Food and Agriculture Organization of the United Nations

Guide on digital agricultural extension and advisory services

Use of smartphone applications by smallholder farmers

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 2023

Required citation:
FAO. 2023. *Guide on digital agricultural extension and advisory services – Use of smartphone applications by smallholder farmers.* Rome. https://doi.org/10.4060/cc4022en

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ISBN 978-92-5-137561-7
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Foreword

Accessibility to digital innovations and literacy in digital tools are paramount to unleashing the potential of rural communities to reap the dividends of current digital agriculture economy. This will contribute to the United Nations' Sustainable Development Goals (SDGs). While Internet use is growing, significant barriers continue to exist, with the digital literacy gap widening and the digital literacy in rural areas lagging behind. In response, FAO has launched a number of initiatives to strengthen its leadership in promoting digital innovations and farmers' digital literacy for the transformation of agrifood systems. In 2020, FAO established the International Platform for Digital Food and Agriculture and launched 1 000 Digital Villages Initiative. The FAO Digital Services Portfolio, composed of a variety of applications, databases and platforms, has also been developed. These digital services strengthens access to useful data, information, maps and statistics.

Driven by development initiatives of integrating digital agriculture as a core strategy to transform agrifood systems by deploying a multitude of digital tools in most countries, agricultural extension and advisory services (EAS) have been undergoing a rapid digitalization process over the past decades. Digital innovations bring new opportunities for EAS delivery, including improving accessibility to services in geographically remote areas, bridging the information gaps among different value chain actors, and contributing to fair trade and inclusive markets, social and financial inclusion and others (FAO, 2021). Digitalization of EAS can enhance accessibility, delivery, transparency, scope and impacts of information and services for smallholder farmers, including rural youth and women. Major digital EAS initiatives have started to provide a range of services, including EAS, market linkages, financial access, supply-chain management, agricultural intelligence, and various kinds of bundled services provided by platforms (Africa Union, 2020; FAO, 2021). However, smallholder farmers face a myriad of challenges and capacity gaps in access to digital EAS. Recent studies revealed that smallholder farmers' digital literacy, along with insufficient digital human capital development and infrastructure investments in rural areas, have become the paramount barriers and constraints for them to access and benefit from digital EAS (Kansiime *et al.*, 2021). Therefore, smallholder farmers need to be

empowered through innovative approaches to enable them to access digital EAS for achieving economic, environmental and social gains sustainably, while leaving no one behind in the digital era.

Taking into consideration that the smartphone has become an emerging digital tool for smallholder farmers to access digital EAS, we developed this guide to support farmer training on digital literacy through which smallholder farmers can gain essential skills to access digital EAS via smartphone. This guide provides a training framework composed of basic knowledge and skills on using a smartphone, access to digital EAS, access to e-commerce, and capacity building via smartphone. It also provides an Annex on the basics of smartphones. The targeted users are farmer trainers and related EAS agents working in the field of farmer empowerment on digital literacy. It can be adapted to and integrated into training of trainers (ToT) courses, e-learning courses, farmer digital vocational schools, farmer digital training schools and other practical approaches of training on digital literacy of smallholder farmers.

This publication provides a concrete and practical training material for contributing to the achievement of the FAO-led International Platform for Digital Food and Agriculture and 1 000 Digital Villages Initiative. We hope that this training guide will also contribute to improve farmers' digital literacy and related innovations to promote an inclusive and sustainable development in smallholder farming systems for better production, better nutrition, a better environment and a better life while leaving no one behind.

We encourage creativity and adaptation when trainers use this guide, and welcome feedback for its further improvement.

Acknowledgements

The overall drafting and coordination of this guide were carried out by Puyun Yang, Selvaraju Ramasamy, and Yapeng Ou from the Office of Innovation (OIN) of the Food and Agriculture Organization of the United Nations (FAO).

This publication was made possible by the valuable contributions of many people from a variety of backgrounds, both from and outside FAO. Sincere thanks are extended to Dr Min Wan (CABI East and Southeast Asia), Dr Feng Zhang (CABI East and Southeast Asia), Dr Manju Thakur (CABI South Asia) and Ms Claire Curry from the Centre for Agriculture and Bioscience International (CABI) who drafted the section 3.2.3; to the Pinduoduo Corporate Affairs team who drafted the section 3.3; and to Dr Yue Shi and Prof Wenjiang Huang from the Aerospace Information Research Institute of the Chinese Academy of Sciences (CAS) who drafted the Annex on basics of smartphones. Special thanks go to Dr Yelitza Colmenarez, Dr Sathis Sri Thanarajoo, Dr Eduardo Hidalgo, and Mr Arulanandam Vakeesan for all the support and contribution through the CABI-led Plantwise programme.

OIN colleagues, Nevena Alexandrova, Meng Zeng and Lu Jiang kindly reviewed chapters related to their areas of expertise and provided valuable technical comments and inputs to the guide. Special thanks go to Cristiano Consolini who prepared screenshots for sections 3.1.1 and 3.2.2 and Ms Nadia Pellicciotta who prepared the figures in sections 3.1.3 and 3.1.4 of this guide.

We would like to express our sincere gratitude to the following external reviewers Dr Dannie Romney (CABI), Dr Mark Berthelemy (CABI), and Dr Monica Kansiime (CABI) for taking the time to provide insightful feedback.

Finally, we would also like to thank Ms Nadia Pellicciotta for graphical design and layout.

Abbreviations and acronyms

EAS	extension and advisory services
AFSTA	African Seed Trade Association
ASHC	Africa Soil Health Consortium
AU	Africa Union
CABI	Centre for Agriculture and Bioscience International
COVID-19	coronavirus disease 2019
CPU	central processing unit
FAO	Food and Agriculture Organization of the United Nations
FMP	farming management platform
GPS	Global Positioning System
GPU	graphics processing unit
IBM	International Business Machines Corporation
ICTs	information and communications technologies
IPS	in-plane switching
ISFM	integrated soil fertility management
LCD	liquid crystal display
LED	light-emitting diodes
LPDDR	low-power double data rate
LTE	long-term evolution
MAIP	multiactors agricultural innovation platform
NGO	non-governmental organization
OIN	Office of Innovation
OS	operating system
PMDG	pest management decision guide
PPP	public-private partnership

PWKB	Plantwise Knowledge Bank
RAM	random-access memory
SDGs	Sustainable Development Goals
SMS	short message service
SoC	system-on-a-chip
SSA	sub-Saharan Africa
TECA	Technologies and Practices for Small Agricultural Producers
ToT	training of trainers

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1. Introduction

An increasing number of governments in developing countries have approved policies that support the use of digital solutions and tools in alignment with national, regional or global economic policy frameworks. For example, African countries promulgated policies within the framework of the Africa Union's (AU) Digital Transformation Strategy for Africa (2020–2030), which has set continental digital policy objectives and priorities with development of an integrated and inclusive digital society and economy in Africa as its vision. The country-level policies include digital agriculture as a major strategy to improve agricultural production, with public–private partnerships (PPPs) as one of its core objectives (Asenso-Okyere and Mekonnen, 2012). This has led to a widespread diffusion of digital products and services on the continent. Indeed, the next period of growth in mobile connections is expected to come mainly from rural communities (Trendov *et al.*, 2019).

According to Kansiime and others (2021), by the end of 2019, 477 million people in sub-Saharan Africa (SSA) had subscribed to mobile services, accounting for 45 percent of the population. Equally, infrastructure deployment in SSA increased 3G coverage from 63 percent in 2017 to 70 percent in 2018, extending access to more than 80 million people. In China, 4G Internet/broadband network had covered 98 percent of administrative villages by the end of 2020, with the number of Internet users in rural area reaching 309 million, accounting for 55.9 percent of rural population (Trendov *et al.*, 2019). As a whole, there are 989 million Internet users in China, accounting for 70 percent of Chinese population, and 99.7 percent of Internet users access Internet via mobile devices. In 2020, there were 253.8 mobile phones per 100 households in rural areas of China.

The integration of digital agriculture into strategies and policies aimed at improving agricultural production, strengthened PPPs, and the availability of digital information resources have driven the adoption of digital tools and solutions to improve agricultural extension and advisory service (EAS) delivery over the past decade. Furthermore, the COVID-19 pandemic has triggered and broadened use of digital tools (World Bank, 2020) for sharing information, delivering EAS to farmers, and to some extent receiving the feedback from them. Digital technologies bring new opportunities for EAS delivery, including improved accessibility to services in geographically remote areas, bridging the information gaps among

different value chain actors, and contributing to fair trade, market accessibility, social and financial inclusion and so on (FAO, 2021). Digitalization of EAS can enhance accessibility, delivery, transparency, scope and impacts of information and services for smallholder farmers, including rural youth, rural women and other vulnerable groups. Major digital EAS initiatives have started to provide a range of services, including agricultural advisory services, market linkages, financial access, supply chain management, agricultural intelligence and various kinds of bundled services. Specifically, EAS agents are expected to promote the use of digital tools and the Internet for disseminating information on technologies, disease control, price information and so on (Sejersen *et al.*, 2020). Besides, digital tools have been increasingly deployed to improve the accountability of EAS. The application scope of digital tools are to be broadened both as EAS delivery tools and as mechanisms for demand articulation, monitoring, and greater transparency and accountability (Davis, 2020).

It is acknowledged that EAS provision through digital tools has the potential of revolutionizing agriculture and significantly improving smallholder farmers' livelihoods in Africa (Kansiime *et al.*, 2021). However, the potential of digital EAS tends to be unfully harnessed and their benefits unequally distributed due to an evident, widening digital divide between rural and urban areas, gender, and different social groups both within and among regions. Indeed, emerging economies and especially rural areas risk being left behind in the digitalization process, mainly due to weak technological infrastructure, high costs of technology, low-level digital literacy and digital skills, weak regulatory framework and limited access to services (Trendov *et al.*, 2019).

The availability, accessibility and affordability of digital EAS for smallholder farmers are critical to ensure an inclusive development of digital agriculture while reducing the digital divide. Enhancing their digital skills is therefore one of the fundamental conditions that enable the uptake of digital EAS by smallholder farmers. Recent studies have however revealed that smallholder farmers' low digital literacy, along with insufficient human capital development and investments in infrastructure especially in rural areas, has become paramount barriers and constraints for them to access and harness the potential benefits of digital EAS (Awadalla, 2019; Tsan *et al.*, 2019; Kansiime *et al.*, 2021; Evans, 2019). Especially, smallholder farmers in rural areas in developing countries have limited access to and utilization of digital EAS, especially those delivered via emerging digital tools. For example, radio is still the most prevalent device used by smallholder farmers to access EAS, followed by television and mobile phones, and use of computers is less than one percent in Kenya and three percent in Uganda (Kansiime *et al.*, 2021). In many developing countries, smallholder farmers lack digital tools and literacy and affordable Internet access due to high Internet costs (Hudson et al., 2017; Tsan *et al.*, 2019; Kansiime *et al.*, 2021). Therefore, smallholder farmers need training to enhance their digital literacy so as to improve their uptake of digital EAS. This

Do you know this?

Although digital EAS are increasingly delivered through mobile phones, especially smartphones, at the same time, there has been a dramatic shift in the way radio and television are used in developing countries. The proliferation of privately owned and community radio stations is providing farmers with high-quality material in local languages and the opportunity to participate in the two-way flow of information in ways undreamt of a generation ago. Radio services are particularly important for farmers who live in remote areas where EAS agents seldom or never venture and where there is little or no access to the Internet. They are also highly cost-effective.

Each tool has its own niche, advantages and disadvantages. Successful digital EAS initiatives tend to recognize and build on the existing capacities and knowledge of farmers and entrepreneurs. Frequently, different tools can be combined to good effect. For example, some extension projects have successfully blended the use of short message services (SMS), the Internet and radio. However, there are too many examples of ICT-based projects that have worked well, only to collapse once the funding ceases. They should therefore be designed with sustainability in mind. It is important to ensure that the benefits of digital EAS do not flow exclusively to enlightened and better-off farmers. Digital EAS should target the poor and women, and there should be a strong emphasis on ensuring their sustainability when managed by local communities.

Source: **Pye-Smith, C.** 2012. *Agricultural extension, a time for change: Linking knowledge to policy and action for food and livelihoods.* Wageningen, Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA). https://publications.cta.int/media/publications/downloads/1689_PDF.pdf

proves to be the crux of the goal to leave no one behind in the digital era. Considering the above-mentioned benefits of digital EAS, the challenges of their uptake, and the importance of digital empowerment of smallholder farmers in particular, this guide provides a framework for designing training activities aimed at enhancing smallholder farmers' digital literacy in terms of basic knowledge and skills on using digital tools (particularly smartphone), access to digital EAS, access to e-commerce, and capacity building. Also, considering that there has been a revolution in digital tools over the past three decades, with mobile phones becoming a key tool for transmitting knowledge and market information to farmers (Pye-Smith, 2012), this guide highlights the use of smartphone to access digital EAS. It also provides an Annex on the basics of smartphones. The targeted users are trainers in the field of farmer empowerment and related agents of public EAS agencies. It can be used for a variety of scenarios related to farmer training. It can be adapted to and integrated into training of trainers (ToT) courses, e-learning courses, farmer digital vocational schools, farmer digital training schools and other practical training approaches of training on digital empowerment of smallholder farmers.

2. Goals and scope of application

2.1 Goals

This guide is aimed to support training activities and curriculum development for promoting smallholder farmers' access to digital EAS via smartphone. Therefore, it seeks to empower smallholder farmers in developing countries through innovative training activities to enable them to access digital EAS. The specific goals are:

Strengthening smallholder farmers' training on digital empowerment through enabling policies and institutional supports; therefore,

- Government should commit to training on digital empowerment of smallholder farmers with the support of public policy; include building capacity in digital competence for staff of all sectors at all levels of agricultural administration and public EAS sectors, supported by clear regulatory framework; and provide adequate public funds to support digital EAS and ensure more demand-driven digital EAS.
- EAS agencies should integrate training on digital empowerment of smallholder farmers into their mandates as an essential service provided to meet smallholder farmers' practical and emerging needs.
- Public EAS providers' performance of digital EAS delivery is to be monitored and evaluated, with specific attainable goals and indicators.
- A coordination mechanism between different government departments at different administrative levels is to be established, including departments of agriculture, education, finance, information and communication technologies (ICTs), etc. for collaboratively supporting training on digital empowerment of smallholder farmers.
- Gender targets are to be incorporated as part of the investments,

explicitly funding grantees who prioritize women in terms of training on digital empowerment of smallholder farmers.

Strengthening training on digital empowerment of smallholder farmers through empowering EAS providers, therefore

- conducting needs assessment to review capacities of EAS providers and understand smallholder farmers' needs for digital EAS based on existing infrastructure; and identify education and training needs of smallholder farmers to access digital EAS and relevant needs of capacity building of EAS providers;
- empowering EAS providers through training of trainers (ToT) courses, e-learning platforms and practical implementation of training activities on digital empowerment of smallholder farmers;
- conducting demonstration and EAS programmes through EAS agencies, private sectors, non-governmental organizations (NGOs), digital platforms and farmer organizations to conduct training on digital empowerment of smallholder farmers; and
- engaging different sectors such as EAS, education, ICT enterprises, inputs supply, agribusinesses, NGOs, investing and financial agencies and farmer organizations to take coalitional and coordinated actions to promote training on digital empowerment of smallholder farmers.

Strengthening training on digital empowerment of smallholder farmers through innovative training approaches, therefore

- analysing and identifying gaps between smallholder farmers' realities and their potential, which could be harnessed through digital EAS;
- setting up goals for training smallholder farmers to access digital EAS;
- developing training guidelines and training curricula to enhance smallholder farmers' digital skills based on needs assessment;
- promoting participatory training courses on digital empowerment to build up smallholder farmers' digital capacities and skills; and
- developing necessary infrastructures and facilities, for example, multiactors agricultural innovation platforms (MAIPs), digital platforms, farmer digital vocational schools, farmer digital training schools, etc., to host joint actions on training on digital empowerment of smallholder farmers that are aimed at improving their access to digital EAS.

2.2 Scope of application

The main targeted users of this guide are professional trainers in the field of farmer empowerment and related agents from public EAS agencies. They can use this guide for a variety of scenarios

related to farmer training on digital literacy. It can be adapted to and integrated into training of trainers (ToT) courses, e-learning courses, farmer digital vocational schools, farmer digital training schools and other practical approaches of training on digital empowerment of smallholder farmers.

In general, training on digital empowerment of smallholder farmers should start with the design and implementation of ToT courses. The trained trainers from public and private EAS sectors will be able to promote training on digital empowerment in smallholder farmer communities. When properly trained, lead farmers are empowered to work with trainers to conduct participatory farmer training. Training on digital empowerment of smallholder farmers must be inclusive, with the engagement of the hardest-to-reach ones and also vulnerable groups, especially women and young farmers.

The application of this guide should be aimed at the development of smallholder farmers' basic knowledge and skills on using appropriate digital tools such as smartphones in particular for the purpose of not only accessing daily information, digital EAS, e-commerce and so on, but also building up their self-learning abilities by using a smartphone.

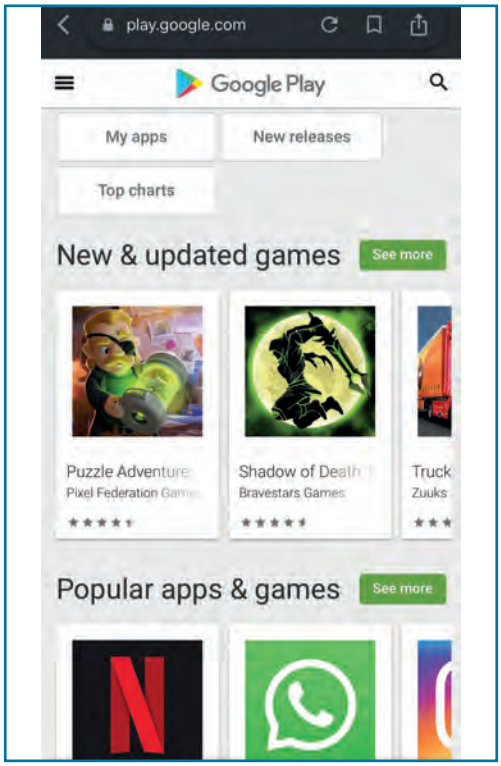
3. Proposed training curriculum

3.1 Getting started

3.1.1 How can I download and install applications for accessing agricultural extension services?

It is suggested to download apps from Google Play or App Store on a smartphone. However, this can also be accessed from other sources.

STEP 1 Find “App Market” on your smartphone (displayed as “App Store” on some phones), and click to enter and you will see the homepage of App Market as the screenshot below shows.



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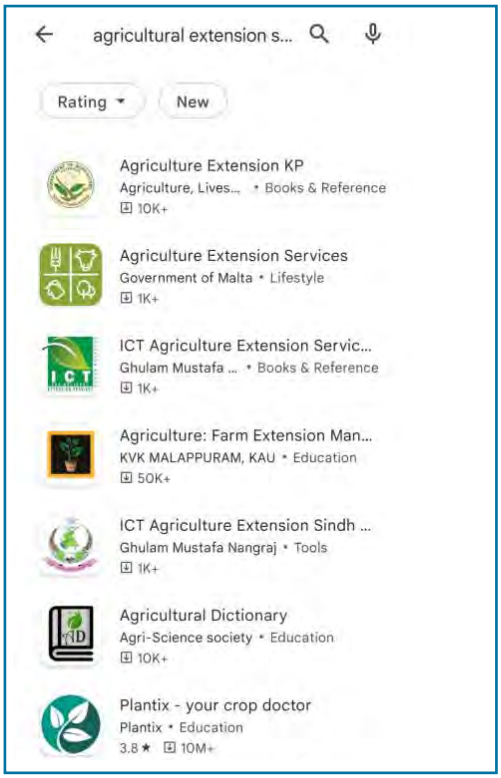

STEP 2 Type the theme/name of the app in the search box that you would like to download. For example, type and search “agricultural extension services”.

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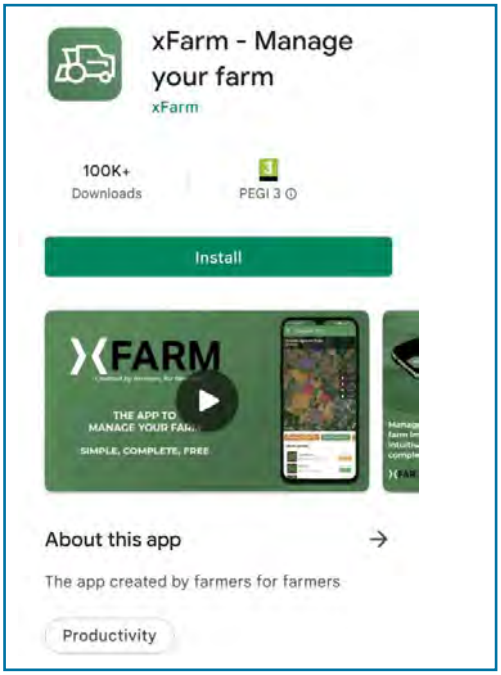
STEP 3 You will see a list of apps related to the theme “agricultural extension services”. Scroll down the list. For example, if you choose to install the app “xFarm – Manage your farm”, click on it to consult the details. If you want to download it, click “Install” to download and install it.



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TIPS

- We recommend you to download the software in a WiFi environment. Otherwise, it will consume a lot of data of your mobile network.
- Never download software from unknown sources. When choosing software, give priority to software marked as “official” in the “App Store” or “App Market”.
- Never connect without judgment to passwordless WiFi from unknown sources to prevent fraudsters from using fake base stations to steal user information.
- Before downloading an app, make sure that it is available in your country/region as some apps have limited geographical coverage.
- When an app has more downloads than the other similar ones, this means that it has more users. This is an indicator of its maturity and popularity.

3.1.2 How can I register an account for a WhatsApp application?

STEP 1 Download and launch the app: Download WhatsApp Messenger for free from your “App Store” or “App Market”. To open the app, tap the WhatsApp icon on your home screen.

STEP 2 Review the Terms of Service: Read the Terms of Service and Privacy Policy, then tap Agree and Continue to accept the terms.

STEP 3 Register: Select your country from the drop-down list to add your country code, then enter your phone number in the international format, namely,

with the country code. Tap Done or Next, then tap OK to receive a 6-digit registration code via SMS or phone call. To complete registration, enter the 6-digit code.

STEP 4 Set up your profile: In your new profile, enter your name, and then tap Next. You can also add a profile photo.

STEP 5 Allow access to contacts and photos: Contacts can be added to WhatsApp from your Contacts. You can also allow access to your phone's photos, videos, and files.

TIPS

- Fill in the information as required. Blanks with "*" means obligatory information.
- Verifying your phone number with a registration code is the only way you can activate your account, and you must be able to receive the code on your phone.
- WhatsApp can only be used with one phone number on one device at a time. After you successfully register your phone number on WhatsApp, anyone who might be using your account is automatically logged out and your account is protected.

3.1.3 How can I create a WhatsApp group?

You can create a WhatsApp group in two ways.

Option one:

STEP 1 Launch WhatsApp: Do this by tapping over the WhatsApp icon in the menu.

STEP 2 Open dot menu: Tap on the three dots ⋮ in the upper right corner.

STEP 3 Create a new group: Tap over the option "New group" shown on the top.

STEP 4 Add participants: Type the contact name in the search box, or scroll the list and tap over the name of the contact to add it to the group. Then tap on next in the lower right corner.

You cannot add participants without adding them to your Contacts, whereas you can message them without adding the contact.

STEP 5 Add subject: Type the subject of your group, i.e. name of the group and tap on the check mark.

STEP 6 Confirm group created: In Chats list, if you see your

group name, this means that you have successfully created a group.

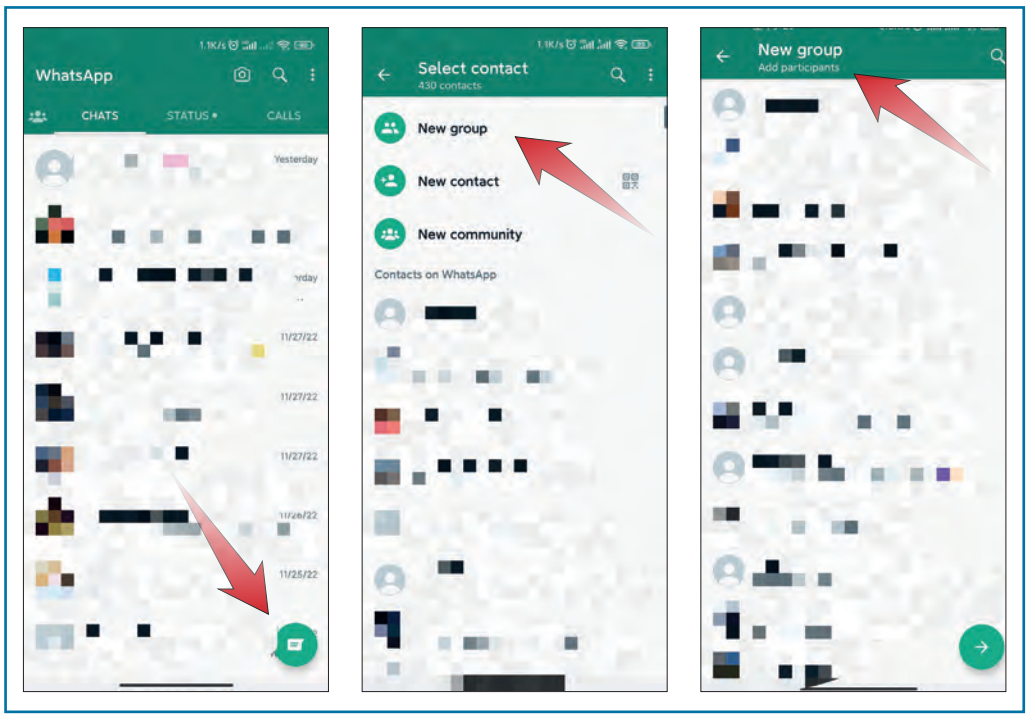
STEP 7 Add profile photo (optional) and more participants: Tap on the group and then three dots in the upper right corner. Now tap on the group info, and tap on the space for a profile photo, now you can select profile photo for your group from the gallery. You can mute notifications for the group if you want to. You can add more group members by tapping on the icon that looks like a person with plus sign.

STEP 8 Tap the Completion icon when you are finished.

Option two:

STEP 1 Click on the Message icon on the lower right of the screen to send a new message. There are three options here. You can create a new group, create a new contact, and select one of the existing contacts to send a message. Click on New group to begin from scratch.

STEP 2 In the next screen, you will see all the contacts that you have on your smartphone in alphabetical order. You will be asked to add participants here. Tap on the contacts that you want to be a part of this group.



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STEP 3 After adding all the contacts that you want to be a part of this group, tap the Next icon at the right bottom.

STEP 4 Repeat steps 5–7 in Option one.

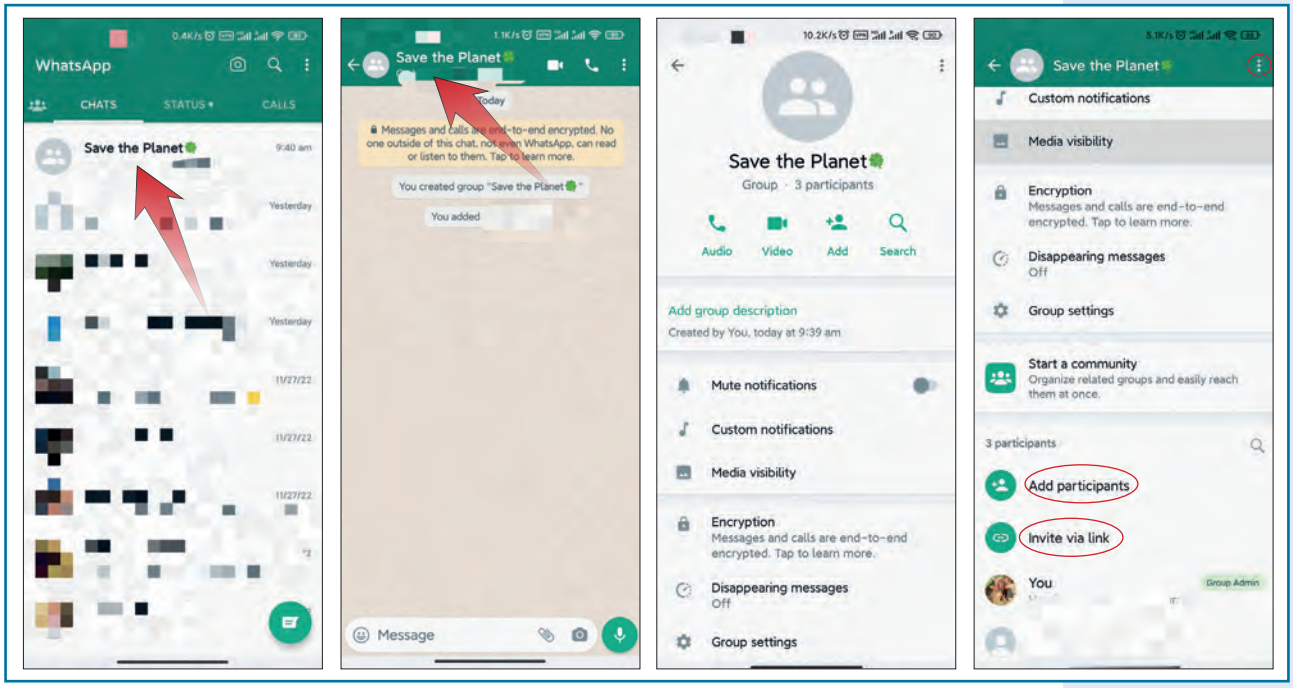
- If you are creating a group, you are the admin of the group. You can designate more admins to the group. Adding and removing a member can only be done by group admins.
- You can create a WhatsApp group with up to 512 participants.
- The group subject limit is 25 characters.
- WhatsApp is just an example here. You can also create groups on Facebook Messenger, WeChat and other social media platforms, depending on their popularity within your community.

3.1.4 What can I do in a WhatsApp group?

Members in a WhatsApp group, who can be friends, colleagues, family members, business contacts and so on, generally have similar interests, needs and backgrounds. You can use the group to communicate and interact with other members by sending written messages, voice messages, pictures, and videos. You can also share relevant information and documents that can be interesting for the others. If a member of the group sends any message, it goes to all the members.

If you are a group admin, you can invite people to join a group by sharing a link with them. You can reset link at any time to make the previous invite link invalid and create a new link. Follow the following steps to invite other people to join the group:

STEP 1 Create WhatsApp Group Invite Link: Launch WhatsApp and open the group that you just created. Click on the header, at the top of the screen where you will see the name of the WhatsApp group, to open group options. Scroll down until you see “Invite via link” and click on it to create an invite link. You can also click the icon Add to add from your contacts manually, or click on the menu button on the top right and select “Add participants” to do the same.



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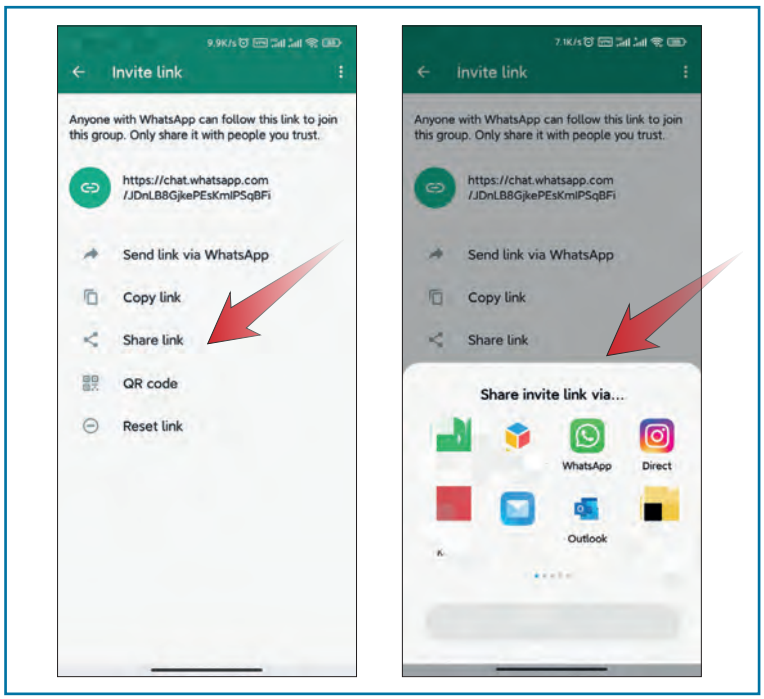
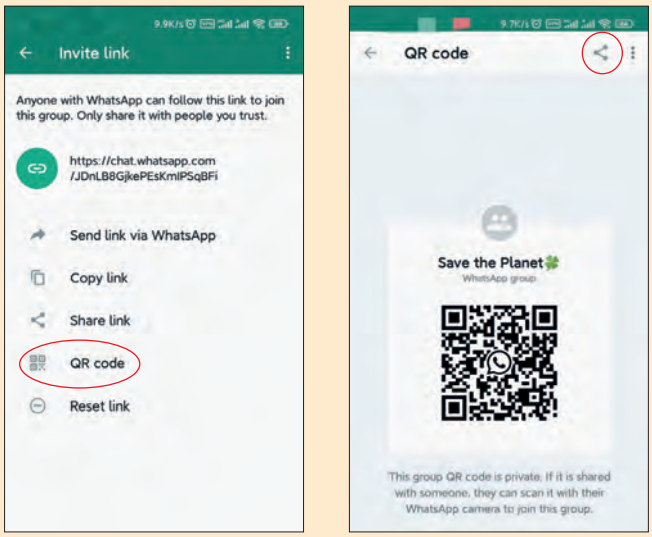
STEP 2 Share WhatsApp Group Invitation Link: On the page that shows up, you can click “Copy link” and then paste and send group invitation link in any app you want on your smartphone like messages, other chat apps, web pages, forums, social media, and so on. You can also click “Send link via WhatsApp” or “Share link” to share the link with others that you would like to invite.



©WhatsApp, modified for privacy

TIPS

- You can also use the QR code option to invite others to join the WhatsApp group. In this case, once get the QR code, you need to have others scan it so as to join the group. You can also click the icon on the header to share the QR code with your contacts. To reset QR code, click the menu button .



©WhatsApp, modified for privacy

- Any WhatsApp user with whom you share an invite link can join the group, so only use this feature with trusted individuals. It is possible for someone to forward the link to other people, who could then join the group without additional approval from the group admin.
- Be aware of those who have physical access to your phone as they can use your WhatsApp account without your permission.
- Do not click on the links that appear to be sent by an "acquaintance". The links may contain viruses. Be alert to the possibility that the number of the seemingly "acquaintance" may be forged or stolen.
- As admin, you need to actively manage the group especially if it has a large membership and you are not familiar with everyone. If there is someone who misbehaves in the group (for example, sending misinformation or inappropriate, misleading or suspicious messages, using discriminatory words or any verbal violence and so on), you need to warn them to stop. If this does not work and they continuing misbehaving, you can remove them from the group.

As admin you can also restrict group members from messaging. To restrict messaging:

STEP 1 Open the group you created and click on the header, at the top of the screen where you will see the name of the WhatsApp group, to open group options. You can also click on the menu button on the top right and select Group Info to do the same.

STEP 2 Click on WhatsApp Group Settings > Send messages > Only Admins. Once you have restricted your WhatsApp group, the members will not be able to send messages to the group. And if they open the group they will see that only the admins can now message in the group.

3.1.5 How can I protect myself from online frauds and scams?

Although smartphones can make our life and work convenient, they can also be used by fraudsters to induce us into frauds and scams. What are the common frauds and scams? And how to protect ourselves from frauds and scams?

① Prize winning information

Fraudsters often send fraudulent text messages (SMS) to mobile phone users randomly in the name of some popular cultural programmes (like TV shows) or promotional activities. Never trust the fabricated winning information inside! Never click on links in scam text messages!

② Fake customer service

Fraudsters may forge fake text messages in the name of the customer service of your bank to induce you to call a fake customer service number and then commit fraud. Do not click on the fake bank website link in the fraudulent text message. Once you click to log in, the fraudsters can get your bank card information and steal the money from your bank account! Fraudsters will also forge text messages from the mobile phone or Internet operator's customer service to induce you to click on fraudulent websites. Once you download and install their software with virus , they will steal the money from your bank account!

TIPS

- Never trust the content of any unverified text messages! Do not reply directly to the text messages! Do not click the link directly, and do not return any suspicious call!
- Be sure to only use the official customer service number to call the official customer service for consultation.

③ Posing as an acquaintance

Fraudsters pretend to be your friends, landlords, teachers and other acquaintances to induce you to click on viral websites in the tone of an acquaintance.

TIPS

Do not click on the links in the messages from seemingly acquaintances. If there is a bank transfer issue, please make a phone or video call with the "acquaintance" who seemingly have sent that message to you first.

④ Posing as government departments, such as public security, social security, etc.

For example, fraudsters may pretend to be a staff from the vehicle management department, enticing you to download a software with virus and thereby stealing your important personal information.

Fraudsters may pretend to be a staff member of the public security bureau. They often deliberately fabricate the fact that you have been found committing "illegal activities", and use a threatening tone to lure you to call another fraudulent phone number. Fraudsters may also pretend to be social security staff and send text messages to induce you to call fake social security bureau contact numbers.

TIPS

- Do not trust so-called government text messages related to accounts, money, transfers, etc.
- Do not directly return calls, text messages or open links. Always verify the authenticity of the sender first.
- If necessary, contact the relevant local government departments to confirm.

⑤ WIFI scams

Usually, fraudsters use free WiFi to lure you to search for links. Once you get connected with the free WiFi, they can easily intercept the network data and crack the password by replacing with an illegal website, and finally steal and transfer your money.

TIPS

- Do not connect to unknown or suspicious free Internet. Do not use WiFi from unknown sources, and turn off automatic connection.
- Do not set your mobile phone to automatically log in online banking and mobile banking.
- Keep your phone safe and install phone security software.
- Set an online payment amount limit.

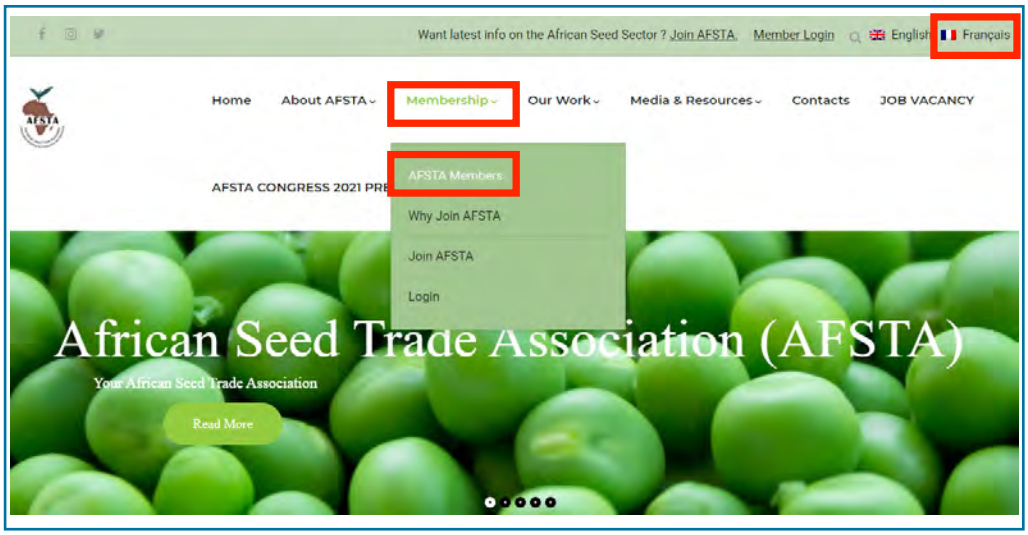
3.2 Access to digital AEAS

3.2.1 How can I access the information on high-quality agricultural inputs such as seed, crop varieties, fertilizers and pesticides on the Internet by using a smartphone?

We recommend you to buy seeds produced by certified manufacturers. You can find this information on the official website of the African Seed Trade Association (AFSTA).

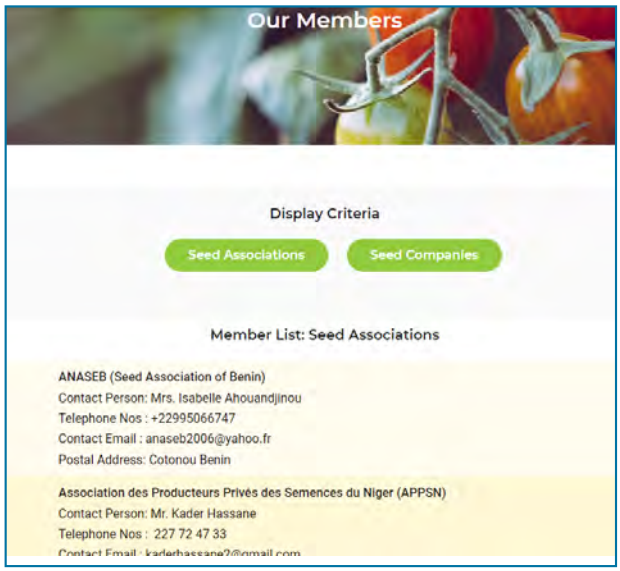
STEP 1 Type “African Seed Trade Association” in the search box of your Internet browser or directly click the link: https://afsta.org/.

STEP 2 Once on the official website of the AFSTA, click the “Membership” and in the drop-down menu click “AFSTA Members”. You can switch the display language to French by clicking “Français” in the top right corner.



©The AFSTA

STEP 3 On the membership list, you can either find the contacts (contact person, phone number, email address, etc.) of affiliated seed associations in your country by clicking the button “Seed Associations” or a list of seed companies by clicking the button “Seed Companies”.



©The AFSTA

There are also emerging applications which offer, among many other services, access to agricultural inputs. However, these apps tend to function only in a certain country or region.

TIPS

To buy high-quality agricultural inputs, it is better to go to formal inputs stores, not from some market stalls or informal agricultural inputs stores, especially those that sell loose. Follow the following five-checks to verify the quality of seeds:

- Check the qualifications of the seed agricultural inputs store. Mainly check whether the seed store has a complete industrial and commercial license.
- Check the label information of the seed outer packaging bag. Crop seeds sold in the agricultural market must be clearly marked on the outer packaging label: crop type, variety name, seed category, net content, production date, quality index, name of the manufacturer, specific address, contact information, seeds sale license number, quarantine certificate number and so on.
- Check whether the category of seeds marked on the production license is consistent with the issuing agency.
- Check the introduction and instructions of the seeds. Regular and high-quality brand seeds have seed instructions and variety profiles, which will clearly explain the suitable planting sites, variety characteristics, sowing methods, and sowing dosages of the seeds.
- Check the appearance of seeds. High-quality seeds tend to have the same grain size, neat appearance, plump and full, consistent and shiny color, plump embryos with the same position of bumps and wrinkles, no damaged grains and so on.

?

Do you know this?

A major barrier to agricultural technology adoption in sub-Saharan Africa is the low availability and uptake of high-quality agricultural inputs, coupled with a lack of reliable information on input quality. The ubiquity of substandard inputs directly reduces farmer productivity and, together with the perception of widespread counterfeiting, reduces demand for high-quality inputs. This lowers input prices and reduces profits for producers of genuine products, causing a form of adverse selection in which counterfeit products push high-quality genuine products out of the market.

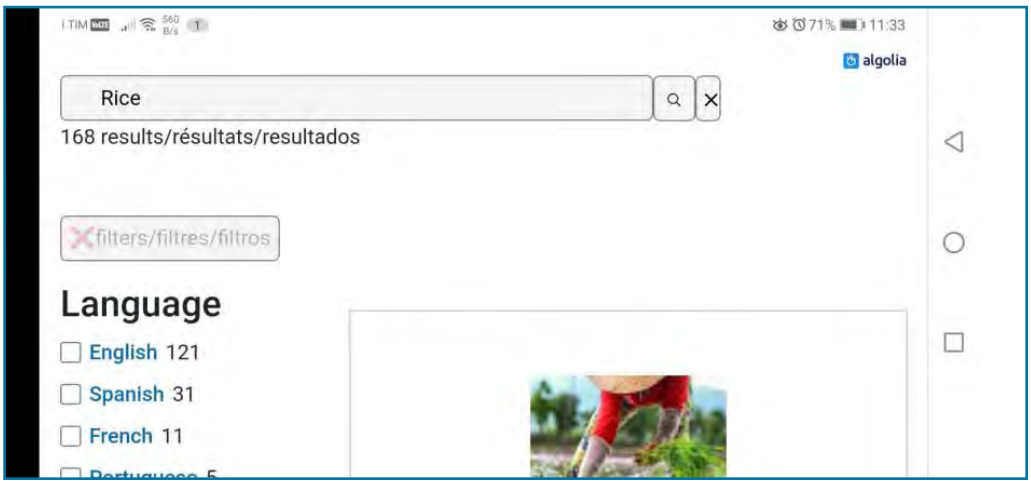
Source: **Tsan, M., Totapally, S., Hailu, M. & Addom, B.K.** 2019. *The digitalisation of African agriculture report 2018–2019*. Wageningen, CTA. https://www.cta.int/en/digitalisation/issue/the-digitalisation-of-african-agriculture-report-2018-2019-sid0d88610e2-d24e-4d6a-8257-455b43cf5ed6

3.2.2 How can I search for farming and animal husbandry techniques on the Internet by using a smartphone?

Technologies and Practices for Small Agricultural Producers (TECA) is an optimal free access online platform to access farming and breeding techniques. Launched by the FAO in 2002, the TECA platform responds to the need for a systematic and user-friendly online archive of technologies, practices and innovations, including success stories and case studies on family farming. It gathers successful agricultural technologies and practices of crop production, livestock production, fishery and aquaculture, forestry, bee keeping, agricultural mechanization and so on to facilitate knowledge exchange and help family farmers in the field. Moreover, it also demonstrates evidence-based good technologies and practices with regard to cross-cutting issues such as natural resources management, post-harvest, marketing, capacity development, climate change adaptation, disaster risk reduction, nutrition and so on. All the technologies and practices, collected from a wide range of regions and countries, are recorded in a standard format, using clear language and supporting visuals to provide detailed specifications, and made available in different languages (English, French, Spanish and Portuguese) to reach a wider audience.

You can access the TECA platform and search the wide range of technologies and practices by inserting one or more keywords, and/or by filtering according to language, category, country, region, related Sustainable Development Goals (SDGs) or source. Taking rice cultivation for example:

STEP 1 Type “rice” in the search box.

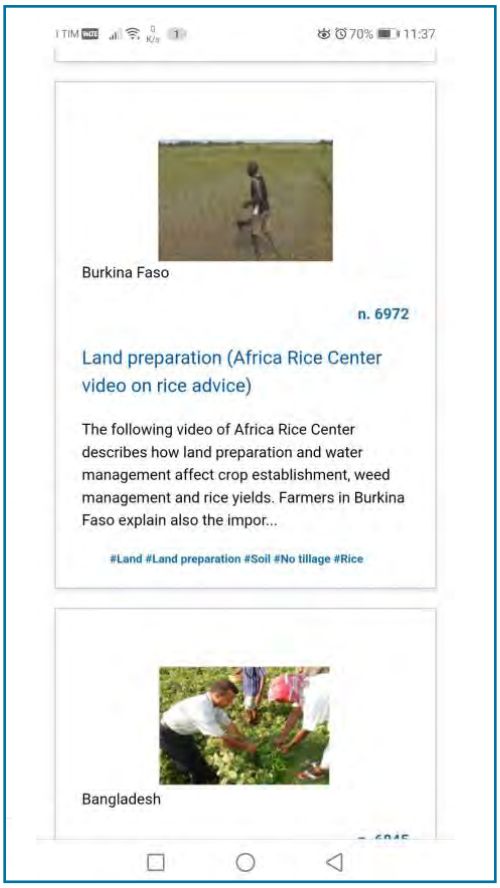


©FAO/TECA

STEP 2 Set the filter according to your preferences.

©FAO/TECA

STEP 3 Click the search icon next to the search box and scroll down the results to find the item(s) that are interesting for you.

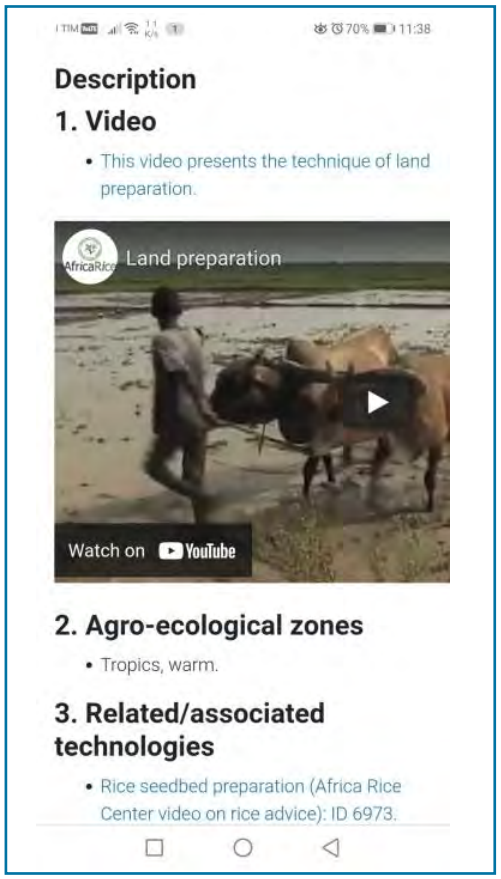


©FAO/TECA

STEP 4 If you want to learn techniques related to land preparation for rice cultivation, for example, click on it to consult the details. On the page that opens, you can see the detailed information related to the technology.

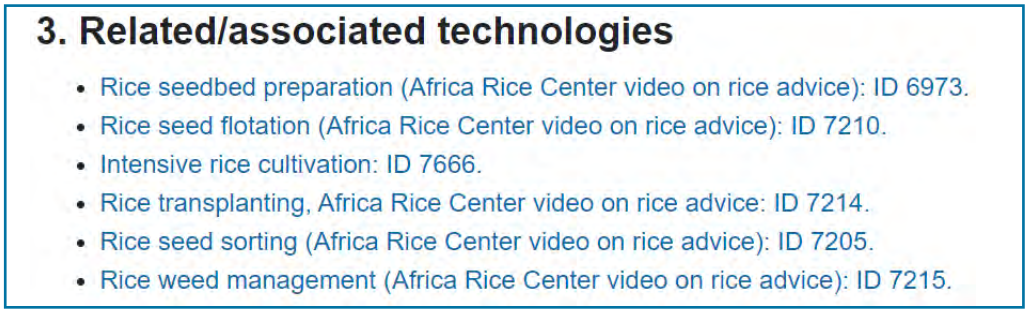
©FAO/TECA

STEP 5 Scroll down and you will see the video on the technique of land preparation. Click on it to start playing.



©FAO/TECA

On the same page, you can also see a list of related or associated technologies. If you are interested, you can click on the title to consult the details.



3. Related/associated technologies

- Rice seedbed preparation (Africa Rice Center video on rice advice): ID 6973.
- Rice seed flotation (Africa Rice Center video on rice advice): ID 7210.
- Intensive rice cultivation: ID 7666.
- Rice transplanting, Africa Rice Center video on rice advice: ID 7214.
- Rice seed sorting (Africa Rice Center video on rice advice): ID 7205.
- Rice weed management (Africa Rice Center video on rice advice): ID 7215.

©FAO/TECA

- To replicate these technologies and practices in their own context, the users can request more information by contacting: teca@fao.org.
- Advantages of TECA include: (1) easy format and language to facilitate adoption in the field; (2) technologies are validated and adopted by farmers and producers and technically cleared by experts; (3) information is made available in the long run; and (4) TECA knowledge base covers a wide range of agricultural topics.
- Some technologies are presented as written documents, while others are videos.

Useful resources

There are a number of online platforms that you can access to gain knowledge on agricultural techniques. Below you can find a list of commonly used ones:

- **Pest Distribution and Risk Atlas for Africa** – an open-access, mobile-accessible resource that combines up-to-date information on major insect threats to crop production with risk maps for each pest and predictions for future climate scenarios.
- **Africa Soil Health Consortium (ASHC)** – a CABI managed programme dedicated to creating down-to-earth campaigns on integrated soil fertility management (ISFM). You can consult its ISFM materials library which shares over 460 communication and extension support materials covering 30 crops. The media formats include print, audio-visual, and radio formats and multiple languages including English, French, Portuguese, Swahili and 20 other African languages.
- **Plantwise Knowledge Bank** – a CABI-led gateway to practical online and offline plant health information, including diagnostic resources, best practices of pest management advice and plant clinic data analysis for targeted crop protection.

Emerging farming management platforms in sub-Saharan Africa

The **Farmz2U** is a web-based farming management platform (FMP), optimized for mobile access, that aggregates baseline data on sustainable farming practices across sub-Saharan Africa, piloted in Nigeria and Kenya. The FMP makes the process of becoming a farmer easier and better structured. Targeted towards young smallholder farmers, Farmz2U's FMP supports users' decision-making on what and how to grow sustainably through its digital extension service and increased access to market services. Aimed at bringing more value to youth farmers, Farmz2U addresses the target audience's needs through digitalization which enhances active participation from technology appeal, thus increasing youth involvement in agriculture. In addition, through the FMP, farmers, especially young farmers, have increased access to market services like capital to commence or expand farming operations, and buyers to ensure offtake and guaranteed income once produce is harvested. With access to a smartphone and the Internet, Farmz2U FMP increases economic opportunities of smallholder farmers.

The **M-Omulimisa Mobile App**, now functioning in Uganda, supports extension service providers in the provision of interactive extension services. Farmers can use the App to ask agricultural-related questions (they can even attach pictures of diseased plants/animals) in their local languages and receive feedback from their respective agents or technical M-Omulimisa staff and government extension officers who have been trained on how to use the platform. The app includes an agricultural information repository – in summarized text and illustrative graphics – that includes easy-to-use guides for farmers and extension agents. It provides accurate, relevant and up-to-date information on pests and diseases, good agronomic practices, post-harvest handling among others. The app also enables farmers and extension agents to report disease and pest outbreaks using geotagged pictures. The same mobile App enables village agents to profile farmers and their groups and aggregate farm-inputs demand to secure subsidized credit through its Group Input Loan Facility.

Source: Farmz2U. 2022. *Farmz2U.* Cited 11 March 2022. https://www.farmz2u.com/
M-Omulimisa. 2022. *M-Omulimisa.* Cited 11 March 2022. https://m-omulimisa.com/

3.2.3 How can I solve my cultivation technical problems online?

You can consult **The Plantwise Knowledge Bank (PWKB)**, a CABI-led open access platform, to access actionable plant health information and services with which you can identify pests and manage your crops. With over 15 000 factsheets, pest management decision guides and species pages in more than 100 languages, the platform provides a number of tools for plant doctors, extension agents, and farmers, such as an image-led diagnostic tool, interactive pest distribution maps, pest alerts, country resources,

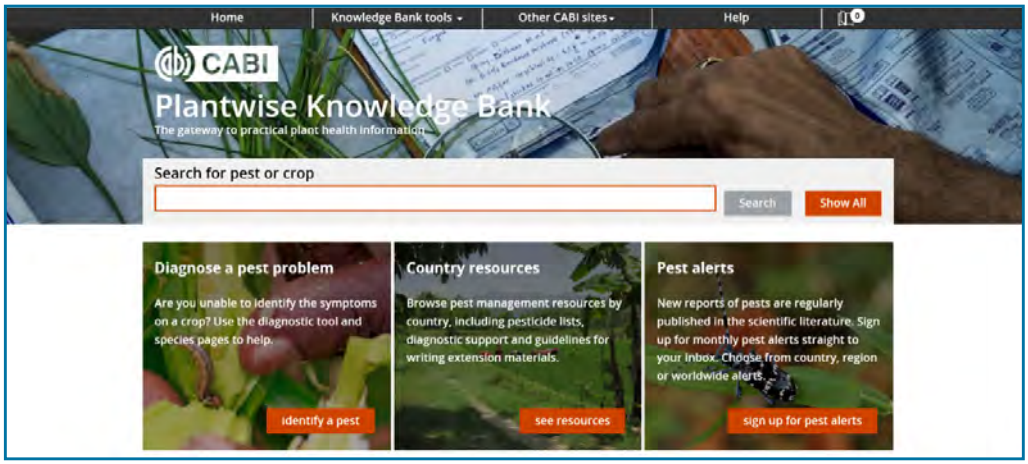
and factsheet library. There are two tools especially useful for smallholder farmers:

- **Identify a pest:** Are you unable to identify the symptoms on a crop? Use the diagnostic tool and species pages to help.
- **Factsheet booklet builder:** Create your own PDF factsheet booklet, which you can download and print.

Plantwise is a global programme led by CABI to increase food security and improve rural livelihoods by reducing crop losses. It works with countries to provide good advice to farmers at local plant clinics. Now those advice is available free access online on the Plantwise Knowledge Bank platform.

How to access the Plantwise Knowledge Bank

Click www.plantwise.org/KnowledgeBank and it will bring you to the homepage of Plantwise Knowledge Bank.

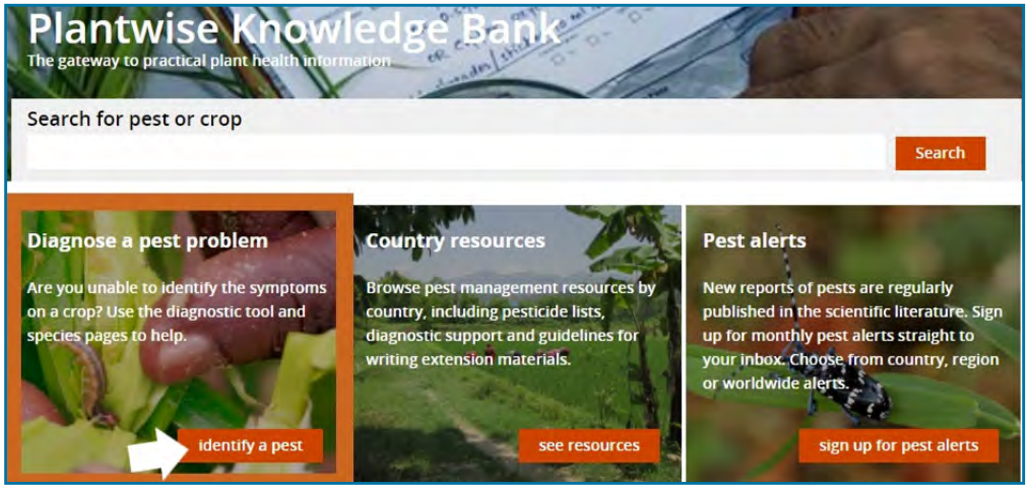


©CABI

How to use the tool to Identify a Pest

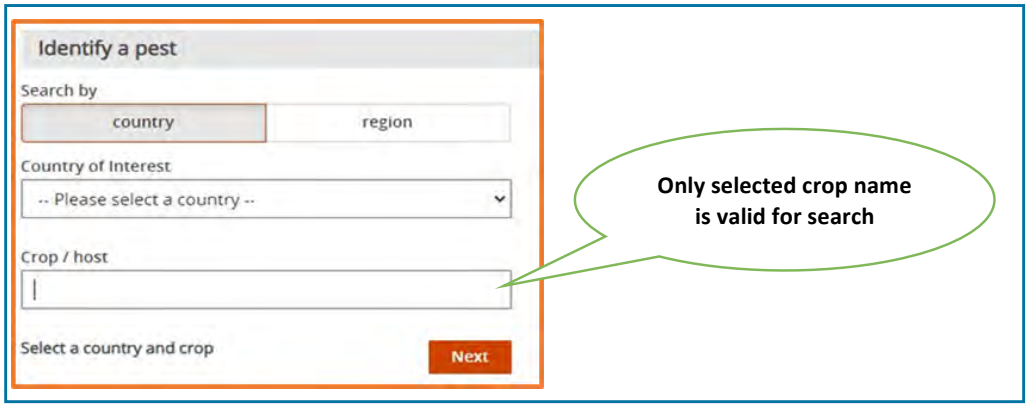
To be able to provide effective solutions to a plant health problem, diagnosing a pest accurately is very crucial. The PWKB diagnostic tool is an image-based tool to help you diagnose a crop problem through the symptoms observed and the part of the plant affected.

STEP 1 From the Plantwise Knowledge Bank homepage, navigate to the "Diagnose a pest problem" tile and click "Identify a pest".



©CABI

STEP 2 Once clicking on "Identify a pest", you are able to search by country or region from the drop-down list. Type the crop name into the search box, and a list of suggested crops will appear to choose from.

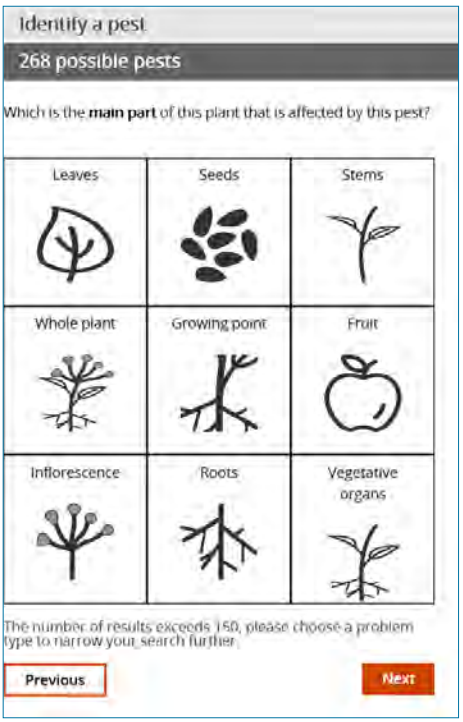


©CABI

STEP 3 Two steps to narrow down causes: Firstly, to select the main part of this plant affected by the pest; secondly, to select the type of problem if you already know, otherwise select "not sure". Click the corresponding tills to filter the result.

TIPS

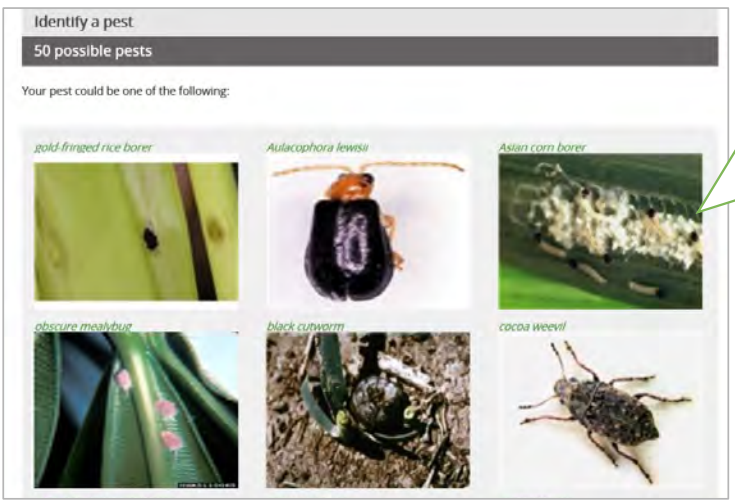
Both steps are single choice. Although, in some cases, several parts of the plant can be damaged, the main part of the affected plant needs to be determined in terms of main problem.



Main part of affected plant selection *Type of problem selection*

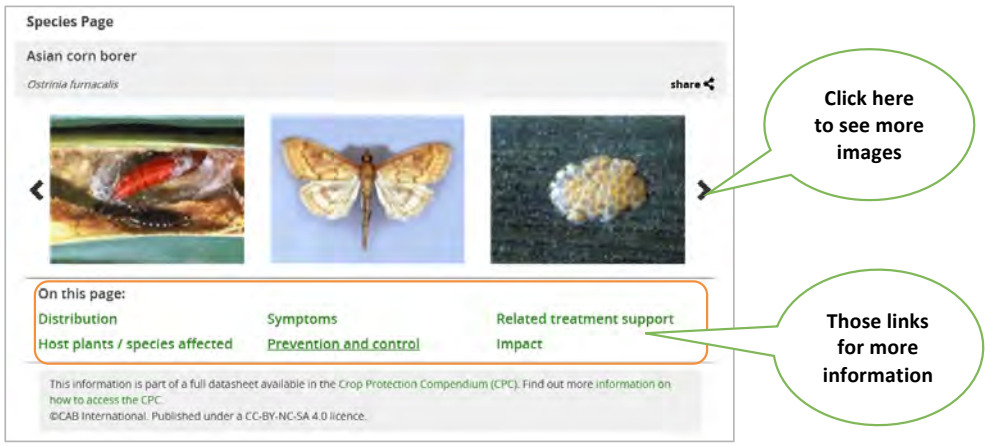
©CABI

STEP 4 A list of possible pests is given, each pest with an image and linked to the corresponding species page, which is a technical factsheet providing information on crop symptoms, preventative methods and effective solutions to the problem.



A List of possible pests in the result page

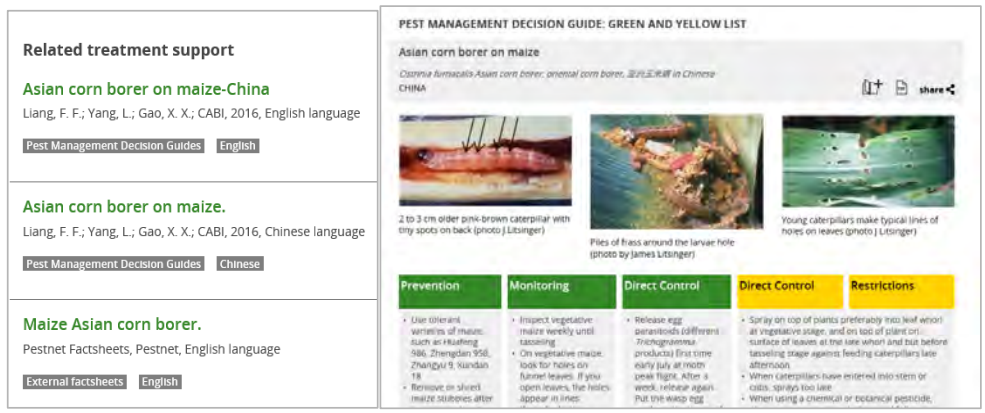
©CABI



Species page

©CABI

STEP 5 At the bottom of species pages, there is a list of related treatment support documents available in the PWKB. Click the document title for more details. A Pest Management Decision Guide (PMDG) in this case.



Related treatment support

©CABI

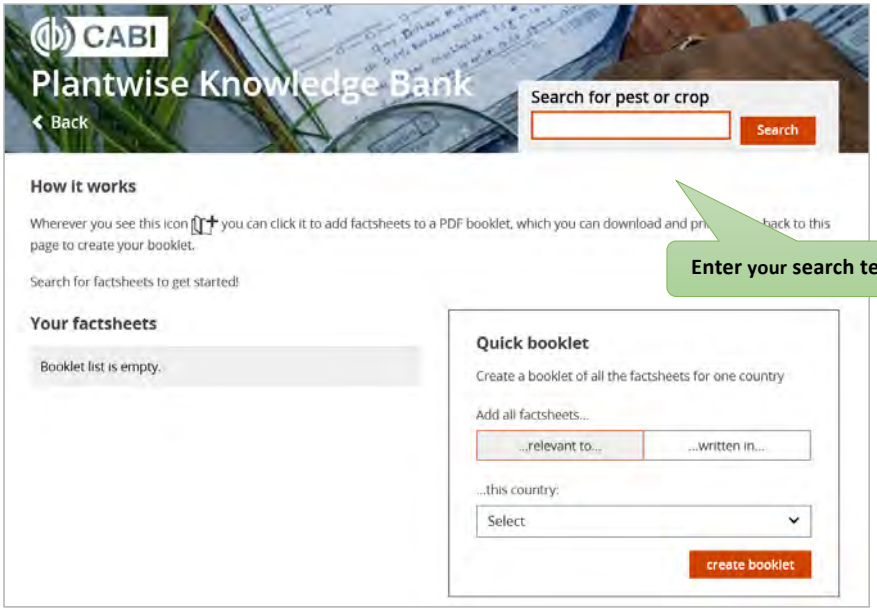
How to use the tool Factsheet Booklet Builder?

You may not access the Internet all the time, and you may want to have access to the factsheets that are most useful to you. The Booklet Builder helps you build a customized booklet of Plantwise factsheets and PMDGs as per your choice.

Plantwise Factsheets are written by country partners specifically based on farmer needs. They give a quick outline of how to recognize a crop problem, a little background information about the problem, and step-by-step instructions on how to solve it. Every factsheet is supported by photographs to help explain the problems and remedies. Plantwise Factsheets are reviewed by local farmers and technical experts to ensure that the information is easy to understand, practical to use, and the recommendations are safe and follow sound scientific principles.

STEP 1 Access to Plantwise Knowledge Bank homepage (www.plantwise.org/KnowledgeBank), click booklet icon 0 at the top-right corner of webpage to open the tool.

STEP 2 Search for the pest or crop of interest to you on the search box. Or, you could also use quick booklet tool to create a booklet of all the factsheet for your country.



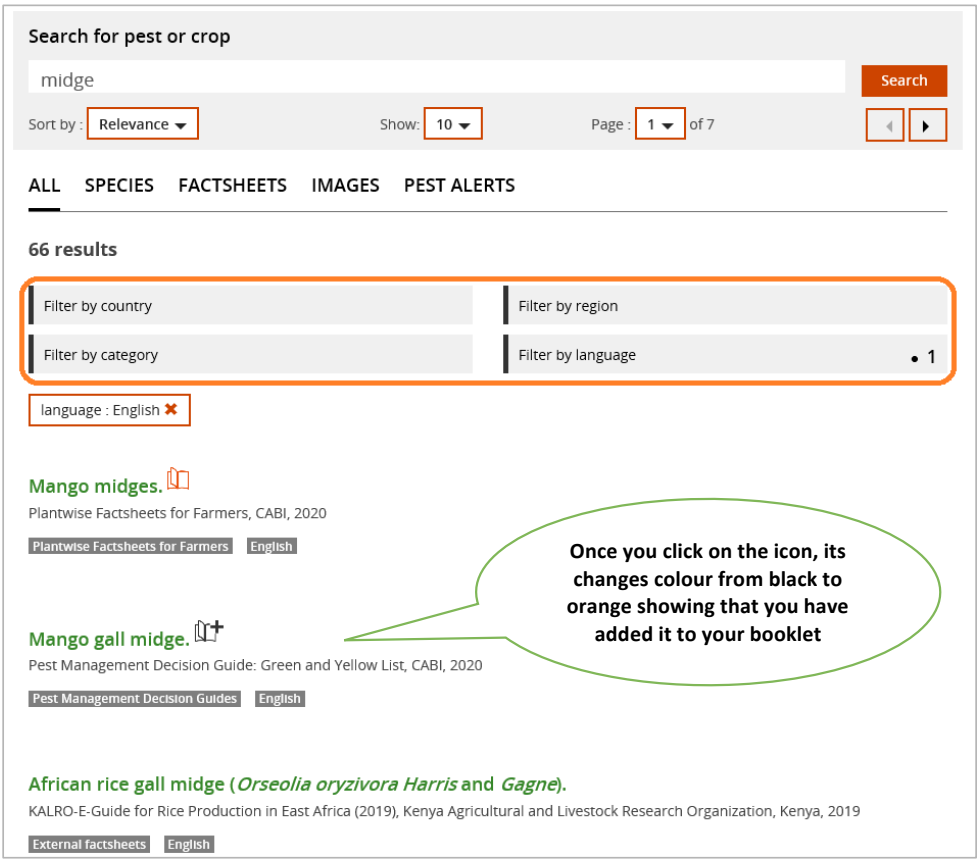
Factsheet Booklet Builder homepage

©CABI

STEP 3 On the search results page, the four filters can help you further narrow down your search results by country, region, category and language. You will see a booklet icon on the right side of Plantwise factsheet title. Click on the icon to add the factsheet to your booklet. Click on as many factsheets as you want to include in your booklet.

TIPS

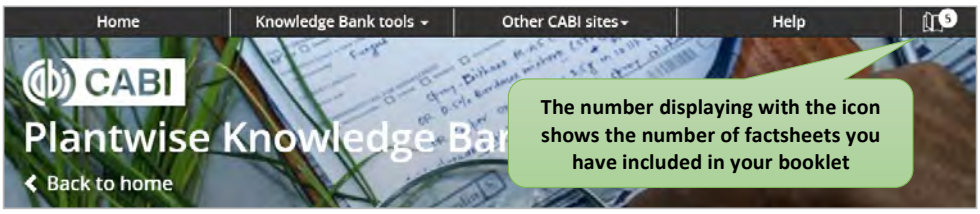
Only factsheets developed by Plantwise could be included in your booklet. Some factsheets without booklet icon after their titles, are external factsheets, which cannot be included in your booklet.



Plantwise Knowledge Bank search results page-1

©CABI

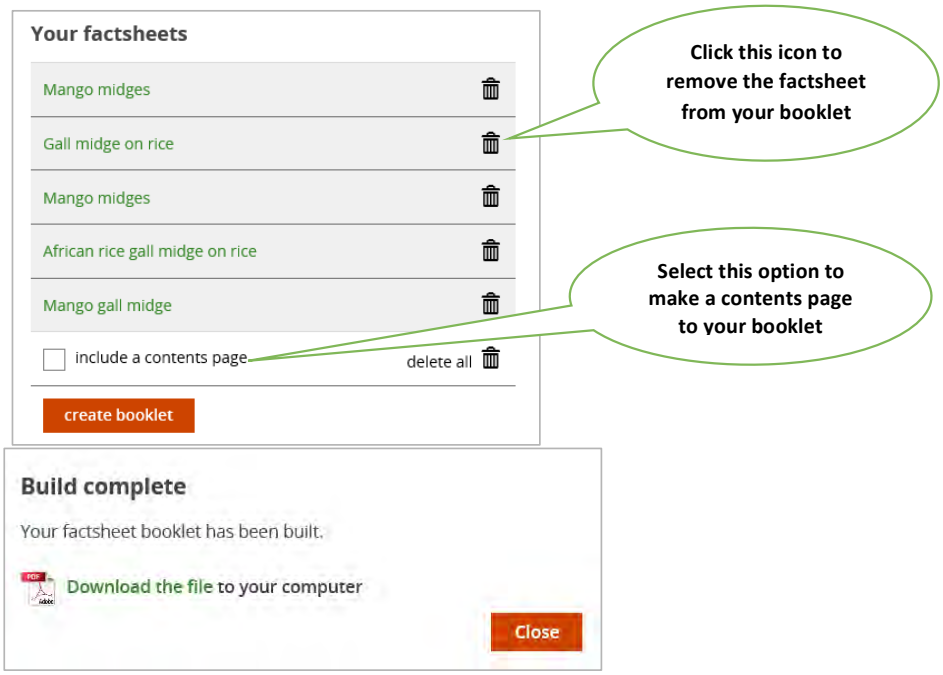
STEP 4 Click on the booklet icon on the top right of the black menu bar on the search results page, which will take you to the factsheet booklet builder page.



Plantwise Knowledge Bank search results page-2

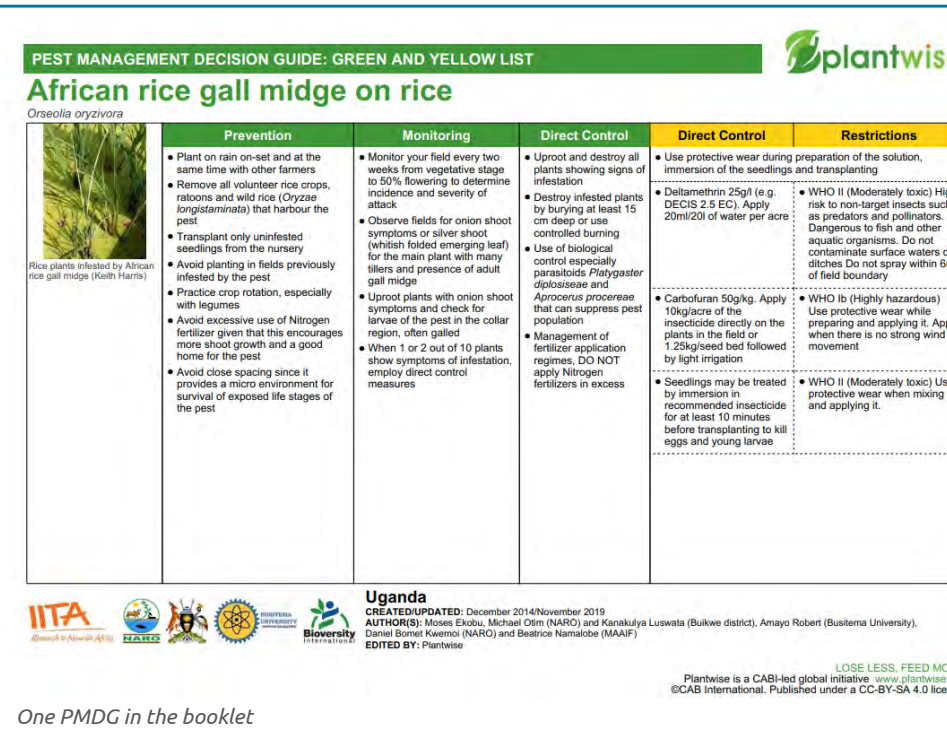
©CABI

STEP 5 You will see a list of all factsheets that you have added to your booklet. You could further edit your booklet, and then clink on "create booklet" to build and download the booklet as a PDF file.



Plantwise Knowledge Bank Booklet Builder page

©CABI



PEST MANAGEMENT DECISION GUIDE: GREEN AND YELLOW LIST

plantwise

African rice gall midge on rice

Orseolia oryzivora

Rice plants infested by African rice gall midge (Keith Harris)

Prevention	Monitoring	Direct Control	Direct Control	Restrictions
• Plant on rain on-set and at the same time with other farmers • Remove all volunteer rice crops, ratoons and wild rice (*Oryzae longistaminata*) that harbour the pest • Transplant only uninfested seedlings from the nursery • Avoid planting in fields previously infested by the pest • Practice crop rotation, especially with legumes • Avoid excessive use of Nitrogen fertilizer given that this encourages more shoot growth and a good home for the pest • Avoid close spacing since it provides a micro environment for survival of exposed life stages of the pest	• Monitor your field every two weeks from vegetative stage to 50% flowering to determine incidence and severity of attack • Observe fields for onion shoot symptoms or silver shoot (whitish folded emerging leaf) for the main plant with many tillers and presence of adult gall midge • Uproot plants with onion shoot symptoms and check for larvae of the pest in the collar region, often galled • When 1 or 2 out of 10 plants show symptoms of infestation, employ direct control measures	• Uproot and destroy all plants showing signs of infestation • Destroy infested plants by burying at least 15 cm deep or use controlled burning • Use of biological control especially parasitoids *Platygaster diplosiseae* and *Aprocerus procereae* that can suppress pest population • Management of fertilizer application regimes, DO NOT apply Nitrogen fertilizers in excess	• Use protective wear during preparation of the solution, immersion of the seedlings and transplanting	
			• Deltamethrin 25g/l (e.g. DECIS 2.5 EC). Apply 20ml/20l of water per acre	• WHO II (Moderately toxic) High risk to non-target insects such as predators and pollinators. Dangerous to fish and other aquatic organisms. Do not contaminate surface waters or ditches Do not spray within 6m of field boundary
			• Carbofuran 50g/kg. Apply 10kg/acre of the insecticide directly on the plants in the field or 1.25kg/seed bed followed by light irrigation	• WHO Ib (Highly hazardous) Use protective wear while preparing and applying it. Apply when there is no strong wind movement
			• Seedlings may be treated by immersion in recommended insecticide for at least 10 minutes before transplanting to kill eggs and young larvae	• WHO II (Moderately toxic) Use protective wear when mixing and applying it.

Uganda

CREATED/UPDATED: December 2014/November 2019
AUTHOR(S): Moses Ekobu, Michael Otim (NARO) and Kanakulya Luswata (Buikwe district), Amayo Robert (Busitema University), Daniel Bomet Kwemoi (NARO) and Beatrice Namalobe (MAAIF)
EDITED BY: Plantwise

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One PMDG in the booklet

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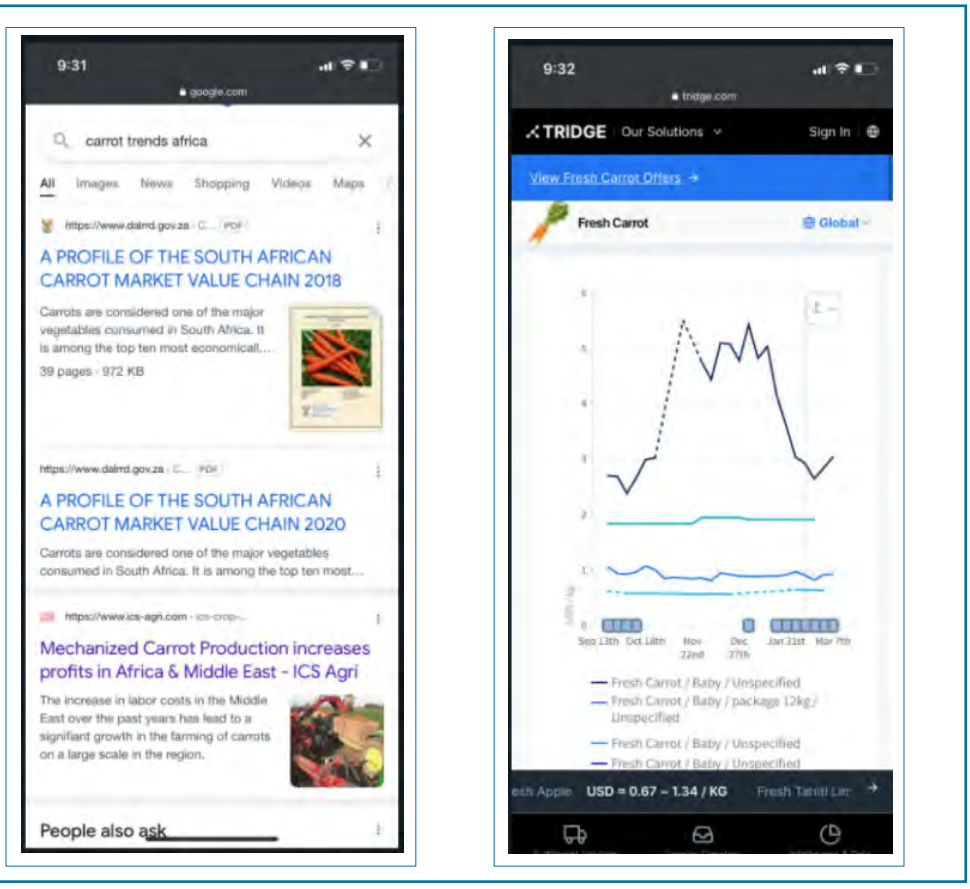
3.2.4 How can I find relevant information about planting and breeding trends, and market information, using the smartphone?

We highly recommend you to conduct detailed search on the Internet.

STEP 1 Launch your Internet browser. The most popular browser on smartphones running on Android OS is Google Chrome.

STEP 2 In the search bar, use well-defined search terms, including "trend" or "market information" or "price" + "plant variety" or "animal breed" + "region, e.g. sub-Saharan Africa".



©The Internet

TIPS

- Go through a few links, not just the first few, as they could be advertisements.
- You may also regularly check reputable trade publications, such as AgriBusiness (https://www.agribusinessglobal.com/) or Farmers Weekly (geography-specific).
- If the words "promotion" or "advertising" appear in the search results, do not click without judgement and learn to distinguish the authenticity of information.

3.2.5 How can I gain techniques on post-harvest, value addition and packaging online?

Over recent years, the scope of digital EAS has gone beyond the narrow focus on production-related services and increasingly included services related to non-farm activities. These services range from post-harvest, value addition, financial access to packaging, e-commerce and so on. The aim is to allow smallholder farmers to capture more value added on the agrifood value chain, while enhancing their ability to access resources and market. Currently, developing countries are seeing emerging digital tools in the form of digital platforms and applications which are expected to facilitate smallholder farmers' access to these services.

Digital platform for multiple non-farm services

Bountifield offers youth and women in rural areas new opportunities as post-harvest technology entrepreneurs who can provide a fee-for-service to farmers to process, preserve and sell their crops. Bountifield's "business in a box' model" equips them with technology, access to financing and information they need to drive agribusiness value addition and reduce food loss. Bountifield works with local suppliers to develop and disseminate manual threshers and multicrop grinders to women farmers, including women groups engaged in value addition. The Bountifield designed tools and programmes have been incorporated across Senegal. Today, young women entrepreneurs use this technology to produce a range of products such as blended flour of all kinds, peanut paste, coffee, and medicine. Young men have primarily been the owners of the manual threshers, providing processing services to young women farmers at the post-harvest time. Bountifield has also trained young male artisans to support local repair and maintenance of equipment. These are often poor rural youth in sub-Saharan Africa with limited employment options. This post-harvest service is important for countering some of the climate challenges that farmers have been facing, helping them save more of their staple crops, and adapt to their environment.

Source: Bountifield. 2022. *Bountifield*. Cited 11 March 2022. https://bountifield.org

3.2.6 How can I interact with EAS agents via smartphone?

Smartphone is a powerful tool which enables you to get instant production-related help online. You can interact with EAS agents and experts either through the more conventional mode of call centre, which often allows seeking information in real-time through calls or SMS, or through the emerging mode of online platforms and apps which normally offer a variety of associated services.

Useful resources

Plusfarm (PAMS) serve as a digital tool for farm management. Operating in Kenya, it aggregates farmers, produce buyers, and agronomists in one platform. It offers farmer profiling and tailored digital EAS both online and on unstructured supplementary service data (USSD) platforms. The goal is to provide timely and relevant knowledge to farmers to help them increase yields. PAMS offers agronomists a personalized channel for disseminating agronomic recommendations in real-time and on need basis, reducing agroexpert to farmer ratio. With PAMS, farmers, once registered, can monitor farm inputs, keep records, access crop financial and performance reports, access markets and agronomists. They are also able to identify and consult with verified agroexperts in real-time through calls or SMS and learn from other farmers.

iShamba is a Kenya-based call centre of agricultural experts where farmers can SMS in questions or call in to speak to an expert for instant help. This requires signing up to iShamba premium at a cost. Once they sign up, farmers will also receive agricultural tips on crops and livestock, weekly updates on market prices, and weather forecasts. Agricultural tips are sent direct to cellphone, following the crop calendar of the region where a farmer is located. The farmer can always contact the call centre to change the crop or livestock he or she receives tips on. Registered members also receive alerts on farmer events, which are a good place to meet and exchange ideas with other farmers, learn about new farming technologies, and interact with input suppliers. iShamba sends details of event dates, location, hosts and entry charges if any.

Source: Plusfarm. 2022. *Plusfarm.* Cited 16 May 2022. https://pamskenya.com/
iShamba. 2022. *iShamba.* Cited 16 March 2022. https://ishamba.com/

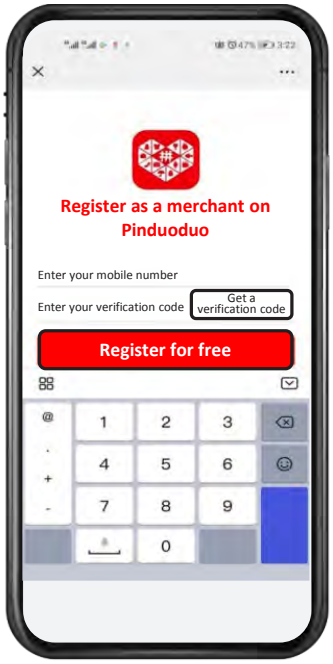
3.3 Access to e-commence

In this section, the application “Pinduoduo” is used to demonstrate how to access e-commerce via smartphone. Trainers should use the following contents as a reference and contextualize them in accordance with local available applications for e-commerce.

3.3.1 How can I register an account on e-commerce platforms?

STEP 1 Download the application (or app) from your App Store.
You may have to download the merchant app directly, instead of the app for consumers.

STEP 2 Launch the app.



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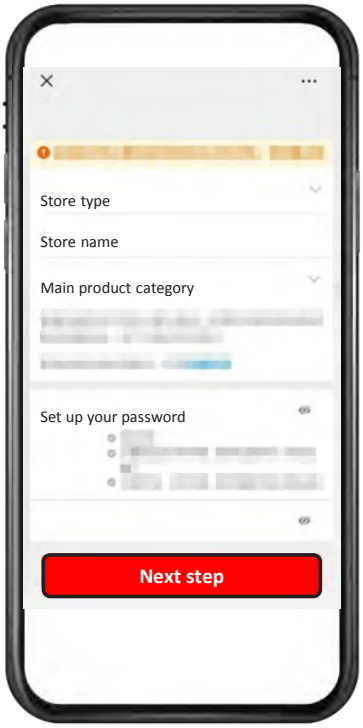


©Pinduoduo

STEP 3 Follow the instructions to set up a merchant account.

The account is usually linked to your mobile phone number. You may receive a verification code via SMS to continue with the registration.
You may need to provide further details, e.g. name, address, and bank details to receive payment.

STEP 4 Start exploring the app's functions. Use support tools/seek help from customer service on the platform.

TIPS

- Choose a secure password and keep it confidential.
- Fill in personal/store information clearly and accurately.
- Keep documentation.
- Also set up a user account to explore the user experience. This will help you to improve your listing.

Emerging E-commerce Portals in Africa

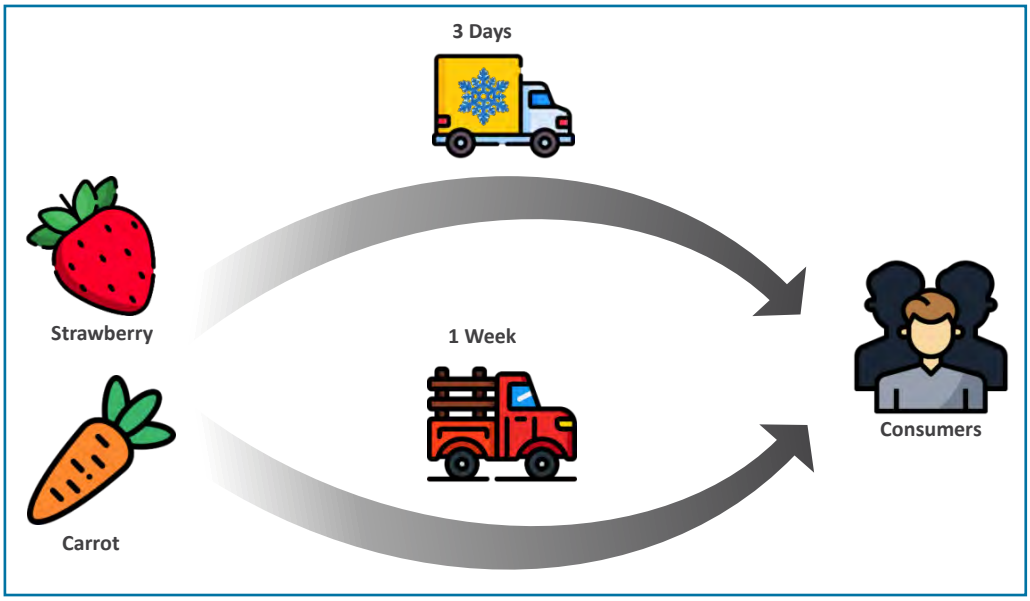
Fresho by Ifarm360, a crowd farming platform based in Kenya, leverages technology and partnerships to shorten the supply chain and delivering fresh produce directly from farmers to consumers at low cost. Its partners include neighbourhood stores, women and youth who are keen to participate in the digital economy, taking orders and delivering to their friends/family/ community and earning regular income. A farmer looking for a direct access to market can register online and supply them with high quality produce.

ePoultry is a Nigeria-based digital agriculture platform that provides smallholder farmers with access to funding, access to market and modern skills. The platform strengthens the link between farmers and consumers by ensuring consumers have easy access to farm produce at great prices by either ordering online or visiting its physical outlets.

Source: ePoultry. 2022. *ePoultry.* Cited 12 March 2022. http://www.epoultry.ng/
Farmz2U. 2022. *Farmz2U.* Cited 11 March 2022. https:// www.farmz2u.com/
Fresho. 2022. *Fresho.* Cited 17 March 2022. https://www.fresho. co.ke/

3.3.2 How do I choose logistics partners and properly package my agriproducts?

Agricultural e-commerce can require very different solutions from usual agricultural sales, as products can travel farther and through different networks.



©Pinduoduo

STEP 1 Check if the platform has recommended partners/ third-party service providers.

STEP 2 Check local vendors to see if they can shift to your target destinations.

STEP 3 Negotiate a long-term contract with the local vendors.

TIPS

- Use what works for you, while complying with platform requirements.
- Different agriproducts have different packaging and handling requirements (e.g. cold storage, humidity control, delicate handling, ripening times, vacuum sealing).
- You may be able to provide more value to customers by using a slower delivery service and charging lower prices, or a faster one for a slightly higher price.
- Always improve. Observe what other merchants on the platform are providing. Seek feedback from consumers every few months.

3.3.3 How can I design a good name for my agriproducts?

STEP 1 Learn the platform's classification categories and put your item where your consumer expects to find it. For example, put tomatoes under vegetables (instead of fruits).

STEP 2 Highlight selling point. For example, product variety, characteristics (sweet, fresh), seasonal specialty (summer/winter only), geographical indications/ product origin, awards. Where possible, add relevant photos (e.g. award labels, unique terrain).

TIPS

- Use easy-to-search keywords. For example, include the word "carrot" if you are selling a type of carrot.
- State offer clearly, for example weight (nett/gross), packaging type.

3.3.4 How can I take good photos?

©Pinduoduo

STEP 1 Select nice-looking products and clean them.

STEP 2 Especially for fruits, cut or peel them so consumers can see how they look.

STEP 3 Set product against clean backgrounds to increase visibility. Avoid props.

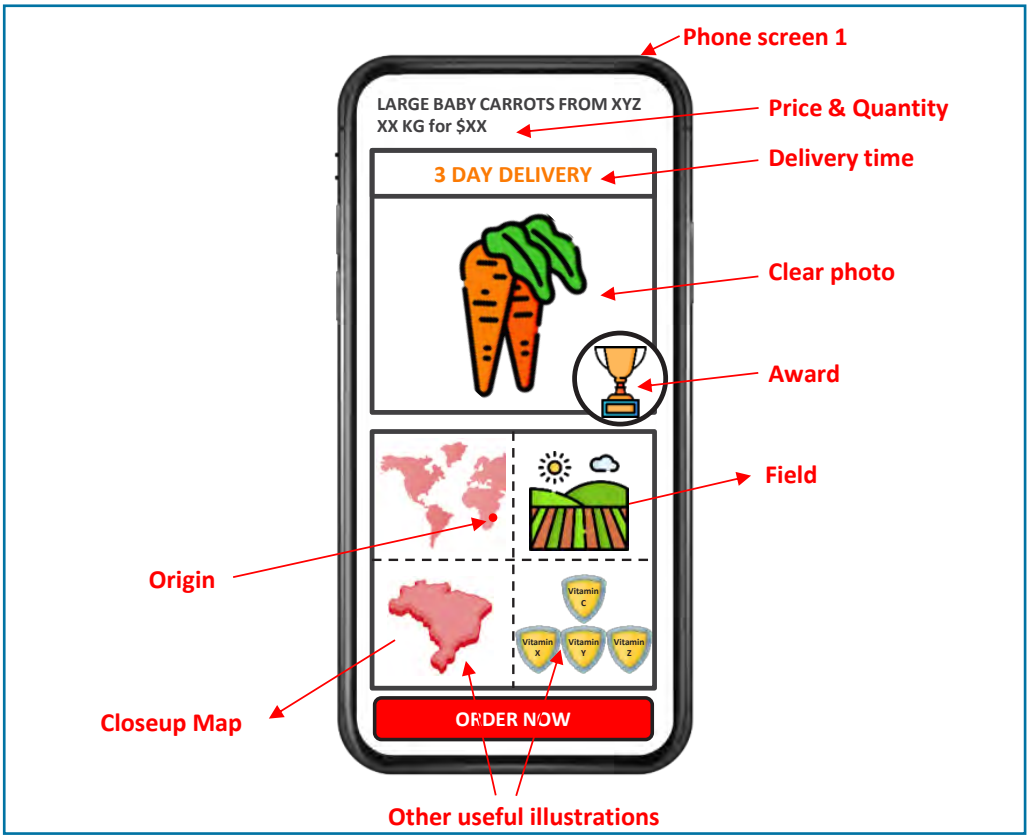
STEP 4 Set smartphone on a steady surface. Use a tripod if available.

STEP 5 Fill the frame with your item.

TIPS

- Turn off the flash and use soft natural light (morning before noon works best). Do not use filters.
- Take high-resolution shots, distance, and close-up shots. Consider showing the scale of your product (e.g. take a shot with a ruler or common object).
- Include photos of products in the field/packaging stages/with you, the farmer.
- Always test the final photos on the platform to see if their dimensions and colours work well.

3.3.5 How can I write a good description of my agriproducts?



©Pinduoduo

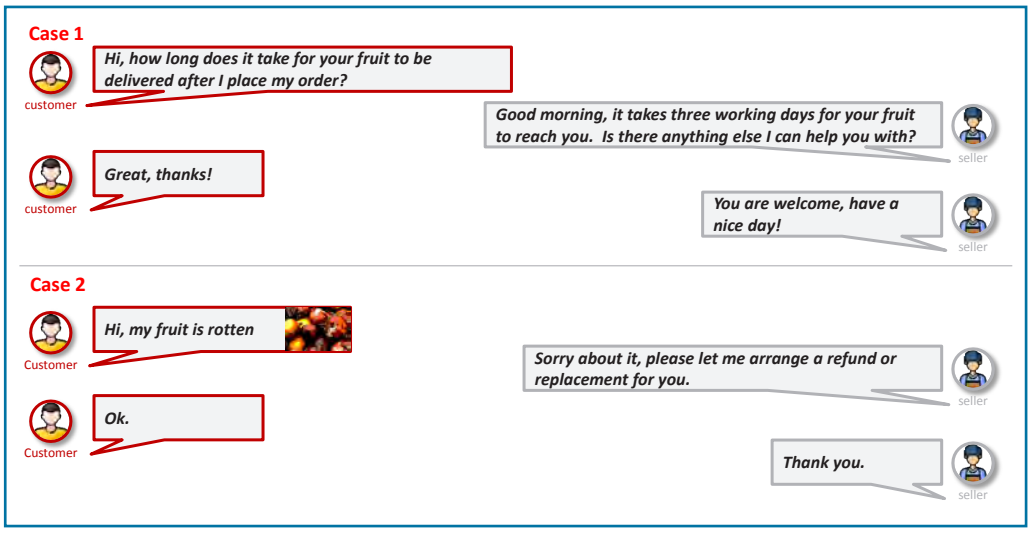
STEP 1 Always take good pictures following the tips below:

- Reduce shake by placing camera on a stable surface. Use tripod if available.
- Use a white backdrop, such as white cloth or paper, so that your product stands out. White also reflects light onto your product and makes it evenly lit.
- Try to use natural daylight, near a window, or shoot in a well-lit place.
- Shoot a variety of angles and distances and pick the best ones.

STEP 2 Ensure to include basic information, such as price and quantity, delivery time, etc.

STEP 3 Emphasize origin and specific local qualities (sunshine, temperature, etc.) that make the product unique and delicious.

3.3.6 How can I communicate well with customers online?

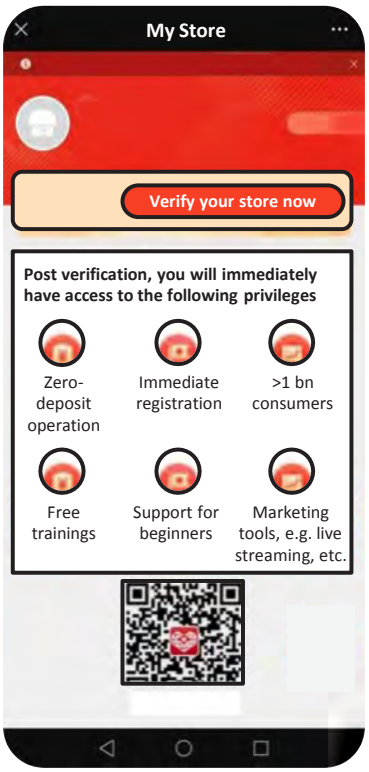


©Pinduoduo

TIPS

- Always use the chat function on the platform.
- Be polite. Greet the customer and ask how you can help. Use photos when helpful. Seek feedback on how to improve. End off with a thank you.
- Customers may return with complaints and/or seek refunds/ replacements. Develop a firm but fair approach to respond to consumers. Always be polite.
- Set aside time to respond to consumers.

3.3.7 How can I use common promotional techniques?



©Pinduoduo

©Pinduoduo

Festivals and subsidies (provided by the platform) are the two main types of promotional techniques. To better promote your products on the platform, follow the tips below:

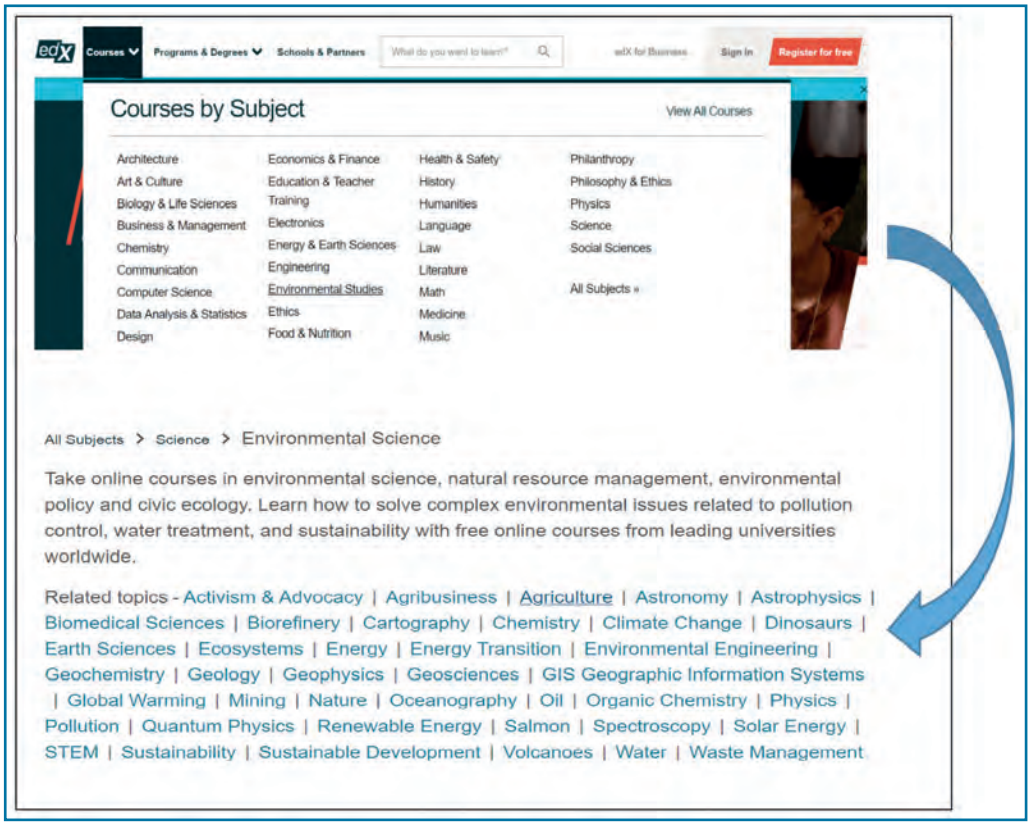
- Always check the merchant interface for festivals and subsidies.
- Prepare/earmark supply for the promotional activity.
- Apply to join the festivals or get the subsidies.
- Create campaign banners to attract customers.
- Ensure delivery and answer questions patiently.

3.4. Capacity building

3.4.1 How can I search for and participate in online agrifood training courses or webinars?

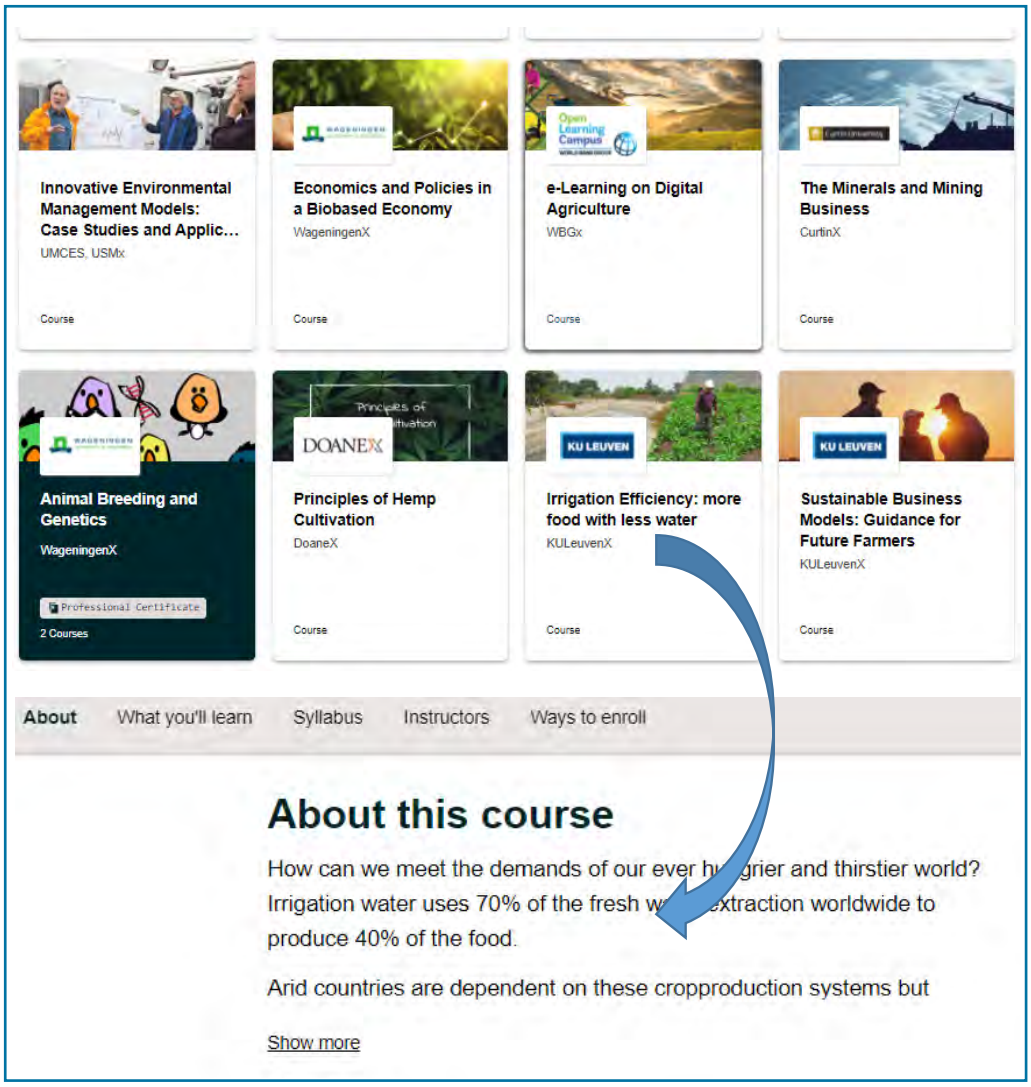
You can find a variety of courses on agriculture on edx.org. edX is an American massive open online course provider created by Harvard and MIT. It hosts online university-level courses in a wide range of disciplines to a worldwide student body, including some courses at no charge. You can take a course in five steps as follows:

STEP 1 Open the website and click on "Courses" and then Environmental Studies (where you can find courses on agriculture, agribusiness, sustainable development, water management, waste management and some other subjects related to agriculture). Click "Agriculture" for example.



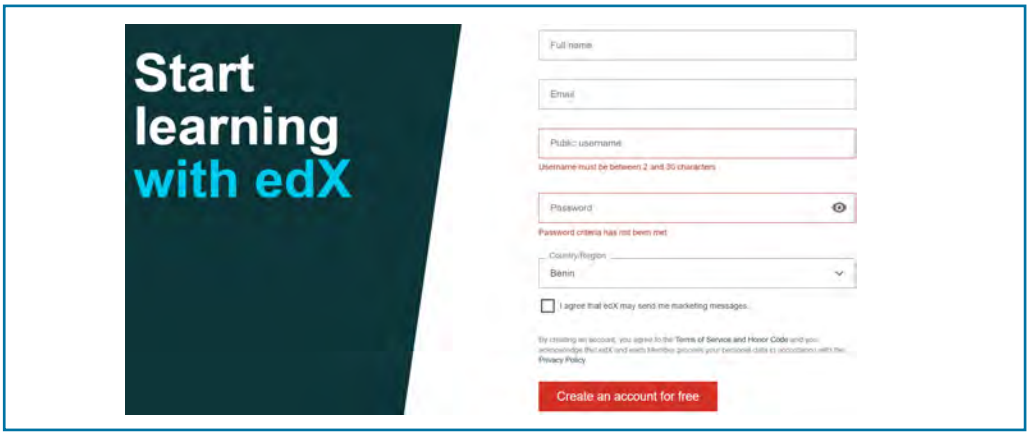
©edX

STEP 2 Once entered, you will see a number of courses. Scroll down the list to find a course which you are interested in. For example, choose the course “Irrigation Efficiency: more food with less water”. Click on the course box to enter the course and check the basic information, such as course description, learning objectives, syllabus, instructors, and so on.



©edX

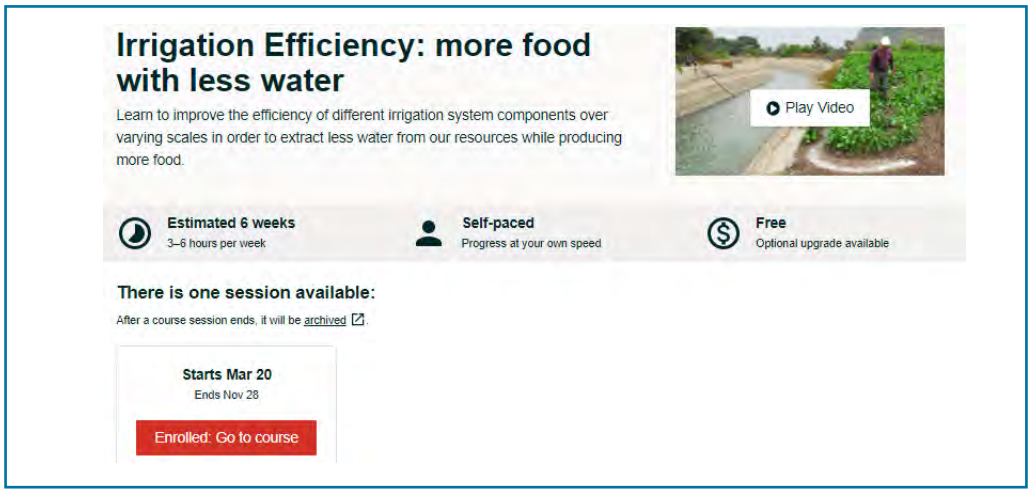
STEP 3 If you decide to take the course, you need to get enrolled first. Click “Enroll now” and you will be led to the registration page. Fill in all the information required and click “Create an account for free”.



©edX

STEP 4 After logging in, you need to choose between Verified Track which is often payable and Audit Track which is for free.

STEP 5 Once you successfully enrolled yourself, click “Enrolled: Go to course” and start the course.

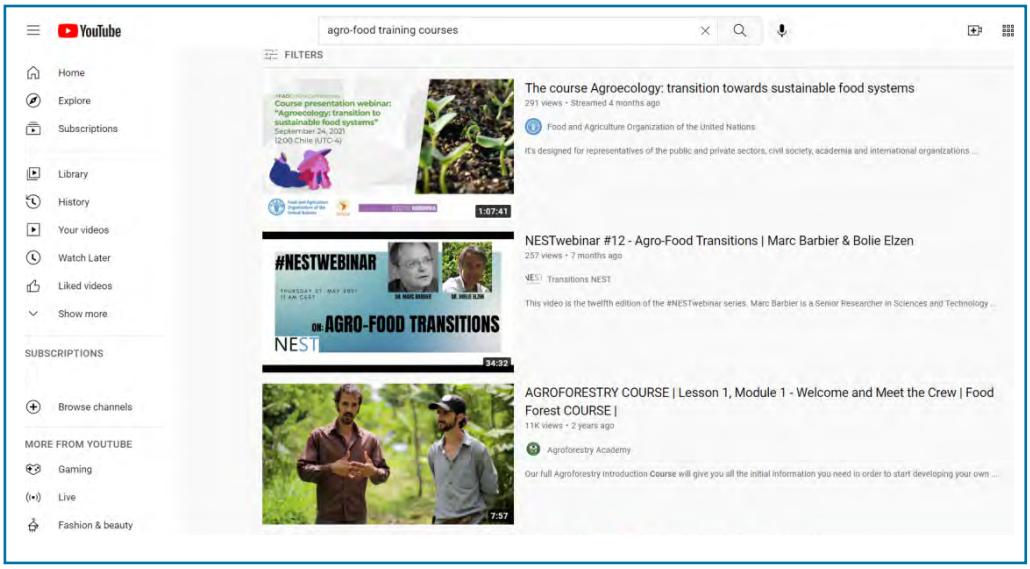


©edX

You may well try the Open Learning Campus run by the World Bank Group and the FAO elearning Academy. There are quite some other on-line training platforms similar to edx.org, including Coursera, Skillshare, Wikiversity, Khan Academy, etc.

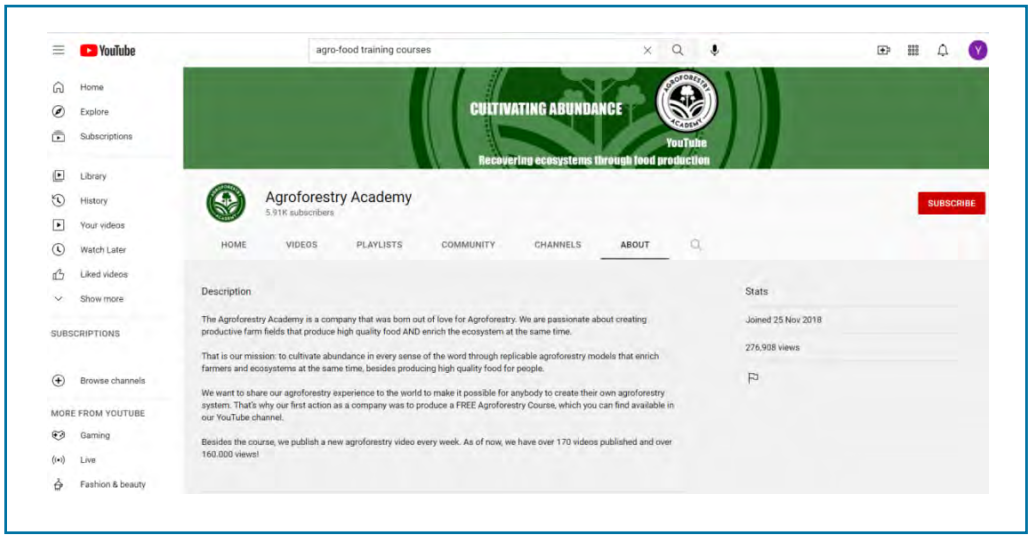
You can also search for online courses, webinars and training on YouTube.

STEP 1 Open YouTube on your browser and put in the search box, for example, “agrifood training courses”.



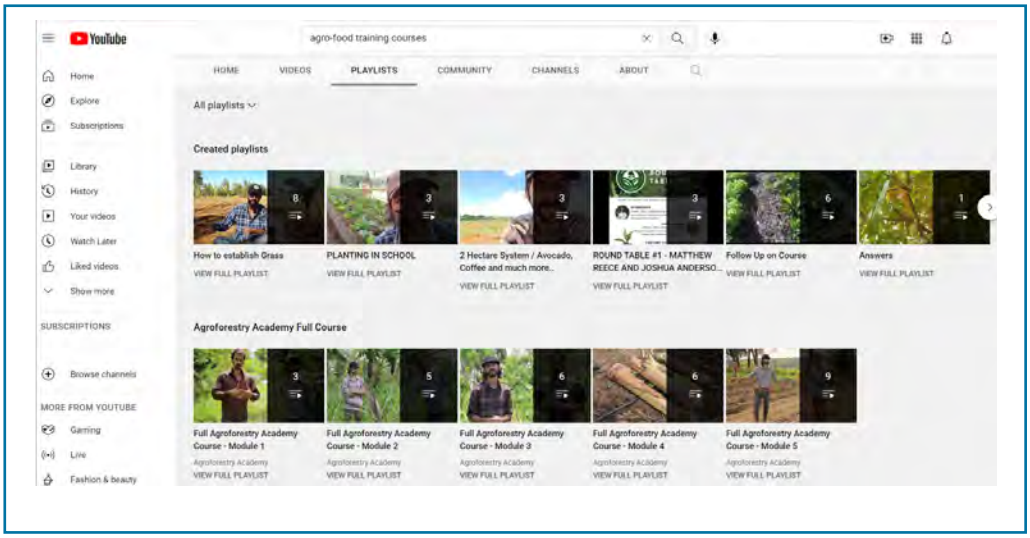
©YouTube

STEP 2 Scroll down the results to find a course that you are interested in. For example, you choose the “agroforestry course”. Before clicking on the video to watch it, click on the channel owner to check the credibility of the course. In this case, the channel is created by the Agroforestry Academy.



©YouTube

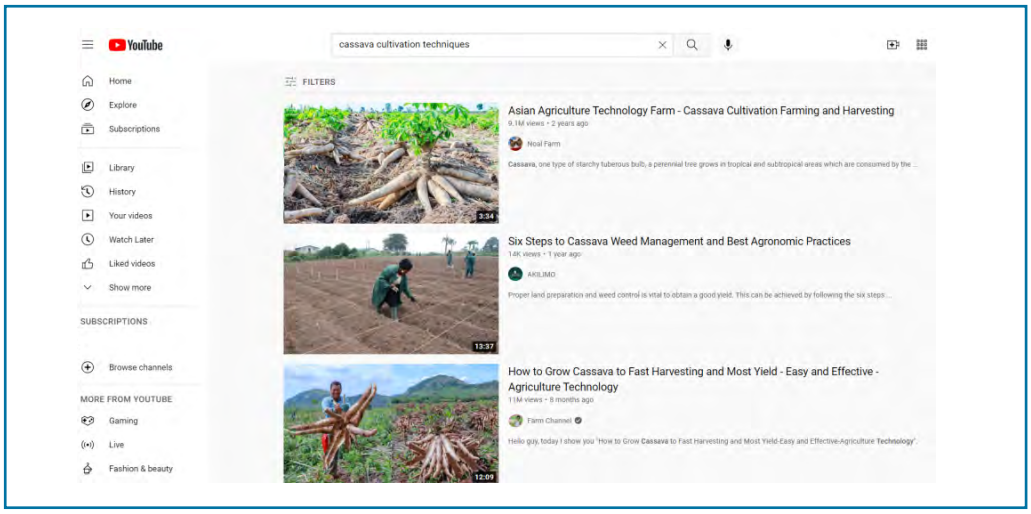
STEP 3 Search in the playlist any courses to your interest.



©YouTube

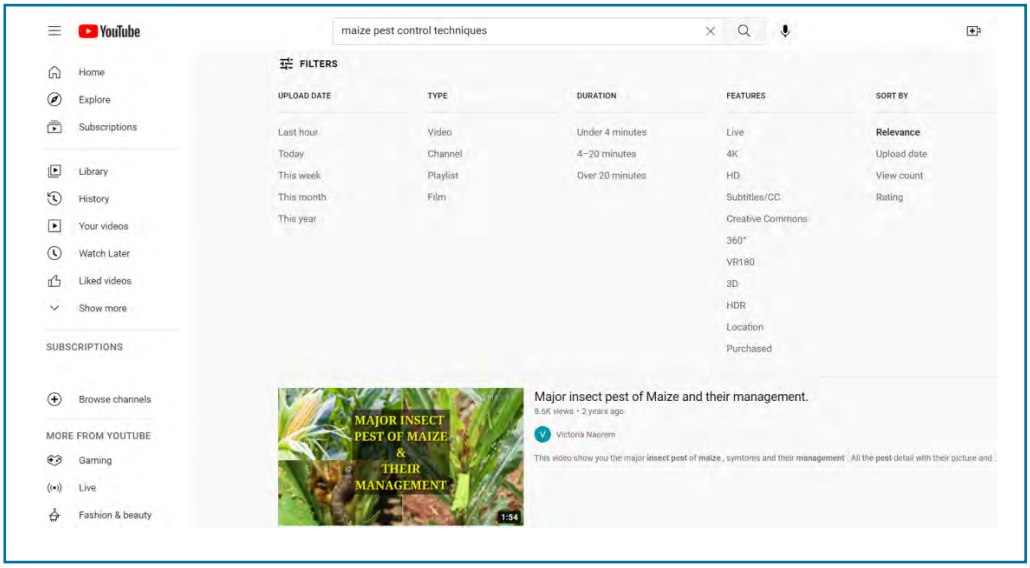
3.4.2 How can I search for short videos online to learn agricultural techniques on the Internet by using a smartphone?

Besides the TECA Platform, you can use YouTube to search for short videos on agricultural technologies. Taking “cassava cultivation” for example, type “cassava cultivation techniques” in the search box, you can scroll down to select the video to your interest.



©YouTube

You can also set the filters to personalize your search.



©YouTube

Useful resources

Digital Green, now functioning in Ethiopia, Ghana, India, Niger and the United Republic of Tanzania, is an online platform with Community Video, a video library currently with more than 6 000 locally relevant videos in more than 50 languages. The videos feature agricultural practices and nutrition behaviours that maximize the benefit for farmers. They were co-created in collaboration with grassroots partners and rural farmers themselves, allowing farmers to share knowledge with one another that build resilience and increase productivity and improve their nutritional status.

Source: Digital Green. 2022. *Digital Green*. Cited 16 April 2022. https://www.digitalgreen.org/

3.4.3 How can I interact with other farmers and farmer groups?

Digital tools have made it easier to organize farmers into learning groups. Often times, digital learning groups are in the form of a chat group on a social media platform that is regularly used by all members (e.g. WhatsApp group, Microsoft Teams chat, Facebook Messenger group, WeChat group and so on). The members can be farmers from neighbouring rural communities or even a more extended territory. You can join this kind of groups if there are any. You can also create a learning group using a social media platform that is popularly used in your community and add fellow farmers. The good thing is that the group size often grows "naturally" as members tend to invite other farmers from their social networks to join.

4. Conclusions

Following accelerating technological advances and continuously improving ICT infrastructure in rural areas, agricultural extension and advisory services (EAS) have been undergoing a rapid digitalization process over the past decades. Bringing new opportunities for EAS delivery, digital EAS can enhance accessibility, delivery, transparency, scope and impacts of information and services for smallholder farmers. However, smallholder farmers face a myriad of challenges and capacity gaps in access to digital EAS. To enable them to access and benefit from digital EAS, they need to be empowered to access digital EAS for achieving economic, environmental and social gains sustainably.

Considering that smartphone is becoming one of the most prevailing and important digital tools available for smallholder farmers to access digital EAS, we developed this guide to support farmer training on digital literacy through which they can easily use their smartphone to gain essential skills to access digital EAS. This guide provides a training framework consisting of basic knowledge and skills on using a smartphone, access to digital EAS, access to e-commerce, and capacity building via smartphone. It also provides an Annex on the basics of smartphones. It is useful for farmer trainers and related EAS agents working in the field of farmer empowerment on digital literacy to formulate related training of trainers (ToT) courses, e-learning courses, farmer digital vocational schools, farmer digital training schools and so on.

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Annex
Basics of smartphones

1 What is a smartphone?

A smartphone is a cellphone that allows you to do more than making phone calls and sending text messages. You can use smartphones to browse the Internet and run software programmes like a computer. Smartphones have a touch screen to allow users to interact with them. They can also run various apps including games, personal-use, and business-use programmes for meeting different needs. The picture below is an example of an Apple iPhone, one of the most popular smartphones available today.

Smartphones are loaded with features and capabilities that make them more than a phone. Below is a list of their most popular features:

- Make and receive phone calls text messages;
- Take, show, and store pictures and video;
- Browse the Internet, and send and receive e-mail;
- Global Positioning System (GPS) capability for location and navigation;
- Record and play audio and music;
- Display time and date and other functions such as alarm clock, stopwatch, and timer;

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- Display weather and temperature information;
- Voice dictation and take notes;
- Virtual assistant using Siri, Google Assistant, or Cortana;
- Access utilities, such as a flashlight, e-book reader, and calculator.

More advanced smartphones are now foldable, which enables them to change between a standard smartphone and tablet screen sizes. For example, the Huawei Mate X can unfold to provide an 8-inch screen.

Apple iPhone (2007)

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2 What are the hardware components of a smartphone?

1 Display

The most obvious component of a modern smartphone is its display. While every detail you see is on the outside, it is actually an internal component of the device. Display technologies in smartphones of today come in two main types:

- Those based on liquid crystal display (LCDs) (in-plane switching (IPS) technology and its variations)
- Those based on light-emitting diodes (LEDs) (AMOLED or Super AMOLED and its variations).

2 Battery

Batteries of phones normally use lithium-ion technology that are either removable or non-removable in mobile devices. With these batteries, an important component of a smartphone, you will not have to worry about "calibration"or "testing" issues that were plagued with nickel-based cells. Still, this does not mean that current-generation batteries are not filled with their own issues, and users have to be very careful when handling and using volatile components like these.

3 'System-on-a-chip' (SoC)

The SoC is perhaps the most important component present in a smartphone, and some users might confuse it as being the processor of the device. However, it is far more than that; the SoC not only comprises up of the smartphone's central processing unit (CPU), but graphics processing unit (GPU), long-term evolution (LTE) modem, display processor, video processor, and other bits of silicon that turn it into a functional "system" in a phone.

4 Memory and storage

No smartphone can function without the use of random-access memory (RAM) and memory (system storage). First, for RAM, most mobile devices are chipped with LPDDR3 (low-power double data rate 3) or LPDDR4, while some high-end smartphones are chipped with LPDDR4X RAM. "LP" stands for "low-power", and it reduces the total voltage of these chips, making them highly efficient and giving mobile phones the extended battery life.
LPDDR4 is more efficient and powerful than LPDDR3, while LPDDR4X is the holy grail of RAM, resulting in unprecedented speeds and efficiency. LPDDR4X is more expensive to produce though, which is why you only see them in flagship smartphones. When newer generations of RAM are going to

be introduced, such as LPDDR5, then you guys will see the flourishing of LPDDR4X memory in mid-ranged devices.
As for internal storage, it exists as the flash memory, ranging from 32GB, and can go all the way up to 256GB on some phones. Naturally, as the requirements of users start to rapidly increase based on the amount of storage that they use, phone manufacturers will exponentially increase the amount of RAM present in smartphones. When you fire up your device for the very first time, one thing that you'll notice is that the advertised storage is not the same value as running on the phone.

5 Modems

Smartphones need communication components to receive and send text messages and calls. That is where modems come in, and every SoC manufacturer has their own brand of modems, and this includes Qualcomm, Samsung, Huawei and several others. These manufacturers are also battling it out to release the fastest and efficient category of LTE chips, so if you have come across the term Cat. 9 LTE modem, that is the fastest one out there. However, if your own cellular network does not support those level of speeds,

Smartphone display

Smartphone battery

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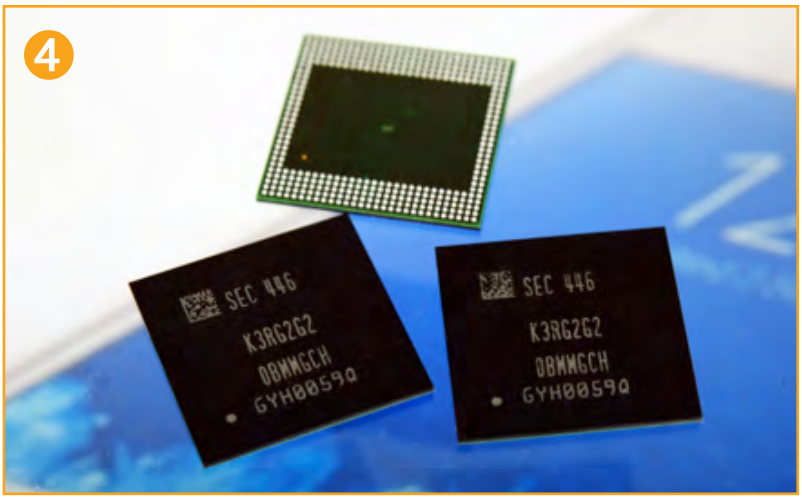

Smartphone memory

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then there's absolutely no point of having such powerful chips present in smartphones.

6 Camera

All smartphones come with a rear-facing and front-shooting camera. A smartphone comprises up of three main parts:

- The sensor (which detects light)
- The lens (the component in which light comes through)
- The image processor

While the megapixels on the smartphone are still an important part of the camera, it carries less importance than it did a while back. Instead, the primary limiting factor is the camera sensor of the phone and how sensitive it is when light passes through the lens.

7 Other sensors

- Accelerometer: Used by apps to detect the orientation of the device and its movements, as well as allow features like shaking the phone to change music.
- Gyroscope: Works with the Accelerometer to detect the rotation of your phone, for features like tilting phone to play racing games or to watch a movie.
- Digital Compass: Helps the phone to find the North direction, for map/navigation purposes.
- Ambient Light Sensor: This sensor is automatically able to set the screen brightness based on the surrounding light, and helps conserve battery life. This would also explain why your smartphone's brightness is reduced in low-light environments, so it helps to reduce the strain on your eyes.
- Proximity Sensor: During a call, if the device is brought near your ears, it automatically locks the screen to prevent unwanted touch commands.

6

Smartphone camera

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3 What is the smartphone system software?

The most important software in any smartphone is its operating system (OS). An operating system manages the hardware and software resources of smartphones. Some platforms cover the entire range of the software stack.
Android is the operating system that most mobile phones use. Developed by Google, most people consider this system because its open source technology allows people to write program codes and applications for the operating system, which means Android is evolving constantly. Smartphone users can decide whether to download the applications. Moreover, Android operating systems can run multiple applications, allowing users to be multitasking mavens. And get this: Any hardware manufacturer is free to produce its own Android phone by using the operating system. In fact, many smartphone companies do just that. Android app's store has hundreds of thousands of apps.
Apple is always innovating, and iOS allows iPhone screens to be used simply and logically. Touted by Apple as the "world's most advance mobile operating system", iOS supports more access from sports scores to restaurant recommendations. As of publication, its latest version iOS7 allows for automatic updates and a control center that gives users access to their most used features. It also makes surfing the net easier with an overhaul to the Safari browser.
Reviewers say that Windows Phone 8 (WP8) is as simple to use as iOS and as easy to customize as Android. Its crowning achievement is LiveTiles, which are programmed squares that users can rearrange on their screen to easily access the information they want. WP8 works well with other Microsoft products, including Office and Exchange. For those who do a lot of calling, connecting to Facebook and texting, WP8 may meet their needs.

4 What do I learn to use smartphone applications for?

Depending on the nature of the applications, you can entertain yourself, learn something new, network with others, purchase and sell products, and do many other daily-life activities on your smartphone without having a desktop or laptop computer.
You can also use smartphone applications to access digital AEAS if there are any available in your country.

5 How do I choose a smartphone?

What you should pay attention to when choosing depends on what you are going to do with your smartphone. Think about what you find important about your smartphone:
The most common operating systems are iOS and Android. iOS can be found on Apple's smartphones, and it is known for its security. However, it does have limited options if you want to exchange files with a non-Apple device. Android is the operating system of all the other brands including Samsung, OnePlus, Huawei, Xiaomi, etc. These brands add their own shell of non-removable apps and extra functions to the operating system.
The RAM is also important. The more RAM, the more tasks the smartphone can do at the same time. The operating system also affects the speed. The newer the software version, the faster the device.

6 How can I charge a smartphone correctly?

Always refer to the user's manual contained in the original package of your smartphone. Below the general steps to charge your smartphone:

STEP 1 Find a charger that fits your cell phone. It usually comes with the phone.
STEP 2 Check the battery on your phone. If it is four or three bars, you do not need to charge it. But once it is down to two, one, or even no bars of power, it needs to be charged.
STEP 3 Plug your charger into an outlet and slid the smaller part into your phone.
STEP 4 Leave your phone to charge until the battery shows four bars (100 percent charged).

Charging a smartphone

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TIPS

- When charging your new mobile phone for the first time, shut it down first and then charge it. You also need to make sure that you charge it for at least an hour or so after it is fully charged, so that the new battery can be fully activated. Ensure as much as possible that there will be no power failure and avoid unplugging and using it temporarily during the charging.
- Make sure the surrounding is relatively dry and the temperature is not too high or too low.
- It is also important to ensure that the original charging cable and plug of the mobile phone are used. Non-original ones will also damage the battery.
- Do not use USB to charge, as it is a slow charging method. The voltage and current are unstable, which will cause damage to the battery.
- You also need to be careful not to cover your phone with objects while charging.

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ISBN 978-92-5-137561-7
9 789251 375617
CC4022EN/1/03.23