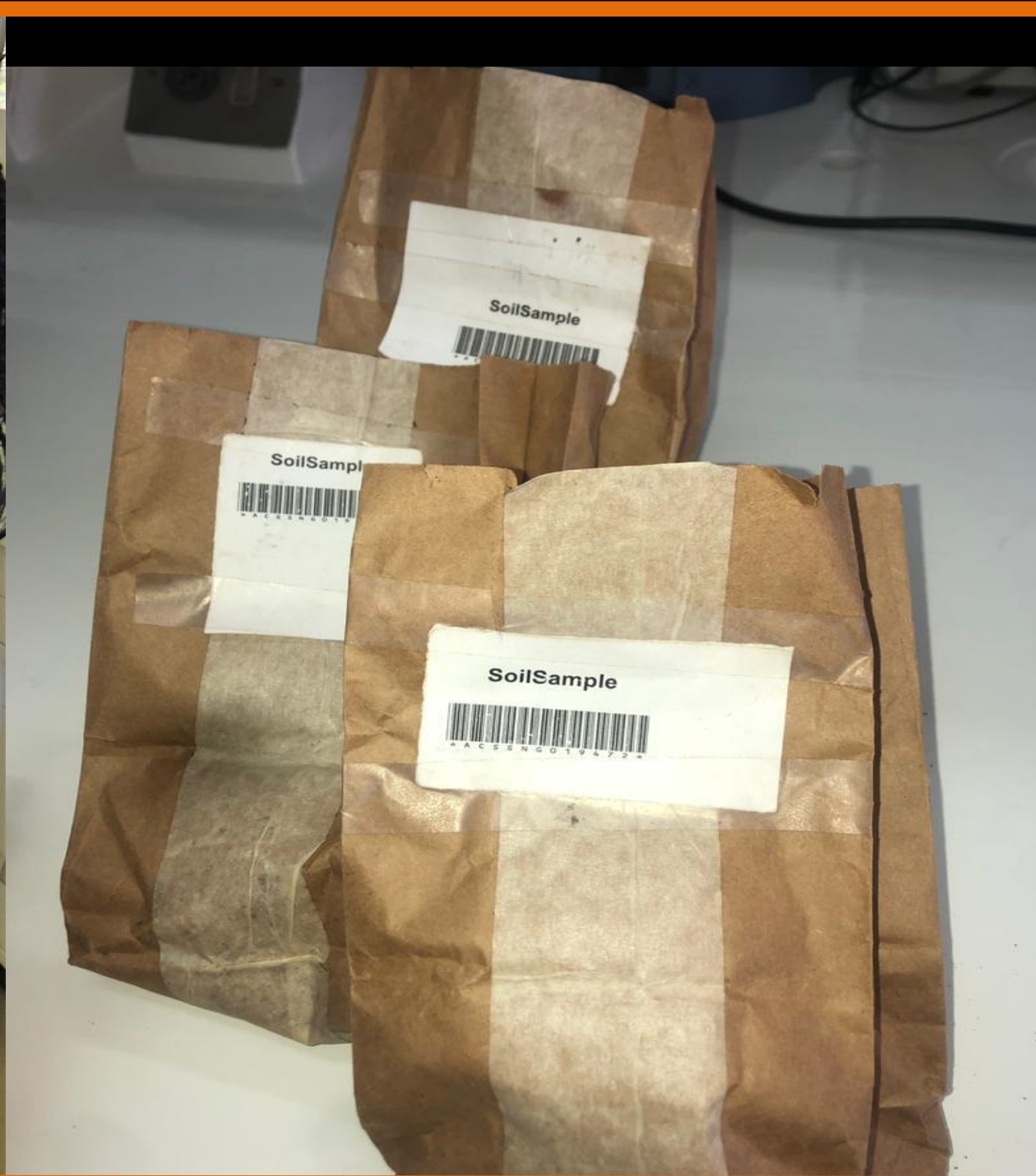


A Researcher Friendly Digital Sample Tracker for Cost Effective Sample Processing

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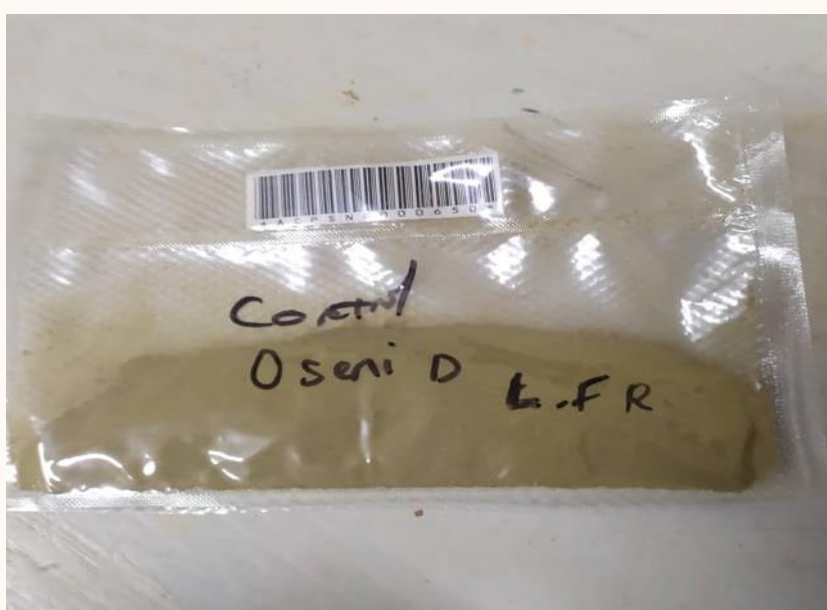
Introduction

A sample tracking system is important particularly when dealing with a large number of samples collected by multiple people across multiple sites to reduce human errors of sample labelling, mismatch and mix up. Leaving the labelling and identification of samples to those collecting or handling may cause incorrect labelling and loss of information about the sample. The African Cassava Agronomy Initiative (ACAI) is introducing an efficient sample tracker system that records a bar code based digital link between the samples, the plants and the plots and the trials from which they were collected. All samples are geo-referenced at sampling, thus their location of origin can be traced in case meta data are incomplete. This is facilitated by using smartphones with a bar code reader in the field when sampling and bar code readers and laptop when samples are registered and processed in the lab.

Field trials to test and develop best agronomic interventions

soil samples

Leaf samples



Ground leaf samples

Sieved soil samples

Lignified stem

Fig. 1: collection of different sample types and states

Objective

- 1 • Easy sampling in large scale multi-location research
- 2 • Efficient and effortless sample tracking and follow-up
- 3 • Cost effective sample handling and processing

Sample Batch Composition

THIS TOOL SERVES TO EITHER COMPOSE, RECEIVE, OR SPLIT UP A BATCH OF SAMPLES. IT REQUESTS TO READ IN A SAMPLE BATCH BARCODE AND THE SAMPLES CONTAINED IN THE BATCH. WHEN SPLITTING UP A BATCH, A REPORT MUST HAVE BEEN GENERATED AND SAMPLES FOR FORWARDING SELECTED. This tool should be used as an Enketo webform. It is easiest to connect a USB hand-held barcode scanner to register barcodes (manual entry is possible but can lead to erroneous recording of barcodes).

SELECT THE PROJECT.
☒ ACAI

SELECT THE COUNTRY IN WHICH THE SAMPLES WERE COLLECTED.
☐ Nigeria
☐ Tanzania

WHAT DO YOU WISH TO DO?
☐ Compose a new batch (generate a new group of samples and assign a batch ID)
☐ Receive an existing batch (confirm if an existing batch contains all plant samples)
☐ Select samples from an existing batch (after having generated a report and selected the samples to forward)

SELECT THE STATION WHERE THE SAMPLES ARE CURRENTLY PHYSICALLY PRESENT.
none selected

WHAT TYPE OF SAMPLES WILL YOU BE SCANNING?
☐ Soil sample
☐ Plant sample

Fig. 2: Introductory page: logging in basic information of the sample .

How the Sample tracker works

The sample tracker consists of **2 web-based forms** hosted by ONA. **The first form**, an enketo web-form, is designed to i) log in all new samples by composing sample batches containing a group of similar samples, ii) log and record the fate of each sample during its life cycle in the project.

Sample Batch Composition

Sample list

READ IN THE BARCODE OF PLANT SAMPLE 1 AND HIT ENTER: ACPSNG000001	THIS SAMPLE HAS BEEN SUCCESSFULLY REGISTERED. HIT THE + BUTTON TO SCAN THE NEXT SAMPLE. <input checked="" type="radio"/> OK
READ IN THE BARCODE OF PLANT SAMPLE 2 AND HIT ENTER: ACPSNG000001	THIS SAMPLE HAS BEEN SUCCESSFULLY REGISTERED. HIT THE + BUTTON TO SCAN THE NEXT SAMPLE. <input checked="" type="radio"/> OK
READ IN THE BARCODE OF PLANT SAMPLE 3 AND HIT ENTER: ACPSNG000001	THIS SAMPLE HAS BEEN SUCCESSFULLY REGISTERED. HIT THE + BUTTON TO SCAN THE NEXT SAMPLE. <input checked="" type="radio"/> OK

+

HAVE ALL SAMPLES OF THE BATCH BEEN SCANNED?
☒ Yes ☐ No

THE BATCH CONTAINS 3 SAMPLES. PLEASE CONFIRM THIS IS CORRECT.
☒ Yes ☐ No

Next

Next steps

PLEASE PROVIDE A DESCRIPTION FOR THIS BATCH, AND HIT ENTER:
For example: "Cassava without previous root trial" or "SB-IB-PS-2018-10-26T14:27" Do not use special characters like commas, semicolons, hyphens or dashes. Provide at least 10 characters to describe the batch.
validation soil sample from south east

READ IN A NEW BARCODE FOR THIS BATCH AND HIT ENTER:
ACPSNG000000
THIS BATCH WILL BE REFERRED TO AS: **SB-IB-PS-2019-01-16T08:52**
PLEASE CONFIRM THAT THIS BATCH NAME, AS WELL AS THE DESCRIPTION OF THE BATCH HAVE BEEN CLEARLY INDICATED ON THE BAG OR CONTAINER OF THE BATCH, NEXT TO THE BARCODE LABEL.
☒ Yes ☐ No

WHAT WILL BE THE NEXT ACTION FOR THIS BATCH OF SAMPLES?
Only one sample action can be selected for a given batch. The samples will be split (the sample part will be forwarded for analysis and part will remain stored), then first physically split the samples using the "Split" form "Split Sample Label", then compose new batches containing an aliquot of each original sample, and select the action for each of the new batches.
☒ Remain stored at the current station
☐ Sent to another research station

PLEASE JUDGE THE QUALITY OF THE BATCH:
Only the batch that contain a mixture of good and poor quality samples should be separated in new batches with either good or poor quality. Use the composite batch option to do so.
☒ Good quality
☐ Doubtful: some mold, rot, moisture... but likely still useful for analysis
☐ Compromised: severe mold, rot, moisture... and unlikely still fit for analysis

PLEASE INDICATE HOW SAMPLES ARE CURRENTLY PROCESSED IN THIS BATCH:
☒ Raw (unprocessed)
☐ Air- or sun-dried
☐ Oven-dried at 105°C
☐ Oven-dried and milled
☐ Fine-milled

☐ Save as Draft

Fig. 3: composition of sample batches and logging in the state and the location of the sample on the enketo web-form

The **second web-based form** is a shinyapp (an interactive web app built from R) in which the decision is made to discard, store or process for analysis. These decisions are based on relevant information about the sample from the project database: trial type, location, sampling dates, validity of trials, sample quality, etc.

Sample processing dashboard

Home Make selection Forwarded Samples Check samples

Country: Nigeria Sample Type: Plant samples Sample Batch ID: ACSBNG000384

Trial Code: All

Description	Batch name	Location	Batch quality
Root samples from NOT2 trials 2017 season	SB-IB-PS-2018-10-26T14:27	Nigeria	OK

☒ Hide processed batch

Show 10 entries Copy CSV

Search:

sampleBatchID	plantSampleID	motherID	generation	samplingDay	sampleType	plantingDate	rootYield	trialValidity	reportAction	trialCode	Level
21 ACSBNG000384	ACPSNG103504	ACPSNG103504	Mother	Aug 10, 2018	tuberizedRoots	NA	TRUE	Not indicated	forward	NOT-2	plot
22 ACSBNG000384	ACPSNG103506	ACPSNG103506	Mother	Aug 10, 2018	tuberizedRoots	NA	TRUE	Not indicated	forward	NOT-2	plot
23 ACSBNG000384	ACPSNG103515	ACPSNG103515	Mother	Aug 10, 2018	tuberizedRoots	NA	TRUE	Not indicated	forward	NOT-2	plot
24 ACSBNG000384	ACPSNG103533	ACPSNG103533	Mother	Aug 9, 2018	tuberizedRoots	NA	FALSE	Not indicated	discard	NOT-2	plot
25 ACSBNG000384	ACPSNG103575	ACPSNG103575	Mother	Aug 9, 2018	tuberizedRoots	NA	TRUE	Not indicated	store	NOT-2	plot
26 ACSBNG000384	ACPSNG103582	ACPSNG103582	Mother	Aug 9, 2018	tuberizedRoots	NA	TRUE	Not indicated	forward	NOT-2	plot
27 ACSBNG000384	ACPSNG103593	ACPSNG103593	Mother	Aug 9, 2018	tuberizedRoots	NA	FALSE	Not indicated	store	NOT-2	plot
28 ACSBNG000384	ACPSNG103597	ACPSNG103597	Mother	Aug 9, 2018	tuberizedRoots	NA	TRUE	Not indicated	store	NOT-3	plot
29 ACSBNG000384	ACPSNG103597	ACPSNG103597	Mother	Aug 9, 2018	tuberizedRoots	NA	TRUE	Not indicated	store	NOT-2	plot
30 ACSBNG000384	ACPSNG103622	ACPSNG103622	Mother	Aug 9, 2018	tuberizedRoots	NA	FALSE	Not indicated	discard	NOT-2	plot

Fig. 4: ACAI sample tracker dashboard for making decisions .

Pros and Cons

Pros: The sample tracker tool enables researchers to know where a sample is located and at which stage of processing or analysis the sample is at any moment. The system helps to save on handling and processing labour, time and costs by limiting all processing and analyses to only those samples relevant to creating the decision support tools.

Cons: The batched sample still needs to be manually updated on the shiny app web dashboard using R script. Decisions are still being made manually.

Acknowledgement

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