Spatial distribution of phosphorus in the Hill Field, UCD Research Farm

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Introduction

Irish soils, with few exceptions, are thought to be of similar age, dating back to the end of the last ice-age some 10,000 years ago. In a site of uniform age and parent material the spatial distribution of native soil P should reflect hydrological and mass transport mechanisms. Where soil P enrichment from additions of manure and fertiliser has taken place the spatial distribution may reflect the same transport mechanisms. The work reported here was undertaken to establish the spatial distribution of P in a fertiliser and manure enriched field with sloping topography over an elevation range of approximately 6 metres on the UCD Research Farm at Newcastle, Co Dublin.

Materials and Methods

The Hill Field at the Research Farm is roughly square in shape, occupies an area of approximately 4.5 ha and ranges in elevation from 70 to 76 m O.D.. The field was surveyed using standard GPS techniques and the captured data processed cartographically by AutoCAD 14. Topsoil (0 – 10 cm) samples for chemical analysis were drawn using a Dutch Auger at the intersections of a 15 x 15 m grid over the field during October/November 2003. In addition to the topsoil samples so drawn, subsoil samples were taken at two depths, 30 – 40 cm and 70 – 80 cm, at 50% (every other) of the 15 x 15 m grid intersections. Total soil P was measured in nitric-perchloric acid digests of duplicate 0.2g fine earth samples ground to pass a 70µ sieve. P in the digests was measured by inductively coupled plasma optical emission spectrometry (ICPOES).

Results and Discussion

With the exception of a Gley in the north-eastern sector below the 72m contour, the soil of the Hill Field is a Brown Earth/Minimal Grey Brown Podzolic (Lalor, 2004). The vegetation is ryegrass dominant ley-pasture that is cut annually for silage. The field has a history of pig and cattle slurry application stretching back some 40 years.

The nitric-perchloric digestion procedure for total P gave values for standard soils (Canmet) within 95% of those quoted. The mean total P values of 1089 mg P/kg for the 0 – 10 cm depth (Table 1) are typical of well managed and maintained agricultural soils. Soil P declined with depth as evidenced by mean total P values of 641 mg P/kg at 30 – 40 cm and 553 mg P/kg at 70 – 80 cm depth. All these values were calculated after the removal of outliers using the Grubb test (Grubb and Beck 1972).

Table 1. Total Soil P (mg/kg)

Soil Depth	n	Max	Min	Mean	sd
	All samples				
0-10 cm	203	1401	797	1089	106
30-40 cm	97	1126	349	641	144
70-80 cm	97	4444	234	609	428
	Outliers removed (Grubb Test)				
0-10 cm	203	1401	797	1089	106
30-40 cm	96	996	349	636	136
70-80 cm	95	1052	234	562	161

The spacial distribution of P at the 3 sampling depths in the Hill Field is depicted in Fig 1. It shows localised areas of P enrichment at each sampling depth but no consistent correspondence between them.

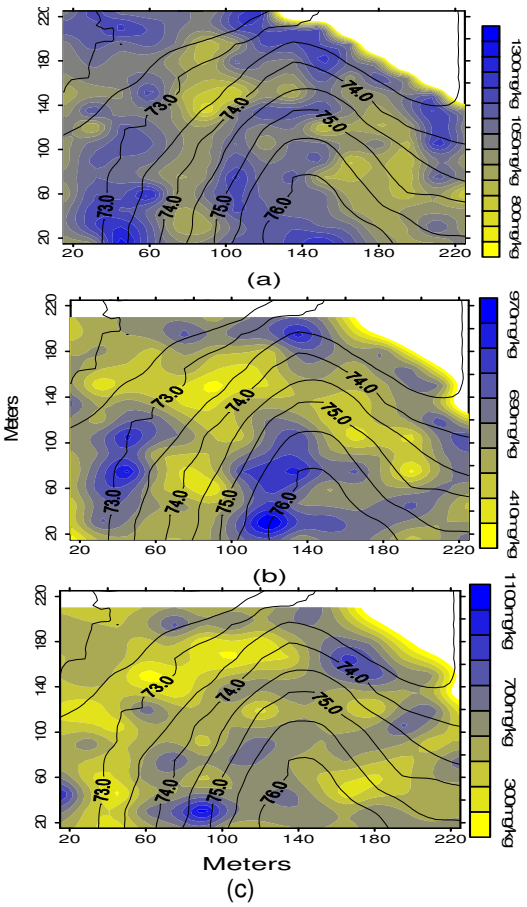

Figure 1 Distribution of total P in the Hill Field. (a) 0-10 cm; (b) 30-40 cm; (c) 70-80 cm depth

Conclusions

The localised areas of P enrichment in the Hill Field appear to be randomly distributed rather than associated with slope position or topography.

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References

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