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Effect of continuous maize cultivation on soil condition and yield in Northern Laos

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Abstract

In Northern Laos, maize is cultivated in continuous cropping without fertilizer, fallowing nor any other soil conservation practice. It is expected that this inadequate management in maize cultivation will degrade soil and decrease yield. However, there is limited information about the change of soil condition and yield under continuous maize cultivation. We tried to evaluate the change of soil condition and yield under continuous maize cultivation in Northern Laos. Our study was conducted in farmer's flat and slope fields in Sainyabuli province where maize cultivation had been introduced earlier than the other provinces of Northern Laos. Our study was conducted in 21 fields in 2014, and in 19 fields in 2015. We analyzed grain yield and soil characteristic (total carbon (TC), total nitrogen (TN), available phosphorus (Av-P), exchangeable cation, pH, soil texture) at 3 places in each field. The 3 places were set at different elevation level (lower position, middle position, upper position) in slope fields. Further, the period of continuous maize cultivation and crop management practice were investigated. Then, by evaluating the relation between the period of continuous maize cultivation and yield and the soil characteristics, the effect of maize cultivation was estimated. Crop management practices were similar among the investigated fields. Maize was cultivated in rain season. Grain seed and cob were harvested on September or October, but shoot was left on the fields. No crop was cultivated during dry season. Fertilization and fallowing has never been conducted under continuous maize cultivation. On the other hand, the period of maize cultivation was different among the fields, and ranged from 2 years to 30 years. In the slope fields, as the period of continuous maize cultivation was longer, the contents of TC and TN were lower at all 3 positions, Av-P content was lower at the upper position, exchangeable potassium (Ex-K) content was lower at the middle and the upper positions. The other soil characteristics weren't related with the period of maize cultivation in the slope fields. In contrast, soil characteristics weren't related with the period of maize cultivation in the flat fields. Yield was lower as the period of maize cultivation was longer at the upper position of the slope fields. At middle position of slope fields, yield tended to be low with increase of the period of maize cultivation. In contrast, yield wasn't related with the period of continuous maize cultivation in flat fields. From the results about crop management, it was presumed that the period of maize cultivation was one of the main factors causing the difference of yield and soil characteristics among the fields. Therefore, from the result of yield and soil condition, it was considered that the continuous maize cultivation decreased soil productivity in the slope fields with decline of TC, TN, Av-P, Ex-K and yield at upper position of slope fields, and decline of TC and TN in the other positions in Sainyabuli province.

Keywords: maize, Northern Laos, soil, yield

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