Standard Operating Procedures (SOPS) for the Indiana Corn and Soybean Innovation Center

The following SOP’s should be used to familiarize yourself with the equipment. Most of the equipment at ICSC will also require hands on training.

Below is a list of contacts in case of an emergency.

Emergency Contacts for Indiana Corn and Soybean Innovation Center (ICSC)

Dial 911 for Red Light Emergency

Facility Address:
Indiana Corn and Soybean Innovation Center (ICSC)
Agronomy Center for Research and Education (ACRE)
4750 US Hwy 52 West
West Lafayette, IN 47906

If you're not sure, you can call Purdue Police non-emergency number and tell them the problem 494-8221.

Jason Adams, Facility Manager
Office: 494-2007
Cell: 765-491-1264

Purdue Dept. of Radiological & Environmental Management, REM (Safety and spills): 494-6371

For a serious problem with the building that you can't contact Jason about, call Purdue Police non-emergency number 494-8221. They will page a maintenance person who is on-call.
ICSC Standard Operating Procedures (SOP)

TABLE OF CONTENTS

GENERAL FACILITY PROCEDURES
- RESERVING EQUIPMENT ................................................. F001
- CAMFIL DUST COLLECTOR FILTERS .................................... F002
- OUTSIDE COLLECTION BINS ........................................... F003
- PHENOMICS VACUUM SYSTEM ......................................... F004
- HIGH BAY RADIANT HEAT ................................................ F005

TRANSPORTATION/MOVING
- FORKLIFT ........................................................................ T001
- WALKIE STACKER .......................................................... T002
- PALLET JACK ................................................................. T003

DRYING AND STORAGE
- BULK DRYING .................................................................. DS001
- POST HARVEST STORAGE ............................................... DS002
- WISCONSIN OVENS ....................................................... DS003

THRESHING AND SHELLING
- ALMACO TRUNKLINE ..................................................... TS001
- ALMACO MAIZER ............................................................ TS002
- ALMACO BT-14 SOYBEAN THRESHER .............................. TS003
- AGRICULEX SINGLE EAR SHELLER ................................. TS004
- ALMACO HEAD THRESHER ............................................... TS005
- ALMACO DOWN DRAFT TABLE ......................................... TS006

CLEANING
- ROOT WASHING STATIONS ............................................ C001
- CARTER DAY ASPERATOR ............................................... C002
- SEED SHAKER ............................................................... C003
- ALMACO SEED BED CLEANER ........................................ C004
ICSC Standard Operating Procedures (SOP)

TABLE OF CONTENTS

COUNTING/TREATING

<table>
<thead>
<tr>
<th>AGRICULEX SEED COUNTER</th>
<th>CT001</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNTER/COLOR AND SHAPE SORTER</td>
<td>CT002</td>
</tr>
<tr>
<td>OLD MILL SEED COUNTER</td>
<td>CT003</td>
</tr>
<tr>
<td>SEED TREATER</td>
<td>CT004</td>
</tr>
</tbody>
</table>

GRINDING

| LARGE SEED AND PLANT GRINDERS | G001 |
| UDY GRINDERS | G002 |

MEASURING

| SCALES | M001 |
| PHENO ROVER | M002 |
| DICKEY JOHN | M003 |
| EAR PHOTPMETRY | M004 |
| ROOT SCANNER | M005 |
| LEAF AREA INDEXER (LAI) | M006 |
| MOBILE SEED LAB | M007 |
| NIR | M008 |
| 3D SCANNER | M009 |

PRINTING

| PACKET PRINTER | P001 |
| STAKE PRINTER | P002 |
| 3D PRINTER | P003 |
Standard Operating Procedure – Reserving Equipment

1. Purpose
The purpose of this SOP is to give instruction on how to reserve certain pieces of equipment at the Innovation Center.

2. Scope
Anyone who may need to reserve equipment in the Innovation Center.

3. Prerequisites
Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. Responsibilities
PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. Safety Concerns

- none

6. Procedure

1. You will first need to be trained on ICSC safety procedures as well as equipment specific procedures
2. After completion of all training procedures. The facility manager will send an email outlining the steps to set up iLabs. Which is the platform for reserving equipment

To register for an account:
To get started, you must register for an account:

Documents: SOP short-form
To Create an Equipment Reservation:
Once you have been accepted into your PI’s lab and assigned account string, you can schedule equipment time.

1. Navigate to the core page:  
   https://purdue.ilabsolutions.com/service_center/show_external/4110
2. At the upper right hand of the page where it says, ‘Welcome Purdue user, click here to log in or register,’ select **click here**.
3. Enter your Career Account and password, and sign in.
4. Select the **Schedule Equipment** tab and click on the ‘View Schedule’ button next to the instrument of interest. Click and drag on the time frame you would like to schedule your reservation for.
5. A window will pop up that will allow you to verify your reservations details and provide payment information before saving the reservation.

To Create a Service Request:
Once you have been accepted into your PI’s lab and assigned Account String, you can create service requests.

1. Navigate to the core page:  
   https://purdue.ilabsolutions.com/service_center/show_external/4110
2. At the upper right hand of the page where it says, ‘Welcome Purdue user, click here to login or register,’ select **click here**.
3. Enter your Career Account and password, and sign in.
4. Select the *Request Services* tab and click on the ‘Request Service’ button next to the service of interest.
5. You will be asked to complete a form before submitting the request to the core.
6. Your request will be pending review by the core. The core will review your request and either Agree to the work or they will ask for more information if needed.

**Starting the Equipment once it is reserved:**
1. When you are ready to start your equipment after you reserve it. Go back to the home page for ICSC in iLabs.
2. Click on the Kiosk Link.
   a. This can be done from any computer at ICSC or your computer. There is not an app to do this but the website may be accessed from any device to start the machine.
3. Once you click on the Kiosk, you should see the equipment that you have reserved with a green start button.
4. Press start and this will power up your machine.
5. When you are done working return to the Kiosk page and press finished on your machine

7. **References**

Please watch the instructional video or see Innovation Center Facility manager.

8. **Definitions**

- **ACRE** – Agronomy Center for Research and Education
- **PI** – Principal Investigator
- **Seed Counter** – A piece of equipment used for counting seed
- **SOP** – Standard Operating Procedure

Documents: SOP short-form
Standard Operating Procedure – Camfil Dust Collector Filters

1. **Purpose**

The purpose of this SOP is to give instruction on how to change the Camfil Dust Collector Filters at the Innovation Center.

2. **Scope**

For those qualified to change the filters.

3. **Prerequisites**

Must be knowledgeable enough with the Camfil dust collectors to change the filters.

4. **Responsibilities**

Innovation Facility staff facility staff, farm staff, Purdue Building Maintenance personnel

5. **Safety Concerns**

- Falls
- dust
- Pinch points
- Electrical shock
- Compressed air

6. **Procedure**

1. Disconnect electrical power to the fan and control box. Disconnect compressed air service from the compressed air header. Bleed all air from
the air header. Perform an OSHA approved LOTO procedure on these or any other energy source.

2. Open the access door at the front of the unit, swinging it out of the way.

3. Rotate the left side clamp bar counter clockwise and pull toward you until it clears the clamp bar clockwise until it resets on the bottom of the HEPA filter module.

4. Rotate the right side clamp bar clockwise and pull toward you until it clears the clamp bar latch bracket. Then rotate the clamp bar counter clockwise until it rests on the bottom of the HEPA filter module.

5. Pull the first filter out by sliding it off the clamp bar tubes.

6. Pull the second filter out.

7. If the dust collector is equipped with filters behind the front filters. First remove the front filters as mentioned above. Then use the long handled tool attached to the dust collector to reach the other filters.

8. Remove a new filter from the shipping carton, taking care not to cut or otherwise damage the filter. With the gasket side up, place the bottom edge of the filter on the clamp bar tubes. Push the filter in until it reaches the filter stop at the end of the clamp bar tube.

9. Slide the filter spacer onto the clamp bars, the “tag” must be down (if equipped).

10. Install the second filter, push the filter in until the spacer is tight against the back filter and the front filter is tight against the spacer.

11. To seal the filters, repeat steps 2 and 3 in reverse order. Visually check the gasket to make sure it is compressed when the clamp bars are latched.

7. **Lockout Tagout Procedures**

The electrical lock out is done at the front panel of the individual dust collection unit. Turn the large red switch counter clockwise to disconnect the power then place your lock on the switch. The shut off to the compressed air is located near the gutter by the dust collectors. Or on the north wall of ICSC just behind the exterior threshing line.
8. **References**

Please see Innovation Center Facility manager for instructions or owner’s manual.

9. **Definitions**

ACRE – Agronomy Center for Research and Education

LOTO – Lockout Tagout. The act of locking a machine or device so it may not be energized during maintenance

SOP – Standard Operating Procedure
Standard Operating Procedure – Outside Collection Bins

1. Purpose
The purpose of this SOP is to give instruction on how to empty the large dust and ground plant material bins at the Innovation Center.

2. Scope
For those needing to empty the large bins. The preferred method would be to contact the facility manager. If that is not an option. Any Purdue forklift trained operator may empty the bins.

3. Prerequisites
Must be Purdue forklift certified.

4. Responsibilities
PIs, Technicians, grad students, undergrads, faculty, farm staff, university employees.

5. Safety Concerns
- Pinch points
- Falling Bin from forklift
- Heavy Lifting

6. Procedure
1. Shut the dust collector hopper by pushing in the long black handle on the bottom of the dust collector cone. This prevents debris from coming out while bin is being rolled away and the dust collector will remain operational for a small amount of time while bin is being emptied.
2. Remove the connecting tube by releasing the large gray snap ring.
3. Use the three small chains to hold up the connecting tube.
4. Use forklift to pull dump bin away from dust collector. Do not use Walkie Stacker.
5. Release the two large binders and open the lid to the dump hopper.
6. Use the large chain to hold the dump hopper lid open.
7. Release the safety latch at the back of the bin.
8. Pick up the dump hopper with the forklift from behind the dump hopper.
9. Lift the dump hopper over the large roll of trash bin.
10. Either release the rocking mechanism by pulling on the cable or by lightly tapping the paddle on the front of the dump hopper to the roll of dumpster.
11. After the bin has been emptied, place it back on the ground.
12. Manually roll bin back into upright position.
13. Latch the back safety latch.
14. Latch the two large lid binders.
15. Place the bin back under the dust collector.
16. Un-hook the changes and snap the tube back in place.
17. Open the hatch by pulling the black handle back out.

7. References

Please see Innovation Center manager for instructions.

8. Definitions

ACRE – Agronomy Center for Research and Education
SOP – Standard Operating Procedure
Standard Operating Procedure – Phenomics Vacuum System

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Vacuum System at the Innovation Center.

2. **Scope**

Anyone who has a need to run the vacuums.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- none

6. **Procedure**

1. The central vacuums are located in rooms 1168 and 1136.
2. Retrieve the vacuum lines from the wall mount
3. Obtain the desired attachment from the accessory basket
4. Hook the hose to one of the vacuum ports
5. Turn the green “Systems on Button” Located on the wall
6. Proceed to vacuum
7. When complete press the red “Systems off” button
8. Return the hose and accessories to the wall brackets

Documents: SOP short-form
7. **Lockout Tag out Procedure**

1. Obtain key to the vacuum cage form the facility manager
2. Locate the blue switch on the main vacuum electrical panel located outside under the back porch
3. Place appropriate lock and tag the device

8. **References**

Please see Innovation Center manager for instructions or access to the owner’s manual.

9. **Definitions**

ACRE – Agronomy Center for Research and Education

LOTO – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance

PI – Principal Investigator

SOP – Standard Operating Procedure
Standard Operating Procedure – High Bay Radiant Heat

1. Purpose

The purpose of this SOP is to give instruction on how to run the high bay radiant heat at the Innovation Center.

2. Scope

Anyone who may need to operate the high bay radiant heat in the Innovation Center.

3. Prerequisites

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. Responsibilities

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. Safety Concerns

- none

6. Procedure

1. There are 8 different radiant heating units in the Highbay room of ICSC
2. Each unit is run independently with its own timer
3. To operate locate the timer that is near the heater mounted on the large steel beam
4. Turn the dial to desired length of time. 30 minutes max.
5. The heater will turn off automatically at the end of the set time

Documents: SOP short-form
6. Repeat the steps to turn it on again

7. **References**

   Please watch the instructional video or see Innovation Center Facility manager for instructions or access to the owner's manual

8. **Definitions**

   - **ACRE** – Agronomy Center for Research and Education
   - **High Bay** – The tall part of the Innovation Center used to work on UAVs and the Phenomobile or other field sensors
   - **PI** – Principal Investigator
   - **Seed Counter** – A piece of equipment used for counting seed
   - **SOP** – Standard Operating Procedure
Standard Operating Procedure – Forklift

1. Purpose
The purpose of this SOP is to give instruction on how to start and operate the ACRE/Innovation Center facility forklift safely.

2. Scope
Anyone who has a need and is Purdue trained and licensed to run a Forklift. The only room at the Innovation Center facility that the forklift is allowed in is the high bay and the hard surfaces surrounding the building.

3. Prerequisites
Must be Purdue forklift certified to use the forklift at ACRE or the Innovation Center facility. Also, must go through Innovation Center facility guidelines and watch facility safety and procedural videos online.

4. Responsibilities
- Supervisors
  - Ensure that all employees under their direction who are designated to operate a forklift are trained, evaluated, and certified prior to operation of the equipment. Ensure that certification is kept current (e.g., re-evaluation/driving test and refresher training, as applicable) and notify REM of employees who are no longer employed with their department or whose job has changed and are no longer assigned to operate a forklift as part of their duties. Notify REM of accidents and near misses involving forklift operation. Ensure that forklifts and attachments are appropriate for the use conditions and maintained in safe operating condition. Immediately remove defective equipment from service until repaired or replaced. To the extent feasible, reduce operational hazards presented by the use location and loads.
- Employees

Documents: SOP short-form
Complete all components of training at the required intervals. Complete classroom and hands-on training, and demonstration of competency in operation. Conduct pre-operational inspections prior to start of each shift. Do not operate a forklift that does not successfully pass the pre-operational checklist. Immediately stop operating any defective forklift or attachment and report the situation to the supervisor. Read the manufacturer’s operations manual. Observe all precautions discussed in training and the recommendations of the manufacturer of the forklift.

5. Safety Concerns

- Pinch points
- Running over feet
- Falling bins, pallets
- Tipping
- Running into objects, people
- Overhead clearance
- Getting stuck in soft surfaces

6. Procedure

Before Operation

1. Only trained personnel with current authorization are allowed to operate Forklifts. Authorization requires successful completion of initial classroom training, hands-on work-area specific training (practical), and a driving test (evaluation).
2. Passengers are not permitted on or in the forklift or load.
3. Daily visual inspection must be made to ensure that the horn, lights, brakes, tires, gas supply, hydraulic lines, etc. are in safe working condition. Employees may not operate an unsafe forklift at any time.
4. Fill fuel tanks out of doors while the engine is off.
5. Operators must wear seatbelts

Picking up a load
6. Do not exceed the safe load capacity of a forklift at any time. Do not counterweight a forklift to increase its lifting capacity.
7. Forks should always be placed under the load as far as possible. Do not lift a load with one fork.
8. No load should be moved unless it is absolutely safe and secure.
9. When unloading trucks or trailers, the brakes on the vehicle must be set (locked) and the wheels chocked.
10. No person is permitted to stand or walk under elevated forks.

Moving the load

11. The operator's view should not be obstructed by the load. In the event of a high load, the forklift should be driven in reverse.
12. Operators must look in the direction of travel.
13. The forks should not be operated while the forklift is traveling.
14. When the forklift is not carrying a load, the operator must travel with the forks as low as possible (maximum of 4 inches on paved surfaces). When carrying a load, it should be carried as low as possible (consistent with safe operation, 3 to 12 inches above the surface).
15. On a downgrade, the forklift should be driven in reverse, and the forks raised only enough to clear the surface.
16. On an upgrade, the forklift must be driven in the forward direction, following the load, and the forks raised only enough to clear the surface.
17. Use extra care when handling long lengths of bar stock, pipe, or other materials.
18. Avoid sharp or fast end-swings.
19. Operators should avoid making jerky starts, quick turns, or sudden stops. The operator is not permitted to use reverse as a brake.
20. Forklifts should be driven on the right side of the road or aisle-way.
21. Forklifts must be operated at a safe speed with due regard for traffic and conditions.
22. Slow down on wet and slippery surfaces and at cross aisles or locations where vision is obstructed.
23. Operators entering a building or nearing a blind corner must make their approach at reduced speed, sound the horn, and proceed carefully.
24. Operators must give pedestrians the right-of-way at all times.
25. Operators must not drive toward any person who is in front of a fixed object or wall.
26. Operators should not put their fingers, arms, or legs between the uprights of the mast, or beyond the contour of the forklift.
27. Operators must drive with both hands on the steering wheel. Horseplay is prohibited. Do not drive with wet or greasy hands.
28. No person is permitted to ride as a passenger on a forklift or on the load being carried.

Parking

29. Forklifts must be safely parked when not in use. The controls must be neutralized, power shut off, brakes set, key removed, and the forks secured in a lowest position, flat on the surface, and not obstructing walkways or aisles.
30. A forklift may not be left on an incline
31. Forklifts may not be parked in areas that will block exits, stairways, fire extinguishers or any other emergency equipment

7. **Lockout Tag out Procedures**

1. Set parking break
2. Remove the key

8. **References**

Please see Innovation Center Facility manager for assistance or access to the owner’s manual

9. **Definitions**

ACRE – Agronomy Center for Research and Education

**LOTO** – Lockout Tagout. The act of locking a machine or device so it may not be energized during maintenance

PI – Principal Investigator

SOP – Standard Operating Procedure

Documents: SOP short-form
1. **Purpose**

The purpose of this SOP is to give instruction on how to start, operate and charge the Walkie Stacker at the Innovation Center.

2. **Scope**

Anyone who has a need and is Purdue trained and licensed to run a Forklift or Walkie Stacker. The Walkie Stacker is only to be used in the ICSC Facility receiving room, the high bay and the hard surfaces to the north of the facility. It should not be operated in any other room within the facility.

3. **Prerequisites**

Must be Purdue certified to use the Walkie Stacker. Also, must go through Phenomics facility guidelines and watch facility safety and procedural videos online.

4. **Users**

PIs, Technicians, grad students, undergrads, faculty, university employees and farm staff.

5. **Safety Concerns**

- Pinch points
- Running over feet, being struck by Walkie Stacker
- Falling bins, pallets
- Running into people, building, objects, vehicles
- Falls and tip overs
- Battery explosions

Documents: SOP short-form
6. **Operating Procedure**

1. Perform a general walk around to determine if Walkie Stacker is in good working order. Check the following items:
   a. Battery is charged
   b. Wheels are in good condition
   c. Check both forks to see if they are worn, bent or broken
   d. Inspect lift chains for damage
   e. Check load backrest is in place and secure
   f. Look under truck for hydraulic leaks
   g. Test the horn
   h. Check that all control levels work smoothly

2. If at any time you see a defect or have a concern, contact the ICSC facility manager.

3. Turn the truck on by placing the control handle vertical and turning the key ON (green dot).

4. Braking: Move the control handle all the way down or all the way up to apply the brake (see Brake Zone Label). When you let go of the control handle it will automatically go to the upper braking zone.

5. To Raise: Push the Raise Button and release when the forks are at the desired height.

6. To Lower: Push the lower button all the way for fast lowering. Push the button part of the way for slower lowering speed. Release the button when the forks at the desired height.

7. To Tilt: Push the top of the Tilt switch to tilt the tip of the forks up; Push the bottom of the Tilt switch to tilt the tip of the forks down.

8. To Reach: Push of the Reach switch to extend the forks. Push the bottom of the switch to retract the forks.

9. Load: Make sure the load is secure, level and not too heavy for the Walkie Stacker to handle

10. Steer the truck in the direction you want to go by moving the control handle from side to side.

11. Travel: Move either Forward/Reverse Rocker in the direction you want to move. The farther you move the rocker from the neutral position, the faster the truck will move. For high travel speed, turn the travel speed switch to the high speed position ( ), and move either the Forward/Reverse Rocker to the maximum travel speed position.

12. When operating the Walkie Stacker in the forward position the recommended walking area is directly behind the control handle. While the
Walkie Stacker is traveling in the reverse direction the recommended walking area is directly to the right or left of the walkie stacker to prevent being run over by the Walkie Stacker.

13. Plugging: This is another way to slow or stop the Walkie Stacker. While the truck is in motion in either direction, move the Forward/Reverse rocker to the opposite direction that you are traveling. Plugging will not hurt the Walkie Stacker.

14. Reversing Button: The reversing button is located at the end of the control handle. If you accidentally hit the reversing button while working in close quarters, the truck will move in the direction of the forks until the button is released. The reversing button cannot prevent all injuries.

15. Horn: Push the switch on the underside of either grip to sound the horn. Use the horn to warn pedestrians and other drivers. Use your horn when you come to an intersection or cross walk.

16. Charging: When the Battery Charge Display is showing a yellow light it is time to charge the Walkie Stacker. Park the Walkie Stacker in the designated spot in the receiving room. Turn the Walkie Stacker off. Do not disconnect the battery. Open the battery access panel on top of the Walkie Stacker. Use the provided extension cord. Plug one end of the cord into the charging socket in the battery compartment. Plug the other end into the AC outlet.

17. Charging Light Status:
   a. Steady Yellow Light: If the light does not come on, or goes out, make sure the AC outlet is working and the extension cord is OK.
   b. Flashing Yellow Light: Means the something is wrong with the battery or the charger. Notify ICSC manager.
   c. Flashing Green Light: Means the charger is working.
   d. Steady Green Light: Means charger is finished

7. **Lockout Tag Out Procedures**

   1. Remove Key, then place the key in LOTO box
   2. Place lock on LOTO box
   3. Fill out LOTO tag and report to Facility Manager
   4. To remove LOTO. Unlock the box and place the key back in the Walkie Stacker

Documents: SOP short-form
8. References

Please see Phonemics Facility manager for assistance or access to the owner’s manual

9. Definitions

ACRE – Agronomy Center for Research and Education
LOTO – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance
PI – Principal Investigator
SOP – Standard Operating Procedure
Walkie-Stacker – Battery powered walk behind pallet jack with the capabilities to stack bins or pallets on shelves
Standard Operating Procedure – Pallet JACKS

1. Purpose

The purpose of this SOP is to give instruction on how to operate a Pallet Jack at the Innovation Center.

2. Scope

Anyone who has a need to move pallets, bins or skids at the Innovation Center. Please do not use Pallet Jacks in the long hallway of the facility to prevent any damage to the floors or glass walls.

3. Prerequisites

Must go through Innovation Centers guidelines and watch facility safety and procedural videos online.

4. Responsibilities

PIs, Technicians, grad students, undergrads, faculty, farm staff, university employees.

5. Safety Concerns

• Pinch points
• Running over feet
• Running into something

6. Procedure

1. Place forks of the pallet jack into position under or in the pallet or bin.
2. Lift the load by pushing the lever under the handle down or in the forward position. Then pump the handle until the load is lifted of the floor.
3. To travel with the load place the lever in the middle or neutral position. Then either push or pull the load to desired location.
4. To lower the load pull the lever up toward the handle until the load has lowered to the floor.
5. Pull pallet jack from under the load.

Documents: SOP short-form
7. References

Please see Innovation Centers manager for assistance or access to the owner’s manual.

8. Definitions

PI – Principal Investigator
SOP – Standard Operating Procedure
Pallet Jack – Manual powered equipment for lifting pallets or bins of the ground and moving them around.
Standard Operating Procedure - Bulk Dryer

1. **Purpose**

   The purpose of this SOP is to give instruction on how to load, log and operate the large bin dryers at the ACRE facility.

2. **Scope**

   Anyone who has a need to dry plant or seed material and is forklift licensed at Purdue University. The bins must be loaded in a way that encourages airflow. Meshed bags work better for airflow than paper bags.

3. **Prerequisites**

   Must be forklift certified to load the bins on the dryers.

4. **Responsibilities**

   PIs, Technicians, grad students, faculty, farm staff.

5. **Safety Concerns**

   - Falling lids
   - Falling drying bins
   - Pinch points

6. **Procedure**

   1. Contact Jason Adams at ICSC to turn on the dryers if they are not already running 765-494-2007
   2. Label white drying bin with project owner and date the bin was placed on dryer with duct tape located in mailbox next to the dryers
   3. Determine which dryers you want to use
a. 140°F for Plant material  
b. 90°F for seed

4. Remove bin cover from the dryer.

5. Carefully place the bin onto the dryer making sure it is completely nested on the dryer.
   a. Never place the bins more than three high on the dryer.
   b. It is best to place newer/wetter material on top of multiple staked bins. If you place wetter material on the bottom and dryer material on top. The moisture from the bottom will be forced through the dryer bins on top.

6. Replace bin cover

7. On the backside of the dryer, make sure the vents are open. By turning the wheeled crank.
   a. Please make sure the vents are open for at least two of the bin bays while dryer is running. This prevents excessive airflow backup into the blower fans.

8. If you are taking the last bin off the dryer then please contact Jason Adams to turn off the dryer 765-494-2007

9. Return all bay covers when you are done and close the vents in the back.

7 Lockout Tag out Procedures

1. Locate the blade switch associated with that dryer.
2. Turn blade switch off and place your lock ant tag on
3. Locate the shutoff for the gas
4. Turn the gas off and lock and tag the gas
5. Once work is completed remove the locks
6. Remove the lock on the gas and turn on the gas
7. Remove the lock from the blade switch and turn on the power

8. References

Please see Phonemics Facility manager or ACRE staff with any questions.

9. Definitions

ACRE – Agronomy Center for Research and Education
ICSC – Indiana Corn and Soybean Innovation Center

Documents: SOP short-form
**Bulk Dryer**
Agronomy Department
ACRE
Innovation Center

<table>
<thead>
<tr>
<th>SOP #</th>
<th>ICSC DS001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revision #</td>
<td>1</td>
</tr>
<tr>
<td>Implementation Date</td>
<td>6/22/16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Page #</th>
<th>3 of 3</th>
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<td>Author</td>
<td>Jason Adams</td>
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**Drying Bins** – Large white metal containers. Some are labeled AEC

PI – Principal Investigator

SOP – Standard Operating Procedure
Standard Operating Procedure - Post-Harvest Storage in East Shed

1. **Purpose**

The purpose of this SOP is to give instruction on how to store large plastic bins and other research material in building 57 at the ACRE campus.

2. **Scope**

Anyone who has a need to store post-harvest seed or plant material at ACRE.

3. **Prerequisites**

If you will be moving bins around with a forklift than you must be trained and certified by Purdue to operate a forklift. Bins may be moved around in the East Shed by using a pallet jack if stacking of bins is not necessary.

4. **Responsibilities**

PIs, Technicians, grad students, faculty, farm staff. When you are done with the bins it is your responsibility to clean them out for the next user. Empty bins are stored in the East Shed.

5. **Safety Concerns**

- Crush hazard
- Falling bins

6. **Procedure**

1. Place plant or seed into large 48in x 45in plastic bins or on the wooded drying racks
   a. Do not fill past the top of the bins to prevent your material from being crushed when stacked
2. Label each bin with the owners name and date at a minimum.
3. Place bins in any available section in the east shed.

Documents: SOP short-form
a. Keep bins between the lines to be able to access the bins from all sides
4. You may place bins 2 wide between the lines
5. Do not stack bins more than 4 high. Less if the bins are heavy.
   a. When staking make sure the bins are nested properly and evenly around all sides of the bins.
6. Try to place only material from one PI in a section. This will help with keeping material sorted later
   a. If you fill a particular section then proceed to the next available section

7. References

Please see Phonemics Facility manager or ACRE staff with any questions

8. Definitions

East Shed – Building number XX located just east of the bulk dryers
PI – Principle Investigator
SOP – Standard Operating Procedure
Standard Operating Procedure – Wisconsin Oven

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Wisconsin ovens at the Innovation Center.

2. **Scope**

Anyone who has a need to dry plant or seed material.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Burns
- Pinch points

6. **Procedure**

**Start Up**

1. Place the Main Disconnect switch “ON”.
2. Make sure the “Blower(s) Stop/Emergency Manual Off” button is pulled out.
3. Place the “Control Power” selector switch to the “ON” position. The “Control Power” light will be lit.

Documents: SOP short-form
4. Push the “Alarm Silence/Reset” button.
5. Push the “Blowers(s) start” button.
6. The “Safe Guards Met” light will be lit.
7. Adjust temperature controller to desired setting.
8. Place the “Heat” selector switch to “On” position. The “Heat On” light will be lit.
9. When the process timer is in the “Alarm” position, the “Process Complete” light will turn on and the horn will sound. When the process timer is in the “Shutdown” position, the “Process Complete” light will turn on and the oven will shut down.

**Shut Down**

1. Place the “Heat” selector switch to the “Off” position.
2. Allow the blower to run until the oven cools to below 200°F/93°C.
4. Push the “Alarm Silencer/Reset” button.
5. Place the Control Power Switch “Off”.
6. Place the Main Disconnect switch “Off”.

**Process Timer**

Turn the (3) position switch to one of the following modes.

**OFF**

1. Start up the oven according to the startup instructions.
2. Shutdown the oven according to the shutdown instructions.

**Process Alarm**

1. Place load in oven.
2. Select the amount of process time required for your product and set the timer accordingly.
3. Adjust the temperature controller to the desired setting.
4. When the temperature in the oven has reached the point temperature, the process timer will start timing.
5. When the process timer times out, the alarm will sound. The oven heat will continue to stay on.
6. To restart the timer, turn the selector switch momentarily to the “Off” position.

**Shutdown**

1. Place load in oven.
2. Select the amount of process time required for your product and set the timer accordingly.
3. Adjust the temperature controller to the desired setting.
4. When the temperature in the oven has reached the set point temperature, the process timer will start timing.
5. When the process timer times out, the heat will shut off.
6. After the heats shuts off and the oven begins to cool (when oven cools to 150°F) the circulation blower will shut down.
7. To restart the timer, turn the selector switch momentarily to the “Off” position.

**Removal of shelving**

1. Pull the shelving out until it reached the safety latch on the right side of the railing
2. Reach in and flip the safety latch up
3. Temporally store the shelving on the side of dryer A or behind dryer B

**7. Lockout Tag out Procedures**

1. Each oven has a blade switch to lock out the oven flip the associated blade switch to off.
2. Place your lock and tag on the blade switch.
3. Test to see if the oven will come on
4. Perform your work
5. When work is complete, remove locks and tags
6. Turn the blade switch back on

**8. References**

Please see Innovation Center Facility manager for instructions or owner’s manual.

Documents: SOP short-form
9. Definitions

ACRE – Agronomy Center for Research and Education

LOCKOUT – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance

PI – Principal Investigator

SOP – Standard Operating Procedure
Standard Operating Procedure – Almaco Trunk line

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Almaco Trunk Line at the Innovation Center.

2. **Scope**

Anyone who may need to run plant material through the Threshing and Shelling Room.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online. ICSC 101 and ICSC 140, 150, 160, 170 or 180 depending on the crop you will be processing.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Pinch points
- Hearing protection
- Eye protection

6. **Procedure**

Start Up

1. In the Threshing and Shelling room go to the **Threshing Line Control Panel**. Located on the large gray box on the north wall.

Documents: SOP short-form
2. Navigate to the Main Screen. Then start the line by touching the Auto Start up Screen in the lower left of the display.
   a. Hit Start. This will start the Grinder, inside conveyer and Dust Collector C.
3. Next, determine what station you are working at. If the station is labeled with an “A” then you will need to turn on dust collection “A”. If the station is labeled with a “B” then you will need to turn on dust collection “B”. If you are working outside you will only need to turn on the outside conveyer.
4. To turn on the individual dust collectors or outside conveyer. Return to the Main Screen by touching Goto Main Screen in the lower right corner.
5. Then touch Goto Equip Screen. This will take you to the Equipment Overview screen.
6. To start either “A” or “B” dust collector touch Start up Dust Collector button. Then start either dust collector “A” or “B”. Whichever one is needed to run your work Station.
7. If you will be working, outside and need to start the outside conveyer return to the Equipment Overview screen. Then touch the Start up Grinder & Conv button. Then press Outside Conveyer Start.
8. To shut down the threshing and shelling line. Return to the Main Screen by touching GOTO Main Screen button
10. Then Press Stop.
11. NEVER RUN IN MAINTENANCE Mode

E-Stops
   If at any time, the E-Stops are used to turn equipment off. (These are the large red push buttons all around the equipment). The following steps will need to be done to get the equipment functional again.
1. Determine which E-Stop was engaged by either one of these two ways.
   a. Walking around and seeing which one has the red indicator light on the button. Then to disengage, push down and turn clockwise.
   b. Or on the Threshing Line Control Panel. Navigate to the Main Screen.
      i. Touch Goto Estop Screen
      ii. Navigate to either the Station Estop Screen button or the Equip Estop button. In either screen if the dot next to the station or equipment is colored in black. Then that signifies that that Estop has been engaged. You will then need to go
to that Estop and disengage it by pushing down and turning clockwise.

2. Then on the Threshing Line Control Panel. Press the red Emergency Stop Reset button to the left of the touch display.

3. The final step to reset the Estops will be to go outside to the large dust collectors on the north side of the building. You will need to look at each dust collector and make sure the Control Power On button is on. If the green indicator light on that button is not lit then press the button until the green light comes on.

7. **Lockout Tagout Procedure**

1. Place one lock on the throw off switch on the Threshing Line Control Panel.
2. Place one lock on either or both of the airlines to the east of the Threshing Line Control Panel.
3. Perform maintenance
4. To turn the equipment back on remove the locks and tags on the air lines
5. Remove the locks and tags on the throw switch
6. Turn the air and electricity back on

8. **References**

Please see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

ACRE – Agronomy Center for Research and Education

Almaco Trunk Line – This is the piece of equipment in the Threshing and shelling room that all the threshing and shelling components dock up to. It is used to transport waste material away from the thresher and shellers and conveying dust out of the room. The plant waste plant material is then ground up and the dust will go to the filters.

Documents: SOP short-form
LOTO – Lockout Tagout. The act of locking a machine or device so it may not be energized during maintenance

PI – Principal Investigator
SOP – Standard Operating Procedure
Standard Operating Procedure – Almaco Maizer

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Almaco Maizer at the Innovation Center.

2. **Scope**

Anyone who may need to shell multiple ears of corn through a sheller in the Threshing and Shelling Room.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Pinch points
- Hearing protection
- Eye protection

6. **Procedure**

1. You will want to confirm that the screens in the Seed Boss are the appropriate screens for the product you are cleaning. If the screens need
to be changed. Please find the facility manager or exchange them with a small Allen Wrench.

2. Start the Trunk line and Dust Collection System. Please refer to SOP TS001.

3. Start the Maizer by pressing the black button at the front of the Maizer.

4. Start the Air Transfer fan by pressing the black button under the transfer conveyor.

5. Start up the conveyor by pressing the green button on the side of the conveyor.

6. Start up the Seed Boss by pressing the green button toward the back of the Seed Boss.

7. Feed ears into the front of the Maizer either by using the bulk shoot at the lower front of the Maizer. Or by feeding them in one at a time through the plexi-glass access panel toward the top of the Maizer. Never place your hands past the red line.

8. To transfer the shelled grain to the Seed Boss. Throw the lever on the back of the Seed Boss to the “Transfer” position.

9. After the grain has transferred, throw the lever to the “Dump” position.

10. Clean grain will transfer to the bucket to the side of the Maizer. The Dirty or miss-sized material will go to the bucket at the end of the Seed Boss.

11. To turn everything off just hit the Stop buttons on each of the four components.

7. **Lockout Tagout Procedures**

This is a description on how to LOTO the MAIZER, blower, conveyor and Seed Boss. You may lock out one or all these pieces of equipment as needed.

1. Place a plug cover on the MAIZER, then lock and tag it.

2. Place a plug cover on the blower, then lock and tag it.

3. Place a plug cover on the conveyor, then lock and tag it.

4. Place a plug cover on the Seed Boss, then lock and tag it.

5. Place a lock and tag on the pneumatic toggle switch on the transfer switch on the Seed Boss.

6. Tyr to energize the equipment.

7. Perform maintenance.

8. Remove lock on the pneumatic switch on the Seed Boss.

9. Remove the lock on the conveyor.
10. Remove the lock on the blower.
11. Remove the lock on the MAIZER.

8. References

Please see Innovation Center manager for instructions or owner’s manual.

9. Definitions

ACRE – Agronomy Center for Research and Education
Almaco Maizer – This is the piece of equipment in the Threshing and shelling room that is used to shell bulk ears of corn. It may be attached to a gravity table for cleaning seed and the cobs will be conveyed to the trunk line.
Alamco Seed Boss – This piece of equipment is used to clean and size grain.
LOTO – Lockout Tagout. The act of locking a machine or device so it may not be energized during maintenance
PI – Principal Investigator
SOP – Standard Operating Procedure
Standard Operating Procedure – Almaco BT-14 Soybean, Sorghum and Small Grain Thresher

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Almaco BT-14 Thresher at the Innovation Center.

2. **Scope**

Anyone who may need to thresh single soybean plants, sorghum heads or small grains through a thresher in the Threshing and Shelling Room.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Pinch points
- Hearing protection
- Eye protection

6. **Procedure**

1. Dock the thresher to the truck line.
2. Start up the trunk line and dust collection system. Please refer to SOP TS001.

Documents: SOP short-form
3. Turn on thresher
4. Place plant into thresher. If plant material is Soybean than insert the plant with the top of the plant going in first
5. The seed will drop to the collection basin at the bottom of the thresher. Clean out any large debris if necessary
6. Using the foot pedal. Transfer the seed to the aspirator.
7. Press on the actuator gate to release the seed into your container.
8. If you are getting splits in the soybeans or not enough of the seeds being shelled from the pods. Then ask the facility manager to help adjust the belt tension.
9. If you are getting too much debris in your sample or think you are losing too much seed out the conveyor. Then see the facility manager to adjust the winnowing fan speed.

7. **Lockout and Tagout Procedures**

1. Unplug the thresher
2. Obtain a lock from the LOTO kit by the thresher and sheller control panel
3. Place a plug cover over the electrical plug and use a padlock to lock the cover
4. Fill out the tag and zip tie it to the lock.
5. Try to energize the equipment.
6. Report to the facility manager that you have locked out a piece of equipment.
7. To unlock, remove the lock and tag.

8. **References**

Please see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

**ACRE** – Agronomy Center for Research and Education

**Almaco Bt-14 Thresher** – This is the piece of equipment in the Threshing and shelling room that is used to thresh single soybean plants or small grain heads

Documents: SOP short-form
LOTO – Lockout Tagout. The act of locking a machine or device so it may not be energized during maintenance
PI – Principal Investigator
SOP – Standard Operating Procedure
Standard Operating Procedure – Agriculex Single Ear Sheller

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Agriculex Single Ear Sheller at the Innovation Center.

2. **Scope**

Anyone who may need to shell single ears of corn in the Threshing and Shelling Room.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Pinch points
- Hearing protection
- Eye protection

6. **Procedure**

1. Turn on the main trunk line and the dust collector that corresponds to the station you are working at. Refer to SOP TS001
2. Turn on the sheller
3. Turn on the small conveyor if you will be discarding your cob
4. Place an ear into the sheller

Documents: SOP short-form
5. If you did not get all the kernels of the ear or the ear became lodged in the rollers. You can adjust the roller pressure by turning the roller gauge on the side of the sheller.

6. If you ever need to remove the side panels to clean out debris you must first unplug the machine.

7. The keys to open the panels are located on the end of the plug.

8. After the seed is shelled and falls into the funnel. Press the foot transfer pedal.

9. Adjust the air flow in the transfer line if there is too much or too little air to deliver the seed.

10. Remove seed from the actuator tube then proceed to the next sample.

11. After the day or job is complete, turn off the sheller and conveyor and clean the equipment and the surrounding area for spills.

7. **Lockout Tag out Procedure**

   1. Remove the plug form the power
   2. Place a plug cover over the plug
   3. Place the proper lock and tag on the cover
   4. Try to energize the sheller
   5. When the maintenance is complete. Remove the lock and tag

8. **References**

   Please see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

   **ACRE** – Agronomy Center for Research and Education

   **Agriculex Single Ear Corn Sheller** – This is the piece of equipment in the Threshing and shelling room that is used to shell single ears.

   **LOTO** – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance

   **PI** – Principal Investigator

Documents: SOP short-form
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<td>3 of 3</td>
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<td>Jason Adams</td>
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**SOP** – Standard Operating Procedure

**Documents:** SOP short-form
Standard Operating Procedure – Almaco Head Thresher

1. **Purpose**

   The purpose of this SOP is to give instruction on how to operate the Almaco Head Thresher at the Innovation Center.

2. **Scope**

   Anyone who may need to thresh sorghum or wheat heads in the Threshing and Shelling Room.

3. **Prerequisites**

   Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

   PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

   - Pinch points
   - Hearing protection
   - Eye protection

6. **Procedure**

   1. Turn on the main trunk line and the dust collector that corresponds to the station you are working at. Refer to SOP TS001
   2. Dock the thresher to the truck line.
   3. Plug thresher in.

Documents: SOP short-form
4. Turn on thresher.
5. Place head into the thresher.
   a. Do not place hand to deep into shoot. Make a fist while holding the stem to keep from putting your hand in to deep.
   b. Consider leaving a long stem on the head while harvesting
6. Use the white lever to the left of the threshing shoot to clean the threshing drum.
7. Use the compressed air lever to clean out any seeds that may have been held up.
8. Check the grate at the bottom of the unit to see if any large head parts fell down.
   a. If you are getting to much large material at the bottom, consider turning up the winnowing fan.
   b. If you are losing, too much seed consider turning down the air.
9. Use the foot pedal to run the seed through the aspirator.
   a. Use the air control knob on the clear tube to adjust the air pressure. You want just enough air to force the seed up but not too much that you lose too much seed.
10. Use the hand control lever at the bottom of the clear tube to empty the seed.
11. At the end of the day, use the compressed air to clean the machine.

7. **Lockout Tagout Procedures**

1. Remove the threshers plug from the power.
2. Place the plug cover over the plug.
3. Place the proper lock and tag on the cover.
4. Try to energize the Thresher
5. When the maintenance is complete, remove the lock and tag.

8. **References**

Please see Innovation Center manager for instructions or owner’s manual.

Documents: SOP short-form
9. **Definitions**

**ACRE** – Agronomy Center for Research and Education

**Almaco Head Thresher** – This is the piece of equipment in the Threshing and
shelling room that is used thresh sorghum to wheat heads

**LOTO** – Lockout Tag out. The act of locking a machine or device so it may not be
energized during maintenance

**PI** – Principal Investigator

**SOP** – Standard Operating Procedure

Documents: SOP short-form
Standard Operating Procedure – Almaco Down Draft Table

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Almaco down Draft Tables at the Innovation Center.

2. **Scope**

Anyone who may need to work with dusty plant material in the Innovation Center.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Pinch points

6. **Procedure**

1. Turn on the trunk line as described in SOP TS001
2. Turn on the appropriate dust collection unit that corresponds with your work station
3. Place plant material or bags on the downdraft table
   a. There will be a slight downdraft of air to help control the dust
4. Occasionally the sump at the bottom of the down draft table will need to be cleared of debris

Documents: SOP short-form
a. To do this place a bucket under the table and pull on the slide gate under the downdraft table
5. Be sure to clean the table after each use

7. References

Please see Innovation Center manager for instructions or owner’s manual.

8. Definitions

ACRE – Agronomy Center for Research and Education
Almaco Down Draft Table – This is the piece of equipment in the Threshing and shelling room that is used remove dust from bundles of plants.

PI – Principal Investigator
SOP – Standard Operating Procedure
Standard Operating Procedure – Root Washing Station

1. Purpose

The purpose of this SOP is to give instruction on how to operate the Root Washing Stations at the Innovation Center.

2. Scope

Anyone who has a need to wash roots.

3. Prerequisites

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. Responsibilities

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. Safety Concerns

- Slips
- Eye Hazard

6. Procedure

1. The preferred space for the root washing stations is outside under the porch. In the event of unsuitable weather the root washing station may be used inside room 1168 but cleaning up will need to be a big priority.
2. Hook water line up to the hydrant. If working outside a hydrant key may be acquired from the facility manager.
3. Make sure sediment catch bins are placed under the root washing station.

Documents: SOP short-form
4. Wastewater outside may be allowed to drain to the parking lot drains. Wastewater inside is not allowed to drain into interior facility drains. A hose will need to be attached to drain the waste water outside.

5. If there is only a small amount of waste sediment then you can dispose of it in the green roll off dumpster in the ICSC back parking lot. If there is a lot of waste soil generated then the facility manager may choose to obtain the back hoe from the farm to save the waste soil.

6. To wash roots run water over your sample until the desired results are met.

7. At the end of the day or project the root washing station must be cleaned and returned to its proper location.

7. **References**

   Please see Innovation Center manager for instructions.

8. **Definitions**

   ACRE – Agronomy Center for Research and Education
   PI – Principal Investigator
   SOP – Standard Operating Procedure
Standard Operating Procedure – Carter Day Aspirator

1. **Purpose**

The purpose of this SOP is to give instruction on how to run Carter Day Aspirator at the Innovation Center.

2. **Scope**

Anyone who may need to operate the Carter Day Aspirator in the Innovation Center.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- dust

6. **Procedure**

1. To start the aspirator, power up both the fan and feed roll by pressing the green run button, then adjust the control knobs on the right side of the aspirator.
2. Set the air valve control “K” to “3” initially.
3. Fill the feed hopper with material.
4. Look into the feed hopper to make sure the feed roll is covered over the entire length of “A”.

Documents: SOP short-form
5. Gradually increase the feed rate to the desired capacity. This is achieved by spinning the dial on the Feed roll control knob “J”. (Increasing/decreasing the frequency increases/decreases the speed from 2-20 RPM).

6. Inspect the product discharging under the feed roll at “B”. If all the material is being lifted, reduce the air velocity using the dial on the fan control knob. (As before with Feed roll control knob “J”, Increasing/decreasing the frequency increases/decreases the speed from 1400-1800 RPM). If product contains light material, increase air velocity “H”. Check for an even curtain of material across the length of the machine. If the curtain is not uniform, decrease air velocity “H” or adjust the feed gate spring tension “P” until a uniform curtain is achieved.

7. Continue adjusting the feed rate via “J” and the air control dial “H” and air valve control “L” until the primary separation results are satisfactory; the duct control “N” has very little effect on the primary separation. When satisfactory results are obtained, note the settings on the air valve control pointers “K” as well as the Fan/Feed roll motor frequencies for future reference.

8. Check intermediate separation results in lifting is pans “C” and “D” and air settings discharge in pan “E”.

7. **Lockout Tag out Procedures**

   1. Place a plug cover over plug
   2. Place a lock and tag on the cover
   3. Try to energize the equipment.
   4. When maintenance is complete, remove the lock and cover.

8. **References**

   Please watch the instructional video or see Innovation Center Facility manager for instructions or access to the owner’s manual

9. **Definitions**

   ACRE – Agronomy Center for Research and Education
   Aspirator – Device that uses air to separate material of different weights
   PI – Principal Investigator
   SOP – Standard Operating Procedure

Documents: SOP short-form
Seed Tray Shaker

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the seed tray shaker at the Innovation Center.

2. **Scope**

Anyone who wants to use the seed tray shaker to clean, sort, or size seed.

3. **Prerequisites**

Must go through Innovation Centers guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, graduate students, undergrads, faculty, farm staff, university employees.

5. **Safety Concerns**

- Pinch points

6. **Procedure**

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<td>Soy</td>
</tr>
<tr>
<td>11/64</td>
<td>Round</td>
<td>Popcorn/Soy</td>
</tr>
</tbody>
</table>
Operating Instructions

1. Strap the desired trays to the shaker
   a. Be sure to place the bottom tray in to catch the seed or debris
2. Place the product in the top tray
3. Turn on the switch
4. To reset the time press the “reset” button
5. Adjust the times with the arrow buttons
6. Once the time is set, press “reset” again
7. Press the white start button

7. Lockout Tagout Procedures

1. Place the lock cover over the plug.
2. Lock and tag the plug cover.
3. Try to energize the equipment
4. When maintenance is complete. Remove the lock and plug cover.

8. References

Please see Innovation Centers manager for assistance or access to the owner’s manual

9. Definitions

PI – Principal Investigator
SOP – Standard Operating Procedure
Standard Operating Procedure – Almaco Seed Bed Cleaner

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Almaco Seed Bed Cleaner at the Innovation Center.

2. **Scope**

Anyone who may need to clean seed in the Threshing and Shelling Room.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Pinch points
- Hearing protection
- Eye protection

6. **Procedure**

For cleaning grain coming off the Maizer:

1. Obtain the correct screens
   
   a. To change the screens remove the side panels with the Allen wrench, wrenches are located in magnetic tray on cleaner

Documents: SOP short-form
b. Remove the screens  
c. Add the desired screens  
d. Replace the side panels
2. Place bins to catch the grain under the side and end chute
3. Turn on the main trunk line and dust collectors “A” and “B” see SOP TS001
4. Turn on the cleaner
5. After the seed is shelled in the Maizer transfer the seed to the aspirator by moving the lever switch to transfer
6. After the seed is transferred empty the seed to the cleaner by moving the lever to “dump”
7. Adjust gate to control the speed of the grain. Many times the cleaner works better if there is a substantial amount of grain moving over the screens.
8. Clean seed will dump out the side. Debris and odd sized seed will dump out the end
9. Be sure to clean the screens between the samples
10. Turn off the machine after you are done and clean up any spills.

Cleaning Bulk Seed

1. Obtain the correct screens  
a. To change the screens remove the side panels with the Allen wrench, wrenches are located in magnetic tray on cleaner  
b. Remove the screens  
c. Add the desired screens  
d. Replace the side panels
2. Place bins to catch the grain under the side and end chute
3. Turn on the main trunk line and dust collectors “A” and “B” see SOP TS001
4. Turn on the cleaner
5. Pour the seed at the upper end of the cleaner or transfer the seed from either the Maizer of through a vacuum tube located in the cabinets in room 1124
6. Adjust gate to control the speed of the grain. Many times the cleaner works better if there is a substantial amount of grain moving over the screens.
7. **Lockout Tag out Procedures**

1. Remove the plug from the outlet
2. Place a plug cover over the plug
3. Place the appropriate lock and tag on the plug cover
4. Place a lock and tag on the air transfer toggle
5. Try to start the seed bed cleaner to see if it is energized
6. After maintenance has been performed, remove the lock on the air toggle
7. Remove the lock on the plug cover

8. **References**

Please see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

ACRE – Agronomy Center for Research and Education
Almaco Seed Bed Cleaner – This is the piece of equipment in the Threshing and shelling room that is used to clean seed
LOTO – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance
PI – Principal Investigator
SOP – Standard Operating Procedure

Documents: SOP short-form
Standard Operating Procedure – Agriculex Seed Counter

1. Purpose

The purpose of this SOP is to give instruction on how to operate the Agriculex Seed Counter at the Innovation Center.

2. Scope

Anyone who may need to count seeds coming off any of the equipment in the threshing and shelling room.

3. Prerequisites

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. Responsibilities

PIs, Technicians, graduate students, undergrads, University employees, faculty, farm staff.

5. Safety Concerns

- Pinch points
- Hearing protection

6. Procedure

Basic Operation of Counting

1. You will start by attaching the seed counter to the equipment.
2. Replace the seed collection funnel on the counter with the one currently on the machine. This may take assistance from the facility manager,

Documents: SOP short-form
3. Attach the air supply line from the overhead air reels in the Threshing and Shelling room to the seed counter
4. Turn on the seed counter and let it boot up
5. You may need to navigate to the main menu with the arrow keys

Totalize Mode

1. To run totalize mode press “1” on the main menu
2. Run the sample through the thresher or sheller
3. Hit the up arrow button to transfer the seed
   a. You may need to adjust the airflow on the black knob near the funnel. If you are losing too much seed in the collection bag then the airflow needs turned down. If the air is not delivering the seed to the counter then you need to turn the air up
4. The total seed count will be displayed on the screen
   a. Be sure to check the first few samples and adjust the sensitivity on the black dial on the counter
5. Place an envelope or tray under the forward silver shoot to collect the seed

To count and cut seed

1. Navigate to the main menu
2. Press “2” to count and cut
3. You have the opportunity to enter a number to discard before the seed goes through the counter
   a. Enter a number then press ok
4. Then enter the number of seeds in the sample then press ok
5. Run the sample through the thresher or sheller
6. Press the up arrow to deliver the seed to the counter
   a. You may need to adjust the airflow on the black knob near the funnel. If you are losing too much seed in the collection bag then the airflow needs turned down. If the air is not delivering the seed to the counter then you need to turn the air up
7. The total seed count, initial discard, and the seed count will be displayed on the monitor
   a. Be sure to check the first few samples and adjust the sensitivity on the black dial
8. Be sure to place a packet or container under the discard or back silver shoot
9. Then when you place a packet under the forward shoot it will discard the counted seeds in the front and the discarded seeds in the back

7. **Lockout Tag out Procedure**

1. Remove the plug from the power
2. Place a plug cover over the plug
3. Place the proper lock and tag on the cover
4. Try to energize the sheller
5. When Maintenance is done then remove lock and tag

8. **References**

Please see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

ACRE – Agronomy Center for Research and Education

*Agriculex Single Ear Corn Sheller* – This is the piece of equipment in the Threshing and shelling room that is used to shell single ears

LOTO – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance

PI – Principal Investigator

SOP – Standard Operating Procedure

Attachment 1

Documents: SOP short-form
Copy the file “SDSC1.xlam” to your computer. It is available on the memory stick provided, and updated versions will be available on our website.

The machine communicates with a Windows® computer using Bluetooth®. It requires the third-party software “Modbus Poli®” to be installed on the computer. This is available from modbuspoli.com.

After installing this and licensing it, plug the Bluetooth dongle into a USB port on the computer. It should automatically install its own driver. You should get a message that the driver has installed successfully.

Click on the Bluetooth icon in the lower task bar. It may be on the “show hidden icons” button. It may also take time to appear after the dongle has been installed or your computer re-booted. Click “add a device”. If required, check “my device is set up and ready to be found”. It should find your machine, with a name like SDSC1201501, which is the serial number of your unit, listed on the nameplate.

Double click or right click the icon. Click on the pairing code (or passkey) option, and enter a code of the last 6 digits of the serial number (no space). For example, the pairing code for SDSC1201501 is...
<table>
<thead>
<tr>
<th>PURDUE AGRICULTURE PLANT SCIENCES</th>
<th>Agriculex Seed Counter</th>
<th>SOP #</th>
<th>ICSC CT001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agronomy Department ACRE Innovation Center</td>
<td>SOP #</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Implementation Date</td>
<td>8/2/17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page #</td>
<td>5 of 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOP Owner</td>
<td>ICSC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last Update Date</td>
<td>7/30/18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Jason Adams</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

201501.

You should get a message that your device has been added. You may also get an option to “look for it in devices and printers”. If so, click that. If not, open “devices and printers” from the control panel. Either way, right-click on the SDSC1 icon that should be there and select properties. Go to the hardware tab. Note the number of the com port the machine is on. Don’t worry if the status of the device says “not connected.” Often, it will reconnect itself when there is a demand for it.

Open a copy of the workbook “SDSC1.xlsm” in Excel. You need to enable Excel Macros. A control box for the SDSC1 will also appear. Probably, there will be a message at the bottom saying “no communication.” If so, it is probably because the com port number is wrong. To correct it, follow this procedure:

Click the stop button in the control box. Then, click on the tab at the bottom which says “settings” to change to the settings worksheet. You need to change the number labelled “Communications port” to the number of the appropriate bluetooth com port, which you should have found earlier. For example, if your SDSC1 is on the bluetooth serial port com5, enter 5 here. If you could not see for sure which bluetooth serial port your machine is on, you may need to use trial-and-error. After changing the com port number, return to sheet 1 of the workbook. Save the file and shut down Excel (if you just close the file without closing Excel, it may not work. Excel seems to need to re-start to detect the com port.)

Re-open SDSC1.xlsm. If communication is established, there will be no warning in the line at the bottom of the window, and the communications warning light on the SDSC1 should go out. If unsuccessful, repeat this procedure with a different Bluetooth serial port number. If still unsuccessful, try re-starting Excel (after saving the workbook with the new port number), or restarting the computer and/or the SDSC1. You can also try removing the SDSC1 on the bluetooth button of the task bar and re-pairing with it.

To edit the workbook you always need to either click “STOP” in the control box or close it. Otherwise, the program is running and trying to enter counts and barcodes in the spreadsheet.

After setting up, we recommend that you create a template workbook with the name of your choice, and always take a copy of this template file for each new workbook. You can also customize the template workbook by adding titles, instructions, etc. The program starts recording in the line where the active cell is at start-up, so when you save your template file, position the active cell where you

1 Different computers behave differently, so here are some other things to try if the above gives problems. The Bluetooth dongle should have created virtual com ports on your computer. To see these, open the device manager and select “ports COM & LPT”. You should see a number of “Bluetooth Serial Ports”. Take note of the port numbers. Another way to see the virtual serial ports is to open Modbus Poll: Click Connection -> connect. The connection should be “Serial port”. If you then click for the drop-down list “Serial Settings”, you get a list of available ports, including the virtual Bluetooth ports. This may be an easier way to do it in Windows 8. Because the Bluetooth dongle can create several virtual com ports and only one of them will work, this can require trial-and-error. If you have trouble establishing a connection, try clicking on the Bluetooth icon in the taskbar, click “Bluetooth places”. You should see the serial number of your SDSC1 listed as a device name. Double click to establish a connection. If you have trouble, it can help to remove the device and then pair with it again.
You can now install the barcode reader. This also communicates with your computer by Bluetooth. It is already set up and charged. You should only need to plug the base into a USB port on the computer and position the handset on the base. It should install itself and be ready to go.

**Totalize Mode**

Totalize mode will count all of the seeds in a sample and enter the result in a spreadsheet. It can be used with a barcode scanner to enter barcodes with each count. If the machine is not in totalize mode, you can select the mode either on the machine or on the computer. On the computer, select the mode and click OK. On the SDSC1, press the left arrow to get a menu and press 1 to select to select totalize. Changing the mode on the SDSC1 also changes it in the computer, and vice versa.

You are now ready to count. If using barcodes, we recommend selecting the option to warn if no barcode. Then, if you forget to scan a barcode for a sample or if, for some reason, the barcode does not get entered in the spreadsheet, the warning light on the SDSC1 will come on and a message will appear in the control box.

If you want to change the entry line, or if, at any time, you want to edit the spreadsheet to enter a title or comment or erase data, simply click stop in the control box. This halts program execution so you can edit the spreadsheet normally. When you are done editing, position the active cell where you want the first line, and click start.

You should be aware that the program needs to be running for changes made in the control box to take proper effect. You can tell if the program is running or not by looking at the stop/start button. If it says stop, the program is running.

The sensitivity knob should normally be set to the least sensitive position (10) for corn. For smaller-seeded crops, you may need a lower setting. This can be determined by count tests.

You are now ready to begin. Shell the first ear. When grain is detected in the collection unit, the pneumatic elevator will come on and blow seed up into the counter. You may wish to adjust the air flow in the elevator using the control valve on the air line. Too little flow will cause the elevator to jam up. Too much can cause seed to be lost into the dust collection bag.

In totalize mode, the seed gate is closed until an envelope is placed over the spout, lifting the envelope sensor.
At any time you can place an envelope in position. When seed stops falling, remove the envelope. This causes the count to appear in the spreadsheet beside the barcode (if used). The program then advances to the next line in the spreadsheet.

**Cut Mode**

In cut mode, a certain number of seeds is allowed to pass through the gate into an envelope which must be in place. The valve then closes, retaining seeds inside it until the first envelope (the sample envelope) is removed, and a residue envelope put in place. The gate then re-opens. After the second envelope is removed and the pneumatic elevator has stopped, the counts of both the sample and residue envelopes are written to the spreadsheet. If there are too few seeds (i.e., fewer than the cut size set), it is not necessary to put the residue envelope in place, although it will do no harm if you do. The count will be written in the sample column after the elevator stops.

You can select cut mode on either the SDSC1 or the computer. Changing one will also change the other. On the SDSC1, press the left arrow to get a menu, select option 2, and punch in the number of seeds you want to cut at. Press OK. On the computer, select cut mode, punch in the number of seeds, and click OK.

As in totalize mode, a barcode scanner can be used. You can also halt the program to edit the spreadsheet or change the entry line.

Place the sample envelope on the spout so that it lifts the envelope sensor. If desired, you can use the envelope holder to hold it there. Shell an ear. After the set number of seeds has fallen, the gate will close. You can then remove the sample envelope and put the residue one in place. This will cause the valve to open again. After all the seeds have fallen, remove the residue envelope.

If there are too few seeds, placing the residue envelope is unnecessary, and it will remain empty. But you may find it easier to just place the two envelopes every time rather than checking if this is the case.

It is also possible to discard the residue seed by placing a container to collect all the residue. Simply lift and release the envelope sensor by hand instead of placing a residue envelope.
Standard Operating Procedure – Color Sorter

1. **Purpose**

   The purpose of this SOP is to give instruction on how to operate the Color/Shape Sorter and seed counter at the Innovation Center.

2. **Scope**

   Anyone who may need to sort seed by color, shape or count seed in the Innovation Center.

3. **Prerequisites**

   Must go through Innovation Center guidelines and watch facility safety and procedural videos online. It is recommended to get hands on training with this machine.

4. **Responsibilities**

   PIs, Technicians, graduate students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

   - Hearing protection is required if the VMek is placed in the Threshing and Shelling Room

6. **Procedure**

   1. Turn on the computer by pressing the blue button on the left side of the counter
      a. The Counter will automatically load in the program that does not deal with soybean hilum sorting
2. If the software does not initialize automatically. Then hit the INIT button on the bottom right then wait for it to initialize
3. Either load a “Recipe” in the drop down menu or create a new one.

For Counting:

1. Load in Ejector Test in the recipe drop down.
2. Press on to turn the lights on in the lower right.
3. Make sure there is a bin set under both the discharge and ejection chutes
4. Make sure the gate is down inside the hopper
5. Place the seed in the hopper
6. Press start on the bottom right side of the screen
7. The machine will count and display the number on the top of the screen
8. If you want information about the seed that passed you can go to the Analytics tab and hit populate
   a. This will give you data regarding the seed that passes and the information may be saved or downloaded.
9. Before you repeat the steps be sure to clear the data from the previous count by pressing clear data at the bottom of the screen on the recipe tab

For sorting

This process is the same regardless of whether are sorting for color or for shape.

1. Open the classifier tab
2. Define the classifier names by clicking on the cell and naming them. I.e. good…bad or orange…yellow
   a. You may add classifiers up to five but the lower the number the better. To do this press the Add New button.
3. Press setup. This will add a tab with each name
4. Select the desired tab then press on to turn on the lights
5. Press the capture on button the drop representative sample that you want to use for the bulk of the sample. This sample will not be ejected.
6. Press capture off
7. Select add radio button to the desired channel
   a. Adjust the Min/Max sliders to isolate the desired colors
      i. This step will take some adjusting and trial and error on the user’s part.
8. Repeat the above steps for each tab

Documents: SOP short-form
9. After the parameters have been set you then load the recipe and run the samples as listed above

7. **Lockout Tagout Procedures**

1. Turn off the machine
2. Turn large Red switch on the right of the machine to the off position
3. Place the appropriate lock and tag on the sorter
4. Try to energize the machine
5. After maintenance is complete then remove the lock and tag.
6. Turn the red switch back on.

8. **References**

Please watch the instructional video or see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

ACRE – Agronomy Center for Research and Education

**LOTO** – Lockout Tagout. The act of locking a machine or device so it may not be energized during maintenance

PI – Principal Investigator

SOP – Standard Operating Procedure

Documents: SOP short-form
Standard Operating Procedure – Packet Seed Counter

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Packet Seed Counters at the Innovation Center.

2. **Scope**

Anyone who may need to count seed in the Innovation Center.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- none

6. **Procedure**

***First choose the desired seed counter. We have five that count and package and one that counts and weighs. The counter with the scale underneath is the one that weights***

**The Packaging Counter**

Documents: SOP short-form
This counter maybe used to count the total lot of seed or count a desired amount and place in a package.

To Totalize:

1. Turn on the counter
   a. Place the “Count/Hold” switch to hold
   b. Turn the feeder switch to off
2. Place the seed in the upper bowl
3. A bag will need to be placed at the bulk discharge as well as the packet discharges
4. With the arrow pointing at Totalize, press set
5. Flip the “Count/Hold” Switch as well as the feeder switch
   a. If at any time you want to pause the counter just flip to Hold
6. The counter should run and count the entire lot
7. Adjust the speed as needed
8. Adjust the ribbons on the bowl to line up the seed in a single file, single layered fashion

To count and package

1. Turn on the counter
   a. Place the “Count/Hold” switch to hold
   b. Turn the feeder switch to off
2. Place the seed in the bowl
3. A bag will need to be placed at the bulk discharge as well as the packet discharges
4. Press next to place the arrow to lot size then press set
5. Enter number of lots you want to run. If you are not sure just put in a large number then press next
6. Enter the number of seeds you want per envelope then press set
7. Then press run
8. Flip the “Count/Hold” Switch to count. Then flip the Feeder “on/off” switch to on.
9. The seed will be counted into the packet with the green light…When that packet reaches the desired seed count it will automatically switch to the next packet
10. Remove the first packet and replace it with an empty one
11. The counter will cycle back and forth between packets until done
12. Adjust the speed as needed and the ribbons on the bowl to align up the seed.
13. If at any time you need to pause just flip the switch to Hold.
14. At any time you can return to the main menu by pressing mode.
15. When you are done you can empty the seed bowl by dumping it into the silver chute then into your discard bag.

The Weighing Counter
This counter maybe used to count the total lot of seed or count a desired amount and weigh the sample.

To Totalize and weigh:

1. Turn on the scale and zero
   a. Note: If at any time you are running this counter and you receive an error. Most of the time it is due to the scale not being at zero. Press zero on the scale and reset on the counter to clear the error.
2. Turn on the counter
   a. Place the “Count/Hold” switch to hold
   b. Turn the feeder switch to off
3. Place the seed in the upper bowl
4. Press menu to get to the main screen if needed
5. Press enter at the operation selection
6. Press reset twice at Totalize…This will count your entire lot
7. Flip the switch to Count
8. Adjust the speed dials and ribbons on the bowl as needed to get the correct flow coming out of the bowl
9. At any time you may place the switch to hold to pause or press menu to go back to the beginning.

To Count and weigh:

1. Turn on the scale and zero
   a. Note: If at any time you are running this counter and you receive an error. Most of the time it is due to the scale not be at zero. Press zero on the scale and reset on the counter to clear the error.
2. Turn on the counter
a. Place the “Count/Hold” switch to **hold**
b. Turn the feeder switch to **off**
3. Place the seed in the upper bowl.
4. Press **menu** to get to the main screen if needed
5. Press **enter** at the Operation selection
6. Press **next** to advance to the Default # of seeds selection
7. Press **enter**
8. Press **enter** to change the number of seeds to count
9. Type in the number you want counted and press **enter**
10. Press **reset** twice and flip the switch to count
11. Adjust the speed and ribbons on the bowl to desired speed
12. Once the sample is counted, record your weight
13. When finished empty the bowl by tilting it to the right and collecting it in a container

7. **Lockout Tagout Procedures**

1. Unplug the machine
2. Place a plug cover over the lock
3. Lock and tag the plug cover
4. Try to energize the counter
5. Perform maintenance
6. Remove the lock and tag

8. **References**

Please watch the instructional video or see innovation Center manager for instructions or owner's manual.

9. **Definitions**

**ACRE** – Agronomy Center for Research and Education

**LOTO** – Lockout Tagout. The act of locking a machine or device so it may not be energized during maintenance

**PI** – Principal Investigator

Documents: SOP short-form
Seed Counter – A piece of equipment used for counting seed
SOP – Standard Operating Procedure
Standard Operating Procedure – Seed Treater

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Seed Treaters at the Innovation Center.

2. **Scope**

Anyone who may need to treat seed in the Innovation Center.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online. Also must have gone through Purdue WPS training if using any type of regulated chemical in the treater.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Inhalation
- Dermal
- Chemical exposure
- Pinch points
- ALWAYS WEAR THE APPROPRIATE PPE AS SUGGESTED BY THE CHEMICAL LABEL. Since there are two seed treaters in the small room. You will also want to consider the PPE requirements on the seed treatment being used on the adjoining seed treater.

6. **Procedure**

Documents: SOP short-form
1. Bring in the appropriate seed treatment.
   a. It is the user’s responsibility to bring in their own seed treatment. The seed treatment must be in a sturdy container (preferably the original labeled container). Or a properly labeled secondary container. The facility manager has secondary labels if needed. 
   b. A lab mixer is part of the seed treating equipment. You may consider putting in a mixing bar in your container to aid in agitation. 
   c. An SDS sheet must be presented to the facility manager before seed treatment begins.
2. Place the labeled chemical container on the agitator.
3. Turn on the power to the equipment by flipping the switch on the wall near the door. It is the switch with the little red light.
4. Turn on the agitator.
5. Turn on the power to the treater,
6. On the Touch screen, F1 will take you to the “Home Screen”. F2 will take you to the “Adjustments Screen.”
7. Press F2
8. Adjust your pump time, coat time and door open time accordingly.
   a. The pump time is the amount of time that seed treatment is delivered to the mixing drum.
   b. Coat time is how long the seed rotates in the drum.
   c. Door open time is how long the door stays open.
9. You may make adjustments anytime to these settings to get the proper seed coat in the most efficient way. In the end, all your seed should be properly covered without excessive seed treatment. If at any time you have seed treatment coming out of the spout you are putting too much treatment on.
10. Press F1 to return to the “Home Screen”.
11. Turn on the Rotor
12. Turn on the Atom.
13. Adjust the drum speed at any time as needed.
14. Dump the seed into the upper chamber.
15. Press the foot pedal.
16. Place package under the exit spout. If this is not done seed will spill onto the floor.
17. Repeat

Clean up

Documents: SOP short-form
1. Clean up all equipment at the completion of the task or at the end of the day.
2. You may either follow the cleanup directions on the drum.
3. Or you may use the cleaning supplies on site to clean up the equipment.
4. Be sure to pump fresh water through the lines.

7. **Lockout Tagout Procedures**

   1. To lock out the equipment unplug the machine and place a cord cover over the outlet.
   2. Attach a lock and label
   3. Try to energize the equipment
   4. Perform maintenance
   5. Remove lock and tag

8. **References**

   Please watch the instructional video or see Innovation Center manager for instructions or owner's manual.

9. **Definitions**

   - **ACRE** – Agronomy Center for Research and Education
   - **LOTO** – Lockout Tagout
   - **PI** – Principal Investigator
   - **PPE** – Personal Protective Equipment
   - **SDS** – Safety Data Sheet
   - **Seed Counter** – A piece of equipment used for counting seed
   - **SOP** – Standard Operating Procedure
   - **WPS** – Worker Protection Standards. This training gives you vital safety information in regards to agricultural pesticide usage at the ACRE farm campus.

Documents: SOP short-form
1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the seed and plant grinders at the Innovation Center.

2. **Scope**

Anyone who may need to grind small lots of seed and plant material in the Innovation Center.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online. Must have hearing evaluated by the Purdue Audiology Clinic.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Pinch points
- Noise

6. **Procedure**

**Operation**

1. Turn on the power
2. Always start the mill before adding the samples.

Documents: SOP short-form
3. Rotation begins by turning on the green button and selecting one of the three run modes that will be described later
4. Rotation ends by pressing the red stop button
5. Desired speeds are achieved by pressing the up down arrows on the keypad
6. Materials that do not flow free may need to be forced in the chamber with the plunger
   a. For optimum results feed material slowly to the approximate rate of ground material being delivered
   b. Do not overload the chamber
7. Hard or tough material should be reduced to a smaller size before feeding into the mill
   a. If jamming occurs stop the mill immediately with the red button
   b. Open the door and remove the jamming particles
   c. A safety interlock prevents operation of the mill with the chamber door open
8. After each sample is finished, clean the chamber per your labs requirements. NEVER SPRAY CLEANING SOLUTION IN THE BACK OF THE CHAMBER. This causes solution and dust to collect behind the drum causing the drum to be jammed up and contaminated.

Run Mode:

1. Move the cursers using the up/down feature and select Run Mode
   a. The speed shown in parenthesis (xxx) is the set speed and is controlled by the user
   b. The speed on the right is the tachometer readout or actual speed
2. The cursor can be moved with the up and down arrows
3. Move the cursor to the RPM line item and press enter
4. The speed can now be increased or decreased pressing and holding the up/down arrows
5. Press the enter button once more to move the cursor again
6. To pause the mill move the cursor to the Pause and press the enter button
7. To resume select resume and press the enter button
8. To go back to the main menu move the cursor to the Exit item and then press the enter button

Timed Run Mode:

Documents: SOP short-form
1. Move the cursor using the up/down feature and select Timed Run Mode
2. The up/down arrows can be used to move the Cursor between parameters
3. Press the enter button to adjust setting
4. Now the up/down arrows can be used to change the parameters values
5. Press the enter button once more to move the Cursor again
6. Once the time is set move the Cursor to the RPM line item
7. Press the enter Button.
8. The speed can be set using the up/down arrows
9. Press the Enter Button once more to move the Cursor again
10. Now that the data is set navigate the Cursor to the START line item and press the Enter Button
11. After selecting START the mill will begin at the selected speed and the timer will begin counting down
12. The speed can be adjusted in real time using the same procedure as outlined in Run Menu section
13. The mill and countdown timer can be paused and resumed

Speed Run Mode:

1. Move the cursor using the up/down feature and select Speed Run Mode
2. Select the Speed Run Mode form the menu and press Enter Button
3. You will be prompted to with the Speed Run Mode Setup Menu
4. Navigate the Cursor to the RPM line item and press Enter Button
5. Adjust the speed with the up/down arrows
6. Press the Enter Button
7. Move the cursor between Start and Exit
8. Exit will take the cursor back to the main menu
9. Keep the Cursor next to the Start line item and press the Enter Button
10. You will now be taken to the Speed Run Menu The mill will begin at the speed selected

7. **Lockout Tag out**

1. Turn off the grinder
2. Unplug the grinder

Documents: SOP short-form
3. Place plug cover LOTO device over the plug
4. Lock and tag the plug cover
5. Try to energize the grinder by turning it on
6. Perform maintenance
7. Remove the lock and cover
8. Plug grinder back in

8. References

Please watch the instructional video or see Innovation Center manager for instructions or owner's manual.

9. Definitions

ACRE – Agronomy Center for Research and Education
LOTO – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance
PI – Principal Investigator
SOP – Standard Operating Procedure
Standard Operating Procedure – UDY Grinder

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the UDY Grinders at the Innovation Center.

2. **Scope**

Anyone who may need to grind small lots of seed and plant material in the Innovation Center.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, faculty, farm staff.

5. **Safety Concerns**

- Pinch points
- Noise
- Dust

6. **Procedure**

1. Choose the proper size screen and place it in the slot in the grinder chamber
2. Choose the desired grinder cover
3. Latch down the grinder cover
4. Make sure cone shaped filter is in the grinder cover
5. Place glass or plastic container under the discharge chute
6. Turn on the grinder
7. Insert material into the grinder through the cover

Documents: SOP short-form
8. When Grinding is complete, turn the switch off
9. Clean the grinder

7. **Lockout Tag out**

1. Turn off the grinder
2. Unplug the grinder
3. Place plug cover LOTO device over the plug
4. Lock and tag the plug cover
5. Try to energize the grinder by turning it on
6. Perform maintenance
7. Remove the lock and cover
8. Plug grinder back in

8. **References**

Please watch the instructional video or see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

ACRE – Agronomy Center for Research and Education

LOTO – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance

PI – Principal Investigator

SOP – Standard Operating Procedure
**Standard Operating Procedure – Scales**

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the scales at the Innovation Center.

2. **Scope**

Anyone who may need to weigh seed in the Innovation Center.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- none

6. **Procedure**

Table Top Scales: Either 2200g max weight or 10,000, max weight

1. Retrieve desired scale from cabinets in Plant and Seed Processing room
   a. Scales may be moved throughout the building
2. Turn scale on
3. Zero or tare scale
4. If scale does not seem to be working properly then turn scale over to see if it is in lock mode
5. Scales may be hooked up to PC with connecting cables located in the drawers near where the scales are stored
6. Scales must not leave the ICSC facility
7. Return scales back to shelves when finished

Floor Scale: 250lb max

1. Turn on the scale
2. Zero or tare the scale
3. Place material to be weighed on the platform
4. Turn off the scale when you are done

7. **Lockout Tagout Procedures**

1. Unplug the machine
2. Place a plug cover over the lock
3. Lock and tag the plug cover
4. Try to energize the scale
5. Perform maintenance
6. Remove the lock and tag

8. **References**

Please watch the instructional video or see Innovation Center Facility manager for instructions or owner’s manual.

9. **Definitions**

ACRE – Agronomy Center for Research and Education
PI – Principal Investigator
SOP – Standard Operating Procedure

Documents: SOP short-form
Standard Operating Procedure – PhenoRover

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the PhenoRover at the Innovation Center.

2. **Scope**

Anyone who may need to operate the PhenoRover at the Innovation Center or ACRE campus.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety videos. As well as hands on training by Innovation Center facility manager or designee.

4. **Responsibilities**

PIs, Technicians, grad students, University employees, faculty, farm staff.

5. **Safety Concerns**

- Falls
- Rollovers
- Pinch points
- Burns
- Electrical shock
- Hydraulic Pressure

6. **Procedure**

Documents: SOP short-form
Prestart

1. Refer to operator’s manual for complete details.
2. Check tire inflation (60 psi) LF_____ RF_____ RR_____ LR_____ and lugnut torque (107 lbs./ft.).
3. Grease center pivot (use only special grease for PhenoRover) 50 hrs.
4. Check for leaks around hoses, engine, fuel tank, hydraulic cylinders, etc.
5. Check Fluids:
   a. Engine Oil
   b. Coolant
   c. Hydraulic fluid
   d. Fuel (diesel only)
   e. Generator fuel and oil
6. Check belt tension on fan/alternator/AC.
7. Check boom pivots and lift cylinders, bolts tight.
8. Check that boom is properly mounted and secured.
9. Check that each sensor is properly attached.
   a. Grab each sensor and wiggle each direction.
   b. Grab each sensor mount and wiggle each direction.
   c. Check sensor mounting bolts are tight.
   d. Check electrical connections and cords are clear and have enough movement for all machine operations.
10. Check that batteries are secured and charged.
11. Check that data cord is detached and removed from the machine.
12. Check that any other cords or battery chargers are unhooked and removed from machine.
13. Start generator:
   a. Turn on the fuel
   b. Turn the key
   c. Choke as needed
14. Turn key to first position and check that all warning lights are operational. Wait for glow plug light to extinguish before starting engine.
15. Start engine, check that warnings extinguish properly.
16. Allow engine to warm up for a minute or two at idle before heavy operation.
17. Check that hydraulics and electronics are operational before travelling to field.
18. Raise ladder before leaving building or making sharp left turns.
19. Increase engine speed to ~1/2 throttle when in building.
20. Maintain slow safe speed when maneuvering in or near building.
21. Be aware that moving the steering wheel when machine is not moving forward will swing the boom to the left and right in an arc that may strike people/objects.
22. Refer to Phenorover operation protocol for field operations.
23. Refer to Phenorover post operation protocol for end of day operations.

Special Notes:
- If any questions, please contact Andy Linvill or Jason Adams

Field Operation

1. Refer to Operators Manual for complete details.
2. Refer to Phenorover prestart protocol and checklist before starting.
3. Absolutely no riders on phenorover!
4. At all times check around machine to be clear of people, other equipment or objects that might damage or be damaged by moving the machine.
5. Be aware that moving the steering wheel when machine is not moving forward will swing the boom to the left and right in an arc that may strike people/objects.
6. Raise ladder before leaving building and making sharp left turns.
7. Lifting/lowering machine (Manual page 30):
   a. Only raise/lower machine on level surface.
   b. Check overhead clearance before raising machine.
   c. Set parking brake.
   d. Increase engine speed to full throttle.
   e. Use “up/down” switch to raise/lower machine.
   f. Machine should be in lowered position for transport to and from field.
   g. Boom should be at its highest limit before raising the chassis of machine to keep center of gravity as low as possible.
8. Adjusting machine width (Manual page 31):
   a. Only change width on level surface, preferably grass or gravel, not pavement or cement.
   b. Only change width while driving forward at a safe speed (~3-10mph).
   c. Increase engine speed to full throttle.
   d. Use “in/out” switch to adjust width.
   e. Machine should be at widest setting for transport to and from field.
   f. Limit speed when machine is at narrowest setting to prevent tip over.
9. If any warning lights come on, cease operation; reduce engine speed as long as safely possible before shutting off. Diagnose and fix problem before resuming operation. If unable to diagnose or fix, contact Andy Linvill or Jason Adams.

10. GPS autosteer operation:
   a. Turn on Trimble system with button on back of monitor on the top right.
   b. Select Trimble GPS on right of main desktop screen. Agree to all warnings from Trimble.
   c. Touch tractor icon in upper right of start screen. Use the pre-setup Phenorover settings.
   d. If field has already been set up, select field from dropdown menu. Select “enable auto steering”. Select correct line for the field and nursery to be used. Engage auto steer with “steering wheel” icon in lower right corner.
   e. Touch “wrench” icon to exit field and open another field or to back out of program to shut down.
   f. Touch “shutdown” to shutdown Trimble program.

11. Computer operation:
   a. Starting computer
   b. Connecting to sensors
   c. Infield operation (is machine receiving and recording data)
   d. Pause recording data? (If we need to stop for a few minutes or on turn around?)
   e. Stop recording at end of field before transporting back to buildings

12. Continuously watch machine for loose or broken parts. Ensure sensor operation and attachment

13. Keep an eye on the weather. Return to building if threat of rain or lightning. Sensors are not water resistant!

14. Refer to Phenorover Post Operation protocol and checklist for end of day procedures.

Special Notes:
- If any questions, please contact Andy Linvill or Jason Adams

Post Operation

1. Refer to operator’s manual for complete details.
2. Before entering building, be sure that machine is in lowered position.
3. Reduce engine speed to ~1/2 throttle when in building.
4. Maintain slow safe speed when maneuvering in or near building.

Documents: SOP short-form
5. Be aware that moving the steering wheel when machine is not moving forward will swing the boom to the left and right in an arc that may strike people/objects.

6. At all times check around machine to be clear of people, other equipment or objects that might damage or be damaged by moving the machine.

7. Allow engine to cool for a few minutes before shutting off. This allows oil to cool the turbocharger to a safe temperature that will prevent damage.

8. Lower boom to lowest position, set parking brake and turn off hydraulic drive system before shutting engine off.

9. GPS Shut down:
   a. From run screen, touch “wrench” icon to back out of field to start screen.
   b. Touch “shutdown” icon to shutdown Trimble system.

10. Computer download and shutdown

11. Turn key to shut off engine.

12. Turn switch on generator to off position then turn valve on fuel cap to off to keep fumes in tank and prevent them accumulating in building.

13. Walk around machine and inspect for broken/loose pieces, fluid leaks, flat tires, etc. Notify Andy Linvill or Jason Adams immediately if anything is not right. Do not leave it broken for the next person to fix.

Special Notes:
- If any questions, please contact Jason Adams or Andy Linvill

7. **Lockout Tagout Procedures**

   1. Remove Key from ignition
   2. Remove positive cable from batter and place a plug over the cable
   3. Place the appropriate lock and tag over the cable
   4. Try to start the PhenoRover
   5. Perform maintenance
   6. Remove lock and tag

Documents: SOP short-form
8. References

Please watch the instructional video or see Innovation Center Facility manager for instructions or owner’s manual.

9. Definitions

ACRE – Agronomy Center for Research and Education
LOTO – Lockout Tagout
PhenoRover – High clearance sprayer chasse equipped with sensors used for collecting data from the field.
PI – Principal Investigator
Seed Counter – A piece of equipment used for counting seed
SOP – Standard Operating Procedure
Standard Operating Procedure – Dickey John Moisture Reader

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Dickey John at the Innovation Center.

2. **Scope**

Anyone who may need to measure seed moisture at ACRE or ICSC.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, graduate students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- none

6. **Procedure**

**Running the sample**

1. Turn on the Dickey John
   a. Wait for it to boot up. This may take a minute or two
2. Select analyze and pick the product that you are sampling
   a. The last 4 that have been run through the machine will be displayed
3. Once you select your product, press the “green” button

Documents: SOP short-form
4. Place the product in the hopper. Be sure to add enough to go break the beam at the sensors at the top of the bowl. When you have added enough the light will go form yellow to red
5. At this screen, you may enter a sample ID and customer ID. Or just press the “green” button through the selections until the sample cycles through
6. After the sample has run through empty the tray at the bottom the replace the tray
7. From here you can quit or run the next sample

**Downloading the results**

1. Return to the main menu
2. Press view results
   a. You can download the results from the view results screen
3. Be sure to place a packet or container under the discard or back silver shoot
4. Then when you place packet under the forward shoot it will discard the counted seeds in the front and the discarded seeds in the back

**7. Lockout Tag out Procedure**

1. Remove the plug from the power
2. Place a plug cover over the plug
3. Place the proper lock and tag on the cover
4. Try to energize the sheller
5. Perform maintenance
6. Remove lock and tag

**8. References**

Please see Innovation Center manager for instructions or owner’s manual.
9. **Definitions**

**ACRE** – Agronomy Center for Research and Education

**Agriculex Single Ear Corn Sheller** – This is the piece of equipment in the Threshing and shelling room that is used to shell single ears

**LOTO** – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance

**PI** – Principal Investigator

**SOP** – Standard Operating Procedure
Standard Operating Procedure – Ear Photometry Box

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Ear Photometry Box at the Innovation Center.

2. **Scope**

Anyone who may need to image and phenotype ears at ICSC

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- None

6. **Procedure**

Quick Guide to Photometry Camera Setup and Operation

- At this time the Canon camera models (T1i/T2i/T3i/T4i/T5i/T6i/500D/550D/600D) are supported by the photometry group.

- An external power source to power the camera via the AC adapter is advised when available. If AC power is not possible, then an internal or external battery system can be used. Multiple internal batteries may be needed to power the system for extended times.

Documents: SOP short-form
• Lighting of the ear samples within the box is provided by the built in camera flash only. At this time, no independent light sources are used.
• The focal length of the camera should be manually adjusted to 18 mm by turning the zoom lens. o A small piece of no-mar tape can be placed around the focal adjustment ring to secure the zoom position at 18mm. Taping the lens can prevent image spatial calibration errors arising during later processing stages. [Blue paint tape works well.]

Before the camera is installed into the photometry box and/or used for collecting photometry, images a few items need to be configured within the camera system software and computer.
• Power on the camera and set the Date and Time to correct values using the camera menu. Also, be sure that the computer controlling the cameras has been set with the correct date and time. The image metadata will record the date\time information with the photo that will be used later. Refer to the camera instructions to set the date\time value.

• Disable the auto power off function of the camera.
• Confirm the image “quality” setting is enabled as “MEDIUM FINE”.
• Verify the following camera settings: o Mode dial is in the Manual (M) position;
  o The “AF” switch on the lens is in the “ON” position;
  o The “Stabilizer” switch on the lens is in the “OFF” position.

• The flash should be enabled and physically opened prior to making the USB to PC connection and prior to initializing the software. o You cannot open the Image Capture application until after the camera is attached to the computer with the USB cable and turned on. The application looks for the camera and will close if it is not attached.

When not used for photometry, the cameras can be safely removed and repurposed for other projects. Please clean the camera lens frequently using lens cleaning fluid and a soft lens cloth. Sharp images are vital for the image processing steps to generate high quality data. Further details regarding camera settings and image acquisition process are presented in the software section.
Quick Guide to Photometry Camera Setup and Operation

Image Capture Operation

Instructions for photometry image capture are as follows:
• Be sure that the camera configuration items specified above have been completed. Mount
  the camera in the photometry box. Be sure the camera is level!
• Plug in the AC power cord to the camera or install the battery pack.
• Connect the USB cable from the computer to the camera.
• Place correctly oriented ear samples into the box (tips toward the door).
• With the photometry box door open and the camera flash open, double click the EOS
  Image Capture icon to start the application. The Image Capture application should start. If
  the application does not start or if there are any issues with the computer establishing a
  connection to the camera (next step) or if the application freezes up or stops working, then
  shut down the image capture software, then try cycling the power to the camera (off/on),
  disconnecting/reconnecting the USB cable, and then try to restart the image capture
  software. It is not uncommon for Windows to lose communication with the camera system.
• Once the Image Capture software is started, a window should open up with the Setup View
  tab visible. If the Setup View tab is not visible then navigate to: View > Toolbars > Camera
  Dialog Bar to enable the Setup View tab. The connect button on this tab should be clicked to
  connect to the camera. Once connected to the camera the “Live View” tab should be chosen.
  The live preview will be black if the doors to the sample box are closed or a lens cap is on the
  camera. Open the door to see the sample. The Live View function MUST be enabled in order
  to acquire images. Remember to shut the door prior to collecting an actual photometry
  image. The camera flash will provide the sample lighting even though the preview is not
  visible. The live preview is used mainly for setting the focus of the image.
• On the “Setup View” tab navigate to the folder to save the images in. A ‘best practice’ is to
  save the images to a folder accessible by all users of the computer that has no permissions
  associated with it. Save the images to a location on the local machine other than the
desktop. Saving images to a network folder will noticeably slow the image capture process.
  [The default is C:\Canon.]
• The Image name line can be populated through free text or by using a barcode scanner. All
  images should have the following naming convention for uploading to Image Viewer
  Collection: o EUID + “_” (underscore) + Consecutive number  o  Examples: 65478623_1.JPG;
  65478623_2.JPG; 65478623_3.JPG
  The consecutive number will be 1 and 2 for the two samples from the centre of the plot.
  Images designated as “_ 3” will be used for the FLEX calculation.
• The image names can also be input by using a preconfigured Excel workbook with the
  image names in Col A. This template is opened by using the “DataInfo View” tab. A template
  is available on the EP SharePoint site.

Documents: SOP short-form
• The camera is triggered to collect each image when either the “Enter” button is hit, the scanner reads a barcode or the “Next” button is clicked on the DataInfo tab.

### Spatial Calibration Procedure

Spatial Calibration refers to the process of translating image pixel units to actual spatial units (typically cm). Spatial calibration accuracy depends on physical layout, camera & lens hardware and settings, method of determination, and image distortions. This document describes a simple and easy method for spatial calibration determination. Each photometry box should be calibrated and the information applied during analysis to ensure best accuracy of physical measurements (e.g. length, area, etc.).

1. Collect an image of a 12” or longer ruler using assay specific settings (e.g. ear photometry). The ruler should be placed diagonally in the same plane as where the sample exists (see Figure 1). For ear photometry, the ruler should be placed on top of the ear tray. For kernel photometry, the ear photometry tray should be removed and replaced with the foam board and the ruler should be placed on top of the foam board. If a scale + foam board/tray is used in combination with the photometry, the ruler should be placed on the foam board or tray.
Figure 1. The ruler is placed in approximately the same plane as the subject being imaged.

2. Open the image in the photometry software load the ruler image image viewer and click on the image spatial calibration button (See Figure 2).

Figure 2. The red arrow notes the spatial calibration button noted

Documents: SOP short-form
The ‘Create Spatial Calibration’ window will open.

![Create Spatial Calibration Window]

You will calibrate the image by drawing one reference line across the spatial reference and specifying the line length in the calibration units. Set the line color so it will be visible on your image.

- **Line Color:**
  - Choose a color that is easy to see.

To enable a more accurate placement of the beginning and end of the drawn line, you can increase the magnification on the picture using the preset Zoom buttons. [See Image 4].

Generally, a 50% zoom is sufficient.

Click on the “Draw Reference Line” button. A drawing line will appear on the image. A longer distance is typically a better practice than a short distance determination. Input the known

![Image 1 - Create Spatial Calibration Reference]

Select a line color that is easy to see and start at either end of the ruler and left-click and hold the mouse key to draw the line.

![Image 4 - Image Spatial Calibration]

- To enable a more accurate placement of the beginning and end of the drawn line, you can increase the magnification on the picture using the preset Zoom buttons. [See Image 4].
  - Generally, a 50% zoom is sufficient.

Click on the “Draw Reference Line” button. A drawing line will appear on the image. A longer distance is typically a better practice than a short distance determination. Input the known

Documents: SOP short-form
distance in the text box that the graphic line represents and click 'OK'. The calibration factor will appear on the screen (see Image 5).

Image 5 - Ruler image with calibration line drawn and Reference units for the Calibration line.
Record the calibration value for later use during image analysis. Optionally reposition the ruler in different orientation and repeat. Consider collecting a few readings and developing an average value for best accuracy. A typical spatial calibration factor for T1i, T2i, T4i, T5i, and T6i cameras ear photometry is ~66-72 pixels / cm. For T3 camera, the value is typically ~58-64 pixels / cm. Click on ‘Finish’ to close the Spatial Calibration tool.

Research Image Capture

Support for Canon EOS Rebel Series; Single and Multiple Cameras;
Tasks
1. Configure the camera(s) and verify windows connection.
2. Install Research Image Capture (RIC) software
3. RIC Operation
4. Assay Settings
5. Optional scale integration

Operation Definitions:
• User-mode: This mode is used for conducting production assay image collection by technicians. Users operate the software according to a specific and predetermined process. The user can select the settings, but cannot change the settings. The software enforces a QC process specific to the assay deployment. E.g. Ear Photometry.
• Power-mode: Skilled users who wish to change, set, and/or manipulate the camera settings or establish new settings for production assays. QC enablement is optional.

Camera Configuration
Note: EOS Rebel Cameras, currently T1i, T2i, T3, T3i, T4i, T5i, T6i, 500D, 550D, 600D.
✓ Camera menu items: Before software installation and without connecting the camera to the computer, power on the camera and access the menu items.
  a. Set the current Date/Time;

Documents: SOP short-form
b. Disable the option for “Auto” power off and any other power management options;

c. Also set the “Image Review” time to “OFF”. For most of our current production settings (e.g. Ear photometry);

d. Set the “Image Quality” option needs to be set to the “Middle Fine JPG” “M” setting (Special assays can utilize greater image quality if needed.)

e. Disable the “Red-eye reduce.” Setting;

f. “Release shutter without card option is “ON”;

g. Set the “AF method” to Quick mode;

h. Disable the Live View Shoot setting;

[i. **Special ops** If you are configuring for simultaneous multi-camera image capture operation, your cameras must be provided a unique numbered name (e.g. 1, 2, 3). This needs to be done using the Canon software provided with your camera. Contact Jim for help with this if needed.

Camera Hardware items

a. Enable the AutoFocus option of the lens (AF) and Disable the Stabilizer setting. These buttons are on the side of the lens.
Ear photometry and Seed photometry assays require flash, focal length, and dial settings to be set properly. With the camera on and disconnected, open the flash by pushing the flash button, turn the lens to a focal length of “18”. Optionally put a small piece of tape on the lens to lock the focal length at 18. Turn the camera mode dial to “M” for manual operation.

**Verify native windows connection with the camera**

a. With camera power off, connect the USB cable to the camera and to a USB 2.0 or (preferred) USB 3.0 port on your computer.

b. Power on the camera and allow Windows to recognize the camera and install drivers (if needed).

c. IF THERE ARE ANY ISSUES WITH THE COMPUTER ESTABLISHING A CONNECTION TO THE CAMERA:
   i. CYCLE THE CAMERA POWER;
   ii. DISCONNECT/RECONNECT THE USB CONNECTOR. WINDOWS MUST COMMUNICATE PROPERLY WITH THE DEVICE IN ORDER FOR THE IMAGE CAPTURE SOFTWARE TO WORK.

d. Turn off the camera before installation of the Research Image Capture Software.

**Research Image Capture Application Installation.**

1. If you have any camera settings developed for special assays other than Ear Photometry, please contact insert name here, insert phone here to preserve your assay before completing steps below.

2. Remove any previous version of the software (ReCtrlCameraEOSInstaller) from the computer system using Control Panel | Programs and Features | Uninstall programs (Screenshot). Additionally,

   Manually delete the “C:\Program Files (x86)\Pioneer Hi-Bred\ConfigEOS\” folder and all subfolders to remove any prior settings that may be remnant from previous installations.
3. Install the new Image Capture application by navigating to this directory and double clicking the setup.exe file.

Accept the default settings for installation options during the setup process, but select the “Install for everyone” option, when presented.

**Installation will start with the Visual C++ Runtime Libraries window below.**

- Click Install, and check the ‘Repair Microsoft’ box, then click Next to install. These Libraries are necessary for the Image Capture to operate properly.
• Allow the installation to complete and then click Finish.
• Once the setup application has started the user will be prompted to install the software in the default folder. Also, make sure to select the “Everyone” who uses this computer radio button.
Select Installation Folder

The installer will install ReCtrlCameraEOSInstaller to the following folder.

To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".

Folder: C:\Program Files (x86)\Pioneer Hi-Bred\ReCtrlCameraEOSInstaller

Install ReCtrlCameraEOSInstaller for yourself, or for anyone who uses this computer:

- Everyone
- Just me
Confirm Installation

The installer is ready to install ReCtrlCameraEOSInstaller on your computer.

Click "Next" to start the installation.
• Click ‘Close’. After installation, a shortcut with icon (below) will be shown on the desktop.

![Install Complete]

Research Image Capture (RIC) Operation

1. Confirm the camera hardware is set appropriately for the assay selected, eg. Ear photometry and Seed photometry requires that the lens focal length is set @ “18”, camera mode is “M”, and the flash is popped up on the camera, and the lens cap removed.
2. With camera power off, connect the camera to the computer via USB cable. Turn on the camera and wait for Windows to recognize the device.

Documents: SOP short-form
3. If you are running ear photometry, seed photometry, or other assays in the photometry “box”, it is recommended to start the application with either the lid or the door open and an object placed somewhere in the field of view so that some light can enter the camera such that it can start up with proper focus and light metering.

4. Once windows has recognized the camera, then start the RIC software from the desktop icon. Note that if a camera is not connected and communicating with the computer, the software will close with this message.

   a. Double click on the EOS icon on your desktop ( ) and click ‘Yes’ on the User Account Control window to launch the software. You will need to be an administrator on the computer for everything to work properly.
5. Once the RIC application is started, the screen below should appear. Note the camera connection status, version update, App Messages, & scale status, and current settings choice is visible on the application. The windows can be docked/undocked, and rearranged to best suit the user preference.

6. To select the proper settings for the desired assay, go to File | Load Settings, and choose the appropriate assay (e.g. Ear Photometry). Wait a few moments after selection to allow the settings to upload to the camera before attempting to trigger the camera. Note: If you are running a named assay such as “Ear Photometry”, a QC process will be enforced that will prevent image capture from collecting images without proper camera settings. The “Discovery” settings can be used for developing new assays or casual image collection without the QC protocol enforcement.
7. If the live view window is present, this can be used to view a live video feed from the camera and enables switching of software controlled autofocus on/off. These features can be used as needed, but for regular image capture, it is best to operate with the Live View feed “ON” and with autofocus turned “ON” to ensure focused images for analysis.

8. Image Capture Instructions

   a. Specify a valid directory for the image files to be saved on your C:\ drive. The recommended and default is C:\Canon, but can be changed as needed.

   Note: Do not use network locations as security permissions will cause major application problems and furthermore the time to transfer images across network will slow down the image capture process significantly.

   b. Type in an Image Name and press “ENTER” on the keyboard or scan a barcode to trigger the camera to take a picture. The images will be stored in the directory indicated in the File Saved Path box of the software.
Note: Named assays such as Ear Photometry or Seed Photometry may require incorporation of the EUID into the Image name. The standard naming convention is EUID_picturerep.JPG, e.g., (123456789_1.jpg). If multiple reps are captured for one EUID then the preferred naming convention is (123456789_1.jpg, 123456789_2.jpg, etc). The Auto increase function can help you with the setting the rep number if barcode scanning a single EUID value.

c. If needed, uncheck the overwrite box to save a different image of an earlier captured image with the same name.

d. An alternate method of providing file names to the system is by importing a spreadsheet or CSV file of unique names into the DataInfo View box. Once the list is populated, click Next to trigger the camera and advance rows. Contact Jim Lowry for more details on this method and to obtain the image capture name template.

e. Successful image capture should result in the image file being saved to the directory and the image appearing on screen.
Note for Ear Photometry, the position of the color card in the above images. The actual card should always be on the left side of the image and the White square should ALWAYS be on the upper left and the Black square ALWAYS on the lower left in every captured image. For the gray scale card, the black rectangle must be closest to the ear tray and the white rectangle closest to the wall of the enclosure. Also please take care in keeping the color/gray scale card clean and free of any residue. THE EARS SHOULD BE CENTERED IN THE TRAY, IN LINE WITH THE COLOR/GRAY SCALE CARD AS ABOVE with the ear “butts” at
the bottom of the image, this equates to having the ear “tips” pointing toward the door. It is preferred that the ears are not at the top or bottom of the tray. Also, try not to have any preferred orientation to the ears (good side up, less missing kernels, etc), as we are looking for a random representation of the ears to analyze.

f. Unsuccessful image capture will result in an error message (an orange oval with a white exclamation mark, with a message ‘No Image Captured – Please Check the Camera Settings.’) Also a message appears in red at the lower left of the screen eg. ‘Capture Status: Please check the focal length! Rotate the lens to 18 mm!’

g. Occasionally, an error will occur whereby the systems seems hung up. For example, the sample name is entered but the camera does not fire and the text box does not clear for the next sample. In that case, it is likely that the camera rejected the settings specified by the RIC application. To clear the box, you may need to manually push the camera button to force it to take a picture. Once cleared, retry taking the picture as usual. If a “lock up” condition persists or if nothing seems working, try restarting the camera, application, or the computer in that order until the issue resolves.

About RIC Views and Window Information

The five tabs in the window allow the user control of the software. These are explained below. The tabbed windows can be arranged anywhere on the screen. They can be docked on the top, bottom, left or right side of the window by clicking on the menu bar and dragging them to
the cross-visible below. Dropping the window on the cross will position the tabbed window. The individual blocks pointed out at the bottom of the screen correlate to the four positions of the cross and can be used to position the windows also. The windows can be undocked, separated and placed anywhere on the screen. The tabs can be arranged in multiple windows by dragging the tabs to another window. By using the Pin button, the tabs can be moved to the side or bottom of the window.

**Setup View:** Allows image name to be manually input into window or scanned in with a barcode reader. File saved path is also chosen in this tab.

![Setup View Image](image)

Example Ear Photometry Camera settings are as shown belows:

Documents: SOP short-form
**Ear Photometry Box**

**Agronomy Department**

**ACRE Innovation Center**

<table>
<thead>
<tr>
<th>SOP #</th>
<th>ICSC M004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revision #</td>
<td>1</td>
</tr>
<tr>
<td>Implementation Date</td>
<td>8/4/17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Page #</th>
<th>23 of 37</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOP Owner</td>
<td>ICSC</td>
</tr>
<tr>
<td>Last Update Date</td>
<td>7/30/18</td>
</tr>
<tr>
<td>Author</td>
<td>Jason Adams</td>
</tr>
</tbody>
</table>

**Exposure Mode:** M  
**Expo. Comp:** 0  
**Exposure Time/Tv:** 1/200  
**Av:** 5  
**ISO:** 100  
**X/Y Resolution:** 72  
**White Balance Cloudy**

**DriverMode:** Single Shooting  
**AFMode:** One Shot AF  
**Picture Style:** Standard  
**ImageQuality:** Medium Fine.jpeg  
**MeteringMode:** Evaluative  
**Focal Length:** 18 mm

**MetaData View Tab:** Shows image capture settings of the current image displayed
Live View: Allows for optimizing of the camera prior to image capture. This is controlled by the image capture software.

ImageQC View: Allows the user to create a new Reference image. [NOT for general use.]

DataInfo View: This tab allows the user to import a previously generated file (.xls, .xlsx, .csv) of image names. The image names should be in column A of the spreadsheet. Incorporation of the EUID into the image name is the preferred image naming convention. The “Load Image Data” button is used to load the file and when the “Next” button is clicked the camera is triggered to collect the image and it will advance to the next row of image name. Checking the box next to the image name will cause the software to not collect that image. The first row of the Excel spreadsheet should be blank or contain a header. The last row of the spreadsheet should also contain a dummy name. If the spreadsheet is loaded without a dummy last row, the last image can be collected by highlighting the last image name and then clicking the “Previous” button.
SUPPORTING INFORMATION

To disable the Microsoft Popup Window
1) Connect the Camera to the PC and then Open the Control Panel (Start | Settings | Control Panel | Scanners and Cameras or Devices and Printers).
2) Right click on the Canon EOS Rebel T1i and select Properties. Click on the Events tab and then click on the Take no action radio button. This will disable the Microsoft popup window.

Administrative or Power User Mode Operation
1) This mode is used to access camera settings, toggle QC behavior or otherwise develop new assays for user mode deployment.
2) To access the camera settings, the program must be started from the command line with administrator rights. Connect and turn on the camera as usual, but start the app from a CMD line.
3) At the command prompt enter the application path and supply the argument “-s” to begin admin mode.

Documents: SOP short-form
"C:\Program Files (x86)\Pioneer Hi-Bred\ReCtrlCameraEOSInstaller\ReCtrlCameraEOS.exe" -s
If successful, the application will start and access to the camera settings will be active.
**Assay Settings**

Multiple image capture protocols have been developed to support project needs. The goal of the settings is to ensure that all users operating the equipment will capture the images with the same camera settings each time the images are collected. Three general settings are deployed at install time 1) Ear Photometry, 2) Seed Photometry, and 3) Discovery settings. The settings packages are deployed in the following location:

C:\Program Files (x86)\Pioneer Hi-Bred\ConfigEOS

The structure of the settings package includes:

- A required registry file with the same name as the settings folder E.g. Ear_Photometry.reg, Seed_Photometry.reg, and Discovery.reg;
- Reference images for each camera model supported by the settings that are used if the QC process is enabled. The naming convention is CameraModel_SYSREFIMAGE.JPG e.g T5i_SYSREFIMAGE.JPG. If the integrated scale is supported;
- And a file named ScaleSettings.xml (this is required only when using Seed Photometry and a scale).

The Discovery settings are intended for assay development and contain no QC reference images. By default the QC check box is unchecked.

To develop and save a new assay setting, work with the discovery camera settings and then you can save the settings. Go to File |Save Settings, and specify a new name for the assay and press ok. You will need to manually collect and deploy appropriate SYSREF images as needed for QC, if your assay requires QC of the capture settings to be monitored.
Ear Photometry Analysis Procedures User Guide

The goal of the photometry image analysis software is to output calibrated ear measurement data from standardized images of corn ears. Annotated images are an additional output that will help with the visualization of trait data and to help identify analysis errors. The batch processing mode of analysis is used to process a specific folder of photometry images using specific input settings. There is no recursive folder processing available currently. The steps to running the image analysis process and generate data are described below.

1. Organize the images into convenient logical groupings by folders in preparation for analysis. Because the analysis input parameters (especially color cube settings) must be supplied for each folder of images, it is critical that images be separated by folders for any
Documents: SOP short-form

experimental condition that requires (unique) input parameters to be used. Common conditions for grouping are: hybrid vs. inbred ears, kernel moisture content, kernel and cob colors, day of image collection, special yield or kernel count calibration settings, # of images per plot sampled, and/or by field tracking unit such as PRISM experiment, AOI location or farm \ field name. Generally, the same input parameters should be used for all images from the same experiment.

2. Copy the image folders to be processed as subfolders of “C:\EP_PROCESS\IMAGES\”

3. It is critical that you use and maintain a consistent naming procedure for the image folders! It is also critical that folders created during the analysis process NOT be deleted or renamed should there be a need to Re-process the images. Any results created during the initial imaging analysis will be over-written when images are re-processed.

4. There are two default analysis configurations available; General Hybrid and General Inbred.

5. If a new analysis configuration is required, you can make a copy of an existing configuration folder (e.g. “C:\EP_PROCESS\SETTINGS\INBRED\PTDryConfig”) and then save the folder with a new name that is relevant to the specific task (e.g. “C:\EP_PROCESS\SETTINGS\INBRED\MyConfig1”). The details of the files contained in the configuration folders are found in the Appendix. You will edit these files as needed for the customization using the photometry analysis application.

6. Start the Photometry analysis application by double clicking the “Photometry II” icon on the desktop.

7. Browse to and load the Ruler Image taken for Spatial Calibration. It is recommended to use a minimum 12” (30cm) or 18” (45cm) length, the longer the better. It is BEST to measure in cm. See the Photometry Spatial Calibration 2015 documentation for procedures.

8. Navigating within the Folder View to C:\EP_PROCESS\Images\{subfolder} will populate the thumbnail view window. Open several (>3) representative test images from the image set to process which have visible kernels, cob, and tip kernel abortion.
9. Once opened, use the color cube segmentation tool, found on the toolbar, to create or confirm the required color cube file settings.

10. Load the 'kerandcob.cub' file to visualize the total ear color segmentation
Color Dropper – is the green marker icon
Eraser – is shown as the eraser icon
11. Use the dropper and eraser tools, to select/deselect ear colors until most of the ear is highlighted in red, but without significant background selection. You may need to use the zoom tool to help with the color settings. When satisfied with the preview results, click on the ‘Color Cube’ button and save the ‘kerandcob.cub’ file settings. The file must be named ‘kerandcob.cub’ and saved in the directory that will be used for the image analysis. Repeat the same process for the ‘ker.cub’ color settings except highlight only the kernel colors without significant background or cob color. Be sure to include colors that exist in the space between kernels. Some overlap of cob color detection is normal.
You must decide the appropriate balance of kernel and cob color settings for the analysis. Save the ‘ker.cub’ color settings. The file must be named ‘ker.cub’ and saved in the directory that will be used for the image analysis. You will also need to click on the ‘Color Cube’ button and ‘Set as default’ the ‘kerandcob.cub’ and ‘ker.cub’ files.
12. Check/confirm the color settings are valid for a representative group of images in the directory to process. User skillfulness is required to accurately make the color settings for the total ear and kernels.
13. When the color settings have been made, you can close the test images.
14. Load the images to be processed using the File | Open option and browsing to the correct folder. Select all images to be processed.
15. Once the images are loaded start the analysis using the Batch Wizard from File | Batch Processing | Ear Photometry or Kernel Photometry.

**Wizard Step 1:**
16. The analysis configuration files are chosen in the 'Image Processing setting' drop down. You will also need to identify the folder containing the images in the 'Input Image Collection' drop down. Both are on page 1 of the wizard.
You must also set the Number of images per plot and the number of ears per image (Target). On the right side of this frame the number of plots to be process will be displayed. Click ‘Next’.

**Wizard Step 2:**

17. Enter the correct input settings for each parameter presented on page 2 of the wizard. Most settings will rarely need to be changed once they have been validated and it is unlikely that the settings will need to be changed very much from the default parameters. It is advisable to start with the default setting for the watershed filtering.

18. The Spatial calibration factor collected (written down) from the calibration process done earlier in the setup MUST be entered before proceeding. [This is the icon ] [See the ‘Photometry Spatial Calibration’ documentation for this process.]

19. Align the images within the processing limits using the adjustable box (dotted lines) for a representative sample of the images loaded, lower right of the wizard.

20. You can also select ‘None’, ‘Cob Kernel color’, or ‘Kernel color’ above the images to verify the validity of the Image Processing settings loaded.

Documents: SOP short-form
Wizard Step 3:

21. The output traits calculated are shown on Page 3.
22. If the number of Plants/Acre are known enter them in the ‘Misc’ frame. If this is unknown the default is 36050. A value here is required in order to calculate the PHTYLD (photometry yield) of the plot.
23. Click on ‘Finish’ to start the analysis of the images.

24. After processing, a new set of folders and two data output files will appear in the original image directory location. The new folders will be named PROCESSED, UNPROCESSED, ERRORS, BLANK, MERGED and RESULTS. The PROCESSED folder will contain an annotated copy of each image that was processed with markings for ear and kernel objects. The UNPROCESSED folder will contain the original images. The RESULTS folder contains temporary data files. The ERRORS folder contains images that were rejected by the algorithmic QC process. Please consult the errorlog.txt file to determine the error source explanation. The BLANK folder contains images from which no ear objects were found (these may or may not be errors) and thus manual visualization is needed to confirm. The MERGED folder contains the PROCESSED and UNPROCESSED merged images. The data outputs from the photometry batch processing include two simple tab delimited text data files. The data files are named “RESULTS_AllEPData.txt file and “RESULTS_stats.txt”. These files are best viewed using Microsoft Excel. Simply right click on the file and then select open with Excel from the menu.

25. Production traits are traits that have been validated by the photometry group. Non-production or “Discovery” traits are measurements which are currently in review status by the photometry group. Most all of the production and discovery traits have been created in PRISM for research usage.
26. Data interpretation and final data QC is the responsibility of the research user. To help identify image analysis data problems consider visualization of the annotated imagery that exists in the processed folder. Use the imagery to confirm that the ear and kernel objects were separated and identified correctly from the background and that kernel objects are not over/under split by the watershed algorithm. Check that all apparent full sized kernel objects are marked and that cob material is not significantly falsely identified as kernel objects. A small number of false positive kernel objects can be expected for some genetic material. See the Photometry Manual 2015 for several common analysis disorders detailed in the troubleshooting section.
27. Subsequent image directories can be processed using the same configuration settings or by supplying new inputs. Be sure to check the color settings prior to each batch-processing event.
28. Send data to database.

7. **Lockout Tag out Procedure**

1. Remove the plug from the power
2. Place a plug cover over the plug
3. Place the proper lock and tag on the cover
4. Try to energize the sheller
5. Perform maintenance
6. Remove lock and tag

8. **References**

Please see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

**ACRE** – Agronomy Center for Research and Education

**Agriculex Single Ear Corn Sheller** – This is the piece of equipment in the Threshing and shelling room that is used to shell single ears

**LOTO** – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance

**PI** – Principal Investigator

**SOP** – Standard Operating Procedure

Documents: SOP short-form
Standard Operating Procedure – Root Scanner

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Root Scanner at the Innovation Center.

2. **Scope**

Anyone who may need to measure roots samples at ICSC.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, graduate students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- none

6. **Procedure**

*Note – This SOP will only give the very basic procedures on running the Root Scanner. Please refer to the Software Manuel for a more in depth description on how to analyze the samples*

   1. Log into the computer using your Purdue Credentials
   2. Turn on the scanner
   3. Click the WiRhizo Icon
## Running the Software

1. WinRHIZO has two built-in methods of scanning. The first one, called our *Simple interface method*, is selected by default. As its name implies, it is very simple to use and was designed for washed roots extracted from soil placed directly or in our trays on the scanner glass. This is the method we suggest to try first unless you have a special application. To scan with it you must deactivate (turn off) Use Scanner TWAIN Interface (THAIX) in Image Acquisition Parameters. This method is optimised for use with our positioning system and scanners. When it is used, WinRHIZO takes some decisions for you and it is fast because the preview step (used to select the area to scan) is bypassed. For example, by default it will scan in grey levels (our recommended settings unless you have a special application) using the scanner's TPU (cover) lighting system (the one that gives better contrasts). If you indicate it to scan in color (make sure you have a good reason to do so), then it will use the Reflective lighting system because it produce better colors (you will then have to install the proper background behind the roots if they are not in an opaque media).

2. WinRHIZO's other built-in scanning method is more complex and is for users who want more control over the scanner settings. The latter is made possible by using the preview step to select the area to scan, adjust the contrast, colors, filters and other parameters. To use that method, you must activate Use Scanner TWAIN Interface in Image Acquisition Parameters. When it is used, the scanner manufacturer TWAIN interface is displayed before each scan and you must select in that window all the scanning parameters (dpi, grey vs. color image type, light source, pixel depth ...).

3. It is also possible to scan using other programs (such as Photoshop) or stand alone applications (such as Epson Scan) which come with scanners. With this approach, images are scanned from these programs, saved to disk then later loaded in WinRHIZO for analysis. Some reasons for using this method can be: 1) to allow scanning of images on one computer and analysis on another or 2) to use high-end scanning features not provided in WinRHIZO such as scanning multiple selections at once (one per Petri dish for example). Scanning using stand alone applications varies in function of the program used and is described in the program/scanner documentation. If you use this scanning method, you will have to make sure the file format you use is supported by WinRHIZO (see "WinRHIZO'S SUPPORTED IMAGE TYPES AND FILE FORMATS" on page 31). The most common error we've seen in selecting a format is using a tiff compressed format (only uncompressed can be used and the selection of using or not compression is an option when saving files).

4. Whatever the scanning software or method, if you work with a scanner purchased with WinRHIZO, make sure that at analysis time the Scanner cal/calibration file is installed as described in "THE SCANNER.CAL FILE" on page 8 to get more precise measurements. This is located in the software manual.

### Scanning within WinRHIZO
5. To scan from WinRHIZO, you must select the source name corresponding to your scanner and click Select. This name can be found in the scanner manufacturer manual and in Regent’s manuals shipped with our scanners (Ex: STD4800 Scanner For WinRHIZO). It is important to never scan with a source which name begins with WIA. Click Caned to analyse images stored on disk.

Scanning with our Simple Interface

6. To scan with our simple interface which we recommend to try first (see previous page), you must turn off Scanner aftert fl1cturer fnl ce [='J if) in Image/Acquisition Parameters then set the other scanning parameters in that window according to one of the next two sections.

SCANNING WITH THE RECOMMENDED SETTINGS {GR EY LEVELS}

7. Unless you have specific reasons to scan in color (see next section), select the Grer /nels image type. WinRHIZO will use the scanner TPU light for such images. When that light is used, you must not place a background behind the root, simply close the scanner cover light. Then enter the resolution in dpi (400 is a good starting point). You might need to increase this value up to 600 or 800 for thin or very thin roots but this will produce larger images that takes a longer time to analyse and occupy more space on your hard disk (if you decide to keep them).

8. Assuming you use our positioning system and trays, verify that Riu1n11oniong s_Fsten7 and ri1h Jru_r are activated. Select a tray size (click the width and length buttons corresponding to the tray size in cm) that can hold your sample and place it on the scanner glass. Keep in mind when selecting a tray and placing roots in it that there is a gap of approximatively 0.5 cm that is not scanned near its edges.

9. Close the scanner TPU cover and click the disk icon to do the scan. If this is the first scan it might take longer because of the light warm up. If it takes an abnormal amount of time to scan, it can be because the dpi is extremely high (1200 or 2400) or that an object is present in the TPU calibration slit area. Some examples of objects that should not be there are: the positioning system frame, tray, roots, dust or debris. In addition to producing extremely slow scan, the presence of such objects often results in vertical lines or bands in the image.

Scanning with our Simple Interface in Color
Although we do not recommend scanning in color, there are times when this is required such as:

1) to get root morphology in function of root color (length of beige vs. brown roots),
2) to analyse roots in a non translucent growing media (pouch,...),
3) to analyse non root samples
4) to quantify an object diseased areas based on color (red or yellow vs. green leaf areas)

10. Only the WinRHIZO Pro and Arabidopsis versions can use color information. The other versions always convert a color image to grey levels before analysing it (you will not see it though) so it is a waste of resource to scan this way because: 1) color images takes up to seven more time the memory during its analysis compared to a grey levels image, 2) they occupy three more times the space when saved as a tiff uncompressed file and 3) are much slower to analyse.

11. When you select Cu/or as the image type in Image/Acquisition Parameters, WinRHIZO automatically uses the scanner's reflective lighting system (below the glass) instead of the TPU light because it produces much better color contrasted images (the TPU light will produce good color images of translucent objects only). With this lighting system, you must place a contrasting background behind the roots. By "contrasting" we mean of a color NOT present on the roots. The blue background we provide with our scanners is a good choice.

12. You must also set the other image acquisition parameters (dpi, scan area...) as described in the previous section. Note that when the reflective light is used for scanning instead of the TPU light, the scan area is slightly larger and you do not have to care about objects in the calibration slit area (light calibration is done under the glass).

13. Once the background is positioned and parameters are set, click WinRHIZO's scanner icon to do the scan. If you have just turned on the scanner or changed the image type from grey to color, the first scan will take a longer time to complete (to warm up the lamp).

Scanning with the Scanner Twain Interface in WinRHIZO

Scanning with the TWAIN interface gives you greater control than the previous two methods over the scanner settings and parameters, but slightly less than the next one. As it is a more complex method, it requires more experience from you. To scan with this interface you must activate [/se Scun1111r . ia111: j1ct urt r Inte1:ace rTTf -t J in Image/Acquisition Parameters then set the other scanning parameters in the TWAIN window displayed before each scan. Among them there will be the dpi, image type (grey levels vs. color), bits per pixels, light source (TPU vs. Reflective) and many others such as filters and contrast and color enhancements. The same important remarks about these settings
14. made in "SCANNING WITH OUR SIMPLE INTERFACE" on page 29 also applies, so it is worth reading it. Note that only one image can be scanned at a time (per TWAIN window display) with this method. If you need to scan more than one image at a time, you must use the next method.

15. WinRHIZO can only scan the following two types of images: 8 bits per pixel grey levels images (256 grey levels) and 24 bits per pixel color images (millions of colors). If you encounter problems after acquiring an image (if it is not displayed correctly on screen), it is worth verifying that is has one of these two formats. Grey levels is recommended unless your application needs color (for examples of color applications see "COLOR ANALYSIS" on page 41). These images analyze faster and take less space when they are stored.

Scanning in another Program

16. When you scan in other programs you must pay attention to use an image type (bits per pixels) supported by WinRHIZO as described next. We recommend to store images in tiff files over jpeg or bmp because it retains 100% of the image details and information. If you use it, you must pay attention to save the files as uncompressed (this is an option at saving time in most programs).

WinRHIZO’s Supported Image Types and File Formats

17. WinRHIZO can load the following three types of images stored in tif, jpeg or bmp files:

- 8 bits per pixel grey levels images (256 grey levels). This is the recommended format.
- 24 bits per pixel color images (millions of colors). Use it only when doing a color analysis.
- 1 bit per pixel black and white images. These images contain only 2 light intensities, black and white and are not recommended for their lack of information. If you choose to work with this type of image, the analysis will be faster if you use a threshold of 128 in Analysis/Root & Background Distinction.

If you use the tif format, make sure these are saved as "uncompressed" otherwise they won't open in WinRHIZO.

18. If you use the tif format, make sure these are saved as "uncompressed" otherwise they won't open in WinRHIZO.

256 grey levels images are recommended unless your application requires color. You can scan in color if for example you need to measure root morphology in function of color or when your roots are in a media other than water or air.
For examples of color applications see "COLOR ANALYSIS" on page 41.

7. **Lockout Tag out Procedure**

1. Remove the plug from the power
2. Place a plug cover over the plug
3. Place the proper lock and tag on the cover
4. Try to energize the sheller
5. Reverse order at the end of the repair

8. **References**

Please see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

ACRE – Agronomy Center for Research and Education
Root Scanner – This is the piece of equipment used for scanning root images
LOTO – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance
PI – Principal Investigator
SOP – Standard Operating Procedure
Attachment 1
Standard Operating Procedure – Leaf Area Indexer

1. Purpose
The purpose of this SOP is to give instruction on how to operate the Leaf Area Indexer at the Innovation Center.

2. Scope
Anyone who may need to measure leaf samples in the Innovation Center.

3. Prerequisites
Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. Responsibilities
PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. Safety Concerns
- entanglement

6. Procedure

   Instrument Activation
   1. Move the ON/OFF switch to ON
   2. Press the “Lamp Start” button and hold for 2 seconds
   3. Press the Zero button to clear the display
   Refer to manual if any errors occur

Documents: SOP short-form
## Calibration Procedures

1. Start the lamp and allow it to warm up for 5 minutes or more.
2. Make sure the camera position and lens settings match the marks indicated for .1mm².
3. If there are belt flaws or debris on the belt causing spurious counts, then you may need to clean or replace the belt.
4. Run the edge-intensive standard through the meter at least 10 times. Repeat over all areas of the belt.
5. If the error ever exceeds 2%, carefully turn the CAL screw clockwise to increase or counter clockwise to decrease. See owner’s manual.
6. As a confirmation, perform the same 10 measurements with the 10 cm² round calibration disk.

## Choosing the Resolution

The Leaf Area Indexer utilizes 2 different resolutions, .1 and 1.0mm². .1mm² is more accurate and better suited for complex leaves. 1.0mm² may be preferred for large volumes of leaves where debris on the belt may be an issue. To change calibration, please refer to the owner’s manual.

## Cleaning the Transparent Belts

Clean belts with water and cloth or absorbent paper. Try to keep water off the mirrors. Access to lower belt is achieved by turning the machine on and off.

## Operation Procedures

1. Recording LAI may be done in two ways.
   a. You may choose to use a Windows connection. If so please refer to owners manual.
   b. Recording information by hand may also be done.
2. Once everything is set up. Simply run the leaf sample into the machine and record the data on the readout.
3. Repeat the process.
7. **Lockout Tag out Procedures**

1. Unplug the machine
2. Place a plug cover over the lock
3. Lock and tag the plug cover
4. Try to energize the machine
5. Perform maintenance
6. Remove the lock and tag

7. **References**

Please watch the instructional video or see Innovation Center Facility manager for instructions or owner’s manual.

8. **Definitions**

**ACRE** – Agronomy Center for Research and Education

**PI** – Principal Investigator

**LAI** – Leaf Area Indexer

**SOP** – Standard Operating Procedure
Standard Operating Procedure – Mobile Seed Lab

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Almaco Mobile Seed Lab at the Innovation Center. This document is intended to aid in use of the harvest software and assist with understanding harvest process events or procedures that coincide with using VantageHD.

2. **Scope**

Anyone who may need to run plant material through the Threshing and Shelling Room.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online. ICSC 101

4. **Responsibilities**

PIs, Technicians, graduate students, faculty, farm staff.

5. **Safety Concerns**

- Pinch Points

6. **Procedure**

1. Plug in Mobile Seed Lab
   a. Turn on the Seed Spector
   b. Turn on the Mobile Demand
2. Double Click on the Vantage HD icon
3. In the Settings Tab. Click on the following Settings
   a. Harvest Type: Single Plot
   b. Hardware Options: Free Standing WH

Documents: SOP short-form
c. Plot Setup: User defined plot settings
d. Data Recording Options: Check the boxes as required by your research. Create a .txt file and locate for storing data

4. Go to Delay Settings
   a. Set equipment delays to 0
   b. Set Holding Hoppers / Cyclones to 0
   c. Set Weigh Hoppers to open 2.0 and close 1.0
      i. If this is not enough time to empty sample. Then increase the Open time
   d. Set Test Weights delays to 0

5. Go to Calibration Tab
   a. Press the MST icon
   b. Press upload
   c. Press Save
   d. Press WT icon
   e. Press upload
   f. Press Save

6. Go to Field Setup tab
7. To start a new field press the New Field Icon then proceed to the next steps. Otherwise the previous field will load
   a. Define Field Properties
   b. Click on the Show NAV box
   c. Define Harvest Pattern
   d. Select Data file location

8. Click on the Harvest Tab
9. Place seed sample into weigh hopper and let the sample settle
10. Place your bucket or other containment under the weight bucket
11. Press cycle
12. Repeat the process

Refer to owner's manual for further instructions as needed

7. **Lockout Tag out Procedure**
   1. Place a plug cover over the plug
   2. Place a lock on the cover
   3. Place a tag on the lock
   4. Try to energize equipment
   5. Perform maintenance
6. Remove lock and tag

8. References

Please see Innovation Center manager for instructions or owner’s manual.

9. Definitions

ACRE – Agronomy Center for Research and Education
LOTO – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance
Mobile Seed Lab (MSL) – Portable equipment used to collect weight and moisture sample of seed
PI – Principal Investigator
SOP – Standard Operating Procedure
Standard Operating Procedure – NIR

1. **Purpose**
   
The purpose of this SOP is to give instruction on how to operate the Perten NIR at ICSC.

2. **Scope**
   
   Any one that many need to run samples through the NIR.

3. **Prerequisites**
   
   Must go through Innovation guidelines and watch facility-training video.

4. **Responsibilities**
   
   PIs, Technicians, grad students, faculty, farm staff.

5. **Safety Concerns**
   
   - none

6. **Procedure**
   
   1. Machine should be turned on. If you need to log in to computer. The password is enilno

   2. Open NIR Software SimPlus (Profiles)
3. Click on Analysis tab.
4. Under “Select a Product”, select the crop and cup you wish to use. It should highlight and your selection should appear next to ‘Product:’
5. Count or place your clean material sample cup. Be sure to wear gloves, as oil from your hands may lead to bad results. If you are using a small cup, make sure seeds are together in the center of the mirror cup. If you are using a large cup, be sure to fill entire cup. This is because if seeds are small it may not give an accurate reading if the seeds are dispersed. Clean seeds are seeds that are free of mold or damage. Discolored seeds may give poor a reading. If no clean seeds are available make a note in the results screen (explained later)
6. Count 15 seed and place in plastic boat.

7. Seed should be placed together in center. Seeds that are spread out may lead to high MDistance (poor results). This is especially true on entries with small seeds.

8. Either enter a sample name into the “Sample ID” then press analyze
9. Or scan in a barcode. This will enter your sample ID then automatically advance to analyze
10. After the run an ‘Analysis Results’ page will appear. Check the MDistance column for high scores. Scores over 10 are considered bad and the sample should be rerun.
11. High MDistance can be caused by several reasons. Poor seed quality, seed spread out on the mirror cup, and small seed size are the most common. If the sample is rerun and still has a high MDistance, use three runs and average the numbers together.

12. If changes to the entry name or notes need to be added, go to ‘Results’ tab. Click on the entry you wish to edit.
13. This will display the results for the entry. You will not be able to change the name of the entry. Click on the ‘Sample Information (2)’ tab and write notes or new sample ID. The example below shows that the sample had a bad run, and should not be used. This will display in the excel file when it is exported.
7. Extracting Data

1. Click on the ‘Reports’ tab. Fill in time and date you started collected the samples and when you finished. Choose ‘Whole Soybeans (Mirror Cup)’ under products to eliminate other products types.

2. Click ‘Export Report’ on bottom left of screen.

3. Click browse on Export Report box.
4. Go to desktop and save file to a folder.
5. Give the file a name. Make sure the file ends with .CSV. It will not be saved automatically as a CSV file; you will have to add the '.CSV'. Example: OilandProField2015.csv

6. Click save file. In the 'Export Report' box, click export.

7. The data will be added to the folder on the desktop that you selected. Add the data to a flash drive or you can email the data to yourself. Data is output as a comma separate values file (.csv). Open in excel and format as you desire.
8. **Lock out Tag out Procedures**

1. Remove the plug from the outlet  
2. Place plug cover over the plug  
3. Place the proper lock and tag over the cover  
4. Try to start the NIR  
5. When work is complete remove the tag and lock  
6. Remove the plug cover  
7. Plug the NIR back into the outlet  

9. **References**

Please see the Innovation Center manager for instructions or owner’s manual  

10. **Definitions**

ACRE – Agronomy Center for Research and Education  
NIR – Near infrared  
PI – Principal Investigator  
SOP – Standard Operating Procedure  

Documents: SOP short-form
### Standard Operating Procedure – 3D Scanner

**1. Purpose**

Coming Soon.

**2. Scope**

Coming Soon

**3. Prerequisites**

Coming Soon

**4. Responsibilities**

PIs, Technicians, grad students, faculty, farm staff.

**5. Safety Concerns**

- Coming Soon

**6. Procedure**

1. Coming Soon

**7. References**

Please see Phonemics Facility manager or ACRE staff with any questions.

**8. Definitions**

Documents: SOP short-form
Standard Operating Procedure – Packet Printer

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the Packet Printer at the Innovation Center.

2. **Scope**

Anyone who may need to print seed packets in the Innovation Center.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Pinch points
- Entanglement

6. **Printer Procedure**

1.) If packet feeder is not attached, attach them before starting.

2.) Use **Very Black** ink ONLY. Put 4 cartridges in the imager.

3.) Keep the cartridges in an upright position once the protective caps are removed. **You want to prevent air from entering into the jets on the bottom of the cartridge!!!**

4.) Align imagers so the **Packet** will pass directly under the imager.

Documents: SOP short-form
5.) Adjust knobs on top of imagers so there is enough clearance for packets to travel through. Test this by manually sliding a packet under the imager with the machine off.

6.) Load packets into the feeder.

7.) Turn printer on with power switch on back of machine. This should light up the orange Printer Ready light on top of the machine. Press the red button to turn on the printer feeder, it will light up and belts will begin to move. The packet feeder has its own set of controls.

8.) Before you begin to print test feed some packets to ensure that they feed through consistently without catching on anything. After testing, you can shut off both feeders until you are ready to print. Consistency is important to ensure a good print job.

9.) Open Launch Jet Engine GUI from the Home Screen
   a. Select “Run as Administrator”
   b. For User name type “.\printer”
   c. For password type “AccufastP4”

10.) THIS STEP IS ESSENTIAL! Open the “Pen Status” tab. Hover your mouse over each bar individually. A box should pop up that says “Very Black” if it says anything else, you need to shut the machine off, take the cartridges out, make sure they are right and then put them back. Reopen the software and check it again. It needs to read the proper ink. The two PrimeX and Very Black inks operate at different volts and they will burn up if they machine is not reading it right. Each cartridge is $75. (The number of jets should be close to or 300) If not remove cartridge and wipe on clean “lint free” cloth or “Kem-wipe”.

11.) Open a packet template. If you do not have a packet template, refer to Supplementary Packet Printing Tips section following this set of instructions. This will walk you through how to properly set everything for printing packets. I recommend saving this template and using it each time. When you print next, you can use the same template as long as the data sheet uses exact same heading names.

12.) Open the Form Design Tab. Load you data source, press the Load Data Source button. It is cream colored with a blue arrow pointing to the right. ALL DATA FILES MUST BE IN .CSV FORM.

13.) Open the Data drop down menu. Click on Modify Schema. In that menu, make sure the box with “First Record Contains Field Names” is checked. Click Ok.

14.) Place data on the form design using the Field Block Button ((F)). The parentheses are blue around the F.

Documents: SOP short-form
15.) Right click the field book and open properties. Add data field desired and rotate the field block how you would like. Resize and position on the form design.
   a. If you are using barcodes, do not overlap them over fields.
   b. If you overlap between ink cartridges, it will not always line up properly and the barcodes will not read.

16.) Place rest of your Data on the form design.

17.) When ready to print, press the red square button on the printer to turn the feeder on. **DO NOT HAVE THE PACKET FEEDER ON.** Open the print manager tab. Select desired fields to print. Right click and click “Add Fields.” I recommend purging 1-2 packets to ensure cartridges are working properly. To do this, set “Initial Pages to Purge” to 1 or 2.

18.) Click the Green **Start Print Job** button on the Print manager tab. It will turn gray for about 8-10 seconds. Once it turns red, turn on the packet feeder. Packets will feed through machine and be printed on.
   a. The packet feeder will not stop once the data source is done printing so you will need to shut off by pressing the red button. It will keep sending packets through the machine, but it will not print on them.

19.) Once you are done printing you can save your Job. Remove the Ink and place the covers back on them so they do not dry out. Shut the machine off and fill out the form with your information.

20.) It is very important when you remove the ink cartridges please keep them upright until the protective caps are replaced. This prevents air from entering into the jets!

**Supplementary Printing Tips**

P4 Packet Printing basic setup.
1. Setup Screen for Packet Printing
2. Form Design setup screen using the (F) button.

Documents: SOP short-form
3. Double click or right click on the “Field Block” w/blue border to open properties

4. Properties opens then select Data Field you wish to print. Click on “Add Field” button.

Documents: SOP short-form
5. Once selected it is highlighted, click on the “Add Field” button and the dialogue box displays the Field Name inside <<...>>. You can then add a label by typing in front of the << characters.
6. View of Data after print job is created.
7. Each Record Block you wish to print, corresponds to a column within your data file.
   (Item with blue border is Range)

8. Each Record Block you wish to print, corresponds to a column within your data file.
   (Item with blue border is Row)
9. Print Manager showing Data that Record Block has available to print.
10. Item with Blue border is the Bar Coded item. Use same process as above only make it a Barcode.
11. To make these modifications to the data being printed simply right click on the object. (See window that opens)
12. Pen Status Tab. Used to check health of the Ink Cartridges (Pens as software refers to them)
13. Each should be at 300. If not clean using lint free cloth/tech wipe. Do not use any water on Very Black Ink!

14. This is an example without Pens in Print head.
15. Always stop Print Job before removing or inserting Pens (Ink Cartridges).

Documents: SOP short-form
7. **Lockout Tagout Procedures**

1. Unplug the printer
2. Place a plug cover, lock and a tag on the plug.
3. Try to re-energize the printer
4. Perform maintenance
5. Remove tag and lock.
6. Plug in the printer.

8. **References**

 Supplemental manuals found in drawers near the printer

9. **Definitions**

**ACRE** – Agronomy Center for Research and Education  
**LOTO** – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance  
**PI** – Principal Investigator  
**Stake Printer**- Used to print information on to field packets  
**SOP** – Standard Operating Procedure
Standard Operating Procedure – Stake Printer

1. **Purpose**
   The purpose of this SOP is to give instruction on how to operate the Stake Printers at the Innovation Center.

2. **Scope**
   Anyone who may need to print field stakes in the Innovation Center.

3. **Prerequisites**
   Must go through Innovation Center guidelines and watch facility safety and procedural videos online. **Must Use specific MIDCO stakes.**

4. **Responsibilities**
   PIs, Technicians, grad students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**
   - Pinch points
   - Entanglement

6. **Printer Procedure**
   1.) Attach stake feeder and tray before starting, if not already done.
      a. The Stake feeder has two cords that need to be plugged in. The gray cord goes into the **Control Cable** port and the side of the machine. The black cord goes into the **Accessory Power** port on the back of the machine.
      b. Check adjustment of pressure roller to assure proper feeding of the stakes from the feeder to the transport belts. (Too tight stakes will not feed; too loose will

Documents: SOP short-form
not make good contact with the belt and stakes will not “get-up-to-speed”. This can cause misaligned printing.)

2.) Use **PrimeX Black** ink **ONLY**. Put both cartridges in the imager closest to the feeder.

3.) Keep the cartridges in an upright position once the protective caps are removed. **You want to prevent air from entering into the jets on the bottom of the cartridge!!!**

4.) Set feeder speed (knob on top of Printer) to a slower speed than packets. You will need to adjust this to a faster speed as you begin testing.

5.) Align imager so the **Stake** will pass directly under the imager. (This is the top imager closest to the feeder. Move the lower imager off to the side next to the control panel).

6.) Adjust knobs on top of imagers so there is enough clearance for stakes to travel through. Test this by manually sliding a take under the imager with the machine off.

7.) Load stakes into the feeder with the top of the stake towards the printer. **You must use MIDCO approved stakes.**

8.) Turn printer on with power switch on back of machine. This should light up the orange **Printer Ready** light on top of the machine. Press the red button to turn on the printer feeder, it will light up and belts will begin to move. The stake feeder has its own set of controls. The red square button will need to be lit up. If it is not, press it. To start the feeder, press the round green button, to stop it press the round red button.

9.) Before you begin to print test feed some stake to ensure that they feed through consistently without catching on anything. After testing, you can shut off both feeders until you are ready to print. Consistency is important to ensure a good print job.

10.) Open Launch Jet Engine GUI on your desktop.
     a. Select “Run as Administrator”
     b. For User name type “.\printer”
     c. For password type “AccufastP4”

11.) **THIS STEP IS ESSENTIAL!** Open the “Pen Status” tab. Hover your mouse over each bar individually. A box should pop up that says “PrimeX Black” if it says anything else, you need to shut the machine off, take the cartridges out, make sure they are right and then put them back. Reopen the software and check it again. It needs to read the proper ink. The two PrimeX and Very Black inks operate at different volts and they will burn up if they machine is not reading it right. Each cartridge is $75. (The number of jets should be close to or 300) If not remove cartridge and wipe on clean “lint free” cloth or “Kem-wipe”.

12.) Open a stake template. If you do not have a stake template, refer to **P4 Stake Printing Basic Setup** section following this set of instructions. This will walk you through how to
properly set everything for printing stakes. I recommend saving this template and using it each time. When you print next, you can use the same template as long as the data sheet uses exact same heading names.

13.) Open the Form Design Tab. Load you data source, press the **Load Data Source** button. It is cream colored with a blue arrow pointing to the right. **ALL DATA FILES MUST BE IN .CSV FORM.**

14.) Open the **Data** drop down menu. Click on **Modify Schema.** In that menu, make sure the box with “First Record Contains Field Names” is checked. Click Ok.

15.) Place data on the form design using the Field Block Button ((F)). The parentheses are blue around the F.

16.) Right click the field block and open properties. Add data field desired and rotate the field block how you would like. Resize and position on the form design. Place in fields 1 and 2 only. Fields 3 and 4 will not work because we are only using #1 and #2 ink cartridges to print on stakes. I recommend not placing any data above the ½-inch mark.

    a. If you are using barcodes, do not overlap them over fields. **(Keep them on either pen 1 or pen 2 only)**

    b. If you overlap between pens, it will not always line up properly and the barcodes will not read.

17.) Place rest of your Data on the form design.

18.) When ready to print, press the red square button on the printer to turn the feeder on. **DO NOT HAVE THE STAKE FEEDER ON.** Open the print manager tab. Select desired fields to print. Right click and click “Add Fields.” I recommend purging 1 stake to ensure cartridges are working properly. To do this, set “Initial Pages to Purge” to 1.

19.) Click the Green **Start Print Job** button on the Print manager tab. It will turn gray for about 8-10 seconds. Once it turns red, turn on the stake feeder by pressing the round green button. Stakes will feed through machine and be printed on.

    a. The stake feeder will not stop once the data source is done printing so you will need to shut off by pressing the red button. It will keep sending stakes through the machine, but it will not print on them.

20.) Once you are done printing you can save your Job. Remove the Ink and place the covers back on them so they do not dry out. Shut the machine off and fill out the form with you information.

21.) **It is very important when you remove the ink cartridges please keep them upright until the protective caps are replaced. This prevents air from entering into the jets!**
### Supplementary Printing Tips

**P4 Stake Printing basic setup.**

1. **Setup Screen for Stake Printing**

   ![Stake Printing Setup Screen](image)

   - **Current Configuration:** 1.00 x 5.50 mm, no packets 2015
   - **Job Setup (in Inches):**
     - **Form Size:** Custom, Width: 12.00, Height: 1.00
   - **Print Resolution (DPI):** Vertical: 600, Horizontal: 300
   - **Barcode Showing:** Specific Settings
   - **Paper Orientation:** Normal
   - **Image Setup (in Inches):**
     - **Engine:** 1
     - **4th Pen:** Distance From Top Edge: 0.0000, Distance From Sensor: 1.6000, Stitching: All Possible, External I/O: None
     - **Print Density:** 100.00%, Opposite Side
     - **Conveyor Direction:** Left To Right
     - **Pen Direction:** Manual Down

2. **Form Design setup screen using the (F) button.**

   ![Form Design Screen](image)

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Documents: SOP short-form
3. Double click or right click on the “Field Block” w/blue border to open properties

4. Properties opens then select Data Field you wish to print. Click on “Add Field” button.
5. Once selected it is highlighted, click on the “Add Field” button and the dialogue box displays the Field Name inside <<...>>. You can then add a label by typing in front of the << characters.
6. View of Data after print job is created.
7. Each Record Block you wish to print, corresponds to a column within your data file. (Item with blue border is Range)

8. Each Record Block you wish to print, corresponds to a column within your data file. (Item with blue border is Row)
9. Print Manger showing Data that Record Block has available to print.
10. Item with Blue border is the Bar Coded item. Use same process as above only make it a Barcode.
11. To make these modifications to the data being printed simply right click on the object. (See window that opens)
12. Pen Status Tab. Used to check health of the Ink Cartridges (Pens as software refers to them)

Documents: SOP short-form
13. Each should be at 300. If not clean using lint free cloth/tech wipe. Do not use any water on PrimeX Ink!

14. This is an example without Pens in Print head.
15. Always stop Print Job before removing or inserting Pens (Ink Cartridges).
For setup of printing on paper, envelopes or any other paper products follow the same basic procedure. Only difference is you will be using the “Very Black” ink, which is water, based, number of Ink Cartridges and the size of your form.

7. **Lockout Tagout Procedures**

1. Unplug the printer
2. Place a plug cover, lock and a tag on the plug.
3. Try to re-energize the printer
4. Perform maintenance
5. Remove tag and lock.
6. Plug in the printer.

8. **References**

Please watch the instructional video or see Innovation Center manager for instructions or owner’s manual.

9. **Definitions**

- **ACRE** – Agronomy Center for Research and Education
- **LOTO** – Lockout Tag out. The act of locking a machine or device so it may not be energized during maintenance
- **PI** – Principal Investigator
- **Stake Printer**- Used to print information on to field stakes
- **SOP** – Standard Operating Procedure
Standard Operating Procedure – 3D Printer

1. **Purpose**

The purpose of this SOP is to give instruction on how to operate the 3D Printer at the Innovation Center.

2. **Scope**

Anyone who may need to print three-dimensional objects for use in the Innovation Center research building or on their grant project.

3. **Prerequisites**

Must go through Innovation Center guidelines and watch facility safety and procedural videos online.

4. **Responsibilities**

PIs, Technicians, graduate students, undergrads, University employees, faculty, farm staff.

5. **Safety Concerns**

- Burns
- Pinch Points

6. **Procedure**

Preparing the model

1. The software that prepares models for 3D printing on the Zortrax printers is called Z-Suite. You may use any 3D modeling software that you are comfortable using to create your file, as long as you are able to output it as a .stl.

Documents: SOP short-form
2. Open your .stl file in Z-Suite, by navigating to the “+” symbol on the left navigation bar, and then to your saved .stl. (Note: large .stl files may take several minutes to load, see the 3D Scan Cleanup Guide for details on how to reduce the size of your .stl file)

3. Additional models may be added by clicking the “+” button.

4. Orient and size your model for printing. Generally, printing in or near the middle of the plate is best. Also, be sure to orient your model to minimize overhangs and for the easiest removal of support material. Select your model by right clicking on it. Then select the appropriate tool to modify your print. The Move button allows you to shift the position on the plate, the rotate button rotates the model, and the Scale button changes the size of the model. Models that overlap or fall off the edge of the build plate will be highlighted in red. Models too large for the build plate may be split into multiple pieces using the Split Tool

5. When your object is oriented and ready to print, click the Print button.
6. The default settings work well for most models, but there are some settings that - depending on your model - you may want to adjust. Profile: Should ALWAYS be set to Z-ABS. Layer Thickness: Selecting a smaller layer thickness will give you more detail, but will take significantly longer to print. Larger layer thickness will print faster but with less detail. Speed: Should ALWAYS be set to Normal for best results. Infill: Determines how dense the interior mesh of the model is. Full infill will take the longest to print, but yield a more sturdy and solid model. Support: The higher the angle of the support, the more support will print. Increase this angle if your model has areas that are sagging due to being unsupported. A setting of 0% will print with no support material. The Support Lite check box will make supports easier to break off of your model, but more likely to break off and fail while printing. Print Cooling: Normally, auto fan speed works best. If your print is having trouble with warping, set the fan speed to 0%. If fine details are drooping, increase the fan speed.

7. When your print is ready, select Prepare to Print. Note: this process may take several minutes depending on the size of your print.
<table>
<thead>
<tr>
<th>SOP Owner</th>
<th>ICSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOP Owner</td>
<td>ICSC</td>
</tr>
<tr>
<td>Revision #</td>
<td>1</td>
</tr>
<tr>
<td>Implementation Date</td>
<td>10/31/17</td>
</tr>
<tr>
<td>Last Update Date</td>
<td>8/6/18</td>
</tr>
<tr>
<td>Author</td>
<td>Jason Adams</td>
</tr>
</tbody>
</table>

![3D Printed Model](image)

**Fig 7 - Print Preview**

Documents: SOP short-form
8. When your print is ready, Z-Suite will show you a preview. The blue is your model and white is support material. Across the bottom of your screen, you will see a summary of your settings as well as an estimated print time. If something does not look correct, click back and re-adjust your print settings. If everything looks good, click Save to print to save your .code file.
9. Copy your .zcode file to a USB stick or memory card and insert it into the printer.
10. Insert the SD card into the printer.

Preparing the printer

1. Turn on the printer
2. Load the spool with the material on the spool holder at the back of the printer.
3. Load the material through the extruder
4. Turn the knob to the model being printed
5. Push knob to begin the process

7. **Lockout Tag out**
   1. Unplug the printer
   2. Place a plug cover over the plug
   3. Lock and tag the cover
   4. Try to re-energize the printer
   5. Perform maintenance
   6. Remove lock and tag
   7. Remover cover
   8. Plug back into outlet

8. **References**

   Please watch the instructional video or see Innovation Center manager for instructions or owner's manual.

9. **Definitions**

   **ACRE** – Agronomy Center for Research and Education
   **3D Printer** - Used to print three-dimensional objects
   **LOTO** – Lockout Tag out. Protocol used for safely disabling equipment to be able to safely service equipment.
   **PI** – Principal Investigator
   **SOP** – Standard Operating Procedure

Documents: SOP short-form