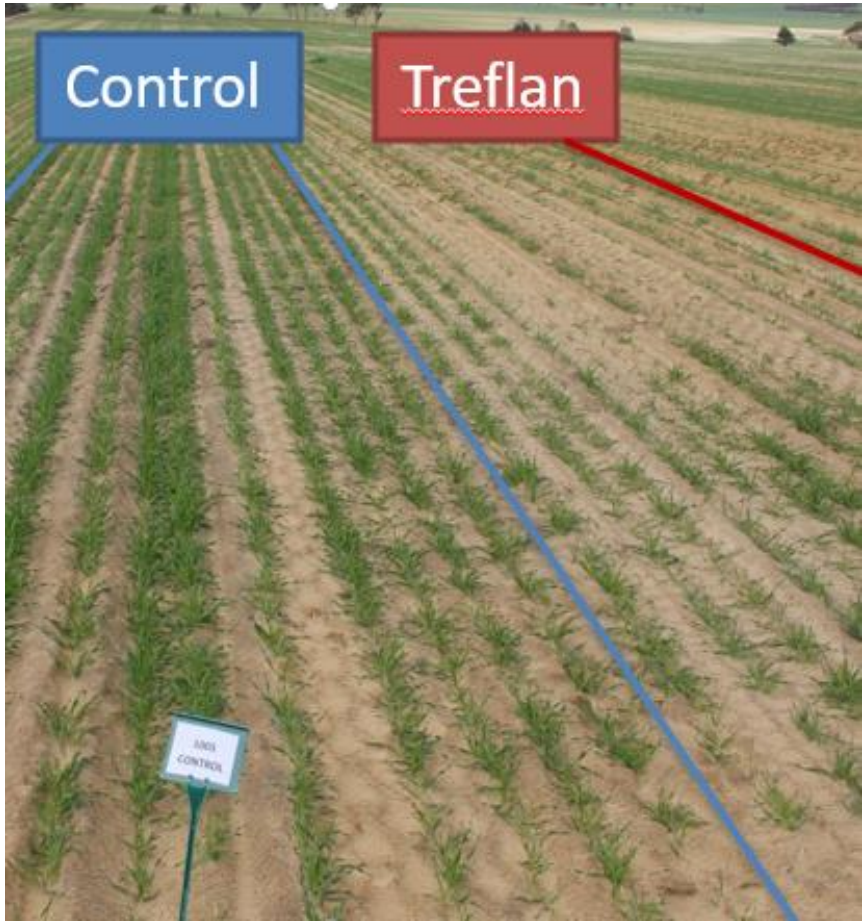
Poor Herbicide – seed separation

Risk is particularly high in the first season with no stubble and low soil bulk density

Furrow infill Overwatch damage after spading



Wind movement and shallow seeding increase trifluralin damage after MBP

Traffic and soil movement increase Boxer Gold damage after MBP

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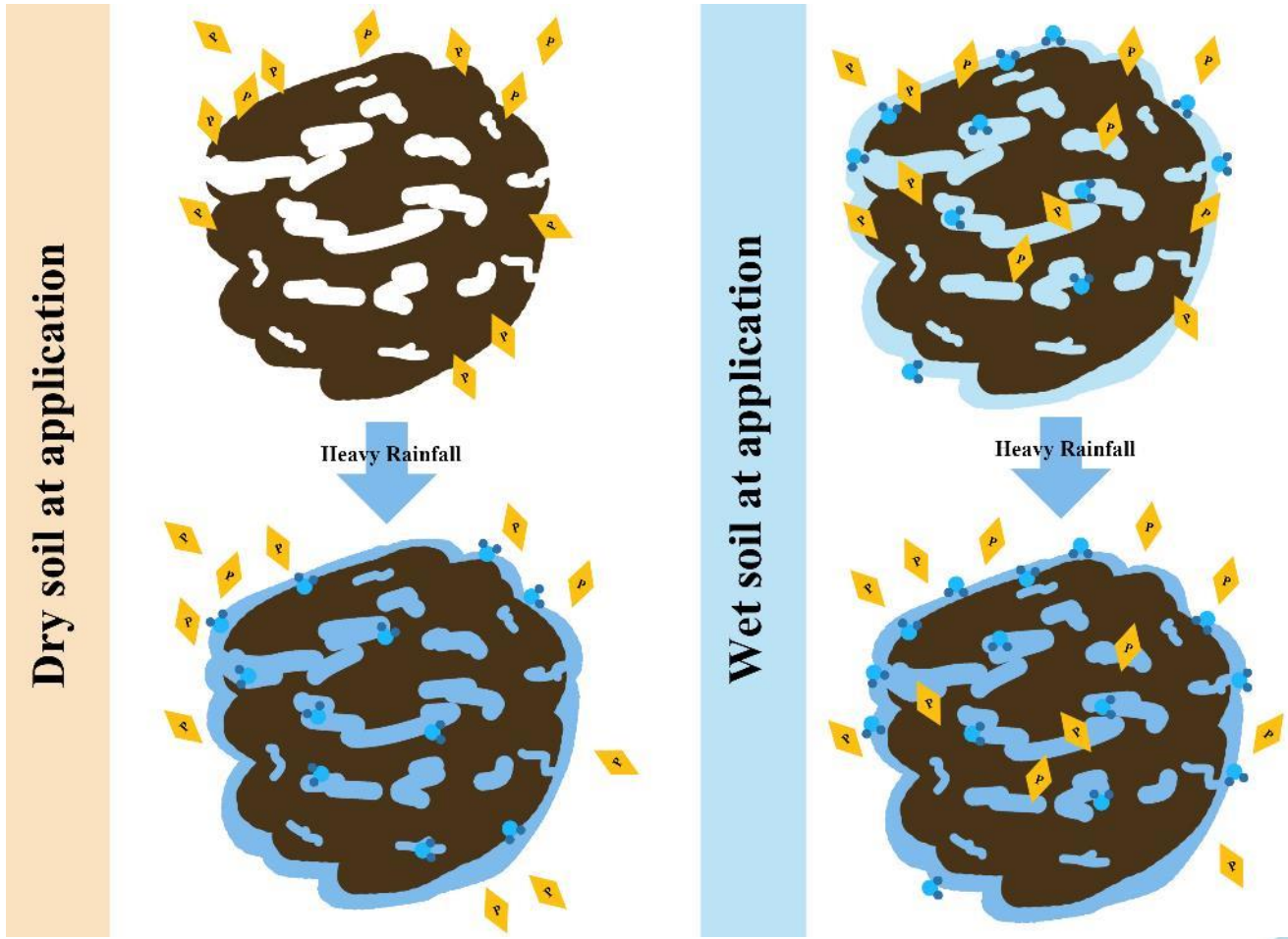
Environmental conditions

Environment Factor and Crop Damage	Corrigin 2017	Corrigin 2018
Rainfall 30 days pre-sowing	14mm	40mm
Large rainfall events post-sowing	19mm 2 days post	None
Annual rainfall	417mm	351mm
Herbicide damage	70% yield loss	15% yield loss

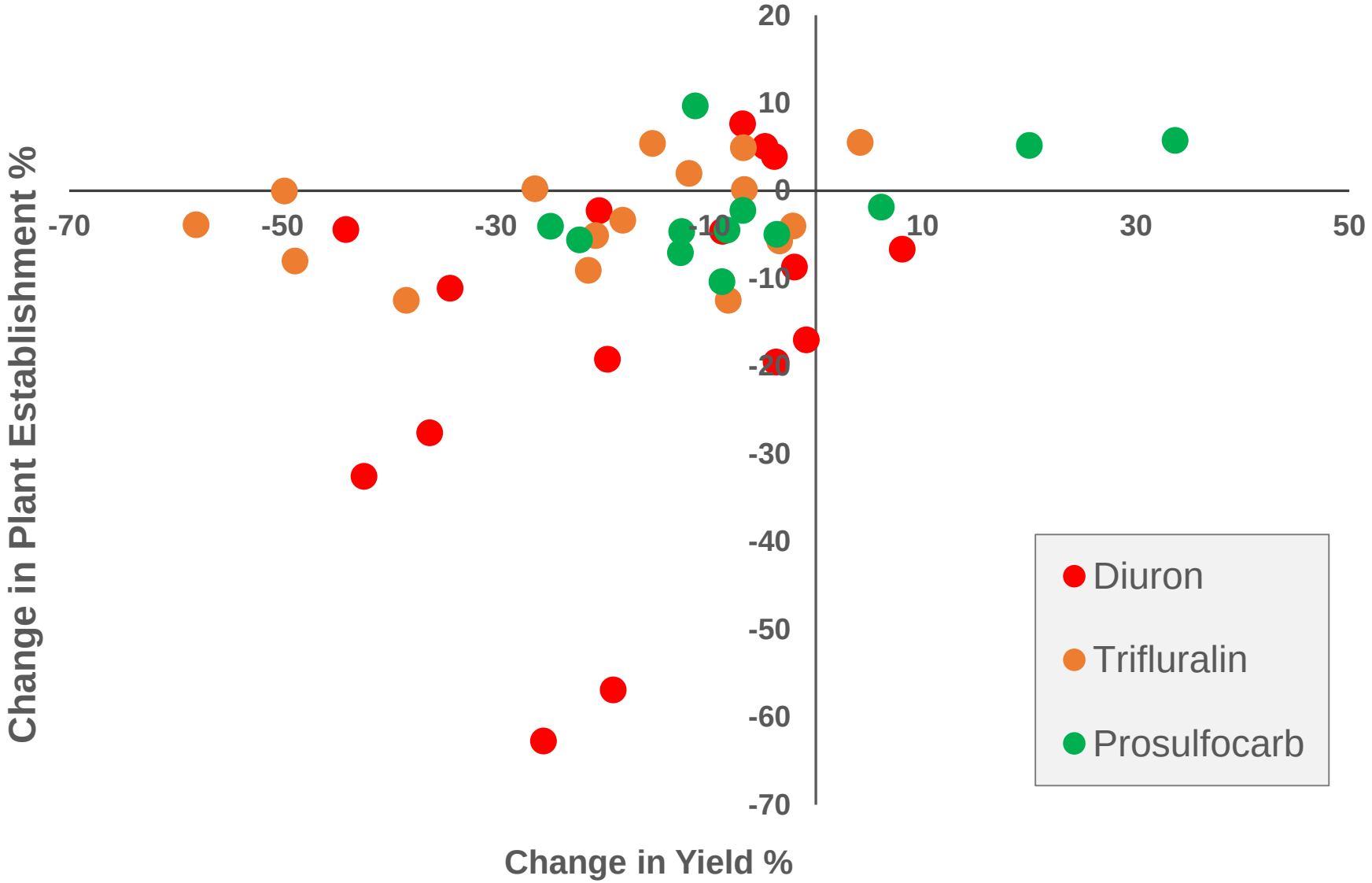
Dual phase sorption



* P=Pesticide

Herbicide selection

Percent change in wheat establishment and yield following inversion and deep mixing at Esperance and Geraldton, two seasons after amelioration



Herbicide Chemistry – consider herbicide characteristics

Trifluralin: Binds tightly to organic matter

Diuron: Significant binding to organic matter. Increased leaching and mobility in low clay and organic matter soils

Prosulfocarb: Slightly mobile, moderate binding to organic matter

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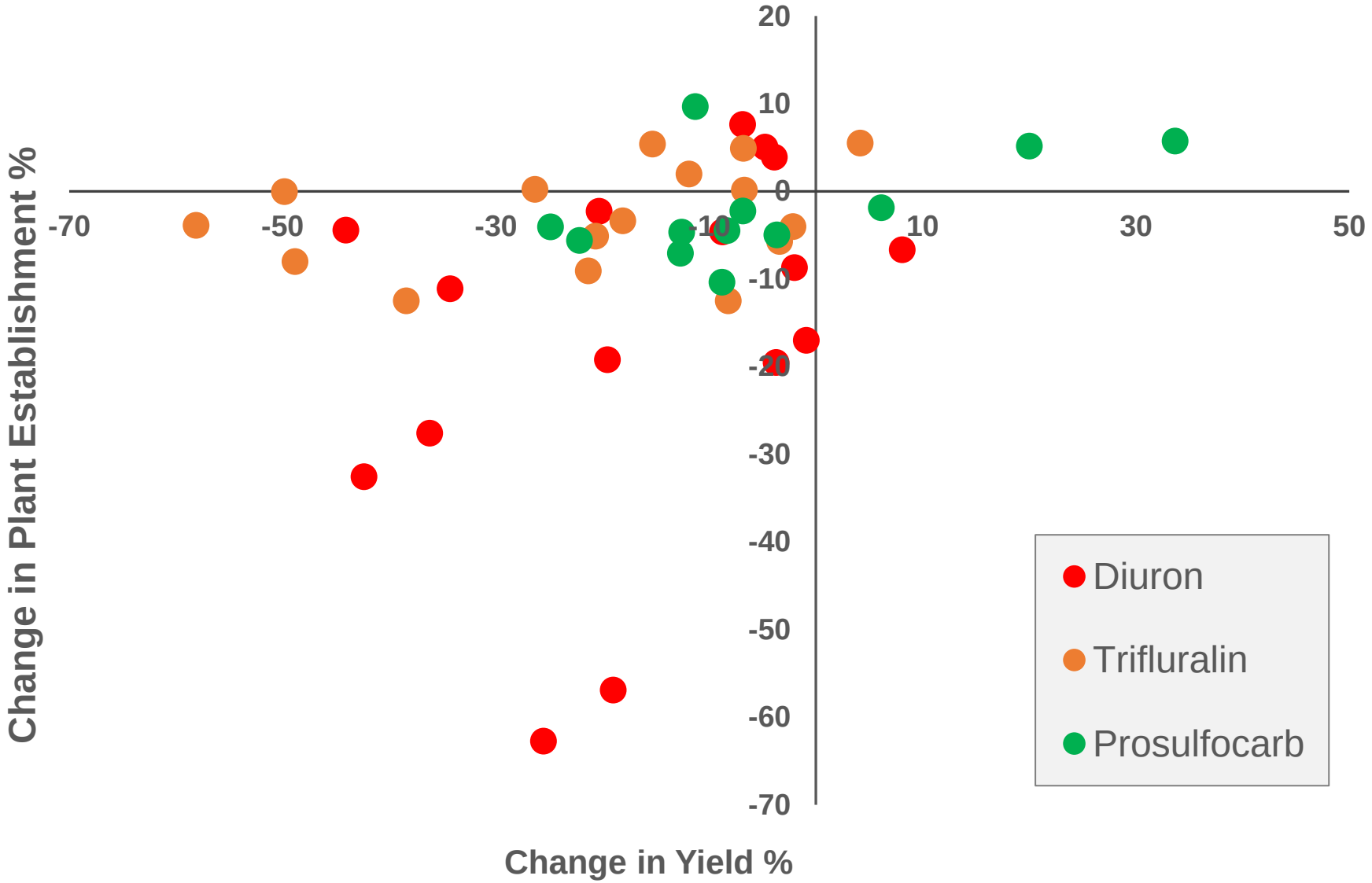

Herbicide Chemistry – consider herbicide characteristics

Do herbicides rely on physical separation from crop to ensure crop safety?

Is herbicide sorption particularly sensitive to change in soil surface composition (organic matter, clay%, pH or stubble)?

Effective rate for weed control vs safe rate for crop productivity

Herbicide strategy

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			Risk of herbicide damage		
			Low	**Medium**	**High**
			Not much change in Soil organic matter or clay content, some surface residue remains, good soil moisture conditions.	Moderate change in either soil organic matter or clay content, little surface residue remains, marginal soil moisture conditions.	Large change in either soil organic matter or clay content, no surface residue remains, poor soil moisture conditions.
Risk of weed pressure	**Low**	Low weed density and good weed burial likely.	Normal pre-emergent herbicide regime should be safe to use.	Carefully consider pre-emergent herbicide. Consider not using in first- year post-amelioration.	First year post amelioration consider using no pre-emergent and assess whether post-emergent is needed in year one.
	Medium	Moderate weed density or very good weed burial likely.	Normal pre-emergent herbicide regime should be safe to use.	Carefully consider pre-emergent herbicide. Consider post-emergent options.	If possible, use a robust post-emergent in year one and no pre-emergent.
	High	High weed density or good weed burial unlikely.	Normal pre-emergent herbicide regime should be safe to use.	Carefully consider pre-emergent herbicide. Consider post-emergent options.	Consider a combination of a chemical tolerant crop variety and post emergent herbicide to avoid using a pre-emergent.

Herbicide strategy – wheat example*

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			Risk of herbicide damage		
			Low	**Medium**	**High**
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Risk of weed pressure	**Low**	Low weed density and good weed burial likely	**Any recommended herbicide**	Pyroxasulfone Pyroxasulfone + Prosulfocarb	**Prosulfocarb Post** Trifluralin 1L+ Prosulfocarb
	Medium	Moderate weed density or v. good weed burial likely	Terrain + Triallate Overwatch +Callisto	Pyroxasulfone + Callisto Trifluralin 1L+ Triallate	Pyroxasulfone + Triallate Mateno post
	High	High weed density or good weed burial unlikely	Overwatch+ Voraxor Prosulfocarb + Jaguar post	Overwatch Mateno Post Pyroxasulfone + Callisto	**Imi tolerant variety** **Late winter amelioration and cover crop**

* Note: general advice based on a small number of research trials, individual results may vary.

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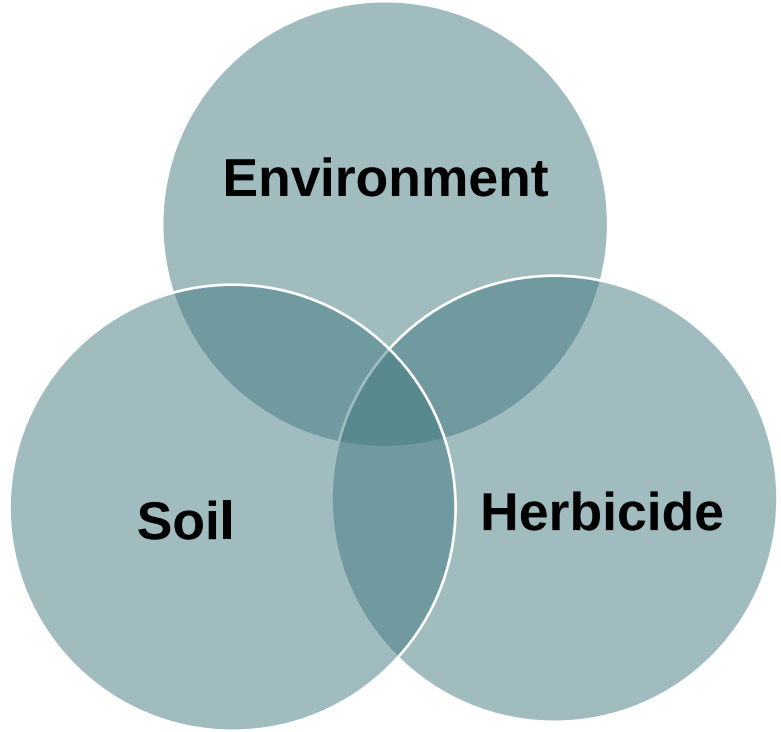

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Increasing farming system profitability and longevity of benefits following soil amelioration

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