

How do cultivar mixtures perform under defined soil tillage regimes?

Adrian C. Newton, Paul D. Hallett, A. Glyn Bengough, Kirsty Binnie, Dennis C. Gordon, David C. Guy, Blair M. McKenzie and Tracy A. Valentine

Scottish Crop Research Institute, Invergowrie, Dundee, DD2 5DA, UK.
Correspondence: Paul.Hallett@scri.ac.uk



Background

- Modern tillage and farming systems use lower input.
- Many modern crop cultivars are bred for high input systems and grown as monocultures.
- Plant genetic traits that allow crops to perform well under minimum/zero tillage need to be identified to assist with developing new varieties.
- Genetic diversity of mixed cultivars grown together may decrease the impact of disease and maintain yield and quality despite variable climatic and soil conditions.

Field Experiment

Five tillage systems employed to manipulate the soil physical environment:

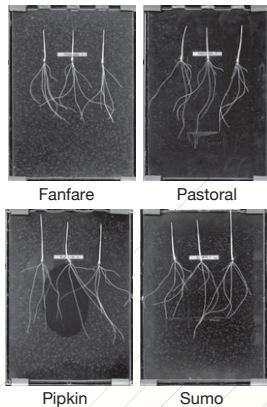
- zero-tillage;
- minimum tillage;
- conventional ploughing to 20 cm;
- conventional ploughing to 20 cm and compaction by wheeling of the entire plot; and
- deep ploughing to 40 cm depth.

Experiment commenced in autumn 2003 and is on-going.

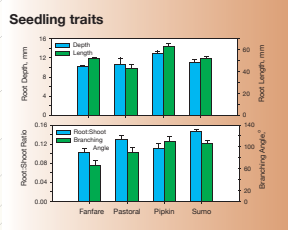


Selecting Mixtures

- A screen of winter barley cultivars selected four varieties with contrasting root traits and pathogen resistance.
- National List attributes identified cultivars for further screening in the laboratory.
- Root gel chambers allowed root branching angle, length and depth to be measured on 10 day old seedlings.



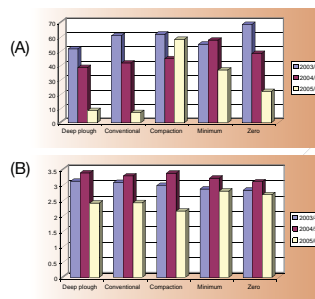
- Seedling roots varied significantly in length^{***}, angle^{**} and root:shoot ratio^{**} between cultivars.



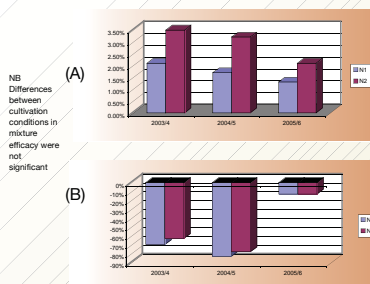
*** $P < 0.001$; ** $P < 0.01$

Trial Results

Effect of cultivation on Area Under the Disease Progress Curve (AUDPC) (A) and yield (B).

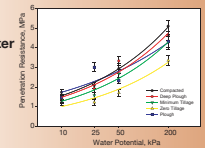


Effect of mixtures compared with the mean of their monoculture components on AUDPC (A) and yield (B) at two fertiliser levels.

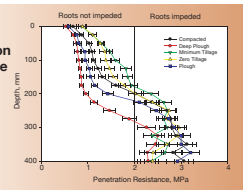


Soil Physical Properties

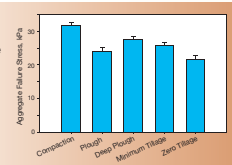
Mini-penetrometer at Different Water Potentials



Field Penetration Resistance



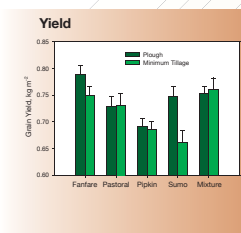
Soil Aggregate Strength



- Lower input soil tillage = greater mechanical impedance in first 2 years of study.
- Aggregate strength influenced by tillage.

Cultivars and Mixtures

- Grain yield affected significantly by tillage and cultivar.^{***}
- Mixtures outperformed average yield of all monocultures.^{**}
- Note – data collected in first year of experiment.



Conclusions

- Impact of tillage on crop performance is cultivar dependent.
- Mixtures maintain or improve yield and may reduce the impact of variable climatic or soil conditions.
- Data will be collected over several seasons to investigate temporal shifts as soil and climatic conditions change.
- Genetic traits beneficial for crop performance in low input tillage will be studied using root mutants from SCRI's barley mapping population.

Acknowledgements

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