Rostock long-term field experiment (Germany)

The experiment was established at the experimental station of Rostock University in autumn 1998 to study the effects of different P fertilizer practices. It is located in northeast Germany in a maritime influenced area 15 km from the Baltic Sea shore. The average annual temperature is 8.1°C, the average annual rainfall amounts to 600 mm. The soil texture is a loamy sand (Haplic Luvisol according to the FAO nomenclature), and the initial plant available P content (double-lactate P, Pdl) was 42 mg per kg soil (indicated a suboptimal P supply according to the German soil-P classification). The Ptotal content in soil was about 490 mg per kg. The soil pH is about 5.6

The characteristics of the experiments are:

- Split plot design, whereas organic fertilization constitutes the main plots (applied every third year), mineral P fertilization constitutes the sub plots (applied every year), and management practice constitutes the sub-sub plots, four replicates of all plots
- Three levels of organic fertilizers: I) without, II) cattle manure, III) biowaste compost), three levels of inorganic fertilizers: I) without, II) TripleSuperP (TSP) autumn application, III) TSP spring application (until 2006) and biomass ash (since 2007) = resulting in nine fertilizer treatments = nine sub-plots per replication (36 sub-plots in total)
- The amount of P applied with the organic and inorganic fertilizers were similar. Accordingly, the plots with combined P application received the double P amount (see table 1)
- Sub-plot size (combination of organic and inorganic fertilizer application) is 24 x 5 m
- The sub-plots were maintained accurately in size since the beginning of the experiment
- The sub-plots are currently divided into four sub-sub plots to establish the third factor (cropping systems) (in total 144 plots)

<u>The following data is available for all year since 1998:</u>

- Plant: Plant yield and nutrient uptake
- Soil: Pwater, Pdl, Pox, Feox, Alox, PSC (P sorption capacity) and DPS (degree of P saturation), pH, Corg, Mg-DL, K-DL at 30 cm depth twice per year in spring and autumn

<u>The following data is available for selected years since 1998:</u>

- Plant: Phenological and morphological data, colonization of plant roots with mycorrhiza fungi
- Soil: activity of acid and alkaline phosphatases and dehydrogenase (in different soil depths), Cmic, Pmic, organic and inorganic P fractions, distribution of P fractions in soil profile (30, 60, and 90 cm),

Table 1: Fertilizer treatments (org fertilizers x inorg fertilizers) and cumulative P amounts applied from 1998 to 2019 (after crop harvest – before application of autumn fertilizers) (P, kg per ha)

treatment	P supply	Removal	Balance
Control	0	477	-477
TSP	499	531	-32
TSP/ash*	397	500	-103
cattle manure (CM)	460	530	-70
CM+TSP	959	531	428
CM+TSP/Ash	857	549	308
compost (Com)	460	532	-72
Com+TSP	959	561	398
Com+TSP/ash	857	577	280

* in this treatment TSP (spring application) was applied until 2006, biomass ash was applied from 2007 on.

Soil sampling was/is done twice per year (in spring at beginning of vegetation time and after crop harvest)
Plant sampling was/is done according to the cropping system (usually once per year at harvest).

All samples from the beginning of the experiment until now are stored (dried soil and plant samples, selected soil samples are frozen at -20°C)

The plots of this experiment were cropped as follows:

1999: spring oilseed rape (*Brassica napus*)
2000: spring wheat (*Triticum aestivum*)
2001: spring barley (*Hordeum vulgare* L.)
2002: spring oilseed rape
2003: winter wheat
2004: winter barley
2005: winter oilseed rape
2006 to 2009: maize (*Zea mays*)
2009: green winter rye (*Secale cereale*) (as green manure) followed by sorghum (*Sorghum bicolor*)
2010: sorghum
2011: sunflower (*Helianthus annuus*)
2012: winter rye

Since 2013 four different crop treatments (sub-sub plots) were established:

2013 to 2015: sole and mixed cropping in four crop treatments: maize, maize + phaseolus bean (*Phaseolus coccineus*), sorghum, sorghum + Andean lupin (*Lupinus mutabilis*),
2016 and 2017: maize, maize + phaseolus bean, potato, spring barley
2018/2019: winter wheat, winter barley combined with catch crops (Serradella (*Ornithopus sativus*), Phacelia (*Phacelia tanacetifolia*))
2019: spring barley.
2020: maize, potatoes, red clover (*Trifolium pretense*), alfalfa (*Medicago sativa*)

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