

| 学 位 論 文 要 旨   |   |
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| 氏 名   | Md. Sagirul Islam Majumder  |
| 題 目   | <b>Tropical Legumes for Improvements of Red Soils and Crop Production</b><br><b>(赤色土壌の改良と作物生産のための熱帯マメ科植物に関する研究)</b> |
| <p>Most of the red soil in tropical and subtropical regions has low organic matter, nutrients, water holding capacity and high phosphate fixing capacity. Therefore, chemical fertilizers are used increasingly worldwide for efficient crop production, which causes soil degradation and environmental pollution. Thus, the legumes could be used in agriculture to reduce chemical fertilizer application and to improve soil physio-chemical properties, soil nutrients, biological properties and crop yield. A series of experiments has been conducted in laboratory and greenhouse to evaluate growth characteristics, biomass production and nutrient status of tropical and subtropical legumes hairy vetch (<i>Vicia villosa</i>), chickpea (<i>Cicer arietinum</i>), grasspea (<i>Lathyrus sativus</i>), dhaincha (<i>Sesbania aculeata</i>), mungbean (<i>Vigna radiata</i>), lentil (<i>Lens culinaris</i>) and soybean (<i>Glycine max</i>), and their effects on crop production to select some legumes as green manure in red soil management.</p> <p>The legumes were cultivated from March to May (spring), June to August (summer), and November to January (winter) in cultured soil and red soil. In cultured soil, the highest plant biomass was obtained from dhaincha (41.84g pot<sup>-1</sup>) followed by chickpea (16.45g pot<sup>-1</sup>), grasspea (9.8g pot<sup>-1</sup>), soybean (8.92g pot<sup>-1</sup>) and mungbean (8.47g pot<sup>-1</sup>) when planted in March. Dhaincha and mungbean produced 117g pot<sup>-1</sup> and 41.43 g pot<sup>-1</sup>, respectively when planted in June. Dhaincha produced 3 times and mungbean produced 5 times higher biomass in June plantation as compared to that in March plantation.</p> <p>In red soil, the highest plant biomass was obtained from soybean (4.35g pot<sup>-1</sup>) followed by dhaincha (2.84g pot<sup>-1</sup>), chickpea (2.80g pot<sup>-1</sup>), grasspea (2.75g pot<sup>-1</sup>) and mungbean (1.87g pot<sup>-1</sup>) in March plantation. Dhaincha and mungbean produced 16.41g pot<sup>-1</sup> and 18.96g pot<sup>-1</sup> biomass, respectively in June plantation. In November plantation, chickpea and grasspea produced dry biomass 8.413 g pot<sup>-1</sup> and 10.56 g pot<sup>-1</sup>, respectively. Dhaincha produced 10 times, and mungbean produced 6 times of biomass in June plantation than in March plantation. Chickpea produced 3 times and grasspea produced 4 times higher biomass in November plantation than in March plantation.</p> <p>Total nitrogen in dhaincha, grasspea, soybean, mungbean and chickpea was 4.73, 3.77, 2.73, 2.68 and 2.67%, respectively; phosphorous was 0.18, 0.08, 0.01, 0.06 and 0.04 mg g<sup>-1</sup>, accordingly; and potassium was 2.48, 2.59, 1.87, 3.12 and 3.34 mg g<sup>-1</sup>, accordingly.</p> <p>Effects of soybean, mungbean and dhaincha on soil and turmeric cultivation were evaluated. The soil with green manure plant was found to be loose and had lower soil bulk density and higher soil moisture than untreated soil. Turmeric plants treated with the legumes survived longer and resulted in increased 155-216% shoot biomass and 89-143% yield. The highest turmeric yield was obtained with mungbean (213 g plant<sup>-1</sup>) followed by dhaincha (176.9 g plant<sup>-1</sup>) and soybean (166.4 g plant<sup>-1</sup>).</p> <p>Hairy vetch effects on red soil and turmeric were evaluated. The soil with hairy vetch was loose and had higher soil moisture and lower bulk density. All the turmeric plants treated with hairy vetch survived longer and had significantly higher growth parameters and yield. Hairy vetch provided organic matter and nutrients, and improved soil microbial activities. Bacteria and fungi in the soil amended with hairy vetch were 3.7-fold and 4-fold higher, respectively, compared to control soil. Two isolates, SI-17URAgr and SI-19URAgr were identified as <i>Talaromyces pinophilus</i>, which produced considerable organic acids and solubilized phosphorous and zinc.</p> <p>This study showed that all the legumes used in the experiments could be cultivated in subtropical Okinawa, which were different in biomass production with the season. However, dhaincha and mungbean grew best in summer, and chickpea and grasspea in winter. Hairy vetch grows well in winter. These five legumes provided better organic matter and nutrients, and improved soil physio-chemical properties and microbial activities, which integratedly contributed to increased plant growth and yield. These five legumes could be used as green manures to improve soil and crop production.</p> |   |