



# First results with a new test design for the determination of a substance specific Plant Uptake Factor (PUF) for use in regulatory fate modeling

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## OBJECTIVES

- Propose a new standardized test design to derive Plant Uptake Factors (PUF) for regulatory leaching models
- Consider recommendations of stakeholders (EUregPUFWorkshop, York, UK, 2013)
- Check validity of the new study protocol in a ring test – Discuss results and next steps

## SUMMARY & OUTLOOK

- Test statistically evaluated: average plant uptake factor of 0.72 for 1,2,4-triazole in wheat with a CV of 23%
- Promising test protocol established: an experimentally simple, reproducible hydroponic (hp) uptake test
- Potential for artefacts reduced: root integrity by procedure + pre-phase ensured
- Clarifications to protocol by labs: decrease evaporation, climate variability; increase minimum water uptake (> 15%)
- Next steps: report to regulatory authorities, clarifications in a new version of the protocol, publication in prep.

## RESULTS, METHODS & MATERIALS

### Plant uptake

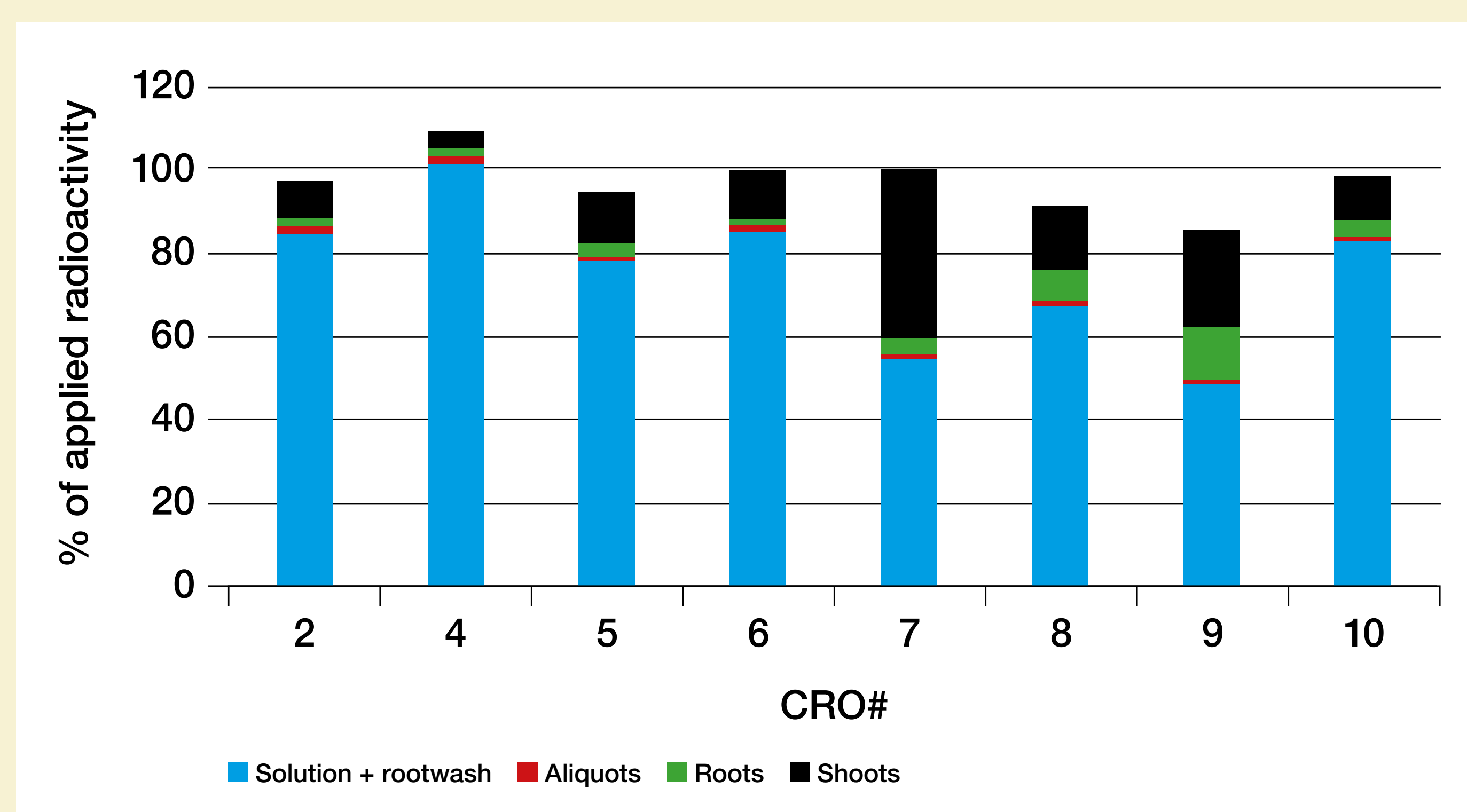


Figure 1: High fraction in shoots within 6 days

84% of the substance taken up is freely translocated from roots into shoots (Fig 1). Higher total substance uptake is correlated with lower PUF due to higher water uptake.

Table 1: Evaluation of 8 labs (with 6 d measuring period)

	min-max	mean	SD	CV (%)
Translocation shoots (%)	72 – 93	83.7	7.3	8.7
Radioactive recovery (%)	92.2 – 109	98.1	4.9	5.0
Biomassfactor	1.3 – 5.04	2.2	1.1	51.7
Water uptake by plant (%)	4.96 – 62.86	24.9	19.7	79.2
Evaporation (ml)	1.81 – 14.88	5.0	4.3	84.9
Plant weight (g)	1.6 – 7.84	4.7	2.2	46.4
PUF	0.48 – 0.94	0.72	0.2	23.1

### Round robin test on uptake experiment in a hydroponic system:

Test item: <sup>14</sup>C-labeled 1,2,4-triazole (log Kow: -0.58)

Crop: spring wheat (variety Tybalt), germination in perlite, pre-phase in hp system  
Brown glass test vessels were used to minimize algae growth and photo degradation;  
2 plants per vessel, 300 ml solution/vessel

BBCH 12: start of 2 d equilibration phase with substance

BBCH 13: start of 6 d uptake measuring period

### Model confirmation

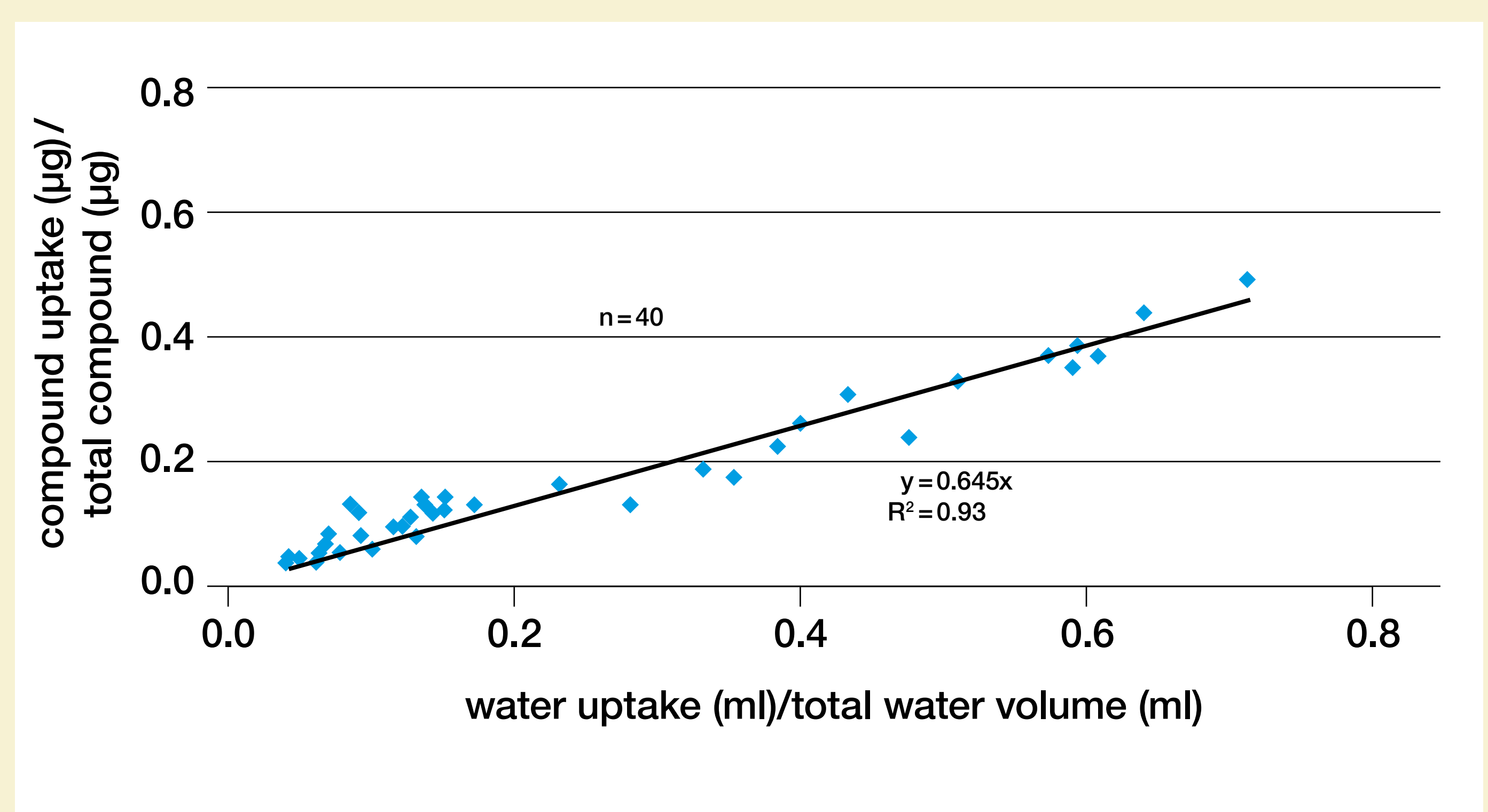


Figure 2: Correlation of normalized water uptake vs normalized compound uptake by the plant

The correlation of  $R^2 = 0.93$  demonstrates a significant relationship between the transpiration of the wheat plants and chemical uptake (Fig 2).

Evaluation round robin test: Plant Uptake Factor (PUF) of 0.72 with a CV of 23% in new test (Tab 1). Recovery of radioactivity 98% and good plant health until end of the experiment show suitability of new design & protocol.

### Ten laboratories have tested new study protocol:

Nominal test item concentration: 100 µg/L

50% Hoagland nutrient solution + MES Buffer (pH 6.5)

5 <sup>14</sup>C-treated replicates; 3 controls without test item;

1 stability control; 3 evaporation controls; 1 <sup>12</sup>C-treated rep.

Greenhouse conditions: Temperature 20–24 °C;

Humidity 25-75%; Light day/night 16h/8h

## ACKNOWLEDGEMENTS

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## REFERENCES

- Hingston, Klunder, Schriever 2013: EUregPUFWorkshop Report, York, UK.
- Sweeney, 2014, submitted: PUF formula