UC Davis IR-4 Field Research Center

Department of Plant Sciences, One Shields Ave, Davis CA 95616

2020 STANDARD OPERATING PROCEDURES - TABLE OF CONTENTS

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SOP numbering Format: [Facility ID] - [sop category] - [sop number] . [version number]

*All SOPs have been reviewed prior to signing

SOP's submitted by: _____ 2/4/20 _____ 2/4/20

Guy Kyser* — Date — Seth Watkins* — Date

Field Research Director, UC Davis — Field Research Director, UC Davis

SOP's approved by: Mikal Olson — 2/5/20

Assistant Regional Field Coordinator* — Approval Date

SOP Number: UCD-10-1.1	Pg 1 of 1
Title: IR-4 Program Management	

PURPOSE: To define the responsibilities of the University of California, Davis IR-4 Field Research Center management.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURES:

1.0 Field Research Director Responsibilities

1.1 Ensure each study is conducted according to an approved protocol and Standard Operating Procedures (SOPs), and that appropriate documentation is provided. Maintain good communication with the Study Director and the Regional Field Coordinator (RFC).

1.2 Ensure that personnel, resources, facilities, equipment, materials and methods are available as scheduled and are adequate for the completion of the project.

1.3 Ensure that all personnel involved in study conduct are adequately trained to perform their assigned tasks. Training will include Good Laboratory Practices and Standard Operating Procedures.

1.4 Report all deviations from the protocol, GLPs or SOPs to the Study Director and the RFC and initiate remedial action when required. Respond in writing to all QAU findings.

1.5 Maintain a study list of all IR-4 field research projects. Maintain an IR-4 project organizational chart.

1.6 Maintain on file a current summary of training, education and experience; and a job description for all personnel engaged in the conduct of a study.

1.7 Ensure that all required records are maintained, and archived when appropriate.

SOP Number: UCD-10-2.9	Pg 1 of 2

Title: Standard Operating Procedures

PURPOSE: To provide guidelines for creating, revising, maintaining and archiving Standard Operating Procedures (SOPs).

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURES:

1.0 All SOPs will be uniquely identified by number. Each number will begin with the prefix 'UCD' to identify the research facility (University of California, Davis IR-4 Field Research Center), followed by SOP category, sequential SOP number and version number.

SOP Categories:		
	10	Administration
	20	Data
	30	Test System
	40	Test Substance
	50	Test System Samples
	60	Equipment

Format: (Facility ID)-(sop category)-(sop number).(version number)
Example: (UCD)-(10)-(1).(1).
Attachments will use the same format. If more than 1 attachment per SOP number letters will be used to differentiate (i.e. a, b, c,)

2.0 All current, active SOPs will be listed on a Table of Contents. The SOP Table of Contents listing all SOPs will be signed and dated by the author (submitting scientist), and by the Regional Field Coordinator (RFC) or Assistant Regional Field Coordinator (ARFC), signifying approval. SOPs are effective as of the date approved by the RFC/ARFC.

3.0 Each SOP will define its scope and purpose; describe procedures routinely implemented, and the records that may be required by these procedures. Each page will be numbered.

4.0 Original signed SOPs shall be stored in the UC Davis Retention File and copy(s) kept in areas accessible to all study personnel.

5.0 Each SOP shall be reviewed approximately annually, and revised to reflect current procedures, if necessary. A "revision" provides a substantive change in the meaning of the SOP. Correcting spelling and formatting errors along with making minor changes that clarify the intended meaning of the SOP do not constitute a revision. Retired SOPs will be listed in the index as "Retired" for the first year and may be removed in subsequent years. Outdated SOPs will be permanently archived at the IR-4 Headquarters archive and all copies will be destroyed, with the exception of one, to be stored in the UC DAVIS Retention File.

6.0 Each study protocol shall serve as the standard operating procedure for that study and shall supersede UC DAVIS SOPs in the event of a conflict with them.

7.0 Common abbreviations used in UC DAVIS SOPs and raw data generated during the conduct of IR-4 Program research trials may include the following:

Abbreviation	Definition
Ag Dept.	Agriculture Department (designate County)
ARFC	Assistant Regional Field Coordinator
&	and
@	at
CAS	Chemical Abstract Number
CDFA	California Department of Food & Agriculture
CIMIS	California Irrigation Management Information System
Coop.	Cooperator off Station
CV	Curriculum Vita
E.G.	For Example
EPA	(United States) Environmental Protection Agency
F Mgr.	Farm Manager
FDB	Field Data Book
FID #	Field Identification Number
FRD	Field Research Director
GLP	(EPA) Good Laboratory Practices
GPA	Gallons Per Acre
IR-4	Inter-Regional Research Project #4
MSDS	Material Safety Data Sheet
NIST	National Institute of Standards Technology
PTO	Power Take Off
QAU	Quality Assurance Unit
RH	Relative Humidity
RFC	Regional Field Coordinator
RPM	Revolutions Per Minute
SD	Study Director
SDS	Safety Data Sheet
SOP	Standard Operating Procedure
SRA	Staff Research Associate
TRT	Treated
TS	Test Substance
UC	University of California
UCD	University of California Davis
UTC	Untreated (control)
UCDPLSC	University of California Davis, Department of Plant Science

SOP Number: UCD-10-3.2	Pg 1 of 1
Title: Personnel	

PURPOSE: To define requirements for all trial personnel and related records.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURES:

1.0 A copy of a professional resume or curriculum vitae (CV), a job description, and training records for each person engaged in the conduct of a trial will be retained on file.

2.0 All personnel will be adequately trained for their assigned tasks. As appropriate, training curriculum will include SOPs, GLPs, UC policies, and technical training relevant to the magnitude of residue studies.

3.0 Personnel records will be reviewed, updated, signed & dated annually.

4.0 A Personnel Short Form or a CV for any temporary or seasonal field personnel will be retained on file. CVs or Personnel Short Forms will not be completed or retained for temporary work crews or other UC Davis personnel that may occasionally be utilized for non-GLP plot maintenance tasks. The aforementioned personnel will be directly supervised by GLP trained staff.

SOP Number: UCD-10-4.1	Pg 1 of 1
Title: Quality Assurance	

PURPOSE: To define Quality Assurance procedures used to ensure that facilities, equipment, personnel, methods, practices, records and controls utilized in GLP studies meet regulatory requirements.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 The QAU (Quality Assurance Unit) shall be knowledgeable of GLPs, procedures used in conducting IR-4 field studies and preferably familiar with the facility. It will maintain a master schedule sheet of all current studies. QAU shall be entirely separate and independent from any involvement, direction or conduct of the study.

2.0 The QAU should conduct a facility inspection approximately every two years to ensure compliance of facility operations with facility SOPs and regulatory requirements (EPA GLPs).

3.0 The QAU will inspect studies at intervals adequate to ensure the integrity of testing processes. These studies and phases will be selected by the QAU.

4.0 Any deviations discovered during an inspection that may pose a threat to study integrity will be immediately brought to the attention of the Study Director and the RFC. Any deviations discovered during an inspection that do not pose a threat to study integrity will be documented in the inspection report.

5.0 The Field Research Director's written response to the deviations should be a brief explanation as to why the deviation occurred. If the deviations are management corrective, the Field Research Director should explain what future actions will be taken to preclude recurrence. The completed QAU report and Field Research Director's response will be forwarded to the Study Director, with copies to the RFC and QAU.

6.0 After completion of the field study, QAU will review the FDB and supporting data for accuracy, completeness, conformity to the protocol, and compliance with GLP.

SOP Number: UCD-10-5.1	Pg 1 of 2
Title: EPA Inspections	

PURPOSE: To provide guidance for facilitating audits by the Environmental Protection Agency, Office of Compliance Monitoring.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Prior to Inspection

1.1 When received, the Notice of Inspection will be reviewed to determine the specific intent of the inspection. The Study Director(s), Quality Assurance Unit, and other interested parties will be notified of the pending audit or review as soon as possible.

1.2 Personnel who may be associated with the trial(s) or facilities audit should be briefed and scheduled to be available for the audit.

1.3 Documents that may be required during the inspection may include, but not necessarily be limited to:

1.3.1 QAU Master Schedule
1.3.2 SOPs
1.3.3 Facility and study-related raw data
1.3.4 Personnel Records (training, CVs, job descriptions)

1.4 Information not subject to EPA inspection includes, but may not necessarily be limited to:

1.4.1 QA Inspection Findings
1.4.2 Financial data
1.4.3 Confidential personnel data
1.4.4 Non-GLP research data

1.5 Organizational charts, facility maps and any information specific to the facility or area should also be made available to assist inspectors during the audit.

2.0 During Inspection

2.1 The inspection team will be received at UC Davis following standard facility policy. Name tags will be provided to each inspector and the inspection team will be escorted to a conference or meeting room.

2.2 Each inspector will be asked to provide credentials and the name and badge number of each inspector will be recorded. The inspection team will be asked to provide the proposed inspection agenda and expected duration.

2.3 Personnel shall provide only what is specifically requested by inspectors. Personnel shall not provide extraneous information in order to avoid disrupting the inspection schedule. If personnel are unable to provide requested information, they will refer the inspector to the appropriate personnel and will not speculate what the answer may be.

2.4 Comments, observations and discussions associated with the inspection will be documented.

2.5 In the event that a non-compliance issue is raised during the inspection, every attempt shall be made to correct the deficiency and provide confirmation of that correction to the inspection team.

3.0 Post Inspection

3.1 All personnel involved in the inspection should attend the exit interview. Issues, comments, concerns and suggestions discussed during the exit interview will be documented.

3.2 Any discrepancies or deficiencies shall be discussed and clarified if necessary. It will be verified that any problems that may have been discovered and mitigated during the inspection have been duly noted in the inspection record.

3.3 A complete set of all copies of all documents provided to the inspection team will also be retained along with inspection notes.

3.4 After the inspection, all interested parties will be informed of inspection activities and findings. Remedial action for problems that may have been detected during the inspection will be discussed and a plan of action initiated.

3.5 If required, inspection findings will be responded to in a timely manner.

SOP Number: UCD-20-1.4	Pg 1 of 2
Title: Raw Data (Recording)	

PURPOSE: To define methods used to ensure that raw data supporting a study conducted in compliance with GLP guidelines are collected and recorded accurately and promptly.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 All raw data will be recorded in permanent black or blue ink and will be initialed and dated by the person recording the data, on the day of entry. If this data is not recorded on the day of entry- the day of the procedure and the date of entry shall be noted. Any correction or changes made to raw data shall not obscure the original entry, and reasons for the change, date and initial, will be recorded.

2.0 All information transcribed from original raw data such as recorder charts, logbooks, etc., will be identified as such, and the source of the data noted.

3.0 Whenever a raw data document is copied, it will be clearly identified as a true copy and initialed and dated by the person verifying its authenticity. Use of red “Original” stamp will be used where appropriate.

4.0 Study Specific Data

4.1 All study-specific data should be clearly marked with the name of the project, Field I.D. Number, and other information that may be needed to understand the data and its source.

4.2 The study protocol will be carefully referenced to ensure that all data required are collected and recorded promptly. It is the responsibility of the Field Research Director to ensure that all raw data, summaries and other items connected with the study that need to be retained are stored in the study file.

4.3 All study specific raw data will be recorded on the IR-4 Field Data Reporting Form or placed in the IR-4 Field Data Book. Each portion of the form should be filled in as completely and accurately as possible as it pertains to the study after the information is available.

4.4 Unused FDB pages will be lined out and initialed and/or signed, and dated. Unused spaces or lines on a page may also be lined out and initialed and/or signed and dated. Entries made to line out unused portions of a page will be made in a manner that clearly distinguishes them from entries that may have been made to indicate repetitive information (i.e. - a distinct arrow, ditto marks, etc.)

4.5 Extra pages may be photocopied when needed. In trials with multiple applications, pages 6A and 6B (Application Equipment) only need to be included once, if the equipment and application types do not change. These pages shall be included at the first application. Likewise, pages 6L and 6M (Differentiation of Multiple Trials & Equipment Maintenance Log) only need to be included once, with the first application. Other than these duplicate pages, no pages will be permanently removed from the book.

4.6 The narrative portion of the FDB forms should be used to summarize the findings or provide clarification, if necessary.

4.7 At a minimum, information to be retained in the FDB should include (when applicable):

4.7.1 Copies of applicable facility records and supporting data (temperature, weather, personnel and equipment records; custody logs; correspondence, etc.)
4.7.2 All data required by the protocol
4.7.3 Performance data (pest counts, yield, phytotoxicity)

SOP Number: UCD-20-2.2	Pg 1 of 1
Title: Disposition of Field Data Books	

PURPOSE: To provide guidelines for handling study specific raw data at study completion.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Upon completion of the study, the Field Research Director (FRD) shall submit the completed FDB, including original raw data from field work as well as copies of supporting data (correspondence, protocol deviation forms, facility logs and records, etc.) to the Regional Field Coordinator:

IR-4 Western Region Coordinator
Dept. of Environmental Toxicology
4218 Meyer Hall
One Shields Ave.
University of California
Davis, California 95616-8588

2.0 The Regional Field Coordinator (RFC) will review the FDB for completeness and accuracy, and follow up with the FRD if necessary to obtain additional information or clarification.

3.0 After review, the RFC will transfer the FDB to the Quality Assurance Unit for audit. After Quality Assurance review, the FDB will be sent to the Study Director.

SOP Number: UCD-20-3.8	Pg 1 of 1
Title: Archiving Raw Data	

PURPOSE: To define procedures for maintaining, transferring and archiving original facility raw data.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 The official IR-4 Archive is located at IR-4 Headquarters office. No original raw data will be permanently archived at the UC Davis IR-4 Field Research Center

2.0 Prior to archiving, raw data documents will be stored in the UC Davis IR-4 Field Research Center Field Retention File. The Retention File is stored in a file cabinet located in the office of the Field Research Director that remains locked when unattended.

3.0 The IR-4 Field Research Director and Field Research Center Director serve as respective primary and back-up administrator of the Retention File. The Retention File may only be accessed by designated administrator, or under their direct supervision.

4.0 The Retention File will contain, at a minimum:

4.1 True copies of historical: SOPs (outdated); facility records (temperature, equipment, inventory, etc.).

4.2 Current originals: SOPs; facility records (temperature, equipment, inventory, etc.).

4.3 Copies of: Completed FDBs, less than 1 year old (copies of older FDBs may be held in general storage); QA inspection reports.

4.4 Copies of all historical and originals of all current personnel records (CVs, job descriptions, training), organization charts, maps, climatic data.

5.0 Original documents that will be permanently archived at IR-4 Headquarters will include, at a minimum:

5.1 Historical: SOPs; facility records (temperature, equipment, inventory, personnel, training, FDBs are also archived at IR-4 Headquarters after QA/QC reviews.

6.0 Original documents to be permanently archived will be transferred to IR-4 Headquarters on an approximate annual schedule. The archiving schedule will be determined by the FRD.

6.1 Transfer to IR-4 can be by hand or by courier service. If a courier service is used, then a Chain of Custody Form consistent with IR-4 Advisory #2006-1 will be used and should include identity of the service and a tracking number that can be used to trace the shipment. Included with the shipment should be an inventory of the transferred documents. Also send a copy of the Chain of Custody and inventory form to the Western Region IR4 office in Davis.

SOP Number: UCD-20-4.2	Pg 1 of 1
Title: Rounding Off	

PURPOSE: To ensure consistency in rounding off numbers in a calculation.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 The method of mathematical rounding shall be applicable in all instances where the rounding of digits is necessary.

2.0 Whenever applicable, all numbers should be rounded to the second number to the right of the decimal point (e.g. 1.257 would be reported as 1.26). When the last digit is a five the number two places to the right of the decimal place will be rounded up (e.g. 1.255 would be reported as1.26). Do not round any numbers within a calculation; round only the final calculation result.

3.0 If the readability of equipment limits the reporting of numbers equal to or less than two digits right of the decimal, then the actual number should be reported (e.g. 1.25 would be reported as 1.25 and 1.2 would be reported as 1.2).

4.0 When using electronic data capture for numerical information such as electronic notebook calculations or weather data, this SOP will default to the limit of detection and rounding of this equipment or programs unless otherwise noted by protocol or specific study SOPs.

5.0 An exception to the above rounding guideline would be when calculating the overage factor for application mixes. The Field Research Director may use as many numbers as deemed necessary (minimum of two) to the right of the decimal point.

SOP Number: UCD-30-1.2	Pg 1 of 1
Title: Commodity Establishment and Maintenance	

PURPOSE: To provide guidelines that ensures commodities are grown under good agricultural practices and provide a uniform crop for study.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Site selection will be made in accordance with the accepted horticultural practices for the commodity. Whenever possible, test sites will be located at UC Davis or land controlled by the University. When necessary, test sites will be located in a commercial production field or orchard.

2.0 When field trials are conducted in commercial production fields, accepted grower practices will be considered as standard procedure unless it conflicts with the protocol. Crop establishment and maintenance will usually be the responsibility of the grower.

3.0 In conducting studies off-site with a grower, the FRD will communicate frequently with the grower about agronomic activities in and around the test site. The grower should be kept fully informed of the study requirements for the plots, and be able to provide a record of agronomic activities for the site.

4.0 When trials are conducted at UC Davis, agronomic or horticultural practices shall be performed to bring the production practices within the requirements of the commodity.

5.0 For questions concerning crop production, current published literature may be used for reference, or an extension/horticulture specialist familiar with the subject production practices may be consulted.

6.0 The protocol will define the crop species. If the variety is not defined, those most commonly grown in the area by commercial producers should be used. If a commercial producer is providing transplants, those most uniform will be selected.

SOP Number: UCD-30-2.5	Pg 1 of 2

Title: Test Site (Selection, Design, Maintenance, Destruction)

PURPOSE: To provide guidelines for test site selection and management.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURES:

1.0 The test site should be located so there is sufficient isolation to preclude contamination from interfering materials from external sources such as commercial operations or other research studies.

2.0 Treated and untreated control plots will be adequately separated to prevent cross-contamination during test substance application. Factors such as the type of application equipment and the type and size of the test system should be considered when determining buffer distances. All plots will be separated by a distance that ensures contamination does not occur.

3.0 Experimental design of the plot will be driven by the protocol. If not defined by the study protocol, a commonly accepted experimental design (e.g., complete randomized block, replicated strip, etc.) will be used, when applicable.

4.0 The test site will be large enough: a) to accommodate the required number of replicates, buffer zones and treatments in accordance with an approved protocol, and b) for the commodity to be grown under commercial conditions yielding samples of sufficient size for analysis where required. The test site should be large enough so that no more than 50% will be required to satisfy the sampling requirements of the protocol.

5.0 Each plot will be established using a suitable measuring device. End boundaries will be clearly defined with visible markers such as stakes or flags. The Field I.D. number, treatment name, and FRD contact phone number will be clearly displayed at the test site.

6.0 The test plot boundaries, locations to each other, to established landmarks and to the North azimuth shall be recorded on a plot map. The closest distance between treated and control plots, and the distance to at least one permanent landmark shall also be recorded. When applicable, sub-plots and/or replicate plots will be documented. In addition, the approximate location of permanent landmarks may be recorded using low-definition GPS equipment such as a smartphone, or determined post facto using Google Earth. This is a navigational aid for locating the plot and is not a substitute for measuring the distance on the ground from landmarks to plot corners. Low-definition GPS equipment may be used to determine plot locations if the accuracy of such equipment is verified (and accurate within 30') by recording the positions of permanent landmarks visible on Google Earth as follows:

6.1: Locate a permanent marker clearly visible in Google Earth
6.2: Use smart phone to record GPS coordinates of permanent marker
6.3: Export GPS coordinates from phone to Google Earth
6.4 Use Google Earth ruler tool to compare recorded location versus known location.
6.5 Record time, coordinates and proximity in GPS verification log
6.6 Verify permanent marker at least three times

7.0 Whenever possible, maintenance pesticides should be approved by the Study Director prior to use. No pesticide should be applied to the test system that may interfere with the objectives of the study. When necessary, the analytical laboratory will be contacted for additional information that may be required to determine suitability of a maintenance pesticide.

8.0 After test substance application, plot maintenance activities will proceed from the untreated control plot first before moving into the treated plot(s).

9.0 When required, at the conclusion of the field study, crops treated with the test substance will be destroyed in accordance with regulatory requirements. In most cases, row crops will be disked under; and commodities from permanent crops will be dropped to the ground or removed from the test site, and destroyed in a manner that will render it unusable.

SOP Number: UCD-30-3.1	Pg 1 of 2
Title: Performance Evaluation	

PURPOSE: To define procedures for collecting performance field data.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURES:

1.0 Phytotoxicity Data

1.1 Consult the protocol to determine the method and timing of the phytotoxicity data. If no method is cited proceed as follows:

1.2 Where possible, make pretreatment evaluations within 24 hours before the initial pesticide treatment and phytotoxicity ratings two to four weeks after the treatment. If symptoms occur before, during, or after this period that warrant an additional reading, then phytotoxicity data should be taken as necessary.

1.3 Randomly select plants in the middle row of each plot and record a phytotoxicity rating of 0 to 10. 0= no injury, 10 = death of plant.

2.0 Efficacy/Pest Control Data

2.1 Consult the protocol to determine the method and timing of the pest data. If no method is cited then proceed as follows: where possible, take pest data within 24 hours before the initial pesticide treatment and within two weeks after the treatment and at various intervals thereafter, depending on the pest life cycle and at the termination of the study.

2.1.1 Disease data: record the name of the disease(s) being observed. Record the symptom(s) for each disease. Randomly select plants in the middle row of each plot and record the severity of each disease in a rating system of 0 to 10 for each plant. 0 = plant healthy; 10 = plant dead. one through nine = the percentage disease appearing on the plant. If there are less than five plants or trees per plot, record data from all the plants in a plot.

2.1.2 Insect data: record the name of the insects(s) being observed. Record the damage symptom(s) for each insect. For damage symptoms, randomly select plants in the middle row of each plot and record the severity of damage for each insect in a rating system of 0 to 10 for each plant. 0 = plant healthy; 10 = plant dead. 1 - 9 = the percentage damage appearing on the plant. If there are less than five plants or trees per plot, record data from all plants or trees in a plot. For insect pest population counts, take a random sample of the pest population (i.e. five leaves/plant of five plants/plot, four 3-inch diameter soil cores/plot, 100 apples/tree, etc.) to ensure an accurate reflection of the pest density/unit area.

2.1.3 Weed data: Visually observe each plot and record the names of the five most prominent weed species and the approximate percentage of the area they cover in each plot. Randomly place a grid covering an area of one quarter meter square (50 cm each side) in the plot. Where possible, count the number of weeds in the grid. If weeds are too numerous to make counting the entire area possible within a reasonable period of time, then count the number of weeds in one quarter of the grid, multiply by four and record this value as the number of weeds in the grid.

2.1.4 Nematode data: Record the damage symptom(s). For damage symptoms, randomly select ten plants in the middle row of each plot and record the severity of damage. Randomly select plants for diagnosis by UC Davis Nematology Department.

3.0. Yield Data

3.1 Where possible, obtain a reasonably up-to-date copy of the United States standards for grades of the commodity under study from the Agricultural Marketing Service or other sources. If U.S. grade standards do not exist, then consult other sources and document the plant stage, fruit ripeness, or other characteristics needed to determine quality.

3.2 Check the protocol for information on time of harvest. If none, then follow commercial practices in the area for the time of harvest of the commodity. These practices should be documented.

3.3 Where grading standards are known or exist, the commodity should be graded accordingly at harvest.

3.4 Each portion of the commodity, divided as to its quality standard, should be weighed or measured to determine yield. Use a certified scale to record weights. Calibrate scale prior to use to ensure accuracy. Written records should be kept of each measurement for each plot.

3.5 The method used to harvest the commodity should be referenced.

SOP Number: UCD-40-1.12	Pg 1 of 3

Title: Test Substance Receipt, Storage and Disposal/Spray Additives

PURPOSE: To provide guidelines for managing test substances in a manner consistent with GLP requirements.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Test Substance Receipt

1.1 Test substances will be received at University of California, 1 Shields Avenue, Davis, CA 95616 (PES Building, Rm 1111, or Robbins Hall, Rm 104). The FRD shall be notified on the same day, or reasonably thereafter, by office personnel and will transfer the test substance to the UC Davis IR-4 Field Research Center test substance storage area located within the Hanson Laboratory, 265 Robbins Hall.

1.2 Upon receipt, the test substance will be compared to the requirements of the protocol and logged into the appropriate FDB and into the UCD Field Research Center pesticide storage log. If all required information is not included at the time of chemical receipt the Study Director will be notified of the missing information.

2.0 Test Substance Storage

2.1 Test substances will be stored in accordance with label and MSDS instructions, and the current policies and guidelines of UC Davis.

2.2 At a minimum, all test substances must be labeled with:

2.2.1 Name, CAS or code number
2.2.2 Batch/lot number
2.2.3 Expiration date
2.2.4 Storage conditions

In the event that any of this information has not been provided, every effort will be made to secure that information and add the found (from COA, MSDS, or Study Director) information to the container label.

2.3 Test substances will be stored in a dry, well-ventilated building that is separate from offices or sample storage areas. Test substances will not be stored next to food, feed, seed, fertilizer, or other articles intended for consumption or use by humans or animals; or near food, beverages, tobacco, clothing and eating utensils.

2.4 The test substance storage area is climatically controlled sufficient to maintain storage temperatures between 40 and 95 degrees Fahrenheit..

2.5 The storage temperature will be monitored with a minimum/maximum thermometer and a data logger will be used as backup.

2.6 The test substance storage facility shall be locked when unattended, and accessed only by authorized persons.

2.7 Highly visible identification signs shall be posted on doors, to advise of the hazardous nature of the storage facility's contents.

2.8 Telephone numbers and names of personnel responsible for and knowledgeable of the contents of the storage facility shall be prominently posted.

2.9 Materials such as absorptive clay, granulated activated charcoal, hydrated lime, and sodium hypochlorite shall be readily available for emergency treatment or detoxification of spills or leaks.

2.10 Test substances that could be damaged by moisture or water will be stored in a manner that will not compromise their integrity.

2.11 A current inventory of all test substances in the storage unit shall be posted in an inside location accessible and visible to study personnel. This inventory will include the information required by local regulations.

3.0 Test Substance Disposal

3.1 The original containers for all GLP test substances must be retained until completion of the study and the Study Director has approved disposal of the containers.

3.2 EPA regulations require that test substance container(s) must be retained until the final study report is completed. Study completion can be confirmed by contacting the Study Director or the Regional Field Coordinator, or by searching the IR-4 web site under the Food Crops Database Search Options (https://www.ir4project.org/fc/fc-database-search-options/).

3.3 Where possible, the test substance and containers should be returned to the manufacturer or designee. Transportation must be according to all Federal, State, and local laws and regulations.

3.4 Test substance and/or containers not returned to the manufacturer or designee may be transferred to the UC Davis Plant Sciences chemical warehouse and used for maintenance applications after completion of the field study.

4.0 Spray Additives

4.1 GLP labeling requirements for reagents (i.e. adjuvants, spray additives) are: name, concentration, storage conditions and expiration date.

4.1.1 If temporary containers are used (i.e. a subsample dispensed from the purchased container or a properly labeled secondary container [see 4.1.2 below]) they should be used only for the purpose of measuring or preventing contamination. They should be adequately labeled to ensure the product is uniquely identified, but need not be labeled per GLP as required for the original or secondary containers. Excess material poured into a temporary container should not be used for subsequent GLP trials and should be discarded, i.e., not returned to the original or secondary container.

4.1.2 Secondary containers are permitted for storage (e.g. a 1 gallon container subdivided into 100 ml containers for ease of use and transport to remote sites), but must be properly labeled per the original container and now take on all the requirements and properties of an “original container”.

4.1.3 Spray additives will be stored in a location that has limited access and is temperature monitored.

4.2 Spray additives will be in good condition prior to use - the physical characteristics of the additive should not have changed from purchase or be compromised (i.e. different color, consistency [cloudy, darkened] or smell or appear rancid).

4.3 Spray additives must be handled in a manner to prevent cross contamination with test substances and other spray additives.

4.3.1 Spray additives will be dispensed from the original or secondary spray additive container using (a) a graduated cylinder (following the measuring protocol in 40-2. 1) or (b) a factory sealed newly opened pipette or syringe. After a pipette or syringe is used it is discarded and never used again. This pipette or syringe never returns to the spray additive container. The test substance is also dispensed by a different newly opened pipette or syringe, discarded after use.

4.5 If an expiration date is not available (i.e. on the label or SDS, or from contacting the manufacturer directly) then the FRD should assign one that does not exceed 2 years from the purchase date. It is also recommended that the FRD include the date the container was opened as a helpful reference date.

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SOP Number: UCD-40-2.6	Pg 1 of 3
Title: Test Substance Application	

PURPOSE: To provide guidelines for test substance application methods that ensures study integrity and compliance with regulatory requirements.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Safety

1.1 All UC Davis pesticide safety policies will be followed by all personnel involved in handling pesticides.

1.2 All personal protective equipment and clothing as required by the label or study protocol shall be worn in the handling of pesticides for storage, mixing and application. Emergency personal protective equipment (e.g. coveralls, respirators) must be available when handling hazardous (Class I) pesticides.

1.3 A supply of soap/detergent and water should be readily accessible for cleanup in the case of an emergency.

1.4 When applicable, re-entry restrictions will be observed following pesticide applications. For persons who regularly handle organophosphates and/or large quantities of carbamates, a cholinesterase level should be established, and monitored on at least an approximate annual basis.

2.0 Measuring

2.1 Liquid

2.1.1 Graduated Measurement Devices

2.1.1.1 When measuring with a device marked in graduated increments, volume should not be estimated. The increment nearest the actual volume level should be the reported volume so that a greater degree of accuracy is not implied.

2.1.1.2 Exact measurements should be made by measuring to an exact increment, and cylinders or pipettes with greater accuracy used when necessary. When measuring chemicals, tank mix additives or tank mix carrier, all measurements must be the exact volume as recorded in the data. For the carrier (e.g. water), record only to the level of accuracy of the largest measuring device used. For example, if a 1000 ml graduated cylinder with 10 ml increments and a 250 ml graduated cylinder with 2 ml increments are both used, the amount of carrier may only be recorded in 10 ml increments.

2.1.3 When measuring spray system discharge volume during calibration, measurements from each nozzle must be made with the same cylinder to eliminate any variance in the accuracy between cylinders, except when different size nozzles are used in single application (i.e. Airblast sprayer).

2.2 Dry

2.2.1 Calibration of the weighing instrument should be verified prior to weighing the quantity for use in the study using weights that bracket the target weight of test substance.

2.2.2 Weighing instruments shall have a readability to at least 0.1 gram.

2.2.3 If the precise amount needed for application is known, a dry test substance can be pre-weighed into a temporary container. If the substance is to be used immediately, the temporary container should be adequately labeled to insure the product is uniquely identified, but need not be labeled per GLP. If the substance is not used immediately, the temporary container has the same labeling requirements as the original or secondary containers. In either case, the label should indicate the amount (weight) of test substance contained. This temporary container is subject to the same storage and monitoring requirements as the original container.

3.0 Mixing

3.1 The method of mathematical calculations used to determine test substance usage shall be the choice of the FRD. Tank mixes will be prepared in a volume appropriate for optimal spray system operation and plot coverage that avoids excessive tank mix remainder after application.

3.2 When preparing a tank mix using a liquid test substance formulation, the total tank mix volume will be adjusted by the volume of formulated test substance. If the amount of test material is very small (less than .5 % of total volume) in comparison to tank mix volume it will not be necessary to adjust the total volume of the tank mix for the test substance.

3.3 A portion of the carrier will be added to the spray tank before the test substance is added. When possible, part of the pre-measured carrier will be used to thoroughly rinse chemical containers and/or measuring utensils into the spray tank.

3.4 If deemed necessary, a homogenous slurry will first be prepared by blending pre-measured test substance with a small amount of the pre-measured carrier, and then added to the spray tank when necessary to ensure proper dispersion of dry formulations.

3.5 In the case of small (back pack) applications the entire treatment of pre-measured test substance and carrier may be mixed in an appropriate size container and then added to spray tank.

3.6 Spray mixtures will be sufficiently agitated prior to use, and will be applied to the test plot no more than one hour after preparation, and generally within 5 to 10 minutes.

4.0 Application

4.1 Application will be made when environmental conditions such as wind or rain will not interfere with uniformity. If adverse conditions prevail, and a critical timing is affected, the Study Director should be contacted for guidance. The RFC and/or ARFC should also be notified.

4.2 All precautions should be taken to avoid applying pesticides to, or near, sensitive areas or where drift to these areas may occur.

4.3 When making applications at different treatment rates with the same test substance, applications should be made in order from the lowest to highest treatment rate. When making applications at the same treatment rates but different application volumes per acre (GPA), applications should be made in order from the highest (dilute) to the lowest (concentrate) GPA. It is not necessary to clean application equipment when going from lower concentrations to higher concentrations of the same test substance, but the tank and lines will be emptied between applications.

4.4 Where the application of restricted use pesticides is required in a study, the applicator must be certified or under the direct supervision of a certified applicator.

4.5 After application, excessive tank mix shall be safely discarded by one of the following methods:

4.5.1 Spraying over a non-crop area at the field site in such a way as to ensure contamination of the plot is prevented.

4.5.2 Spraying on a crop with a registered use

4.5.3 Spraying an area of the same crop that will not be used in the study.

4.6 The actual application rate shall be considered acceptable if it is within the range of -5% to +10% of the protocol specified application rate. If the application did not meet this range, the Study Director, RFC and/or ARFC must be notified of this deviation before proceeding with the trial.

SOP Number: UCD-50-1.9	Pg 1 of 3

Title: Residue Sample Collection

PURPOSE: To provide guidelines for collection of residue samples that ensures compliance with regulatory requirements.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 The study protocol will establish specific dates for the collection of samples. If these dates are based on uncontrolled events (plant size, fruit maturity, etc.) then tentative dates should be established and refined as necessary. If requested, the Quality Assurance Unit will be kept informed of these dates.

2.0 Residue sampling supplies should not be stored with or near pesticides or unwashed application equipment. Whenever possible, plastic laminated cloth bags will be used for residue samples.

3.0 Prior to sampling, the exterior of each sample bag will be labeled with at least the following information:

3.1 Field ID Number/crop/test substance
3.2 Field Research Director
3.3 Sample ID/treatment # /crop fraction
3.4 Date sampled/harvested

4.0 An additional sample identification label will be placed inside the sampling bag. This label shall be enclosed in a moisture-proof container (e.g. plastic zip-lock bag), and will contain the same information as outside label. Alternatively, the trial number and sample identification may be written on the outside of the sample bag in permanent marker.

5.0 The study protocol should establish sample quantity. In the event that it does not, samples will be collected that shall be adequate to fulfill the analytical requirements in order to support the objectives of the study. A non-GLP compliant balance may be used to determine sample weights.

6.0 Samples will be collected in an impartial manner that is representative of the entire plot, unless a unique sampling scheme is required by the protocol. Plot edges and ends will be avoided during sampling, unless those areas are an integral part of the sampling scheme.

7.0 Samples will first be collected from the untreated control plot(s), progressing in order from the lowest to the highest treatment rate. Plots may be sampled simultaneously by separate personnel.

8.0 Contamination of the sample in any way shall be avoided during the sampling, labeling, storage and shipping processes. Special care taken during sample collection and handling will include:

8.1 Diseased or undersized crop parts will be avoided
8.2 Care will be taken to avoid removal of surface residues
8.3 Disposable gloves will be worn
8.4 Tools will be cleaned prior to use and between samples
8.5 Soil or plant parts will not be removed from the raw agricultural commodity, or the commodity trimmed, unless required/allowed by the protocol

9.0 Residue samples should be removed from heat and direct sunlight as soon as possible to minimize degradation of the test substance. In the event that the time from collection to frozen storage is expected to exceed one (1) hour, 1) Control and treated samples should be placed in separate containers with ice or ice substitute to preserve the samples prior to frozen storage, if possible, and 2) Temperatures of the samples will be monitored with an appropriate device such as a min/max thermometer or a hobo data logger. Samples of different treatment doses will be transported in a manner that will avoid the potential of cross contamination of samples. Exceptions might include crop samples that must be dried or processed such as grains, beans, nuts and cotton.

Sample Drying

10.0 Drying of raw agricultural commodities to meet protocol requirements for % moisture determination of sample.

10.1 Small sub-samples will be taken prior to harvesting samples to determine appropriate target drying weights. The procedure below will determine target weights for the appropriate RAC and processing sample sizes.

1) Prior to RAC sampling take three samples for drying
2) Process the samples according to protocol (e.g. pit plums) and record wet weight of each
3) Dry the samples overnight or until the recorded weight does not change more than 1%
4) Record the drying start time, dryer temperature, wet weights, interim weights, dry weight and times all the weights are taken. Also document the drying containers used (e.g. type of bag, etc.) and their weights.
5) Calculate the % dry matter of the samples

% dry matter = 100 – ((wet wt. - dry wt.)/wet wt.)

6) Average the % dry matter from all three samples. Use the following formula for determining sample size needed for required moisture percentage in the protocol (e.g. 25% moisture prunes)

Dried commodity sample wt. = raw commodity sample weight * (% dry matter/% dry matter required)

(Where % dry matter required = 100 - % moisture required in protocol)

For Prunes:
Prune sample wt = plum sample wt * (% dry matter/75% dry matter

or inversely:

Plum sample weight = Prune sample wt * (75% dry matter required/%dry matter)

10.2 Take fresh sample required by protocol for the dried samples. Untreated and treated samples will be kept separate and any necessary processing (such as pitting, etc.) will be done before drying. Samples will be stored in a manner to meet protocol requirements during transport to drying ovens.

10.3 Untreated and treated samples will be dried in separate ovens at approximately the same temperatures. Temperatures for both ovens will be monitored with a thermometer.

10.4 Drying temperatures should be according to protocol, or if not specified, shall not exceed 180˚ F. Drying time will be determined when samples have reached (dried down) the desired % moisture range in the protocol.

10.5 Formula for moisture determination:

(A-B)/(A)X100=C % Moisture of Sample

A= wet sample weight
B= dry sample weight
C= % moisture of sample

SOP Number: UCD-50-2.12	Pg 1 of 2
Title: Residue Sample Storage and Shipment	

PURPOSE: To provide guidelines for the proper storage and shipment of residue samples that ensures sample integrity and regulatory compliance.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Storage

1.0 All samples will be frozen as soon as possible following their collection or as soon as any processing requirements have been met, unless other storage requirements are specified by the study protocol. Samples of different treatment doses will be stored in a manner that will avoid the potential of cross contamination of samples.

1.2 Samples identified for post-harvest processing should be processed or shipped to the processor as soon after collection as possible.

1.3 The freezer and/or room where samples are stored shall be locked when unattended.

1.4 Frozen samples will be stored at approximately 0 degrees Fahrenheit (-18 degrees Celsius) and temperatures will be monitored with a verified or certified device. (Thermometers that are NIST certified at 0 C are qualified for this usage.) Temperature spikes which occur during defrost cycles and freezer loading or unloading do not affect sample integrity.

1.5 An inventory log will be maintained of samples stored in the freezer. This log shall contain a description of the sample (sample type), study number, dates/times of freezer entry or removal and the initials of the person storing or removing samples.

2.0 Shipping

2.1 Upon completion of the sampling, the Residue Sample Shipping and Identification Form, (8B) should be completed, signed and dated by the FRD. A copy of the form must be placed in a waterproof container and packed in each sample box along with page 8C. The original Residue Sample Shipping Form shall be kept in the Field Data Book.

2.2 When possible, and less than 50 pounds total weight, all samples should be placed in the same shipping box. The sample bags for each treatment should be placed in a large plastic bag and may be separated by using cardboard layers or other suitable materials between different treatments.

2.3 Prior to, and/or soon after shipping, the residue laboratory will be contacted by phone, fax or e-mail, and notified of shipment dates and methods. Latest contact will be noted in Field Data Book.

2.4 All residue samples will be shipped in suitable containers of sufficient size and strength to hold the residue samples.

2.5 For all shipping containers:

2.5.1 Trial ID# must be affixed or written on the exterior
2.5.2 Must be weighed and the weight recorded on the exterior. No single box should weigh more than 75 lbs.
2.5.3 Must be numbered in a way that indicates the total number of containers being shipped for a given study. (e.g. - 'Box 1 of 1'; or 'Box 1 of 6', etc.)
2.5.4 If treated and untreated samples are shipping in separate containers, each container should be identified as such.
2.5.5 Chain of custody should be placed inside each box.

2.6 When shipping with dry ice:

2.6.1 Insulated containers (boxes or coolers) must be used.
2.6.2 Boxes will be packed with dry ice in quantities sufficient to maintain sample integrity during shipment.
2.6.3 Dry ice should be packed in several locations within the container to maintain an even temperature, where possible.
2.6.4 Container lids and seams should be securely taped. Address labels must be covered with clear tape.
2.6.5 DOT approved hazardous (dry ice) shipping labels must be affixed to the exterior

2.7 Sample shipping will be conducted by commercial overnight air service (FedEx or other comparable company) or by Agricultural Chemical Development Services (ACDS) freezer truck service. If necessary, arrangements will be made with the carrier for pick-up and shipment of the samples. Commercial overnight shipments should not be initiated after Wednesday to avoid weekend delivery. If protocol allows, samples may be hand delivered to participating labs located at UC Davis.

2.7.1 <u>Federal Express (FedEx):</u>

2.7.1.1 For same day pick-up, samples should be brought to the UC Davis Bulk Mail Division by 3:00 P.M.

2.7.2 <u>ACDS (Agricultural Chemical Development Services)</u>

2.7.2.1 Should be notified as far in advance as possible.

SOP Number: UCD-60-1.4	Pg 1 of 1
Title: Borrowed/New/Rented Equipment	

PURPOSE: To describe the procedures used to acquire rented/borrowed equipment for use in GLP studies. It applies to equipment not routinely available at the field test facility.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Procurement Procedures

1.1 Contact the appropriate source for the equipment to be borrowed, purchased or rented

1.2 Determine whether there is an operation manual available for the equipment. Request a copy of the manual when it is available

2.0 Documentation

2.1 The information must be documented for borrowed, purchased and rented field equipment.

2.11 Owner/Source
2.1.2 Description of equipment, e.g., type, make, and model
2.1.3 Year manufactured (when available)
2.1.4 Year acquired (when available)
2.1.5 Purpose
2.1.6 Study identification
2.1.7 Condition upon receipt e.g., good, needed repair
2.1.8 Maintenance performed (when applicable)
2.1.9 Modifications required (when applicable)
2.1.10 Cleaning/decontamination procedures preformed
2.1.11 Research Director statement of suitability for use
2.1.12 Date of use
2.1.13 Time procedure initiated and completed

2.2 The person entering the information must initial and date entries.

2.3 The above information is maintained in the Archives. A copy of the operations manual, when available, will also be kept with the raw data.

2.4 Copies of documentation & operations manuals can be included in FDB when equipment is used for that trial when deemed necessary.

SOP Number: UCD-60-2.9	Pg 1 of 2
Title: Freezers	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data, is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 The freezer thermostat should be set to maintain a temperature of at least 0^0 F (-18^0 C).

2.0 Calibration

2.1 None required.

3.0 Cleaning and Maintenance

3.1 Routine cleaning of the freezer is not considered necessary. On an approximate annual basis, usually during a period when field trials are completed for the season and the freezer can be decommissioned for a short time, the exterior and interior surfaces will be thoroughly cleaned. On powering up again, freezer temperatures will be monitored with calibrated or certified thermometers to ascertain that freezers reach their operating temperature range within a reasonable time. Approximately one week after powering down and up again, freezer min/max temperatures will be checked and recorded to ensure they are stable within the operating temperature range. This monitoring will be completed before any samples are stored.

3.2 Maintenance required as a result of normal wear defines routine maintenance. No scheduled routine maintenance is required.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 UC Davis Facilities O & M Electrical Alarm System is operated by UC Facilities (752-1655). In the event of an individual freezer malfunction, a qualified service representative will be immediately summoned. If the malfunction exceeds 6 hours the contents of the freezer will be transferred to alternate frozen storage areas.

4.1.1 The UCD IR-4 field facility has two freezers, one for treated and one for untreated samples. If one freezer fails, samples can be double-bagged in large plastic bags, sealed, and moved to the other freezer for temporary storage.

4.2 If the malfunction results in a deviation from a study protocol, the deviation will be documented and the Study Director will be notified.

4.3 In event of loss of power all effort will be made to keep samples frozen in freezers. If available, portable power generators provided by UC Davis Facilities Services Emergency Power Group will be utilized.

4.3.1 If the power outage is local, and generators are not available, then freezer temperatures will be monitored and dry ice added as needed to keep temperatures near 0°F. As soon as possible, samples should be moved in a cooler with dry ice to the CHE facility (3792 Old Davis Rd).

4.3.2 If the power outage is regional, and generators are not available, then freezer temperatures will be monitored and dry ice added as needed to keep temperatures near 0°F.

4.4 Maintenance consists of checking and testing the complete alarm system, including the backup battery condition, integrity of connections, sensitivity of sensors and proper communication with dispatch and operations approximately annually. The system is checked by activating the alarm remotely within the system and phone numbers are checked in sequence. The FRD is contacted through email with the maintenance record if the system passes. If there is a problem or malfunction in the system, the FRD is contacted immediately by phone and a Campus Technician meets the FRD at the freezer room for diagnosis and rectification of the problem. The system will be tested manually by removing the temperature probe from freezer thus raising the temperature until the alarm goes off and phone calls are received. (Both freezer probes will be tested - Untreated & Treated). This data will be recorded in the freezer maintenance logs stored at UCD IR-4 FRC.

4.5 Anytime there is a major repair or replacement to the freezers and/or alarm system, the alarm system will be tested to confirm it is working properly.

5.0 Responsible Personnel

5.1 Equipment inspection, cleaning (when required) and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCD-60-3.5	Pg 1 of 3
Title: Sprayer – Backpack	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Prior to calibration, a general inspection will be made of the sprayer for visual damage or potential problems. The spray system will then be operated to verify that the nozzles provide the desired pattern and that the pressure regulator is operating properly.

1.2 The spray system which consists of a CO_2 cylinder, pressure regulator, tank, spray boom and related hoses, may be uniquely adapted to an assortment of application requirements and may either be hand carried or mounted on a variety of application equipment such as a bicycle sprayer, tractor, helicopter, or fixed above a conveyor belt.

1.3 Before operating the sprayer, the regulator valve should be set at the low pressure position before opening the CO_2 valve. The regulator valve can then be adjusted to the desired pressure.

1.4 Calibrated spray pressure, RPM (if applicable) and speed information shall be confirmed prior to spraying. Actual spray pressure, RPM (if applicable) and speed during application will be recorded and should remain unchanged from calibration.

1.5 If the spray system is mounted on application equipment, the equipment will be timed through a test run in the test field prior to the application to verify speed. If the spray system is hand carried, the applicator will be timed through a test run in the test field, to confirm that travel time is accurate. Verification pass time will be recorded.

1.6 Each spray pass through the plot during the application will be timed and recorded to verify the actual application rate.

1.7 After use, the CO_2 valve should first be closed. If the sprayer is fitted with a pressure relief valve, the excess pressure should then be released from the spray system. The air supply hose should first be disconnected from the spray bottle, then the spray boom hose can be disconnected. This sequence will prevent the possibility of expulsion of spray solution from the spray tank.

2.0 Calibration

2.1 Calibration of the sprayer will occur or be verified prior to each use by a method which is accurate and reproducible. This method will be documented and may include, but not necessarily be limited to, the following:

2.1.1 Constant pressure will be set.

2.1.2 Discharge volume of liquid from each nozzle shall be measured and each individual measurement from 3 or more consecutive measurements shall not vary more than 5% from the average of all measurements. Any nozzle which varies greater than 5% should be cleaned or replaced. The average measurement will be used in the final calculations made to determine the actual application volume.

2.1.3 The sprayer speed shall be timed over a known distance, and each individual measurement shall not vary more than 5% from the average of 3 or more consecutive measurements. The averaged measurement will be used in the final calculations made to determine the actual application volume.

2.2 If calibration does not occur on the day of use, sprayer discharge must be verified and documented at least once, and must be within 5% of the calibrated value or the sprayer must be re-calibrated.

2.3 The method of mathematical calculations used will be the choice of the Field Research Director and shall be recorded in the raw data.

3.0 Cleaning

3.1 After use, and between treatments with different chemicals, the spray system will be thoroughly cleaned with soap and water. After the system has been operated and thoroughly flushed with soap and water, it will be thoroughly rinsed with clean water.

3.2 The spray apparatus exterior (tanks and boom) will be hosed with clean water.

3.3 Exceptions to these cleaning requirements may include:

3.3.1 Equipment used in applying chemicals that may require specific solvents to remove chemical residues. In this case, cleaning methods must be thoroughly documented in the trial raw data.

3.4 For trials with multiple treatments of the same test substance at varying rates, applications should be made in order from the lowest to the highest treatment rate, in which case:

3.4.1 It will not be necessary to clean the spray system between treatments. The spray system can be completely drained and the next tank mix prepared. The next application should then proceed only after the boom has been fully charged.

3.4.2 It is preferable to use separate spray tanks. If separate spray tanks are used, all tank mix solution may be drained from the boom back into the spray tank and the boom connected to the next spray tank for application. The next application should then proceed only after the boom has been fully charged.

4.0 Maintenance

4.1 Maintenance required as a result of normal wear defines routine maintenance. Other than replacing worn regulator seals on an as needed basis, no scheduled maintenance is required.

4.2 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken. However, malfunction of a pressure regulator is considered a result of normal wear, and its repair is considered routine maintenance.

5.0 Contingency Procedures

5.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs the application should be stopped. An evaluation of the impact on the trial and plot will be made; the affected areas of the plot will be marked. At this point the Study Director and Western Region Field Coordinator will be contacted to discuss actions to be taken.

6.0 Responsible Personnel

6.1 Equipment inspection, calibration, cleaning and maintenance (routine and non- routine) shall be performed or supervised by the Field Research Director.

7.0 Records

7.1 A record of the dates of equipment inspection and maintenance will be kept in an equipment logbook. Calibration results and cleaning records can be accessed within each FDB part 6 application. Historical records will be retained in the archives.

SOP Number: UCD-60-4.7	Pg 1 of 2

Title: Temperature Measurement Instruments - Thermometers

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Regardless of type, any temperature sensing instrument must be positioned in the target area in a location that is representative of the area and allowed sufficient time to equilibrate before reading.

1.2 If situated in an outdoor or greenhouse area, the instrument should be placed out of direct sunlight and with adequate ventilation to prevent absorbed or reflected heat from affecting its accuracy.

1.3 If present, minimum/maximum temperature indicators must be reset between readings.

2.0 Verification

2.1 Thermometers will be verified at least once a year.

2.2 Thermometers will be verified against a current NIST certified thermometer at two temperature reference points. Thermometers will be verified/standardized near the temperature of actual use. The instruments should be allowed to equilibrate for at least 15 minutes before readings are taken and recorded for both test and reference thermometers at any reference point. If temperature variation from the tested thermometer is greater than 3 degrees from the current NIST certified thermometer, the thermometer will be taken out of service.

2.3 All min/max thermometers are NIST Certified and can be used after NIST certification expiration if they are within 3 degrees of the current NIST thermometers.

3.0 Cleaning and Maintenance

3.1 The instrument will be cleaned when necessary.

3.2 No scheduled routine maintenance is required.

3.3 Non-routine maintenance should not be required. Thermometers which have been determined to not be functioning properly will be replaced.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, verification, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCD-60-5.5	Pg 1 of 2

Title: Temperature/Humidity/Wind Speed Measuring Instrument-Kestrel 3000

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Measure Temperature, Humidity and Wind as directed in Kestrel 3000 operation manual (Attachment 60-5.1.1)

2.0 Verification of Accuracy and Calibration

2.1 Kestrel 3000 thermometer will be checked and verified at least once a year.

2.2 Verification will be checked against a NIST certified thermometer at one temperature reference point. The thermometers should be allowed to equilibrate for at least 10 minutes before readings are taken and recorded for the test and reference thermometers at any reference point. If temperature variation from the certified thermometer is more than 3 degrees, the thermometer should be replaced or returned to manufacture for adjustment.

2.3 Verification of Kestrel 3000 humidity and wind speed will be done by comparing with two other Kestrel devices. If variation is more than 5% of other devices, the equipment will be replaced.

3.0 Cleaning and Maintenance

3.1 The instrument will be cleaned when necessary.

3.2 Maintenance required as a result of normal wear defines routine maintenance. Other than replacing batteries, no scheduled maintenance is required.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, verification, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCD-60-6.7	Pg 1 of 2
Title: Temperature Recording Instruments-HOBO Temp (Onset)	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 While connected to the computer, the instrument is launched (set to record at specified intervals for a specified duration), and battery status checked.

1.2 Unless auxiliary sensory probes are used, the instrument should be placed in a location representative of the area being monitored whenever possible.

1.3 Data will be downloaded on a seasonal schedule, or as needed. At each download interval, data should be printed out and filed.

1.4 Freezer temperatures will not be monitored when they do not contain samples.

2.0 Verification of Accuracy

2.1 Verification of accuracy will be checked at least once a year.

2.2 Verification of accuracy will be checked against a NIST certified thermometer or verified min/max thermometer at two temperature reference points near the device's range of use.

2.3 The instrument will be launched and set to record. Resulting data will be downloaded and compared to values observed on a NIST certified thermometer or verified min/max thermometer at approximately the same log times. This procedure will be performed at two temperature ranges representing likely extremes. Freezer HOBOs can be checked in a freezer and in a refrigerator; ambient HOBOs can be checked in a refrigerator and at room temperature.

If temperature variation from the reference thermometer is more than 3 degrees, the instrument should be replaced or adjusted, if possible.

3.0 Cleaning and Maintenance

3.1 The instrument will be cleaned when necessary.

3.2 Maintenance required as a result of normal wear defines routine maintenance. Other than replacing batteries when necessary, no scheduled maintenance is required.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, verification, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCD-60-7.5	Pg 1 of 1
Title: Weights (Verification)	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data, is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Weights should be stored in a closed container and should be handled as carefully as possible.

1.2 The weight should be visually inspected prior to use to confirm that it is undamaged.

1.3 The weight will be placed on a weighing instrument that has been cleaned and tared.

1.4 The weighing instrument will first be allowed to stabilize, then the results recorded in the appropriate logbook.

2.0 Verification

2.1 Calibration weights will be verified against certified weights on an approximate annual schedule or by verifying on recently calibrated balance.

3.0 Cleaning and Maintenance

3.1 As needed.

4.0 CONTINGENCY PROCEDURES

4.1 If a weight is suspected to be faulty, it should be checked against another weight and replaced if necessary.

5.0 Responsible Personnel

5.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, verification, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCD-60-8.2	Pg 1 of 2
Title: Weighing Instruments	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 If the instrument is capable of reporting data in more than one type of unit of measurement (i.e. - grams, ounces, grains, etc.), the measurement mode should be checked prior to use and adjusted if necessary.

1.2 The instrument must first be tared (set to zero) and the digital readout should be observed for any fluctuations which might indicate potential problems that may affect instrument performance, such as an improperly situated weighing plate, or, for more sensitive instruments, air currents.

1.3 Once the instrument has been determined to be functioning properly, weighing may commence.

1.4 When weighing into a container, the instrument must again be reset to zero after container has been placed on it, and before weighing procedures begin.

2.0 Calibration

2.1 Certified calibration or verification with recently certified weights shall be performed on an approximate annual schedule.

2.2 Calibration will be verified prior to use. For this purpose, certified or verified weights will be used, and whenever possible, this should be achieved with weights which encompass the desired target weight. If it is determined that the accuracy of the instrument varies by more than 1% from target, it should be adjusted in accordance with the instructions provided by the manufacturer. If a problem persists, the instrument shall be serviced by the factory service department or other qualified service personnel or replaced.

3.0 Cleaning and Maintenance

3.1 The instrument shall be thoroughly cleaned when necessary.

3.2 Maintenance required as a result of normal wear defines routine maintenance. The following routine maintenance will be performed as necessary:

3.2.1 If present, batteries will be replaced when necessary.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, calibration, cleaning and maintenance (routine and non- routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCD-60-9.9	Pg 1 of 3
Title: Sprayer – Airblast	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Calibration

1.1 Prior to calibration, a general inspection will be made of the sprayer for visual damage or potential problems. The spray system will then be operated to verify that the nozzles provide the desired pattern and that the pressure regulator is operating properly and the spray coverage of the trees is adequate.

1.2 Place a length of Tygon tubing, or similar material, over each nozzle to be used to make the application.

1.3 Charge the sprayer system at whatever pressure is required to get proper coverage of the trees/vines.

1.4 After system has been charged allow water to run through the tubes before collecting spray.

1.5 Discharge sprayer for at least 30 seconds. Collect the output from all tubes into one container. Repeat two more times, with two more containers, for a total of three output collections. Record outputs, tractor rpm, and sprayer pressure.

1.6 Calculate the average total discharge and the delivery rate of the sprayer for the three runs.

1.7 Perform necessary calculations to determine target pass time(s) for application.

1.8 Speed Calculation:

1.8.1 Drive Tractor (at operating RPM and psi) with sprayer tank filled with approximate amount of spray to be applied, along a test track (usually the length of the treated plot) with terrain similar to that of the test plot.

1.8.2 Record the time taken to cover the length of the test track.

1.8.3 Perform a total of three runs. Calculate speed, if needed.

2.0 Operation

2.1 With sprayer hooked up to tractor, fill tank with enough water to test sprayer.

2.2 Activate PTO and adjust RPM to proper pressure

2.3 Become familiar with valve switch controls for boom operation.

2.4 Empty remaining water after testing system.

2.5 Filling tank:

2.5.1 Fill tank with approximately one-half to two-thirds of the carrier water needed for the application.

2.5.2 If a liquid material is used the determined volume of material will be poured into the tank. Rinse the material out of the container (the rinsate) into the sprayer. Then pour the remaining water into the tank. Use carrier water for the rinsate.

2.5.3 Prior to dumping in the remaining carrier water, subtract the amount of liquid materials from the ending value.

2.5.4 If the amount of test material is very small when compared to the volume of water used the amount of test material may be added to the overall volume of liquid used to determine amount sprayed.

2.5.5 If a powder is used, fill the tank with 1/2 to 2/3 of carrier water and then dump the powder, then add the remaining water. Agitate the tank before application. If necessary, a slurry may be made using carrier (water).

2.6 For trials with multiple treatments of the same test substance at varying rates, applications should be made in order from the lowest to the highest treatment rate, in which case:

2.6.1 It will not be necessary to clean the spray system between treatments. The spray system can be completely drained and the next tank mix prepared. The next application should then proceed only after the sprayer has been fully charged.

2.7 Read Protocol chemical label, and adjuvant label (if applicable) for additional or special mixing & loading requirements. The trial Protocol over rides the chemical label.

3.0 Cleaning

3.1 After use, and between treatments with different chemicals, the spray system will be thoroughly cleaned to prevent contamination of other crops with test material.

3.2 Sprayer cleaning procedure: Drain remaining spray in a waste area, discharge sprayer to purge system, remove and clean filter, rinse interior of spray tank and drain, add clean water to tank, discharge sprayer again to purge system, drain tank. Repeat last procedure (from adding clean water) two more times for triple rinse.

3.3 Exceptions to these cleaning requirements may include:

3.3.1 Equipment used in applying chemicals that may require specific solvents to remove chemical residues. In this case, cleaning methods must be thoroughly documented in the trial raw data.

4.0 Maintenance

4.1 Check for broken/worn/loose sprayer nozzles and hoses and replace, if necessary

4.2 Check and maintain pump oil level

4.3 Apply grease to all grease nipples at beginning of season and as needed

4.4 Record inspection, maintenance (routine and non-routine), testing and calibration in appropriate log.

4.5 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

5.0 Contingency Procedures

5.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs the application should be stopped. An evaluation of the impact on the trial and plot will be made; the affected areas of the plot will be marked. At this point the Study Director and Western Region Field Coordinator will be contacted to discuss actions to be taken.

6.0 Responsible Personnel

6.1 Equipment inspection, calibration, cleaning and maintenance (routine and non- routine) shall be performed or supervised by the Field Research Director.

7.0 Records

7.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Calibration results can be accessed by reference of the study number recorded in the Equipment Log at the time of these operations. Historical records will be retained in the archives.

SOP Number: UCD-60-11.2	Pg 1 of 3

Title: Test Substance Injection System into Drip Irrigation

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURES:

1.0 Operation;

1.1 Ensure the irrigation system is operating properly and can support the injection system to meet protocol and safety requirements. (No back flow of test substance into delivery system). Back flow prevention valve, pressure regulator, pressure gauge and filter shall be placed in the delivery line before the injector.

1.2 Prior to calibration, a general inspection will be made of the injection system for visual damage or potential problems. The injection system will then be installed in line around a second pressure regulator and operated to verify that the irrigation delivery system can provide the desired pressure and is operating properly.

1.2 The injector system is made up of the injector, 2 flow valves, metering valve, and ¼" plastic tube with filter attached at the end which is put into chemical/carrier container.

1.3 Calibrated injection flow rate shall be confirmed prior to injection application. Actual injection flow will be timed and recorded and should remain unchanged from calibration. A flow meter can be installed in line after the injection system as a secondary device for accuracy verification.

1.4 Immediately after chemical/carrier injection, the suction tube will be taken out of the chemical container and put into a vessel with clean water to push all the chemical/carrier into the drip system and into the treated plot. Clean water can also be added to the chemical container allowing the suction to inject the rinse water into the drip system. The injection system flow valves will be closed and the irrigation water will be allowed to bypass the injection system to push all the chemical/carrier through the drip system into the treated plot. Length of time the irrigation system is run after the injection is dependent on the protocol requirements.

2.0 Calibration

2.1 Calibration of the injection system (suction) will occur or be verified prior to each use by a method which is accurate and reproducible. This method will be documented and may include, but not necessarily be limited to, the following:

2.1.1 A known amount of water/carrier only will be measured into a graduated cylinder or calibrated vessel large enough to contain the amount of water for testing. A predetermined amount of time will be calculated for the test, the injector valves opened and water allowed to flow through the injector system which will suck the water/carrier out of the vessel. A timing device will be started when the valves are opened and stopped when the valves are closed. The amount of water sucked from the graduated cylinder will be determined by subtraction and the suction rate/time calculated. This test will be repeated 2 more times to obtain an average suction rate.

2.1.2 Calibration of the suction rate can be performed not more than 48 hours before the actual injection, or according to protocol.

2.2 Calibration of the flow rate of the delivery system will occur or be verified immediately prior to each use by a method which is accurate and reproducible. This method will be documented and may include, but not necessarily be limited to, the following:

2.2.1 A predetermined number of emitters in the treated plot (minimum of 2/drip line) will be isolated in such a way that the water exiting each emitter can be caught. The water will be measured. A timing device will be initiated when the catch cup is put under the emitter and stopped when the catch cup is removed. Place a catch cup under a single emitter at the approximate beginning of each irrigation line and collect the output for a known amount of time (ideally 1 to 2 minutes), then measure and record the discharge volume. Repeat this at the approximate middle and end of each irrigation line. Emitter output can be variable, but should be reasonably consistent.

3.0 Cleaning

3.1 No cleaning of injector is required. After injections a known amount of clean water will be run through the injector as described in 1.1.4.

3.1.1 The outside of the injector system may be washed off with clean water and allowed to air dry away from plot area if deemed necessary.

3.2 Injector system will then be stored in the pesticide equipment storage room.

4.0 Maintenance

4.1 Maintenance required as a result of normal wear defines routine maintenance. Other than replacing worn seals on an as needed basis, no scheduled maintenance is required.

4.2 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken. However, malfunction of a pressure regulator is considered a result of normal wear, and its repair is considered routine maintenance.

5.0 Contingency Procedures

5.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs the application should be stopped. An evaluation of the impact on the trial and plot will be made; the affected areas of the plot will be marked. At this point the Study Director and Western Region Field Coordinator will be contacted to discuss actions to be taken.

6.0 Responsible Personnel

6.1 Equipment inspection, calibration, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

7.0 Records

7.1 A record of the dates of equipment inspection, calibration and maintenance will be kept in an equipment log book. Calibration results cleaning and maintenance records can be accessed within each FDB part 6 application. Historical records will be retained in the archives.

SOP Number: UCD-60-12.1	Pg 1 of 2
Title: Portable Drip Applicator	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California, Davis IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 The application system consists of mix tank, pump, filter, pressure regulator, hoses, and valves that can be adapted to various drip emitter irrigation lines.
1.2 Arrange irrigation lines in the test plots in a manner that represents standard irrigation practice for the crop. Attach irrigation lines to application system.
1.3 The pump should be started, and the system checked for leaks before output verification.

2.0 Verification

2.1 Add sufficient water to tank to complete three verification runs and start pump. After system has been running, check irrigation lines to ensure all emitters are flowing.
2.2 Place a catch cup under a single emitter at the approximate beginning of each irrigation line and collect the output for a known amount of time (ideally 1 to 2 minutes), then measure and record the discharge volume. Repeat this at the approximate middle and end of each irrigation line. Emitter output can be variable, but should be reasonably consistent.

3.0 Application

3.1 Add calculated volume of carrier/irrigation water to mix tank, filling to exact gallonage mark (if applicable). Add test substance and then agitate.
3.2 Start pump, run entire volume of mix through application system, stirring tank mix occasionally to ensure uniform distribution of test substance.
3.3 Apply additional measured volume of irrigation water as specified in protocol.

4.0 Cleaning

4.1 If additional clean irrigation water has been applied, the system is considered to be clean.
4.2 If no irrigation has been applied, flush system by washing down inner surface of tank and running clean water through pump.

5.0 Maintenance

5.1 Maintenance required as a result of normal wear defines routine maintenance. No scheduled maintenance is required. Normal maintenance due to normal wear includes repairing and replacing lines, hoses, valves etc.as needed.

5.2 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken. However, malfunction of a pressure regulator is considered a result of normal wear, and its repair is considered routine maintenance.

6.0 Contingency Procedures

6.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs the application should be stopped. An evaluation of the impact on the trial and plot will be made; the affected areas of the plot will be marked. At this point the Study Director and Western Region Field Coordinator will be contacted to discuss actions to be taken.

7.0 Responsible Personnel

7.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

8.0 Records

8.1 A record of the dates of equipment inspection, verification and maintenance will be kept in an equipment log book. Verification results, cleaning, and maintenance records can be accessed within each FDB part 6 application. Historical records will be retained in the archives.