Standard Operating Procedure (SOP) for Land Preparation and Planting

Authors & Contributors

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1. Introduction

Land preparation and planting are very important in the successful establishment of a trial. A poorly prepared land can affect seed germination, increase weed pressure, increase insect and disease pressures, and may affect other mechanized operations like planters. Likewise, planting requires attention to avoid planting entries in the wrong plots or the wrong order and to ensure uniform germination and plant stands. This document describes standard operating procedures (SOPs) for preparing cowpea experimental land and the planting procedures. This living document will continuously be updated to reflect the most current advances in the cowpea breeding program.

2. Purpose

The purpose of this document is to outline the roles, responsibilities, and guidelines for preparing cowpea experimental land and the key considerations during planting the trials.

3. Scope

This document contains outlines of steps involved in land preparation and planting cowpea experiments. It covers land preparation procedures, planting field trials, and planting segregating and breeding lines. Considerations for both manual and mechanized planting are described.

4. Definition of terms

Land preparation: Activity that consists of (1) the removal of shrubs, crop residues, wood, or any debris on the surface of the land and (2) the creation of good soil conditions (aeration, drainage for easy growth, and development of roots). Plowing, harrowing, ridging, and mulching are key operations for land preparation.

Planting: Activity that consists of putting plants, plant cuttings, or seeds into the ground so that they will grow. Generally, it is synonymous with sowing, which is putting seed into the ground so that plants will grow. Three methods of direct seeding are mentioned: broadcast, hill, and drill.

5. Roles and Responsibilities

All staff involved in implementing breeding activities in the cowpea improvement program at IITA must use the land preparation and planting SOP. No alteration should be made to the procedures unless approved exceptionally by the program leaders. The individuals responsible for each section of the SOP are listed below.

Crop Lead breeder Responsible for the overall management of the breeding program and for delegating team responsibilities. He is also responsible for availing the funds required to procure land preparation materials. The crop lead also cross-checks the planting list to ensure what will be planted matches what was planned for the season.
Associate scientists (AS): Support the CLB with follow up and implementation of land preparation activities.

Research farm unit Responsible for land allocation, ploughing, harrowing, and ridging the trial land.

Research supervisors Responsible for organizing all the planting materials and supervising and guiding the technicians during planting of trials.

Field technicians (FT) Responsible for verifying that the land is prepared in time and is well prepared. Field technicians are responsible for arranging seed packets in the right planting order and implementing the planting together with the causals.

6. Procedure

Step1: Key considerations for land preparation

- Apply appropriate herbicide (e.g. glyphosate (Round-up) at the rate of 4 L/ha) immediately after the last harvest or during fallow. This is important for effective weed control and for enriching the soil.
- For a completely new site, start with bush clearing about 6 weeks before the expected planting time. This should then be followed by ploughing.
- In preparation for ploughing, irrigate the field a day before if there is no rain. Generally ploughing should be done after the first rain if there is no irrigation facility.
- At about 4 weeks before planting, conduct initial disc ploughing to "till" or dig-up, mix, and overturn the soil.
- After two weeks, perform disc harrowing to break the soil clods into smaller masses and incorporate plant residues. In some cases, a second harrowing may be needed if there are a lot of plant residues in the plot.
- For manual planting, make straight ridges, following the trial design and plot orientations.
- For mechanized planting, no ridges should be made but an additional field levelling is required to ensure uniform plots and ease of planter operation.
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Step2: Key considerations for planting yield trials

- This SOP describes both mechanized planting and manual planting. Mechanized planting, where available, should be used mostly for trials (IET, PYT, AYT, ANCT, CIT, and RCT) and seed multiplication plots, while manual planting will be reserved for breeding lines.

- Prior to planting, barcode plot tags must be designed, similar to the labels used on the seed packets. The barcode printer must be adjusted for proper printing of the tags.
- Planting should be performed when the rain is well established. Generally, planting dates depend on the length of the raining season and the maturity of the lines, as one should avoid having matured plants when it is still raining.

6.1 Mechanized planting

- Have the planter ready, well-cleaned, and calibrated to plant 4 meters.
- The tractor driver must be coached on the expectations and requirements for planting. He must be aware that seed packets will be changed after every 4 meters of a plot. The alleys should have been clearly marked during field layout and mapping.
- Take the planter to the field
- Consult the field map, determine the starting plot, and position the tractor in the right place.
- One person should be designated to sit up and feed the seeds into the hoppers, while another person on the ground would hold the planting order and frequently check to be sure the right plots are being planted.
- Once planting has begun, there must be a warning sound to alert the seed feeders so that they can change the seed packet for the next plot. This is aided by planting cable that have designed Knots that auto generate sound after every 4 meters to facilitate plot to plot planting without pausing the tractor run.
- Planting will continue column-by-column, each column having 4 rows.
- At the end of each column, the diver must raise the planter, make a U-turn, re-align the planter at the correct spacing and at the correct starting point, bring the planter down, and begin the planting. NOTE: Alley marks must be clearly visible.
- One person should also be designated to always deliver the right seed tray for the next column planting.
- After planting, barcode tags should be placed on iron or wooden pegs in each plot.
- Record planting date.

6.2 Manual planting

- In the case of manual planting, the following should be considered:
- The field should have been mapped and pegged, ensuring 4 rows by 4 meters and following the specified experimental designs and trial dimensions.
- One row (ridge) is commonly left blank after every 4 ridges to separate between the plots.
- Make holes of 3.0cm deep at a spacing of 20cm in between hills. This should accommodate 20 hills per 4-meter row.
- Layout seed packets plot-by-plot, strictly following the randomization provided for the trial.
- Plant 2 seeds per hill in all four rows in a plot
- Supervise planting to be sure no seed packets are shifted to another plot. Ensure that planting is moving in the right direction as dictated by the randomization.
- After planting, barcode tags should be placed on iron or wooden pegs in each plot.
- Record planting date.
- Assemble the used seed packets for references and potential gap filling if there are remaining seeds.

Step3: Planting progenies from segregating populations

- We normally plant several generations in the field ranging from F2 to F5, all of which are under generation advancement and line fixing.
- For F2s, the target is to have a maximum of 500 F2 plants per cross and these will be advanced to successive generations using single seed descent (SSD), with slight modification to guard against complete loss of a single seed.
- F2s are planted in 10-meter plots of five rows, spaced 20 cm apart.
- For F3s, each of the 500 F2s will be represented by one short F3 row. Therefore, plant a plot of 1 meter by 1 row for all F3s. This implies that, for a single cross, you will have about 500 short rows planted with F3 plants and only one healthy looking plant will be harvested from each row to form seeds for F4 generation.
- Seeds for F4 should be planted in 2 meters by 1 row plots, and these will be harvested in bulk to obtain enough seeds for some initial observations at F5.
- For F5s, the lines are now fairly fixed, and some data can be recorded. Therefore, these should be planted in 2 rows of 4 meters. Where possible, this should be planted in a special design (particularly augmented design) with repeated checks.

- For F6 onwards, they are already fixed lines and will be entered in yield trials, and the planting strategy for trials has been discussed under key considerations for planting yield trials.

7. Appendix

Contacts for support

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