ABSTRACT

Land terracing is promoted as a management practice for effective soil conservation in hilly areas of Rwanda. However, terraced lands are likely to have low crop productivity where management practices, especially fertilizer application, do not consider the changes in the soil properties following terracing. Fertilizer recommendations currently in use are based on studies done in non-terraced land. The objectives of this study were therefore to determine the changes in soil properties following bench terracing and the effects of nitrogen and phosphorus, and bioslurry application on soil properties and maize growth, N uptake and yields in terraced lands. Trials were conducted at medium and high altitudes sites in Rwamagana and Gicumbi Districts of Rwanda. In the first trial, a Randomized Complete Block Design with factorial arrangement was used. Factors comprised terracing (terraced and non-terraced lands), slope positions (top, middle and bottom) and soil depths. The physical, chemical and biological properties of soil were determined. The second and third field trials were conducted using a Randomized Complete Block Design in factorial arrangement replicated three times. The second trial had two factors; nitrogen fertilizer at four levels (0, 60, 120 and 180 kg N ha-1) and phosphorus fertilizer at four level (0, 40, 80 and 120 kg P2O5 ha-1). Data on maize growth and yields were collected. The third trial comprised four levels of mineral nitrogen (0, 30, 60 and 90 kg N ha-1) and four levels of bioslurry (0, 6, 12 and 18 t ha-1 in the medium altitude site and 0, 5, 10 and 15 t ha-1 in the high altitude site). Maize growth, N uptake and yields were measured, and the residual effect of treatments on soil properties was evaluated. Results showed significant ($P < 0.05$) changes in certain soil properties after terracing. Terraced lands had higher levels of silt, hydraulic conductivity and populations of bacteria and fungi. Nonterraced lands had higher clay content, water retention capacity and organic carbon. On maize performance, nitrogen fertilizer rates of 120 and 180 kg N ha-1 combined with phosphorus rates of 80 and 120 kg P2O5 ha-1 resulted in significantly ($P < 0.05$) higher grain yields of 6.4 – 6.5 t ha-1 in the medium altitude site and 6.0 – 6.1 t ha-1 in the high altitude site. A higher agronomic nitrogen use efficiency was obtained with application of 60 and 120 kg N ha-1 . Soil organic carbon, total nitrogen and populations of bacteria and fungi increased with increase in bioslurry rates. Bioslurry rates of 12 and 18 t ha-1 in medium altitude site and 10 and 15 t ha-1 in high altitude site combined with 60 and 90 kg mineral N ha-1 resulted in significantly ($P < 0.05$) higher grain yields of 7.8 - 8.0 t ha-1 and 6.9 -7.3 t ha-1 in medium and high altitudes sites, respectively. The study

shows that bioslurry and inorganic fertilizer application in terraced lands need to be adjusted from current recommendations for enhanced maize yields.