Capstone Two - Project Ideas

Background:

Nitrogen is one of the most important and central minerals in the plant’s life, it is involved in many aspects and processes of its life, among them is chlorophyll, nucleic acids and amino acids formation. The specific nitrogen condition that the plant consume will affect the plant’s survival and growth. A plant that is growing under some nitrogen condition will present some set of phenotypes, such as roots and shoots phenotypes. For example – high nitrogen condition might be toxic to the plant, and as a result the plant will have shorter root, and smaller leaves.

Glucosinolates (GSL) are metabolites that are produced in the Cruciferae family (broccoli, cauliflower etc.), and have a key role in defense against herbivores and pathogens, as they are toxic to them. Specific glucosinolates affect plants growth and development through different mechanisms. There are a few dozen different structures of GSLs, and different conditions will affect the content of these structures in the plants.

There are several links that connect between nitrogen and GSLs, the most basic one is that nitrogen is part of the basic structure of all GSLs. In this project I will try to understand this connection, and the involvement of environmental parameters in this connection.

Project Ideas:

1. Is there a connection or correlation between geographical and /or environmental conditions and nitrogen phenotypes? (Developmental and biochemical)
2. Is there a connection or a relationship between nitrogen phenotypes and GSLs content?
3. Can we predict nitrogen phenotypes or GSLs content based on environmental parameters?

The datasets:

1. Nitrogen and phenotypes: this dataset contains data on ~13000 plants that grew on 4 different nitrogen conditions (2 sources, 2 concentrations). The data includes phenotypes for each seedling under each condition, under two categories: developmental phenotypes (roots and shoots phenotypes) and biochemical phenotypes (GSLs measurements). Here is the process in which we created this dataset:

Developmental phenotypes (roots and shoots)

1,135 plant accessions

The experimental design

Different nitrogen treatments

4 nitrogen conditions X 1135 accessions X 3 replicates

=13,620 plant

KNO3

NH4HCO3

0.1mM

1mM

Analyzing data

Collecting data

Biochemical phenotypes (GSLs amounts)

1. Environmental data: the different accessions (1135 accessions, with different genetic backgrounds) were collected from different locations around the world. This dataset contains information for different environmental parameters for each location (weather, geography, minerals etc.).
2. Seeds GSLs data: this dataset contains GSLs information on each one of the seeds of the 1135 accessions, and not the plants when they grow under the different nitrogen conditions. Might serve as a GSL reference.