

**Course Outline, Plant Breeding for Drought Tolerance**  
SOCR 570, Online course, 1 credit  
Department of Soil and Crop Science, Colorado State University

**Instructor:** Patrick Byrne, [patrick.byrne@colostate.edu](mailto:patrick.byrne@colostate.edu), 970-491-6985, C131 Plant Science Bldg., with assistance from Drs. John McKay and Bill Bauerle (Colorado State University) and Dr. Stephen Baenziger (University of Nebraska-Lincoln).

**Timing:** Fall semester, odd-numbered years

**Text:** No text book is required. All readings will be available online.

**Objectives:** Successful students who take this course will

1. Understand the importance of knowing the target environment for improving drought tolerance.
2. Become familiar with the major elements of plant response to drought.
3. Learn the primary and secondary phenotypic traits used in selecting for drought tolerance.
4. Understand how quantitative trait locus analysis has been used to locate genes for drought tolerance.
5. Learn about successful examples of improving drought tolerance in a variety of crops, both through conventional plant breeding and transgenic methods.
6. Understand the potential benefits and limitations of using wild germplasm and landraces for improving drought tolerance.
7. Be able to plan a strategy for incorporating drought tolerance selection in a plant breeding program.

The 15-week curriculum will be divided into 15 lessons, delivered via a voice-over PowerPoint presentation, a video, a relevant reading assignment, or combinations of these media. An assessment tool (either a quiz or a written assignment) will be included in all lessons. Most lessons will require student participation in an online discussion. Homework assignments will include analysis of a target environment for a specific crop, a review of the drought tolerance literature for that crop, a report of an interview with a practicing plant breeder, and a proposal for a plant breeding program to improve drought tolerance. There will be a comprehensive proctored final exam.

**Submission of assignments:** Assignments will be submitted via the Colorado State University online course environment whenever possible (we may need to make exceptions if video or audio files are submitted). Each of the four homework assignments has its own due date. After the due date, the maximum number of points available will decline by 20% per day; e.g., if an assignment is worth 10 points if submitted by the due date on Monday, the maximum is 8 points on Tuesday, 6 points on Wednesday, etc.

**Time requirements:** The expected time needed to view the online content is approximately 1 hour/week, with an additional 3 hours/week estimated for reading the assigned material, completing the homework assignments and portfolio, and participating in discussions.

**Sequence of lessons**

<b>Week</b>	<b>Topical Content</b>
1	Introductions. Knowing the target environment.
2	Plant response to drought stress. Plant strategies for dealing with drought.
3	Selecting for yield: Historical evidence, practical considerations.
4	Secondary traits as selection criteria for improving drought tolerance.
5	Secondary traits (continued).
6	Secondary traits (continued).
7	Wild species and landraces as sources of drought tolerance.
8	Quantitative trait locus analysis for drought tolerance traits.
9	Transgenic approaches: Principles and methods.
10	Transgenic approaches: Examples for abiotic stress tolerance.
11	Breeding for drought tolerance: Experience with grain crops.
12	Breeding for drought tolerance: Experience with legume crops.
13	Breeding for drought tolerance: Experience with horticultural and oilseed crops.
14	Integrating drought tolerance selection in an applied breeding program.
15	Integrating drought tolerance selection in an applied breeding program (continued).

<b>Evaluation:</b>	Homework assignments	60%
	Quizzes	10%
	Class participation	10%
	Final exam	20%

<b>Grading:</b>	90-100%	A
	80-89%	B
	70-79%	C
	60-69%	D
	<60%	F