Open field Geometric primitives’ representation by a 2D low-cost LIDAR for vineyard sprayer application under different conditions.

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**Abstract.**

Light Detection and Ranging (LIDAR) is the application of Laser to distance measurement of objects. A pulsed light or a continuous wave defines distance through two different principles; Time of Flight (TOF) and Phase-Shift (PS). Recently, 2D and 3D TOF LIDARs found application in the agricultural field for vegetation analysis and distribution of agricultural input, intending to optimize the quantity of distributed active principle. In standard distribution systems around 30 - 50% of pesticed can be lost by drift or deposition on non-target areas. The most used devices are TLS (Terrestrial Laser Scanner), particularly the MTLS (Mobile TLS).LIDAR is considered to be potentially more accurate in point distance definition and more suitable to determine small objects or vegetation gaps with respect to Sonar (the other device commonly applied for the same purposes).The present study aims to test a 2D low-cost LIDAR-based real-time sprayer for vineyards by positioning specific targets and their subsequent recognition in the point cloud analysis. The test was conducted in an open field with different light conditions and speeds. Field tests were conducted in Arcevia municipality, Marche region, Italy (43.517325, 12.966688 – coordinates system WGS84).The prototype used is composed of 4 different interconnected devices. Field trial consists of recognizing circular (10 to 100 cm of diameter) and square (10 to 30 cm side) targets. The targets, 56 in total, are divided into 28 white (to ensure maximum laser reflectance) and 28 green (to simulate the leaves colour). The outward and return speeds varied between 3 and 8 km/h. In addition, the same device was used to define two-dimensional and three-dimensional structures in comparison. The results show that the system can identify objects or gaps in vegetation, even on small surfaces, and with speeds comparable to those used to apply pesticides. Comparing the two-dimensional and three-dimensional targets represented in the figure shows how the device can even recognize three dimensions.