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Nutrient Balance of Rainfed Highland Rice - Legume Crop Rotation in Northern of Thailand

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Abstract

Highland farmers in Thailand grow one rice crop per year. However, these farmers lack soil maintenance measures as well as crop rotation. A rice-legume crop rotation could therefore be a way to improve land use in these areas. With the objective to increase overall farm productivity and additional income of farmers, an on-farm study was executed in the Mae Wak village, Mae Chaem district, Chiang Mai province at an altitude of 670 m asl between April 2016 and March 2017. A randomized complete block design was used with five treatments and three replicates. The treatments were: (1) rice (*Oryza sativa*) monoculture, (2) rice - navy bean (*Phaseolus vulgaris*), (3) rice kidney bean (*Phaseolus vulgaris*), (4) lablab (*Lablab purpureus*) rice - navy bean and (5) lablab rice - kidney bean. Fertilisers were applied in rice with 156 kg ha^{-1} of urea (46 % N) and 156 kg ha^{-1} of 16-20-0 (N-P-K) at 25 and 45 days after planting, respectively. Navy bean and kidney bean received 125 kg urea ha^{-1} and 125 kg NPK ha^{-1} at 25 and 45 days after planting, while no fertiliser as applied in lablab. No pesticides or herbicides were applied. The experiment showed that rice grain yield with 5.5 5.7 t ha^{-1} was non-significant different between the treatments. Legume grain yield was 1.5 – 1.6 t ha^{-1} in navy bean and 1.0 – 1.3 t ha^{-1} in kidney bean. Total crop residue and nitrogen retaining in the soil was significant different between treatments. Total crop residue in rice legume crop rotation increased by 1.4 – 1.6 times compared to rice monoculture. Nitrogen retained in the soil increased by 2.0 – 2.2 times in rice-legume and 2.6 – 2.7 times in lablab-rice-legume when compared to rice monoculture. Nitrogen showed an overall negative balance throughout the experiment with a N removal of 4.6 51.8 kg N ha^{-1}, with the highest N removal registered for the rice monoculture treatment. Therefore, a rice - legume based cropping system reduced the nutrient removal from the highland rice fields. Furthermore, future work has to evaluate the adoption of crop rotation by highland farmers and has to explore the local knowledge on sustainable agriculture.

Keywords: Legume, nutrient balance, rice

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