Enhancing the capacity of smallholder farms to tap into digital climate service technologies opportunities for improved crop production in the cercles of Sikasso

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Registration process on the Sanji platform of Orange Malii.

Summary

In the Sahel, the agricultural sector, based mainly on rainfed farming system is extremely sensitive to climate change due to the higher frequency of excess heat, and changes in rainfall patterns leading to crop failure and crop damages from pests and diseases. In Mali, this threat of climate change is of particular concern as 80% of the population is engaged in agriculture and livelihoods, and are largely dependent on natural resources that are constantly degrading. Based on this observation, our approach was to help a group of 100 farmers to better integrate climate information and agricultural advice into their production systems through the Sénékèla/ Sandji platform in the cercles of Sikasso and Kadiolo. A user group of 10 to 15 farmers was set up in seven (7) villages. The constitution of these groups took into account all social strata, including women who are the most marginalized in rural areas. Producers were trained in the use of the system (registration, interpretation of messages, holding a conversation with the agroadvisor). By using the platform, the farmers were able to better plan their activities, make decisions based on climate forecasts and have access to agricultural advice in real time. To evaluate the system, a study was conducted with a sample of 68 producers; the methodology adopted was based on data collection through a questionnaire and two rating sheets given to producers. The results show that the technology has had a positive impact on the lives of beneficiaries. We have seen a decrease in production costs of more than 30%, better use of inputs for 72% of producers and a decrease in working time (60.3% of producers). The majority of users (88%) are satisfied with Sénékèla/Sandji as a tool for disseminating climatic information, and 71% of forecasts received by producers were confirmed, which proves the effectiveness of the system.

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Introduction

Today, climate change is a major threat to agricultural production systems in Sahelian countries (Jalloh et al., 2013; Niang et al., 2014). If nothing is done in the short and medium term, the impacts of climate change will challenge agricultural production systems that are already weakened (Traoré et al., 2008). In Mali, this problem is much more acute insofar as the national economy is essentially based on the agricultural sector (agriculture, forestry, livestock and fishing). This sector employs about 80% of the active population and contributes almost 45% of the GDP, with 75% of export earnings (FAO, 2014).

Malian agriculture is essentially rain-fed and, therefore, largely dependent on climatic conditions (Makougoum, 2020). Since smallholder farmers are extremely vulnerable to adverse weather conditions, including insufficient rainfall, being able to anticipate climate fluctuations a few days to a few months in advance can make a real difference in the adaptation strategies of these populations in the face of climate change. This will reduce the risks of food crises due to lack of data at appropriate scales. However, the dissemination of climatic information is essentially ensured by the State, and the forecasts issued are based on general information that is not customized to the specific needs of producers. In addition, the system of supervision of producers and extension of agricultural innovations is ineffective due to the small number of agents and the inadequacy of the budget. In response to those constraints, international research organizations have strengthened the capacities of stakeholders to generate climate information and develop climate advisory services including their dissemination using ICT tools and evaluating the impacts of their use (Abberton *et al*, 2021). In 2021 growing season, ICRISAT initiated a pilot study on the use of the Sénèkèla/Sandji platform with 100 smallholders in the Kadiolo and Sikasso cercles. The objective of this study was to evaluate the effectiveness of the tool in disseminating climate information and agricultural advice to farmers.

I. Presentation of the innovation

1.1. The Sènèkèla service

Sènèkèla (peasant) is an ICT service launched in Mali in 2013 by Orange (telecom operator) to help Malian farmers increase their agricultural yields by offering information about agricultural inputs. A hotline with specialized agricultural staff covering a range of agricultural topics and market prices (Palmer, 2014) provide information. The call center provides advice (in French and Bambara) on farmers' daily agricultural issues including cultivation methods, seeds, sowing time and fertilizer use (GSMA, 2015).

1.2. The Sandji Service

The mobile phone company Orange Mali, in partnership with the company Ignitia, has established a daily rainfall forecast system that is delivered via the mobile phone of each user. Thus, each day, the customers receive SMS containing the forecast of the day's and the next day's rainfall via mobile phone. Sandji provides farmers with accurate (3 km), reliable and localized weather information for a given period (1 day, 1 month, 1 season).

II. Approach and data source

The activities took place in the circles of Sikasso and Kadiolo through seven villages chosen on the basis of a list provided by AMEDD (The Malian Awakening Association for Sustainable Development), a local NGO operating in the area. Hundred smallholder farmers were selected on the basis of their participation in to CSAT (Climate Smart Agricultural Technologies for improved rural livelihoods and food security in Mali) Project and their ability to use the service (knowing how to read, interpret the messages and fill in the rating sheets). The selection of beneficiaries was all inclusive. The producers were trained in the process of using the platform. The monitoring was carried out throughout the season. Between July and October two surveys were conducted among a sample of 68 producers chosen at random. These producers were subjected to a semi-directive questionnaire through interviews and covered aspects related to socio-demographic characteristics, cultivation practices and the perception of producers in relation to the use of the platform. The Sénékèla/Sandji scorecards were also collected; these scorecards provided us with information on the level of efficiency of the forecasts and the content of the group calls with the telephonist. The analyses focused on descriptive statistics, a normality test followed by a paired-sample. Student's t-test was also conducted to make comparisons before and after the use of Sénékèla/Sandji to assess its effect on agricultural activities during the season.

III. Results

3.1 Activities achieved through forecasting

Seventy one percent (71%) of the information received was found to be accurate. A large majority of users (88%) were satisfied with the service, with climate information depending on the confidence placed in the forecast. Figure 1 shows that 45% of the forecasts were used by the producers to carry out sowing, 21% to carry out the spreading of fertilizers, while only 2% of the forecasts were used for ploughing. Sowing, fertilizing and weeding were the main activities carried out as planned.

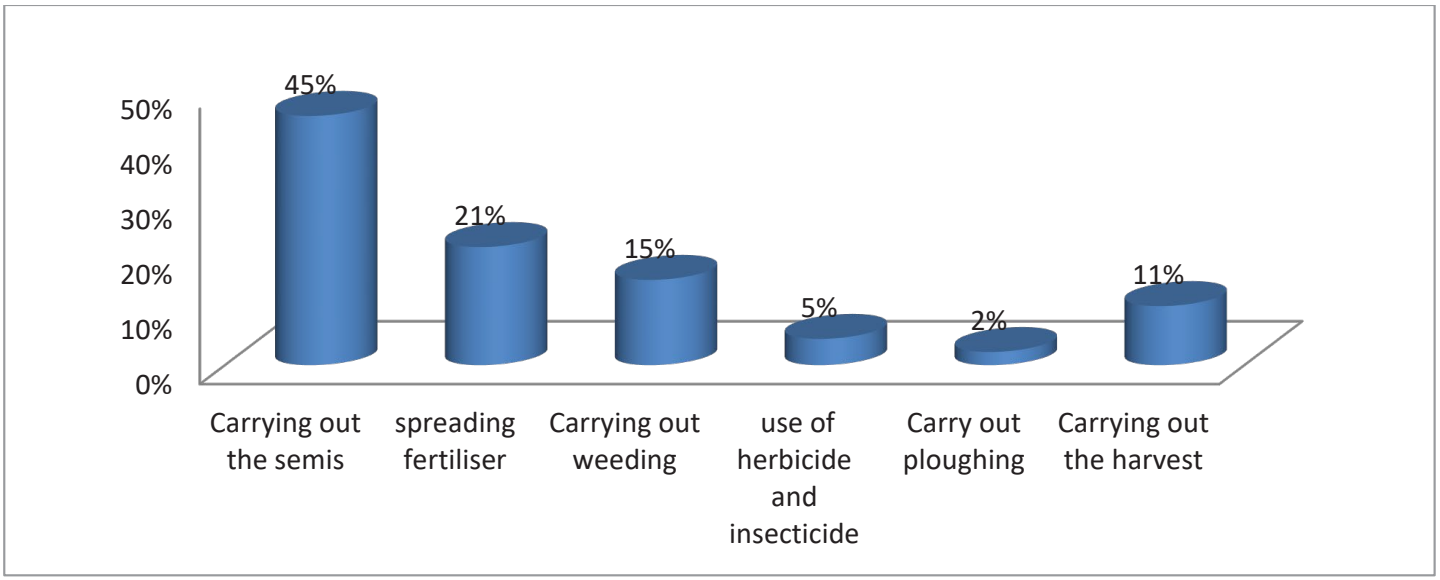

Figure 1. Activities carried out in response to forecasts. Source: Field survey.

3.2 Change in management practices

Eighty eight percent of producers improved their agricultural management practice following the use of climate information. The use of the Sénékèla/Sandji platform provided producers with a decision support tool to better plan their agricultural activities. Figure 2 presents that effect of using the Sénékèla/Sandji platform on agricultural management practices: 75% of the producers planned their input use better, 54.41% planned sowing and harvesting better, 48.53¨% made better use of working time. In addition to agricultural activities, women were particularly able to derive other benefits such as planning household activities (washing, drying) of food according to rainy events

3.3. Perception of benefits of using the Sénèkèla/ Sandji platform by producers

The results of the analyses show that farmers perceived that Sénékèla/Sandji had positive effects on the lives of the beneficiaries. This includes:

- **Improved efficiency in input use**: Seventy two percent of farmers reported reduce use of agricultural inputs after they paid more attention to forecasts before making decisions. Table 1 shows that 13% farmers used less fertilizer and 26% less pesticide. Thus, Sandji has promoted more efficient use of inputs and reduced the environmental impact of agriculture.

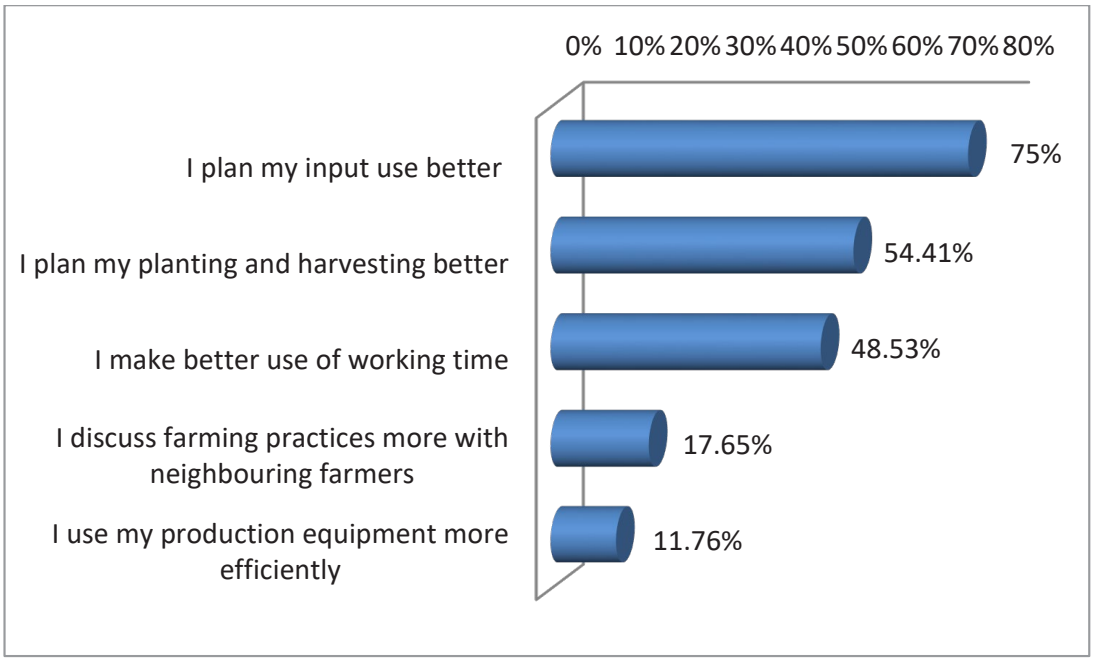

Figure 2. Effect of using the Sénékèla/Sandji platform on agricultural management practices. Source: Field survey

- D**ecrease in work time**: Rainfall information allowed 60% of farmers to avoid resuming certain tasks (sowing, weeding, crop treatment), these tasks must be done in a timely manner as the case of sowing when rain is expected, weeding, spreading and treatment in case of dry weather, a significant difference was observed between the work time before and after the use of the technology (Table 1).
- **Adapted agricultural practices**: With this technology, 54 % of producers reported sowing at the right time and 31% of the producers chose the varieties to be grown (short or long cycle) according to seasonal forecasts. Also, these producers used adapted means of control against pests according to the agricultural advice received.
- **Reduction in production costs of about 31%**: The rationalization of the use of inputs led to a substantial reduction in production costs and an increase in producers' income. This surplus can be used by producers to diversify their activities.
- **Secure harvests**: The forecasts helped 29% of the producers to avoid losing or prevent damage to their harvests. In rural areas, harvests are kept in the open before being stored in granaries. The forecasts helped the producers protect their harvests from unforeseen rainfall.
- **Community learning**: Ninety one percent of the producers were in the habit of sharing advice and forecasts with other producers and family members, some of whom even signed up voluntarily.

3.4 Comparison of averages before and with Sénèkèla/ Sandji

The result of the comparison test shows a significant difference between the quantities of fertilizer, herbicide used and work time following the use of the Sénèkèla/ Sandji platform.

Table 1: Student's t-test result. Source: Field survey.

Variables	With Sandji	Before Sandji	Difference (%)	P-value
Area (Ha)	3,485,598	3,094,293		0.30
Quantity of seed used (Kg)	83.69	78.40		0.72
Quantity of fertilizer used (Kg)	369.16	479.23		0.08
Amount of herbicide used (Liter)	12.90	12.92		0.99
amount of insecticide used (kg)	9.83	16.79		0.003**
Working time (Man/day)	123.47	158.32		0.03**

*** Significant at 1%, ** significant at 5%, * significant at 10%

Results of the paired student's t-test before and with Sandji is presented here.

IV. Discussion

The results of our investigations show that climate forecasts have contributed significantly to reducing the production costs of farmers. This is confirmed by Simelton (2017) in a similar study conducted in 2019 showing that farmers have more capacity to plan agricultural activities thus avoiding wasting inputs, which saves both seeds, fertilizers, pesticides and labor, all of which can be converted into monetary values. In fact, since climate information appeared reliable, and understandable, most of the forecasts were used to carry out sowing. The sowing dates are key periods for the farmers in that nearly 25% of the sowing is delayed due to poor start to the rains (Marteau et al., 2011). Moreover, rainfall forecast information allowed farmers to choose crop varieties according to their cycle length and the area to be planted. Farmers can benefit in terms of increased income and reduced climate risk through the use of scientific seasonal forecasts (Sultan et al., 2013). Our study does not directly show the impact of using climate information on agricultural production. However, another study in Ghana indicated that 90% of the producers who integrated the use of climate information via phone into their farming practices saw an increase in their productions (Nikoi et al., 2016). Moreover, in Senegal, a study similar to this one was conducted to assess the proportion of farmers who had access to information services and the impact of these services on farmers' decisions and behavior. That study concluded that the yields of test farms that strictly applied climate information were higher than those farms that did not strictly apply climate information (Lo and Dieng, 2015).

Conclusion and policy implication

From the study conducted among producers, we can state that the Sénékèla/Sandji platform is an innovative and effective tool to help strengthen farm resilience to climate change. Its use during the 2021-2022 agricultural season has had a beneficial impact on the lives of beneficiaries; thanks to the forecasts, the producers were able to better plan their agricultural activities and improve their level of efficiency through the optimal use of inputs, in addition to community learning.

Several policy implications emerge from our study. Private and public investments are needed to improve producers' access to climate information, particularly by increasing the areas covered by the network, reducing the level of illiteracy in rural areas, and making the Sénékèla/Sandji platform as widely available as possible in the farming community.

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