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Agri-Food Sector Green Innovation Centers Project (ProCIV)

"Evaluation of the performance of the forecasting system meteorological data by IGNITIA and ProCIV »

Final report

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ignitia TROPICAL WEATHER FORECASTING

SOFITEX

SUMMARY

summary

The Green Innovation Centers Project (ProCIV) in partnership with the Swedish company IGNITIA, SOFITEX and the Ministry of Agriculture and Hydro-agricultural Development (MAAH) provided a rainfall forecasting service to producers in the West region of Burkina.

In June 2019, 75 SOFITEX and ProCIV agents were trained to master the use of forecasts for the supervision of approximately 4,300 beneficiary producers. The service was provided from June to October 2019 to producers.

The results of the evaluation of the performance of the system reveal that the producers used the information on rainfall to plan their agricultural activities and to better manage the various cropping operations during the agricultural season.

The relevance of the service provided is supported by statements from beneficiaries. A coherence of the intervention has been sought through the partnership with SOFITEX to reach the greatest number of producers in the West and to take corrective measures on the quality of the service during the implementation.

The weather forecast system was effective. 75% of the producers surveyed received daily messages regularly, every morning at the same time. According to agents, producers often found them accurate to the point of winning their confidence completely. The producers and supervisory staff unanimously agreed on the reliability of the service.

67% of the producers surveyed used the forecasts to better manage plowing operations and sow at the right time (85% of these producers). Producers cited the 100% frequency saving in pesticides, as resulting changes in forecast use during the season. Producers' access to weather forecasts has reduced fertilizer and pesticide losses. 85% of the producers surveyed declared having used the forecasts to carry out effective weeding or ridging. In addition, there was efficient management of the workforce (83% of producers). Finally, 82% of the producers surveyed declared having harvested, then dried and stored at the right time thanks to the meteorological information.

The effects produced by the use of forecasts are noticeable, according to the statements of the beneficiaries. The optimum management of inputs combined with the good management of cultivation operations probably impacted the increase in the production of the beneficiaries. However despite attempts during the study, there is no certainty to quantify these effects. Several parameters may have interfered, including rainfall.

In terms of sustainability, the availability of beneficiaries to contribute to the financing of the service lays the foundations for its continuity.

From a gender perspective, the technology provided has been useful for low-scale female farmers on small plots. The weather forecast information allowed them to plant and harvest at the right time.

Despite these results, the quality of the service provision and in particular its consistency, remains the main determinant for the adhesion of all the actors, mainly the extension services and the producers.

1. Context

The Green Innovation Centers Project (ProCIV) operationalizes the special initiative “One world without hunger” of the German Ministry of Economic Cooperation and Development (BMZ) which aims to reduce poverty and hunger in the world.

In Burkina Faso, the project operates in the Hauts-Bassins, Cascades, Boucle du Mouhoun and South-West regions, mainly in the value chains (CVA) of sesame and rice. Its aim is as follows: “innovations in the agricultural and food sectors have contributed to sustainable rural development in the selected rural regions”.

To achieve this objective, ProCIV operationalizes three (03) main modules: (i) Module A: Local innovation systems; (ii) Module B: Capacity building; (iii) Module C: Agribusiness.

In connection with these strategic axes, ProCIV concluded in May 2019 a contract with IGNITIAGhana Ltd to provide, over the period from June 17 to October 18, 2019, daily rainfall forecasts by SMS to 5,000 producers in its area of intervention.

At the start of the activity, 4,307 producers were identified by ProCIV in collaboration with SOFITEX, for the reception of forecasts by SMS. The sending of messages began at the end of June 2019 after the census of producers, subscribers of the telephone companies Orange, Telmob and Telecel.

Alerted from the start of a reception of messages below expectations and in a pronounced way among Orange company subscribers, ProCIV organized a telephone survey in July 2019 among a sample of 150 producers. The results confirmed the initial concern, indicating about 30% receipt of messages. With the support of IGNITIA, a correction was made tending to standardize the reception of messages from August.

Subsequently, ProCIV planned a more systematic mid-term evaluation by telephone with 450 producers to obtain an initial feedback from users on the quality of the service.

The results of this evaluation produced the following information: (i) message reception estimated at 60%, with the performance of the 3 networks more or less comparable; (ii) a large majority of receiving SMS 5 to 7 times per week; (iii) approximately 66% of the producers in the sample, readjusted according to their accessibility, consider the information provided on the forecasts to be fairly accurate and useful for planning their activities.

Based on these preliminary results, ProCIV planned a final performance evaluation of the experienced weather forecasting system, mainly to find out what the beneficiaries may have done with the information received. The evaluation focused on the producers who, during the mid-term telephone evaluation, expressed their satisfaction and stated that the information received is useful for planning their field work.

2. Weather forecast supply program

2.1Partnership

During the 2019 agricultural campaign, the Green Innovation Centers Project (ProCIV) in partnership with the Swedish company IGNITIA, SOFITEX and the Minister of Agriculture and Hydro-agricultural Development (MAAH) and with the company SOFITEX cotton, provided a rainfall forecasting service to producers in the large western region of Burkina Faso, in order to assess the performance and impacts of the forecasting system.

2.2 Identification of beneficiaries

The beneficiaries of the service are initially the sesame and rice producers supervised by ProCIV as part of its agricultural value chain development program in the Hauts-Bassins, Cascades and Boucle du Mouhoun regions. and Southwest. These producers, identified by ProCIV agents at the start of the season, present two profiles according to the agricultural production zones. The first profile is that of small producers of rainfed rice and sesame, generally combining maize.

The census of these producers by ProCIV agents requiring the geolocation of producers took a little longer than expected and limited the target number to around 1,700 producers.

The second group which has joined the producers supervised by ProCIV consists of cotton producers from the cotton regions of Banfora, Bobo and Houndé, supervised by SOFITEX. These producers were identified as part of a first pilot weather forecast experiment conducted by IFDC and IGNITIA, during the 2017 crop year. They are large producers, operating an average of ten hectares of land. area and generally providing direct loads of their production to the ginning plant. These producers often also produce sesame.

Their census consisted of a clearance of the basic list of 4000 producers supervised by SOFITEX in the cotton regions of Banfora, Bobo-Dioulasso, Dédougou and Houndé, having

benefited from the forecasting service in 2017 as part of an IFDC, SOFITEX and SOCOMA partnership.

Together, a total of around 4,500 producers were selected for the provision of weather forecasts, including 3,800 cotton growers, and 1,700 producers supervised by ProCIV. For each producer, the geographic coordinates of its main field were measured and recorded. Finally, around 4,300 producers were selected after verifying the telephone numbers and eliminating duplicates.

2.3 Implementation

2.3.1 Calendar

Following the census of producers, ProCIV planned the training sessions for agents. The training of ProCIV agents was organized at the beginning of June and that of SOFITEX agents in the last week of June 2019.

The provision of the Service began in June for producers supervised by ProCIV and in July for those supervised by SOFITEX. The service provision was stopped in October.

2.3.2 Monitoring by agents

After the training of the producers, the agents proceeded to verify the reception of the messages by the producers, their comprehension capacities and the accuracy of the predictions.

Then, as part of their day-to-day activities, officers followed up with producers to further explain the content and use of the messages.

2.3.3 Monitoring of the process by the beneficiary institutions

After the start of the service provision in June for producers supervised by ProCIV and July 2019 for those supervised by SOFITEX, ProCIV implemented a mechanism for monitoring and evaluating the activity. Communication between ProCIV and SOFITEX remained quite limited during this period.

The first follow-up activity consisted in verifying the effective reception of the messages at the level of the producers benefiting from the service. Feedback from SOFITEX and ProCIV agents revealed a low SMS reception rate, particularly for numbers from the ORANGE mobile telephone network. In order to better understand the problem, ProCIV organized a small survey by telephone with 150 producers.

The results of this first survey confirmed a reception of 30%, well below expectations.

Several hypotheses on the reasons for non-reception have been formulated, in particular the temporary absence of the subscriber, an incorrect number, a blocked number, the lack of prior information from the producer on the service, the lack of coverage. through the network, etc. On the basis of these worrying results exchanges between ProCIV and IGNITIA and then between IGNITIA and telephone companies resulted in an improvement in the provision of the service from August.

Subsequently, in August 2019, in order to verify the various assumptions and to have an initial feedback from users on the quality of the forecasts, ProCIV organized a more systematic mid-term evaluation with users. This mid-term evaluation consisted of a telephone survey of selected supervisors, called upon to inform and train producers before the start of sending SMS messages, and a telephone survey based on a questionnaire to 450 producers.

The results of the mid-term review confirmed the assumptions for non-receipt reasons and also produced some new information on receipt. An average reception of 58% was estimated, with reception confirmed by Telmob, Orange and Telecel subscribers at 61%, 59% and 40% respectively. 65% of users received the messages 5 to 7 times a week. Almost all the producers (99%) who receive the messages on a regular basis find the forecasts always or generally correct and 66% find the information useful for planning their activities.

At the end of the first two phases of rapid assessment of the provision of the service, focused on reception factors and the general assessment of the system, ProCIV is interested in the last phase of the assessment in use. and the exact usefulness of the forecasts for producers who have always received the messages, and who have stated that they find them correct and useful.

This report describes the results of this final phase of the assessment.

2.3.4 Reported constraints

At the start of the exercise, several constraints were reported during the start-up phase:
The time taken for the census of producers has impacted the schedule of agent training which happened later than expected.

The monitoring of the producers by the agents was mainly limited to checking the reception and understanding of the messages.

At the start of the service provision, a low message reception rate was observed, particularly on Orange numbers.

3. Evaluation

3.1 Objectives of the evaluation

The overall objective of the evaluation was to investigate the SMS weather information provision service for future promotion as a reliable and viable service.

More specifically, the evaluation aimed to collect and analyze information in order to:

- Understand the use and benefits (quantitative and qualitative) of the service for producers;
- Have an indication of the effect of the information on returns;
- Understand the opinions, interests and perspectives of producer-users on the system;
- Appreciate the willingness of users to contribute to such a weather forecast service.

3.2 Methodological approach of the study

The approach adopted to evaluate the performance of the meteorological forecasting system piloted by ProCIV and IGNITIA favored a consultative and participatory approach, a proximity survey approach with a reasoned sample, the consideration of gender and the triangulation. Its main stages are listed below.

3.3 Development of the analysis plan

The development of the study analysis plan was the roadmap for organizing and analyzing survey responses to achieve the evaluation objectives set out in the terms of reference. This plan provided, in a precise manner, the information that will be collected through the design of the collection tools with the segmentation of the people surveyed, the detailed program for the implementation of the evaluation study and the outline plan of the report. final.

3.4 Development of collection tools

Guided by the analysis plan, three (03) data collection tools described below were designed to collect the data necessary to make appropriate judgments about the weather forecast system.

- **Questionnaires for individual interviews**

Two types of structured individual questionnaires were designed to collect quantitative and qualitative information. One is addressed to the head producers who have received the forecasts by SMS and the other to the extension agents of ProCIV and SOFITEX, who have supported them.

- **Focus Groupe interview guide**

An interview guide was produced to conduct the semi-structured interviews with the groups of producers who benefit from the weather forecast service.

3.5 Scoping of the study

The scoping meeting took place on November 30, 2019 at the ProCIV office in Bobo-Dioulasso. It made it possible to analyze the methodological approach proposed for the evaluation as well as the tools developed for data collection and to retain a consensus methodology.

The work of the meeting resulted in the choice of sampling and the amendment of the 03 data collection tools, in particular the producer survey sheet, the focus group survey sheet and the agent survey sheet. The schedule for the conduct of the field collection phase was determined according to the geographical location of the places of residence of the people targeted for the surveys.

3.6 Development of the sampling strategy and selection of samples

In order to concentrate on the actual use of the forecasts, the sampling was of a reasoned type. It was drawn from the sampling frame of a random sample of 450 producers out of 4,307 beneficiaries, formed during the mid-term evaluation carried out by ProCIV in August.

From this sampling frame, it was filtered a population of 100 producers who estimated during the mid-term evaluation the reliable and exact forecasts and to have received at least 04 SMS per week.

Considering a 10% confidence interval and a 10% margin of error, 55 individual interviews were sorted. This sorting took into account the number of beneficiaries per village, the grouping of sampled villages to minimize travel, the support partner (ProCIV or SOFITEX), accessibility and security constraints, geographic representativeness at scale. of the greater West region. The table below summarizes the sampling methodology.

Table: N ° 1: Sampling methodology

Selection criteria on a sample of 450 interview producers surveyed at m i-par or rs			**Number producers**	**Number focus agent interviews at group (H + F + J) investigate**	**Number Villages Tools**		**of collection**
Reception at least exact useful week	Infor- mation or 04	Forecast SMS per often exact	55	5	10	5	3

Source: Producer surveys - field evaluation phase

The choice of villages is reasoned on the basis of the sampled producers. The collection tools are the questionnaires for agents, producers and focus groups.

3.7 data collection

The data collection concerned primary and secondary data.

The documentary review focused on exploiting the reports produced previously on the training of trainers and the results of the mid-term evaluation of the experience in order to gather the relevant elements to feed the analysis of the results.

The other main source of data collection was the conduct of individual interviews and focus group with the beneficiaries who are the producers receiving the SMS on forecasts and the extension agents of ProCIV and SOFITEX. The diversity of actors interviewed served to triangulate the information collected.

The data collection covered the period from 03 to 17 December 2019 and resulted in the results quantified in the table below.

Table: N ° 2: Number of individual and focus group interviews

	Interviewed producers			**Agents Interviewed**			**Focus Group interviews**			**Total**
Region	ProCIV	SOFITEX	**Under Total**	ProCIV	SO-FITEX	**Under Total**	ProCIV	SO-FITEX	**Under Focus**	
BMH	7	3	10	1	2	3	1	0	1	**14**
Waterfalls	0	8	8	0	5	5	0	1	1	**14**
Tops Basins	6	13	19	3	3	6	0	0	0	**25**
South West	3	0	3	1	0	1	1	0	1	**5**
Total	**16**	**24**	**40**	**5**	**10**	**15**	**2**	**1**	**3**	**58**

Source: Evaluation survey results

3.8 Data clearance, analysis and processing

The data collected was entered in Excel, filling in all the variables identified for the analysis. Two types of data were entered, namely quantitative data and qualitative data.

The next step was to check the contents of the database, in order to eliminate any inconsistencies. Additional information was sought from certain producers and agents surveyed in order to verify the accuracy of the data considered to be outliers and to correct them.

The modalities of the qualitative data of the variables were coded to facilitate their importation and their processing in the analysis software. The database thus constituted was imported into the SPSS software for analysis on the basis of the elements of the analysis plan prepared. In addition to SPSS, the data was analyzed in Excel.

The processing of quantitative and qualitative data produced the first statistical tables and tools that were used for data analysis.

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3.9 Reporting

All of these analyzed data formed the backbone of the production of the provisional report, taking into account the evaluation questions and the expected results.

4. Limitations of the study

The study sought to assess the yields of crops that were used in weather forecasts and the quantities of inputs used over the last three (03) agricultural seasons. These measures were based on the declarations of the producers, which were sometimes forecast or subject to interpretation or omission. Other more appropriate tools than simple declarations would have made it possible to objectively measure these types of data.

Also, we were confronted with the absence and or the insufficiency of certain data leading to recontact certain informants.

Finally, one of the main limitations was the low quota of interviews with women, which in turn was limited by their low participation in the experiment. This is linked to the fact that the program targeted heads of farms.

5. Study results

5.1 Main characteristics of the individuals surveyed

The individuals surveyed are Agents and Producers supervised by ProCIV and SOFITEX in western Burkina Faso.

The producers surveyed are composed of 98% men and 2% women. 14% of these producers are under 30 years old, 38% are in the 30 to 40 age group and finally 48% are over 40 years old. The age range of the agents surveyed is presented in the table below.

Table N ° 3: Age group of officers surveyed

Slice Age Agents	Percentage
> 35	60.0
16-35	40.0
Total	**100.0**

Source : Agent evaluation survey data

About 75% of these producers are literate, 38% are at primary level and 21% at secondary level.

The main crops sown are cotton, maize, rice, sesame, sorghum and cowpea.

5.2 Assessment of the implementation process

5.2.1 Producer census

The geo-referencing of producers took a little longer than expected and limited the number of producers initially targeted by ProCIV. This process delayed the training of agents, then subsequently that of producers, leading to a later start than hoped for the provision of the service by IGNITIA, particularly in June for producers supervised by ProCIV and in July for those supervised by SOFITEX.

A future weather forecasting program should take into account the time needed for the census of producers in the timing of the planning of its activities.

5.2.2 User training

❖ **Training of trainers**

The survey revealed that 20% of the agents surveyed did not participate in the training of trainers session. Not having been trained in the use of weather forecasts, these agents did not train the beneficiary producers, for whom they were responsible for supervising. This probably helped to lower the rate of producers trained to use the forecasting service.

Measures should be taken to ensure, in a future forecasting program, the training of all the agents supervising the producers who should benefit from the provision of the service.

❖ **Training of producers**

Generally, agents have organized training for producers through producer grouping centers, ranging from 1 to 4 centers depending on the number and location of producers.

SOFITEX agents trained producers most often during practical training carried out to develop technical itineraries through field schools set up during the campaign. In some cases, officers have individually trained heads of farms, close to their places of residence.

The survey carried out among producers indicates that 25% of the producers surveyed have not been trained.

The main reason reported by agents on the reasons for the unsatisfactory participation of producers in the training is the inadequate period which coincided with an intense occupation of the producers for the seedlings, activity decisive for the success of the agricultural season. SOFITEX agents also said they were taken on several tasks during this pivotal period of the campaign.

The other reasons reported are the long distances to be covered by some producers to reach the training centers and sometimes requiring support. There was also initially the reluctance of some producers, thinking of yet another activity before realizing its effectiveness later.

The training of producers should be planned for a period allowing their full participation.

5.2.3 Activity monitoring

❖ **Monitoring of producers by agents**

At the end of the training of the producers, the agents carried out a follow-up of the producers for the exploitation of the messages received. At the start of the reception of messages, some agents made the producers aware of the fact that they were constantly on the telephone network every morning in order to read the messages sent regularly.

Then, the follow-up consisted of checking that the producers received the messages and that they were able to use them, and if necessary to assist them in the event of difficulty. Officers also verified the accuracy of the forecasts and their use by producers.

However, 20% of the agents surveyed declared that they had not carried out any formal monitoring of the activity. The reasons given are the absence of orientation at the institutional level and the non-participation in the training of trainers, which did not allow them to be equipped to supervise producers.

The agents' follow-up made it possible to report early on the faulty level of message reception, which made it possible to reach out to the service provider to take corrective measures as soon as possible.

According to the agents, a more formal follow-up of the producers over the duration of the campaign would have allowed a better use of the technology by the producers.

5.3 Quality of service

❖ **Service provided**

Messages were sent regularly after the corrective measures taken at the start of the supply.

About 75% of the producers surveyed declared that they received the messages every day and only 25% received 4 to 5 messages during the week. Daily messages providing 24-hour and 48-hour forecasts arrive at the same time each morning.

For reading these messages, 70% of the producers surveyed said they understood the content. The remaining 30% illiterate were assisted either by an educated member of the family, or by a neighbor, or the secretary of the group, or even by the agent.

The delivery of daily messages was therefore efficient after the corrective measures taken on the reception level at the start.

Unlike daily messages, the reception of monthly and seasonal messages was poor. Only 35% of the producers surveyed declared having received the monthly and seasonal messages. 15% do not know if they received it. 50% of producers surveyed therefore declared that they had not received monthly and seasonal messages.

Of the 35% who received them, only 43% managed to understand them. Otherwise, only 15% of the producers surveyed were able to use the monthly and seasonal messages.

The reception and use of monthly and seasonal messages were therefore not satisfactory.

❖ **Reliability of forecasts**

According to the agents surveyed, the producers they worked with during the campaign consider the forecasts reliable. 14 supervisory staff out of 15 surveyed stated that the forecasts were often correct. Only 1 agent found them to be average.

The focus group survey of producers confirms this opinion. Producers believe the forecast is at least 80% correct.

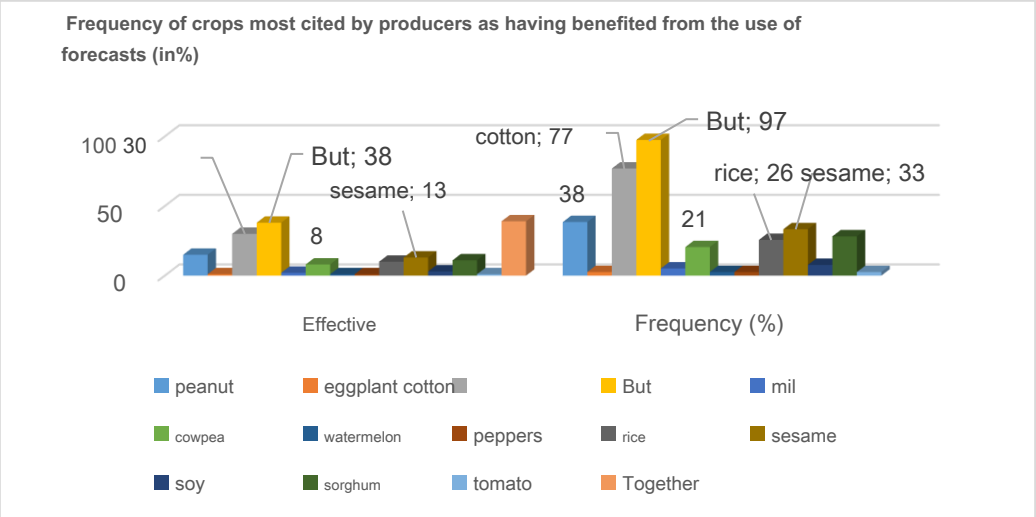
5.4 Use and benefit of the service

5.4.1 Benefits reported by producers

Producers said they benefited from using the weather forecast. Rainfall information enabled them to better manage plowing and sowing operations, better manage the application of fertilizers and pesticides, better manage crop maintenance and labor, and finally better manage harvests. and post-harvest.

❖ **Main crops**

The main crops that have benefited from the use of the forecasts according to the producers are maize (frequency 97%) and cotton (frequency 77%), as well as sesame (33%) and rice (26%), as illustrated in figure N ° 1.



Source: Producer surveys - field evaluation phase

Graph N ° 1: Main crops that have benefited from the use of forecasts

In the farms benefiting from the service, the women used the forecasts on their small plots of sesame and peanuts cultivated in addition to common family fields. However, the small size of the surveyed sample does not allow conclusions to be drawn.

❖ **Land preparation management**

33% of the producers surveyed did not use the weather forecast when plowing. This is because some growers had already plowed their fields at the start of the weather forecast service provision. Others did not yet understand the point.

67% of the producers surveyed therefore used forecasts to better manage plowing operations. Some testimonials from the producers are listed below.

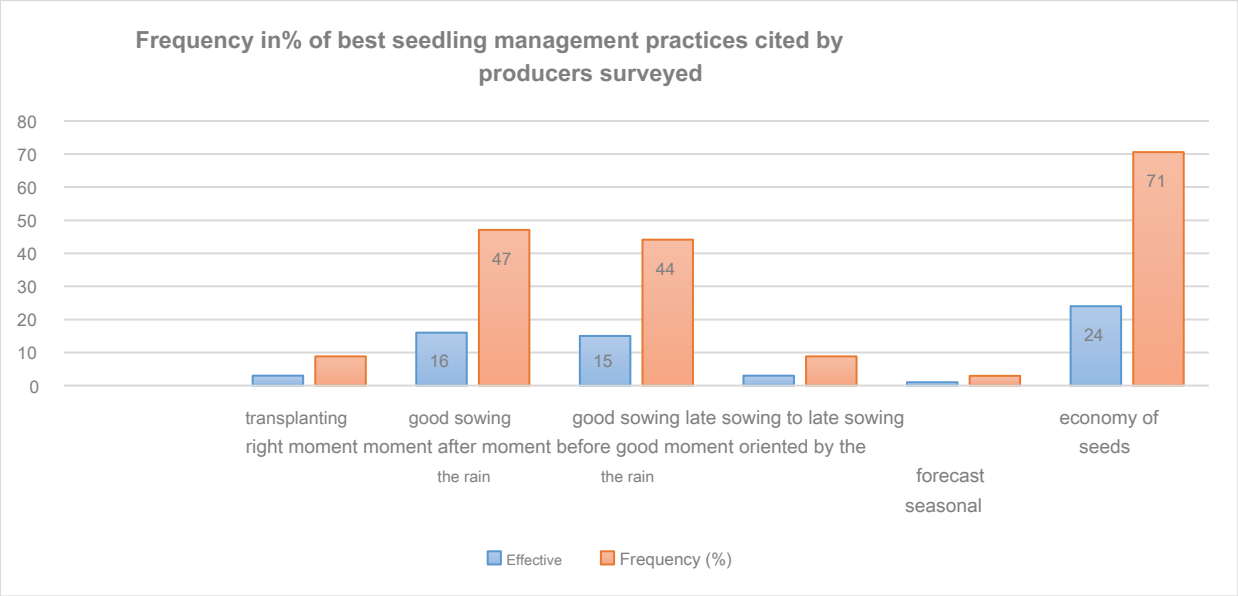
While I was waiting for the rain to plow and be able to sow, I received a message predicting a heavy morning rain for the next day. This information helped me make the decision to anticipate same day dry plowing with the tractor. The next morning it rained. I sowed after the rain and the plants grew well.

If I receive a message in the morning predicting rain the next day, I postpone the plowing for the next day after the rain. This allows me to carry out another activity. The rainfall information allowed me to have deep plowing with the ease of crushing the earth for leveling and increasing the plowed area in a shortened time.

❖ **Seedling management**

85% of the producers surveyed declared that the use of weather information enabled them to sow at the right time, before or after the rain. This rate, although high, is limited by the fact that some producers had already sown when the service was started or even by the fact that some producers did not yet understand the content of the messages.

The new practices for better management of cropping operations cited by producers for sowing at the right time, and therefore better managing sowing and the gains obtained are presented in graph N ° 2.



Source: Producer surveys - field evaluation phase

Graph N ° 2: Good seedling management practices using the forecasts cited by the producers surveyed

Seed savings were the characteristic gain from using forecasts according to 71% of the producers surveyed (71% frequency). With rainfall information, a greater proportion of growers prepare to sow after the rain (47% of frequency cited) while the others anticipate to sow (44% of frequency) being almost certain that it will rain. These two practices are illustrated by the testimonials of the producers:

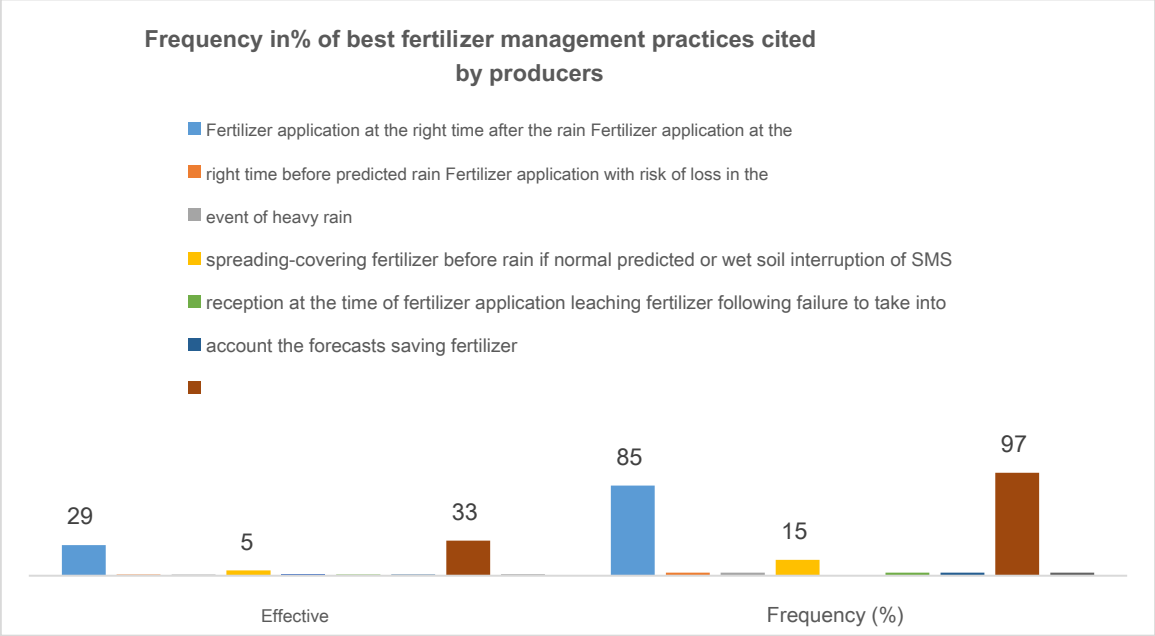
During the 26-day pocket of drought, I received a message one morning predicting heavy rain the next day. I then got ready and waited until the next day to plant my corn after the rain. It did rain and the seedlings germinated well after 04 days.

I used 25 kg of corn seeds obtained from the agricultural service, on an area of 1.75 Ha. Thanks to the use of the weather forecast, I did not have to re-sow and there was a residue of seeds. In comparison, last year, I received 50 kg of corn seeds that I used on an area of 1 Ha. The seedlings were affected by a pocket of drought which led me to reseed.

At the start of the sowing, I still did not receive the messages. I sowed the cotton, there was no rain and the seeds rotted. Subsequently when I started to receive messages, I received a message predicting rain. Having the habit of sowing dry, I sowed in anticipation and it rained. The result was satisfactory with good cotton emergence.

❖ **Fertilizer management**

86% of producers surveyed declared that they had used forecasts to better manage the application of their fertilizer. The good practices adopted for the management of fertilizer, cited by the producers surveyed, are presented in graph N ° 3.



Source: Producer surveys - field evaluation phase

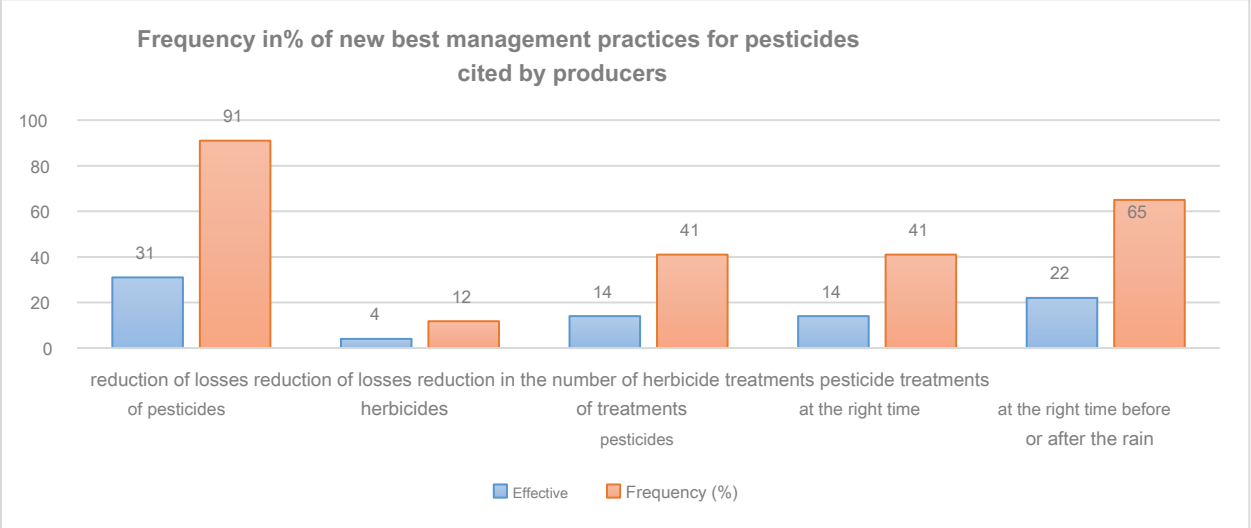
Graph N ° 3: Good fertilizer management practices through the use of forecasts

The use of rainfall information allowed producers to apply the fertilizer at the right time after the rain (frequency of 85%) and to avoid losses through runoff.

A producer surveyed testifies: *This year I didn't have to waste any fertilizer unlike in previous years. Two years ago I produced corn. When applying the fertilizer, I carried the necessary fertilizer to the field to cover the entire area with the help of a workforce that I had mobilized. After spreading the fertilizer over 1 Ha, it started to rain before the workers had time to cover it. The ground being sloping, the rain washed away the applied fertilizer. I had to add 3 bags of fertilizer, or 150 kg, on my plot of 2 Ha of corn.*

❖ **Pesticide management**

100 /% of producers who had access to meteorological information declared that they had better manage pesticide treatments. The new best management practices for cropping operations cited by producers are shown in Figure 4.



Source: Producer surveys - field evaluation phase

Graph N ° 4: Good pesticide management practices through the use of forecasts

Pesticide losses (91% frequency) were eliminated this year according to the producers surveyed because of the use of forecasts. They made it possible to carry out pesticide treatments at the right time before or after the rain (frequency 65%). The producers testify:

I had invited a large group of people for the insecticide treatment in my cotton field. I received a message in the morning predicting an early morning rain. So I made the decision to postpone the treatment. That day there was a heavy rain. If I had not postponed the treatment I would lose my products.

In the past, I was often unsuccessful in herbicide. Thanks to the forecast information, I always wait until after the predicted heavy rains before treating. This has allowed me this year to successfully eliminate weeds.

❖ **Management of cultural maintenance**

85% of producers surveyed declared that they had used forecasts to better manage crop maintenance. Growers used the forecast to effectively weed or weed at the right time after or before the rain. A producer testifies:

I had planned to weed my cornfield with my family. I received a message predicting morning rain. I warned my wives who were surprised because there were no large clouds formed. We postponed the weeding work and went about other business and it did rain.

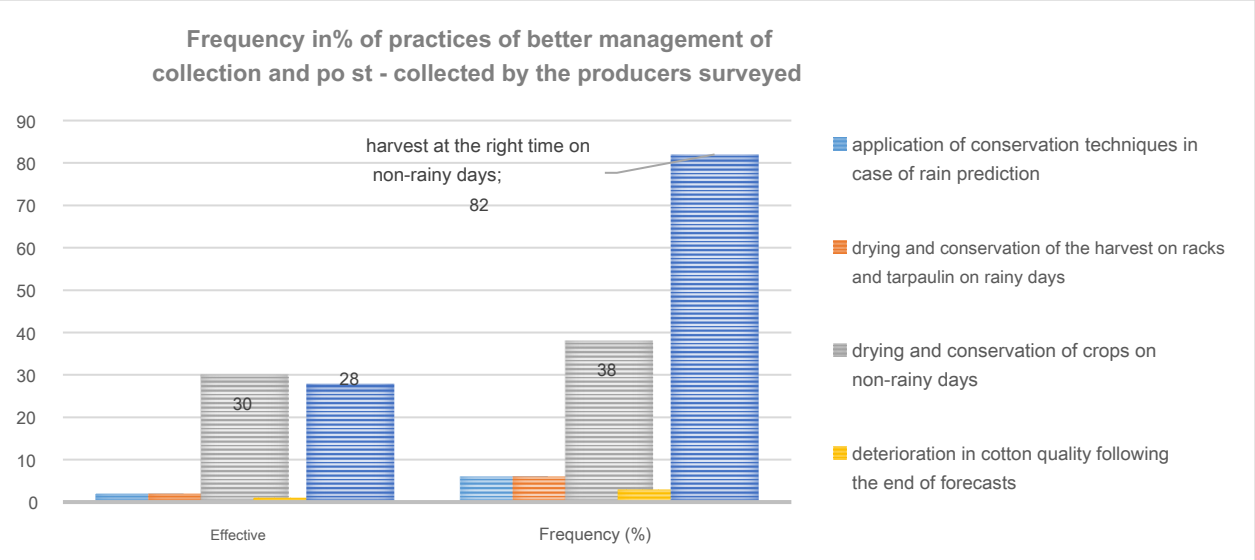
❖ **Workforce management**

According to 83% of the producers surveyed, the use of forecasts enabled them to manage labor efficiently, by planning it at the right time without risk of losing the money spent in the kitchen or of remuneration, due to of an impediment by a rain. A producer testifies:

During the winter season, I had mobilized a workforce of 30 people for the work in my field. The day scheduled for the work, I received a message announcing a morning rain. Women had to prepare for workers. So I hurriedly returned to my field to deprogram the work. It actually rained around 12 noon that day. If I had not received the information, I was going to waste my money on kitchen and labor expenses without the planned work being perfectly done.

❖ **Harvest and post-harvest management**

Producers have better managed harvests, drying and conservation of harvests with access to information on forecasts for, according to 82% of producers surveyed. However, for certain producers and certain crops, at the time of harvest, the reception of SMS had been stopped, in particular in October.



Source: Producer surveys - field evaluation phase

Graph N ° 4: Good harvest and post-harvest management practices through the use of forecasts

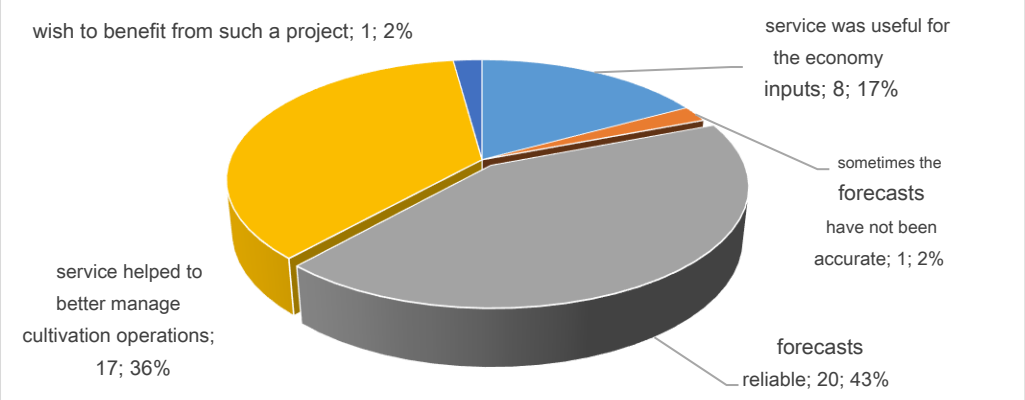
According to the producers, the harvests were carried out at the right time on non-rainy days (82% frequency) as well as the drying and conservation of the crops (38% frequency), thanks to access to weather forecasts. Some testimonials from producers illustrate the good practices adopted:

I don't harvest if the forecast calls for rain. Last year the rain hit my lowland rice production because I did not receive a weather forecast.

We produce rice in a lowland which quickly becomes engorged with water. At harvest time, I received a message announcing an afternoon rain and a morning rain the next day when I had to start the rice harvest. I postponed the harvest in order to avoid exposing it to the rain and consequently to favor the deterioration of the quality of the harvested rice.

❖ **Opinions of neighboring producers**

Producers reported opinions from neighbors with whom they shared weather information (Graph N ° 5).



Source: Producer surveys - field evaluation phase

Graph N ° 5: Opinions of neighbors reported by l beneficiaries of the service

The main opinions of neighbors reported by beneficiaries are the reliability of forecasts (43% frequency) use for better management of cropping operations (36% frequency) and savings in fertilizer (17% frequency).

The average number of beneficiary neighboring producers as well as the average distance from the nearest neighbor field are reported in the table below.

Table N ° 4: Average number and average distance from fields of neighbors who have benefited from sharing information on weather forecasts

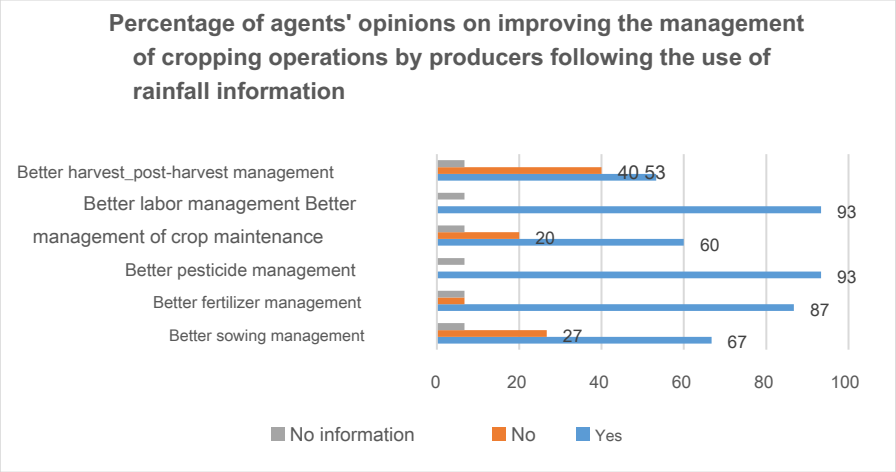
Statistics	Average number of Neighbors benef here		Average distance to neighboring field near (Km)
Sample number	Valid 39		33
Average		11.51	5.15
Std. Deviation		10.908	4.797

Source: Producer surveys - field evaluation phase

The beneficiary producers would have shared the rainfall information with 11 neighbors on average, 5 km apart on average.

5.4.2 Benefits reported by management

100% of the sample of 15 agents surveyed believe that producers' access to rainfall information has helped them to better manage crop operations, particularly sowing, application of inputs, crop maintenance, harvesting and post -harvesting and organization of the workforce (Cf Graph N ° 6).



Source: Agent survey - field evaluation phase

Graph N ° 6: Management practices of producers' cropping operations following the use of forecasts, reported by agents,

It emerges from the opinion of the agents surveyed that the management of agricultural labor, pesticide treatments and the application of fertilizers are the farming operations that have benefited the most from the use of rainfall information. 93% of the agents surveyed noted better management of pesticides and labor by producers due to access to meteorological information. 87% noted better management of fertilizers.

However, 40% of the agents felt that the producers did not use the forecasts for the harvest and post-harvest operation for two reasons. At harvest time, the month of October was continuously rainy and, the other reason, the reception of messages was stopped in the month of October.

27% of agents also believe that the producers did not use the forecasts at the time of plowing because they did not receive the messages yet. It is the same at the time of sowing (20%).

On the basis of these opinions, the agents described the effects of the use of forecasts on the change in producers' practices towards better management of the various cropping operations and respect for technical itineraries.

According to them, the forecast information has enabled growers to factor in rainy days to **better planning of plowing.** For example, if the farmer programs to plow his field and he receives the message that says "today likely dry weather". It leaves and it passes to another activity. On the other hand, if the message announces today (or tomorrow) rain or a great chance of rain, it is 100% sure that it will rain. In this case, he begins to plow. This allows him to save time in carrying out multiple tasks and to benefit from other plowing contracts. The plowing was carried out without difficulty. However, some producers had already plowed before receiving the SMS.

When sowing, if the grower receives an SMS "great chance of rain or heavy rain", he refrains from sowing before the rain. He sows afterwards. On the other hand, he anticipates to sow when the message foresees normal rain. It does not sow during a period of "dry weather". This practice enabled producers to save seeds, have good germination rates and avoid reseeding.

Usually, growers wait until they hear a rain message before **to apply the fertilizer.** If the grower notices that it is normal rain, he anticipates to apply the fertilizer. On the contrary, if it is a heavy rain, he waits after the rain.

The forecast helped the producer to **apply phytosanitary treatments** without risk of leaching. He consults the messages before making the decision to process. If the message is for rain, it waits until after the rain to process.

At the time of weeding the grower uses the forecast for planning effective weeding that will prevent regrowth.

The weather forecast provided a compass for the farm manager in **the use of its workforce.** If heavy morning rains are forecast, it gives the alert to wait for the scheduled activity, for example phytosanitary treatments or the spreading of fertilizers in order to avoid losses.

The rainfall information allows the producer **plan harvesting periods** and the days of drying of its products, in order to obtain a good conservation and quality products. However, at harvest time, some producers did not benefit from it because of the cessation of SMS.

5.4.3 Opinions, interests, perspectives of Users.

❖ **Producers' opinions**

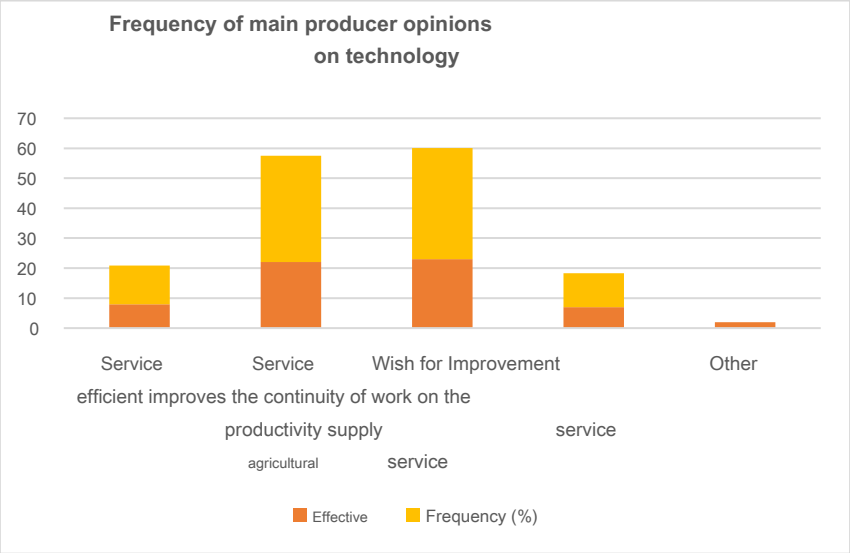
In general, the producers expressed their satisfaction with the use made of rainfall information and would like the actors who support them to mobilize to enable them to integrate this technology from now on into their agricultural campaign. The table below summarizes their main opinions, almost positive.

Table N ° 5: Producers' opinions on the weather forecast service provided

General opinion of producers	Effective	Freq (%)
Efficient service		**12.9**
excellent service	3	4.8
total satisfaction for the service which remains a first in the interventions good working	1	1.6
tool to help producers and users in agriculture	2	3.2
service to be generalized for having produced a lot of profit	1	1.6
best currently reliable channel for providing weather information	1	1.6
Service improves agricultural productivity		**35.5**
service allows the producer to be oriented in the conduct of his activities	2	3.2
service allows a good organization of agricultural activities service will help women to	5	8.1
better plan their agricultural work service will help women save time in their various	1	1.6
tasks	1	1.6
service allows the producer to increase his productivity service prevents	5	8.1
the producer from falling into arrears	1	1.6
multiple benefits from the service such as savings in fertilizers, pesticides, time savings, and increased production	4	6.5
service helps producers avoid loss of inputs	3	4.8
service allows the producer to obtain better returns	1	1.6
Desire for continuity of service provision		**35.5**
willing to pay for the service in view of the benefits derived from the neighbors wish that all	2	3.2
means be mobilized for the continuation of the service	1	1.6
desire for continued provision of the service	17	27.4
SOFITEX and UNPCB must be involved in providing the service	2	3.2
Improvement to be made		**11.3**
good service to improve the interruptions observed at the start of the supply performing	1	1.6
service which can be improved if it is provided very early, in April it is important to train the	3	4.8
producers well to master the use of the service send messages in the main local languages	1	1.6
in more french	1	1.6
send voice messages	1	1.6
Other		**3.2**
Service not used due to illiteracy	1	1.6
very grateful to the project which financed the provision of the service	1	1.6
Total	**62**	**100**

Source: Producer surveys - field evaluation phase

The graph below brings together the main opinions of producers on the technology, detailed in the previous table.



Source: Producer surveys - field evaluation phase

Graph N ° 7: General opinion of producers

The opinions of the producers surveyed focus on two points. This is the testimony on the performance of the service likely to improve agricultural productivity (around 49%) and the need to ensure the continuity of service provision (around 37%).

Indeed, the producers believe that the service has been efficient insofar as they have drawn perceptible benefits. Meteorological information has helped to better manage cropping operations, including plowing, sowing, applying inputs, carrying out cropping maintenance, managing farm labor, harvesting then drying and storing produce at the right time. This good timing allowed them to avoid waste and loss of inputs compared to previous years.

However, according to them, this performance would improve if the service is provided from the start of the agricultural campaign, with good supervision in controlling the use, regularity in the provision of meteorological information and the translation of messages. in the main local languages.

❖ **Agent Reviews**

Table N ° 8: Changes reported by supervisory staff

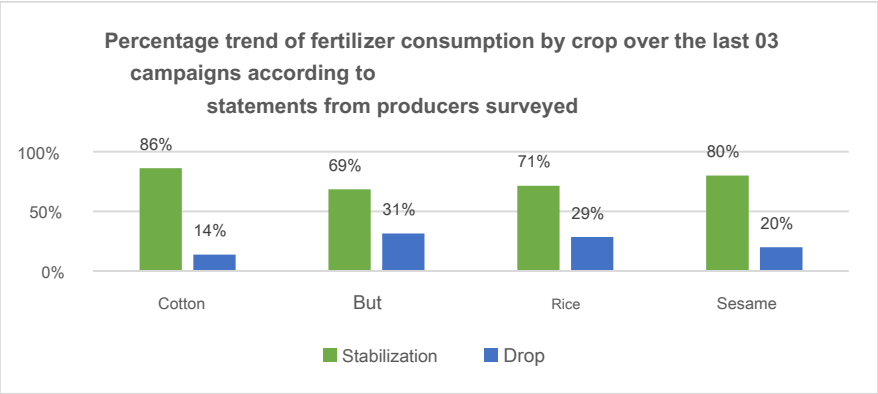
Significant changes in the practices of producers reported by agents
Before, producers watched the sky to see if it was going to rain or not and thus took risks because this approach was not reliable. They worked without orientation, at the head. Now these are the messages that guide them in the organization of their cultivation operations. Producers now avoid inclement weather in the conduct of their activities. During the campaign, they focused on SMS to establish the timetable for their work. They are now making decisions that allow them to make their activities profitable, by increasing their production, thanks to the use of rainfall information. Most importantly, they now have confidence in the information provided by the weather forecast service.
Every morning, the producers hasten to consult the SMS in order to orient themselves on what to do during the day. Weather forecasts have helped them in decision-making for the conduct of their activities, especially concerning the application of fertilizers, phytosanitary treatments, weeding, ridging and management of agricultural labor.
The new practices of producers following access to forecasts allow SOFITEX to reduce the losses of inputs put in place for producers and consequently improve the recovery of input credits.
The use of weather forecasts has fostered the openness of producers towards agricultural entrepreneurship

Source: Producer surveys - field evaluation phase

5.4.4 Effects of the use of the meteorological service

❖ **Effects on fertilizer consumption**

According to producers' statements, access to forecast information enabled them to apply the fertilizer at the right time and not lose it through runoff or leaching, or even neutralization for lack of moisture. The graph below compares fertilizer consumption between the last crop year with forecast use and that of the two previous seasons.



Source: Producer surveys - field evaluation phase

Graph N ° 8: Trend in fertilizer consumption by crop over the last 03 campaigns reported by the producers surveyed.

The data in the graph show that over the last 03 campaigns, the doses of fertilizer added according to estimates provided by the producers, remained stable for cotton (86% of frequency cited), for corn (69% of frequency), for rice (71% frequency) and for sesame (80% frequency). This indicates that the producers have respected the recommendations.

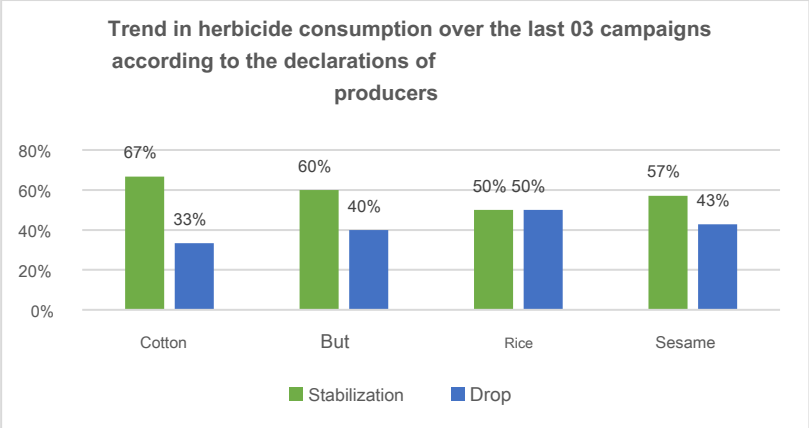
Thus, by respecting the recommended doses of fertilizer and by adding the fertilizer at the right time without risk of losing it, access to forecasts has allowed optimum use of the fertilizer for the benefit of the crops grown and their productivity.

However, for a small proportion (14% for cotton, 31% for corn and 29% for rice), a slight decrease in fertilizer consumption is observed, potentially attributable to several factors, such as underdosing. , lack of availability of fertilizers, diversion for other crops, etc. he
It is not at all confirmed that this decline has any relation to the use of forecast information.

❖ Effects on Pesticide Consumption

It concerns exclusively the consumption of herbicides since the insecticides were used for the cultivation of cotton with generally respect for the recommended dose of 16 l / ha.

Thanks to the rainfall information, the producers have avoided the leaching of herbicide treatments (93% frequency). According to them, they saved the herbicide by avoiding losses and for some by reducing the number of treatments.



Source: Producer surveys - field evaluation phase

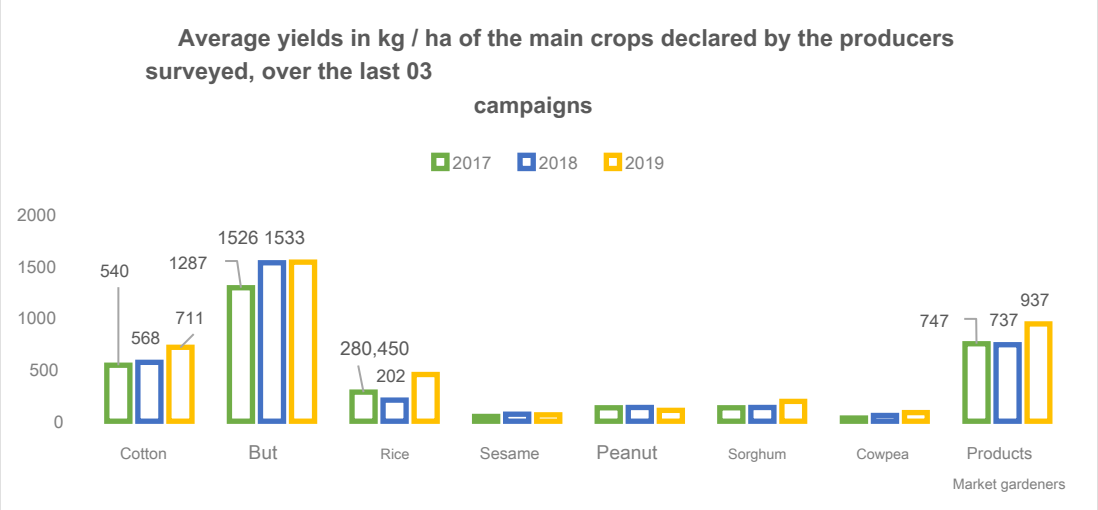
Graph N ° 9: Trend in pesticide consumption by crop over the last 03 campaigns reported by the producers surveyed.

The drop in herbicide consumption over the last three seasons (30 to 50% depending on the crop), declared by the producers surveyed, is more significant compared to that of fertilizers. This trend can be justified, at least in part, by the use of rainfall information. However other factors such as underdosing of the product may have played a role.

❖ The effect of using information on outputs

Producers say they made better use of seeds, fertilizers and pesticides on crops grown during the season, thanks to the information received on the forecasts. They sowed, applied inputs and harvested at the right time. They did not waste inputs that were used well for the benefit of crops. On this basis, the majority of producers surveyed estimated that their production would increase. In order to triangulate this information, an estimate of the areas and productions of the different crops over the last 03 campaigns was made.

based on their statements. The graph below reproduces the results of this estimate.



Source: Producer surveys - field evaluation phase

Graph N ° 9: Average yields per crop for the 2019 campaign that benefited from the use of forecasts and the 02 previous campaigns, declared by the producers surveyed.

The graph shows a significant increase in cotton and rice production in the last crop year, compared to previous years. There has been a slight increase in the production of crops with very few inputs, especially sorghum, cowpea or peanuts.

This increasing trend is confirmed by the statements of an agent investigated and alluding to the use of weather forecasts: *This year, the producers are unanimous on the fact that the production has changed compared to last year. Production yields have increased.*

However, there is no certainty to attribute this increase to the use of weather forecasts as many parameters may have contributed, such as rainfall.

On the other hand, sesame production has declined. Producers report excess water that has harmed flood-prone fields. In general, the main reasons cited by producers, when crop production has not increased, are damage from pests, the downward trend in production, pockets of droughts that occurred in August and September, use of poor soil, excess water at harvest time.

5.4.5 Funding of the service

❖ **The users' point of view on their contribution to access to the service.**

In view of the benefits derived from the use of forecasts, almost all producers (96%) said they were open to paying the cost of the daily message.

Table No. 5: Average price of the estimated daily SMS of the declarations of the producers surveyed

Statistics	Producers surveyed	SMS cost (F CFA)
Number of samples	Valid 34	
Average of the proposed contribution		**23.82 CFA**
Std. Deviation		17,497CFA

Source: Producer surveys - field evaluation phase

The average contribution to the price of the daily SMS calculated on the basis of the declaration of the producers surveyed is around 24 FCFA. This price is close to that proposed during the focus group interviews, which is 25 FCFA.

In addition to the proposals for the contribution to the payment of the cost of the daily SMS, the producers have formulated other support scenarios:

- Identify interested producers and propose SMS pricing per package of services according to the producers' means
- Offer a monthly or seasonal subscription formula like the contractualization adopted by Insurance with variants such as 1,000 FCFA per month, 2,500 FCFA and 5,000 FCFA per season

- Use the cooperative's channel for the provision of the interactive
- pay-per-call service

6. Main conclusions

The evaluation of the performance of the weather forecast system piloted by ProCIV in collaboration with its partners in western Burkina Faso reveals that producers have used information on rainfall to plan their agricultural activities and better manage the various cropping operations. during the agricultural season.

These new practices adopted by the beneficiaries, optimizing the use of inputs, have potentially contributed to the increase in production.

The relevance of the service provided is supported by statements from beneficiaries. In the opinion of one producer interviewed, this activity remains a first in the interventions of the partners which corresponds to their expectations. It is recognized that climate variability is currently a concern for producers. Like the other producers in the country, producers in the West of Burkina Faso have experienced a difficult start to the agricultural season in recent years, due to the scarcity of rains at this critical period for sowing, and the multiplication of pockets of drought. They were also confronted with the sudden end of the rains at the end of the season or, on the contrary, an extension of the rains.

The ProCIV / SOFITEX partnership has been promoted to ensure consistency of the intervention making it possible to reach the greatest number of producers in the West for the experience. This partnership allowed the start of the activity to quickly detect an abnormally low message reception rate compared to expectations and to take immediate corrective measures in consultation with the service provider IGNITIA and other stakeholders in the supply chain. . However, communication was limited between the two (02) partners IGNITIA and SOFITEX during the implementation.

The weather forecast system by IGNITIA and ProCIV was effective. 75% of the producers surveyed received daily messages regularly, every morning at the same time. According to agents, producers often found them accurate, to the point of winning their confidence completely. This level of confidence is recounted by an agent reporting the story of two seed producers in the Cascades region who took the time to wait for rainy days before sowing, despite pressure from those around them. Thanks to this patience, the seedlings benefited from a good emergence. The reliability of the system is further confirmed by the opinions of neighbors (at around 50% of frequency) who have benefited from the sharing of information. The unanimity of producers and supervisors is therefore made on the reliability of the service.

67% of producers surveyed used forecasts to better manage plowing operations in order to sow at the right time (85% of these producers). This enabled them to save seeds. According to agents, growers did less dry sowing and re-sowing.

Typically, growers cited the 97% frequency fertilizer saving and 100% frequency pesticide saving as changes resulting from forecast use during the season. They claim that they did not have to waste inputs. Producers' access to weather forecasts has reduced fertilizer and pesticide losses.

According to the agents, the use of the forecasts made it possible to discipline the producers in their way of working, in particular for the spreading of fertilizer and the application of pesticides. Producers are now avoiding loss of inputs through runoff or leaching and, in addition, producers have reduced the number of treatments with phyto products. They no longer spread the fertilizer without covering it. They manage to cover before the onset of heavy rains.

85% of the producers surveyed declared having used the forecasts to carry out effective weeding or ridging, contributing to weed control. In addition, there was efficient management of the workforce (83% of producers). This enabled them to save money in the organization of the work and to save time in the management of their activities.

Finally, 82% of the producers surveyed declared having harvested, then dried and stored at the right time thanks to the meteorological information.

The effects produced by the use of forecasts are already noticeable, according to the statements of the beneficiaries. The more optimal management of inputs, combined with the good management of cultivation operations have potentially impacted the increase in the production of the beneficiaries. However despite attempts during the study, there is no certainty to quantify these effects. Several parameters may have interfered, including rainfall.

In terms of sustainability, the availability of beneficiaries to contribute to the financing of the service lays the foundations for its continuity. A prerequisite would be the development of a participatory and inclusive model and above all a guarantee of reliability.

From a gender perspective, the technology provided has been useful for low-scale women farmers on small plots of legumes. The weather forecast information allowed them to plant and harvest at the right time. However, it must be recognized that very few women were involved, neither in the test nor in the evaluation.

Despite these results, the quality of the service provision and in particular its consistency, remains the main determinant for the adhesion of all the actors, mainly the extension services and the producers. Future programs should take measures to correct the shortcomings noted and listed below.

There were some pitfalls in setting up the service. The census of beneficiaries took much longer than expected, leading to the organization of training of actors at a pivotal period for both producers and extension agents.

The preparation of beneficiaries was therefore not optimal with some repercussions on the effectiveness of the forecasts.

At the start of the service provision, the daily message reception rate was low, suggesting several hypotheses including the issue of harmonizing the service supply chain including the designer IGNITIA, the service providers and the telephone networks. . The survey also found that during the implementation of the service, the rate of receipt and use of monthly and seasonal messages turned out to be low. A very small proportion of producers surveyed were able to use these types of messages, which are useful for decision-making at several levels in the conduct of agricultural activities.

The late start of the provision of the service and its stopping before the end of the harvests did not make it possible to fully cover the cropping operations, in particular the preparation of the ground, the sowing and the harvest. During this phase, losses of inputs or products were identified in certain producers surveyed.

Recommendations

The following recommendations are made by actor with a view to correcting the shortcomings observed and proposing orientations for future promotions of the weather forecast system.

ProCIV and SOFITEX

Improve the investments made, by continuing the activity by taking advantage of the achievements and lessons and by involving the beneficiaries in an exit strategy, in order to consolidate the system for its appropriation by the beneficiaries.

Develop a roadmap covering the agricultural campaign and specifying the calendar of activities and the role of actors within the deadlines of the end of March 2020.

ProCIV

Anticipate the arrangements to be made to provide quality service at the right time at the start of the agricultural season, in order to optimize the expected results.

Design a high-performance monitoring and evaluation system integrating data collection tools to measure quantitative and qualitative socio-economic data on the performance of the system.

Pilot discussions to promote a reliable and sustainable service provision model involving the various stakeholders on the basis of decisive consultation and involving the beneficiaries in the phased management of the system.

Develop a participatory control mechanism for the quality of the service provided, likely to continue at the end of the project.

SOFITEX

Take the opportunity to identify beneficiaries for information / awareness on the service provided and conditionalities.

Develop a strategy of capacity building in cascades making it possible to reach all the beneficiaries extended to the members of the operation educated in order to guarantee the mastery of the use of technology, and taking into account gender.

Internalize the monitoring of beneficiary producers in the current activities of monitoring and supervision of field partners.

IGNITIA

Provide a constant and sustainable quality service to guarantee user ownership short-term final.

Include mobile phone companies and bulk SMS providers in the contracting process for continued business.

APPENDIX 1: Testimonials from producers

SOIL PREPARATION
Before, I plowed my fields without any orientation. Now, with access to forecast information, I plan the various plowing operations.
I cultivate rice in a lowland. I used the weather information to better organize my second plowing of the rice plot.
If I have to plow and I get a message that says it will rain the next day, I postpone the plowing for the next day after it rains, then I do another activity.
The forecast information allowed me to have deep plowing with the ease of crushing soil for leveling and increasing the plowed area in a shortened time.
During the plowing season, if I receive a message in the morning that includes a message for the next day, the information allows me to prepare for plowing the next day.
SEEDING
The forecast helped me to successfully transplant eggplant and pepper. When transplanting the plants, I received a message in the morning predicting rain. I transplanted and it rained the same day.
When I started sowing the rice, I was not yet receiving any forecast messages. I sowed dry and it rained the next day. Then it rained on the 6th day, then there was an interruption in the rains for 2 weeks. The rice plants that grew were then invaded by grass. The culture being lost, I burned the plot and I opted for transplanting in July when I received the forecasts by SMS. According to the forecast I transplanted and the plants developed well, while initially my neighbors were septic as given the late estimated period
During a 26-day pocket of drought, I received a message one morning predicting heavy rain the next day. I then got ready and waited until the next day to plant the corn after the rain. It actually rained. The seedlings germinated well after 04 days.
During the sowing period, I received a message predicting rain the next day. I plowed dry the same day and it did rain the next day. After the rain I sowed and the cotton germinated well
While I was waiting for the rain to plow and be able to sow, I received a message predicting a heavy morning rain for the next day. This information helped me make the decision to anticipate with same day dry plowing with the tractor. The next morning it rained. After the rain, I sowed and the plants grew well
By sowing at the right time in advance or after the rain, I obtained good emergence of my crops and this allowed me to save my seeds. For example for the cultivation of corn, I used 2 bags of seeds per hectare instead of 3 bags per hectare in previous years
I used 25 kg of corn seeds obtained from the agricultural service, on an area of 1.75 Ha. Thanks to the use of the forecast information provided by the messages, I did not have to re-sow and there was a residue of seeds. In comparison, last year, I received 50 kg of corn seeds that I used on an area of 1 Ha. The seedlings were affected by the pocket of drought which led to reseeding.
During the sowing period, I had planned to sow the corn. I received a message in the morning predicting dry weather the next day. This information led me to postpone the semi
Since I started receiving the weather forecast messages, my farming practices have changed. I now know when to do a semi at the right time
I received a message saying dry weather and rain the next day. This information allowed me to plow my field the same day and sow the corn the next day after the rain which germinated well.

If I receive a message in the morning predicting morning rain, I anticipate to sow before the rain. This allowed me to have a good emergence of my cotton crop and to save the seed that I still have at home whereas last year I did a lot of re-sowing
I used the forecast to plan the seedlings. Depending on the intensity of the rain announced, I proceed to the semi taking into account the quality of the soil and crops (maize, sorghum). The sandy soils allow sowing whatever the intensity of the rain while the clay soils do not allow good seedling emergence after heavy rain
This year, I did not have to reseed compared to previous years where I had to do 03 or 04 reseeds. The information allowed me to seed at the right time.
I had to go and sow cotton in the morning. I received a message informing me that it will rain in the afternoon. The information I received encouraged me to sow as much as possible to benefit from the effect of humidity to speed up seed germination. It actually rained in the afternoon and then there was a good lift.
I intended to go and sow cotton in my field in the morning. I received a message predicting rain during the day. I mobilized the family to go and sow and we sowed over a large area to anticipate before the rain. It actually rained that day. We subsequently observed good germination.
During sowing, if I receive a message forecasting rain, as I make ridges before sowing, I wait until after the rain to sow in order to have a good emergence. If I sow on the ridges before the rain, the emergence will not be good.
At the start of the sowing, I still did not receive the messages. I sowed the cotton, there was no rain and the seeds rotted. Subsequently when I started to receive the messages I got a message predicting rain, as I am used to dry seedlings, I sowed dry and it rained. The result was satisfactory with good cotton emergence.
At the time of sowing, there was a pocket of drought. I received a message predicting rain the next day. I sowed the cotton and indeed the next day it rained and the germination was good
A neighbor had to go and sow. He consulted me about the forecast for the day and I reassured him because the rain was only forecast for the next day. It sowed and it did rain the next day.
At the beginning of August, I got a message about the seasonal forecast for a rainy October. With this information, I made the decision to late sow groundnuts and an extra portion of cotton. At the end of the campaign, I collected good quality peanut seeds and tops.
Thanks to the messages I received on the forecast, I managed to cultivate an additional area of 2 hectares of maize because the weather forecast was for late rains in the season.
In the village, some producers no longer wanted to sow after a certain period because they were not reassured about the prolongation of the rain on the plant cycle. However after receiving the seasonal messages, they decided to sow the sesame
INPUT MANAGEMENT
When applying the fertilizer, when I receive a message that it is forecasting morning rain, I wait until after the rain before applying the fertilizer.
During the campaign I did not have to resume phytosanitary treatments because I carried out the treatments at the right time thanks to the use of forecasts
If I get a message that forecast normal rain the next day, I anticipate to apply the fertilizer the day before. On the other hand, if the message foresees a heavy rain, I wait until after the rain to apply the fertilizer
In the past, I was often unsuccessful in herbicide. Thanks to the forecast information, I always wait until after the predicted heavy rains before treating. This allowed me this year to successfully eliminate weeds by herbicide. I also reduced the number of herbicide treatments. I only performed 02 this year instead of 03 treatments usually.

I had invited a large group of people to do the insecticide treatment in my cotton field. I received a message in the morning predicting an early morning rain, then I made the decision to postpone the treatment. That day, there was a heavy rain in the morning.
I had to do a treatment on my cotton field in the afternoon and received a message in the morning predicting rain in the afternoon. I postponed the treatment for the next day and it did rain.
During the period of application of NPK in my cotton field, I received a message predicting rain. I waited until after the rain to apply the fertilizer.
I had programmed to treat my cotton. I received a message around 7 am that predicted rain in the afternoon. I treated my cotton in the morning and the rain fell around 4 pm. This treatment was successful because the product had time to act before the rain fell.
We had now become accustomed to burying the fertilizer before the onset of rain if we receive a message that forecast rain. Without the weather information, before we apply the fertilizer over a large area which is exposed to leaching by rainwater. Now with access to the weather forecast, we plot the areas to apply the fertilizer according to the information received on the rainfall forecast.
When we receive the information on the probability of a morning rain, we wait until after the rain for the pesticide treatments. In the event that it is a night rain, we deal from morning until noon. Last year I had to take phytosanitary treatments at least twice.
This helped us not to waste any more our inputs and therefore to save money compared to previous years. Last year I had to apply urea and butter to bury it on an area of 5 ha of cotton. I then gave 5 bags of urea to the children to cover the area. The children went to replenish the fertilizer. After applying the fertilizer to half the area, there was heavy rain. I was then forced to add three bags of fertilizer.
During one morning, I had not yet had time to consult the message early, as the children had gone to the fields to process cotton. At around 9 a.m., I realized that the message was for a morning rain. I then joined the children in the field to tell them to cancel the treatment, but they did not believe me. By the time they porridge the product and start processing, it started to rain.
Last year, as we were not yet benefiting from the service, it happened that we applied the fertilizer and an hour later the rain came out. this year we had not experienced these fertilizer losses
Based on the information on the forecast for dry weather or rain, I plan the treatments.
When I apply the herbicide correctly in a wet period, the regrowth time of the grass is longer, which allows me to reduce the number of treatments
I had received a message that predicted a heavy rain when I had to apply the fertilizer in my cotton field located in a lowland. I waited after the rain to apply the fertilizer which would have been lost if I did not have the information
The messages allowed me to limit the number of pesticide treatments because I did not have to resume treatments
On several occasions I postponed the planning of pesticide treatments. The forecast helped me a lot with the processing operations.
I have not had any loss of fertilizer. Last year I applied fertilizer to my cornfield and in the evening there was a heavy rain which washed away some of it. I was forced to add 50 kg bags During the campaign, on several occasions, I had to reschedule herbicide treatments in my corn field, following the receipt of a message predicting rain during the day. I did less herbicide and insecticide treatments this year compared to last year.

This year I did not have to lose any fertilizer unlike in previous years. The year passed, I produced corn. When applying the fertilizer, I carried the necessary fertilizer to the field to cover the entire area, assisted by a workforce. After spreading the fertilizer over 1 Ha, it started to rain before the workers had time to cover it. The land being sloping, the rain washed away the fertilizer. I had to add 150 kg of fertilizer on my plot of 2 Ha of corn crop.
At the level of our cooperative, we use weather forecasts to transport inputs from the City of Dédougou to our village Kodougou.
While applying the fertilizer, I received a message that it would rain in the afternoon. But since the predictions can sometimes be inaccurate, I applied the fertilizer to my cotton field during the day. Unfortunately for me, it rained overnight and the water washed away some of my fertilizer. I was then forced to apply 6 additional 50 kg bags of fertilizer in my cotton with an area of 6 Ha.
During one morning, I went to the field to do a treat on my cotton crop. Arrived at the field, I received a message predicting rain in the afternoon. This information led me to abandon the phytosanitary treatment to reschedule it the next day. In the evening, it actually rained.
According to the agent's recommendations, the fertilizer should be applied and closed. As we sow large areas, we cannot respect this. The forecast helps us target the rainy days to apply the fertilizer after the rain so as not to lose it
Weeding tends to replace weeding now
Before we spread the urea dry and we push it so as not to waste time. But through the use of forecast messages, we wait until after the rain to apply urea and butter.
Before receiving the messages, we usually apply the fertilizer dry and when there is a heavy rain, it is washed away. With the messages, if I consult it and it forecasts a rain, I wait until after the rain to apply the fertilizer and cover it.
Before, when I treated my field, I was sometimes surprised by the rain which leached the treatment products, thus promoting the resistance of the tracks. Using forecasts allows me to postpone processing on rain forecast days. I have not had to resume treatment this year.
I had to apply the fertilizer in my field. I received a message during the morning predicting a great chance of rain. I asked my son to postpone the operation at the risk of not being able to cover the fertilizer applied before the rain. That day, there was indeed a big rain
The messages helped me not to apply the fertilizer during a drought pocket
In previous years, it happened that I applied the insecticides and immediately after the rain fell. This year the messages allowed me not to be surprised and to apply the treatments after the rain
At the time of hilling, if rain is forecast, I apply urea and I do the hilling before the rain.
My older brother once sent his son for treatment in the field. I advised him not to do it because I had received a message that called for rain. It actually rained.
One day, I was going to the field with the members of the family to spread the fertilizer. We got up early and after loading the fertilizer into the cart I got a message that it would rain. I had a tarpaulin prepared which we took away so that when we arrived in the field we could assess the possibilities of spreading the fertilizer. But when we got to the field, it started to rain. We covered the fertilizer with the tarpaulin to protect it. He has a lot more, but our fertilizer has been well preserved. After the rain, we waited until the afternoon to apply the fertilizer. This experience has enabled us to preserve our fertilizer and apply it at the right time.
Last year I did 8 insecticide treatments on cotton while this year I did 7.
CULTURAL INTERVIEWS

During a period of dry weather, I received an overnight rain forecast in the morning, which prompted me to organize the labor force for the work the next day. Due to the dry weather, the people I invited were skeptical. It actually rained around 1 a.m. At the first hour, I reminded by message the people I had invited for the work.
One day in the morning, I received a message predicting an early morning rain when my big brother, Sanou Moussa had invited a group for work in his field. Having received the message, I alerted him and he didn't believe. In response, he let me know that it is only God who knows whether there will be rain or not. Indeed that day it rained from 10 am to 3 pm. My brother therefore spent for the meal while the work was not done. So he lost his money.
When pulling the grass, if I receive a message predicting rain, I collect the pulled grass in one place to promote their wilting and therefore their elimination.
I had planned to weed my cornfield with my family. I received a message that predicted morning rain. I warned my wives who were surprised that there weren't many messages. We postponed the weeding work to go about other occupations and it actually rained
I do not weed if there is a rain forecast, I wait after. I proceed to hilling the crops if there is a forecast for rain.
During the hilling stage, I took advantage of the dry weather forecast to plan the hilling of my corn and cotton field located in a land that is clogged with water when it rains.
Regarding the weeding operations, if we had to weed on sandy soil and in the morning the message is for rain, we prefer to go to weed on stony soils where the grass will no longer grow back. Grass grows quickly on sandy soils when it rains for the next few hours.
During one morning, I received a message predicting an early morning rain the next day while I had mobilized the young people to weed my cornfield that day. This information allowed me to reschedule the work for another day. I was able to save money and free up time for other activities because it actually rained.
At the time of weeding, if the message foresees rain during the day, some time before the rain, I stop the weeding to continue it well after
The weeding being difficult if the ground is very wet, if I receive a message which foresees a rain the next day, I anticipate to weed in order to occupy myself on other activity the next day.
I noticed that the newly created ridges deteriorate under the effect of the rain. With access to the forecast, I wait until after the rain before crashing.
If the message calls for rain the next day, I prepare to plow or butter. Currently, we do not weed anymore, but we proceed directly to the weeding. If rain is forecast, I organize myself for another activity
When we receive messages predicting a great chance of rain we organize the cultural activity taking it into account because we are aware that there is a risk of flooding.
WORKMARK MANAGEMENT
I scheduled labor once for work in my cotton field and in the morning I received a message predicting a great chance of rain. To follow up on this information, I opted to postpone the work. It actually rained that day.
I had mobilized a workforce of 30 people for the work in my field. On the day of the work, I received a message announcing a probable morning rain. Women had to prepare for workers. So I hurriedly returned to my field to deprogram the work. Surprised, the people there were upset and unhappy. It actually rained around 12 noon today.

I managed the workforce better by rescheduling certain jobs requiring the mobilization of the workforce when rain was announced on the day of the works. It saved me money. A day's work costs CFAF 1,000 per person.
My wife is a member of a women's cooperative which provides services. The cooperative being able to harvest 6 Ha of cotton during the day, I invited him to harvest my cotton in October. On the day scheduled for the harvest, I received a message predicting rain. Therefore, I advised the women to postpone the work for another day. These women generally having a tight schedule at this period, they disputed my information relying on the fact that in the month of October the forecasts are less reliable. But, I was uncompromising and I was right. It actually rained. This decision allowed me to save money because I would have spent for a day of work that was not full.
If I receive the information that forecasts rain during the day when I have scheduled work involving labor and meals and requiring a lot of expense, I postpone the work for the following days
During the harvest, I had mobilized a working group for the cotton harvest. In the morning, I received a message predicting a morning rain. So I asked the working group that was already there to return. After they left it rained. I lost some money for the kitchen, but I limited these losses by saving on the support of the group.
If I receive a message that forecasts rain in the afternoon and that I have organized work mobilizing the workforce, together we organize to speed up the work in order to finish it before the onset of rain.
HARVEST - DRYING AND STORAGE
During harvest, if dry weather is forecast, I schedule the children to harvest corn. If rain is forecast, I prepare the tarp to cover the sorghum crops.
During the millet harvest, the day when the message foresees rain, I avoid placing the crops on the ground so as not to contribute to its degradation by the effect of humidity
Using the forecast helped me to sell my watermelon production in September. Having sown watermelon early, the harvest was scheduled for September. At harvest, I followed the forecast provided by the messages to harvest during "dry" weather. To get my watermelon production out of the field during a rainy season in the countryside, I identified a dry day. During this day, I accelerated the harvest by employing more labor to harvest and load the production in a transport truck parked on a main road 2 km from the field.
At harvest time, I had planned to harvest cotton, then in the morning, I received a message predicting rain during the day. I postponed the operation and then waited for the forecast of dry weather to harvest
I had to spread out my peanut production and then received a message that it would rain. I kept the production protected before bringing it out on the following non-rainy days.
I lost part of my harvested cotton production that I harvested. To keep it, I exposed it to the sun to dry it. Unfortunately there was a rain which damaged part of this cotton. This happened because I was no longer receiving the weather forecast information.
I had planned to harvest my cotton very early, but following the weather forecast, I waited for the rains to stop before harvesting.
For the drying of my maize crop, I checked the message forecast every morning before taking my production out.
At the time of cotton harvesting, if the message announces rain during the day, we wait until the next day to harvest.
In the month of October, I still received the forecast for rain. This has led me to postpone the harvests every time to avoid deterioration of the corn and cotton products.

When harvesting my corn in September, when the weather forecast called for dry weather, I harvested.
I had invited 20 people for the corn harvest. The day they were to come to my field, I checked the messages and then saw that rain was forecast. I then asked the group to postpone the work for the next day and it did rain.
I built a home produce drying hedge on which I spread my corn production. I received a text message announcing a night rain. I informed the family that there was going to be rain, but the family members were amazed because there were no clouds during the day. We brought down the pile of corn and covered it with tarps. It actually rained.
We produce the rice in a lowland which quickly becomes engorged with water. At harvest time, I received a message announcing an afternoon rain and a morning rain the next day when I had to start harvesting my rice. I postponed the harvest to avoid exposing it to rain and to promote a deterioration in the quality of the harvested rice
I do not harvest if rain is forecast. Last year the rain hit my lowland rice production because we are not receiving the forecast messages.
The forecasts allowed us to manage the early harvests. For example, if I plan to harvest and the message announces rain, I postpone harvesting work.
If the message is for a forecast of rain while I want to harvest, I mow the sesame plants and collect them in small piles following the conservation techniques we have learned, so that the seeds do not rot from the excess. humidity.
During the harvest, if I receive a message that says there will be rain, I cover the harvested products to prevent them from being beaten by the rain and degrading.
SUPPORT ON THE RELIABILITY OF THE SERVICE
During a forecast, I got a message based on which I let a friend know that it was going to rain today, but the latter replied that it was wrong because the clouds were not formed. Indeed that day, there was a heavy rain in the afternoon. Another time in August, I told him it will be dry the next day and we had a bet since August is usually rainy. Again I won the bet because it was indeed dry.
This year the messages are not something invented. He was concrete.
Rainfall information was shared with neighbors. At the beginning, they did not trust the reliability of the weather forecasts that we receive. But attitudes quickly changed when the forecast was accurate
I can attest to the interest of the neighbors who came to consult me about the forecasts.
UNDERSTANDING MESSAGES
I had my educated child read only 2 messages during the campaign. Subsequently I did not want to ask him more for regular reading of messages
At the beginning, the agent came to my field to explain to me how the service provided through text messages on the weather forecast works. But in his day I did not quite understand. It was only in July that I started to use the forecast messages because when I received them before I did not understand the contents or how to use them. The ProCIV agent advised me to have my educated son read them.
At the time of plowing, we were not interested in the content of the messages. It was from the seedlings that we began to seriously consult the messages.
WEATHER INFORMATION
I became the weather forecast for the village because the other producers came to ask me for information as the rain forecast was coming true.

On several occasions, I communicated rain forecasts to my entourage but initially they were not convinced. As the forecasts developed, they became interested in this type of weather service. They also sought to know how to access it.
In the places of talks, I had to announce rains following the reception of messages. The people present did not believe it and thought that it was still one too much activity for the producers who could not bring them much. But as and when my predictions came true. So they started to take me seriously.
PRODUCTIVITY
Receiving messages has helped us a lot to better manage time in the conduct of our various activities.
Since I have been producing rice 4 years ago, I have not managed to produce as much as this campaign.

APPENDIX 2: Survey questionnaires

Producer Survey Sheet

Inquiry date: / _____ / _____ / _____ /

Partner : ……

Region: …… Province: …… Municipality: …… Village: ……

Name & Surname of Producer: …… .. **No.** phone :……..

Education level: Literate ☐ Illiterate ☐ Primary studies ☐

Secondary studies ☐ University studies ☐

Age / _____ / Gender: M ☐ F ☐

Q1: Service

Q1.1 How did you learn to use the weather forecast messages?

……

……

……

Q1.2 How many times have you received the messages during the week?

1 time ☐ 2 times ☐ 3 times ☐ Four times ☐ 5 times ☐ 6 times ☐ 7 times ☐

Q1.2 Should messages arrive at the same time each morning? Did you receive them as planned?

Yes ☐ If yes, at what time? / _____ /

No ☐ If not, specify:

……

Q1.3 Was the content of the messages understandable?

Yes ☐ No ☐ If, other or not, specify:

……

……

Q1.4 Did you receive other types of forecast messages?

Yes ☐ No ☐ No idea ☐

Q1.5 If yes, was the content of these messages understandable?

Yes ☐ No ☐ If, other or not, specify:

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Q1.6 What tips on forecasting helped you the most?

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Q1.7 Did you have any other forecasting information needs? Which ones?

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Q1.8 Did you have any other information needs? Which ones? ....

…… .....

……

Q2: Using the service

Q2.1 Have you used the weather forecast to plan your farming activities?

Yes ☐ No ☐

If yes, how ?

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Q2.2 Have the forecasts helped you to make better use of inputs (seeds, fertilizers, herbicides, insecticides, etc.) and to manage your other activities? Yes ☐ No ☐

☐ ☐

Q2.2.1 On the quantities of seeds On the time of sowing

If other, specify :……

In what way?

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……

On which cultures …….

Q2.2.2 On the quantities of fertilizers ☐ When to apply fertilizers ☐

In what way?

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……

On which crops: …… ...

Q2.2.3 When to apply pesticides ☐ On the quantities of pesticides ☐

On the number of treatments ☐

In what way?

……

……

……

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……

……

On which crops: …… ...

Q2.2.4 When to plow ☐ Weeding ☐ Ridging ☐

If other, specify :……...

In what way?

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On which crops: …… ...

Q2.2.5 On workforce management ☐

In what way?

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On which crops: …… ...

Q2.2.6 On the time of harvest ☐ On drying / storage of products ☐

In what way?

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On which products: …… .....

Q3 Most significant changes

Q3.1 Can you tell us a story that shows a change that struck you as a result of using the weather forecast?

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Q3.2 What did you learn yourself? can you share it?

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Q4: Cultures practiced

Q4.1 What crops are the subject of the weather forecast? Sesame

☐ Cotton ☐ But ☐ Rice ☐ Cowpea ☐ Soy ☐

If other, specify :……

Q5: Production

Q5.1 Input quantities

Inputs		Culture 1 .... Culture 2						Culture3		
		2017	2018	2019	2017	2018	2019	2017	2018	2019
Herbi cides	(Liter)									
	(Ha)									
Sem nces	(Kg)									
	(Ha)									
NPK (kg)	(Kg)									
	(Ha)									
Insect icide	(Liter)									
	(Ha)									
Urea (Kg)										
	(Ha)									

Q5.1.1 Has the amount of inputs used this year changed compared to last year?

Yes ☐ No ☐

If yes, specify and justify: ……

……

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……

Q5.2 Agricultural yields

Main crops having benefited from weather forecast	Campaign 2017		2018 campaign		Campaign 2019	
	Sup (ha)	Prod (Kg)	Sup (ha)	Prod (Kg)	Sup (ha)	Prod (Kg) *
1)						
2)						
3)						

Q5.1.1 Have your crop yields changed this year compared to last year?

Yes ☐ No ☐

If yes, specify and justify: ……

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……

Q6: Coverage

Q6.1 Have you had to share weather forecast information with neighbors?

Yes ☐ No ☐ If so, with how many neighbors? / _____ /

How far away were the fields from the furthest neighbor? / _____ /

Q6.2 Have you received feedback from neighbors

Yes No If so, specify?

……

……

……

……

Q7: Support for service

Q7.1 Would you be prepared to pay to continue to benefit from the service? Yes

☐ No ☐ If so, how many by SMS? / _____ /

Q7.2 Did you have other proposals to allow continuity of service

……

……

Q8: Your general opinion of weather forecast technology

……

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……

……

……

APPENDIX 3: Terms of Reference