Integrated Breeding Platform (IBP)

Crossing

BMS 13.0-14.0 Manual

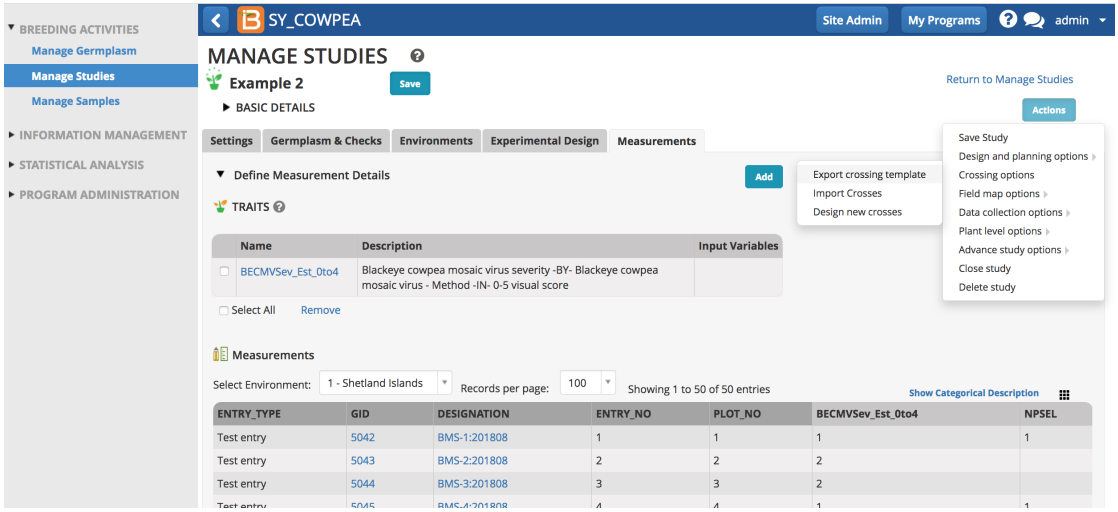
About

Crosses use generative breeding methods that increase allelic diversity by combining alleles from different progenitors. The BMS allows crosses to be designed/recorded two ways: (1) using a crossing template (.xls) or (2) the Design Cross tool.

Crossing Template

The crossing template allows users to record crosses within and between studies, and allows individual crosses to be described by different methods. Use the crossing template (.xls) to record crosses.

- From within a study, select export crossing template from the Actions menu.



Description Sheet

- Open the .xls file in Excel. The description sheet provides crossing record metadata. Description sheet editing is optional, such as to add to record additional variates.

LIST NAME			Enter a list name here, or add it when saving in the BMS				
LIST DESCRIPTION			Enter a list description here, or add it when saving in the BMS				
LIST DATE	20190528		Accepted formats: YYYYMMDD or YYYYMM or YYYY or blank				

CONDITION	DESCRIPTION	PROPERTY	SCALE	METHOD	DATA TYPE	VALUE	COMMENTS
LIST USER	PERSON WHO MADE THE LIST	PERSON	DBCV	ASSIGNED	C	Shawn Yames	See valid user names and IDs on Codes sheet (or leave blank)
FEMALE STUDY	The name of the study of the female parent	STUDY	CODE	ASSIGNED	C	v12 Performance Trial	

FACTOR	DESCRIPTION	PROPERTY	SCALE	METHOD	DATA TYPE		COMMENTS
FEMALE PLOT	Plot No of the Female in the Female Study	PLOT NUMBER	NUMBER	ENUMERATED	N		Identifies the female parent's plot location - mandatory.
MALE STUDY	The name of the study of the male parent	STUDY	CODE	ASSIGNED	C		Identifies the male parent's study. If left blank, the male parents will be assumed to be in the same study as the female parents.
MALE PLOT	Plot No of the Male in the Male Study	PLOT NUMBER	NUMBER	ENUMERATED	N		Identifies the male parent's plot location - mandatory.

VARIATE	DESCRIPTION	PROPERTY	SCALE	METHOD	DATA TYPE		COMMENTS
BREEDING METHOD	Breeding method applied to each cross event	BREEDING METHOD	BMETH_CODE	OBSERVED	C		Breeding method to apply to the cross - optional; see Codes sheet for more options
CROSSING DATE	Date that the cross was made (YYYYMMDD)	CROSS DATE	DATE	APPLIED	N		Date that pollination occurred - optional
NOTES	Technicians notes about the cross	COMMENT	TEXT	OBSERVED	C		Optional

ABOUT THIS TEMPLATE	Use the observation sheet to record bi-parental crosses in this study as different plots reach floral maturity. Parental germplasm is tracked to genealogy via study plot number. Female parental plots must be located within this study. When no study name is specified for the male parent, pollen is assumed to come from plots within this study. If pollen is imported from another study, the study name must be specified in addition to plot to correctly identify the male parent.

Description | Observation | Codes | Study List

Observation Sheet

The plot number for the male and female plants (template cells highlighted in pink) is mandatory data that must be added. Parental germplasm is tracked to genealogy via nursery plot number. Female parental plots must be located within the associated nursery. When no nursery name is specified for the male parent, pollen is assumed to come from plots within this nursery. If pollen is imported from another nursery, the nursery name must be specified in addition to plot to correctly identify the male parent. Optional information includes default columns of data.

FEMALE PLOT	MALE STUDY	MALE PLOT	BREEDING METHOD	CROSSING DATE	NOTES

Description | Observation | Codes | Study List

Codes Sheet

The codes sheet provides all the available users and breeding methods available.

	A	B	C	D
1	Section	Information Type	fcode	fname
2	CONDITION	USER		Mariano Crimi
3	VARIATE	BREEDING METHOD	ALP	Allo-polyploid
4	VARIATE	BREEDING METHOD	AUP	Auto-polyploid
5	VARIATE	BREEDING METHOD	BCR	Backcross
6	VARIATE	BREEDING METHOD	TBL	Broad based tester, line
7	VARIATE	BREEDING METHOD	TBP	Broad based tester, pop
8	VARIATE	BREEDING METHOD	CBC	CMS backcross
9	VARIATE	BREEDING METHOD	CCX	Complex cross
10	VARIATE	BREEDING METHOD	PCC	Convergent cross
11	VARIATE	BREEDING METHOD	CCU	Cross, cytoplasm unknown
12	VARIATE	BREEDING METHOD	CDC	Double cross
13	VARIATE	BREEDING METHOD	PDB	Double cross pop
14	VARIATE	BREEDING METHOD	BDU	F1 backcross, cytoplasm unknown

Description | Observation | Codes | Study List

Study List Sheet

The study list contains details that allow for orientation in the female nursery. All females are expected to reside in the designated nursery. Any or all of this information can be pasted in the observation sheet to help the crossing process.

FEMALE STUDY	FEMALE PLOT	ENTRY_TYPE	GID	MGID	DESIGNATION	CROSS	OBS_UNIT_ID	BLOCK_NO
v12 Performance Trial	1	Test Entry	1000130	1000130	DF32	-	925477f7-2c89-412e-8a1a-eff4b50ccc14	1
v12 Performance Trial	2	Check Entry	1000077	1000077	BMS-6	-	1de7a596-c8ea-41ec-9405-ea9010173b9e	1
v12 Performance Trial	3	Check Entry	1000075	1000075	BMS-4	-	7ff58990-704a-4b59-aa2a-6ec159503543	1
v12 Performance Trial	4	Test Entry	1000146	1000146	DF48	-	ca4cc394-9466-41bb-91ee-045d1e020be8	1
v12 Performance Trial	5	Test Entry	1000159	1000159	DF61	-	01e103b7-b7a6-470a-a9ae-ba2890edef1d	1
v12 Performance Trial	6	Test Entry	1000105	1000105	DF7	-	85dee6a8-0ecd-4507-b847-2f6dc1ef5938	1
v12 Performance Trial	7	Check Entry	1000073	1000073	BMS-2	-	5534ae3c-dff0-4ed2-88d6-166da4161399	1
v12 Performance Trial	8	Check Entry	1000078	1000078	BMS-7	-	a5b8fa09-2a22-49de-b2b5-6f7f4c3b3d63	1

Description | Observation | Codes | Study List

Edit Template

- Enter mandatory data (female and male plot numbers) into the observation sheet. Save the .xls file.

FEMALE PLOT	MALE STUDY	MALE PLOT	BREEDING METHOD	CROSSING DATE	NOTES
1		2			Cross with pollen from within study, allow BMS to choose breeding method, date unspecified
1	2019 M1	34		20190523	Cross with pollen from another study, allow BMS to choose breeding method, date specified
1		0	PPO	20190523	Cross female with unknown male, open pollenated (PPO) breeding method, date specified
1		2,3,4,5	POC	20190523	Cross female with pollen mixture, polycross (POC) breeding method, date specified

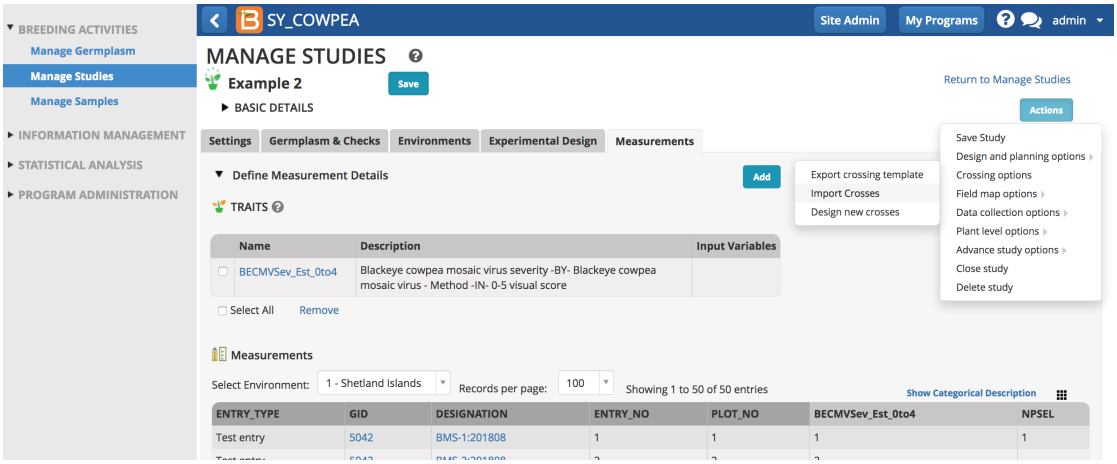
Description | Observation | Codes | Study List

Crossing Record with Observations:

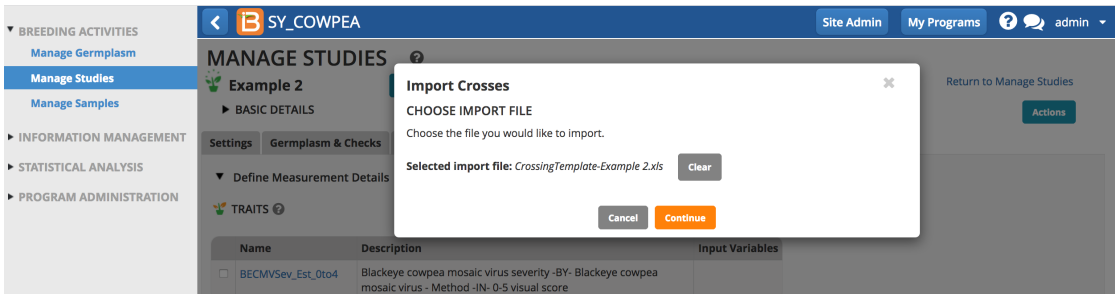
- Specify FEMALE and MALE PLOTS. When the MALE PLOT comes from another study, the study name is indicated (row 2). When the MALE PLOT comes from within the current study no male study name is needed. If the male is unknown, GID 0 is entered as the male parent. If the male parent is a pollen mixture, all the pollen donors are listed with commas seperating.
- Breeding method can be specified per cross. The breeding methods left blank will be defined later via the user interface.
- Crossing Date: Year, month, day (YYYYMMDD)

Import Crosses

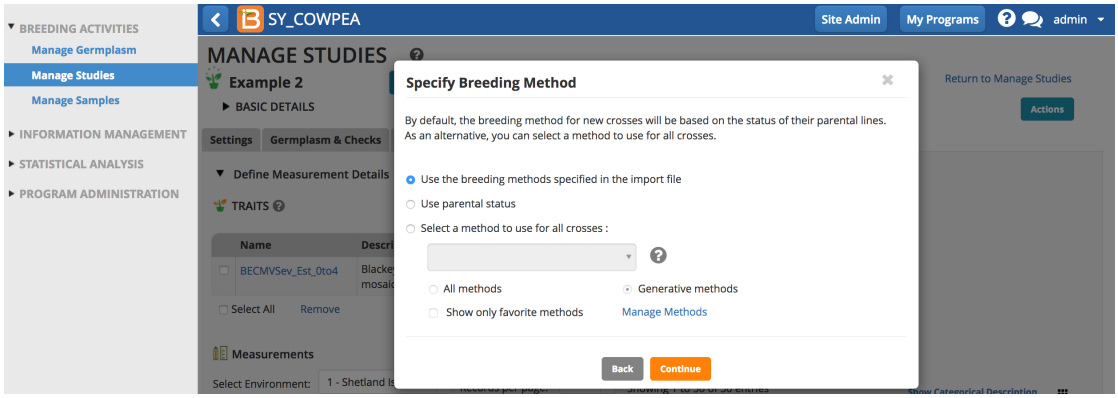
- Select Import Crosses from the Actions menu.



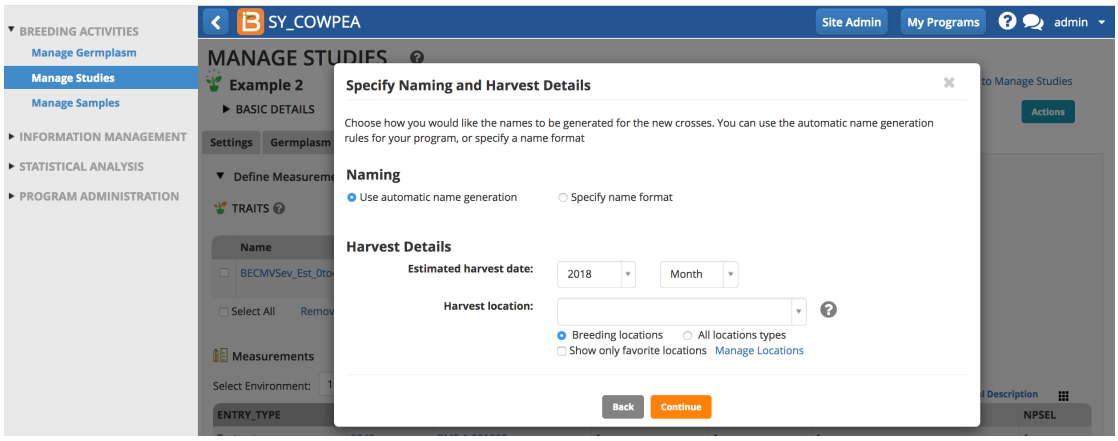
- Choose import file and select Continue.



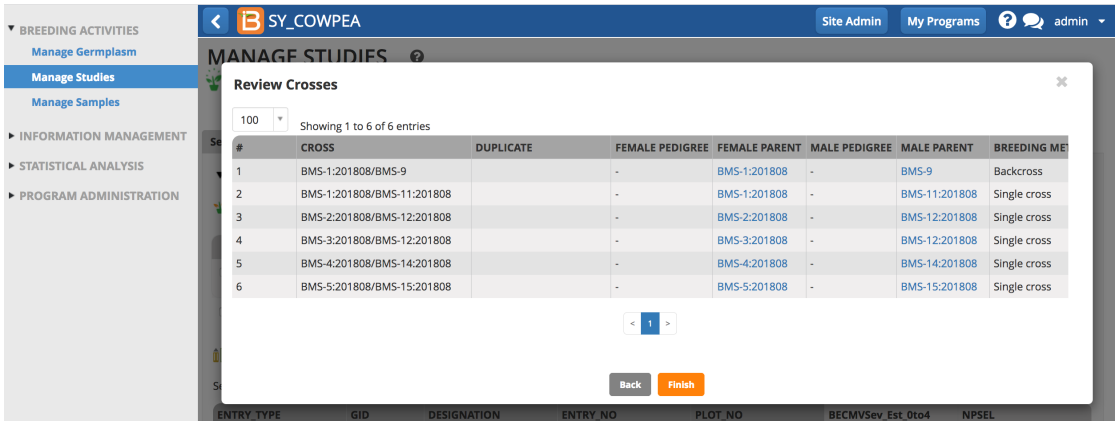
- Specify how the breeding method(s) will be applied to the imported crosses.



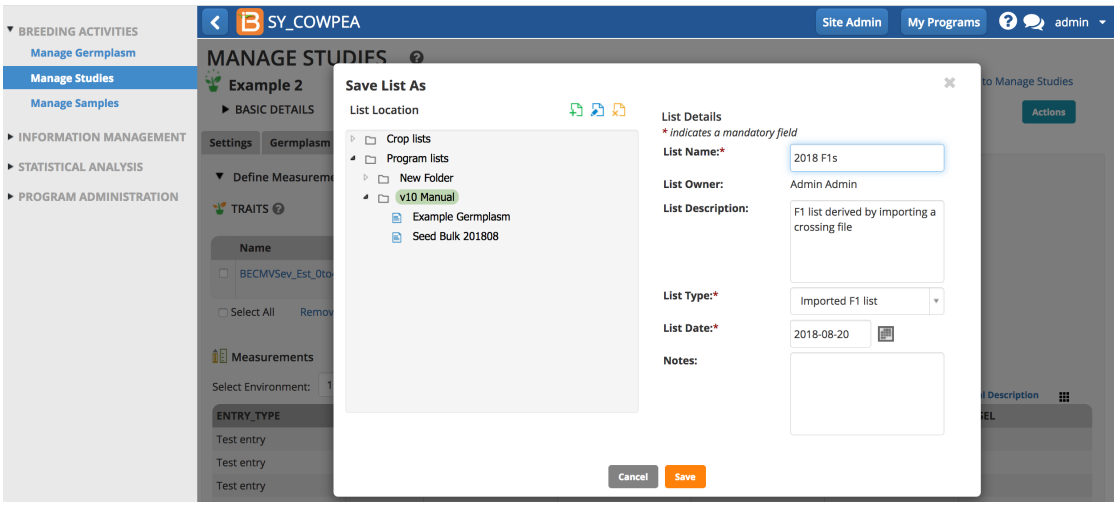
- Specify the naming conventions and harvest details, and Continue. Most breeders will use the automatic naming conventions customized for their breeding institute.



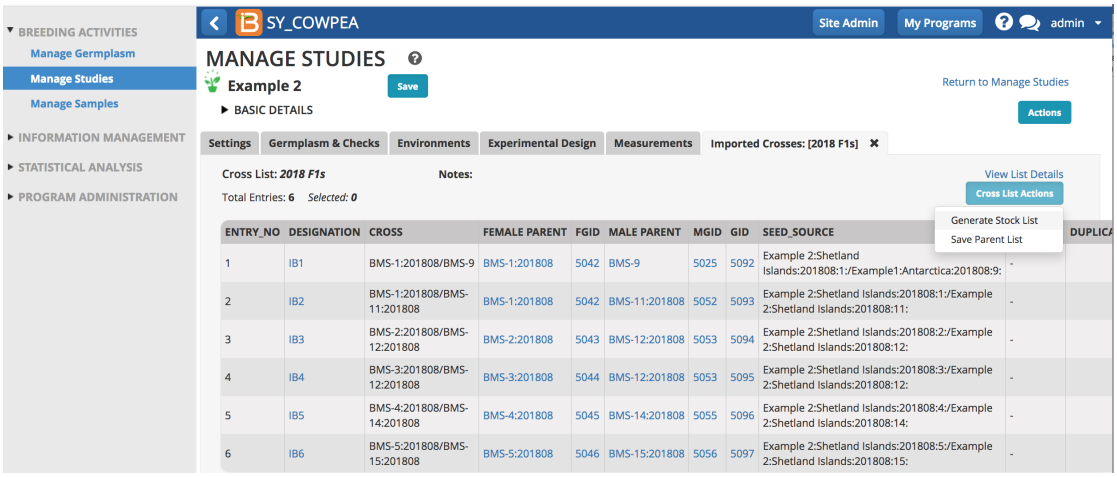
- Review the crosses and select Finish.



- Save the list.



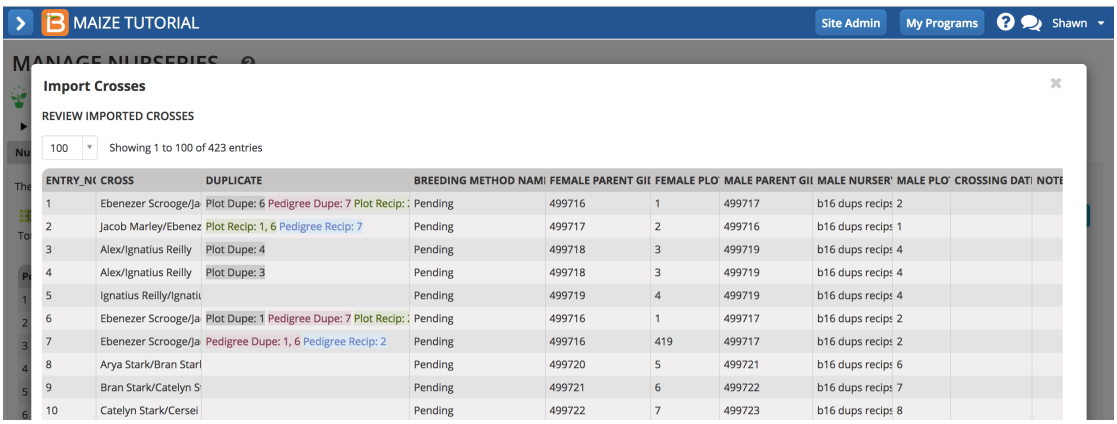
- The imported cross list is now available for review from within the study and also fromManage Germplasm.



Duplicate & Reciprocal Cross Detection

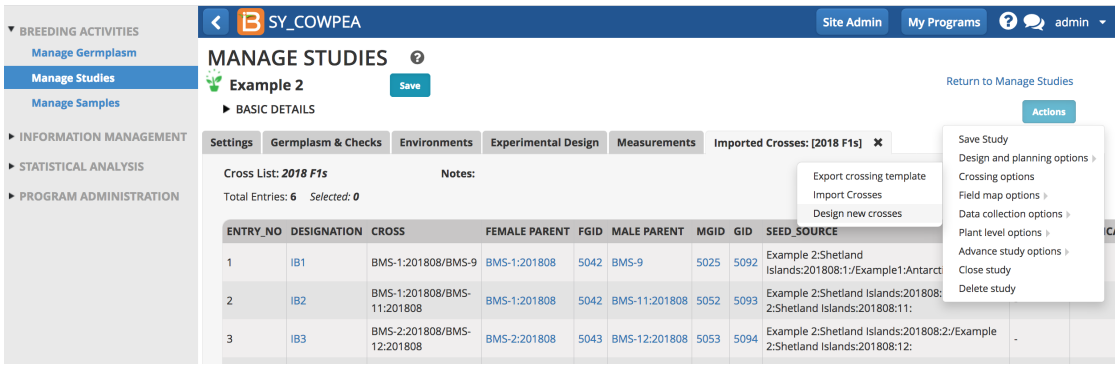
The BMS detects duplicate and reciprocal crosses during cross design import.

- Plot duplicates: When a cross is preformed more than once between the same plots in a nursery
- Pedigree duplicates: When germplasm with a single GID is planted in multiple nursery plots and involved in duplicate crosses
- Plot reciprocals: When a reciprocal cross is preformed between the same plots in a nursery (example: plot1 X plot2 & plot2 x plot 1)
- Pedigree reciprocals: When a reciprocal cross is preformed between the same germplasm (example: GID1x GID2 & GID2 x GID1)



Design Crosses

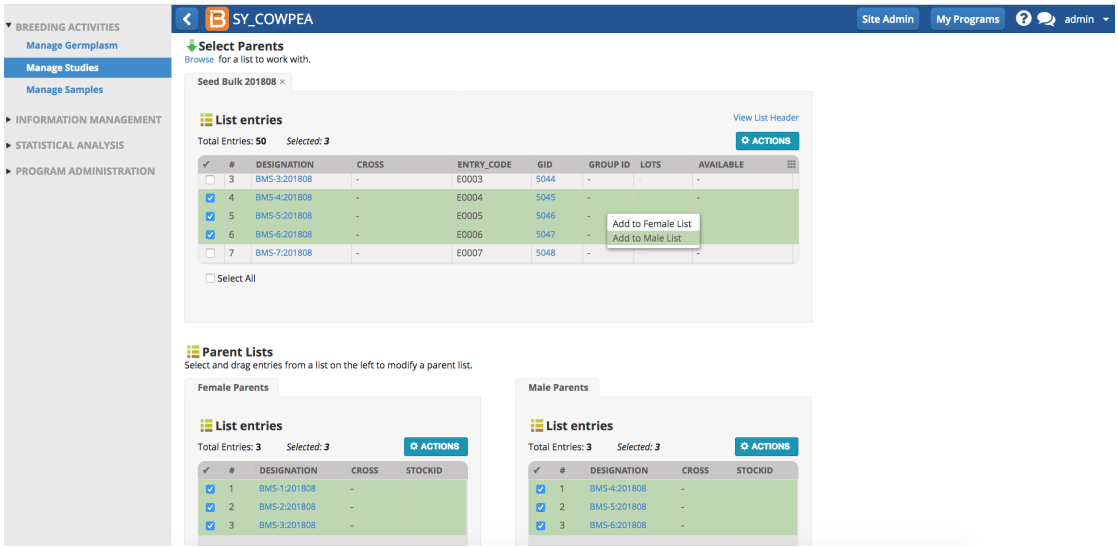
- From within a study, select export crossing template from the Actions menu.From within a study, select export crossing template from the Actions menu.



Specify Parents

By default the list associated with the current study is displayed. Other lists can be browsed for use as parents.

- Browse for germplasm and select parents by dragging and dropping to the appropriate female and male parental lists. Manage and edit parental germplasm from the Actions menu. If the male parent is unknown, the male parent list can be left blank. If the male parent is a mixture of pollen, the male parent list will become the list of possible pollen donors.

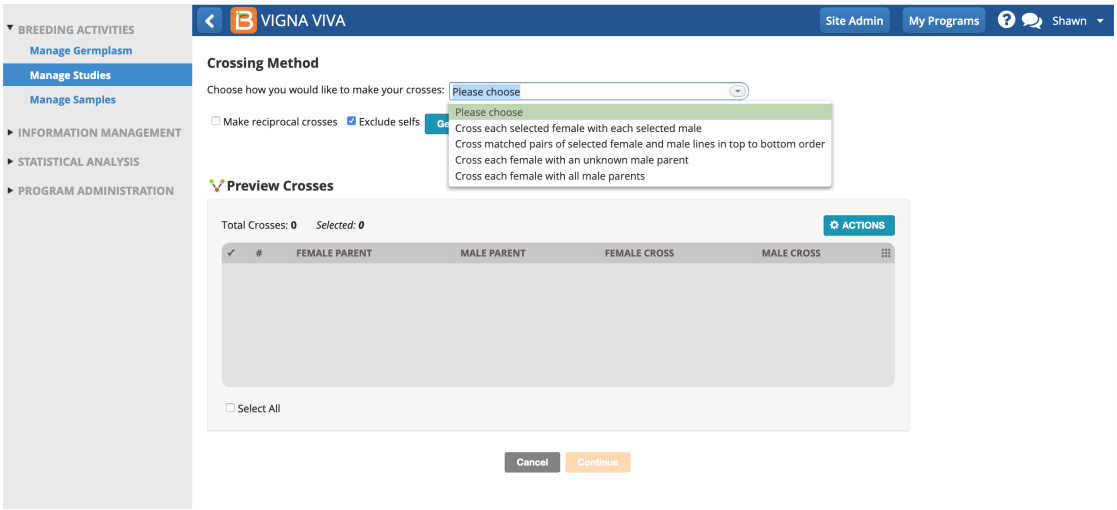


Crossing Methods

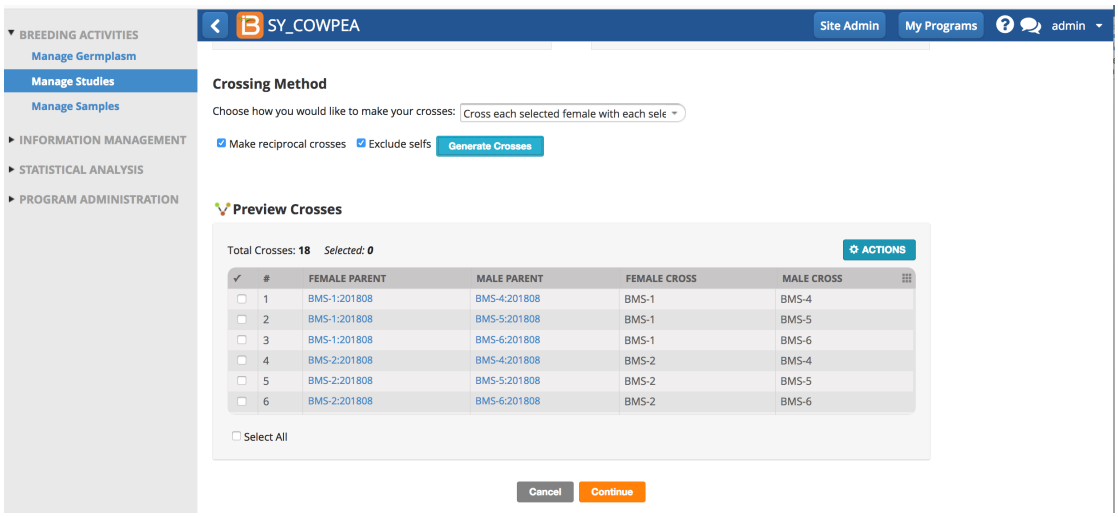
The Breeding Management System supports numerous mating schemes.

Crossing Method	Mating Scheme		List Structure	Reciprocals Included
Cross matched pairs of selected female and male lines in top to bottom order	Single Pair Mating	Parents matched once by pairs	-	no
		Parents matched once by pairs with reciprocal crosses	-	yes
	Nested mating (NC Design I)	Each male parent is mated to different subset of parents (or vice versa)	entry order important	possible
Cross each selected female with each selected male	Factoral or Tester Mating (NC Design II)	Each male is mated with each female	-	no
		Each male is mated with each female and vice versa	-	yes
	Diallele	Half-diallele: each parent is mated to every other parent, excluding reciprocal crosses and selfing	parent lists the same	no
		Full-diallele: each parent is mated to every other parent, including reciprocal crosses and selfing	parent lists the same	yes
		Partial and disconnected diallele: selected subsets of full diallele, including reciprocals and selfing	entry order important	yes
Cross each female with an unknown male parent	Open Pollination	The male parent is unknown. The unknown male parent is represented as GID 0 in pedigree.	-	no
Cross each female with all male parents	Polycross	The male parent is a pollen mixture. All possible male parents are included in pedigree.	-	no

- Choose the appropriate crossing method for your mating scheme.



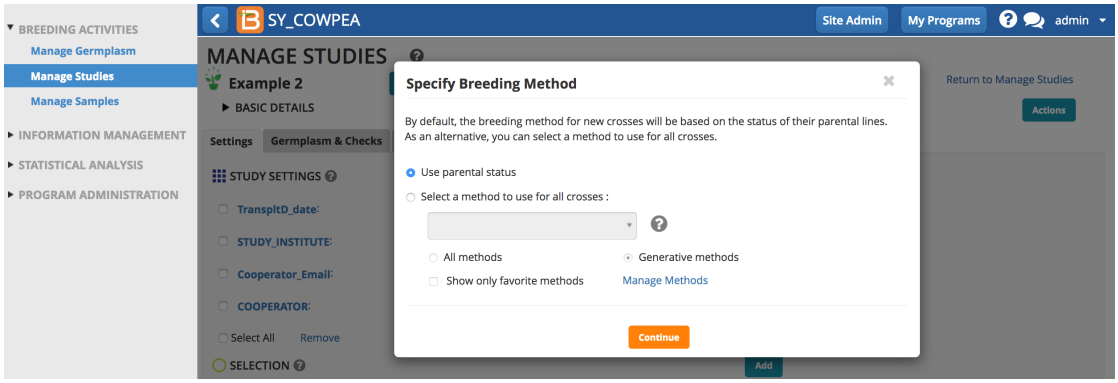
- Choose whether to include reciprocal crosses or to exclude selfing from the crosses. Select Generate Crosses and Continue.



Breeding Method

Advance a cross by applying a generative method. By default, the breeding methods unspecified in the cross template will be based on the status of their parental lines. Otherwise, the option to select a single method for all pending Breeding Methods is available.

- Select 'Use parental status' or specify and breeding method. Continue.



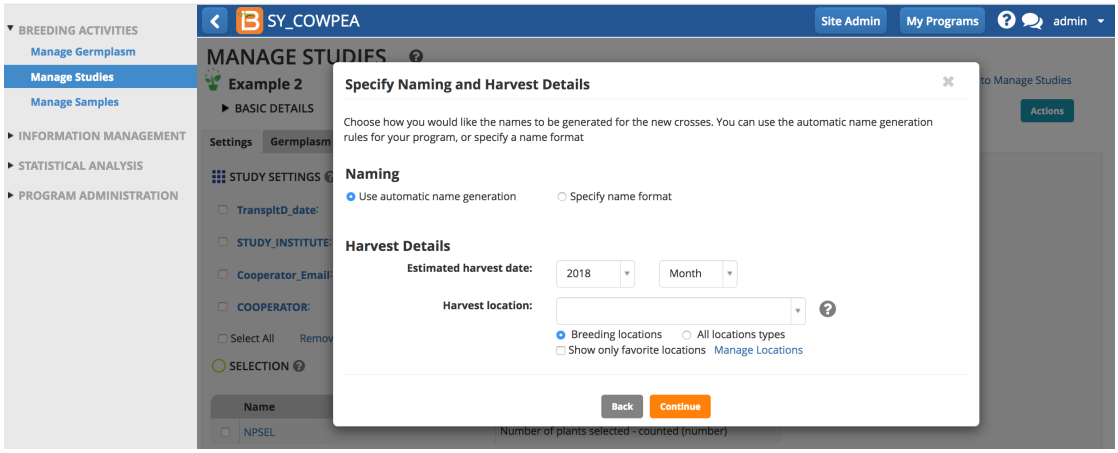
Parental Status

The BMS can apply the following breeding method based on the pedigree of the parent:

- Single Cross: Both parents are lines from different crosses.
- Double-Cross: Both parents are F1s with no parents in common.
- Triple-Cross: One parent is an single cross F1. The other parent is an inbred line and IS NOT a parent of the single cross F1.
- Backcross: One of the parents is an F1. The other parent is an inbred line and IS one of the parents of the F1 parent.
- Recessive Backcross: One parent is a F2, whose source is an F1. The other parents is an inbred line and IS a parent of the F1 source.

Cross Naming

- Chose to use your institute's automatic naming conventions or specify name format.



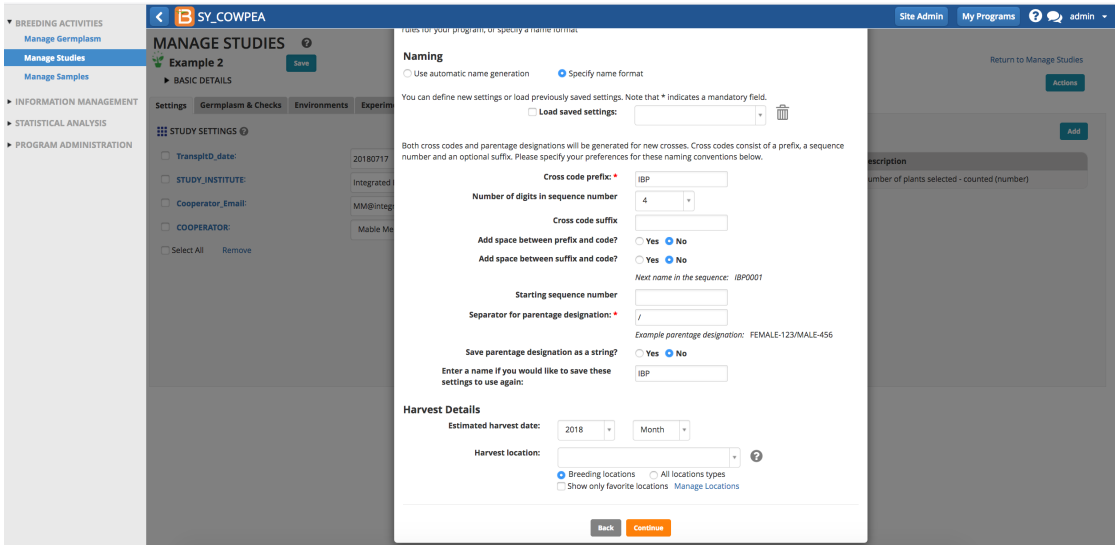
Automatic Name Generation

Automatic name generation uses the BMS default settings or settings customized by the system administrator. See your system administrator for more details on your institution's rule-based naming conventions.

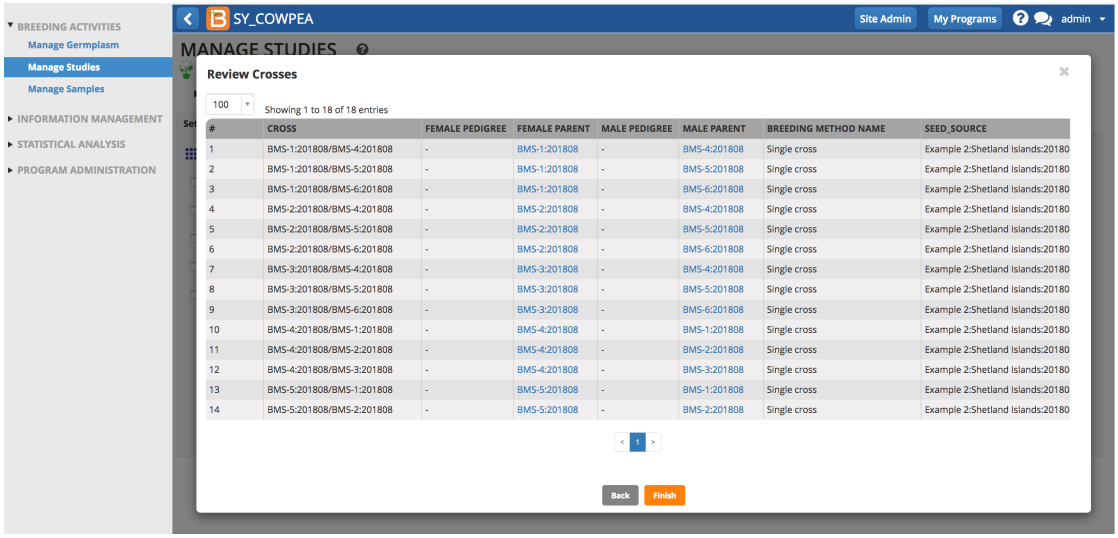
Specify Name Format

Specify name format is more flexible than automatic name generation and customizable within a breeding program. Depending on institutional management structure, you may use one naming option in favor of the other.

- Name formats can be saved for later use or editing.

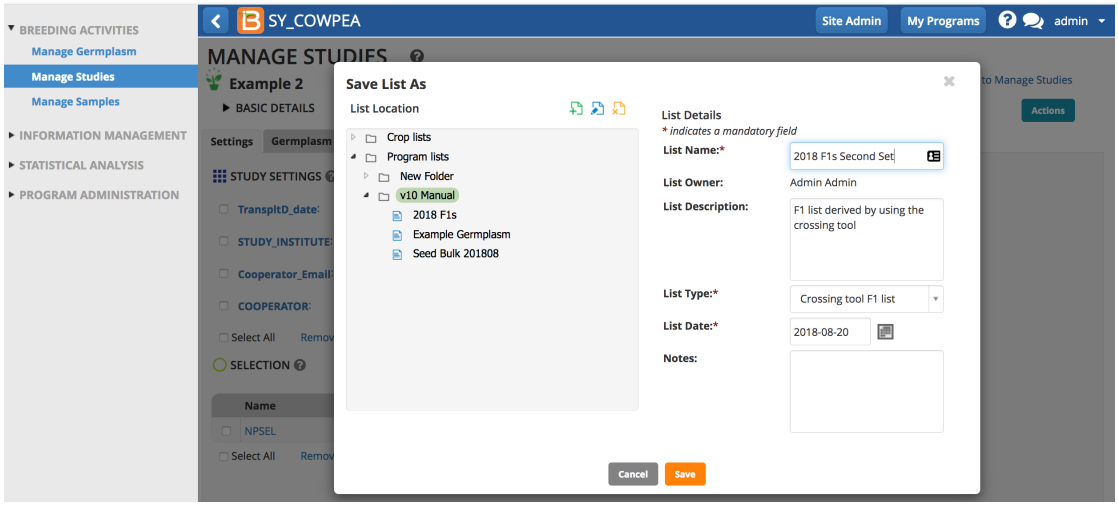


- Review crosses and Finish.



Save Crosses

- Save crosses to create a new germplasm list.



Save Parent List

The cross list can now be viewed in the associated nursery.Harvest labels and stock inventory updates can also be made.

- Select save parent list to create a list of unique parental germplasm used in your cross design.