



SEED INSPECTION MANUAL

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PRE-AMBLE

Quality seed is defined as varietal pure with a high germination percentage, free from disease, disease causing organisms pests and with a proper moisture content and weight. Quality seed insures good germination, rapid emergence, and vigorous growth. These aspects translate to a good stand (whether greenhouse or field). Poor quality seed results in “skips,” excessive thinning, or yield reductions due to overcrowding, all of which diminish profitability. Vigor is often implied when discussing seed quality and most growers have come to use the terms quality and vigor interchangeably. Vigor is defined as those properties that determine the potential performance of seed during germination and establishment. Seed vigor is generally related to yield in vegetables. Therefore, high-vigor seed should be used in all instances to ensure good stand establishment under varying field conditions. Different seed lots sown in the same environment may act differently and seedbed factors (temperature, water content, etc.) strongly affect seed performance. Fluctuations (airspace, moisture, temperature, etc.) in the seedbed environment are the most important factors in determining final seedling emergence. Furthermore, large seeds of a particular species frequently produce more vigorous plants and uniform stands than small seeds. Most seeds are fairly hardy; however, seeds in the bean and pea family (snap, lima, southern pea, English pea, etc.) are fragile and should be handled with extreme care. Dropping these seeds from any height while loading or unloading or pouring into seed hoppers will crack their seed coats and decrease germination. National and international seed companies strive to provide high quality vegetable seed through various milling processes and stringent disease screening. These techniques reduce the total tonnage of raw seed but increase the overall quality. Minimum germination standards regulate the seed industry. However, most companies attempt to exceed these minimum standards.

KEPHIS ensures that only high quality seed of released varieties are available for use by the farmers. This is achieved through field inspection, seed processing, seed testing, post control plots and post certification survey.

Quality Assurance in KEPHIS is a department, which undertakes field inspections among other mandates for the certification of seed crops. In the department are Seed Inspectors who are the public relations group for the organisation due to their extensive contact with the seed companies. The Inspectors report to their respective Regional Managers or Co-ordinators for allocation of duties/zones of operation during the inspection season.

1.0 GENERAL REQUIREMENTS FOR INSPECTION

1.1 Inspection tools and documents required

The forms/tools that are used throughout the field inspections are as follows: -

- Crop registration form or SR5
- Variety Descriptors
- Field map and or contact of field guide
- Tape measure
- Seed Regulation Form6 (SR6) Booklet
- seed inspection manual
- Stationery.
- One meter rule
- Hand lens (X10 and X20)
- Tally counter
- Appropriate protective clothing
- Appropriate disinfectant (where applicable)
- Inspection kit (e.g Knife, gloves, blade, poly- bags)
- Relevant Disease compendium
- Sampling bags and cooler boxes where applicable
- Quick diagnostic test kits for pathogens

2.0 Variety Maintenance

1.2.1 Purpose of Variety Maintenance

The purpose of variety maintenance is to ensure varietal identity and purity is preserved during multiplication of breeders seed. This is to ensure that breeders seed conform to the variety descriptor and the variety is free of seed borne diseases. It is the responsibility of the breeder/variety maintainer to maintain the identity and purity of their varieties. Plant examiners and inspectors jointly with the breeder/maintainer observe varieties during check plot observation to ensure varietal purity and identity is maintained.

1.2.2 Eligibility

For schedule 2 crops only released varieties shall be eligible for check plot observation. For non-schedule 2 crops the variety should have a variety descriptor derived from a DUS report.

1.2.2 Procedure of check plot observation

The Breeder/ Seed merchant (Authorized Maintainer) creates a new application in the SC&PVP system at least 14 days prior to the check plot observation and specify the following;

- i. Seed company/Breeding institution
- ii. Name of Breeder (Variety developer)
- iii. Species
- iv. Variety
- v. Resultant hybrid (If parental line)
- vi. Evidence of Authorization to multiply breeders seed (for Authorized maintainers)
- vii. Stage of observation (1,2 or 3)
- viii. Proof of origin
- ix. Number of rows (Stage 1); number of plots (Stage 2); Size of field (Ha) (Stage 3),
- x. Site/Location(provide site coordinates or upload site map)
- xi. Date of planting
- xii. Proposed Date of Check plot observation
- xiii. Stage of growth (Flowering, Grain/cob)

1.2.3 Verification of Applications

The inspector shall verify all the application details and in particular;

- a) Confirm that the variety is officially released for 2nd Schedule crops and DUS report for non-schedule 2 crops.
- b) Evidence of Authorization for Authorized maintainers
- c) Proof origin for stage 2 and 3
- d) Availability of a variety descriptor

1.2.3 Procedure for Check plot observation

The check plot observation shall be carried out jointly by the plant examiner/seed inspector and breeder/variety maintainer

- a) Verify the stage of observation (Stage 1,2,3) and growth stage of the variety as per the application
- b) Establish that appropriate isolation distance/time is provided
- c) Establish varietal identity (trueness to type) based on the descriptor
- d) Establish varietal purity of the rows, plots and/or bulk plot
- e) Establish that the variety is free from seed borne diseases as specified in the seed regulations
- f) Give a verdict on the rows, plots and /or bulk plots based on appropriate tolerances
- g) The check plot observation team shall make a report in the provided format.

3.0 SEED INSPECTION

2.1 Purpose of seed inspections

The purpose of crop inspection is to provide a third party unbiased inspection and completion of a report on the isolation, condition, and purity of the crop. It is the inspector's responsibility to describe the crop as observed at the time of inspection.

Specifically field inspections are completed through checking the following;

- The previous cropping history of the field should be such that the risk of undesirable volunteer plants of the same or related species contaminating the seed crop is reduced to minimum
- The isolation from other crops of the same species to reduce the risk of contamination with undesirable pollen
- The physical isolation to prevent mechanical admixtures at harvest
- The isolation from source of seed-borne diseases and pests
- Freedom from weeds and other crop species especially those whose seeds may be difficult to separate from the seed crop during seed processing
- Freedom from seed-borne diseases
- Trueness to type. There should not be more off-type plants present than the varietal purity standards allow
- The seed inspector may reject a crop should it be excessively weedy or severely lodged.

- During random counts an inspector should not spot an off-type/disease plant outside his counting matrix and try to include it in his count.
- However in all cases any factor with nil tolerance is taken into account at any time it is spotted.

2.2 Registration of seed crops

The application forms (SR5) for field registration should be submitted to KEPHIS office, not later than four one month after planting , duly filled and accompanied by:-

- e) Proof of origin of the seed sown e.g. labels,
- f) Registration and Inspection fees.

2.3 Cropping History

The previous cropping history of the field should be such that the risk of undesirable volunteer plants of the same or related species contaminating the seed crop is reduced to minimum.

2.4 Seed classes

The following categories (generation systems) of seed shall be recognised:-

- i) Breeder's seed – originating from the breeder/check plots
- ii) Pre-basic – progeny of breeder's seed
- iii) Basic seed – progeny of pre-basic or breeder's seed
- iv) Certified seed (C1- C2) – progeny of basic seed.
- v) Standard seed (as per seed regulations)

2.5 Sampling procedure for field inspection

Seed field shall be entirely uniform. If a field is not uniform in growth or has not matured evenly due to environmental factors, it shall be separated so that fields of even maturity are registered as a crop and be kept apart from the other crops by a clear path which is 2 meters wide

2.6 Reporting

After inspection information is recorded into field inspection result booklet (SR 6 form). A report for the seed crop is given based on the observations made. The original copy of inspection result in form SR 6 is given to the grower or their representative within 24 hours and a copy sent to the seed company within seven (7) days.

2.7 Seed transportation/storage

Raw seed shall be transported to the premises of a seed merchant. Before transportation, all containers shall be clearly and permanently marked with distinguishing marks.

2.8 Best Practices

- a) Avoid notifying the growers on when the seed crop is to be inspected.
- b) As much as possible, avoid using merchant(s)/grower(s) means of transport.
- c) Observe ethical practices at all times.
- d) Submit inspection report (SR6) promptly.
- e) Make field inspection decisions based on laid down standards and regulations.
- f) Avoid gifts from clients.
- g) Record all decisions and observations including photographs.
- h) Plan to inspect the crop at the right stage.

3.0 MAIZE (*Zea mays*)

3.1 Hybrids are produced by the combination of:-

- i) Single crosses - produced by crossing two in-bred lines
- ii) Double crosses – produced by crossing two single crosses
- iii) Three way crosses – produced by crossing a single cross and an in-bred line
- iv) Top cross - produced by crossing either an in-bred or a Single cross with an improved population / variety
- v) Varietal cross– produced by either crossing two improved Populations or two broad based varieties
- vi) GMO maize varieties – conventional varieties with genetic traits modification

3.2 Parental Material

- i) In-bred line
- ii) Composites/synthetics
- iii) Crosses

3.3 Isolation

For Breeder, Pre-basic and basic seed, the distance to other maize crops shall be at least four hundred (400) metres.

For certified seed, the isolation distance shall be two hundred (200) metres.

Eight (8) guard rows (males) shall be planted surrounding the entire seed maize field.

3.3.1 Corrections of inadequate isolation

Corrections of inadequate isolation shall be made as follows:-

- a) By completely destroying (not by de-tasseling) the contaminating maize before pollen is shed. OR
- b) By completely destroying, within a time limit specified by KEPHIS, portions of the seed crops which are inadequately isolated from the contaminating maize.

Note

Portions of broken tassels shall be deemed to be shedding pollen, if five (5) centimetres or more of either central stem, the side branches or a combination of the two shall have anthers extended from the glumes. Freshly plucked tassels shedding pollen found on the ground at the time of inspection shall be considered as contamination source.

Field inspection

At least three (3) inspections should be carried out for hybrid seed maize and two (2) for open pollinated maize.

First inspection shall be done at 1% silking stage, second inspection shall be done at most after seven (7) days. Third inspection when silks are no longer receptive.

Preliminary and pre-harvest inspections shall be done.

For OPV, first inspection at 50% flowering and second inspection within 14 days.

3.3.2 Assessment of trueness to Type

The registered crop shall conform to the official description. If it does not conform it shall be rejected.

3.3.3 Varietal Purity

All off-types and doubtful plants shall be removed before tasselling.

If more than either 0.1% off-types or 2% doubtful plants in the male rows shall have shed pollen, the crop shall be rejected. If at the time of final inspection, the female rows shall consist of more than either 1% off-types or 2% of doubtful plants then the crop shall be rejected.

3.3.4 Assessment of Seed Borne Diseases

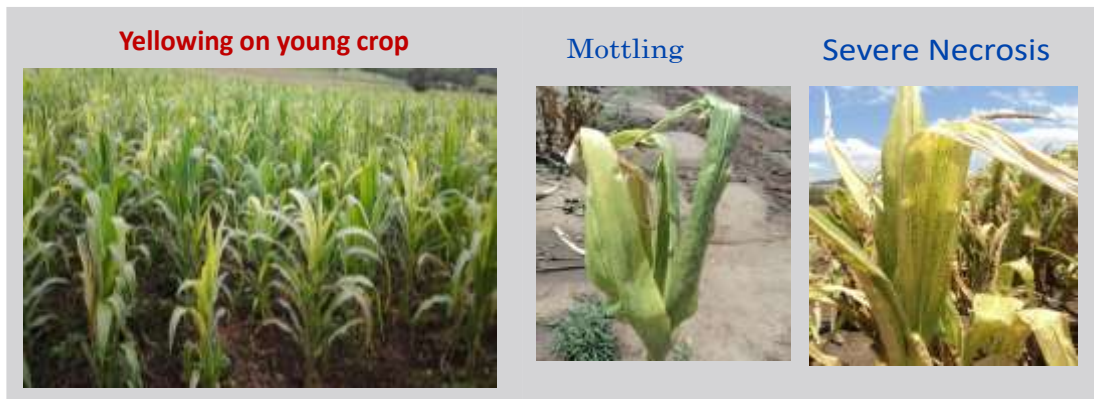
Inspection shall cover these diseases:-

- i) Head smut (*Sphacelotheca reiliana* (Kuhn) Clint).
- ii) Common smut (*Ustilago maydis* (D.C.) Corda).
- iii) Maize lethal necrosis disease (MLND) (Sugarcane mosaic virus and Maize chlorotic mottle virus.)

Any field having more than two (2) plants per hectare of head smut or common smut shall be rejected at the final inspection.

Inspection and sampling procedures for assessing MLND incidence in the field shall be the same as the procedures for assessing off types/diseases in maize seed crops. Any crop having incidence of MLND (or MLND causing viruses) at first and subsequent inspections shall be rejected.

Symptoms of MLND



- Cob husks **appear mature** (brown color) while the grains inside are still milky and the rest of plant is green

Assessment of effective detasseling

You start at a random position in the field in the row next to the male parents and count 20 plants. After that omit one row and proceed to count 20 plants in the third row and again in the fifth row. Cross male parents and proceed to the next block of females.

If a field attain percentage of tassels shedding between 0.8 and 1.3% you make a recount. The average of both counts is the percentage for the field. If the average is more than 1% or a cumulative of 2% in three (3) inspections (3 inspection visits) then the seed shall be rejected. If a crop has more than 2% selfing plants, adjacent seed maize crops shall be rejected (Less than 200m for CIG and 400m for Basic & same variety) (Table 2).

3.3.5 Assessment of weeds and pests

Weed control (also harmful pests should be controlled) shall be carried out adequately so as to enable easy access for the inspector. If the field, on account of weeds is not accessible, the crop shall be rejected.

3.3.6 Assessing Off-types/Doubtful Types in Male Rows

The inspection should start at the side/end of a field in the guard rows. Count 20 plants in one line and omit the next lines repeatedly until the total count is achieved. The suggested travel pattern for taking the random counts are as shown in figures 1-3.

Rejection figures are more than 0.1% for off-types and more than 2% doubtful plants. If the count falls between 0.08% and 0.13% offtypes and 1.8% and 2.3% doubtful plants, a recount should be taken. The average of the two counts is the percentage off-type/doubtful plants.

3.3.7 Assessing Off-types/Doubtful Types in Female Rows

You start at a random position in the field in the row next to the male parents and count 20 plants. After that omit one row and proceed to count 20 plants in the

third row and again in the fifth row. Cross male parents and proceed to the next block of females.

If more than 1% of off types are in the female rows at final inspection the crop shall be rejected.

If 1% or more of the female plants possess

receptive silks and more than 1% of them are shedding pollen at any one inspection visits or more than 2% cumulatively during three days of inspection (3 inspection visits) the crop shall be rejected. The seed crop shall also be rejected if it is inaccessible.

Note

- a) The neighbouring seed crop adjacent to a rejected seed crop on account of conditions stipulated above shall also be rejected if:-
 - i) The female parent plants shedding pollen in the rejected field exceeds either 2% on any one inspection or 4% on a combination of three (3) visits.
 - ii) The failed crop shall have more than either 0.2% off-type plants or 2% doubtful plants in its pollen parent.
 - iii) The rejected neighbouring crop has more than four (4) smutted plants per hectare.
 - iv) The neighbouring seed crop adjacent to the rejected seed crop shall not be rejected if isolation is in accordance with the regulations.
(Table 2)

3.3.8 Assessing Off-types in Open Pollinated Maize Crop

Count 20 plants starting from a random position. Omit 5 rows and continue the count on the 6th row, 12th etc until the full count is achieved. The counts are similar to those of assessing off-type/doubtful plants in hybrids and are as shown in table 1.

First inspection shall be done at 50% anthesis, final inspection shall be done within 14 days after first inspection.

For parental lines at least 3 inspections with first inspection at 25% silking.

For basic seed there shall be no off types allowed, for C1 the crop shall be rejected if it has more than 1% offtypes, for C2 the crop shall be rejected if it has more than 2% off types at any inspection.

Table 1: Minimum number of counts

Area		Minimum Counts	Number of plants	Number of plants
Acres	Hectares		Female rows	Male rows
≤15	≤6	100	2000	1000
16 – 40	7 – 16	200	4000	2000
41 – 80	17 – 32	300	6000	3000
81 – 100	33 – 40	400	8000	4000
Over 100	Over 40	500	10000	5000

Note: for Breeder, Pre basic and basic seed, the number of counts should be doubled

Table 2: Field inspection standards for maize

MINIMUM ISOLATION DISTANCE (METRES)					OFFTYPES OR OTHER CULTIVARS
BREEDER'S	PRE-BASIC	BASIC	C1 – C2		MINIMUM PER 100 PLANTS
400	400	400	200		BR PB B C1 C2 0 0 0 1 2

3.4 Pre-harvest inspection

No crop shall be harvested before physiological maturity is attained. Before seed is harvested, all male rows shall be completely separated from the seed by stooking the male rows leaving a distinct and clear path.

3.5 Machine harvesting

In case of harvesting by means of machine, the seed merchant/grower concerned shall notify KEPHIS for machine harvesting inspection at least 5 days before the date and after pre – harvest inspection. Upon inspection,

use of machine shall only be approved if the following field standards have been met:

- i) Less than 0.1% off type ears or 2% doubtful ears.
- ii) Less than 1.5% ears have insect damaged/sprouted kernel
- iii) Less than 2% ears must have less than 0.5% discolored kernels in white.
- iv) Less than 5% pathogen infested ears
- v) Satisfactory male separation.
- vi) Moisture content should not exceed 22%.

3.6 Harvesting of rejected seed crops

Any rejected seed crop shall be harvested after a post-harvest inspection and disposed off by the merchant under supervision by KEPHIS.

Seed merchants will appropriately dispose of seed lots that test positive for MLND causing viruses under KEPHIS supervision

3.7 Cob inspection and sampling

Cobs will be inspected for conformity with the descriptor at the farm and processing plant.

The harvests from the approved fields shall be transported to the factory upon notification by the merchant. A representative cob sample per crop shall be taken by the inspector for purposes of planting post control plots.

A representative sample shall be taken for MLND testing during lot inspection of the cleaned seed before dressing. In production areas where seed is threshed on site before delivery to the processing factories, sampling shall be done after threshing. Sampling shall be done in accordance with ISTA protocol for sampling. Lots/consignments from which samples are taken shall be marked, delivered and processed without mixing with other lots.

Seed samples delivered in the laboratory shall be germinated and seedling used to extract the RNA for MCMV and SCMV testing using qPCR or any other appropriate method.

Note: Approval for processing will be done only after negative MLN lab results are obtained.

3.8 GENETICALLY MODIFIED SEED MAIZE INSPECTION GUIDELINES

It was agreed that the general procedures for field inspection of maize will be used in the inspection of GMO seed maize alongside the following guidelines which are specific for GMO seed maize

3.8.1 Eligibility

Any person/institution who would wish to deal with GM seed maize in Kenya must first get formal consent from National Biosafety Authority for release of the trait into the environment.

The variety must have been officially released and listed in the National Variety List.

3.8.2 Isolation

The field isolation standards for GMO maize seed shall be same as those of conventional seed.

3.8.3 Labelling

- Only seed lots that pass laboratory test shall be labelled and sealed.
- All Genetically Modified seed maize shall have a GM label on the seed container.

NB:

1. All GM seed lots shall be handled in seclusion from conventional maize seeds.
2. All other inspection parameters shall apply as for conventional maize seed crops.
3. In addition to the standard laboratory tests, GM seed lots shall be tested for presence of genetic transformation event.
4. Rejected seed crops/seed lots shall be disposed off under KEPHIS supervision.

4.0 SORGHUM (*Sorghum bicolor*)

4.1 Isolation

For Breeder, Pre-basic and basic seed, the distance to other sorghum species shall be at least four hundred (400) metres.

For certified seed, the isolation distance shall be two hundred (200) metres.

4.2 Field inspection

At least three inspections should be carried out for hybrid seed sorghum, first inspection at 1 – 5% flowering, second inspection at grain formation stage and third inspection at physiological maturity.

Two (2) inspections should be carried out for open pollinated varieties, first at 50% anthesis, 2nd inspection at grain turning stage.

4.3 Assessment of trueness to Type

The registered crop shall conform to the official description. If it does not conform it shall be rejected (Table 2).

4.4 Varietal Purity

Count 20 plants (heads) starting from a random position. Omit 5 rows and continue the count on the 6th row, 12th etc. until the full count is achieved.

For basic seed no off types allowed, for C1 the tolerance is 1%, for C2 the tolerance is 2%.

4.5 Assessment of Seed Borne Diseases

Inspection shall cover these diseases:-

Covered smut - *nil at final inspection*

Mildew (*Peronosclerospora sorghi*) 1 plant per 1000 plants (0.1%)

Ergot (*Claviceps sorghi*) 1 plant per 1000 plants (0.1%)

Table 1: Minimum number of counts

Area		Minimum Counts	Number of plants(heads)
Acres	Hectares		
≤15	≤6	100	2000
16 – 40	7 – 16	200	4000
41 – 80	17 – 32	300	6000
81 – 100	33 – 40	400	8000

Over 100	Over 40	500	10000
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Note: for Breeder, Pre basic and basic seed, the number of counts should be doubled

Table 2: Field inspection standards for sorghum

ISOLATION DISTANCE					OFFTYPES OR OTHER CULTIVARS
BREEDER'S	PRE-BASIC	BASIC	CIG	2 ND	MINIMUM PER 100 PLANTS (heads)
400	400	400	200	200	BR PB B C1 C2 0 0 0 1 2

5.0 PULSES (Beans, Green grams, Peas, Cowpeas, Soya Beans, Chick pea, and *Dolichos lablab*)

Pulse seed crop shall be inspected at least twice during the growing cycle for basic and certified seed. First inspection at flowering and the second at podding stage. Standard seed shall be inspected at least once at flowering/podding stage.

5.1 Field inspection

- Determine the pattern of travel within the seed crop field for sampling. The pattern should be such that it allows greatest degree of coverage, increases accuracy and conserves time and at the same time ensures that many rows are crossed. **To be taken to general requirements**
- Along the predetermined travel path, observe 100 plants (100 plants is the sampling unit which form one count) in a row (approx. 20m). The number of counts to make will depend on the hectareage and the class (breeder, pre-basic, basic, certified or standard) of the seed crop (Table 1 below).
- Each 100 plants observation should be selected at random and each individual plant inspected for varietal identity and purity. Record the off-type, crops of other species, diseased plants and disease name, weeds and any other observation made in the field. Make a decision to approve or reject the crop based on the field standards (tables 2,3 and 4)

Table 1: Random counts

Hectares	Random Counts	No of plants
<= 6	20	2000
6.1 – 8	24	2400
8.1 – 10	28	2800
10.1 – 12	32	3200
12.1 – 14	36	3600
14.1 – 16	40	4000
16.1 – 18	44	4400
18.1 – 20	48	4800

Note: For breeders, pre-basic and basic the number of counts should be *doubled*

Table 2 Field standards

ISOLATION DISTANCE (M)					
	Breeder's	Pre-Basic	Basic	CI – C2	Standard
Beans	50	50	50	25	15
Broad beans	200	200	200	100	50
Soya beans	10	10	10	4	2
Cow peas	50	50	50	25	15
Peas	50	50	50	25	15
Green grams	50	50	50	25	15
Dolichos lablab	50	50	50	25	15
Chick pea	50	50	50	25	15

Table 3: Disease tolerance

Species	Disease	Tolerance levels
Beans	Halo blight	None during final inspection for all classes
	Anthraxnose	None during final inspection for all classes
	Bean common mosaic	None during final inspection for all classes

	Angular leaf spot	final inspection Breeder/Pre-basic/Basic 0.2% C1 & C2 0.5% Standard – 1%
	Common blight	None during final inspection for all classes
	Bacteria canker	final inspection Breeder/Pre-basic/Basic 0.2% C1 & C2 0.5% Standard – 1%
Garden Peas	Leaf spot	None during final inspection
	Pod spots	None during final inspection
	Bacterial blight	None during final inspection
Cowpeas	Leaf spot	None during final inspection
	Pod spots	None during final inspection
	Bacterial blight	None during final inspection
Soya beans	Bacterial blight	None during final inspection
	Bacterial pustule	None during final inspection
	Soya bean mosaic virus	None during final inspection
Chick pea	Ascochyta blight	None during final inspection
	Fusarium wilt	None during final inspection
Dolichos lablab	Anthrachnose	None during final inspection
	Dolichos yellow mosaic virus	None during final inspection
	Bacterial blight	None during final inspection
	Ascochyta blight	None during final inspection
Green gram	Halo blight	None during final inspection
	Anthrachnose	None during final inspection
	Common blight	None during final inspection

Table 4: Off-types of other cultivars

Species	Max. number per 100 plants			
	BR – B	CI	C2	Standard
Beans	0	1	2	4
Broad beans	0	1	2	4
Peas	0	1	2	4

Soya beans	0	1	2	4
Cow peas	0	1	2	4
Green grams	0	1	2	4
Dolichos lablab	0	1	2	4

6.0 **PIGEON PEA (*Cajanus cajan* (L.) Millsp.)**

Pigeon pea seed crop shall be inspected at least twice during the growing cycle for basic and certified seed. First inspection at flowering and the second at podding stage. Standard seed shall be inspected at least once at flowering/podding stage.

6.1 **Field inspection**

- Along the predetermined travel path, observe 50 plants (50 plants is the sampling unit which form one count) in a row. The number of counts to make will depend on the hectareage and the class (breeder, pre-basic, basic, certified) of the seed crop (Table below)
- Each 50 plants observation should be selected at random and each individual plant inspected for varietal identity and purity. Record the off-type, crops of other species, diseased plants and disease name, weeds and any other observation made in the field.

6.2 **Field Standards**

a. **Isolation**

A seed crop shall be separated from neighbouring similar crops species by distances as shown in the table below.

A.	<i>Minimum distance (meters)</i>	
	<i>Basic</i>	<i>Certified</i>
Fields of other varieties	250	100

B. *Varietal purity*

Factor	<i>Maximum permitted (%)*</i>	
	<i>basic</i>	<i>Certified CI</i>
Off-types	0.10	0.20

b. The minimum number of counts shall depend on the hectarage as follows;-

Hectares	Random Counts
<= 6	10
6.1 – 8	12
8.1 – 10	14
10.1 – 12	16
12.1 – 14	18
14.1 – 16	20
16.1 – 18	22
18.1 – 20	24

For basic seed, pre-basic seed and breeder's seed, the number of counts shall be double the counts indicated

c. Diseases

Diseases	Tolerance
Fusarium wilt (<i>Fusarium udum</i>)	Nil at final inspection
<i>Anthracnose</i>	Nil at final inspection

7.0 SMALL CEREALS (Wheat, Barley, Rice, finger millet, Oats, Rye and Triticale)

The seed regulation require the inspection of all seed crops grown to produce breeders, pre-basic, basic and certified seed classes of wheat barley, Rice, Finger millet, oats, rye and self pollinating varieties of Triticale.

7.1 Inspections

At least 2 inspections shall be done. The first inspection at 50% anthesis and the final inspection at hard dough stage

7.2 Isolation/Separation

Seed crops of wheat, barley, Upland Rice, Finger millet, oats and Triticale shall be separated from other varieties by;

A.	<i>Minimum distance (meters)</i>	
	<i>Basic</i>	<i>Certified</i>
Fields of other varieties Wheat, Barley, Upland Rice, Finger millet, Oats	10	4

Triticale	50	20
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7.3 Trueness to type

The crop as registered shall be required to conform to the description of the variety concerned.

7.4 Varietal purity

Plants, which do not conform to the descriptor, shall be considered as off-types. Pre-basic and basic seed shall be rejected if an average of more than one (1) off type plant per count (100m²) shall be found.

Certified seed first generation shall be rejected if an average of more than five (5) off types per count shall be found. Certified seed first and second generations shall be rejected if an average of more than six (6) plants per count shall be found.

7.5 Seed-borne diseases

Inspections shall be done for

- (a) Bunt (*Tilletia foetida*) in wheat and barley
- (b) Loose smut (*Ustilago spp*) in wheat, barley and oats
- (c) Covered smut (*ustilago hordei*) in barley
- (d) Crops that shall contain an average of more than one head infected with either bunt or smut per count shall be rejected.
- (e) Blast for finger millet

In the event of loose smut or bunt appearing in a neighbouring crop, the crop under inspection shall be rejected if the smutted crop shall be within 100 metres and shall contain an average of more than two smutted heads per count.

7.6 Weeds and other admixtures

(a) If any plant of wild oats (*Avena fatua*, *Avena ludoviciana* and *Avena sterilis*) or thorn apple (*Datura stramonium*) or double thorn (*Oxygonum sinuatum*), wild radish shall be found during the final field inspection, the seed crop shall be rejected.

(b) Admixtures

A seed crop shall be rejected if an average of more than 2 plants per count of other closely related species, which may cause difficulties during processing e.g. barley or oats in wheat or vice versa shall be found.

7.7 Crop stand

The cultural condition of the field shall be such as to permit proper field inspections to be carried out. Crops that shall be found to be so stunted, excessively weedy or diseased, extensively lodged (over 40%) such that assessment of the crop is impossible shall be rejected.

7.8 Field inspection

Starting from a random position assess areas each of 100 metres square (100m²). For practical purposes stretch out your arm and walk 100 paces at right angles to the direction of the drilling assessing the area marked by your stretched out arm and your straight line of movement. As you assess the 100 metre square, cast your eyes around for zero tolerance factors.

The minimum number of counts shall depend on the hectarage as follows;-

<u>Area (Ha)</u>		<u>No of 100 m² counts</u>
Upto 1	-	3
1.1 – 4	-	10
4.1 – 8	-	15
8.1 – 12	-	20
12.1 – 16	-	25
16.1 – 20	-	30
Over 20.1	-	35

NB. Seed fields above 40ha to be split

Note: For basic seed, pre-basic seed and breeder's seed, the number of counts shall be double the counts indicated

8.0 HYBRID SUNFLOWER (*Helianthus annuus*)

8.1 1. Types Recognized

A. Hybrids produced by the combination of:

- i) Single crosses, produced by crossing two inbred lines

- ii) Double crosses, produced by crossing two single crosses
- iii) Three - way crosses, produced by crossing a single cross with an inbred line.

B. Parental Material

- 1) Cytoplasmic male sterile lines "A" Lines
- 2) Restorer lines - lines or varieties of genotypes which are capable of restoring fertility to cytoplasmic male sterile lines when crossed with them i.e. the maintainer Lines ("B" Lines).

8.2 Isolation

The hybrid sunflower fields should be isolated by a distance of four thousand metres (4000) for high status material and one thousand metres (1000) for certified seed.

Note:

Different sunflower seed crops with the same pollinator can be grown with a separation of 2m from each other.

8.3 Field Inspection

At least three field inspections shall be carried out,

- i) At start of flowering
- ii) During flowering
- iii) During seed filling

8.3.1 Assessment of Off-types in female rows

Starting from a random position, count twenty (20) plants, assessing varietal purity therein. Omit one row and make a similar count and assessment of 20 plants. Repeat the procedure until the required number of plants is assessed.

8.3.2 Assessment of off-types in male rows

Count 20 plants along the male row starting from a random position. Omit the next male row and repeat the procedure until the required number is counted.

The number of plants counted will be half the number in females.

8.3.3 Assessing Off types in open pollinated varieties

- Count 20 plants starting from a random position omit 5 rows and continue the count on the 6th row, 12th until the full count is achieved. The counts are similar to those of assessing off-type/doubtful plants in hybrids.
- First inspection shall be done at 50% anthesis, final inspection shall be done when the crop is at physiological maturity
- For basic seed the crop shall be rejected if it has more than 0.2% off types, for C1 the crop shall be rejected if it has more than 0.5%. Number of counts is as below:

Table 1

Acres	Hectare	Minimum number of female plants	Minimum number of male plants
≤15	≤6	2,000	1000
16-40	7-16	4,000	2000
41-80	17-32	6,000	3000
81-100	33-40	8,000	4000
Over 100	Over 40	10,000	5000

8.4 Trueness to type

The lines must conform to the official description

8.5 Varietal Purity

The maximum allowances for off- type plants at the time when 2% or more of the female plants have pollen receptive flowers (Pre-basic and Basic generations) and when 5% or more of the female plants have pollen receptive flowers (certified seed) shall be as specified in the table 2 below:

Table 2

	Pre-basic and Basic	Certified
Off-type plants in the male rows	0.2%	0.5%
Off-type plants in the female rows	0.5%	1%

8.6 Seed-borne Diseases

The sunflower seed crop shall be rejected if at the time of inspection more than 0.5% of the plants (percentage of plants counted) are found with:

1. Sclerotinia wilt and Head rot (*Sclerotinia dahliae*)
2. Verticillium wilts (*Verticillium dahliae*)
3. Botrytis head rot or grey
4. Downy mildew (*Plasmopara halstedii*)
5. *Alternaria helianthi*

Note 1:

If any of the above diseases have been identified in a field, no sunflower seed shall be grown in that field for at least 5 years.

Note 2:

For effective pollination farmers are advised to have bee hives.

9.0 SESAME (*Sesamum indicum*)

The important functions are to check that the sesame seed crop shows the characteristics of the variety as per the variety descriptor. (Varietal identity) and to ensure freedom from other varieties (Variety purity)

Sesame seed crop shall be inspected during the growing season for at least two inspections for basic and certified seed, one at flowering and the second at podding.

9.1 Field inspection

Along the predetermined travel path, observe 100 plants (100 plants is the sampling unit which form one count) in a row (approx. 20m). The number of counts to make will depend on the hectareage and the class (breeder, pre-basic, basic, certified or standard) of the seed crop (Table 3). each 100 plants observation should be selected at random and each individual plant inspected for varietal identity and purity. Record the off-type, crops of other species, diseased plants and disease name, weeds and any other observation made in the field. Make a decision to approve or reject the crop based on the field standards (tables 2,3 and 4)

Table 1: Random counts

Hectares	Random Counts
<= 6	20
6.1 – 8	24
8.1 – 10	28
10.1 – 12	32
12.1 – 14	36
14.1 – 16	40
16.1 – 18	44
18.1 – 20	48

Note: For breeders, pre-basic and basic the number of counts should be *doubled*

Table 2: Field standards

A. Isolation distance in metres	Minimum distance (meters)	
	Breeder -Basic	Certified
Fields of other varieties	50	25
B. Diseases	Tolerance level	
Stem rot (<i>Macrophomina phaseolina</i>)	Nil at final inspection	
Fusarium wilt (<i>Fusarium oxysporum</i>)	Nil at final inspection	
Leaf spot (<i>Alternaria</i> spp)	Nil at final inspection	

Note

Powdery mildew is an important disease for this crop and should be noted during field inspection.

Off-types of other cultivars

Table 3

Species	Max. number per 100 plants		
	BR – B	C1	C2 -
Sesame	0	1	2

10.0 PASTURE

10.1 Isolation

The seed crops of cross fertilizing or partly cross fertilizing species shall be isolated from any possible source of contaminating pollen. The isolation distance shall not be less than the following minimums.

Seed to produce	Isolation distance	Isolation distance
Basic	200	100
Certified	100	50

Further, it shall be necessary to consider plants growing in the surrounding fields or in the borders of the surrounding fields or in the borders of the field under inspection. Kephis may request the grower to mow such neighboring fields or the borders of the field under inspection, if in its opinion there shall be danger of contamination of the seed crop either from cross-fertilization or from mechanical admixtures during harvesting.

10.2 Separation

The seed crops of self-fertilizing species shall be isolated from each other from other crops by a definite barrier or a space of at least 4 metres to prevent admixtures during harvesting.

10.3 Trueness to Variety

The crop as registered shall be required to conform to the official description of the variety concerned.

10.4 Inspection

At least two field inspections shall be made, the first at flowering stage and the last one (stook inspection) just after harvesting but before threshing

10.5 Varietal purity

At the time of field inspection, crops which shall have more than four (4) off-type plants in one count (100m²) for basic seed, ten (10) for C1 and twelve (12) for C2-C4, shall be rejected.

The minimum number of counts shall depend on the hectarage as follows;-

<u>Area (Ha)</u>		<u>No of 100 m² counts</u>
Up to 1	-	3
1.1 – 4	-	10
4.1 – 8	-	15
8.1 – 12	-	20
12.1 – 16	-	25
16.1 – 20	-	30
Over 20.1	-	35

NB. Seed fields above 40ha to be split into field of up to a maximum of 40Ha

Note: For basic seed, pre-basic seed and breeder's seed, the number of counts shall be double the counts indicated

10.6 Ratoon crop

A maximum of five successive years after establishment of a field, the year of establishment exclusive, shall be permitted for acceptance of a crop for field inspection.

10.7 Weeds and other Admixtures

During field inspection, the inspector shall pay special attention to weeds. Crops shall be rejected if any of the weeds listed hereunder as being undesirable for the particular crop under inspection are found at final inspection

Inspected crop	Weeds
For all crops	Couch grass (Digitaria sp.) Scrobi (Paspalum scrobiculatus) Devils Horsewhip (Achyrathus aspera) Blackjack (Bidens sp.) Manyatta grass
Chloris gayana	Wire grass (Pennisetum schimperii) Love grass (Eragrotis sp.) Poverty grass or Rosy Top (Rhynchelytrum repens) Mexican marigold (Tagetes minuta)
Setaria sphacelata	Annual setaria (Pale setaria) Pallice-fusca (Setaria pallidifusca) Burr setaria (Setaria verticillata)

Panicum coloratum and maximum	Love grass(Eragrostis sp) Chinese lantern(Nicandra physalodes) Pig weed (Amarathus sp.) Mexican merigold
Brachiaria ruziziensis	Mexican marigold(Tagetes minuta)
Melinis minutiflora	Mexican marigold(Tagetes minuta)
Legumes	Pig weed

Ergot- infested crops of Panicum sp. shall be rejected.

In all the above cases, conditional approval shall imply that the crop is rejected until proved otherwise through further field inspections and/or scrutiny during processing of the harvested seed lots

10.8 Varietal purity, other crop seeds and Weed Seeds

Note: Although varietal purity shall normally be determined during field inspections, in special circumstances, additional laboratory/greenhouse techniques may be employed.

If any wild oats or Thorn apple seed shall be found, the lot shall be rejected.

11.0 POTATO (*Solanum tuberosum*)

10.1 SCOPE

The requirements are for all procedures involved from Tissue culture plantlets production, mother plant multiplication, production of rooted cuttings and minitubers in the screen house, to field certification of seed tubers.

10.2 Facility inspection and approval

10.2.1 Tissue culture lab

- a. Hygiene of the production facilities & systems.
- b. What quality control measures are in place
- c. The inspection shall be done as per the attached checklist. Annex 1
- d. System audit of quality control measures in place (Check relevant ISO 17025?)

10.2.2 Production facilities inspection

Production facilities (including greenhouse, glasshouse, and screen-house) shall be inspected as per the checklist attached. (Annex 2)

10.3 Inspection of plants in green houses (In-vitro sourced plants, mini tubers and apical cuttings)

Inspection shall be carried out in the presence of the greenhouse authorised personnel. The following aspects are observed during inspections:

- i. Verification of documents
 - a. Source of parent material (including receipt of sale, or letter from owner)
 - b. Health status (indexing report)
 - c. Facility approval report (annual for licensing purposes & reports of scheduled inspections)
- ii. Arrangement of plants within the greenhouse for easier operations like spraying
- iii. Tagging of plants e.g. varieties, planting dates etc.
- iv. All the plants are inspected and visually observed to be free from pests and diseases
- v. Scheduled inspection as per Annex 3

10.4 Inspection and sampling regime for production facilities during Phytosanitary inspections

Inspection and sampling in the production facility shall be done as per the guidelines below:

- An inspector will establish an inspection unit based on the batches (a batch in this case refers to those plants derived from a single in vitro plant).
- Each batch will be considered as a different inspection unit.
- The hyper geometric- based sampling table below shall be used to establish the sample size.
- All plants within an established inspection unit will be inspected.
- Samples from the inspection units will be picked for laboratory pathogen testing.

Inspection unit*	Minimum sample size
1-13	All
14-15	13
16-17	14
18-19	15
20-22	16
23-25	17
26-28	18
29-32	19
33-38	20
39-44	21
45-53	22
54-65	23
66-82	24
83-108	25
109-157	26
158-271	27
272-885	28
886-200,000	29

- Inspection unit is defined by the initial starter material before multiplication begins. If 20 tissue culture plants are the original source for onward multiplication, then 16 plants among the subsequent progeny will be inspected.
- Note that a sampling unit is number of plants originating from a single tissue culture plantlet

10.5 Seed classes

(a) Breeders Seed (stock seed) – the last stage of clonal selection produced in one of three ways:

- i. Mini tubers – tissue culture plantlets are raised to produce mini tubers and treated as clone A.
- ii. Apical cuttings – Apical cuttings obtained from tissue culture plantlets are grown in a greenhouse and multiplied in the field as clone A.
- iii. Clonal tubers 1 – Tubers raised from apical cuttings can be treated as clone A.
- iv. Clonal tubers - In clonal selection, single mother plants are selected from maintenance plots and planted as clone A in individual rows. Conforming clone A rows are planted in subsequent generation as clone B in plots. Conforming Clone B are then planted as clone C which is finally approved as breeder seed.

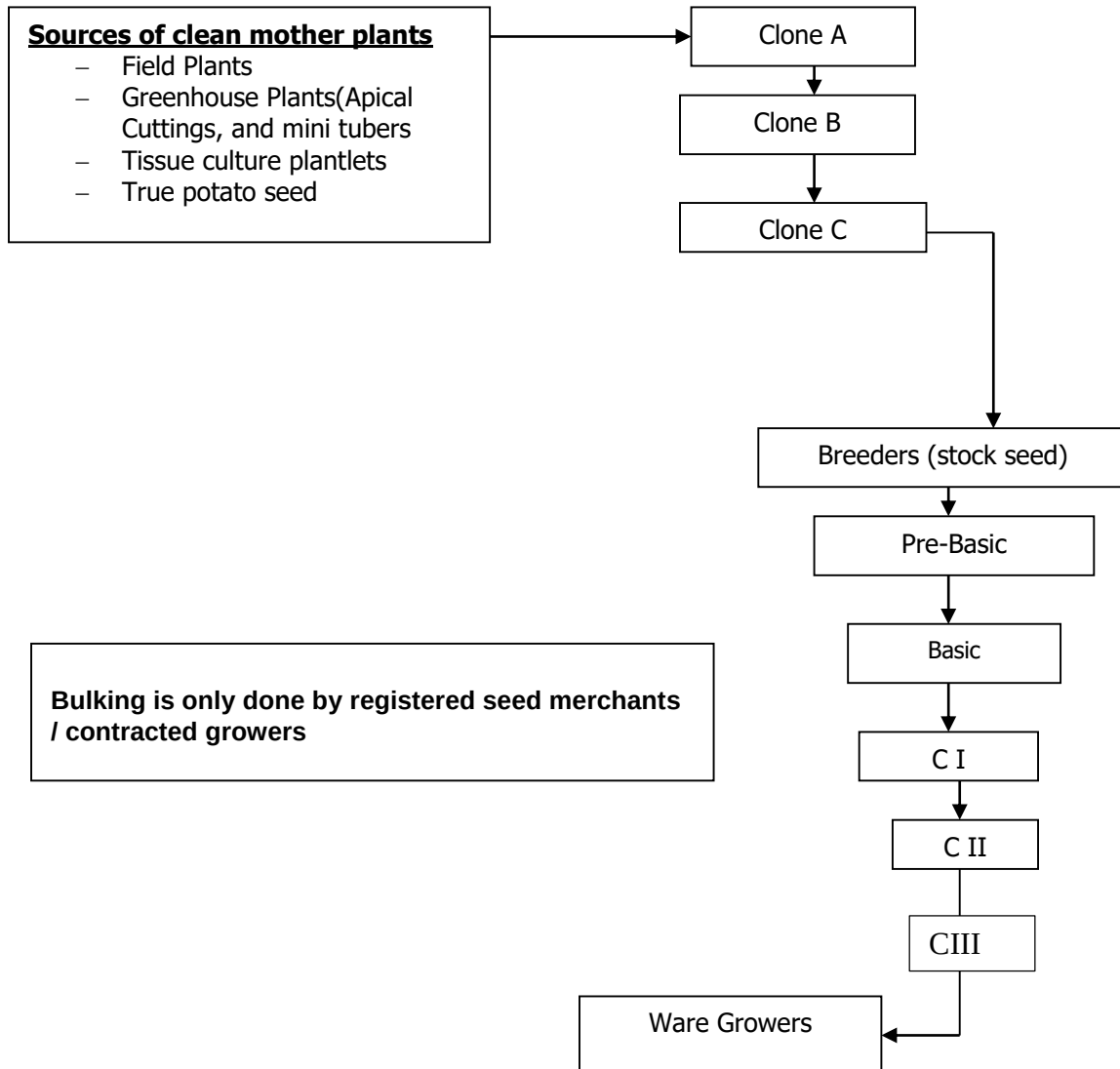
(b) Pre-Basic

(c) Basic seed

(d) Certified(C1-C3)

Note: Soils from fields intended for seed potato production shall have been tested and found free of Potato Cyst Nematode (PCN) and Bacterial wilt.

I. Apical cuttings – Apical cuttings obtained from tissue culture plantlets are grown in a greenhouse and multiplied in the field as clone A.



10.6 Field Inspection

The maximum size of a seed crop shall be 20Ha for ease of making inspection counts. A crop is a field planted within five days/physically separated from any other.

10.7 Facilities for sorting, grading and storage

Any person applying for registration as a Seed Potato grower/merchant shall be required to have access to suitable facilities for sorting, grading and storage of certified seed before approval of the application is granted.

10.8 Separation and Isolation

A seed crop shall be separated from neighbouring commercial potato crops by distances as shown in the table below.

Isolation distance in metres (minimum) from commercial crop

Breeders	Pre-basic	Basic	C1 - C3
100	100	100	50

Offtypes per 100 plants

Breeders	Pre-basic	Basic	C1 - C3
0	1	2	3

A seed crop shall be separated from neighbouring seed crops by a space of at least 5 metres for Basic seed and at least 2 metres for certified seed. In case of sloppy areas, appropriate measures should be put in place to avoid contamination.

10.9 Minimum Inspections

At least two field inspections shall be done during the growing cycle:

- a) First inspection at flowering/canopy cover for non-flowering varieties / tuber initiation stage
- b) The second inspection at full tuber development stage.

10.10 Inspection technique

Starting from a random position in the field count 100 plants (equivalent to 30 metres or paces) along a row omit three rows and continue the count on the 4th row etc..

Minimum number of counts

Area (ha)	No. of counts each of 30m	No. of plants
< 1	10	1000
1-6	20	2000
6.1-8	24	2400
8.1-10	28	2800
10.1-12	32	3200
12.1-14	36	3600
14.1-16	40	4000
16.1-18	44	4400
18.1-20	48	4800

Note: For basic seed double the number of plants counted

10.11 Additional field standards

Inspection shall be done for the following diseases

Disease/Pest	Breeder/ Minituber	PB	Basic seed	Certified seed 1	Certified seed 2	Certified seed 3
*Blackleg (<i>Pectobacterium</i> spp. and <i>Dickeya</i> spp.)	0	0	0	0	0	0
Severe virus disease e.g. leaf roll, Y group of viruses, severe mosaic	0	1	4	8	10	10
Mild mosaic visible in the field (e.g. pvx, pvs)	0	5	10	15	20	20
* <i>Fusarium</i> wilt	0	0	0	2	5	5
* <i>Verticillium</i> wilt	0	0	0	0.5	1	1
Bacterial wilt or Brown Rot (<i>Ralstonia</i> spp.)	0	0	0	0	0	0
Wart disease (<i>Synchytrium endobioticum</i>)	0	0	0	0	0	0

*Nematodes (<i>Meloidogyne</i> spp. <i>Ditylenchus</i> spp.)	0	0	2	3	4	4
***Potato Cyst nematode (<i>Globodera</i> spp.)	0	0	0	0	0	0
Ring rot (<i>Clavibacter michiganensis</i> sp <i>sepedonicum</i>)	0	0	0	0	0	0
Potato spindle tuber viroid	0	0	0	0	0	0
Phytoplasma diseases e.g. Potato stolbur and potato purple top	0	0	0	0	0	0

10.12 Destruction of Foliage

Dehauling date depends on seed size and aphid pressure. The inspector may advise the grower on the appropriate time to dehaulm after approval which should be within 14 days.

10.13 Sampling for *Ralstonia solanacearum* (Bacterial wilt) laboratory test

Before harvesting, a seed grower/merchant should request for sampling for bacterial wilt testing. Starting from a random position in the field count 100 plants (equivalent to 30 metres or paces) along a row; omit three rows and continue the count on the 4th row etc. Take sample(s) from every 30m. Composite the samples and submit at least 400 tubers to the laboratory.

Minimum number of samples

Area (ha)	No. of samples	Min No. of tubers per sample (To make at least 400)
< 1	10	40
1-6	20	20
6.1-8	24	17
8.1-10	28	15
10.1-12	32	13

12.1-14	36	12
14.1-16	40	10
16.1-18	44	10
18.1-20	48	9

10.14 Lot inspection

Lot inspection ensures that the following tolerances are met.

Abnormality	Tolerance (No. of tubers per 50kg bag)	
	Basic	Certified
Scab (<i>Streptomyces spp.</i> , <i>Spongospora subterranean</i>) no more than 50% tuber covered	25	50
Rhizoctonia (<i>Rhizoctonia solani</i>)	10	30
Pink rot (<i>Phytophthora erythroseptica</i>)	0	1
Soft rot (<i>Pectobacterium & Dickeya spp.</i>)	0	0
Tuber moth damage(count all affected tubers)	2	5
Mis-shapen and damaged tubers	0	5
Millipede damage	0	5
Late Blight (<i>Phytophthora infestans</i>)	0	0
Early Blight (<i>Alternaria solani</i>) and Dry rot (<i>Fusarium spp.</i> <i>Phoma spp.</i>)	6	6
Nematodes (<i>Meloidogyne spp.</i> and <i>Ditylenchus spp.</i>)	0	0
Presence of earth and extraneous matter by (% weight)	1	1
Shrivelled tubers which have become excessively dehydrated and wrinkled, % by weight.	1	2

10.15 Grading

Seed potatoes shall be graded into the following sizes:

Size 1: 28mm - 35mm

Size 2: 36mm - 45mm

Size 3: 46mm – 55mm

Size 4: 15mm – 27mm (Mini tubers only)

Tolerances for sizes 1-4 above will not be more than 5 tubers per 50kg.

10.16 Sampling for Post control

A sample of 120 tubers per seed lot shall be taken for post control purposes.

Maximum lot size shall be 40 tonnes

12.0 PADDY RICE

The following classes of seed rice shall be recognized: - Breeder's seed, Pre - basic, Basic and Certified.

12.1 Registration

Proof of origin

- ✓ Check plot observation reports (where applicable)
- ✓ Certification labels
- ✓ Forwarding letter by breeder/MoU (where applicable)

12.2 Registration of seed fields

Application for field inspection should be submitted to KEPHIS in form SR 5 within one month after transplanting by a registered seed merchant.

Only applications from registered seed merchant shall be considered

12.3 Previous Cropping

Fields for certification must not have been under rice production the previous two seasons.

12.4 Isolation distance

Fields for certification must be clearly separated from other fields of the same variety by 4 metres for certified generation and 10 metres for breeders, pre-basic and basic. For different variety should be at least 10m for self-pollinated varieties. For hybrid seed rice the isolation distance should be at least 30 metres.

12.5 Field inspection standards

12.5.1 Number of inspections

At least two field inspections shall be done for a rice seed crop. The 1st Inspection shall be done at 50% flowering stage and final inspection at physiological maturity. Inspection is critical at the following stages of development;

- Reproductive stage – at 50% flowering
- At physiological maturity

12.5.2 Counts

The minimum number of counts shall depend on the hectarage as follows:

Area (Ha)		No. of 100 m ² counts
Up to 1	-	3
1.1 - 4	-	10
4.1- 8	-	15
8.1- 12	-	20
12.1-16	-	25
16.1 – 20	-	30
Over 20.1	-	35

Note:

For basic seed, pre-basic seed and breeder's seed, the number of counts shall be double the counts indicated.

For paddy rice the hectarage for one field should not exceed 10 hectares

12.5.3 Trueness to type

The registered crop shall conform to official descriptors

12.5.4 Varietal purity

A seed crop shall be free from other varieties (**off types**), the maximum admixtures with other varieties permitted is as shown below.

Breeder's seed	1:100 m ²
Pre-basic/basic seed	1:100 m ²
Certified seed	5:100 m ²

12.5.5 Noxious weeds of concern

Seed rice fields should be free from weedy/red rice- the wild type of oryza spp.

12.5.6 Diseases of concern

Disease	Tolerance during Inspection
Rice blast (<i>Pyricularia oryzae</i> (<i>Magnaporthe grisea</i>))	0.1% basic and 0.5% for certified
Karnal burnt (<i>Tilletia indica</i>)	None during final inspection
Basal node rot (<i>Fusarium oxysporum</i>)	1 per 100 m ²

Bacterial leaf blight (<i>Xanthomonas oryzae</i> pv. <i>oryzae</i>)	None during final inspection
Brown spot (<i>Drechslera oryzae</i>)	1 per 100 m ²
Narrow brown leaf spot (<i>Cercospora oryzae</i>)	1 per 100 m ²
White tip nematode (<i>Aphelenchoides besseyi</i>)	None during final inspection

12.6 Laboratory Standards

As per the Seeds and plant varieties Act Cap 326 (Fourth schedule)

Purity	99%
Germination	70%
Moisture	11%
Other crop species	1%

12.7 Rice processing standards

CROP	Screens* (bottom sleeve) mm	Screenings	Grades
Rice	2.0	5	-

- (a) Maximum of 1 seed per litre will be allowed in basic seed lots and 2 seeds per litre for certified seed lots.
- (b) **Weed Seeds** – A maximum of 2 seeds per litre will be allowed in basic seed lots and 4 seeds per litre for certified lots. No seed of wild oats, thorn apple or other noxious weeds shall be allowed.
- (c) **Damaged Seeds** –
 - (i) In basic seed lots a maximum of 10% naked seeds and 10% of cracked seeds in barley and oats shall be allowed, while for certified seed the maximum will be 5%.
 - (ii) In basic seed lots a maximum of 10% of all discoloured seeds, e.g. blue pointed seeds (germ end) and 10% of insect damaged seeds allowed, while for certified seed the maximum will be 5%.
- (d) **Sprouted Seeds.** – In basic seed lots a maximum of 10% short sprouts and 5% long sprouts will be allowed while a maximum of 5% short sprouts and 2% long sprouts will be allowed in certified seed lots.
- (e) The combination of the factors mentioned in (c) and (d) above shall not exceed 10% for basic seed and 5% for certified seed.

13.0 SWEETPOTATO (*Ipomea batatas*)

13.1 Registration of vine growers/seed fields

All persons desiring to undertake multiplication/production of certified sweet potato seed shall make an application to KEPHIS for registration of the crop in Form **SR 5** not later than one month after crop establishment. The application for registration must clearly indicate the site location of the farm on which the crop is grown through a sketch map at the back of the application form.



In making the application the following shall apply;

- Only fields set from certified parental stock or from certified plants secured from certified plant producers or a recognized breeder will be eligible for certification.
- All multiplication sites shall be maintained free of important pests, diseases and off types.
- Fields to be eligible for certification must NOT have been under the production of sweet potato for the previous one and half year.
- Only applications from growers contracted by a registered seed merchant shall be processed. The grower/seed merchant shall meet the cost of certification. Registration as a seed merchant is achieved by meeting the requirements in **Form SR1**, while to become a seed grower you are required to meet the requirements in **Form SR 3**
- Plant materials of sweet potatoes offered for certification shall be maintained practically free of insect pests and diseases. Applicants for certification may be required to spray and/or dust planting material with an insecticide and/or fungicide.
- It shall be the responsibility of the grower to keep all records of activities on the field and furnish the information as and when required by KEPHIS.

- The breeder of any plant variety under certification shall provide the descriptor of the variety for reference by inspectors during inspection.

13.2 Inspection

- The sweet potato seed production fields shall be isolated from other sweet potato seed crops with a minimum distance of **5m** (Br, PB, & B) and 2m (Certified and Standard) to avoid mechanical admixture of other varieties/classes. Ideally a seed crop should be 100m away from commercial sweet potato crops. Sweet potato
- At least one seed handling/storage inspection will be undertaken. At least 2 field inspections for Certified and higher seed classes and one field inspection for Standard seed shall be carried out during the growing season of the crop under certification.
- Inspection shall be done to verify the following parameters:- varietal purity, off type and identity, designated diseases and pests and isolation distance.
- Each ratoon shall be handled as a new crop and thus require new application, the first ratoon shall retain the seed class of the mother crop. The second ratoon shall be downgraded to the next seed class.
- Inspection results shall be noted in Form **SR6** and the original copy served to the grower or his/her representative.
- The cuttings shall be from the tip of a mature vine and shall not be less than **30cm** and should bear at least with **3** nodes. It is advisable to select the cuttings from clean healthy vigorous 2-3 months old fields and the cuttings should be kept for a maximum of **7 days**.

13.3 Field assessment (counts)

Area (ha)	Number of Counts each of 30m ² = 100 plants per count
≤ 0.25	2
0.5	4
1	10
1.1 – 6	20

6.1 – 8	24
8.1 – 10	28
10.1 – 12	32
12.1 – 14	36
14.1 -16	40
16.1 18	44
18.1 – 20	48

FIELD STANDARDS FACTOR	BREEDER SEED	PRE- BASIC	BASIC	C1 – C2	STD
Off types	None	None	None	5 plant per count(100 plants)	5 plant per count(100 plants)
Sweet potato weevil	None	None	None	5 plant per count(100 plants)	5 plant per count(100 plants)
Stem Blight <i>Alternaria pathicola</i>	None	None	None	None	2 plants per count
Fusarium wilt	None	None	None	5 plant per count(100 plants)	5 plant per count(100 plants)
Sweet potato virus disease(sweet potato chlorotic stunt virus and Sweetpotato feathery mottle virus	None	None	None	None	2 plants per acre plant per count(100 plants
*Soil rot (<i>Actinomyces ipomoea</i>)	2 plants per count	2 plants per count	2 plants per count	5 plants per count	5 plants per count
*A vine crop may be rejected on the basis of serious field infestations by other pests such as nematodes and beetles.					

13.4 Labelling

All certified sweet potato plants, **vines**, slips, and cuttings shall be tied in bundles, packaged in appropriate containers with a certification label.

13.5 Seed classes

	Seed parents	Color of labels
Breeders (Br)	Progeny of parental stock	White

Prebasic (PB)	Progeny of parented stock or certified breeders seed	White
Basic (B)	Progeny of certified breeders or certified basic seed	White
Certified (C1)	Progeny of certified Pre-basic or certified basic seed	Blue
C2	Subsequent classes of certified basic seed	Pink
Standard	Progeny of certified generation	Grey

14.0 GROUNDNUT (*Arachis hypogea* L.)

The following classes of seed groundnut shall be recognized: - Breeder's seed, Pre - basic, Basic and Certified seed.

14.1 Previous Cropping

A seed crop of groundnut shall not be eligible for certification if planted on land in which the crops grown within the previous two seasons were of the same kind unless the crops grown within the previous two seasons were of the same variety and of an equivalent or higher class of certified seed and were certified.

14.2 Field Inspection

A minimum of two inspections shall be made at flowering and at physiological maturity.

14.3 Field Standards

Groundnut seed fields shall be inspected as per the standards given in the table below:

Contaminants	Tolerances as per class of seed	
	Breeders/Prebasic & Basic	Certified
Isolation (Minimum distance in meters)		
Fields of other varieties	2	3
Fields of the same variety not conforming to the varietal purity requirements for certification	3	3
Offtypes (maximum permitted %)	0.1%	0.2%
Diseases(Maximum permitted at final inspection)	Breeders/Prebasic & Basic	Certified
Alternaria leaf spot	0.5%	1%

Groundnut rosette virus	0%	1%
Bruchid damaged seed	2%	2%

14.4 Counts

Starting from a random position, count 100 plants along a row (equivalent to 15 m or 15 paces); assess the 100 plants looking around for the factors being inspected against

Area (Hectare)	Number of count each of 15m	Number of plants
< 1 ha	10	1000
1-6 ha	20	2000
6.1 – 8 ha	24	2400
8.1 – 10 ha	28	2800
10.1 – 12 ha	32	3200
12.1 – 14ha	36	3600
14.1 – 16 ha	40	4000
16.1 – 18	44	4400
18.1 – 20	48	4800

14.5 Processing standards

	Br, Pb, B	Certified
Mixed with other crop seed	None	1 per 1000 seed of groundnut seed Zero for other seed species
Weed seed	Zero	zero
Sprouted and heat damaged,	0.5%	0.5%

Insect damaged, discoloured seed, off-colour, cracked seed, broken seed	3	3 per litre
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14.6 Laboratory standard (shell or pods)

As per The Seeds and Plant Varieties Act CAP 326 (Fourth Schedule)

15.0 SUGARCANE (*Saccharum spp. Hybrid*)

Age of the seed cane crop at harvest for seed purpose shall be 6 to 8 months and 8 to 10 months for the sowing in tropics and respectively, seed cane material undamaged and reasonably clean.

Age of seed cane shall be 10-14 months at higher altitude and 6-9 months at coastal regional

Each node of seed cane shall bear on one sound bud. The number of nodes without sound bud shall not exceed 5 % (by number) of the total number of buds per seed cane.

The number of buds, which have swollen up or have projected beyond one centimeter from the rind surface, shall not exceed 5% (by number) of the total number of buds.

Heat Treatment (As prescribed), Foundation Stage (I) shall be raised from heat-treated seed cane.

15.1 Cropping history

(i) A Seed crop of sugarcane shall not be eligible for certification if planted on land on which sugarcane was grown in the previous season.

(ii) Land/seed crop shall be kept free from sugarcane residues and drainage from other sugarcane fields.

15.2 Field Inspection:

A minimum of three inspections shall be made as below:

Stage-I The first inspection shall be made at 45-60 days after planting in order to verify isolation and detect volunteer plants, designated diseases and pests and other relevant factors.

Stage-II The second inspection shall be made at 120-130 days after planting to verify off-type, designated diseases and pests and other relevant factors.

Stage-III The third inspection shall be made 15 days prior to the harvesting of seed canes to verify the age of cane, off-types, designated diseases and pests and other relevant factors.

15.3 Field Standards:

15.3.1 Isolation:

The sugarcane seed production fields shall be isolated from other fields with a minimum distance of 5 m to avoid mechanical mixture of other varieties.

15.3.2 Offtypes, pests and diseases

	Factors	Stage of field inspection	Maximum permissible limits (%)	
			Foundation	Certified
	Off-types	I, II, III	None	None
	Plants affected with designated diseases			
	- Red rot	I, II, III	None	None
	- Smut	I	0.02*	0.10*

		II	0.01*	0.10*
		III	None	None
	- Grassy shoot	II	0.05*	0.50*
		III	None	None
	- Wilt	III	0.01*	0.01*
	- Leaf scald	II	0.01*	0.05*
		III	None	None
Plants affected by designated insect-pests				
	- Top borer	II& III	5.0	5.0
	- Internode bores	III	10.0 [#]	10.0
			None**	None**
	- Stalk bores	III	20.0 ⁺	20.0*
			None**	None**
	-Plassey borer, Gurdaspur bores, Scale insect, mealy bug.	III	5.0	5.0
			None**	None**

KEY

- * Subject to immediate rouging of the whole clump
- ** In areas where the presence of the pest has not been recorded.
- # It gives around 10% affected buds.
- + It gives around 0.5% affected buds.

Designated Diseases shall be:

1. Red rot (*Glomerella tucumanensis*(Speg.) Arx& Muller)

2. Smut (*Ustilago scitaminea* (Sydow))
3. Wilt (*Cephalosporium saccgaru* Butler)
4. Grassy shoot disease (Mycoplasma-like-organism)
5. Leaf scald (*Xanthomonas albilineans* (Ashby)Dowson)

Designated Insect-Pests shall be:

1. Top bores (*Scirpophaga excerptalis* Wlk.)
2. Internode borer (*Chilo sacchariphagus indicus* Kapur)
3. Stalk borer (*Chilo auricilius* Ddgn.)
4. Plassey borer (*Chilo tumidicostalis* (Hmps.)
5. Gurdaspur borer (*Acogpma steniellus* Hmps.)
6. Scale insect (*Melanaspis glomerata* Green.)
7. Mealy bug. (*Sacchariphagus sacchari* Cockerell)

Note:

1. All off-types and diseased plants shall be rouged out along with roots and destroyed.
2. Maximum permissible limits for the stripping of dry foliage shall be 2.0%.
3. The crop should not have more than 10% lodged canes.
4. Seed canes should not have nodal roots. In waterlogged areas, relaxation may be given up to a maximum of 5%.
5. Moisture in seed cane should not be less than 65% on wet weight basis.
6. Germinability of buds should not be less than 85%.

7. Physical purity of seed should be 98%.
8. Genetic purity of seed should be 100%.

16.0 COTTON

The following classes of seed cotton shall be recognized: - Breeder's seed, Pre - basic, Basic and Certified seed.

16.1 Cropping history

The field must have not been grown with a cotton crop for at least two years.

Land to be used for production of certified seed must be free from volunteer cotton plants.

16.2 Field Inspection

At least two inspections of each field must be made.

Critical stage of inspections

- At 50% flowering
- Boll formation
- At 50% boll opening.

16.3 Field Standards

16.3.1 Isolation

Isolation distance shall be observed as per the table below.

Variety	Isolation
<i>Gossypium barbadense</i>	
Fields to produce: -- Basic Seed	

Certified Seed	200 m
Non hybrid varieties	150 m
F1 hybrids produced without CMS	150 m
F1 hybrids produced using CMS	800 m
<i>Gossypium hirsutum</i>	
Fields to produce: -- Basic Seed	
Certified Seed	100 m
Non hybrid varieties	30 m
F1 hybrids produced without CMS	30 m
F1 hybrids produced using CMS	800 m
<i>Gossypium hirsutum</i> x <i>Gossypium barbadense</i>	
(Fixed inter-specific hybrid varieties)	
Fields to produce: -- Basic Seed	200 m
Certified Seed	150 m
Fixed inter-specific hybrid varieties	150 m
F1 hybrids produced without CMS	800 m

16.3.2 Additional field standards

Factor	Tolerance levels	
	Br, Pb & B	Certified
Off-types	1 per 100 plants	5 per 100 plants
Noxious weeds	None	None
Diseases tolerances		
Bacterial blight	Zero	Zero
Fusarium wilt	Zero	Zero
Leaf curl	Zero	1 per 100 plants

*Damage by cotton stainers, cotton aphids, Cotton jasad and African bollworm	2%	5%
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Note: Inspector should also pay attention to the following insect pests: cotton stainers, cotton aphids, Cotton jasad and African bollworm

16.3.3 Processing standards

	Tolerance levels	
Factor	Br, Pb & B	CERTIFIED
Fuzzy, broken, damaged	< 2%	<2%
Other crop seed	None	None

16.3.4 Laboratory standards

As per The Seeds and Plant Varieties Act CAP 326 (Fourth Schedule)

17.0 CASSAVA (*Manhot esculentus*)

17.1 Cropping history

A Seed crop of cassava shall not be eligible for certification if planted on land on which cassava was grown in the last one season.

17.2 Field Inspection

A minimum of two inspections shall be made at 3 months – for 1st inspection which is mandatory for identification of off types and disease presence and the second inspection a month before harvesting

The above applies for a ratoon crop. Three ratoon crops are acceptable.

17.3 Field Standards

17.3.1 Isolation

Fields for certification must be clearly separated from other fields of the same variety by 10 meters for breeders, pre-basic, basic and certified generation.

17.3.2 Cassava Seed Cutting Requirements

Cassava cuttings to be planted for seed production shall be free from pests and diseases and of known origin.

Select healthy planting material (cuttings) only the hard stem (not green), of the required variety.

Harvesting – obtain planting material (cuttings) nearest to the selling time.

17.3.3 Counts

Hectares	Minimum Number of Counts each of 50 plants	Number of Plants (Hills)
≤ 1 Hectare	10	500
1.1 – 6 Hectares	20	1000
6.1 – 16 Hectares	30	1500

Where one plant in a hill is affected by a disease the whole hill shall be rogued.

17.3.4 Additional Standards

Field Standards	Tolerance at final inspection
Maximum Off types %	0
Diseases/Pests	
Cassava Mosaic virus	0
Cassava Brown Streak virus	0
Bacterial blight	0

17.3.5 Stem Cutting Quality Standards

Stem cutting quality standard	
Minimum length	20 - 30 cm

Minimum number of live nodes	3
Minimum diameter	n/a
% skin injury/ scar/ damage (maximum)	20%

18.0 BLACK NIGHTSHADE (*Solanum nigrum*)

Insert photo

18.1 Field Inspections

Basic and certified seed classes shall be inspected at least twice during the growing season of the crop, 1st at 50% flowering and 2nd at berry ripening stage (early maturity) Standard seed shall be inspected at least once at early berry ripening stage.

18.1.1 Inspection technique

Walk along a predetermined travel path, observe 100 plants (100 plants is the sampling unit which form one count) along the rows (approx. 30m). Each count shall be selected at random and individual plants inspected for varietal purity and diseases. Record the off-types, crops of other species, diseased plants, weeds and any other observation made in the field.

The number of counts to be made will depend on the acreage and the class of the seed crop (Table 1). Make a decision to approve or reject the crop based on the field standards (As per tables 2, 3 and 4)

17.2.2 Table 1: Minimum Number of Counts

Area (ha)	Number of Counts each of approximately 30m (100 plants per count)
≤ 0.5	4
0.51 – 1	10
1.1 – 6	20
6.1 – 8	24

Area (ha)	Number of Counts each of approximately 30m (100 plants per count)
8.1 – 10	28
10.1 – 12	32
12.1 – 14	36
14.1 -16	40
16.1 18	44
18.1 – 20	48

Note: For breeders, pre-basic and basic the number of counts shall be doubled

17.2.3 Isolation

A seed crop shall be separated from neighbouring contaminant solanaceous crops by distances as shown in the table below (Table 2)

Table 2: Minimum Isolation distance in metres

	Breeders - Basic	Certified (C1 &C2)	Standard
Solanaceous (non seed crops)	100	50	10
Other seed crops	5	2	2

17.2.4 Disease standards

Parameter	Max. Number per 1000 plants		
	Br – Basic	C1-C2	STD
Bacterial Wilt (<i>Ralstonia Solanacearum</i>)	0	1	4
Anthraxnose (<i>Colletotrichum atramentarium</i>)	0	1	4
Early blight (<i>Alternaria solani</i>)	0	1	4
Mosaic virus (CMV, TMV, ToMV....)	0	5	10
Canker (<i>Clavibacter michiganensis</i>)	0	1	4

17.2.5 Table 4: Off-types of other cultivars

Parameter	Max. Number per 100 plants
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Class	BR – B C1		C2	Standard
Offtype	0	1	2	4

17.3 PROCESSING STANDARDS

At lot examination ensure that chaff, other crops seeds, weed seeds, damaged, diseased, immature, rotten and discolored seeds are less than 1%. **Move to annex**

17.4 LABORATORY STANDARDS

Parameter	Minimum tolerance (%)
Purity	95
Germination	65
	Maximum tolerance (%)
Other crop species	1
Weed seed	0.5
Moisture	9

19.0 JUTE MALLOW (*Corchorus spp.*)



19.1 Field Inspections

A seed crop shall be separated from neighbouring similar crops species by distances as shown in the table below.

18.3.1 Table 1: Minimum Isolation distance in metres

Breeders – Basic	Certified (C1 and C2)	Standard
30		25

Basic and certified seed classes shall be inspected at least twice during the growing season, 1st at 50% flowering and 2nd at podding stage. Standard seed shall be inspected at least once.

18.3.2 Inspection Technique

Walk along a predetermined travel path, observe 100 plants (100 plants is the sampling unit which form one count) along the rows (approx. 30m). The number of counts to make will depend on the acreage and the class of the seed crop.

18.3.3 Table 2. Minimum number of Counts

Area (ha)	Number of Counts each of approximately 30m (100 plants per count)
≤ 0.5	4
0.51 – 1	10
1.1 – 6	20
6.1 – 8	24
8.1 – 10	28
10.1 – 12	32
12.1 – 14	36
14.1 -16	40
16.1 -18	44
18.1 – 20	48

Note: For breeders, pre-basic and basic the number of counts shall be doubled

18.3.4 Table 3. FIELD STANDARDS TOLERANCE

FIELD STANDARDS FACTOR	BREEDER – BASIC	Certified (C1 – C2)	STD
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Off types	None at final inspection	2 plant per count(100 plants)	4 plant per count(100 plants)
Anthrachnose <i>Glomerell cingulate</i>	None at final inspection	2 plants per count	4 plants per count
Sclerotic rot <i>Sclerotium rolfsii</i>	None at final inspection	2 plants per count	4 plants per count

18.4 PROCESSING STANDARDS

At lot examination ensure that chaff, other crops seeds, weed seeds, damaged, diseased, immature, rotten and discolored seeds are less than 1%. **Move to annex**

18.5 LABORATORY STANDARDS

Parameter	Minimum tolerance (%)
Purity	95
Germination	70
	Maximum tolerance (%)
Other crop species	1
Weed seed	0.5
Moisture	9

19 SPIDER PLANT (*Cleome gynandra*)



19.1 Isolation distance

A seed crop shall be separated from neighbouring *Cleome* species by distances as shown in the table below (Table 1)

Table 1: Minimum isolation distance in meters

Breeders – Basic	Certified (C1 and C2)	Standard
100	50	25

19.2 Field inspection

Basic and certified seed classes shall be inspected at least twice during the growing season, 1st at 50% flowering and the 2nd at podding stage. Standard seed shall be inspected at least once at early podding stage.

19.2.1 Inspection Technique

Walk along a predetermined travel path, observe 100 plants (100 plants is the sampling unit which form one count) along the rows (approx. 30m). The number of counts to make will depend on the acreage and the class of the seed crop (Table 2)

19.2.2 Table 2: Minimum number of counts

Area (ha)	Number of Counts each of approximate 30m(100 plants per count)
≤ 0.5	4
0.26 - 0.5	8
0.51 – 1	10
1.1 – 6	20
6.1 – 8	24
8.1 – 10	28
10.1 – 12	32
12.1 – 14	36
14.1 -16	40
16.1- 18	44
18.1 – 20	48

Note: For breeders, pre-basic and basic the number of counts shall be doubled

19.2.3 Table 3: Off-types or other cultivars

Parameter	Max. Number per 100 plants		
Class	BR – B	C1-C2	Standard
Offtype	0	2	4

19.2.4 Table 4. Disease standard

Disease	Max. Number per 1000 plants		
	Br – Basic	C1-C2	STD
Bacterial Wilt (<i>Ralstonia Solanacearum</i>)	0	1	4
Black rot (<i>Xanthomonas campestris</i>)	0	1	4

19.4 PROCESSING STANDARDS

At lot examination ensure that chaff, other crops seeds, weed seeds, damaged, diseased, immature, rotten and discolored seeds are less than 1%.

19.5 Table 5. LABORATORY STANDARDS

Parameter	Minimum tolerance (%)
Purity	95
Germination	65
	Maximum tolerance (%)
Other crop species	1
Weed seed	0.5
Moisture	9

20 *Amaranthus* (*Amaranthus spp*)



20.1 Isolation Distance

A seed crop shall be separated from neighbouring amaranth crop species by distances as shown in the table below (Table 1)

Table 1: Minimum isolation distance in metres.

Breeders - Basic	Certified (C1 and C2)	Standard
400	200	100

20.2 Field inspection

At least two field inspections shall be carried out for basic and certified seed; 1st at 50% flowering, 2nd at grain turning stage. Standard seed crop shall be inspected at least once between 50% flowering and grain ripening stage.

20.2.1 Inspection Techniques

Along the predetermined travel path, observe 100 plants (100 plants is the sampling unit which form one count) in a row. The number of counts to make will depend on the acreage and the class of the seed crop (Table 2)

20.4.1 Table 2. Minimum number of Counts

Area (ha)	Number of Counts each of approximately 30m (100 plants per count)
≤ 0.5	4
0.51 – 1	10
1.1 – 6	20
6.1 – 8	24
8.1 – 10	28
10.1 – 12	32
12.1 – 14	36
14.1 -16	40
16.1- 18	44
18.1 – 20	48

Note: For Breeder, Pre basic and basic seed, the number of counts shall be doubled

20.4.2 Table 3: Off-types or other cultivars

Parameter	Max. Number per 100 plants		
Class	BR – B	C1-C2	Standard
Offtype	1	2	5

Note: Objectional weeds e.g wild amaranthus species shall be nil at final inspection

20.4.3. Table 4. Disease standards

Diseases	Max. Number per 100 plants		
	Br – Basic	C1-C2	STD
Wet rot (<i>Choanephora cucurbitarum</i>)	0	1	5
Fusarium wilt, root rot (<i>Fusarium oxysporum</i>)	0	1	5

20.5 PROCESSING STANDARDS

At processing ensure the following; diseased, discolored and rotten seeds are less than 1%

Parameter	Minimum tolerance (%)
Purity	98
Germination	75
	Maximum tolerance (%)
Other crop species	0.1
Weed seed	0.5
Moisture	9

Annex

21.0. Pearl Millet (*Pennisetum glaucum* L.)



21.1 Isolation Distance

A seed crop shall be separated from neighbouring pearl millet crop as shown in the table 1 below.

Table 1: Minimum isolation distance in meters

Breeders - Basic	Certified (C1 &C2)
400	200

21.2 Field inspection

At least three inspections shall be carried out for hybrid seed millet, 1st at 1% anthesis, 2nd at 50% anthesis and the final at physiological maturity. At least two inspections shall be done for open pollinated varieties, 1st at 50% anthesis and 2nd at grain turning stage.

21.2.1 Inspection technique

21.2.1.1 Assessment of Off-types in female rows

Starting from a random position, count twenty (20) plants, assessing varietal purity therein. Omit one row and make a similar count and assessment of 20 plants. Repeat the procedure until the required number of plants is assessed.

21.2.1.2 Assessment of off-types in male rows

Count 20 plants along the male row starting from a random position. Omit the next male row and repeat the procedure until the required number of plants is assessed.

N/B.The number of plants counted will be half the number in females.

21.2.1.3 Assessment of off-types in open pollinated varieties

Starting from a random position count 20 plants, Omit 5 rows and continue the count on the 6th row, 12th until the full count is achieved as per table 2 below. Tolerances for off types are as per table 3 below.

21.3.2 Table 2: Minimum number of counts

Area in Hectares	Minimum Counts	Number of plants
≤6	100	2000
6.1 – 16	200	4000
16.1 – 32	300	6000
32.1 – 40	400	8000
Over 40	500	10000

21.3.3 Table 3: Off-types of other cultivars

Parameter	Max. Number per 100 plants		
<i>Class</i>	BR – B	C1	C2,
Offtype	0	1	2

21.3.4 Table 4: Disease standards

Disease	Max. No per 1000 plants	
	Br –Basic	C1 – C2
Downy mildew (<i>Sclerospora graminicola</i>)	0	1
Ergot (<i>Claviceps microcephala</i>)	0	2
Grain smut (<i>Tolyposporium pencillariae</i>)	0	0

21.4 PROCESSING STANDARDS

PARAMETER	MAXIMUM NO. OF SEED PER KG	
	BR-B	C1 and C2

Other crop seed	1	2
Weed seeds	2	4

Note: No seeds of wild oats, striga, thorn apple, orobanche shall be allowed. For cracked, diseased, insect damaged seeds a maximum of 5% shall be allowed.

21.5 LABORATORY STANDARDS

Pure seed (Min. % by wt.)	9
Inert matter (Max. % by wt.)	1
Germination (Min. %)	80
Moisture content (Max. %)	12
Other crop seed (Max. No. in whole sample)	1

22 VEGETABLES. (Tomato, okra, cucurbits, eggplant, pepper, crotonaria, Ethiopian mustard, spinach, kales etc.

22.1 Field inspection

At least two field inspections shall be carried out for certified generation and above seed crops and at least one field inspection for standard class. The first inspection will be done at 50% flowering, the second at fruit/pod formation for certified classes.

22.2 Isolation, weeds and diseases

Crop	Isolation (m)	Diseases/Weeds	Tolerance (%)	
Tomato	OPV Basic – 50 C1- 25 STD-10 Hybrid Basic 200 C1- 100	<i>Corynebacterium michiganense</i> (Bacterial canker) <i>Xanthomonas vesicatoria</i> (Bacterial spot) <i>Alternaria solani</i> (Early blight) <i>Didymella lycopersici</i> (Stem canker, stem rot) - Tobacco mosaic virus (T.M.V)	Off type Basic 0.1 C1 0.2 Hybrid Basic 0.01 C1 0.05 Selfing Basic 0.05 C1 0.1 Diseases Basic 0.1 C1 0.5	
Okra	Basic 500 C1 250 STD -100	- Noxious weeds <i>Abelmoschus ficulneus</i> (wild okra) <i>A.manihot</i> <i>A. moschatus</i>	Off type Basic 0.1 C1 0.2	
Cucurbit/ cucumber/ melon	OPV Basic 1000 C1 500 STD-200 Hybrid Basic 1500 C1 1000	Cucumber Mosaic virus	Off type Basic 0.1 CI 0.2 Disease Basic 0.1 C1 0.2	
Egg plant	Basic-200 C1 100 STD 50	<i>Corynebacterium michiganense</i> (Bacterial canker) <i>Xanthomonas vesicatoria</i> (Bacterial spot) <i>Alternaria solani</i> (Early blight) - Didymella lycopersici (Stem canker, stem rot) - Tobacco mosaic virus (T.M.V) - Fruit rot	off type Basic 0.1 C1 0.2 Hybrid Basic 0.01 C1 0.05 Selfing Basic 0.05 C1 0.1 Diseases Basic 0.1 C1 0.5	
Pepper	Basic 250 C1 100	Bacteria wilt	Off type Basic – Nil	

	STD 50	- Tobacco mosaic virus - Leaf blight - Anthracnose	C1 - 1 STD – 5 Diseases Basic – 0.1% C1 – 0.5% Std – 1%	
Crotolaria/sun hemp	OPV Basic – 50 C1- 25 STD-10 Hybrid Basic 200 C1- 100		off type Basic 0.1 C1 0.2 Hybrid Basic 0.01 C1 0.05 Selfing Basic 0.05 C1 0.1	
Spinach	Basic 1600 C1 1000 STD 500	- Fusarium wilt <i>(Fusarium oxysporum f.sp.spinaciae)</i> - Cucumber mosaic virus	Off type Basic 0.1 CI 0.2 Diseases Basic – 0.1% C1 – 0.5% Std – 1%	
Kale/Collards	Basic 400 C1 200 STD 50	- Black leg (<i>Phama legium</i>) - Soft rot - Black rot - Alternaria leaf spot	off type Basic 0.1 C1 0.2 Diseases Basic – 0.1% C1 – 0.5% Std – 1%	
Coriander	Basic 200 C1 100 STD 50	Lathyrus weed	off type Basic 0.2 C1 0.3 STD 0.6	

22.3

23 ANNEXES

23.1 Annex 1: Checklist for inspection of tissue culture laboratory

Facility			
	Requirements	Meeting standard (If yes tick if No (x))	Comment/Remarks
Washing Area	Sinks (lead-lined to resist acids and alkalis), ceramic sinks.		
	Proper drainage system		

	Racks, and have access to water		
	Distiller Or alternative		
	Space for drying ovens or racks		
	Pipette and pipette washer		
	Storage cabinets		
Media Preparation Area	Storage space for the chemicals		
	Culture vessels and closures		
	Glassware required for media preparation and dispensing.		
	Bench space for hot plates/stirrers, pH meters and balances		
	Refrigerators and freezers for storing stock solutions and chemicals,		
	a microwave or a convection oven,		
	Autoclave for sterilizing media glassware and instruments.		
Transfer Area	All surfaces in the room should be designed and constructed in such a manner that dust and microorganisms do not accumulate and the surfaces can be thoroughly cleaned and disinfected. A room of such design is particularly useful if large numbers of cultures are being manipulated or large pieces of equipment are being utilized		
	Laminar flow hood or sterile transfer room be utilized for making transfers. The ventilation should be equipped with a high-efficiency particulate air (HEPA) filter. A 0.3-µm HEPA filter of 99.97-99.99% efficiency works well.		
	Source of electricity, gas.		
Culture /Growth Room	All types of tissue cultures should be incubated under conditions of well-controlled temperature, humidity, air circulation, and light quality and duration. These environmental factors may influence the growth and differentiation process directly during culture or indirectly by affecting their response in subsequent generations. Typically, the culture room or growth of plant tissue cultures should have a temperature between 15°C and 30°C		
	Fluorescent lighting (At least 10,000 lux) the lighting should be adjustable in terms of quantity and photoperiod duration. Both light and temperature should be programmable for a 24-hr period.		
	Air conditioner		

	(The culture room should have fairly uniform forced-air ventilation, and a humidity range of 20-98% controllable to ± 3 percent)		
	Thermometers		
General Requirements			
1.	Technical personnel with tissue culture knowledge		
2.	Isolation from foot traffic		
3.	Thermostatically controlled heat		
	Good lighting		
4.	Locate the building away from sources of contamination such as a gravel driveway or parking lot, soil mixing area, shipping dock, pesticide storage, or dust and chemicals from fields		
5.	The floor should be preferably tiled or concrete. Walls and ceiling should be insulated with a water-resistant material.		
6.	Windows, if desired, may be placed wherever convenient in the media preparation and glassware washing rooms.		
7.	Air conditioning for cooling in each room would be necessary.		
8.	Electric service capacity for equipment, lights and future expansion should be calculated. A minimum 100 amp service is recommended.		
9.	Have adequate waste management procedures		
10.	The facility shall be inspected regularly by KEPHIS.		

Decision: Approved/ Rejected/Pending

Remarks:

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

Name of Company.....

Contacts.....

Contact person/Responsible.....Date.....Signature.....

Name of inspector/ officer/s.....Date.....Signature.....

Name of inspector/ officer/s.....Date.....Signature.....

23.2 Annex 2: Inspection check list for Greenhouse facility (Minitubers and apical stem cuttings)

Requirement	Status	Comments
1. The facility should be insect proof screen/glasshouse or facility.		
2. Cemented slabs /or ground cover within the glasshouse provided with walking paths		
3. Have a double door entry		
4. Have protective clothing and the changing area		
5. Adequate but controlled ventilations		

6. Have competent personnel		
5. Have a pest monitoring and management system		
6. Have operational notifications and records including operating instructions		
6. A disinfecting trough (moat) on the entrance with disinfecting solution is required		
7. Not be accessible to un-authorised persons.		
9. The facility should be used exclusively for the specified purpose		
10. Have adequate waste management procedures		
10. Be inspected regularly by KEPHIS.		

Name of Company.....

Contact person/Responsible..... Date.....Signature.....

Name of inspector /officer.....Date.....Signature.....

23.3 `Annex 3: Production facility Inspection Schedule

CROP	STAGE	PROCEDURE	TIMELINE	INSPECTION VISITS	REMARKS
POTATO	TC Initiation	Done as per annex 1	14 days before commencing production. Applicable to facility approval	1	Mandatory
	Before acclimatization of	PCN & Bacterial Wilt	14 days Before planting. Applicable to facility approval	1	Mandatory

	TC plants/planting of cuttings & mini tubers	testing of growing media			
	During active growth	Inspection & labelling of Apical cuttings & TC plants. Sampling for post control and Disease test	During the growth cycle	1	Mandatory
		Lot inspection	Done within 10 days after receipt of an application	IV	Mandatory

24 Seed certification standards

24.1.1 Field standards

SPECIES		ISOLATION DISTANCE (M)	OFF TYPES	DISEASES / WEEDS TOLERANCE LEVELS
Maize			Max no. per 100 plants	- Head smut 2 plants per ha - Loose smut 2 plants per ha -MLND 1% at any given inspection but zero at final inspection.
	BR	400	0	
	PB	400	0	
	B	400	0	
	C1	200	1	
	C2-C4	200	2	

Sorghum		ISOLATION DISTANCE (M)	Max no. per 100 plants	- Head smut 2 plants per ha - Loose smut 2 plants per ha
	BR	400	0	
	PB	400	0	
	B	400	0	
	C1	200	1	
	C2-C4	200	2	
Millet		ISOLATION DISTANCE (M)	Max no. per 100m²	- Cover smut - Bunt - Egort (1 plant per M² and 2 plants in neighbouring field) - Eleusine indica, Africana, jaegeri, setaria verticillata and dactyloctenium aegyptium weeds -nil at final inspection
	BR	10	1	
	PB	10	1	
	B	10	1	
	C1	4	5	
	C2-C4	4	6	
Wheat		ISOLATION DISTANCE (M)	Max. no. per 100 plants	- Bunt 1 head per 100 m² - Loose smut 1 head per 100 m² - Covered smut 1 head per 100 m² - Wild oat nil at final inspection
	BR	10	1	
	PB	10	1	
	B	10	1	
	C1	4	5	
	C2-C4	4	6	
Barley		ISOLATION DISTANCE (M)	Max no. per 100 plants	- Bunt 1 head per 100 m² - Loose smut 1 head per 100 m² - Covered smut 1 head per 100 m² - Wild oat nil at final inspection
	BR	10	1	
	PB	10	1	
	B	10	1	
	C1	4	5	
	C2-C4	4	6	
Cow peas		ISOLATION DISTANCE (M)	Max no. per 100 plants	- Leaves spots nil at final inspection - Pod spots nil at final inspection - Bacterial blight nil at final inspection
	BR	50	0	
	PB	50	0	
	B	50	0	

	C1	25	0	
	C2-C4	25	0	
Sunflower		ISOLATION DISTANCE (M)	Max no. per 100 plants	- Sclerotinia wilt and head rot (5 plants per 1000 plants)
	BR	4000	2 male 5 female	- Verticilium wilt (5 plants per 1000 plants)
	PB	4000	2 male 5 female	
	B	4000	2 male 5 female	- Downy mildew (5 plants per 1000 plants)
	C1	1000	5 male 10 female	- Alternaria helianthi (5 plants per 1000 plants)
	C2-C4	1000	5 male 10 female	

Rhodes grass and Setaria grass		ISOLATION DISTANCE (M)	Max no. per 100m²		
	BR	200	4		
	PB	200	4		
	B	100	4		
	C1	100	10		
	C2-C4	100	12		
Congo signal		ISOLATION DISTANCE (M)	Max no. per 100m²		
	BR	50	4		
	PB	50	4		
	B	25	4		
	C1	25	10		
	C2-C4	25	12		
Sudan grass		ISOLATION DISTANCE (M)	Max no. per 100m²		
	BR	400	0		
	PB	400	0		
	B	400	0		
	C1	200	1		
	C2-C4	200	2		
Desmodium		ISOLATION DISTANCE (M)	Max no. per 100m²		
	BR	200	0		
	PB	200	0		
	B	200	0		
	C1	100	1		
	C2-C4	100	2		
Potatoes		ISOLATION DISTANCE (M)	Max no. per 100 plants	- bacterial wilt - brown rot - wart - ring rot - Potato spindle viroid - Mycoplasma } nil at any inspection	
	BR	100	0		
	PB	100	1		
	B	100	2		
	C1	50	2		
	C2-C4	50	3		

24.1.2 Processing standards

Crop	Screens* (bottom sieve) (mm)	Screenings Allowed (%)	Grades
Hybrid maize	6.8	5	LF(11.1mm), LR(11.1*23.3mm), MR(9.5*23.3mm), MF(9.5mm), HP(6.8mm), SF(7.9mm),SR(7.9*23.3mm)
Open pollinated maize	6.8	5	LF, LR, MR, MF, HP
Wheat	2.2	5	--
Barley	2.3	5	--
Oats	2.0	5	--
Triticale	2.0	5	--
Potato	28.0 mm - 35.0 mm	--	5 tubers per 50 bag allowed
	36.0 mm - 45.0 mm	--	
	46mm – 55mm		
Mini tubers	15mm – 27mm		

*The requirement can be varied depending on variety and general crop performance as may be agreed upon by the Seed Regulation committee.

NOTE:

24.1.2.1 Maize

A seed lot shall not be allowed to contain more than 2.5% of cracked, diseased and shrivelled seeds.

24.1.2.2 Wheat and Barley

- (a) Maximum of 1 seed per litre will be allowed in basic seed lots and 2 seeds per litre for certified seed lots.

- (b) Weed Seeds. - A maximum of 2 seeds per litre will be allowed in basic seed lots and 4 seeds per litre for certified lots. No seed of wild oats, thorn apple or other noxious weeds shall be allowed.
- (c) Damaged Seeds –
 - (i) In basic seed lots a maximum of 10% of naked seeds and 10% of cracked seeds in barley and oats shall be allowed, while for certified seed the maximum will be 5%.
 - (ii) In basic seed lots a maximum of 10% of all discoloured seeds e.g. Blue pointed seeds (germ end) and 10% of insect damaged seeds allowed, while for certified seed the maximum will be 5%.
- (d) Sprouted Seeds – in basic seed lots a maximum of 10% short sprouts and 5% long sprouts will be allowed while a maximum of 5% short sprouts and 2% long sprouts will be allowed in certified seed lots.
- (e) The combination of the factors mentioned in (c) and (d) above shall not exceed 10% for basic seed and 5% for certified seed.

24.1.2.3 Sunflower

- (i) Mixtures with other varieties – Maximum of 2 seed per litre allowed.
- (ii) Seeds with cracked seed coat – maximum of 5% allowed.
- (iii) Noxious weed seed, e.g. Datura – None will be allowed.

24.1.2.4 Beans and Cowpeas

- (a) Mixture with other Crop Seeds – None allowed in basic seed while a maximum of 1 seed per 1,000 of clearly distinguishable other bean seeds will be allowed for certified seed but seed of other species will not be allowed.
- (b) Weed Seeds: - Free from all weed seeds.
- (c) Other Factors.
 - (i) Spotted beans and heat damaged beans – Maximum 0.5% allowed.
 - (ii) Rejects (insect-damaged beans, off-coloured seeds, beans with cracked skin, broken beans, too small seeds, etc. – Maximum 3 allowed.

24.1.2.5 Sorghum

- (a) Mixtures with other Crop Seeds. - A maximum of 1 seed per litre will be allowed in basic seed lots and 2 seeds per litre on certified seed lots.
- (b) Weed Seeds.- A maximum of 2 seeds per litre will be allowed in basic seed lots and 4 seeds per litre for certified seed., No seed of wild oat or thorn, apple, striga and orobanche shall be allowed.

24.1.2.6 Potatoes

The following diseases/abnormalities will be permitted up to the stated tolerances:

Abnormality	Tolerance (tubers per 50kg bag)	
	Basic	Certified
Scab(<i>Streptomyces spp</i> , <i>Spongospora subterranean</i>) no more than 50% tuber covered	25	50
Rhizoctonia (<i>Rhizoctonia solani</i>)	10	30

Pink rot (<i>Phytophthora erythroseptica</i>)	0	1
Soft rot (<i>Erwinia spp</i>)		
Severe tuber moth	2	5
Mis-shapen and damaged tubers & Severe millipede damage	0	5

24.1.3 Laboratory standards

Species	Minimum Purity % By weight	Maximum Other Crops Seed % by weight	Maximum Weed seeds % by weight	Minimum Germination Capacity %	Maximum Moisture Content %
CEREALS					
Maize	99	Trace	Trace	90	13
Wheat	99	Trace	0.1	85	13
Barley	99	Trace	0.1	90	13
Sorghum .	95	1	1	70	11
Millet .. .	95	1	1	70	11
Oats .. .	99	Trace	0.1	85	13
Triticale .. .	99	1	0.1	80	13
Rye .. .	99	Trace	0.1	85	13
Rice	99	1	1	70	11
PULSES					
Beans .. .	99	Trace	0.1	80	15
Broadbeans .	99	Trace	0.1	80	15
Chickpeas	99	0.1	0.5	75	15
Cluster beans	98	0.1	0.5	75	15
Cowpea ..	98	0.1	0.3	80	12
Dolichos	99	Trace	0.1	80	15
Pea (garden)	98	0.1	0.3	80	12
Pigeon peas	98	0.1	0.3	80	12
Commonvetch	98	Trace	0.1	70	14
French beans	99	Trace	0.1	80	15
Sugar peas	98	0.1	0.3	75	12
OIL CROPS					
Sunflower ..	99	Trace	Trace	85	10
Oil Seed rape	99	Trace	0.1	85	10

Safflower ..	99	Trace	Trace	85	10
Soya beans ..	98	Trace	0.1	75	14
Groundnuts ..	97	Trace	Trace	80	14
Castor beans	98	Trace	0.1	75	14
FIBRE CROPS					
Cotton	98	-	-	75	10
Flax	98	-	-	80	10
Kenaf	98	-	-	75	10
ROOT AND TUBER CROPS					
Beet	97	0.3	0.1	75	11
Irish Potato	99	-	-	-	-
Turnip	98	0.5	0.3	75	10
FLOWERS					
Pyrethrum	30	-	-	40	-
Other Species					
VEGETABLES					
Amaranth ..	98	0.1	0.1	75	9
Artichoke	98	0.1	0.1	75	9
Asparagus	96	0.5	0.5	70	9
Broccoli	97	0.1	0.3	75	10
Brussels sprout	97	1	0.3	75	10
Cabbage ..	97	1	0.1	75	10
Cantaloupe/ Melon	98	1	0.3	75	9
Carrot	95	1	1	65	9
Cauliflower ..	97	0.1	0.3	70	10
Celeriac/Celery	97	1	0.5	70	10
Chicory	95	1.5	0.5	65	10
Chinese cabbage	97	1	0.3	75	10
Collard/kale ..	97	1	0.3	75	10
Cucumber	98	0.1	0.3	80	9
Dill	98	0.3	0.3	65	10
Eggplant	96	0.5	0.3	65	10
Endive	95	1	0.5	65	11
Garden cress	98	0.1	0.5	80	9
Gourds (Several Species)	97	0.1	0.5	60	9
Kohlrabi ..	97	0.1	0.3	75	10
Leek ..	97	0.5	0.5	65	11

Lettuce ..	95	0.5	0.5	75	8
Okra ..	98	0.1	0.5	65	11
Onion ..	97	0.5	0.5	70	11
Parsley ..	97	0.1	0.5	65	10
Parsnip ..	98	0.5	0.5	60	10
Pepper ..	97	1	0.5	65	10
Pumpkin/Squash/cougette ..	98	0.1	0.3	75	9
Radish ..	97	1	1	60	8
Rhubarb ..	95	0.1	0.3	75	10
Rutabaga ..	98	0.5	0.3	75	10
Spinach/swiss Chard ..	97	0.5	1	70	11
Tomato ..	97	0.5	0.3	75	9
Turnip ..	98	0.5	0.3	75	10
Water melon ..	98	0.1	0.3	75	9
Other Vegetable					
Seeds ..	95	1	0.5	50	9
Greengram	98	0.1	0.3	80	-
Coriander	95	0.5	0.3	75	-
Tinda	98	0.5	0.3	75	-
GRASSES	PURITY	GERMINATION	PGS %		
Blue Stem Grass	Same for All classes	50	20		
Buffel Grass					
Cock's Foot					
Paspalum					
Rye Grass					
Setaria					
Rhodes Grass					
Sudan Grass					
Congo Signal					
Coloured Guinea					
Columbus Grass					
Love Grass					
Lawn Grass					
Bermuda Grass					
PASTURE LEGUMES					

Centro	98	55	
Stylo	97	65	
Desmodium	95	70	
Clover	98	75	
Lucerne	98	75	
Siratro	98	80	
Glycine	97	70	

25 Field inspection report form

FORM SR 6

REPUBLIC OF KENYA

KENYA PLANT HEALTH INSPECTORATE SERVICE

INSPECTION RESULTS

Grower Name.....and No.

SpeciesVariety Crop No.....

SpeciesVariety Crop No.....

Does crop have proper cultivar characteristics?.....

Counts	Off-types	Diseases	Other features	Noxious weeds	Other crops weeds
1					
2					
3					
4					
5					
6					
Total					
Average					
Percentage					
Identity					

The isolation distance/time ofdays metres is adequate/inadequate and should be corrected

General conditions of crop e.g. drought, crop husbandry, ect

.....

Further remarks.....

Estimated yieldbags/hectare

This crop is approved/rejected

Signature of seed grower or representativeDate.....

Signature of seed inspector.....Date.....

26 Walking Patterns during field inspection

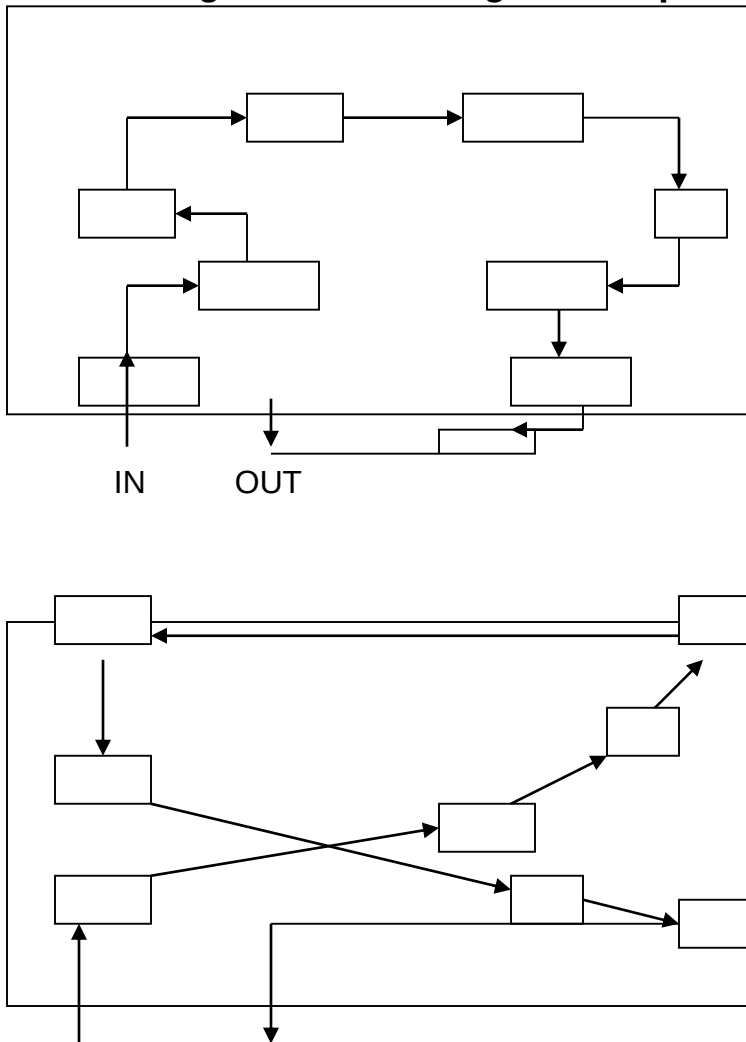
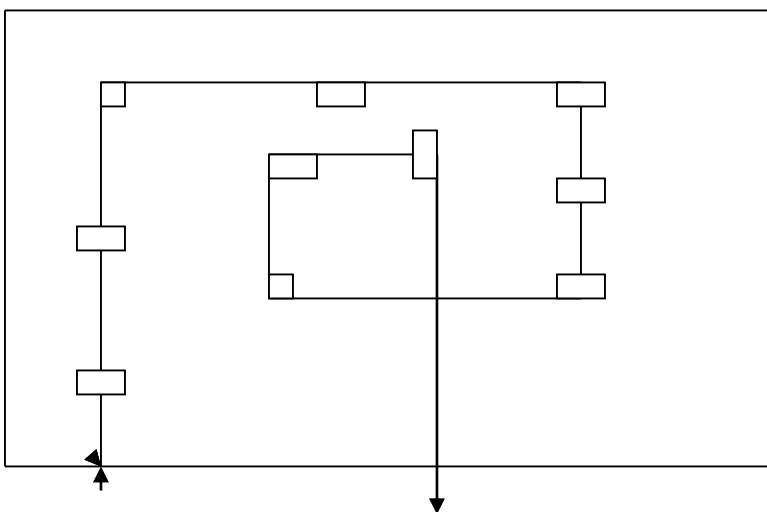
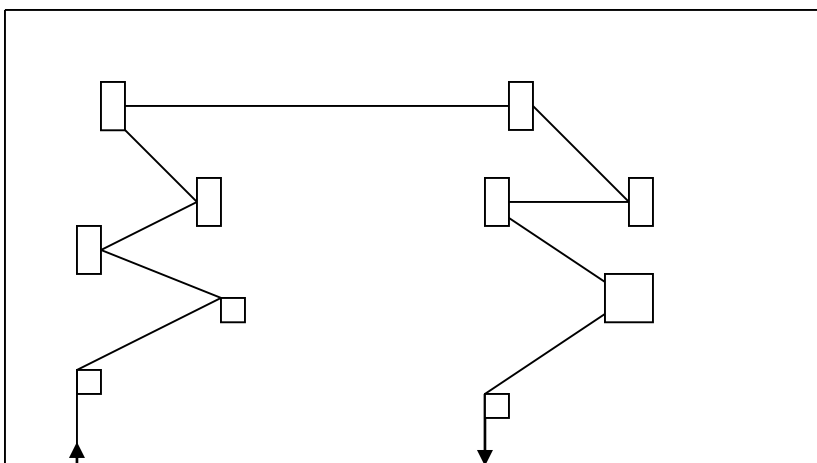


Fig. 1 Field observation of 75% of the seed crop in maize



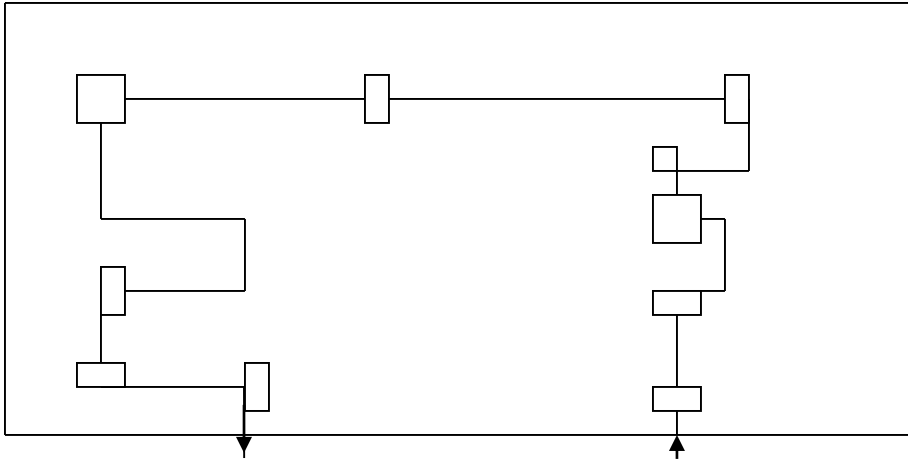


Fig: 8 Observation of 85% of the field in small cereals

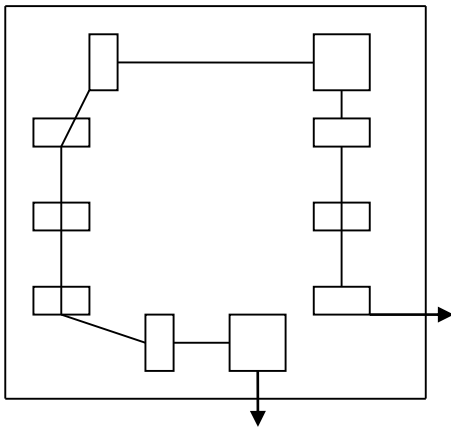


Fig 9: observation of 60% of the field in small cereals

NB: The 75% and 85% movement patterns are recommended but the rest are optional at the discretion of the inspector.