

## The nature of selection during plant domestication - Purugganan & Fuller

In this paper, the authors review archeological evidence that provides clues to the domestication process and compare it to genomic studies of selection during domestication. Archeological evidence suggests that humans were using certain species as food before they began to cultivate them. Unconscious selective forces during early domestication tended to give rise to two common and important traits: increased seed size and reduction in natural seed dispersal mechanisms. Interestingly, evidence suggests that increased seed size evolved much more quickly than reduction of shattering. The authors argue that unconscious selective forces shaped early crop domestication traits while conscious selection shaped crop varieties based on cultural preferences.

The authors reviewed studies that identified domestication genes and their functions in plants. They suggested that traits associated with domestication involve changes in transcriptional regulatory networks while traits associated with diversification (of the crop) involve changes in enzyme-encoding genes. The authors also suggest that selection is stronger in diversification than in the original domestication process.

### Discussion Questions

1. The authors write how domestication is 'animal-plant co-evolution', but only give examples of how the plant has evolved in response to human selection. For co-evolution to occur, humans would also have to evolve in response to plant evolution. The authors make the case that domestication of plants and animals led to the cultural evolution of humans. Is cultural evolution evolution in the biological sense of the word? Can you think of any examples that may suggest genetic changes in humans in response to selection pressures from domesticated plants or animals?

-Perhaps the evolution of tolerance to lactose in adults from populations that have traditionally kept animals for dairy purposes (just a guess)

2. Do you think artificial selection changes during a species domestication? Perhaps changes in planting or harvesting techniques may unconsciously change the type and strength of selection on certain traits. Would it be possible to identify areas of a crop's genome that were under ancient versus recent selection? (seed size evolved much more quickly than shattering)
3. Why do you think humanity is dependent on so few species of domesticated grasses (maize, wheat and rice)? Do you think that there are intrinsic characteristics of grasses that make them desirable crops?

## Seed Banks and Molecular maps: Unlocking Genetic Potential from the Wild

In this paper, the authors argue that the genetic resources of the wild relatives of crop species should be used for crop improvement. Traditional breeding methods rely on selecting individuals with a desired phenotype and crossing them to produce the next generation. However this method will not work to capitalize on the genetic diversity present in crop progenitor species as the wild relatives usually do not display desirable phenotypes. Instead, breeders need to use advanced techniques to identify loci that contribute to desired traits within the wild ancestor and then introgress them into the genetic background of an elite cultivar. Using advanced backcrossing techniques, it is possible to improve an elite line to a greater extent than by using traditional breeding techniques alone.

### Discussion Questions:

1. The authors mention the advanced backcross QTL breeding method. For this method to work, hybrids between the elite line and wild relative must be fertile. Could wild relatives that cannot make fertile hybrids with their derived crops still be a valuable genetic resource to use in improving crops?
2. Are the techniques described in the paper appropriate for all types of crops? For example, fruit trees are often made up of several varieties grafted together as well as they have long generation times. Another example is the banana which is propagated asexually.