

# Automatic Measurement of Stomata Size

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## Abstract

Measurement of leaf stomata is useful to distinguish plant genotypes differing in ploidy level, since stomatal guard cell dimensions show consistent patterns within genotypes that correlate with genome size. We have measured the stomatal complex size in six genotypes of buckwheat (*Fagopyrum esculentum*) that are diploid or tetraploid (15, 178, 81, 86, *Darja*, *Trdinova*). The automated stomata measurement was implemented in StoManager1 Python application [1] using a pre-trained YOLOv8 object detection method. The dimensions of stomata were measured on detected object masks as a rotated bounding box by minimizing the width of the rotated rectangle instead of fitting the minimum area bounding rectangle. The automatic measurements were validated by manual measurement of guard cell length in Fiji (Fig. 1). The stomata sizes in genotypes 15, 178, 81 and 86 were significantly larger than in genotypes *Darja* and *Trdinova*, indicating that the former are tetraploid while the latter are diploid.

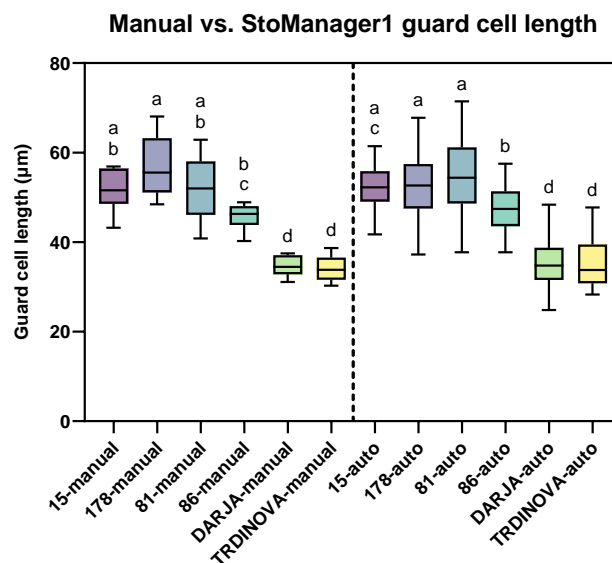


Figure 1: **Buckwheat stomata guard cell length.** The length of the stomata was measured in six genotypes of buckwheat on the peels of the leaf upper epidermis using a manual length measurement method in Fiji (left) and automatic measurement using StoManager1 Python application (right). Letters indicate statistically significant differences tested with ANOVA and Holm-Šidák's multiple comparisons test.

## References

1. J. Wang, H. J. Renninger, Q. Ma, S. Jin. Measuring stomatal and guard cell metrics for plant physiology and growth using StoManager1. *Plant Physiology* **195** (1), 378–394, 2024. <https://github.com/JiaxinWang123/StoManager1>