Do mixed cultivars outperform monocultures under defined soil tillage regimes?

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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

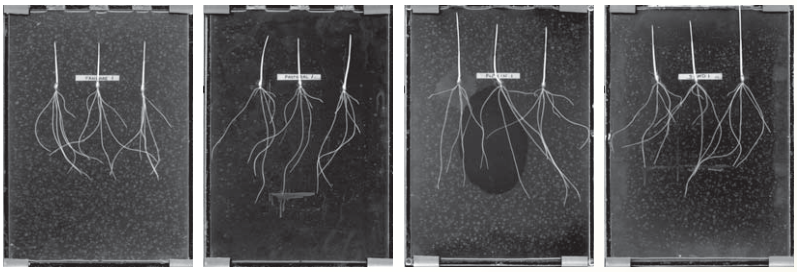
Five tillage systems employed to manipulate the soil physical environment:

(1) zero-tillage;
(2) minimum tillage;
(3) conventional ploughing to 20 cm;
(4) conventional ploughing to 20 cm and compaction by wheeling of the entire plot; and
(5) 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.

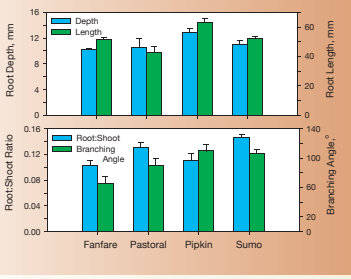


Fanfare Pastoral Pipkin Sumo

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

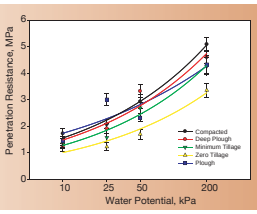
***P*<0.001; **P*<0.01

Seedling traits

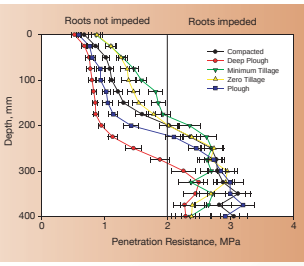


Soil Physical Properties

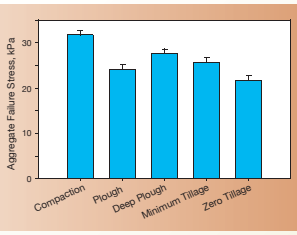
Mini-penetrometer at Different Water Potentials



Field Penetration Resistance



Soil Aggregate Strength

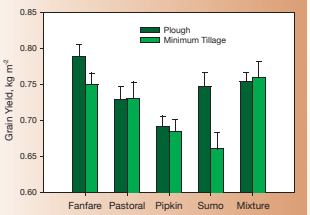


- Lower input soil tillage = greater mechanical impedence in first 2 years of study.
- Aggregate strength influenced by tillage.

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

Yield



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

The Scottish Crop Research Institute is grant-aided by the Scottish Executive Environment and Rural Affairs Department. SCRI farm staff are thanked for establishing and maintaining the field experiment.

http://www.scri.ac.uk/posters/posters/Hallett_Mixtures_Tillage.pdf