Mahindi Master
virtual learning for real farmers

User's Manual

Written By:

Matt Kimball
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Section 1: Introduction

Mahindi Master is a training app designed to help farmers in developing countries safely and effectively make the most of the resources available to them for farming corn on small plots of land.

The word 'Mahindi' is Swahili for maize, or corn.

Mahindi Master was developed by Emilia Tjernström and Rachel Frattarola of the University of Wisconsin – Madison and Travis J. Lybbert of UC Davis. It was programmed and animated in part by Matt Kimball of Snapkick Studios.

Section 2: Setup and Installation

Currently, the only way to install *Mahindi Master* is by manually copying the installation APK file onto the destination device and installing it from a file browser.

Users who want access to the data should install *ES File Explorer* to help with file management. *ES File Explorer* is available for free from the Google Play store.

The easiest way to get the APK installation file onto the target device is to plug it into your primary computer with a standard USB (male) to micro-USB cable (male) cable. Your tablet will then likely ask if you would like to switch it into USB storage mode. Select "Yes," making your tablet appear as an external storage device. It might look like a standard thumb-drive in your list of drives.

Now find the .apk on your computer, and drag it over into a folder on the tablet device drive. Anywhere is fine as long as you can find it again later from ES File Explorer on the tablet. 'DCIM' is a safe bet (where photographs and video are saved).

You will probably need to enable an "install apps from outside Google Play store" on your device. First go to 'Settings', then 'Security' then select 'Unknown Sources'.

Then open ES File Explorer and navigate to the folder you copied the APK file to. Click on it to begin and finish the installation. When you're done, the *Mahindi Master* icon will be visible in your list of installed apps. Additionally, you can press and hold that icon from the Apps list to place it somewhere convenient on your home screen.

Section 3: Running and Stopping

To run Mahindi Master, just click the icon. Nothing to it! However, if you have already run it, you may find it's already running in the background and you actually want to restart it.

To stop the app, long press the 'Home' button on your device (some tablets will require you to swipe 'in' from the edges of the screen to reveal an on-screen Home button). This will bring up a list of currently running apps. Swipe left and right (or up and down, depending on the orientation of the device) to select between the various apps running and find the *Mahindi Master* screen. Then press and hold it and drag it off the screen to shut down the app.

To restart the app, click its icon again and it will start back up at the beginning.

Quick tip: During all levels after the Test Round, the user can press the Mahindi Master icon in the upper left to return to the Title screen to review the results so far.

Step 1: Select the current user

The first thing you see when running the app is the Admin screen, here you can select which user is about to use the app, input the amount per kilogram their fertilizer will cost on the final step, and reset the user's progress (but be careful with that, more below).

To select the current user, press the +/- buttons in the 'Village' and 'HHID' selection panels until the correct user's name is displayed here:
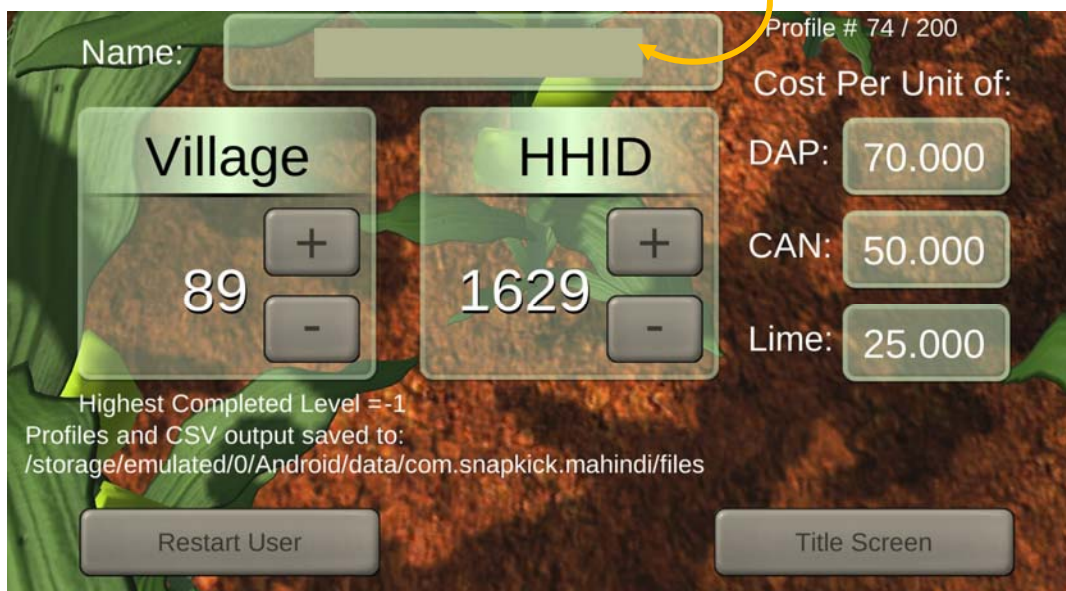
To adjust the amounts each unit (kilogram) of fertilizer costs, click inside the number entry box and an onscreen keyboard will appear allowing you to type in the correct amount (up to six digits of accuracy).

Optionally, you can press the 'Restart User' button, which resets the currently selected user's progress within the app. Generally you should not do this because it will overwrite their usage log.

After selecting a user and pressing 'Title Screen', enumerators should hand the app over to the end user, but should still guide them through the first few screens.

Step 2: Start Game

From the Title Screen, the user will first press the 'Start' button. This brings up the Age Selection screen. This is simply a way for the user to get comfortable with onscreen controls, the actual age they select does not factor into the app's execution at all. But enumerators should verify that they enter the correct age.

When the user is done, they will press 'Next' to proceed to the Acreage Selection screen.

The Acreage Selection is used during the Test Round (Level 1), and the results the app's algorithms use to determine crop yield will be scaled by this number. The user should press + / - to change the Acreage until it is close to the size of their field. When they are done, they press the 'Typical Yield' button to proceed to the next step.

On the Typical Yield screen, the user can select how many 90kg bags of maize they typically harvest from their field. This number isn't actually used in any computations within the app, but it's useful for the app creators to know for future enhancements and additions. When completed, the user should press the 'Dirt' button to move on to the Dirt Type Selection screen.
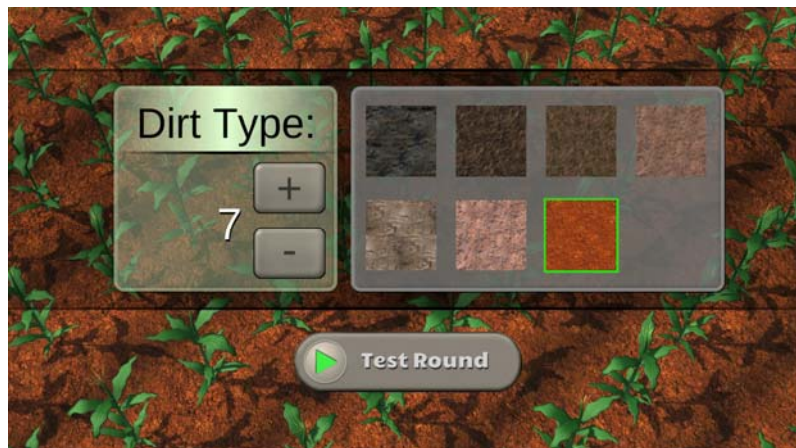
In the Dirt Type Selection screen the user can select the color that makes the app soil look the most like their own field. This selection does not affect yield computations, but is supposed to help the user relate to the program. To select a different dirt, either click on the image of the dirt desired, or use the Dirt selection panels + / - buttons to cycle between the available options. When the user is happy with their selection, they can press 'Test Round' to begin Level 1.

Step 3: Test Round (Sanity check)

The very first level (or "round") of the game is a special round, in which enumerators ask the user what inputs they "normally" apply on their field. This fertilizer selection should correspond with the "typical yield" selected earlier. The enumerator then selects from all available options of fertilizer types to adhere to the farmer's "typical" season.

On the *Fertilizer Selection Screen*, the enumerator selects which of the DAP, CAN, and Lime fertilizers the farmer normally uses, and how much of each to apply. On this special level, the yield will be scaled to the Acreage they selected earlier. On all following levels, the yield is calibrated to a field that is 1 acre.

To change the current fertilizer selection, use the + / - buttons in each of the DAP, CAN, or Lime selection panels. The range is

- DAP: 0 -125, at 25kg increments
- CAN: 0 -125, at 25kg increments
- Lime: 0 – 2,000, at 250 kg increments

This level will show 'OK' rainfall or 'favorable' rainfall, but the Summary screen will show yields for all weather types for reference.

Press 'Start Season' to begin the planting and harvesting animations, and see the results.

Step 4: Planting and Harvesting Animations

Here, the user will watch the options they selected be applied to the virtual field. It is very similar for any of the levels, varying slightly with what fertilizers are available and which are chosen. After a few seasons, the animation will proceed at a faster pace.

Next, the harvest animation will play. First the camera pans over to where the harvest bags accumulate, the maize plants start to dry before harvest, and then corn can be seen flying from the field into the bags where it becomes grain as they fill up.
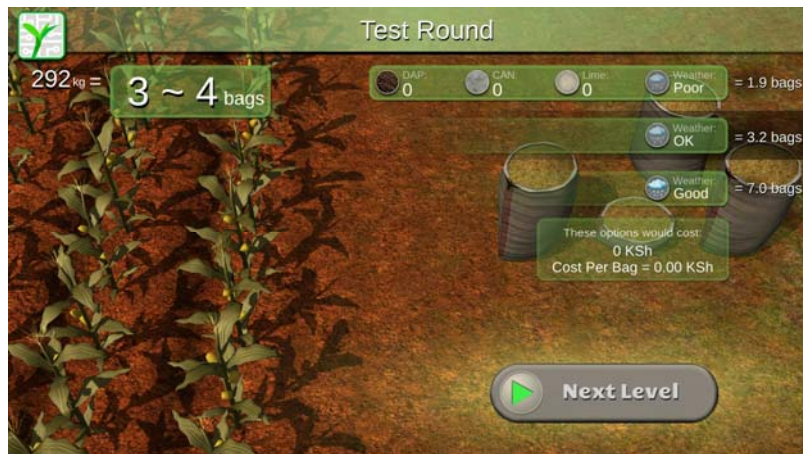
The number of bags shown has a maximum cap at 30, but sometimes the yield will be a little higher than this, so it's best to use the 'Yield Bags' counter in the upper left for reference. Again, in the 'Test Round' level, this number is scaled to the user's selected Acreage, but all further levels will show the yield as 'per acre'.

Also shown on this screen are the total cost of the selected fertilizer options, as well as the cost per 90kg bag. These figures are visible on the right side of the screen, under the summary of selected fertilizers and weather types.

After the harvest animation has completed, the user can select the 'Next Level' button, or press the Mahindi Master icon in the upper left to return to the Title screen if they would like to review the results so far.

Step 5: Subsequent Levels

After the Test Round, the user plays at least 7 levels before arriving to the Final Selection level. These levels gradually increase the number of available options to the user and are described below:

- Levels 2 - 4: Only DAP is available. Rainfall levels will be randomly selected.

- Levels 5 - 6: DAP and CAN are available. Rainfall levels will be randomly selected.

- Levels 7 - 8: All fertilizers are available to select (DAP, CAN, and Lime). Rainfall levels will be randomly selected.

- Levels 9+ : the user may play as many seasons as they wish. DAP, CAN, and Lime all remain available. Additionally, on these levels, the user can select what weather they would like to see. Available options are 'Poor' (not favorable), 'OK' (somewhat favorable) and 'Good' (very favorable). The weather selected affects the yield computed, and is computed based on the 35th, 50th and 65th percentiles of historical rainfall in the user's area.

After any round from level 9 onward, the user can select to play more seasons, or proceed to the Final Round, which is described below.

After level 9+, but before the Final Round, the Results Summary screen is shown allowing the user to press the + / - selection buttons to cycle between all previously played levels and see what the results were. When they're done they press the 'Final Level' button to proceed to the last level.

Step 6: Final Round

This round is a bit different than the previous rounds. In this round, the user has a limited budget to use to select their fertilizer options. Each kg of selected fertilizer will be deducted from their 5,000 KSh budget shown in the bottom left. If the user would like to reset their selection and start over they can click the 'Reset' button next to the allowance.

After making their selection and pressing the 'Start Season' button, the planting and harvest animations are shown again (at a considerably faster pace). After the results are summarized in the harvest summary screen, the user is given the option to Retry with new selections. If they are happy with the results, they can click Done to summarize their final selection.

At this point the user is done, and is given the option to return to the title screen, where they can review their Results from the 'Results Summary' screen, or take another try at the Final Level to try some different options.

Section 5: Results

On the Admin screen, a location in the tablet's file structure is listed under the HHID and Family selection panels. This is where the results for each user are stored, as well as critical profile storage files which keep track of the user's saved options and progress within the app. The format of these summary files is described below.

The results files are stored in Comma Separated Value format (CSV), and they're named something like '52_968_results.csv', where the first two numbers represent the Village ID, then the next 3 or 4 numbers are the Family ID, and then the word '_results'.

You can view these files in Notepad or any text editor, or import them as a spreadsheet in Excel or compatible software. An example is shown below in table form (the way it would look if imported into Excel):

Name	Village ID	HHID	Level	Time started level	Time finished level	DAP (kg)	CAN (kg)	Lime (kg)	Rain	Yield (kg)	Selected acreage	Results scaled?	Final selection level?
Name	52	961	0	35.09516	90.60612	25	25	250	2	1099	5.75	1	0
Name	52	961	1	90.99174	131.898	50	0	0	2	1574	5.75	0	0
Name	52	961	2	132.241	175.8047	75	0	0	3	2509	5.75	0	0
Name	52	961	3	175.946	225.3272	125	0	0	3	2789	5.75	0	0

The timestamps are measured in seconds since the start of the application.

Rain is coded as follows: 1 = Poor, 2 = OK, 3 = Good.

Selected acreage is the acreage indicated before the Test Round.

Results scaled equals 1 when results have been scaled to the user's selected acreage (and only happens in the test round) and 0 when the field size is 1 acre.

Final selection level equals 1 when the round being played is the final selection round. Remember that users are allowed to repeat the final season until they are satisfied with their choice.

In the example above we can see that the user played the first 4 levels, i.e. has not reached the final level yet. We can also see that they played for about 225 seconds seconds so far.

Section 6: Trouble-shooting

Hopefully you won't encounter any problems while installing or using Mahindi Master, but if you do, the following may help.

Ensure that you have completely shut down the application (described in Section 3).

Then, open ES File Explorer to the file path specified on the Admin screen to find the profile data files and results summary.

Plan to make a backups any time you plan to directly manipulate the data files. Copy them into any other folder. If you ever need to restore them, copy them back into the folder you got them from. You can also email them to yourself as an attachment using your favorite email program.

If you encounter any problems or erratic behavior with the app, it could be because the profile data structure has been updated since the last time you ran the app. So the app may have trouble loading the old profile data. To correct this, make sure the app is shut down completely, then delete the following files:

Mahindi_profileData.dat and Mahindi_gameData.dat

Then restart the app – it will recreate those files.

If you have any further problems or questions regarding the use of this app, please feel free to contact the programmer and author of this document, Matt Kimball at the following email address:

Greyworld@Gmail.com

Thanks and good luck!

Have a nice day!