

ALA Cultivar Development#1-7: Cultivar Development – steps, breeding methods, and selection strategies

Prerequisites

eModules 1-6 and Crop Modules in Crop Improvement course.

Purpose

To learn the steps in cultivar development, generation advancement, breeding methods, selection strategies, and ability to assess merits / de-merits of cultivars.

Tasks

Students can be randomly assigned to groups of 2-8 (depending on the class size and time). This group will ideally remain constant for different crops. It is required that students in a group work together to prepare the verbal and written presentations. The written group assignment is due the day of your presentation and every person is expected to contribute equally. [Instructors – you can use verbal or written or verbal and written submission, as per your class requirements].

Each verbal presentation is supposed to be an interactive session where students use the questions given to prepare their presentation framework. Each group will have 20 minutes for their paper discussion. Each group will have two presenters who can use 12-15 minutes for class discussion to go over questions 1 to 9, and leave 3-5 minutes for questions and class discussions. (It will be helpful to your group if you formulate some additional questions to drive the discussion). If time is not a constraint, leave more time for class discussions at the end of presentation. Presenting teams will rotate so that each student gets a chance to present (ideally as #1 and #2 presenter role) during the course of this ALA.

Person #1 – presents Q 1 through 7 (prepare Q7 response in a table format) season-by-season outline at the end of your presentation, (8-10 minutes)

Person #2 – presents (Q8 and 9) and summarizes the information in tables of the manuscript, to highlight the merits of the cultivar. You can use tables presented in the paper to make your case. (this information may also be presented as text, but you are required to read the manuscript text and tables, and present and summarize information by going over the tables). (5-8 minutes)

Each group can decide who serves as the #1 and #2 presenters for a particular crop. You can use ppt, pdf, word, excel formats with the overhead projector, or document reader if you would like to use hard copies to make your presentation.

For group written report: one suggested way to ensure group participation is to have members of the group compile information to different questions and provide to Person #1 and #2 for that week, who will assemble the final report. Person#1 and 2 can decide how to delegate the tasks for information collection. There may be other ways to facilitate group participation to work in a team for mutual learning.

NOTE: each person in a group gets to serve the role of Person#1 and #2 at least once.

NOTE to Instructors: Instructors are expected to facilitate the discussion and clarify student questions, and ensure learning outcomes.

Assignments will be graded for the in-class verbal presentation and a short report no more than 3 pages (single spaced). In-class and written report will be worth equal % marks. Header should include your name, date, crop, course number.

Crop (cultivar registration) paper assignments (one per group) should address the following:

1. Describe the uses of this crop and area of major production.
2. What type of cultivar or genotype was developed? What was/were the objective(s) of the breeding program (to develop the cultivar)? Were the objectives clearly described or did you infer them? If they were not provided by authors, what information you used (presented by authors) to infer the objectives?
3. Describe the parents if they were cultivars, experimental lines or introductions? What traits did the parent possess that made them useful as parents? [Note – this information may not be explicitly presented in each registration paper so you may have to infer to some extent].
4. What type of cross (single cross, three-way cross or other) was created? Why?
5. In which generations was selection practiced and for what traits? If applicable, comment on % selected generation to generation [for clonal crops, please present selection information per season].
6. Was Marker assisted selection practiced? If yes, describe how it was used and if it was effective. What evidence do you have that tells you that MAS was effective? If MAS was not practiced, describe how you would use MAS for at least one trait (which generation, how and why).
7. Outline season-by-season the method(s) used to derive the line that became the cultivar. If provided by the breeder, please include information for each generation and along with it provide the number of locations, experimental design, replications, plot type (single plants, hills, rows, 2- or 4-row). Briefly discuss other alternatives that could have been used, if you have a better plan.
8. Assume you are the breeder of this cultivar and you are presenting to your manager or supervisor, a case to obtain support to release this cultivar. Present the summary on performance, merit and demerits of the cultivars in a concise manner. Identify at least one demerit of the cultivar that you think your company or organization needs to be aware of. Why is it a demerit? If applicable, what strategies can be used to overcome this demerit?
9. Describe the steps in production of breeder seed.

Not in all cases will you find information in the JPR article to answer Q 1-9. If so, please indicate that the paper didn't contain this information.

For your reference, I am providing one cultivar example in wheat (this article is available freely online through the Canadian Journal of Plant Science):

A. K. Singh, J. M. Clarke, R. E. Knox, R. M. DePauw, I. Wise, J. Thomas, T. N. McCaig, R. D. Cuthbert, F. R. Clarke, M. R. Fernandez (2015) AAC Marchwell durum wheat. Canadian Journal of Plant Science, 95:189-195.

NOTE to Instructors: You can look at cultivar registration examples (Journal of Plant Registrations, Canadian Journal of Plant Science, Am. J. Pot Res) depending on which journals are available to you. JPR is the best source for these ALAs. If needed, we can provide a list of cultivar registrations for different crops. You may have to spend more than a week per crop, if the class size is big. You can pick cultivar registration examples from other crops and follow a similar format as described in this ALA. The intent of this ALA is to provide a framework to instructors to facilitate deeper learning among students on the steps in cultivar development, breeding methods and selection strategies. These papers will also allow students to understand and integrate the breeding pipeline and activities.

Examples of different types of crops and cultivars that can be covered with these ALAs:

Date	Crop
Week n	Wheat (pureline)
Week n+1	Potato (clonal)
Week n+2	Soybean (pureline)
Week n+3	Sugarcane (clonal)
Week n+4	Rice (pureline)
Week n+5	alfalfa and turfgrass (synthetic)
Week n+6	Sorghum and sunflower (Inbred for Hybrid development)

You can pick four crops for your students (one each of pureline, clonal, synthetic and hybrids) – each group of student per crop will receive a separate JPR manuscript.