



Tropentag, September 20-22, 2017, Bonn

“Future Agriculture:  
Socio-ecological transitions and bio-cultural shifts”

## Synchronising Legume Residue Nutrient Release with Kale (*Brassica oleracea* var. *acephala*) Uptake in a Nitisol of Kabete, Kenya

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### Abstract

In order to optimise the benefits of plant residue on soil quality improvement, it is critical to synchronise release of nutrients from residue decomposition with plant nutrient uptake. We assessed nutrient release rates of chickpea (*Cicer arietinum*) and white lupin (*Lupinus albus*) residues, and kale (*Brassica oleracea* var. *acephala*) nutrient uptake in a nitisol with the aim of improving synchrony. The parallel experiments; determination of kale nutrient uptake and legume residue decomposition, were carried out at the university of Nairobi field station, between November 2014 and February 2015. The residues were weighed, put in litter bags and buried at 10–15 cm soil depth. They litter bags were retrieved at 0, 15, 30, 45, 60, 75, 90, 105 and 120 days. The kale leaves were sampled at 30, 60 and 90 days after planting. The residues and kale leaves were analysed for N and P concentrations. The decay ( $Y=y_0e^{-kt}$ ) and half-life ( $t_{\frac{1}{2}} = \ln(2)/k$ ) formulae were used to determine the decomposition and mineralisation rates, and time when half of the nutrients or weight is lost, respectively. The weight loss of the legume residues with incubation period (days) was rapid (0–30), moderately rapid (30–60), moderate (60–90) and gradual (90–120). The nutrient half-life for both legumes was found to be between 20 and 30 days of incubation. About 10–33, 50 and 80–86.7 % loss of N by legume residues occurred in the first 10–15, 30–60 and 120 days, respectively. About 50 % of P released occurred between 15 and 30 days for both legumes. Kale nutrient uptake was rapid (first 30 days), moderate (30 to 60 days) and gradual (between 60 and 120 days). The N and P release by chickpea and lupin, and uptake by kale intersected (i.e. point of maximum synchrony between nutrient release and uptake) at day 25 and 30, respectively. For maximum nutrient synchrony between chickpea and lupin nutrient release and kale nutrient uptake, the residues should be incorporated in soil during kale seedling (4 weeks old) transplanting to optimise on residue benefits and minimise loss of available nutrients.

**Keywords:** Chickpea, decomposition, kales, lupin, nutrient release, residue, synchrony