Biophysical factors affecting maize productivity of small-scale farming system under three settlement schemes in North-East Zimbabwe

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Abstract

After Zimbabwe's independence in 1980, the land owned by white farmers was soon started to be seized by the rural population. In 1997, a land reform was instituted, and nowadays most of the "white" farm land is redistributed and parcelled into many small-holder farms. However, due to continuous crop cultivation without adequate fertilization and limited soil conservation practices, crop yields abruptly declined, leading to reduced food security at national level.

The objective of the present study was to identify which biophysical factors limited maize performance at village level along three farming settlement schemes, i.e. communal areas, old resettlement areas and new resettlement areas, in North-East Zimbabwe. These settlement scheme types have been determined by the political and historical development of the country during 90 years of colonial and settler government. Communal areas were settled after the colony period (1889), old resettlements during 1980s and new resettlement areas after 2000. The three schemes have different characteristics in terms of farm size, crop and livestock production system, level of technology use, management, income level and soil type.

The study focused on maize, the main staple crop in the region, in the cropping season 2006-7, and consisted of two main phases: (i) Land use characterization in cropping fields from the three villages and (ii) Detailed maize performance assessment through a soil and crop sampling and, questionnaires regarding crop management and input use.

During the first phase, nine farmers were randomly selected in each village according to wealth status. Most of selected farmers owned more than two maize fields, and in total 48 plots were sampled. The 27 farmers were next interviewed to obtain detailed information regarding land use, farm household, soil characteristics, field management and maize performance. Data retrieved during this phase was evaluated by ANOVA, Spearman correlations and Multiple Regression Analysis. These analyses showed by village and wealth classes the main factors influencing maize performance.

Maize field management is diverse for the tree settlement schemes and influenced by resource endowment. The study showed that the high resourced farmers applied significantly more N (70 kg ha^{-1}) than the low resourced farmers (16 kg ha^{-1}) in the selected villages. The low resourced farmers applied lower amounts of P (1 kg ha^{-1}) in comparison to the medium and high resourced farmers.

Multiple regression analysis showed that 71 % of the variability on maize grain yields could be explained with N fertiliser input (51 %), sand % (13 %) and planting density (plants ha^{-1}) (7 %). The influence of other factors was not statistically significant.

In Hereford (new resettlement scheme), the main factor controlling maize productivity was the amount of N applied, mainly from cattle manure. This driver explained 73 % of maize grain yield variability. R^2 increased up to 78 % when a variable representing weed pressure was added to the model, but this increase was not significant ($p=0.13$). In Chomutomora (old resettlement scheme), 83 % of maize yield variability was attributed to N application (from organic and inorganic sources), organic manure application (other nutrients than N and P provided by manure) and pest pressure. In Kanyera village (communal area), P application explained 75 % of the maize grain variability. Other variables were not included in this model.