



RECOMMENDATION DOCUMENT

**RECOMMENDATION OF NATIONAL BIOSAFETY COMMITTEE (NBC) ON AN APPLICATION BY INTERNATIONAL INSTITUTE FOR TROPICAL AGRICULTURE, IBADAN, TO CONDUCT CONFINED FIELD TRIAL, TESTING OF CASSAVA TO INCREASE STARCH YIELD OF THE STORAGE ROOTS.
APPLICATION REF: NBMA / CFT/**

1. General Information

I Name of Applicant: International Institute For Tropical Agriculture, Ibadan

II Contact Details:

- a) **Name of Contact Person: Lydia Stavolone**
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2. Trial date and location

Date: Dec 2018 – Dec 2021

Location: IITA, Ibadan. GPS information on location of the Confined Field Trial (CFT); Geographical coordinates: 7.490940 N – 3.903835 E.

3. Background Information

This is a new application as it involves cassava clones transformed for increased starch content in the roots. No application has been previously made for CFT of the below-described transgenic cassava clones and commercial release of these transgenic cassava clones before in any jurisdiction. In 2017, the applicant, International Institute of Tropical Agriculture (IITA), received permit for confined field trial (NBMA/CFT/005) to test transgenic cassava other than those included in the present application to be conducted in the below-mentioned confined field site.

4. Brief Identification Of GM And Description of Traits (Inserted Gene) and Purpose Of Modification

The intended phenotypic change to the transgenic cassava lines is an increased starch yield of storage roots, i.e. the developers intend to generate plants with bigger or more storage roots per plant and/or more starch content per storage root on dry weight basis. This phenotypic change should be achieved by simultaneously increasing source and sink capacities. The respective changes should be achieved by simultaneous alteration of expression of some of the following genes using constructs described below.

GPT – Glucose 6-phosphate/phosphate translocator of pea (*Pisum sativum*).

GPTs transport glucose 6phosphate in counter-exchange with phosphate or triose phosphate across inner envelope membranes of plastids. Overexpressing the GPT

mainly in storage roots should increase the import of carbon skeletons (i.e. glucose 6-phosphate) into amyloplasts, the cell organelles responsible for the synthesis and storage of starch granules, through the polymerization of glucose. These carbon skeletons are needed as precursor for starch synthesis (Zhang et al., 2008; Jonik et al., 2012).

NTT – Nucleoside triphosphate translocator1 of thale cress (*Arabidopsis thaliana*).

NTTs transport ATP in counter-exchange with ADP and Pi across inner envelope membranes of plastids. Overexpressing the NTT mainly in storage roots should increase the import of energy (in the form of ATP) into amyloplasts. The energy is needed for starch synthesis (Tjaden et al., 1998; Zhang et al., 2008; Jonik et al., 2012). TMT – Tonoplast monosaccharide transporter1 of thale cress (*Arabidopsis thaliana*). TMTs transport monosaccharides in antiport with protons across the tonoplast membrane. Overexpressing the TMT mainly in leaves should increase the export of hexoses from the cytosol (into the vacuole). Lowering the cytosolic hexose content has been shown to alleviate down-regulation of photosynthetic genes and should thus increase production of photosynthesis products (Wingenter et al., 2010). GlyDH – Glycolate dehydrogenase fusion protein of subunit D, E and F of *Escherichia coli* . GlyDH oxidizes glycolate to glyoxylate. Overexpressing the GlyDH targeted to chloroplasts mainly in leaves should prevent photorespiration by blocking an initial step of this metabolic pathway, the export of glycolate from chloroplasts (Nölke et al., 2014; Dalal et al., 2015). RCase – RubisCO activase. A synthetic chimeric gene consisting of *Arabidopsis* and tobacco sequences is used. Consuming ATP, RCase removes products of RubisCO activity from RubisCO which maintains RubisCO activity. Overexpression of RCase mainly in leaves is supposed to increase the activation state of RubisCO, mainly under conditions of elevated temperature (Carmo-Silva et al., 2015). OEP7-HxK – Outer envelope protein7 of thale cress (*Arabidopsis thaliana*) fused to yeast (*Saccharomyces cerevisiae*) hexokinase2. Hexokinases phosphorylate hexoses to hexose 6-phosphates consuming ATP and releasing ADP. Overexpression of a hexokinase at the outer envelope of plastids mainly in storage roots should lead to an increased production of glucose 6-phosphate in the vicinity of GPT and thus to a higher efficient uptake of carbon skeletons into amyloplasts fueling starch formation.

Note:

Procedures for the conduct of confined field trials are intended to accomplish three important goals:

- 1) preventing the escape from the trial site of novel genes in pollen, seed or other plant parts;**
- 2) preventing GE plant material from being consumed by humans and/or animals; and**
- 3) preventing GE plants from escaping from confinement and establishing and persisting in the environment.**

5. Shipping and Storage

Adequate arrangements have been made for shipping, transport and storage as required by NBMA.

6. Preventing the escape from the trial site of novel genes in pollen, seed or other plant parts

A suitable site map has been provided. Adequate arrangements have been put in place to prevent escape of GM material from trial site. It is recommended that the fence be buried deep enough to prevent burrowing animals from accessing the trial site.

7. Preventing GE plant material from being consumed by humans and/or animals

Adequate arrangements have been put in place to prevent the GE material from being consumed by animals and humans.

8. Preventing GE plants from escaping from confinement and establishing and persisting in the environment

Adequate measures have been described to prevent escape of plant materials from the trial site during the trial, at harvest and after the harvest.

9. Contingency plans

Contingency plans have been described that satisfy NBMA guidelines.

10. Records and Documentation

Measures are in place to ensure adequate documentation of all confinement procedures and data requirements. Documentation of trial data will follow the details indicated herein under terms and conditions, including

1. Clear recording of agronomical characteristics
2. Records for yield data etc

Recommendation

1. The CFT application is recommended for approval subject to
 - i. Site visit by NBMA personnel
 - ii. The terms and conditions below.

Terms and Conditions

Reports

The following reports are required during the progress of the field trial:

Planting Report: Details of trial establishment should be submitted to the NBMA within ten (10) working days after the completion of planting at the trial site. A final field site map shall also be submitted at this time.

Trial Progress Report(s): One or more progress reports should also be submitted during the growth of the crop .

Harvest Report: The researchers shall submit details of site harvest within ten (10) working days after the completion of harvest at termination of the trial.

Other Reports

Incident and Corrective Action Report: The researcher should orally notify the NBMA immediately, and in writing within 24 hours, of any incident involving an accidental or unauthorized release of genetically engineered plant material. The report should include any corrective actions taken or planned, to confine GE material and ameliorate the incident.

Unanticipated Effects Report: The researcher should notify the NBMA in writing within five (5) working days if the GE plants exhibit any substantial unanticipated characteristics, or if any unusual event occurs that may jeopardize the confinement of the GE plants.

Summary Reports

Experimental Report: The researcher should submit an Experimental Report within six (6) months after termination of the trial, summarizing observations, methods of observation, data and analysis of experimental results concerning the trial, required observations, and any unanticipated effects.

Post-Harvest Report: The researcher should submit a Post-Harvest Report within six (6) months after the completion of the post-harvest period. The Post-Harvest Report shall include a summary of observations on volunteers and their destruction, any data and analysis not previously submitted, and any responses required of the researcher by the NBMA concerning results of the trial.

Inspection

Inspectors from the NBMA shall have the authority to inspect proposed and established confined field trial sites and associated support facilities for adequacy and compliance with the Terms and Conditions of the authorisation throughout the trial and post harvest restriction period.

Names, Signatures and Date Of NBC Members

S/NO	NAME	DESIGNATION	DATE	SIGNATURE
1.	Professor Sylvia Uzochukwu	Chairman	17/01/19	
