Nitrogen and Phosphorus Fertiliser Use Efficiency in Grassland Systems.

Ian Fox1, Catherine Watson2,3, John Bailey2, David Wall1
1Teagasc, Johnstown Castle, 2Queens University Belfast, 3Agri-Food and Biosciences Institute
ian.fox@teagasc.ie [www.teagasc.ie/agcatchments/ianfox]

AIM
To quantify nitrogen and phosphorus fertiliser use efficiency in grassland systems across a number of simulated grassland trial sites within the Agricultural Catchments Programme.

INTRODUCTION
Fertilisers are the single biggest input to grassland farms in Ireland. However, nutrient application rates and nutrient use efficiency vary widely across soil types and production intensities.

Increased nutrient efficiency can decrease losses to aquatic environments and reduce greenhouse gas emissions whilst increasing herbage production and profitability at farm level.

OBJECTIVES
 To quantify temporal grass DM yield responses to nitrogen (N) & phosphorus (P) fertilisers at multiple sites across different climatic zones.
 To evaluate soil nutrient efficiency across different soil types at field level.
 To validate recent soil research findings for N and P fertilisers at field scale.

MATERIALS AND METHODS
Experimental Field Sites
4 grassland trial sites located in ACP catchments were established in 2014 (5th est. 2015)
 Arable A - Castledockrell, Co. Wexford
 Arable B - Dunleer, Co Louth
 Grassland A - Timoleague, Co. Cork
 Grassland B - Ballycanew, Co. Wexford (est. 2015)
 Grassland D - Cregduff, Co. Mayo

Experimental Design
28 plots in total laid out in a randomised block design
 7 treatments – 3 Nitrogen
 – 3 Phosphorus
 – 1 Control

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<th>Fertiliser Applications applied monthly from March to October</th>
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<td>N (kg/ha)</td>
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<td>P (kg/ha)</td>
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Experimental Measurements
 Monthly grass DM Yield
 Herbage nutrient concentration (nutrient off-take)
 Residual soil mineral N concentrations
 Soil nutrient status

RESULTS

 Cumulative herbage dry matter yields (DMY) responses range from 7.54 tons ha⁻¹ in Arable A to 26.4 tons ha⁻¹ in Arable B for high N applications while DMY responses range from P1 (7.54 tons ha⁻¹) in Arable A to P2 (25.04 tons ha⁻¹) in Arable B.

 Arable A (well drained soil) produced significantly less DMY across all treatments when compared to all other sites.

 Arable B (poor – moderately drained) produced the greatest DMY across all treatments when compared to all other sites.

 N balance (N input – herbage N offtake) shows Arable A to have the poorest N balance at 300kgNha⁻¹ for high N applications and Arable B to have the greatest N mining potential (>300kgNha⁻¹) where zero N treatment plots.

 P balance (P input – herbage P offtake) shows Arable B with the greatest P mining potential (>40kgPha⁻¹).

 Arable A demonstrated the poorest return for N inputs while Grassland A showed a zero P balance at 60kgPha⁻¹.

CONCLUSIONS
Herbage DM yield responses to N fertiliser applications were linear up to 300kgN ha yr⁻¹ for all sites.

Trend for plant available phosphorus levels to become increasingly available where pH is optimum (results not shown).

Positive yield responses to P fertiliser are possible on high soil test phosphorus sites.

Soil fertility (e.g. organic matter and soil pH) and weather conditions can have an overriding effect on chemical nutrient efficiency and herbage production.

FUTURE WORK
 Final year of data collection from 4 experimental sites (2016)
 Additional soil P extraction methods e.g. Mehlich
 Climatic data analysis
 Mineral N data analysis
 Dissemination of findings to catchment farmers and beyond

These sites are focus points for ACP farmer discussion groups.

This project is funded by the Walsh Fellowship Programme