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High throughput winter pruning weight estimation based on wood volume evaluation

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Abstract (250 words)

There is currently a real need to improve and speed-up phenotyping in experimental set-ups to increase the number of modalities studied. Accurate information acquisition on plant status with high-throughput capacity is the main appeal of on-board systems.
A proximal sensing camera for a proxy of winter pruning weight was tested. We estimated the shoot volume of the vine by image analysis using algorithms that integrate the local shoot section area estimate along the shoot skeleton obtained by a morphological distance transform.
The study was carried out on the GreffAdapt experimental vineyard in Guyot simple training and a canopy management using vertical trellising. The planting density is 6250 vines/ha with a row spacing of 1.6×1m. Five scions grafted onto 55 rootstocks are present and the combination rootstock×scion is different every five plants.
In 2021 and 2022, 10 different rows of 70 plants were phenotyped by photographing each plant with a resolution of 4 pixels/mm² and by the classical method, i.e. the weight of the winter pruning wood. The results are that the winter pruning weight can be estimated at the fine scale of five vines with R^2=0.68 in 2021 and 0.74 in 2022. Incrementing the wood density of the scion into our calculation improves the regression with R^2 reaching 0.81 in 2022. Our approach, in which the estimation is done on the entire visible shoots, showed better results than the only known approach used in commercial devices, which simply uses the linear intercepts of a laser beam along the vine row.

Keywords: vigour confered, field phenotyping, proximal sensing, precision viticulture, grapevine