Keep incremental backups of ARM trial and protocol changes for information security

1) Use separate device such as SD card that is always available; set path in File tab of Tools - Options:

Study data:	C:\Users\Steve\Documents\ARM Data\ARMtutor\	▼	Browse...
	☐ Set as default		
Backup:	F:\ARMBackup\		Browse...
	20 ⬍ Backup interval (minutes)		

2) ARM backup provides strong security against losing trials from hardware or software failures. A backup is added:

   a) Each time a changed study is closed.

   b) When creating a new trial that overwrites an existing trial.

   Backups are stored in dedicated ARMbackup directory, with each study in a separate zip.

   Each saved version is preserved (has a unique name), giving a history of changes since trial was created.

21	G-All Example 8.dat8	7/19/2008 8:25:04 AM	
22	G-All Example 8.dat8	7/19/2008 8:31:56 AM	
23	G-All Example 8.dat8	9/5/2008 9:12:08 AM	
24	G-All Example 8.dat8	7/19/2008 8:31:56 AM	Restored version 22; Last saved versio

   View   Restore   Cancel   Help

3) Easily review point-in-time changes from study list 'Previous Versions' dialog (right-click lower grid to select).

4) ARMbackup is location where future ARM versions will maintain backups of your ARM settings and personal lists, to simplify migrating ARM to a new PC (just transfer SD card).

Use sponsor protocol, when provided

Each contracted trial is nearly always summarized with comparable trials at other locations. Every inconsistency between different trials costs the sponsor time to re-enter or clean up treatments and assessment headers. Even worse, missing site description information may invalidate a trial so sponsor cannot use the trial. To avoid:

1) Follow defined study rules, which visually indicate trial entry fields where information is required (pink) or recommended (light blue).

   Latitude of LL Corner °:
   Longitude of LL Corner °:
   Overall Moisture Conditions:

2) Use treatments as entered, so sponsor has consistent treatments across contractors.

   a) Review treatments from sponsor to ensure that the minimum number of recommended fields are filled:

      i) Type field, which identifies product validation list to use for the entered product, and is frequently used as a selector field in multi-trial summaries. For example, to search for treatments with "any adjuvant".

      ii) Formulation Concentration, Form Unit, and Form Type for any formulated product, even fertilizers or seed. These are key fields for ARM product amount calculations.

         (1) For fertilizers, enter Form. Conc. of the primary test nutrient, and identify that nutrient as the Form Unit. For example, enter Urea as Form Conc=46, Form Unit=% N, Form Type=SG (soluble granule).

         (2) For seed, enter Form. Conc. as the % live seed (germination %), Form Unit as % if ARM should adjust seed quantity calculations for germination % of seed. If ever prompted to enter a Form Type for seed, use GG.

      iii) Rate and Unit for any product for which ARM should calculate product amount requirements.
      Note: Rate and Unit are the primary ARM product amount calculation fields, and are the primary rate match conversion fields for multi-trial summaries. Entering rates only in Other Rate and Other Rate Unit and leaving Rate and Unit blank is not a recommended method!

b) If sponsor did not enter the treatments, then fill out the treatments as described above. If copying treatment information from a Word table or Excel, then paste as a column into Treatment Name.

3) Ensure trial objectives are clearly stated. If not, ask sponsor for clarification before creating trial.
> You do not really understand something unless you can explain it to your grandmother.
> - Albert Einstein

4) Use Scheduled Tasks to create a calendar of events, which should serve as the "plan of work" for trial.

5) If sponsor has pre-entered a trial ID, then **do not overwrite** it with your trial ID. Instead, enter your own trial ID in "Other Trial ID" field in General tab of Site Description. Other Trial ID displays in ARM study list (Ctrl+U to display), so you can easily continue using your trial ID.

6) Create ARM trial with correct randomization **before** laying out trial in field. It often **takes 3 or 4 times longer** to re-enter randomization and data when the trial randomization is incorrect. For multi-factor trials entered into ARM after-the-fact it can even take longer, sometimes days to correct. ARM data verification tools such as Assessment Map rely on correct randomization and spatial arrangement of Trial Map!

7) Maintain any pre-defined assessment headers, to use for each new assessment. The different ways that each trialist enters data headers causes a lot of cleanup effort for trial sponsors.

Pest Code	AMAPA	AMAPA	AMAPA	AMAPA	AMAPA	AMAPA
Rating Type	%CONTROL	%CONTROL	CONTRO	CONTRO		
Rating Unit	0-100	0-100	%	%	0-100	0-100

Avoid this type of "chaos" from inconsistencies, where a simple % control assessment is described 3 ways by 3 different contractors:

8) The best way to avoid this type of diversity is to **select ARM dictionary terms** whenever entering information into data entry fields (Type=CONTRO, Unit=%). This is especially important for assessment data headers, since sponsors want to combine assessments across trials using automated tools such as ARM ST 8. This is not easy when the **same assessment** is described **3 different ways in 3 trials**.

Plan appropriate treatments and replicates to detect expected treatment differences

Two approaches are presented here to estimate number of replicates. Both are from "A Statistical Handbook for Agricultural Field Trials Specialists" by Gerard de Kerchove.

1) Based on minimum treatment difference to detect, which requires estimates of:

a) Assessment variability, typically Coefficient of Variability (CV) is used. Obtain CV from AOV Means Table, descriptive statistics section. Typically is a value between 2 and 15 for agronomic trials.

b) Desired accuracy to detect treatment differences, expressed as percentage of overall trial mean ("Grand Mean" on AOV Means Table). Amount of true difference as percent of mean is between 5 and 25 percent.

c) Level of certainty (80% or 90%) to detect true differences based on selected significance level of 5%.

d) Determine number of replicates from "power table" at right, which is accurate for experiments with **at least 8 treatments**.

Example: Plan an experiment with 80% certainty of detecting a 15% difference between means for an assessment with 8% CV.

Number of replications needed to estimate a percentage difference between two or more means at 5% significance level at a given percent of certainty [Probability level]

Table Nº 1

Probability % [Power]	True diff. as % of mean	Coefficient of Variation [True standard error per unit as percent of the mean]										
		2	3	4	5	6	7	8	10	12	14	16
80	5	3	6	9	13	19	25	33	50			
90		4	7	12	18	26	35	45				
80	10	3	3	3	4	6	7	9	13	19	25	33
90		3	3	4	5	8	9	12	18	26	35	45
80	15	3	3	3	3	3	4	5	7	9	12	15
90		3	3	3	3	4	5	6	9	12	16	21
80	20	3	3	3	3	2	3	3	4	6	7	9
90		3	3	3	3	3	3	4	5	7	9	12
80	25	3	3	3	3	3	2	3	3	4	5	6
90		3	3	3	3	3	3	3	4	5	7	8

The "power table" estimates that at least 5 replicates are required.

2) Based on minimum error degrees of freedom as determined from number of treatments that are tested. This is based on the EPPO (European Plant Protection Organization) recommendation "For a useful statistical analysis to be made, the number of residual degrees of freedom for an Experimental Design should not be less than 12". Residual (error) degrees of freedom for RCB design = (t*r-1)-(t-1)-(r-1) where t=number of treatments, r=number of replicates. For example, 7 treatments and 4 replicates gives 27-6-3=18 error DF; 4 treatments and 4 replicates gives 15-3-3=9 error DF. The table at right can be used for these single factor designs.

Example: Plan RCB design experiment with 3 treatments, 4, and 5 treatments.

	1 Factor	Table N°2
Experimental Design	Number of levels	Minimum number of replicates
Fully Randomized	2	7
	3	5
	4	4
	5	4
	6	3
Random Complete Block [RCB]	2	13
	3	7
	4	5
	5	4
	6	4
	7	3
Latin Square[x]	5	5

[x] For the Latin Square the number of replicates equals number of treatments.

Compare results obtained from the two methods, and select the higher number of replicates.

Important Note: If sponsor has requested testing only 2-4 treatments and 2-3 replicates, then discuss with sponsor the impact on determining treatment differences. It is much too late to discover when analyzing a trial that the trial design makes it impossible to statistically separate key treatments!!

> A clever person solves a problem. A wise person avoids it.
> - Albert Einstein

Many sponsors do not realize the negative impact on power/statistical sensitivity for such a small trial, and **rely on you as the trial expert** to help them design a trial with sufficient statistical sensitivity to meet their objective.

> If we knew what it was we were doing, it would not be called research, would it?
> - Albert Einstein

Send trials to sponsor using "Send to External Sponsor"

Using Send to External Sponsor creates an email message or zip package containing the ARM trial and related trial information. Select either from the File menu (Send to - External Sponsor/Cooperator), or from ARM toolbar.
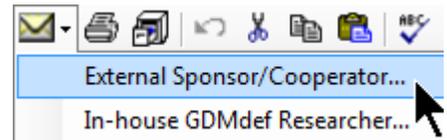
Select which components to include: recommend attachments, *.ede in case sponsor need to import into customized study definitions, and a Word *.rtf report of trial results.

Note: Be certain to create your own trial summary report set, and select your report set instead of the example "Trial Summary.set" provided by default!

Other benefits of using File - Send to External Sponsor:

1) For ARM 9 trials, it automatically also includes the trial in ARM 8 format as well, in case sponsor cannot open ARM 9 trial. This means that **all corporate clients can use your ARM 9 trials** without any compatibility problems or need for conversion!

2) For a Monsanto trial using Monsanto ARM 7 study definitions, Send To automatically also includes the trial in ARM 7 format.

3) For trials with many large attachments such as photos, choose either Web-based Mail or File choices to create a zip file that you can upload to web mail or a file sharing site (such as SkyDrive or DropBox), or save onto a removable device such as a flash drive or CD/DVD. Many email
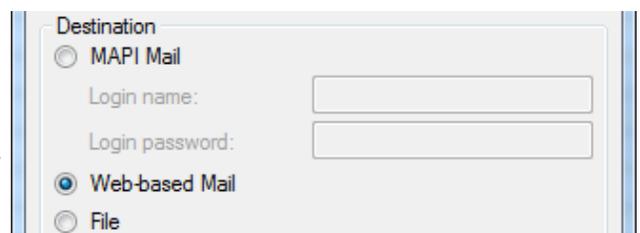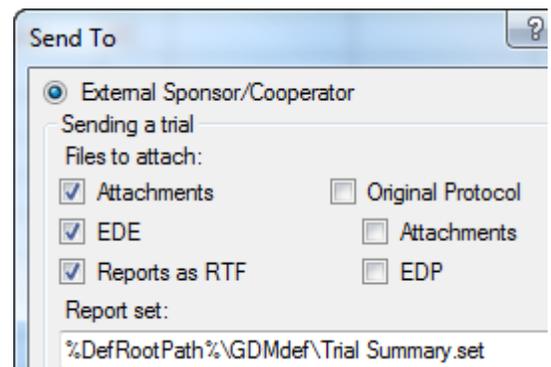
systems cannot accept mail messages larger than 10 to 20 MB. If average photo size is 4 MB, then 20 attached photos = 60 MB.

4) ARM study file version is decided by sponsor company customization when used on a contractors' computer. ARM 9 saves in the accepted standard company file version as defined by each sponsor. **Most local sponsor contacts are not aware of this, so wrongly tell contractors "You must use only ARM 8 (or 7) for our trials"**.

5) EDE files provide a bridge between different sponsor customizations and programs, including DuPont FieldPro.

Installing ARM on a new computer

1) If computer has Windows 8, then install ARM 9.0.5 or newer. ARM 8 and older ARM 9 versions **were not designed or tested** for installing on Windows 8. (We have 9.0.5 install CDs available on request during 2013 NAICC meeting.)
   Note: This rule applies for essentially all programs, not only ARM.

2) Installing ARM 8 on a new computer is **not recommended**. If you have ARM 8 and new computer is Windows 7, and you choose to install ARM 8 anyway, then contact GDM to obtain a download link to the newest ARM 8 version. (This link will be phased out during 2013.) Old ARM 8 install CDs should not be used on a new computer, to avoid wasting hours of your time fighting install issues!
   Note: ARM 8 is under limited support, so GDM assistance for any new ARM 8 installation is charged at $150/hour. ARM 9 performs tasks faster and with fewer problems than older ARM versions - stop wasting your time using ARM 8!

Standardize assessment descriptions

A common approach to standardizing assessment descriptions, which are the data header entries, is to create a template for each different type of assessment. Many sponsor ARM customizations, such as Bayer CropScience and Syngenta, include dictionaries that define many standard methods to describe assessments. These standard templates are often called "Standard Evaluation"

1) Absolute minimum information: Part Rated, Rating Date, Rating Type and Unit. Enter these using standardized codes so information is standardized for sponsors, and use Description field for a "plain English" description.

2) Field that are also frequently needed: crop and pest Code and Growth Stage, Trt-Eval. Interval.

3) Save and use "Standard Evaluation" (*.se) files for assessments, to easily use them again and keep methods consistent within an organization.

   a) Once assessment is filled, then select File - Export - Data Export.

   b) Select File type of 'Standard Evaluation (*.se)', and ensure 'Export selected data columns' is checked.

   c) Choose which data column contains assessment header information to include in the *.se file to create.

   d) Select which assessment header fields contain information that should be saved into the SE. At minimum include Part Rated, Rating Type and Unit. Include Description to make the assessment more readable to a non-technical audience.
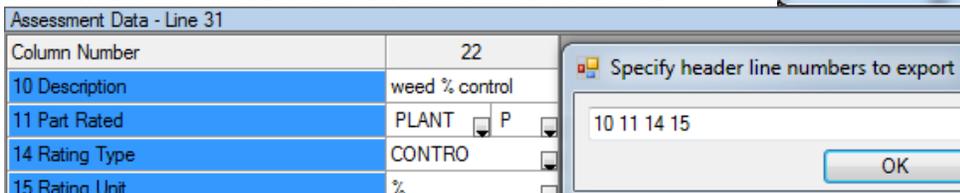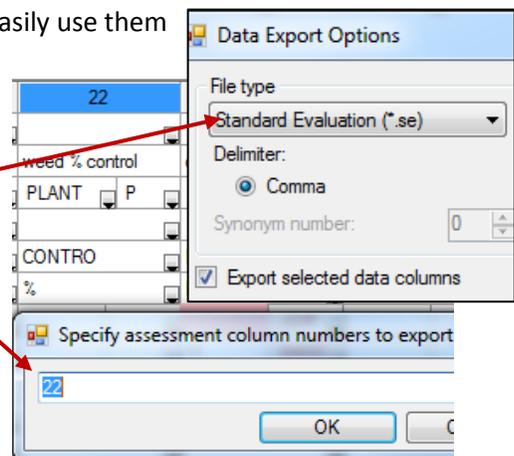
   Select ARM Action Code field to save transformation formula with a calculated data column; be certain to also include original data columns with calculated columns when saving the SE.

e) If you or sponsor has defined study rules about entries in selected fields and you want to include those rules in the *.se, then select Yes to include rule definition in the saved *.se.

f) Name the *.se file with a meaningful name, such as "weed % control.se" for this example.

To add a saved *.se to an assessment column, right-click in the data column in which to add the *.se and select 'Insert SE from File..."

	Undo Insert SE file
✂	Cut
	Insert DCF from File
	Insert SE from File...
	Export SE...
	Hide Current Field
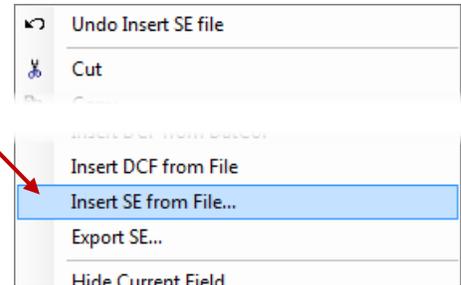
Improve work efficiency

This is a collection of tips to work more efficiently in ARM.

1) Use dual monitors - automatically supported by nearly all laptops when using a full docking station.
   a) Several university studies of productivity found that, depending on tasks, dual monitor configurations increased user productivity from 10 to 44%, and were vastly preferred by users.
   b) Microsoft studies: The first study revealed that the users' productivity increased by 9 percent. Further studies showed even greater increases - at times up to 50 percent for tasks such as cutting and pasting.
   c) In a Wichita study, subjects collected text and images from several documents and Internet pages and arrange them in a work document to recreate a read-only reference PDF. Moving from a single screen to dual monitors would bring a productivity gain of 56 extra days of work per employee per year.
   d) Side-by-Side monitors work well; every workstation at GDM is equipped with dual 24" monitors. Suggest energy efficient LED backlit LCD monitor such as Samsung 24" S24A450BW-1 Widescreen LED Monitor.

2) Use right-click ARM menus, which gather together typical actions into each editor window.

3) Use ARM keyboard shortcuts for common tasks:
   a) F1 to show help for current screen
   b) F5 to show help for current study definition data entry field
   c) Ctrl+U to open study from list
   d) Ctrl+O to browse for trial, Ctrl-B to browse for protocol
   e) " then Enter in blank field to copy treatment line above (in Trt. Name) or data header at left (in first visible field)
   f) Ctrl+P to Print Reports
   g) Shift+F7 to insert repeating site description section, Shift-F8 to delete current
   h) F9 to display validation list for current data entry field
   i) Ctrl+A to validate study and show next error, or Ctrl+E to validate and show all errors

4) Use ARM "picklists" to maintain and quickly fill site descriptions; for GDMdef:
   a) Location: City
   b) Contacts: Study Director, Investigator, Cooperator, Name
   c) Soil: Description Name
   d) Appl. Equipment: Appl. Equipment

A "picklist" is a validation lists you can use to save a related group of field entries, so in another trial you can simply select from the picklist instead of typing the same information again.

The steps are:

   a) Fill all associated data entry fields for the picklist.
   b) Click into the picklist field and press F9 or click the "display list" button.
   c) Select "Yes" button when asked whether to add item to list.

2) Start two ARM programs to copy/paste between studies. Use block marking shortcuts such as the following, and then right-click and choose Copy:
   a) Mark block around all fields of interest for non-grid Header, Protocol Description, Site Description fields to include in block.

b) Click top left corner of any grid to select all information in grid.

c) Click and drag on grid column headings or row counters to select a block.

3) Use Tools - Merge - from ARM Study to fill blank fields in current trial with the same information in another trial from same year or location.

   a) Site description - Crop Description, Maintenance, Soil, Moisture, Application.

   b) Treatments - when starting a new protocol.

   c) Assessment data headers - as starting point for consistent assessment descriptions (although copy/paste may be equally effective).

   d) Tasks - in protocols or trials.

Personalize ARM

This is a collection of tips to personalize ARM so you can work more efficiently:

1) Create personal lists of common selections from master lists, to keep a short list of your typical codes, which also improves consistency.

2) Create saved editor views that display desired entry fields and hide unused editor fields. This is an easy way to simplify ARM editor screens, and ensure needed fields are filled since un-needed fields are hidden.

   a) Hide fields on current editor that should not display on the view. Either clear checkboxes on View Options dialog for the editor, right-click and choose Hide Field on the editor itself, or use the default "Hide empty fields" view.

   b) On View Options dialog for the editor select "Save View" button, and assign a useful name ("My view", "Turf view", etc.).

3) Create report sets. We recommend creating sets for the reports printed during different parts of the year, to simplify producing the same report next year. Steps are:

   a) Select report components to include in report set.

   b) Set desired options for each report in set, such as whether to print only completed fields.

   c) Arrange reports in desired order in set (highlight a report, press and hold Shift, press up/down arrow to move the report)

   d) Select Save Set button. This saved set lists all reports included in the set, plus saves all options for the included reports into the set. When the set is next loaded, the reports plus all options for those reports are opened.
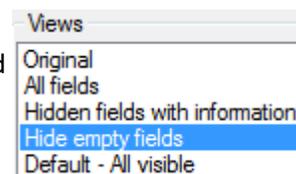
Check for and install ARM updates as they become available

A majority of GDM software support problems are solved by installing the most recent program update, or by upgrading to the newest version while still using an older software version.

With ARM 9, it is also important to keep current on GDMdef study definition updates, since these are now distributed separately.

Read program messages!

ARM messages convey information relevant to the current task, and frequently identify a study situation that should be changed in order to correct errors or wrong calculations.