EU H2020 PROJECT
GA 862848

Linking East and West African farming systems experience into a BELT of sustainable intensification

EWA-BELT

D6.13

Practice Abstract

(First set)

Grant Agreement:	862848
Project Title:	Linking East and West African farming systems experience into a BELT of Sustainable Intensification
Project Acronym:	EWA-BELT
Project Start Date:	1st October 2020
Related work package:	WP6
Lead Beneficiary:	UNISS
Submission date:	30th September 2022 (Revised version 30 January 2024)
Nature:	Report
Dissemination Level:	Public

DISCLAIMER

ACKNOWLEDGEMENT

This document is a deliverable of the EWA-BELT project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement Number 862848.

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History of changes

Version	Date	Description of changes
REV 1	30 January 2024	<u>Practice Abstract n. 1</u>: - In the Dagbani version, the word "*Zinzam"* has been replaced in the text with the word "*Kabga"* that currently is used to refer to the crop "Fonio". - 60Kg ha $^{-1}$ has been corrected both in the English and Moorè version as: *"6000 kg ha^{-1}"*, while in the Dagbani version as "*wuhiya ni Kabga kpalansi di baa wɔi n-daa yina yika ayi ni pirigili"* - In the English version the expression "*deeply row seeding"* has been replaced with "*minimum tillage practice*" and in the Moorè version with the corresponding expression "*lāa sē tuud nē koob sē pā lēebg teng gông tuumdé ti"*, while in the Dagbani version as "*Ka Kabga kpalansi anahi laasabu mi n-daa yina pusheŋa ban daa bi doli pukparilim so' pala la shɛli, yika ayi ni pirigili kam puuni".* <u>Practice Abstract n. 2:</u> The following pictures have been added: - *Figure 2: Sample of botanical and preparation of bio-pesticide (a=Dried neem plants, b= Neem powder, c= filtering of bio-pesticide)* - *Figure 3: Spraying of bio-pesticide and Data collection on the established on-station trials (a= Experiment label, b= spraying of bio-pesticide on common bean crop, c= Data collection on Lablab crop)* - *Figure 4: Phases of preparation of neem mixture from seeds* <u>Practice Abstract n. 3:</u> - The term "apo mediation" both in the English and Italian version has been replaced with: *"direct access to high quality information without intermediaries"*. - *Figure 6 "Main steps of the PlantHead platform workflow"* has been added to better clarify the functioning of Planthead

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EXECUTIVE SUMMARY

This deliverable aims to present the first set of practice abstracts of the EWA-BELT Project (3 out 6) conceived as easy and accessible materials for practitioners.

The first set of practice abstracts presented in this report focus on:

- **Fonio** as a Neglected and Underutilized Specie **(NUS).** A summary of the main results from the experiments carried out in Ghana and Burkina Faso is provided (WP2 - Task 2.1.)
- The use of **Neem seed oil** as an environmentally safe bio-pesticide. A summary of the main results from the experiments carried out in Ghana and Tanzania is provided (WP3 - Task 3.3.)
- The **Planthead** platform**,** a real time remote crop health diagnostic tool promoted within the Project. An overview of its scope and functioning is provided (WP3 – Task 3.1.).

The practice abstracts will be published on the EWA-BELT website and, to maximize the impact at the EU and international level, they will be sent to the EPI AGRI initiative to be published on their website (https://ec.europa.eu/eip/agriculture/en), following the recommended EU common format.

The version presented in this deliverable already respects the EPI AGRI format in term of structure and providing also the translation in the native languages. However, the general information on the EWA BELT project (title, objective, source of funding, etc.), as well as the contacts of the Consortium Partners (name, e-mail, telephone) are not included here since considered not relevant to the scope of this deliverable. They will be sent directly to EPI AGRI by filling in the EU format excel template.

PRACTICE ABSTRACT 1

Organization responsible for the text	• Kundok Development Consult Ldt., Tamale, Ghana • Fondazione Acra, Italy

Title: Introducing Fonio in the Farming systems to enhance Food Security and Incomes in Northern Ghana and Burkina Faso

Given its early maturing stage and nutritious nature, Fonio (*Digitaria Exilis* (Kippist) Stapf) has been known as an important food security crop in the growing areas since it closes the hunger gap between the planting and harvesting period of the major staple crops such as maize. However, nowadays its production is being neglected in many areas of West Africa and no improved varieties are currently available. Kundok Development Consult as part of the EWA-BELT project has introduced and evaluated Fonio production in four Ghanaian districts (Savelugu, West Mamprusi, Talensi and Nabdam) testing four local varieties (Namba, Nnamba, Wagadugu and Nfonikpa). Since Nnamba resulted the highest yielding landrace (~900-1000 kg ha^{-1}), it was proposed to 20 farmer groups in the 4 districts, for a total of 400 farmers, which have been linked to a processor company. Furthermore, five farmers per each district, representing each group, will be trained with a Training of Trainers (ToT) approach on the manual processing of the crop so that by the end of the project, a total of 100 farmers (25 per district) will produce Fonio. On these premises, not only the inclusion of Fonio in the farming systems will have the capability to enhance food security, but also, if produced in larger quantities than farmers own consumption, it could be sold to the mechanical processing company also increasing the farmers' household income. Within the project, the partner ACRA also directed part of its research on Fonio, assessing two different crop management practices in the areas of Zorgho, Loumbila and Guié in Burkina Faso. Preliminary results showed a yield increase of about 124% (830 kg ha^{-1}) under manure fertilization (6000 kg ha^{-1}) and minimum tillage practice compared to the traditional practices with no fertilizer and broadcasting sowing (370 kg ha^{-1}).

Native language: Dagbani, North East Region of Ghana

Kabga Kɔbu Zaŋ Wuhi Pukpariba, Din yɛn che ka Bindirigu ni Liɣiri din yiri Pukparilim ni na Tibigi ti Bɔba ni Yaɣa ŋɔ na.

Ayi lihi di ni bi yuuri ka biri shɛm, n-ti pahi di ni tiri ninsali ningbun' alaafee shɛm, Kabga nyɛla puzuri shɛli din ni tooi gu ka che bindirigu kalinsi bee bindir' pooli luɣ'shɛŋa bɛ ni kɔri li, dɔmi, di tooi biri la saha shɛli bɛ ni biriti bindir' kpana kamani kawana, n zaŋ hali ni di kpuɣibu saha. Amaa saha shɛŋa ti ni ʒiya ŋɔ, Kabga kɔbu nyɛla bɛ ni dii bi kpaŋsi shɛli Afirika wulin luhili bɔba ni di yaɣa ni, ka Kabga balibu din ti tooni gba kani. Kumdok lɛbigimsim tuma yili nim yaɣ'shɛli bɛ ni bɔli EWA-BELT la nyɛla ban zaŋ Kabga kɔbu n-wuhi pukpariba ti Gana ŋɔ yaɣa anahi, ka zahin di kɔbu n-nya din chaŋ shɛm yaɣa anahi maa ni. Lala yaɣa maa n-nyɛ Savelugu, Mamprugu wulin luhili, Talinsi ni Nabdom n-ti pahi di bɔba ni di yaɣa. Yaɣa anahi ŋɔ nyɛla ban buɣisi Kabga ni mali bal' shɛŋa kɔbu, di ni n-nyɛ Namba, Nnamba , Wagadugu n-ti pahi Nfonikpa.

Buɣisibu ŋɔ ni, Kabga bal'shɛli bɛ ni bɔli Nnamba la n daa niŋ viɛnyɛlinga n-gari di taba maa zaa. Yika ayi ni pirigili kam puuni, Nnamba daa kpuɣila kpalinsi awɔi zan chaŋ kpalaŋ pia polo.

Dinzuɣu, bɛ daa zaŋ Nnamba balibu maa n-ti pukpariba laɣinsi pishi, Gana yaɣa anahi shɛŋa bɛ ni daa pii la, ka pukpariba maa zaa daa yiɣisi kɔbishinahi. Bɛ daa lahi bɔla tuma yili shɛli ban mali mashina din maani Kabga ŋɔ, ka bɛ mini pukpariba maa pɔha daa yooi taba, din yɛn che ka pukpariba maa yi ti kpuɣi Kabga maa, ka bɛ zaŋ bɛ mashina maa m- mali li viɛnyɛlinga.

Din lahi pahi, bɛ daa pii la pukpariba anu yaɣa yini kam puuni, ni bɛ ti ba baŋsim zaŋ kpa Kabga malibu polo, di yi ti ko n-kpuɣi, ka baŋsim ŋɔ nyɛla bɛ zaŋ na n-ti wuhi bɛ pukparitaba. Ka di daliri nyɛla bɛ ti yɛn wuligi baŋsim maa n-gili zaa, pukpariba kɔbga n-yɛn mali lala baŋsim maa. Ka yaɣili kam mali pukpariba pishi ni anu, ban mali baŋsim ŋɔ.

Di pala ti yi zaŋ Kabga kɔbu m-pahi ti pukparilim ni ko n-yɛn gu ka che bindir' pooli bee bindirigu kalinsi, amaa bɛ yi tooi kɔri li pam n-yaɣiri dibu zuɣu, bɛ ni kɔhiri di shɛli ka liɣiri maa gba sɔŋ pukpariba maa ka bɛ tooi gbub bɛ dundɔna.

Vihigu zaŋ kpa Kabga kɔbu polo nyɛla tuma yili shɛli ti ni bɔli ACRA, ni zaŋ shɛli chaŋ ti paai Burikina tinsi ata, ka bɛ yuya booni Zorgho, Loumbila ni Guie, ni bɛ buɣisi Kabga kɔbu paya paya maa shɛŋa. Vihigu maa wuhiya ni di daa niŋ viɛnyɛla pam. Vihigu maa laha wuhiya ni Kabga kpalansi di baa wɔi n-daa yina yika ayi ni pirigili puuni, bɛ ni daa zaŋ binkɔb bina ka mani kpalaŋ kabli m-bahi pushɛŋa, ka lahi zaŋ Kabga shɛŋa din nyɛ zaɣ' kahi-bima m-biri. Ka Kabga kpalansi anahi laasabu mi n-daa yina pushɛŋa ban daa bi doli pukparilim so' pala la shɛli, yika ayi ni pirigili kam puuni.

Native language: Mooré, Burkina Faso

Kiu (Fonio) Koob la yõndo koom guidgrē la Koosũm yõndo Ghana (Nord) la Burkina Faso

Kiu wa sē bĩit Tũlga là sē ya rĩib sē tũin koom Ed mĩ-yē Koob yôndo kakũadba yĩinga.kiu tũē songamē tid toi kom yemmdē. Bala a buiũg saasa Ti Kamana nē koodã taaba nã ka taayé(kiu tũē yiilim doogo). Nēeba wũusg yaoũlē la miin-yé bon la koodã wũusg yé. Kiu bises sē bée ka bĩis tũulûlg yé.

Kundok Développent consul tũum wēgĩn (projet EWA BELT) ũb nãanga kiu wa Koob nē Ghana temsã naas sē zoé koo niin kood bois toētoēya (Savelugu, west mamprusi,talensi, la nabdam) lab nãanga kiu kood bĩis sē ya sõmbo n-yiida tãaba (900-1000 kg ha^{-1}) id riika kiu bĩis bamba n-nãanga Koob tēmssa naz puusē nē kakũadb bamba kobs nassé sē pũui saas piisĩ. Teng fãa tũumda nēeba nũ Saas piisĩ wã pũugē tid nã zambs ba (kõnb bangrē)kiũ Koob wēgē ti tuubda (projet) bassego kadũadb baam kũabga (kakũadb pĩisi-la-nũ teng fãa) nã kiinba kiu wã. Kitamē ti kood kang na sõngamē tĩib tong koom lab koosé m paam yõndo kiu wã koosg pũugē ã bîis wũuslem kiêlem.

"Projet"kang pũugē Accra Burkina tũum taaga lũissa toogo Ghana kiu bĩis koob naangr Burkina nĩn bũdbã la koomb mãansiim tũētũēya (zorgho, loumbila nē Guié Burkina solmē). Rē vinēgamē ti mãansiim bamba sõmblom yĩida Burkina kakũadba bũdbã nakingré. Bamb dínga ya 124% (830 ha^{-1}, nē põnsg 6000kg ha^{-1}) lãa sē tuud nē koob sē pã lēebg teng gông tuumdé ti, Burkina kakũadba sē miinimē bũtē (370 kg ha^{-1}, bamb pã niingd põnsg yē).

Figure 1 – Pictures from the experimental sites in Ghana (*Photo credits: KDC, Ghana)*

PRACTICE ABSTRACT 2

Organization responsible for the text	• Council for Scientific and Industrial Research - Savanna Agricultural Research Institute, Ghana • Tanzania Agricultural Research Institute, Tanzania

Title: Use of neem seed oil as an environmentally safe bio-pesticide to manage pest damage in different crops

As part of the research on retrieving plant protection traditional knowledge, several EWA-BELT project partners are investigating the efficacy of plant protection agents in greenhouse or field trials. The use of neem seed oil (NSO), as an environmentally safe pesticide to mitigate fall armyworm damage in maize, was tested by CSIR-SARI in Ghana. About 100-150 mg of NSO was obtained by measuring 1 kg of neem seeds, removing debris and the external covering. The kernel was pounded into a fine paste and kneaded with cold water until the oil emerged, which was then collected with a foam material. A knapsack was first filled to half its capacity with water, followed by sequentially adding 10 ml of liquid soap, 25 ml of NSO, and again water up to 15 L, vigorously shaking with each addition to obtain a homogenous mixture. The first application was done when maize plants were 2-3 weeks old and the second at the 6^{th}-7^{th} week. A reduction in infestation and damage was observed, with a grain yield increase by over 40% compared to the untreated plants. Within the project, the partner KDC is also testing the NSO, produced by local women in Ghana, to manage pest infestation in cowpea. A ~70% yield increase was found compared to the untreated plots and ~10% compared to the use of another tested bio-pesticide: *Securidaca longipedunculata* root extract. Moreover, in Northern Tanzania TARI evaluated the efficacy of different doses (0.5FR, 1 FR, 2FR and 4FR) of a homemade bio-pesticide [full rate (FR) = 0.5 kg of pepper (*Capsicum* sp.) + 3 kg *Tephrosia vogelii* (fish bean) + 1 kg Neem (*Azadirachta indica*) in 20 L water] in controlling field pests on lablab (*Lablab purpureus* (L.) Sweet) and common bean. This treatment allowed an increase in grain yield compared to the untreated plants, up to 2.6 times in common bean and 1.7 times in lablab, which was not significantly different from the use of a synthetic pesticide.

Native language: Dagbani, North East Region of Ghana

Nyimsi wala kpam zaŋ tuhi zunzuya barina kariwana ni

Vihigu shƐya din niŋ zaŋ kpa baŋsim mini tuma shƐya din guri ka tayira binbira, EWA-BELT tuma bƐ taba vihirimi ni bƐ nya soya balibu shƐŋa dini gu ka tari binbira di zahimbu shee. Di balibu puuni, nyimsa wola kpam (NSO) tim tuhiri zunzuya (FAW) ka mali alaafee zaŋ ti ma daa nyƐla CSIR-SARI tum ayili nima ni daa zahim Ghana tingbani ni. Nyimsa wola kpam nyƐla bƐni daa doo shƐli. BƐ daa zaŋla nyimsa kuruga pƐrigili (1kg) ka yihi di pƆyiri maa zaa. Nyimsa wole kpam daa nyƐla bƐni to shƐli ka zaŋ kom mahili n ŋmeli haali ka kpam ti yina. BƐ zaŋla tani chee n zaŋ nyu kpam maa. Kamani 100-150mg kpam n daa yina. Kuruya pƐrigili (1kg) maa ni. Di yƐn tari kariwana ka chƐ zunzuya (FAW) yƆ, di yƐn le la din bahiri tim (knapsack) kom ka niŋ chibo kom bela (10ml) n pahi ka charisili haali ka di zaa ti gabi taba. Di nyaaŋa, nyimsa wola kpam bela (25ml) daa boo pahi chibo kom maa ni ka lahi charisili viƐnyƐlinga. Kom daa lahi niŋ pahi ka di ti payi 15ml boobu la shee ka lahi charisili ka naan bahi kariwana maa. Tuuli bahi bu maa daa niŋ mi saha shƐli kariwana maa ni daa nyƐ bakoi ayi bee ata la ka bahibu din daa pahi ayi maa daa niŋmi dini daa payi bakoi ayobu zaŋ chaŋ bakoi ayopoin. Lala bahibu nima ŋƆ daa booi zunzuya maa barina nima ka che ka di niŋ yari vaabu pihinahi kƆbigu puuni (40%) zaŋ marisi din daa bƐ bahi maa. Di zuru nyimsi wole kpam bahibu buyi maa daa tuhi ka gu ka tari zunzuya (FAW) maa barina nima.

Native language: Swahili, Tanzania

Matumizi ya mafuta ya mbegu ya mwarobaini kama dawa salama kwa mazingira ili kudhibiti uharibifu wa wadudu katika mazao mbalimbali

Matumizi ya mafuta ya mbegu za mwarobaini kama dawa salama kwa mazingira ili kudhibiti uharibifu wa wadudu katika mazao mbalimbali shambani kama sehemu ya utafiti wa kurejesha maarifa ya jadi ya ulinzi wa mimea, washirika kadhaa wa mradi wa EWA-BELT wanachunguza ufanisi wa kutumia mimea kudhibiti uharibifu wa wadudu mashambani. Matumizi ya mafuta ya mbegu za mwarobaini kama dawa salama kwa mazingira kupunguza uharibifu wa viwavijeshi kwenye mahindi, yalijaribiwa na Taasisi ya utafiti wa Kilimo kwenye ukanda wa savanna (CSIR-SARI) ya nchini Ghana. Ambapo takribani miligramu 100-150 za mafuta ya mbegu za mwarobaini zilizopatikana kwa kukamua kilogramu 1 ya mbegu za mwarobaini. Mafuta haya yalipuliziwa kwenye mimea yakichanganywa na sabuni miligramu 10 ya maji, mililita 25 za mafuta ya mbegu za mwarobaini kwenye bomba la lita 15. Jariribio la kwanza lilifanywa wakati mimea ya mahindi ikiwa na umri wa wiki 2-3, kupungua kwa uvamizi na uharibifu kulionekana na ongezeko la mavuno ya nafaka kwa zaidi ya 40% ikilinganishwa na mimea ambayo haikupuliziwa dawa hii ilionekana.

Pia ndani ya mradi huu washiriki wengine kutoka Taasisi ya maendeleo ya Kundok inchini Ghana (KDC) walitumia mafuta ya mbegu za mwarobaini yanayozalishwa na kikundi cha wanawake nchini Ghana, ili kuthiibiti uvamizi wa wadudu kwenye zao la kunde. Ambapo ongezeko la mavuno la 70% lilipatikana ikilinganishwa na mashamba ya zao la kunde ambayo hayakupuliziwa dawa hii, na 10% ikilinganishwa na matumizi ya dawa nyingine ya dukani au viwandani ya kuulia wadudu iliyojaribiwa.

Nchini Tanzania, taasisi ya Utafiti wa Kilimo Tanzania (TARI) ilifanya jaribio kutathimini ufanisi na ufanyaji kazi wa dozi mbalimbali za dawa asili ya mimea kwa ajili ya kuua visumbufu vya mazao shambani itokanayo na mchanganyiko wa pilipili kali iliyosagwa, utupa uliosagwa na mwarobaini uliosagwa na kuchanganywa katika lita ishirini za maji na hatimaye kutumika kudhibiti wadudu waharibifu kwenye zao la Ngwara na Maharagwe. Mchanganyiko huu ulipelekea ongezeko la mavuno mara 2.6 katika zao la maharagwe na mara 1.7 katika zao ngwara, ikilinganishwa na mimea ambayo haikupuliziwa dawa ya asili ya mimea, na ufanisi wa dawa hii ya asili ya mimea haukuwa tofauti sana na matumizi ya dawa ya wadudu ya viwandani iliyotumika.

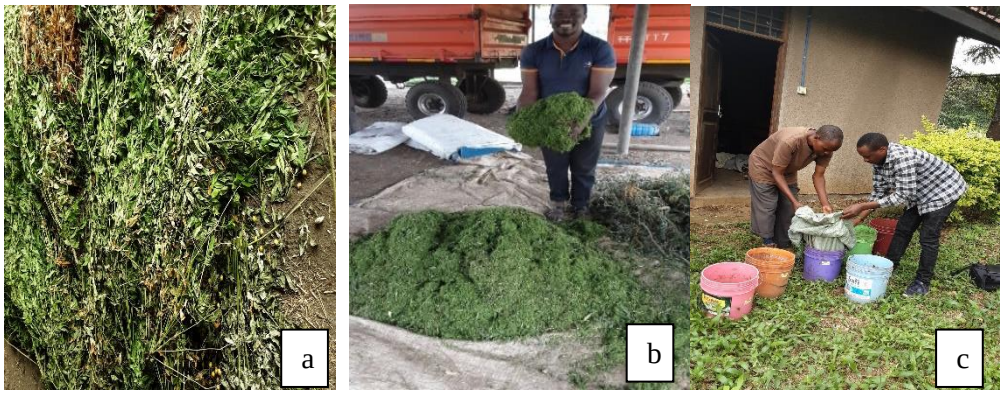


Figure 2: Sample of botanical and preparation of bio-pesticide (**a**=Dried neem plants, **b**= Neem powder, **c**= filtering of bio-pesticide)- *Photo Credit TARI, Tanzania*

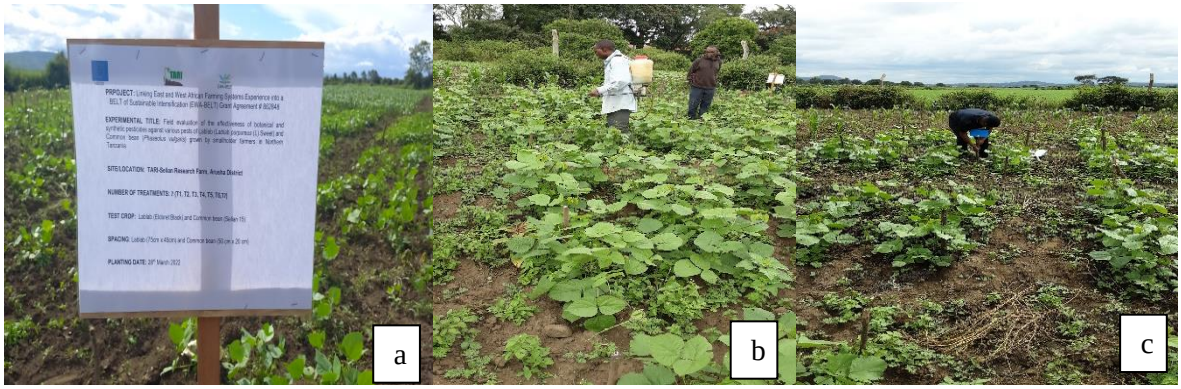


Figure 3: Spraying of bio-pesticide and Data collection on on-station trials (**a**= Experiment label, **b**= spraying of bio-pesticide on common bean crop, **c**= Data collection on Lablab crop- *Photo Credit TARI, Tanzania*

Figure 4: Phases of preparation of neem mixture from seeds (*Photo credit CSIR-SARI, Ghana)*

PRACTICE ABSTRACT 3

Organization responsible for the text	• Osservatorio per la Comunicazione Culturale e Audiovisiva nel Mediterraneo e nel Mondo, Milano, Italy • Desertification Research Centre, Department of Agricultural Sciences, University of Sassari, Italy

Title: Promoting remote real time crop health services to rural communities in West and East Africa: Remote PLANT HEAlth Diagnostic platform-Planthead

Several partners of the EWA BELT project are contributing to the implementation of a PLANT HEAlth Diagnostic (PLANTHEAD) network in Africa, to promote real time diagnosis and environment-friendly crop protection approaches in resource-constrained environments lacking the organizational and/or the sociotechnical system resources to cope with crop health diseases. The network is based on the World Food and Health Security e-Center (HFSeC), and is based on Internet of Things, wearable technologies and mobile devices. The proposed approach conjugates the adoption of low cost, high throughput technologies with a web-based service for farmers, extension, and local research personnel to enable and facilitate: 1) social networking, 2) participation, 3) direct access to high quality information for users without intermediaries 4) openness, and 5) collaboration, within and between user groups. Valorization of traditional knowledge, involvement of local actors, and technology appropriation will increase the likelihood of success of the PLANTHEAD network. The shared database represents an extremely valuable tool for epidemiological studies, as it generates interactive georeferenced maps, thereby allowing real-time monitoring, modelling, and forecasting the progression of a pathogen or any pest that may raise serious food security/safety concern in the area. An artificial intelligence is being trained to recognize and identify the most common foliar diseases on groundnut, a crop that has been unanimously listed as the most grown by the partners in the involved sub-Saharan countries.

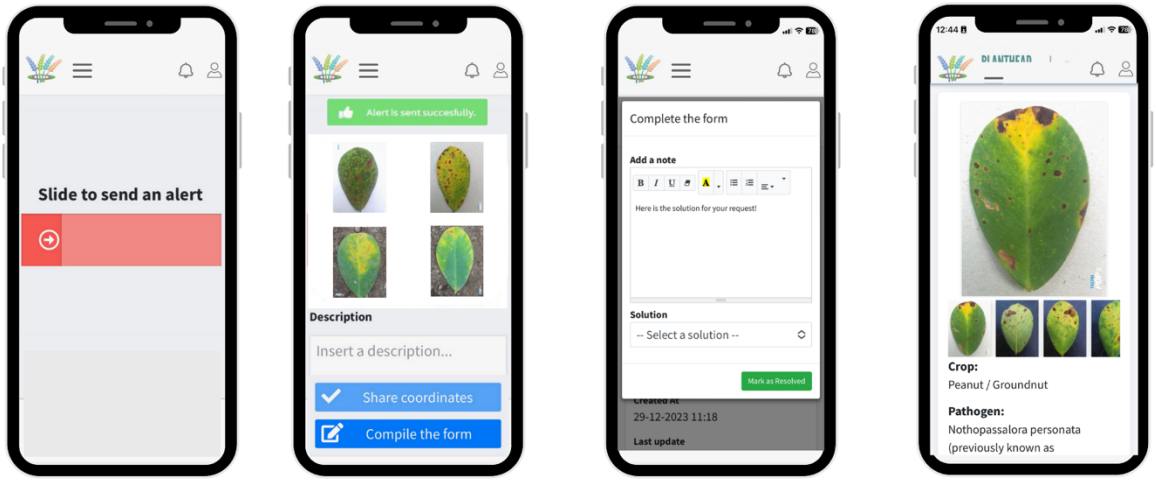
Italiano

Promozione di servizi a distanza e in tempo reale per la salute delle colture nelle comunità rurali dell'Africa occidentale e orientale: Piattaforma diagnostica a distanza per la salute delle piante (PLANT HEALTH).

Diversi partner del progetto EWA BELT stanno contribuendo all'implementazione di una rete “PLANT HEalth Diagnostic” (PLANTHEAD) in Africa, per promuovere la diagnosi in tempo reale di patogeni che colpiscono le colture alimentari e diffondere misure di protezione rispettose dell'ambiente in contesti con risorse limitate e privi di servizi. La rete si basa sul World Food and Health Security e-Center (HFSeC) e sull’ Internet of Things, tecnologie accessibili e dispositivi mobili. L'approccio proposto coniuga l'adozione di tecnologie a basso costo e ad alto rendimento, con un servizio basato sul web rivolto ad agricoltori, extension agents e personale di ricerca locale al fine di facilitare: 1) social networking, 2) partecipazione, 3) accesso diretto degli utenti ad informazioni di

alta qualità senza intermediari, 4) apertura e 5) collaborazione, all'interno e tra gruppi di utenti. La valorizzazione delle conoscenze tradizionali, il coinvolgimento degli attori locali e l'appropriazione della tecnologia aumenteranno le probabilità di successo della rete PLANTHEAD. Il database condiviso rappresenta uno strumento estremamente prezioso per gli studi epidemiologici, in quanto genera mappe georeferenziate interattive, consentendo in tal modo il monitoraggio, la modellazione e la previsione in tempo reale della progressione di un agente patogeno o di qualsiasi organismo nocivo che può causare seri problemi di sicurezza alimentare nell'area. In questa fase, un'intelligenza artificiale si sta progressivamente definendo per riconoscere e identificare le malattie fogliari più comuni sull'arachide, coltura che è stata unanimemente indicata come la più coltivata dai partner nei paesi subsahariani coinvolti.

Figure 5 – a) Peanuts insect damages, b) Peanut rosette virus (*Photo credtis: UoN, Kenya)*



1. The farmer sends an alert

2. The farmer can provide informations, such as localization, photos, crop, a short description of the problem, etc.

3. The researcher in the competent node formulate a diagnosis and assign a solution to the ticket. The diagnosis is stored in the Platform Database for future use.

4. The farmer receives a notification of successful response for his request. Now the ticket is solved and the farmer can view the solution

Figure 6 – Main steps of the PlantHead platform workflow