

Introduction

Higher levels of the antioxidants, lutein and zeaxanthin within North American diets could have various health benefits, including reduced risk of age-related macular degeneration, some types of cancers, and age-related decline in cognitive function associated with dementia. This study will assess antioxidant levels in historically elite temperate maize germplasm by running High Performance Liquid Chromatography (HPLC) on +400 formerly Plant Variety Protected (ex-PVP) inbreds. We will also examine the feasibility of using inexpensive rapid chromameter readings as an initial screen for antioxidant levels. By running correlations between the chromameter and HPLC results.

Objectives

- Measure antioxidants in ex-PVP inbred panel.
- Determine the association between visual color, and analytically measured antioxidant levels to assess the applicability from using color to predict antioxidant levels.

Expired Plant Variety Protection Panel

- The Plant Variety Protection Act (PVPA) was passed by congress in 1970 and assigned intellectual property rights to inbred line developers for 20 years.
- Expired Plant Variety Protected (ex-PVP) lines are varieties that have exceeded the 20 year protected limit. (currently any variety older than 1997).
- Maize ex-PVP inbred lines largely represent the genetic material currently used to make commercial hybrids of today.

HPLC

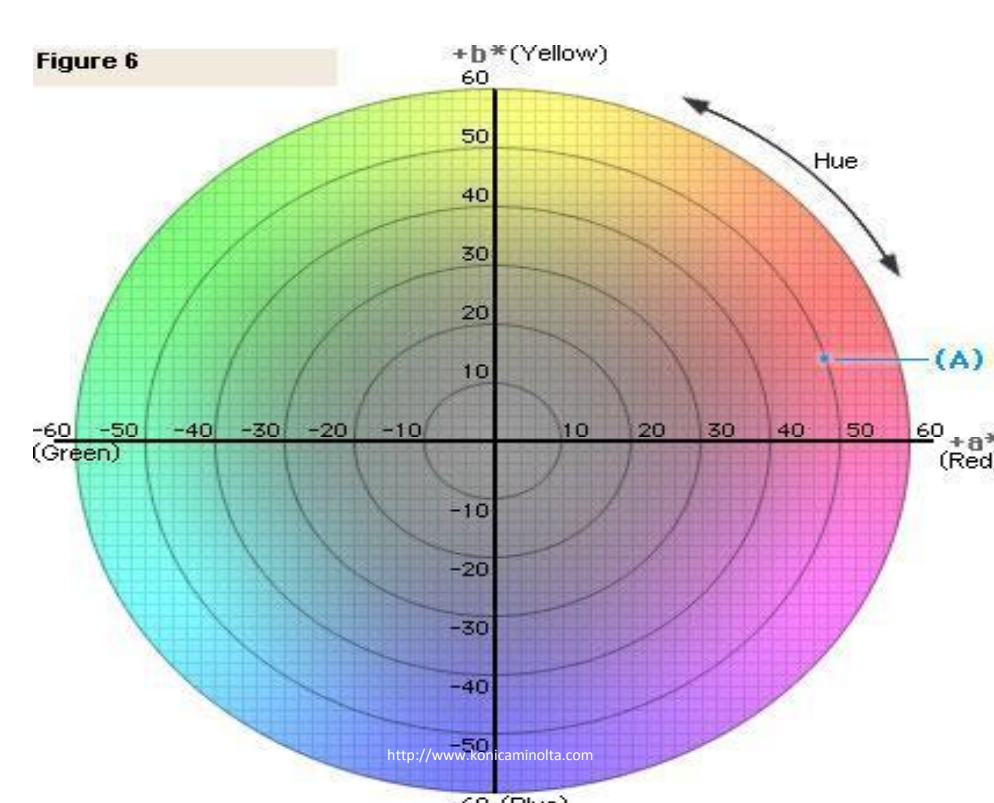
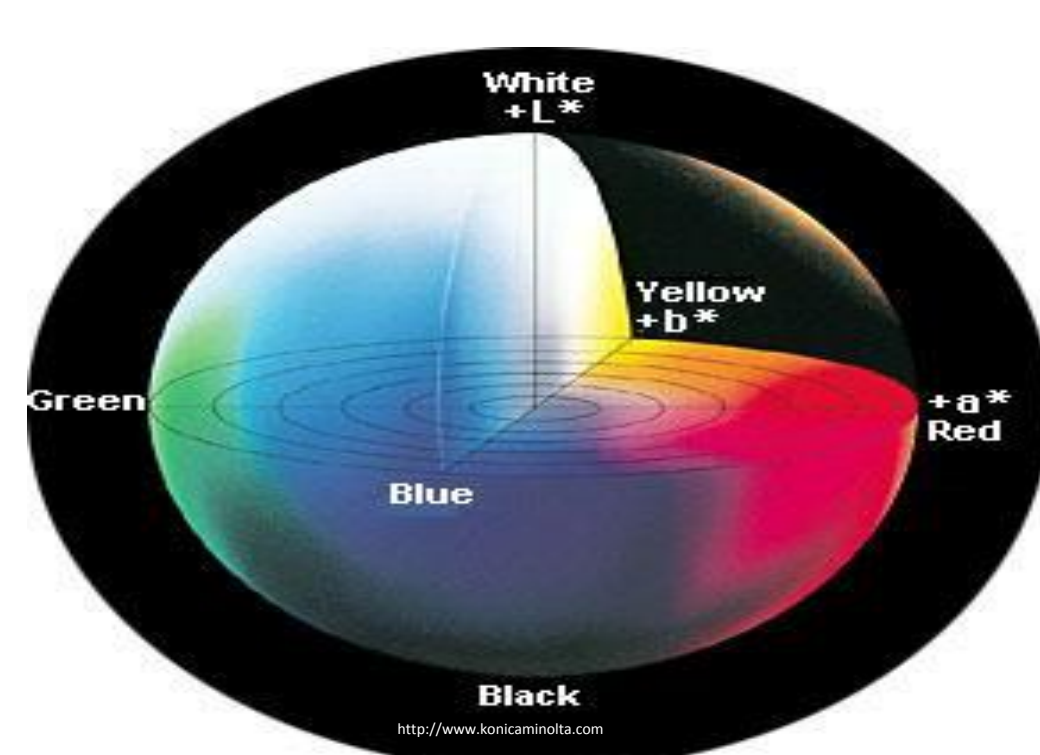


High performance liquid chromatography (HPLC) is the gold standard for quantifying antioxidant levels, while it is highly accurate it is also very expensive, laborious and requires considerable technical knowledge to perform.

Chromameter



Quantitative visual scores based on chromameter have been shown to be useful for GWAS (B. Owens). Indirectly quantifying antioxidants based on chromameter values would be an inexpensive, quick alternative to HPLC. This method has not been tested on a commercially relevant germplasm.



Chromameter Results ex-PVP Panel

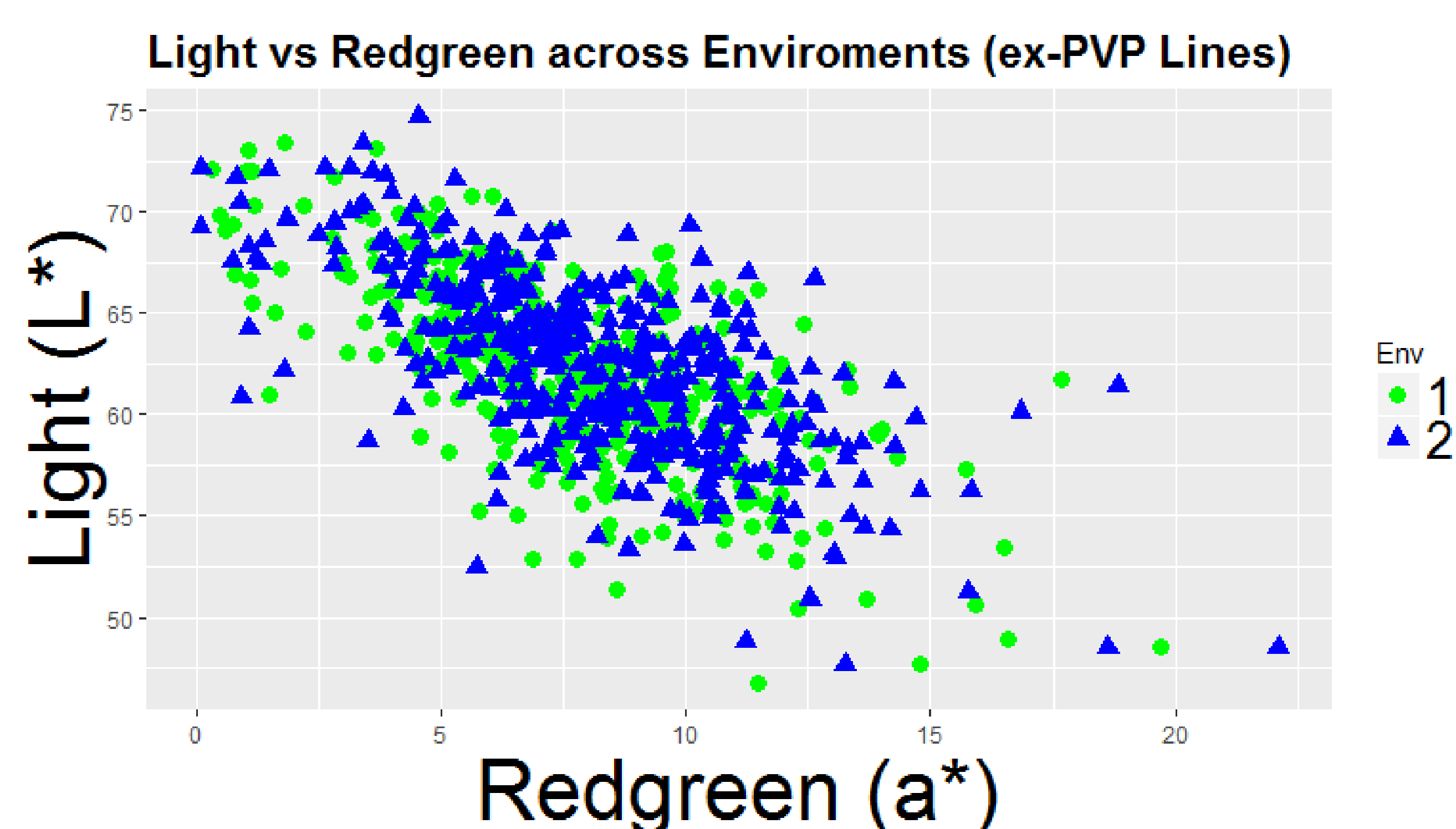


Figure 1: Grain color of ex-PVP Inbred lines. a^* and b^* are the values obtained from the chromameter which converts visual color into a quantitative scale.

Chromameter Results Calibration Panel



Visual color scoring method developed by Kristin Chandler.



Examples showing the color diversity in Maize that correlates to variable levels of Antioxidants I hope to exploit with a quantitative color measurement.

Light vs Redgreen across Genotypes

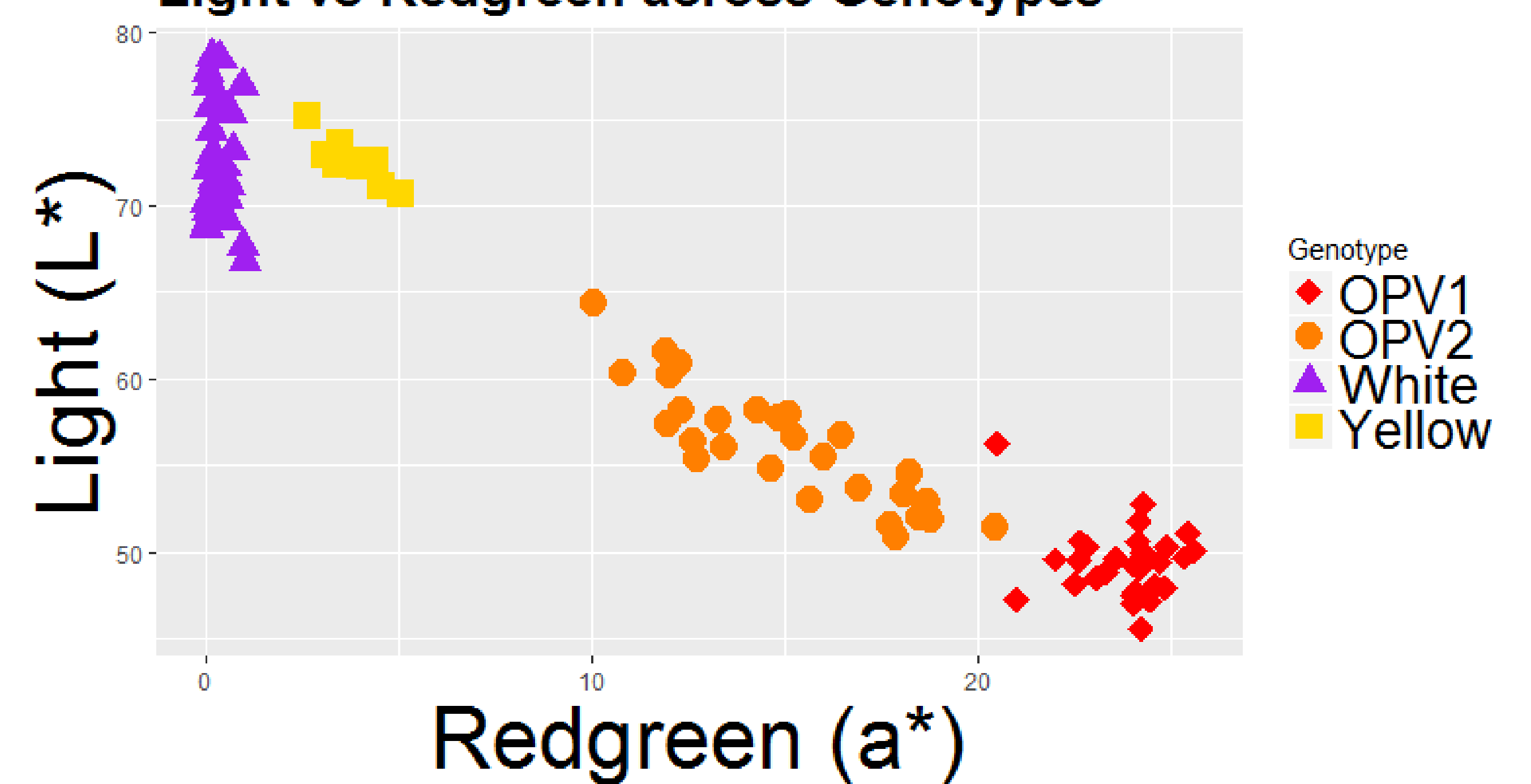


Figure 3: Grain color of two high total carotenoid lines and a white and yellow line. (Redgreen a^*) and (light L^*) are the values obtained from the chromameter which converts visual color into a quantitative scale.

Yellowblue vs Redgreen across Genotypes

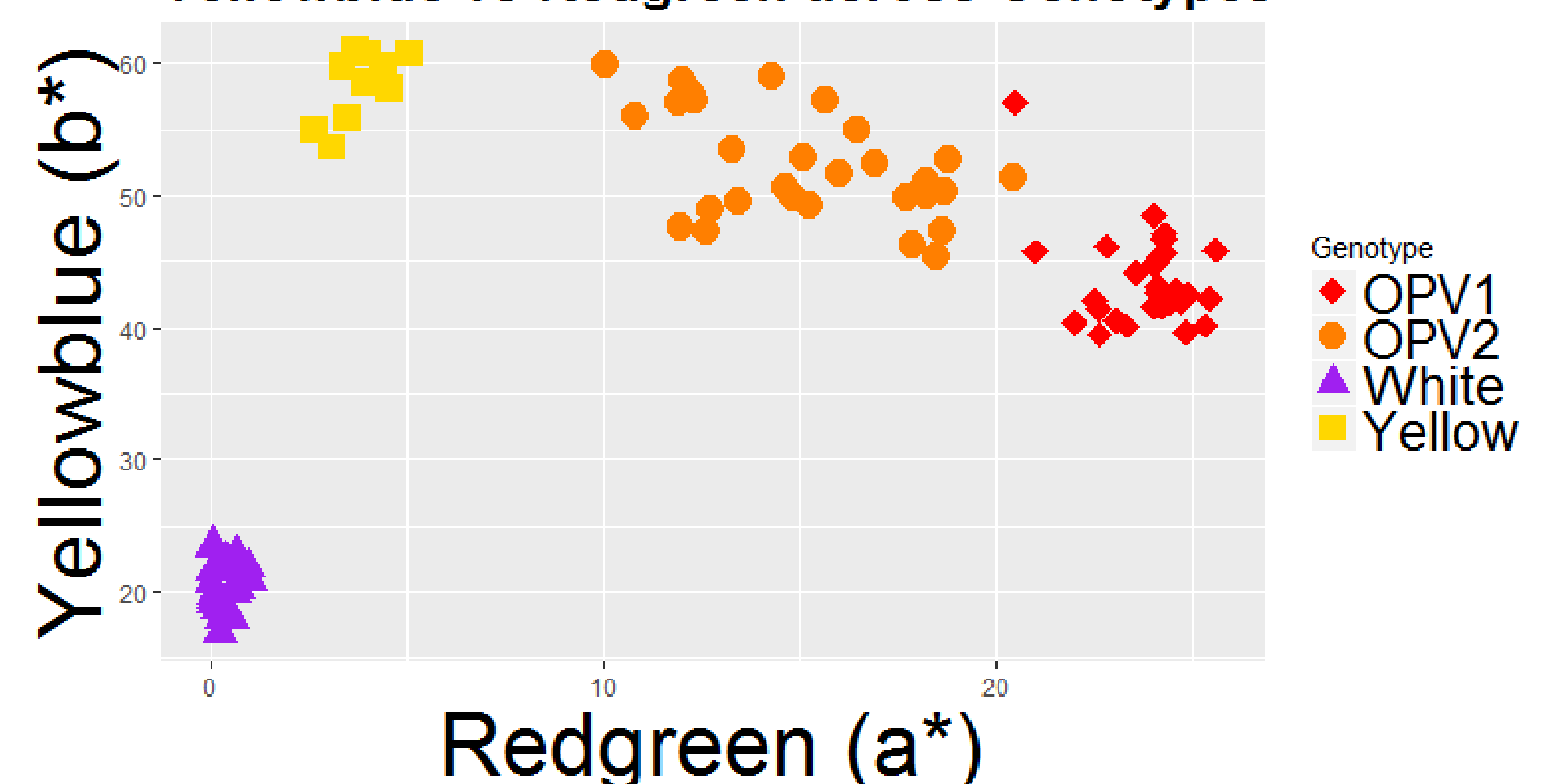


Figure 2: Grain color of two high total carotenoid lines and a white and yellow line. (Redgreen a^*) and (yellowblue b^*) are the values obtained from the chromameter which converts visual color into a quantitative scale.

Expected Results

- Per-Se levels of Antioxidants in ex-PVP inbred panel.
- Strong association between color and antioxidants to justify the feasibility of using chromameter to estimate antioxidant quantities.

Acknowledgements

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References

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- 2) Owens BF, Lipka AE, Magallanes-Lundback M, et al (2014) A foundation for provitamin A biofortification of maize: genome-wide association and genomic prediction models of carotenoid levels. Genetics 198:1699–1716.
- 3) Ruiz D I, Reich M, Bureau S, Renard CM, Audergon JM, Application of reflectance colorimeter measurements and infrared spectroscopy methods to rapid and nondestructive evaluation of carotenoids content in apricot (*Prunus armeniaca* L.). J Agric Food Chem. 2008 Jul 9;56(13):4916-22