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Research Application Summary

Integrated soil fertility management in South Kivu province, Democratic Republic of Congo

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Abstract

This paper describes a collaborative research involving South Kivu province in Democratic Republic of Congo, Rwanda and Burundi to disseminate resilient agro-ecosystem packages. Modifying crop arrangement by planting legumes within and between cassava rows (intercropping) increased bean yields and reduced soil erosion. However, the yield benefit was not apparent in all cases.

Key words: CIALCA, Congo basin, hedgerows, intercroping

Résumé

Cet article décrit une recherche de collaboration impliquant la province du Sud-Kivu en République Démocratique du Congo, le Rwanda et le Burundi pour disséminer les paquets résilients d'agro-écosystème. La modification d'arrangement de culture en plantant des légumineuses à l'intérieur et entre les rangées de manioc (interculture) a augmenté les rendements des haricots et réduit l'érosion du sol. Cependant, l'avantage de rendement n'était pas évident dans tous les cas.

Mots clés: CIALCA, bassin du Congo, bordures de haies, interculture

Background

Sud Kivu province's land, spanning the highlands and lowlands between the Congo Basin and the Great Lakes Kivu and Tanganyika, ranges from young and relatively fertile volcanic soils, to the impoverished red clayey Ferralsols and Nitisols, and from rainforests to dry pastoral plains. Population density, on the other hand, is very high in most areas, among the highest in the Democratic Republic of Congo. However, the agricultural and pastoral pressures on South Kivu is quite variable (Cialca, 2006).

The rainfall in Sud-Kivu is bimodal and allows crop cultivation during two subsequent seasons: the "A" season starts mid-September and ends mid-January, while the "B" season lasts from mid-February to mid-June, followed by a short dry period,

often referred to as the "C" season. The area receives on average 1500 – 1800 mm per year, and the growing period extends to over 325 days per year (Farrow *et al*., 2006). Soil erosion is therefore a problem.

Food security is a major problem in the province, like in the entire Great Lakes Region, with the majority of sites reporting 30-40% of the families being food insecure. Northern Burundi and South Kivu have very high food insecurity (>60% food insecure). Poor food security, poor child nutrition, and poor access to markets are all strongly correlated (Cialca, 2006).

Following a call for proposals of the Directorate General for Development Cooperation (DGDC - Belgium) in April 2004, three proposals from three CGIAR projects, namely CIAT-TSBF, Bioversity International and the International Institute of Tropical Agriculture (IITA) were approved to address food insecurity and related problems in South - Kivu. The above projects operate in parts of Rwanda, Burundi and the Democratic Republic of Congo (DRC), with similar national partner institutes. Thus, due to the complimentary nature of the activities, the institutes agreed to operate as a Consortium to ensure cooperation and complimentarity and avoid technical and financial duplication at the national level. The Consortium for Improving Agriculture-based Livelihoods in Central Africa (CIALCA) is a consortium of the International Agricultural Research Centers (IARCs) and their national research and development partners that aims at close technical and administrative collaboration and planning in areas of common interest, thereby enhancing returns to the investments made by DGDC and accelerating impact at the farm level (Cialca, 2006). The Faculty of Agriculture of the Université Catholique de Bukavu is a partner of CIALCA.

Literature Summary

The goal of the CIALCA project is to improve food security, income, and nutrition of rural populations while conserving the natural resource base in the mandate areas. The purpose is to develop and disseminate in partnerships with all stakeholders resilient agro-ecosystems through integration of stress tolerant and bio-fortified germplasm, inclusion of locally adapted Natural Resource Management (NRM) options, market led diversification and intensification, and revitalization of research for development capacity of all stakeholders.

In the highlands of Sud-Kivu, cassava-legume intercropping is a common practice by smallholder farmers, but productivity is low. It is hypothesized that productivity can be increased by incrementally applying different ISFM components, namely (i) proper agronomic practices (planting in lines), (ii) use of improved legume and cassava germplasm, (iii) a modified crop arrangement that favours the legume intercrop, and (iv) fertilizer application and erosion control measures. Participatory demonstration trials were conducted with farmer groups to assess improvements in system productivity and profitability (Cialca, 2006). This paper reports on the work done by CIALCA in all mandate areas. It describes some trials done by faculty members, mostly ISFM components, in partnership with CIALCA.

Study Description

Treatments in participatory demonstration trials of ISFM were conducted in the highlands of Sud-Kivu included the farmers' common practice (local common bean and cassava varieties, seed broadcast and manure addition) and sequentially added ISFM components: improved bean and cassava germplasm, modified crop arrangements, compound NPK fertilizer application and alternative legume species (groundnut or soybean) (Pypers *et al*., 2010).

Cassava was grown at a spacing of 2m between rows and 0.5m within the row and this allowed intercropping with legumes during two consecutive seasons. In treatments with integration of a second legume, a bush bean was grown in the first season, followed by a climbing bean in the second season (5 months after cassava planting). The legume yield presented is the sum for the first and second legume. All treatments received a basal manure application of 2.5 t ha^{-1}. Fertilizer was applied at 2 bags of NPK (17:17:17) ha^{-1} at planting (equally distributed to the cassava and the legume, and applied in the planting holes/ lines). In the treatment with fertilizer application and integration of a second legume, additional fertilizer (1 bag ha^{-1}) was applied at planting of the 2nd legume (Cialca, 2006).

Evaluation of soil erosion measures included, among various trials, evaluation of efficiency of hedgerows of various species under cassava cultivation: Six species of *Brachiaria, Leucaena, Calliandra, Pennisetum, Setaria, Tithonia* and *Tripsacum.*

Findings

Results in Kabamba area (Zirhahwakuhingwa, 2009) showed that modifying the crop arrangement by planting cassava at 2

m between rows and 0.5 m within the row, intercropped with four legume lines, increased bean yields during the first season and permited a second bean intercrop, resulting in a total productivity increase of 1 t ha^{-1} and additional revenue of almost 1000 USD ha^{-1}. In season 2008 A in Kabamba, stem yields tended (P=0.12) to be higher when cassava was planted at 2 m × 0.5 m. Fertilizer application significantly increased (P<0.01) cassava stem yields in season 2008 A in Kabamba, whereas in all mandate areas crop arrangement, a second legume intercrop did not affect cassava storage root yields. Fertilizer application increased both legume and cassava yield, and net revenue by 400 – 700 USD ha^{-1} with a marginal rate of return of 1.3 – 2.3 (Pieter *et al*., 2010).

Growing soybean as the first legume intercrop did not show differences in beans and cassava root storage yields as shown in the figures (Matabaro, 2010), but significantly reduced cassava stem yields in season 2008 A in Kabamba, relative to when beans or groundnut were grown.

As for hedgerows efficiency evaluation, *Calliandra* planted at high density (0.25 m apart) was the best stabilizer of erosion, followed by *Setaria*, *Pennisetum* (equivalent to *B. ruziziensis*), and *Calliandra* at 0.5 m spacing.

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