

GUIDELINES FOR CONDUCTING NATIONAL PERFORMANCE TRIALS AND DISTINCTNESS, UNIFORMITY AND STABILITY TESTS ON GENETICALLY MODIFIED CROPS IN KENYA

2018



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Published by:

Kenya Plant Health Inspectorate Service - KEPHIS
P. O. Box 49592 Nairobi 00100
E-mail: director@kephis.org

In collaboration with the Program for Biosafety Systems and National Biosafety Authority

Citation:

KEPHIS, 2018. Guidelines for Conducting National Performance Trials and Distinctness, Uniformity and Stability Tests for Genetically Modified Crops in Kenya. Kenya Plant Health Inspectorate Service.

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Foreword

Testing of genetically modified crops in Kenya dates back to 1991, when the first Confined Field Trials (CFT) were conducted. Considerable experience has been gained in this process by researchers and regulators since then. The Seeds and Plant Varieties Act requires that varieties of classified agricultural crops must undergo National Performance Trials (NPT) and Distinctness, Uniformity and Stability (DUS) tests prior to commercialization.

National Performance Trials determine the agronomic potential and adaptability of a new variety while the DUS is a descriptive test that determines whether a variety is distinct from other varieties, sufficiently uniform in its essential characteristics and remains stable after repeated propagation. These requirements apply to both conventional and genetically modified crop varieties. The NPTs and DUS guidelines for testing conventional crop varieties are already available. However, considering the unique nature of Genetically Modified plants, it is important to have these specific protocols that incorporate the biosafety principles.

These guidelines present elaborate and well thought considerations of the experiences already gained. It is expected that these guidelines will facilitate the evaluation and suitability of Genetically Modified Crop varieties for cultivation as a step towards official release and commercialization. Specific protocols for various crops and events will be developed as it becomes necessary.

Esther Kimani, PhD
Managing Director
Kenya Plant Health Inspectorate Service, 2018

Executive Summary

Evaluation and release of new crop varieties is a global practice. In Kenya, this process is guided by the Seeds and Plant Varieties Act. Consideration for the release of new varieties that are genetically modified or hybrids of such varieties is necessary in view of advanced the development of such varieties in the country.

These guidelines therefore highlight the general rules to guide evaluation of varieties of Genetically Modified Crops in Kenya during conduct of National Performance Trials (NPT) and Distinctness, Uniformity and Stability (DUS) tests. Consideration is made to provisions of approval as stipulated by the Biosafety Act No. 2 of 2009.

The design of trials to accommodate evaluation of trait expressions and stability, isolation, site identification and integrity and submission of seed has been addressed. Confirmation testing for the gene of interest has been included to complement field evaluation together with development of crop descriptors, sampling and data collection during such trials.

List of Abbreviations

CFT	Confined Field Trials
DAP	Diammonium Phosphate
DDPSC	Donald Danforth Plant Science Center
DTE	Days to emergence
DTF	Days to flowering
DUS	Distinctiveness, Uniformity and Stability
EDV	Essentially Derived Variety
EIA	Environmental Impact Assessment
GMO	Genetically Modified Organism
ISAAA	International Service for the Acquisition of Agribiotech Applications
KALRO	Kenya Agricultural and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate Service
NBA	National Biosafety Authority of Kenya
NPTs	National Performance Trials
NVRC	National Variety Release Committee
PBS	Program for Biosafety Systems
PD	Planting Date
PHT	Plant height
RCBD	Randomized Complete Block Design
SAH	Stand Count at Harvest
SAS	Statistical analysis system
SAT	Stand count at thinning
SOPs	Standard Operating Procedures
TGs	Test Guidelines
UPOV	The International Union for the Protection of New Varieties of Plants

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Definitions of Terms

Check Variety: means plant variety under commercialization used to compare the candidate varieties in the national performance trial.

Confined Field Trial: any activity undertaken within a field and which involves genetically modified organisms controlled by specific measures to ensure material and biological confinement.

Distinctness, Uniformity and Stability: DUS test means an evaluation to determine whether a new plant variety is distinct from any known plant variety in respect of specified characteristics, uniform in morphological, physiological or other accepted characteristics; and stable in its description after repeated reproduction or propagation.

Essentially Derived Variety: As defined in Article 14 (5)(b) of the UPOV 1991 and section 20 (1C) of Cap 326, an EDV shall be deemed to be essentially derived from another variety and the initial variety when:

- It is predominantly derived from the initial variety, or from a variety that is itself predominantly derived from the initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety,
- It is clearly distinguished from the initial variety.
- Except for the differences which result from the act of derivation, it conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the variety.

Efficacy: the ability to produce a desired or intended result.

Genetically Modified Organism: means any organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology techniques.

Modern biotechnology: includes the application of—

- (a) In-vitro nucleic acid techniques including the use of recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles; or
- (b) Fusion of cells beyond the taxonomic family, that overcome natural physiological, reproductive and recombination barriers and which are not techniques used in traditional breeding and selection.

National Performance Trials: variety trials as specified in the Seeds and Plant Varieties Act of 2012.

Operator: an officer appointed or authorized by KEPHIS and takes responsibility for the agronomic management and data collection on NPT and DUS tests.

Seed: means that part of a plant which is or is intended to be used for propagation and includes any seed, seedling, corm, cutting, bulb, bulbil, layer, marcott, root, runner, scion, set, split, stem, stock, stump, sucker or tuber so used or intended to be so used.

Guidelines for Conducting National Performance Trials and Distinctness, Uniformity and Stability Tests for genetically modified crops in Kenya

1.0 Introduction

Evaluation and release of new varieties in Kenya is guided by the Seeds and Plant Varieties Act, 2012, and the accompanying Seeds and Plant Varieties (Variety Evaluation and Release) Regulations, 2016, herein after referred to as the Variety Evaluation and Release Regulations. Any new variety of crops listed in the Second Schedule (See Annex 1) of the Variety Evaluation and Release Regulations must undergo testing under NPTs and DUS tests, show compliance to the prescribed release criteria and be officially released before approval for commercialization.

NPTs testing is done by KEPHIS following protocols approved by the National Performance Trials Committee (NPTC), while DUS is done following UPOV Technical Guidelines or National Technical Guidelines. These tests are done to ensure that only superior varieties in terms of yields and other attributes are released for commercialization to the farming community.

National Performance Trials for genetically modified crop varieties are conducted after an approval is granted by NBA for environmental release and following successful conclusion of Environmental Impact Assessment (EIA) and Environmental Social Impact Assessment (ESIA) as required by the Environmental Management Coordination Act (EMCA). Genetically modified crop varieties **NOT** listed in the Second Schedule of the Variety Evaluation and Release Regulations **WILL NOT** need to undergo NPTs and DUS before release.

1.1 Objective

The objective of these guidelines is to provide the general principles that shall be followed during the conduct of NPTs and DUS tests of genetically modified crop varieties in Kenya.

1.2 Scope

The guidelines focus on crops listed in the Second Schedule of the Variety Evaluation and Release Regulations of the Seeds and Plant Varieties Act, while addressing the designing, general considerations and testing scenarios for NPTs and DUS tests of genetically modified crops.

2.0 General principles

2.1 General rules to be observed

Good practices shall be observed at all times during conduct of NPT and DUS trials.

- a) The breeder or applicant shall describe the variety with special attention to the modified or inserted gene and attributes or traits conferred. The descriptor for the GM variety may be incorporated within the general information of conventional descriptor while providing adequate information to differentiate the varieties even when the physiological characteristics are not visual.
- b) A trial may be terminated on advice by the National Biosafety Authority.
- c) In case environmental release (open cultivation) approval has been granted, NPT and DUS shall be conducted as per conventional crops.
- d) In cases of conditional environmental release approval, NPT and DUS tests will be carried out in secured sites within isolation distances that will comply with the conditions stipulated in the approval such as control of gene flow and entry of the products into food and feed chain. The site may be isolated from farmers' crops by a distance equivalent to the distance used to isolate basic seed of the specific crop from other crops of the same species, where this condition fits the limits of the approval. Specific isolation distances for different crops are provided in the Fourth Schedule of the Seeds and Plant Varieties (Seeds) Regulations, 2016 (Annex 5).
- e) Duration of trials: This will be for two seasons for all GM crops to determine the stability of the introduced trait, while in consideration of the provisions below testing scenarios.
- f) Testing Scenarios
 - i) Where the conventional version of the genetically modified crop variety has been previously released for the same agro-ecological site or purpose, the GM crop variety will be considered an Essentially Derived Variety.
 - ii) Use of NPT and DUS results of the conventional version of an EDV in scenario (i) above may be requested by the applicant and subject to approval by the National Performance Trials Committee, NPT testing may be done for only one season to confirm the expression of the introduced trait so long as testing is **conducted in more than three sites**.
 - iii) Where the conventional version of the GM crop variety has not been previously released, the GM crop variety will be considered to be a new variety even if the modified trait has been used in other varieties.
 - iv) Where the conventional parent of the GM crop variety has been released previously in the same crop, but in a different variety or different agro-ecological site or different purpose, the GM crop variety will be considered as a new variety.
 - v) Where a conventional version of the GM crop variety has been released under similar agro-ecological conditions in two countries within the regional economic cooperation blocks to which Kenya is a member and has harmonized regional plant variety release regulations and procedures, the applicant may apply for testing for only one season as in scenario (ii).

The provisions in testing scenarios (i-iv) shall apply where an additional trait or new gene stacks or combinations of traits are being introduced in a released variety.

Section A – National Performance Trials (NPT)

3.0 General Technical Operations

3.1 Trial design

This should be based on the number of entries received. Randomization shall be done and entries are allocated plot numbers and replications. Codes shall be used to conceal varietal identity to avoid bias during testing.

Entries: Enter the number of entries with clear identity.

Design: Randomized Complete Block Design (RCBD) -- or any other preferred design.

Replications: At least three (3) replications. Indicate if more than 3 replicates are required.

3.2 Site identification

Sites shall be selected so as to represent growing zones for the crop.

The NPT field must be uniform in fertility and terrain. It should be free from shade, tree stumps, anthills and rocks. The history of the field to be used must be known to avoid variations in fertility. The slope of the field should be minimal.

For genetically modified crops requiring tests for special attributes, the site must enable testing of expression of the introduced trait or the benefits conferred by the trait.

For insect protection or disease resistance traits, the site may be controlled to introduce reasonable populations to enable comparisons unless there is established basis of naturally adequate load of the pest or disease.

For herbicide tolerance traits, the specific herbicide shall be sprayed to enable trait efficacy testing.

Other traits: The trial sites should enable determination of expression or benefit of the trait of interest. For example, where the trait is drought tolerance, the site should allow expression or should provide a rain free period where irrigation can be avoided.

3.3 Land preparation

The seedbed should be uniform, level and of desirable tilth. 20-40 % is the most ideal soil moisture for land preparation. A good seedbed gives a better crop stand.

3.4 Submission of seed

The applicant/breeder should submit enough quality seed for all the sites. Seeds should be submitted as per number needed and not weight since seed weight of different species varies. The number needed is determined by planting density, the number of sites, and the block sizes.

Note: Submission deadlines are 15th of February and 31st August of every year depending on the target season.

3.5 Packaging of seeds

Seeds should be packaged in suitable sealable packaging. Each sealable packaging should bear enough seeds for one plot and should bear the following information: Crop, kit, site, site number, plot number, entry number, and replication number. Genetically modified seed may be subject to specified regulations for labeling and packaging. Quantities of seeds to be submitted will be specified in crop specific protocols.

3.6 Field layout and marking of plots

This should be done in such a way that plots follow sequentially in a left to right orientation. Border rows must be regarded as part of the experiment and should be given the same treatment as the trial plots. The right plot size and shape should be kept. Plot shape should be preferably long and narrow (rectangular) rather than square, and all corners of the experimental field should be right angled. Plot layout style should be serpentine. For slopy landscapes, rows should run along the contours.

3.7 Labeling of plots

Labels bearing plot numbers are placed temporarily, and after completion of sowing, they can be inserted in their final places usually in front of the first row of each plot. The trial shall be clearly labeled as consisting of genetically modified materials.

3.8 Sowing

This is usually done by hand and extreme care must be taken as it greatly influences the accuracy of the trial. Correct planting depth should be observed and seed should be covered adequately. Dry planting is not recommended. Avoid seed-fertilizer contact. Planting more than one seed per hill and early thinning should be done to ensure maximum stand. Planting should be done at the onset of rains.

3.9 Fertilizer application

This should be done at a time when there is adequate moisture in the ground. Each individual plant should receive the same amount of fertilizer for experimental plots- border rows and guard rows. Application rates should be as recommended for each crop.

3.10 Thinning

This is done early to avoid competition and should be done when the soil is wet. In case of missing hills, thinning should be done by compensation, where two plants are left in the hill neighboring the missing hill. All the guard rows should be thinned.

3.11 Weed control

Usually done manually, but pre-emergence chemical weed control is recommended to reduce cost of management.

For genetically modified varieties conferring herbicide tolerance, the selection of herbicide will be influenced by the introduced trait. Uniformity in management should be observed e.g. weeding or spraying with herbicide on the whole trial on the same day or at least a replicate per day.

3.12 Harvesting

All plots should be harvested including the check varieties. The weight of the harvested material is taken at harvest. Avoid harvest on rainy days. Where special traits are being considered, the data for the attribute will be taken when appropriate alongside other parameters.

In case of conditional environmental release, which may limit consumption or cultivation, the harvested materials shall be milled and/or disposed as per procedure provided by NBA regulations.

4.0 Field Observations and Laboratory Tests

Although yield is the most important consideration, it is only one of the characteristics determining a variety's agronomic value. Other characteristics must also be assessed by field observations and laboratory analysis. Field observations are carried out by taking notes on various characteristics. For some varieties, special attributes such as insect protection, drought and herbicide tolerance will be the primary observations of interest.

Biochemical test data may supplement information generated in the site. Biochemical test data which include checking levels of specified molecules e.g. proteins, pro-vitamin or micronutrient shall be confirmed. Any other data required by the regulators will also be confirmed at this stage.

The applicant shall provide protocols or methods for detection of introduced events and data on expression of the trait. This data may be supplied as part of the descriptor as indicated in Annex 3.

Crop specific protocols may be developed from time to time as necessary while following the general guidelines provided in this manual.

Details of distance between conventional varieties and GM varieties as well as crop-specific isolation distances should be provided in crop-specific Standard Operating Procedures.

5.0 Sampling

Some characters require examination of individual plants and this may be time-consuming in view of the plant population. It is important for the operator to obtain a representative sample from which data is taken. The following principles must be observed during sampling:

- a) The sample must be chosen objectively and the sampler should not be biased.
- b) It must be representative such that the whole range of conditions is represented.

6.0 Data Recording

- a) A standard data sheet should be used and bear the following information:
 - Site number and name
 - Plot numbers
 - Entry code/numbers
 - Replicate numbers
- b) Data should be recorded uniformly and consistently.
- c) Accuracy should be emphasized at all times.
- d) Timeliness should be observed to ensure proper representation.
- e) Measurements and scoring scales must be indicated clearly.

6.1 General data to be recorded

1. Date of planting
2. Days to emergence (50% seedlings emerged)
3. Stand count at thinning
4. Days to flowering
5. Disease/Pest scores (Use appropriate scale for the disease/pests)
6. Herbicide tolerance scores (appropriate scale to be used)
7. Lodging scores
8. Plant height at final harvest
9. Maturity date
10. Stand count at harvest
11. Harvest data

A crop diary should be put at the back of the data sheet to accommodate additional information, which includes:

- Soil type
- Rainfall data
- Date of first rains after planting
- Irrigation schedule
- Temperature
- Soil moistures at planting
- Fertilizer rates
- Plot size – spacing, row length, number of rows.
- Name of check variety (The check variety will be one that enables comparisons of traits and is a commercial variety that is already registered).
- Dates of agronomic operations
- Any other activities and abnormalities

6.2 Data entry

This should be done immediately after recording in the field and errors checked when corrections are still possible. Standard datasheets should be used that facilitate easy data sorting and analysis.

7.0 Crop Specific Protocol (*Sample - Indicate Crop and event*)

7.1 Cultural Practices (include crop-specific details)

- a) Spacing
- b) No. of rows per plot, e.g., 4, data should be collected from middle rows.
- c) Length of row
- d) Space between adjacent replicates
- e) Planting depth e.g. 3 – 5 cm
- f) Sowing rate e.g. 3 and 6 seeds per hill
- g) Thinning required e.g. to 1 seedling per hill at 3 – 4 true leaf stages
- h) Guard row requirement, e.g. trial may be surrounded by at least 3 guard rows,
- i) Fertilizer rate: e.g., DAP at 150 kg/ha-1
- j) Weeding – manually done or apply pre-emergence herbicide. Exceptions should be made to accommodate efficacy testing of herbicide tolerance.
- k) Arthropod pest control measures, if relevant to the crop, should be noted. Exceptions made to accommodate efficacy testing of insect resistance traits should be noted.
- l) Disease control measures, if relevant to crop being tested, should be described.
- m) Harvesting.

7.2 Data Collection (*Data to be collected at 2 middle rows or as otherwise specified*)

1. Plot design must specify such a number of rows to allow collection of data on all plants or a representative number of plants.
2. Date of planting (PD)
3. Days to 50% emergence (DTE)
4. Stand count at thinning (SAT)
5. Days to (50%) flowering (DTF) – crop-specific attributes e.g. pollen shed/silking for maize
6. Plant height (PHT) (cm) –
7. Disease/Pest scores (specify) – Use general protocol for scoring severity of diseases and pests. E.g.
 1. = No damage
 2. = Slight damage
 3. = Moderate damage
 4. = Severe damage
 5. = Very severe damage

- Pest counts (use counts as appropriate)
- Other attributes (special attributes) e.g. herbicide tolerance, drought, nutritional traits etc. (Appropriate keys should be inserted)
- 9. Stand Count at Harvest (SAH)
- 10. Yield - per plot
- 11. Special attributes (insert scoring criteria on a crop by crop basis)

Section B – Distinctness, Uniformity and Stability (DUS) Tests

The DUS tests shall be conducted following procedures provided in the UPOV test guidelines DUS tests shall be conducted following procedures provided in the UPOV test guidelines (TG) for the specific crop. For crops where UPOV TGs do not exist, national TGs shall be used.

In case of hybrids, DUS shall be conducted for all the parental components and the resultant hybrid. In this case, the applicant shall provide descriptors and seed for all parents as well as the hybrid to allow simultaneous testing.

For EDVs that have undergone DUS, testing will only involve molecular characterization to establish distinctness due to the presence of the event unless there is evidence to show that genetic modification resulted in change in morphological characteristics of the variety. The applicant shall provide the method for detection of the event. In case of hybrids whose parent(s) have also undergone DUS testing the applicant shall provide the data and DUS test shall only be undertaken for the hybrid.

8.0 General Technical Operations

8.1 Trial design

The trial design shall be as provided in the specific Technical Guideline for the crop.

8.2 Site identification

Testing shall be conducted at a site suitable for the cultivation of the varieties. Measures shall be taken to ensure stress is reduced to a minimum. A site where irrigation facilities are available is recommended.

8.3 Packaging of seeds

Quantities of seeds to be submitted shall be as provided in the specific Technical Guidelines for the crop.

Other operations shall follow the same procedure as for conventional NPT of the same crop.

References

1. Seeds and Plant Varieties Act (Cap 326), 2012
2. Seeds and Plant Varieties (Seeds) Regulations, 2016.
3. Seeds and Plant Varieties (Variety Evaluation and Release) Regulations, 2016
4. Biosafety Act No 2. 2009
5. Biosafety (Environmental Release) Regulations, 2011
6. The International Union for the Protection of New Varieties of Plants (UPOV) Test guidelines for DUS test (http://www.upov.int/resource/en/dus_guidance.html)

ANNEX 1: SEED UNDER COMPULSORY CERTIFICATION

SECOND SCHEDULE (r. 6(2))

Cereals

Maize
Wheat
Barley
Sorghum
Millet
Rice
Oats
Triticale

Pulses

Bean (dry)
Bean (Green podded)
Pea
Green gram
Cow pea
Pigeon pea

Oil crops

Sunflower
Oil-seed rape
Linseed
Soyabean

Ground nut
Sesame

Grasses

Setaria
Rhodes grass
Sudan grass
Congo signal
Panicum spp.
Buffel grass
Columbus grass
Pasture legumes
Centro
Stylo
Desmodium
Clover
Lucerne
Siratro
Lupins

Root crops

Irish potato
Sweet potato
Cassava

Fibre crops

Cotton

ANNEX 2: DATA SHEETS AND ADDITIONAL INFORMATION

NATIONAL PERFORMANCE TRIAL

1. KEPHIS Regional Office:
2. Common name:
3. Scientific name:
4. Variety (i.e.name entry name and experimental name):
5. EDV parent:
6. Release status in East African/COMESA country (EDV and the parent):
7. Origin:
 - a) Country:
 - b) Institution:
8. Objectives:
 - a) Yield data:
 - b) Special attributes or traits (e.g. insect resistance):
 - c) Quality data:
9. Type of design:
10. Number of sites:
11. Number of replications per site:
12. Plot size:
13. Soil type:

DATA SHEETS

- ✓ Pest/Disease record
- ✓ Breeding/ agronomic e.g. germination rate, days to first flowering, days to maturity, yield and quality data sheets.
- ✓ Rainfall
- ✓ Soil analysis

Data analysis – use statistical analysis system or equivalent statistical package

ANNEX 3: APPLICATION FORM FOR NPTs

FORM NPT 1 (r. 8)

SEEDS AND PLANT VARIETIES ACT

To: The Managing Director
Kenya Plant Health Inspectorate Service
P.O. Box 49592-00100
NAIROBI, KENYA

APPLICATION FOR NATIONAL PERFORMANCE TRIALS

(Each entry will require a separate form)

1. Name and address of the applicant(s):

.....

2. Name and address of the agent (if any):

.....

3. Name and address of breeder or discoverer and developer:

.....

4. Species:.....

5. Name or other designation of the plant variety:

.....

6. Type of variety (e.g. Hybrid/OPV):

.....

7. Nature of genetic modification event and trait:

.....

8. Nature of Propagation (true seed, vegetative etc)

.....

9. Kit/agro-ecological /maturity group

.....

10. Special attributes to be tested (NOT yield)

.....

11. Other relevant information

.....

12. Are you the holder of rights for the plant variety? YES/NO.....

(i) If yes, attach certified copy of certificate of grant

(ii) If not, attach the owner's consent to make this application.

13. Name of the country in which the plant variety was bred or discovered and developed:

.....
.....
.....

14. Is the name of the plant variety included in the official variety list of any other country? YES/NO.....

(i) If yes,

(a) Name of the country:

(b) Title of the official variety list:

(c) Date of inclusion in the official variety list:

15. Document(s) in support of the application which should include:

(a) Trials data:

.....

(b) Variety description:

.....

16. Quantity of seed submitted

17. The technical report of DUS is attached (where applicable):

.....

Dated at Day of20

Signature of the applicant/agent (indicate as appropriate)

ANNEX 4: APPLICATION FORM FOR DUS

DUS APPLICATION FORM

1.	ENTRY / VARIETY NAME	
2.	INFORMATION ON THE BREEDING SCHEME AND PROPAGATION OF THE VARIETY	
	2.1 BREEDING SCHEME	
	VARIETY RESULTING FROM:	
	2.1.1 CROSSING	
	(A) CONTROLLED CROSS	[]
	(PLEASE STATE PARENT VARIETIES)	
	(B) PARTIALLY KNOWN CROSS	[]
	(PLEASE STATE KNOWN PARENT VARIETY(IES))	
	(C) UNKNOWN CROSS	[]
	2.1.2 MUTATION	[]
	(PLEASE STATE PARENT VARIETY)	
	2.1.3 GENETIC MODIFICATION	[]
	(PLEASE PROVIDE DETAILS OF THE GENE INSERT AND METHOD FOR DETECTION)	
	2.1.4 DISCOVERY AND DEVELOPMENT	[]
	(PLEASE STATE WHERE AND WHEN DISCOVERED AND HOW DEVELOPED)	
	2.1.5 OTHER	[]
	(PLEASE PROVIDE DETAILS)	
	2.2 METHOD OF PROPAGATING THE VARIETY	
	2.2.1 SEED-PROPAGATED VARIETIES	
	(A) SELF-POLLINATION	[]
	(B) OTHER	[]
	(PLEASE PROVIDE DETAILS)	
3.	ONLY FOR THOSE ENTRIES THAT ARE UNDERGOING / UNDERWENT NPT	
	NAME USED IN TESTING	
	KIT / AGRO-ECOLOGY	
	SPECIFY YEARS UNDER NPT TEST	
	YEAR 1	
	YEAR 2	
	YEAR 3	
	YEAR RECOMMENDED FOR RELEASE BY NPTC	
4.	APPLICANT'S NAME AND ADDRESS	

5.

NAME AND ADDRESS OF ORGANIZATION / PERSON TO BE INVOICED	

6.

QUANTITY OF SEED SUBMITTED (ENOUGH FOR TWO SEASONS)	
---	--

7.

DATE OF SUBMISSION	
APPLICANT'S SIGNATURE	

9.

SIMILAR VARIETIES AND DIFFERENCES FROM THESE VARIETIES		
CHARACTERISTIC IN WHICH THE SIMILAR VARIETY IS DIFFERENT	STATE OF EXPRESSION OF	
	SIMILAR VARIETY	CANDIDATE VARIETY

10.

OTHER INFORMATION



FOR KEPHIS OFFICIAL USE ONLY

11.

REMARKS ON THE SUBMITTED ENTRY	
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12.

CROP CODE	
-----------	--

13.

NAME OF PVPO OFFICER RECEIVING SEED	SIGNATURE	
	DATE	

ANNEX 5: FIELD STANDARDS (Isolation distances)

Species	Isolation, metres (minimum)				
	BR	PB	B	C1	C2
<i>Cereals</i>					
*Maize	400	400	400	200	200
*Sorghum	400	400	400	200	200
Wheat	10	10	10	4	4
Barley	10	10	10	4	4
Triticale	50	50	50	20	20
Oats	10	10	10	4	4
Finger Millet	10	10	10	4	4
*Rice	10	10	10	4	4
†Hybrid rice	30	30	30	12	12
<i>Pulses</i>					
Bean	50	50	50	25	25
*Broad Bean	200	200	200	100	100
Soya Bean	10	10	10	4	4
Cowpea	50	50	50	25	25
Pea	50	50	50	25	25
Green gram	50	50	50	25	25
Chickpea	50	50	50	25	25
Pea	50	50	50	25	25
<i>Oil Crops</i>					
†Sunflower	4000	4000	4000	1000	1000
Safflower	400	400	400	200	200
Rape seed	400	400	400	200	200
Ground nut	3	3	3	3	3
<i>Herbage Grasses</i>					
*Rhodes grass	200	200	100	100	100
*Setaria grass	200	200	100	100	100
Buffel grass	50	50	25	25	25
Congo signal	50	50	25	25	25

Guinea grass	50	50	25	25	25
*Sudan grass	400	400	400	200	200
Columbus grass	400	400	400	200	200
<i>Pasture Legumes</i>					
Stylo	200	200	200	100	100
Desmodium	200	200	200	100	100
Siratiro	200	200	200	100	100
Clover	800	800	800	400	400
Lucerne	800	800	400	400	400
<i>Sugar Crops</i>					
Sugarcane	5	5	5	5	5
<i>Vegetables</i>					
Tomato	100	100	100	50	50
Lettuce	100	100	100	50	50
Egg plant	100	100	100	50	50
Amaranthus	400	400	400	200	200
Pepper	100	100	100	50	50
<i>Root and Tuber Crops</i>					
Irish potato (Isolation from ware crops)	100	100	100	50	50
Irish potato (Isolation from seed crops)	5	5	5	2	2
Cassava	10	10	10	10	10
Sweet potato	10	10	10	5	5
<i>Fiber Crops</i>					
Cotton- CMS hybrids	-	-	-	800	800
<i>Gossypiumbarbadense</i> - Non hybrid and non CMS hybrids	200	200	200	150	150
<i>Gossypiumhirsutum</i> - Non hybrid and non CMS hybrids	100	100	100	30	30
† <i>Gossypiumbarbadense</i> × <i>Gossypiumhirsutum</i>	200	200	200	150	150

Key: BR = Breeder's seed; PB = Pre-basic Seed; B = Basic seed; C₁ . C₂, = Certified generation 1,2



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