CHAPTER 5

CONCLUSIONS

The study on the effects of cultivation practices, liming, and organic/inorganic fertilizers applications including foliar zinc spraying on the increased phosphorus availability and crop productivity for sustainable agriculture on sloping land are concluded as follows.

(1) Furrow cultivation (CF) tended to improve almost all soil physical properties by giving lower BD and higher FC, TP, and AP values, leading to higher rate of infiltration (IR) with higher accession of rain water into the soil profile, almost throughout the 2 experimental years, particularly for the topsoil (0-20 cm depth). These could increased the available soil water for the growing crop as lablab bean during the dry periods, resulting in higher lablab bean productivity compared to the conventional planting (CP). Furthermore, CF also significantly decreased soil acidity by giving higher pH values which caused better nutrient solubility such as phosphorus, which were much more efficiently used by the growing lablab bean than CP during both studied years. Therefore, residual Ext.P in soil were left over under CP more than those under CF. This was corresponded to the lower soil organic matter content and less phosphorus consumption with poorer crop development, and lower yield production of lablab bean grown under CP than under CF in both experimental years.

(2) The soil amendments applications treatments, which were Control or none applications of any lime and fertilizers, liming (L) and organic (OF)/inorganic (IF) fertilizer applications, did not differently affected on soil physical properties of both topsoil and subsoil layers due to insufficient time duration for forming soil structure (the improvements of soil BD, FC, TP, and AP required aggregate stability formation caused by root decaying and accumulation of organic matter which is time consuming). However, the studied soil amendments had significantly different effects on soil reaction (pH), organic matter content (OM), extractable phosphorus (Ext.P) and extractable zinc (Ext.Zn), crop growth and seed yield of lablab bean in both studied years. Liming (L) significantly decreased soil acidity with the highest increasing rate of soil pH values, but gave the lower values of OM and Ext. P in soil compared to OF and IF which gave the highest and the 2nd high values of OM and Ext.P in soil, whilst Control gave the lowest values of almost all the studied soil parameters (pH, OM and Ext.P). Therefore, fertilizers applications (OF and IF) gave better phosphorus consumption or total P-uptake of lablab bean, leading to higher total dry matter and seed yield productions than those total P-uptake and crop production given by liming (L). In addition, L significantly gave the lowest amount of soil Ext.Zn compared to OF, IF and Control which gave the 3rd, 2nd and the highest amount of Ext.Zn due to the increased soil pH, causing the increased formation of zinc-hydroxide, leading to reduction of the soluble Zn in soil.

(3) Foliar zinc and no zinc spray (Zn_1 and Zn_0) applications did not affected on both soil physical and chemical properties. Foliar zinc spraying (Zn_1) under drought stress tended to give better lablab bean growth (height), total dry matter and seed yield production of lablab bean than those without foliar zinc spraying (Zn_0). In addition, the combination effects of foliar zinc spraying and inorganic fertilizer application with furrow cultivation ($CF+IF+Zn_1$) gave the highest crop growth, total dry matter and seed yield productions of lablab bean when compared to the other either single or combination treatments.

The above studied results indicated that the studied treatments such as furrow cultivation, liming, organic and inorganic fertilizers applications including foliar zinc spraying were able to increase crop productivity for sustainable highland rainfed agriculture significantly, by improving both soil physical and chemical properties including nutrient availability such as Ext.P and Ext.Zn in soil, total P and total Zn - uptake by plant. The most important treatment was furrow cultivation which could substantially conserve soil and water leading to efficiently increased water and nutrient uses for crop production under rainfed condition. Applications of Lime, organic and inorganic fertilizers are needed to increase soil pH and organic matter including available P and Zn in acid soil with previously cultivated without any soil conservation practice, whilst foliar Zn spraying is an optional treatment for improving crop development and yield production.

It is recommended that all soil amendments are applied in furrow cultivation to achieve the highest soil and crop productivity in highland rainfed farming system. However, the new furrow construction may not be stable due to instability of the ridge/furrow depth including incorrectly constructed. Hence, furrow preparation should be carefully conducted and additional treatment such as surface mulching with biodegradable materials or ridge cover crop should be applied in order to achieve the highest sustainable soil and crop productivity.