

## **Data Management Plan**

### **Dissecting the genetic architecture of mungbean leaf diversity.**

*Mungbean* is a pulse crop consumed as a staple in South-East Asia, China, and Africa. In those countries, mungbeans are consumed as whole seeds, split seeds, flour, and more commonly as a sprout in North America. The new markets have necessitated Iowa State University (ISU) to start a Mungbean Breeding program to advance research and provide farmers with clean planting seeds. Mungbeans have a high protein content than soybean currently grown on commercial scale for use as animal feed. They are highly digestible and cause less flatulence.

Leaves play a significant role in the growth and physiological functioning of plants. They are the assimilatory pipeline for plants' interaction with the atmosphere, and essential in processes such as photosynthesis, transpiration, biomass accumulation, photon interception, energy balance, soil erosion, crop-weed competition, and the plant's overall yield. In forests, leaves contribute to the overall canopy structure, which defines the below canopy ecosystem.

The plant species highly determine leaf types. They vary a lot from one plant to another in terms of leaf type and leaf characters. Some of the critical leaf characters include leaf shape, maximum length, maximum width, area, margin, and base type.

Herbariums highly utilize the above characters for plant taxonomy. Some leaves are highly nutritious and utilized as food in different parts of the world. Farmers have for a long-time used leaves characters as a method of selecting desired plants to help achieve their goals. Farmers, utilizing leaf knowledge, can determine the physiological condition of a plant. For example, farmers might not have the right equipment to measure the level of nitrogen available for crops, but they can tell the need for nitrogen from the yellowing of leaves.

In this project, we will use the Iowa mungbean diversity panel to achieve various outcomes. Besides the typical leaf characteristics, maximum length, maximum width, and area, we would like to apply image processing to quickly extract other characters such as the circumference, aspect ratio, margin types while applying Fourier transformation and principal functional components to get different shapes. Additionally, we would like to utilize genome-wide association studies (gwas) to understand mungbean leaves' genetic architecture.

At the end of the project, we hope to generate new knowledge of any important quantitative/qualitative loci associated with the different leaf characters. Leaf area is a significant factor among all, as it directly contributes to the total biomass and yield of a plant. We hope also to generate new characters that curators at herbariums and biologists in generate can utilize.

DMP Assignment BCB546 #Spring 2021

Due: 4/07/2021

Kevin Chiteri

### **Data type**

We will take images of ~500 genotypes of mungbean grown in two locations in Boone County, IA. Each location will have two replicates. In total, we anticipate collecting around 2000 images using a digital camera.

### **Data format**

The raw images collected will be in PNG format.

### **Data storage & preservation**

During collection, the images will be temporarily stored on the local computer before being transferred to the SinghBean folder on the Agronomy network at Iowa State University. The images will be stored here permanently unless otherwise.

### **Data sharing**

Extracted data used for analysis will be shared freely as a supplementary in the journal where the paper is published. The processing pipeline will be shared freely on this bitbucket repo (<https://bitbucket.org/baskargroup/aria2/src/master/>). The analysis code will be available on this github repo (<https://github.com/yalek>). Raw image files will be available on request to [arti@iastate.edu](mailto:arti@iastate.edu).

### **Publishing & dissemination**

Once done, a manuscript will be prepared and sent to the appropriate journal. Most likely a journal that accepts preprint release.

### **Roles & responsibilities**

Kevin Chiteri is the designated graduate student working on this project. He will work in collaboration with hired undergraduates for summer data collection. He will also work closely with Zaki Juberi to develop, test and deploy the image processing pipeline. Arti Singh, the PI, will oversee the full project implementation.