

Digital Information Channels in the Rwandan Potato Value Chain (Project 38430)

Final Progress Report (April 2020)

Adam Abramson, Ram Fishman, Alex Muhire

The implementation of the project has faced great delays because of administrative challenges. These delays involved both the negotiations between the legal teams at TAU and IGC, and later on, negotiations between the legal teams at TAU and Nfrnds around the sub-contract to Nfrnds. The net result was that our research team was only able to begin its work in earnest in August.

We have used the time since then to construct the infrastructure that will allow Nfrnds to continue and engage farmers in the coming months in the use of their platform, as re-designed to facilitate our research goal, and to provide us with usage data. Nfrnds were able to eventually implement most, but not all, of the design elements. We were also able to randomly assign users into four treatment groups as described in the proposal.

However, the biggest stumbling block to our progress was low usage of the platform. This was a risk we had anticipated in our original proposal. Unfortunately, usage remained low despite many attempts, described below, made by Nfrnds staff and ourselves to stimulate it.

Below, we describe the process that has consolidated the design of the research itself and the modified Nfrnds platform, as well as some preliminary results on platform usage and data. We are now considering whether and how to increase usage and carry on the research.

Consolidation of the Research Design

Field Visit. A field visit was carried out in Rwanda in October 2018 by Ram Fishman and Adam Abrahamson (PAD). The project funding was not yet received at that time so the costs of the trip were covered without reliance on the project budget. During the visit, focus groups and interviews were held with farmers in the IPCCs participating in the project and meetings were held with Nfrnds staff. The meetings helped the researchers fine tune the research design. In particular, the type of information that seems most valuable to farmers

includes weather forecasts, timely advise on planting activities, information about the availability and prices of inputs in shops, and pest alerts. These insights were shared with Nfrnds. Following the field visit and ensuing discussions, and on the basis of the proposal, we have consolidated the research design as follows.

The Nfrnds platform will, for the purposes of this study, provide three types of service for participating farmers:

- I. **Chat communication functionality** which will enable farmers to exchange text messages amongst themselves (see below) and with agronomic experts engaged by Nfrnds.
- II. **“On demand” dynamical cultivation related information.** Farmers who choose these options on the Nfrnds platform will be able to obtain:
 1. Dynamically updated information about the availability of particular seed varieties and chemical fertilizers in market sources around the IPCC.
 2. Weather forecasts in their area.
 3. An interactive tool for the identification of pests and instructions about treatment.
 4. Instructions about the treatment of major IP pests.
- III. Access to static “wikipedia like” content on cultivation of IP designed with information from the ministry of Agriculture (we refer to this content as mAgri below).
- IV. **Tailored, timely advise on cultivation practices** customised to each farmer’s location, date of planting and variety used.

Experimental Variation in Chat Functionality. From the point of view of our research, as described in the proposal, we are most interested to document informational exchanges between farmers and experts in response to messages seeded by experts, and to understand how this information affects the adoption of various cultivation practices and input choice. To achieve this goal, we need to experimentally generate variation in the type of communication functionality farmers will have access to.

To this end, we randomly divided participating farmers into three treatment groups (and one control group) in terms of the nature of the interaction made possible through the chat:

- I. Farmers in this group receive one way messages in their inbox from an expert to which they cannot respond.
- II. Farmers in this group receive the same message in their inbox to which they can respond in a one on one conversation with the expert.

III. Farmers in this group receive the same message in their inbox to which all members of a group (the composition of which can be experimental) can respond and everyone sees all communications. There will initially be one group per IPCC, containing all farmers in this group, but eventually we will create groups randomly.

The messages themselves would be coming from a group of experts who will seed various types of messages, some of which have already been formulated and some of which will be created dynamically in response to the situation in the field.

Observing Farmer Responses. To measure the impact of communication on farmer choices, we will need to observe it. Our focus will be on input use, primarily seed variety and chemical fertilisers. These choices are observed in two ways in administrative data.

- I. When farmers deposit their harvest in the IPCC for sale, we will observe the variety farmers cultivate and their output as these will be recorded in the Nfrnds system.
- II. As (imperfect) proxies of interest in these inputs, we observe whether farmers inquire about the availability of specific seeds and fertilisers in the second (“on demand”) functionality coded into the modified Nfrnds platform. This will allow us to observe whether farmers are inquiring about the availability and prices of the specific inputs the use of which we are attempting to monitor. We are well aware this falls short of directly observing these purchases directly, but believe it offers a reasonable practical alternative.
- III. We are also hoping to be able to capture actual use of inputs from communication that will take place in the chat platform through textual analysis.

Nfrnds Platform Design:

Nfrnds has re-coded their platform to conform with the research design described above.

The process required prolonged interactions to overcome a wide range of technical hurdles, but its basic building blocks have been agreed on and implemented.

In particular, the main access menu that implement all types of functionality described above has been coded (see Figure 1). Farmers entering the platform can choose between entering the chat platform (functionality I in the description above), and several types of dynamic content (functionality II): interest in weather forecasts; availability (stock and price) of seeds and fertiliser in various market sources in the area (dynamically updated by Nfrnds staff); and pest identification. These modules have been designed and coded,

including a detailed interactive pest identification “decision tree” has been developed and coded.

However, we also encountered several difficulties in designing the platform with Nfrnds. Nfrnds eventually did not enable the dynamic content on seed and fertilizer availability to be customized by location, as we had originally discussed, citing prohibitive costs and manpower requirements. As a result, users choosing that option have to search through a long list of suppliers to find those in their areas, making this option less user-friendly.

Perhaps more importantly, Nfrnds only randomized users into the four treatment arms (including the control) at the entire sample level, and not stratified by IPPC or region, citing similar technical and maintenance costs.

Farmer Training and Activity

In parallel to the process of re-designing and coding the modified platform, Nfrnds staff have begun to more intensively train farmers in the use of the existing chat functionality in three IPCCs. A Rwandan TAU student has been hired as research assistant to interact with Nfrnds staff and monitor their activity.

The main objective was to train farmers on how to access the platform using their own telephone and also registering them in specific groups (IPCCs) so that they would be able share info with their colleagues in the same IPCC with the fellows. So far, 1414 potato farmers from eight IPCCs were trained and registered to use the platform. The eight IPCCs are located in districts of Musanze and Burera in North province, Nyabihu and Rubavu in the Western province of Rwanda.

The field work started on 15th of August 2019 with three fellows working with three IPCCs, one in Musanze district and two in Nyabihu district. On 15th of October 2019, five more fellows were recruited to work with other IPCCs, 2 in Musanze, 2 in Burera, and 1 in Rubavu districts. Training sessions were either taking place at the IPCC office or a fellow would travel to find farmers in the fields. The activities continued on a daily basis. During the session Farmers were shown how to access the platform by dialing *847# on their phone and understand the options available on the main menu. While not on the field, fellows would be talking to farmers via phones, mainly responding to questions on certain features of the platform or request for information on agricultural products.

To make the platform's menu more understandable and stimulate usage, two series of quizzes were launched: one wave in the months of October and November 2019 and a second wave in February and March 2020. Every week a quiz would be put on the platform by a fellow and farmers reply through the platform too. First three respondents with a correct answer were being given an incentive of 2000Rwf. Table A1 and A2 report the content of messages and quizzes that were distributed during two phases of activity, in October 2019 and Feb-March 2020.

As we had described in the original proposal, reaching frequent usage of the platform was a challenge we have anticipated as part of this pilot. The ability to overcome this challenge was cited in our proposal as a key factor that could determine the feasibility of the entire research effort.

During trainings in August, there were some initial positive indication that training was able to raise usage (Figure 2). However, these indications were not sustained or accelerated to the required pace since then.

Usage data started to be received from Nfrnds in late January. Below, we describe some features of this data during the period of February and March.

Overall, despite the training effort, usage, while higher than originally, remained quite low. During these two months, only 300 users entered the platform. The mean number of daily (distinct) users during this period was 42. Figure 1 displays the number of unique users and the number of interactions (basically any key press) per user during the sample period. It shows that the number of users increased by 9 during weekends ($p < 0.05$) and by 13 when quizzes were given ($p < 0.01$). The impacts of the quizzes are sizable in proportional terms, but not large in actual numbers, and they do not seem to persist for very long.

As mentioned above, the main menu of the platform contains six options representing six types of content or interactions: chat, weather forecasts, pest identification, market source of seeds, market sources of fertilizers, mAgri, and chat with experts, which is a category through which users in treatment arms 2-4 can respond to messages received from experts.

Table 1 reports the number of times users selected each of these categories during the sample period. Sixty percent of the menu choices made by farmers were weather. Twenty percent were chat. Table 2 reports the average number of users selecting each of the main menu options per day. Thirty users look at weather forecasts in an average day, fourteen use chat, and fewer than five users choose the other categories in an average day. Figure 4 displays the temporal variation of these indicators.

Given that the quizzes required users to respond through chat, as expected, chat use responded to quizzes in a significant way (increases by 4 from a baseline of 12, $p < 0.05$). We find suggestive, but imprecise indications of “spillover” which led these users to also use other features of the dashboard, particularly for seeds ($p = 0.15$) and weather ($p = 0.16$). This is far below the type of learning effect one was hoping the quizzes will generate.

Examples of what is being developed:



When IPCC farmers enter *847# in their USSD phone, they will reach this main menu:



If a farmer chooses 4. "I have a pest/Disease", they will receive a list of pests/diseases from which they can choose the relevant one for their needs. This will lead them to information on the given pest/disease. They can press 99 to scroll down and continue reading.



When a farmer chooses 'CHAT' he will access all of his chats on the platform.

- Chats with <* means there is an unread message he received.
- Chats with > means user has sent a message.



When a farmer would like more information about the weather, s/he can choose and enter a specific district as well. The results will show the daily weather for one weeks ahead



N-Frnds
Extend your Reach.

Figure 1: Selected screen shots of the modified Nfrnds platform

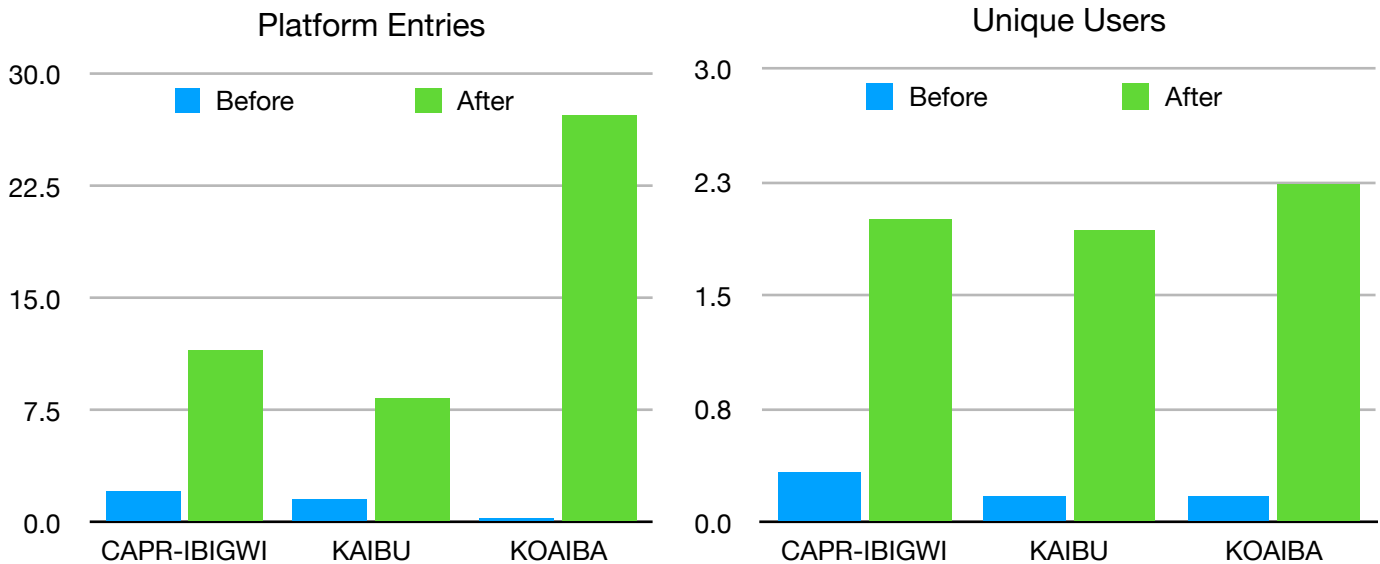


Figure 2: Comparisons of usage of the Nfrnds platform before (Aug 1st-12th) and after (Aug 13th-30th) Nfrnds training activities begun. Left panel: overall platform entries per day. Right panel: number of unique users per day.

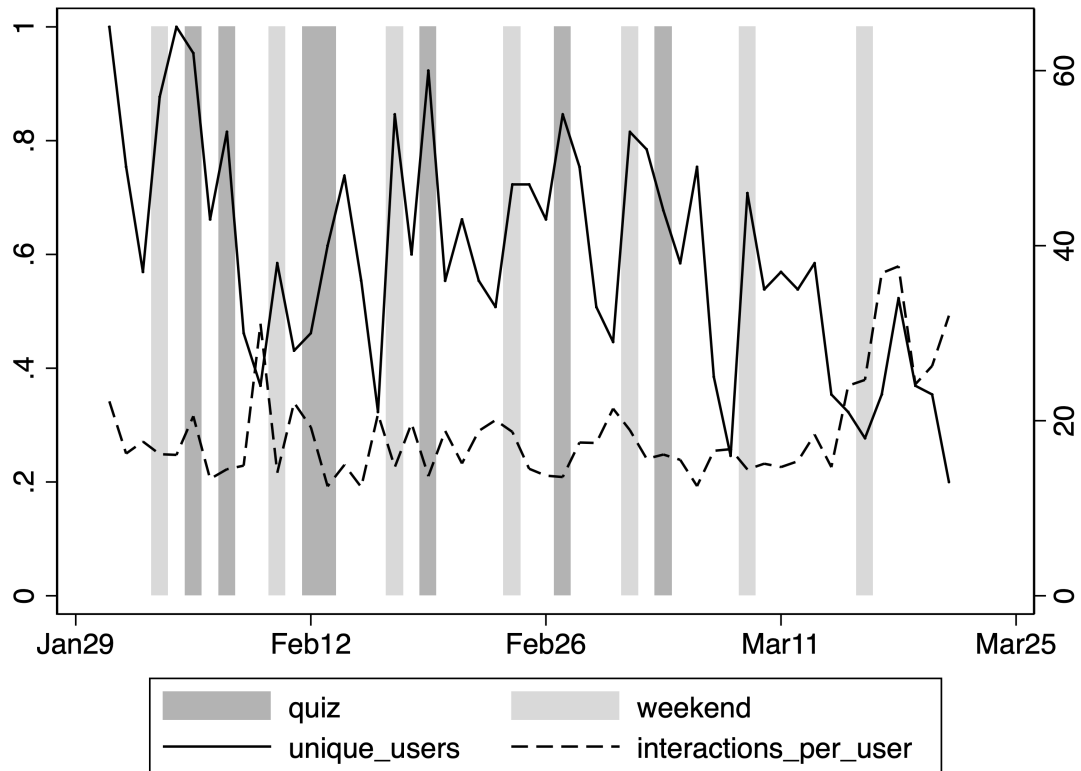


Figure 3: Number of users entering the platform (solid line) and the number of interactions per user (dashed line) during the period of February and March. Weekends and day in which quizzes were given to farmers as incentive to enter the platform are indicated in grey bars.

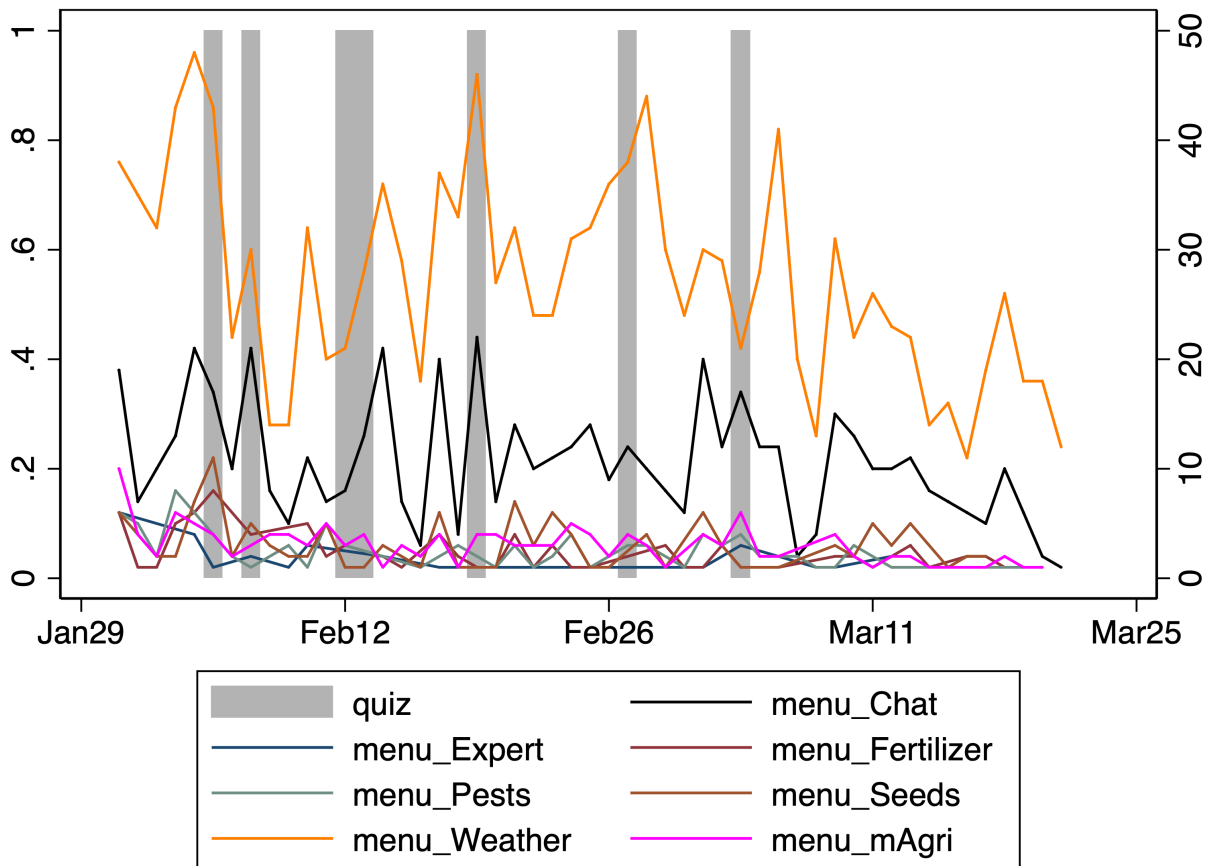


Figure 4: Number of users entering the platform chose one of the six main menu options (chat, expert, fertilizer, pests, seeds, weather and mAgri). Days in which quizzes were given to farmers as incentive to enter the platform are indicated in grey bars.

Category	Freq.	Percent
Chat	668	22.11
Chat with Expert	32	1.06
Fertilizer	93	3.08
Pests	114	3.77
Seeds	135	4.47
Weather	1,835	60.74
mAgri	144	4.77
Total	3,021	100.00

Table 1: Distribution of main menu choices made by farmers during the sample period.

Variable	Mean	Std. Dev.	Min	Max
Chat	13.52096	5.34993	1	22
Chat with Expert	3.03125	1.874866	1	6
Fertilizer	3.666667	2.086881	1	8
Pests	3.745614	1.931625	1	8
Seeds	4.688889	2.661126	1	11
Weather	30.36948	9.053925	11	48
mAgri	4.104167	2.114614	1	10

Table 2: Number of users selecting each of the main menu choices per day.

Day one 28th Oct	Monday	Content	Did you know when potato came to Rwanda? 110 years are over!
Day 2, 29th Oct	Tuesday	Quiz	What exactly Irish potatoes is? a. A fruit b. A stem c. A root
Day 3, 30th Oct	Wednesday	Content	Did you know that eating too much of sprouted potatoes causes stomach ache?
Day 4, 31th Oct	Thursday	Content	Did you know that planting your own seeds increase and spread diseases like KIRABIRANYA and JUNJAMA in your field and seeds?
Day 5, 1st Nov	Friday	Quiz	In N-Frnds platform you cans we weather forecast? A,. Of the day and the following day b. Of the week and the following week
Day 6, 4th Nov	Monday	content	Do you know that eating an unpeeled Irish potato it helps in more nutrients in your boby?
Day 7, 5th Nov	Tuesday	content	Did you know that planting your own seeds increase and spread diseases like KIRABIRANYA and JUNJAMA in your field and seeds?
Day 8, 6th Nov	Wednesday	Quiz	Potato planting holes are dug between? a. 15 to 20 cm deep b. 30 to 40 cm deep c. 5 to 10 cm deep
Day 9, 7th Nov	Thursday	Content	Do you know the cause of Hollow heart potatoes? It is not a disease, but the excess of fertilizer is one of the cause !!!
Day 10, 8th Nov	Friday	Content	Do you know that in a year 2018-2019, Rwanda is ranked the first in East Africa and the fifth producer of Potatoes in Africa !!!
Day 11, 11th Nov	Friday	Quiz	NPK 17-17-17 is a synthetic fertilizer that, a. Stop heavy rain from damaging potatoes b. Increase potato nutrients for an improved yield
Day 12, 12th Nov	Wednesday	Quiz	Potato late blight disease is caused by, a. Flies? b. The water mold or fungi during the rainy season?
Day 13, 15th Nov	Friday	Quiz	In the following crops, which one is in the same family with potatoes? a. Sugarcane b. Tomatoes c. Beans
Day 14, 18th Nov	Monday	Content	Did you know that tomatoes, bell pepper and tamarillo are in the same family with potatoes and can get same diseases!!!, so don't plant one after another, instead plant cereals or vegetables.
Day 15, 19th Nov	Tuesday	Content	Amazing, do you know that potato is not only for eating? It has been discovered that it can produce electricity to light a light bulb!!!

Table A1: timing and content of the first wave of promotional content and quizzes.

Date and time	Type	Treatment I	Treatment II	Treatment III
Jan 28	Message 1	Welcome to this platform, we are going to have a quiz session, First three responders win 2000 Rwf each.	Welcome to this platform, we are going to have a quiz session, First three responders win 2000 Rwf each.	Welcome to this platform, we are going to have a quiz session, First three responders win 2000 Rwf each.
Jan 28	Question 1	The question is: What pest causes galls on Potato Roots? To respond, please call 0785105575	The question is: What pest causes galls on Potato Roots? To respond, please write a chat by pressing 7 in the menu.	The question is: What pest causes galls on Potato Roots? To respond, please respond to this message.
Feb 5	Answer 1	Answer: Nematodes	Answer: Nematodes	Answer: Nematodes
Feb 5	Message 2	Hello! Welcome to the Irish Potato platform. We will be sending you messages here to teach you about farming.	Hello! Welcome to the Irish Potato platform. We will be sending you messages here to teach you about farming. To chat with an expert, press Reply and check responses in menu 7 or To chat with other potato farmers, press reply	Hello! Welcome to the Irish Potato platform. We will be sending you messages here to teach you about farming. To chat with an expert or to chat with other potato farmers, press and reply.
Feb 7	Question 2	The question is: Potato planting holes are dug between: a. 20 to 30 cm? b. 15 to 20 cm? c. 5 to 10 cm?. Choose the letter corresponding to correct answer. To respond, please call 0785105575	The question is: Potato planting holes are dug between: a. 20 to 30 cm? b. 15 to 20 cm? c. 5 to 10 cm?. Choose the letter corresponding to correct answer. To respond, please write a chat by pressing 7 in the menu.	The question is: Potato planting holes are dug between: a. 20 to 30 cm? b. 15 to 20 cm? c. 5 to 10 cm?. Choose the letter corresponding to correct answer. To respond, please respond to this message.
Feb 12	Answer 2	Answer: the answer to the question is b. Potato seeds are planted between 15 to 20 cm deep in a planting hole.	Answer: the answer to the question is b. Potato seeds are planted between 15 to 20 cm deep in a planting hole.	Answer: the answer to the question is b. Potato seeds are planted between 15 to 20 cm deep in a planting hole.
Feb 13	Message 3	There are many Irish Potato varieties. Some have short cycles (90-120 days), and some have long cycles (120-150 days). Talk to your IPCC about different varieties, and press #2 in the menu to see seed availability.	There are many Irish Potato varieties. Some have short cycles (90-120 days), and some have long cycles (120-150 days). To know more about seeds talk to an expert by pressing #7 in the menu and reply and also you can Press #2 in the menu to see seed availability.	There are many Irish Potato varieties. Some have short cycles (90-120 days), and some have long cycles (120-150 days). To chat with an expert or to chat with other potato farmers, press and reply.

Table A2: timing and content of the second wave of promotional content and quizzes.

Table 1-2-1

Date and time	Type	Treatment I	Treatment II	Treatment III
Feb 19	Message 4	Growing your own potato seeds might be free, but you don't get as much yield as if you grow certified seeds. Talk to your IPCC about different potato varieties, and press #2 in the menu to see seed availability.	Growing your own potato seeds might be free, but you don't get as much yield as if you grow certified seeds. To know more about certified seeds talk to an expert by pressing #7 in the menu and reply. You also can Press #2 in the menu to see seed availability.	Growing your own potato seeds might be free, but you don't get as much yield as if you grow certified seeds. To know more about certified potato seeds chat with an expert or to chat with other potato farmers, press and reply. You also can Press #2 in the menu to see seed availability.
Feb 27	Question 3	The question is: What causes Mildew diseases?, which season does this disease mostly occur? To respond, please call 0785105575 and win 2000Rwf	The question is: What causes Mildew diseases?, which season does this disease mostly occur? To respond, please write a chat by pressing 7 in the menu and win 2000Rwf	The question is:What causes Mildew diseases?, which season does this disease mostly occur? To respond, please respond to this message, and win 2000Rwf
Mar 4	Answer 3	Answer: The mildew disease is caused by fungi during rainy season or when humidity is high	Answer: The mildew disease is caused by fungi during rainy season or when humidity is high	Answer: The mildew disease is caused by fungi during rainy season or when humidity is high
March 4	Message 5	Proper soil preparation allows for aeration, free drainage and management of weeds. It also aids in decomposition of crop residues. To Know more about potato farming techniques and soil preparation, press mAgri on #6 in the menu.	Proper soil preparation allows for aeration, free drainage and management of weeds. It also aids in decomposition of crop residues. To Know more about potato farming techniques and soil preparation, press mAgri on #6 in the menu.	Proper soil preparation allows for aeration, free drainage and management of weeds. It also aids in decomposition of crop residues. To Know more about potato farming techniques and soil preparation, press mAgri on #6 in the menu.

Table A2 (cont.): timing and content of the second wave of promotional content and quizzes.