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

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INTRODUCTION

Nitrogen (N) and phosphorus (P) are key limiting nutrients for many cropping systems (Onwonga et al., 2015).

Chickpea (*Cicer arietinum*) and white lupin (*Lupinus albus* L.) are leguminous crops commonly intercropped with kales (Brassica oleracea) (Nduku 2014 and Genga 2014).

Dearth of information regarding synchronization of nutrient released by legume residues with pattern of nutrient uptake by kales to match their demand compelled this study.

MATERIALS AND METHODS

- Study conducted at Kabete field station of the University of Nairobi, Kenya.
- Kale seedlings were grown, parallel to legume residue decomposition plots, in pure stands with 10t/ha of farm yard manure (FYM) applied.
- Kale leaves for N and P analyses were sampled from three middle rows at 30, 60 and 90 days after planting.
- Chickpea and white lupin residues were weighed into litter bags and buried in soil to a depth of about 15 cm and retrieved at 0, 15, 30, 45, 60, 75, 90, 105 and120 days of incubation.
- The residues after washing, were oven dried, grounded sieved and analyzed for N and P content.

Determination of nutrient release rates

- Residue mineralization rates were calculated using a first-order exponential decay function, $Y = y_0 e^{-kt}$ (Wielder and Lang 1982). Where Y= is nutrients remaining at time t, y_0 = initial nutrients available before decomposition, k= decomposition constants, t = time of decomposition.
- Half-life (t½) was calculated using equation; $T_{½} = \ln(2)/k$.

  Where $t_{½}$ = time when half of the nutrient is lost, ln(2) = natural logarithm and k=decomposition rate.

RESULTS

Residue Nutrient release rates: N and P release rates for both legumes are depicted in Fig.1 and 2.

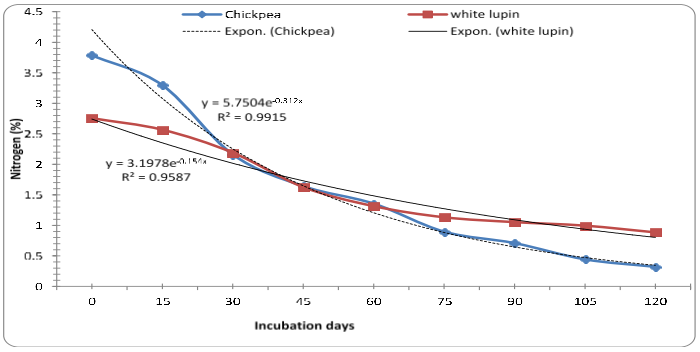

Figure 1: Nitrogen release of chickpea and lupin residues

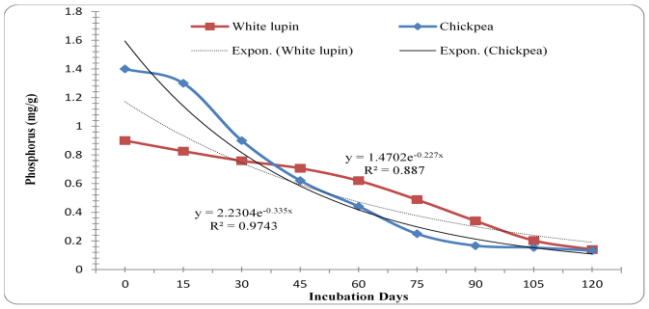

Figure 2: P release of chickpea and lupin residues

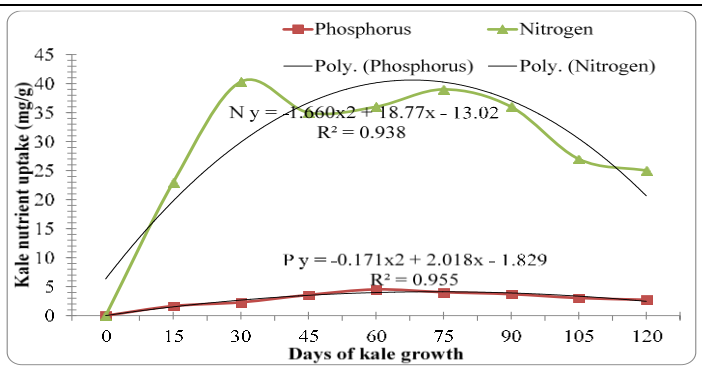

Figure 3: Kale nitrogen and phosphorus uptake

- About 10-33, 50 and 80-87% loss of N by chickpea and lupin was respectively got in 10-15, 30-60 and 120 days.
- Approximately 50% of P released occurred between day 15 and 30 for both legumes.
- Kale leaves had higher N and P concentrations/uptake from day 30 to 60 (Fig.3).
- Calculated half-life for N and P was at day 20 and 30, respectively.

Legume residue N and P release vs. kale uptake

- Optimum synchrony of nutrient release with uptake was also estimated from intersection points of nutrient release curves (Fig. 1 and 2) and nutrient uptake curve (Fig.3)
- The curves intersection for N was at day 25 (chickpea) and 30 (lupin) and P for both legumes being at day 30.
- This closely mirrors and validates the findings from the calculated half-life of N (20) and P (30).

CONCLUSION

For maximum nutrient synchrony between nutrient release and kale nutrient uptake, chickpea and lupin legume residues should be incorporated in soil at kale seedling (28-30 days old) planting to optimize on residue benefits and minimize loss of available nutrients.

REFERENCES

For references, please contact;

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