POLICY BRIEF

Resilience capacity-building of smallholder farmers facing climate change risks: The value of practicing climate-smart agriculture techniques on groundnut and sorghum.

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Summary

In Burkina Faso, agriculture is facing three major constraints. Firstly, the extreme events of climate change such as drought spells and temperature increases. Secondly, soil erosion and low soil fertility. Third, the weak use of organic and chemical fertilizers because of its unavailability, its pricey and the poor income of the farmers. The improvement of soil, mitigation and adaptation of climate change variability is needed to build strong resilience capacity of smallholder farmers. This paper focuses on three objectives. First to analyse the key determinants of indigenous *zaï* and stone rows practices adoption. Afterwards to determine the influence of *zaï*, stone rows, ridge tillage, and *zaï* combined with stone rows on soil health and the performance of groundnut and sorghum yields, and eventually to propose possible policy responses.

Recommendations

- Structuring of smallholder farmers into groups or associations would facilitate the sharing of information on cropping practices and their training in integrated soil management techniques.
- Supporting Climate-Smart Agriculture Technologies such as *zaï* and stone rows combined with organic manure and mineral fertilizer use at large scale. It can be suitable for buffering climate change extreme events (drought, high temperature), reducing erosion speed, increasing water infiltration capacity, increasing nutrients content in the hole, and restorate degraded soils and decrease mineral fertilization financial costs.

Introduction

In Burkina Faso, the agriculture is mainly rain-fed, and dominated by cereals, legumes, oilseeds, and vegetables. Sorghum is the main cereal crop with a production of 1,839,570 tonnes. Groundnuts also occupies an important place in oilseeds crops with a production of 630,526 tonnes. Despite this performance of production, the yields of these crops remain below potentials. For instance, groundnut and sorghum are at 917 $kg.ha^{-1}$ and 1028 $kg.ha^{-1}$ respectively. Drought, water erosion, low soil fertility, low fertilizer supply, irregularity and decreasing rainfall are the causes of the current situation. Perfect example, the decrease of rainfall amount reduced sorghum yield more than 14%. The high emissions will cause the decrease of the national average of sorghum yield by 5.5%. The national average net NPK rate on sorghum is 46 $kg.ha^{-1}$. This policy brief explores the link between smallholder farmers' socio-economic characteristics improvement, soil status improvement, and crop yields increasing by the use of climate-smart agriculture technologies and resilience capacity building.

Increasing smallholder farmers openness and acceptability to agricultural practices

Natural resource degradation coupled with climate change remains a constraint to agricultural production. Perception of land degradation and climate change extremes are critical to coping with these threats and building the capacity of people to be resilient. Thus, the awareness of the level of degradation and the appreciation of the drivers of climate change are highly dependent on the knowledge of the land and the impacts of climate change. Training, information and experience sharing through the media (radio, television, telephone) and direct interaction between members of farmers' organizations are ways of disseminating information on new agricultural technologies. Thus, this dissemination will help smallholder farmers to be confident of the existence of the techniques and to be more openness to accept and adopt them.

***Zaï*, stone rows, organic manure supply, and mineral fertilizer supply by microdosing for climate change risks mitigation and adaptation**

Burkina Faso's vulnerability to climate change and variability, due to its socio-economic and physical characteristics, remains an issue. Farmers are facing highly variable, short and unpredictable rainfall. Still, agriculture is essentially rain-fed. Therefore, this variability of climate change could compromise the availability of water resources for agriculture increase the frequency of runoff and soil erosion leading to the degradation of many agricultural lands. This will reduce the resilience of farmers. Therefore, it is imperative to adopt agricultural innovations that improve the efficiency of rainwater available in the soil for plants use and offer the possibility to improve soil productivity and mitigate climate risks. Farmers already know climate change impacts and their various observations are in accordance with the many scientific claims made by models and empirical evidence. The reduction in crop yields due to intense drought and the negative consequences of climate change and variability are also reported. Indeed, empirical evidence and future projections of Burkina Faso's climate suggest that without sustainable intervention strategies to reduce the risks caused by climate on agriculture, most regions will not be able to produce in quantity and quality. The adoption of climate-smart agricultural practices and technologies appears to be a significant alternative. Thus, this adoption will increase land productivity and crop yields in order to improve food security. It will also contribute to better adaptation and resilience to climate change and variability.

***Zaï*, stone rows, organic manure supply, and mineral fertilizer supply by microdosing for degraded soils restoration and crop yields optimisation**

To deal with continued land degradation and the negative effects of climate change to maintain good production, soil and water conservation technologies have been developed. *Zaï* and stone barriers, organic fertilizer and microdose mineral fertilizers are generally used to improve soil health and increase crop yields under climate change. Indeed, they increase the capacity of water infiltration and maintain soil moisture, reduce the frequency of erosion and increase soil fertility. Moreover, these practices increase the number of organisms living in the soil and the respiration of the soil. In addition, these practices can double the carbon and nitrogen contents, improve the pH values towards an optimum. As a result, degraded soils will be restored and will promote crop development resulting in increased crop yields. In terms of productivity, *zaï* combined with the application of organic manure and little mineral fertilizer increased yield of millet by 2–7 times, and increased sorghum yield by 50% to up to 400% due to improved nutrient uptake. It increases crop productivity in general and achieves fast rehabilitation of degraded land, especially in semi-arid climate. Stone rows aims to slow down the speed of run-off water thereby reducing erosion and improving water infiltration. It improved the adaptation of cropping systems to climate change and variability due to its ability to reduce the impacts of flood and drought extremes on farmers' fields. It also, contributes to concentrating water to the reach of plants and increased crop yields by 59 to 84%. For instance, in Burkina Faso, applying compost on fields with stone rows increased the grain yield of sorghum by 142%.

Policy implications

- Supporting smallholder farmers to organize themselves into groups, associations or cooperatives: it will facilitate their support in training, information on good agricultural practices and the intricacies of extreme climate change events as well as the rational acquisition of agricultural materials and inputs. As a result, there will be an increase in their level of mindfulness and acceptance to practice climate-smart management technologies.
- Promoting climate-smart agriculture technologies such as *zaï*, stone rows, supply of organic manure and mineral fertilizer by microdosing at the farm level and at large scale provides

multiple benefits: it helps to mitigate and adapt to extreme climate events by improving soil properties, while making land-use systems more resilient to climate extremes, increasing agricultural production and building the resilience of farmers.

- Developing and making available maps of the current and future soil status of agricultural areas is essential. These maps of current and future production areas will be useful for agricultural development projects and programmes as well as for farmers to assess and integrate production risks into their production planning. These maps should be based on agro-ecological conditions of agricultural production as well as on regional climate change scenarios.

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