Fluctuation and Controlling Factors of Maize Production under a Variety of Agroecosystems in Southern Province, Zambia (Summary)

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Abstract

To evaluate ecological resilience, field experiments were conducted. The experimental results from the past two years indicated that maize production fluctuated not only in relation to climatic variation but also with topographic and soil fertility conditions.

1. Introduction

To evaluate ecological resilience, field experiments were conducted. In this report, to understand fluctuation of maize biomass and its controlling factors, we examined the experimental results from the past two years. Details of each plot are described in the FY2007 FR1 Project Report and FY2008 FR2 Project Report.

2. General properties of the soils studied

Soil pH was generally neutral but was slightly acidic in some plots. At Site A, total nitrogen was low compared with the other two sites. All plots contained soil exhibiting a sandy texture. Exchangeable cations and cation exchangeable capacity were low. Base saturation percentages were high with the high percentage of Ca indicating that the soils are not well weathered. At Site A, available phosphorus was high even in the deeper horizons.

3. Nutrient stock at the study sites

Total nitrogen in the topsoil (0–15cm depth) was highest at the CSa2. Exchangeable potassium and available phosphorus in the topsoil were highest at the ASn1. Considering all soil depths, total nitrogen was highest at the BCh2 and exchangeable K and available P were highest at the ASm1.

4. Fluctuation of maize production

4-1. Maize production in 2007

With decreasing altitude in each site, the aboveground biomass and grain yield decreased except for BCh1 and BCh2. This decrease could be ascribed to the damage of waterlogging and excessive wetting caused by heavy rain in the lower areas.

4-2. Maize production in 2008

Total precipitation at Sites A and C in the 2008/09 rainy season were 1053 mm and 1245 mm, respectively. These values were slightly higher than the mean annual precipitation of the area, which is less than 800 mm. However, in this year, few fields were damaged by waterlogging and excessive wetting caused by rain according to all participating households interviewed. Only CSa4 was still damaged by rain. With decreasing altitude in each site, grain yield increased except at BKa.

4-3. Fluctuation of maize production between the two seasons

In 2008 the maize yield was higher in all plots except CSa1 in comparison with those of 2007. In both years, the number of established plants was lower than the number of seeds sowed. In particular, the plant number was very low in 2007 presumably due to washing away of maize seeds by heavy rain. The yield per individual maize plant in 2008 increased except at CSa1 in comparison with 2007. Annual variation in maize yields was influenced by the topographical position of the fields. At Site C, CSa1 produced better yields in high-rainfall years, while CSa4 produced lower yields in high-rainfall years.

5. Factors controlling maize production

Maize yield was well correlated with total biomass regardless of weather and soil nutrient conditions. Maize yield was correlated with soil nutrient stock in the overall soil profile, but no correlation between maize yield and nutrient stock in the topsoil was found.

6. Conclusion

A complex relationship between maize production and weather, topography and soil fertility is suggested, which will hopefully be clarified in the future by the ongoing field experiments.