



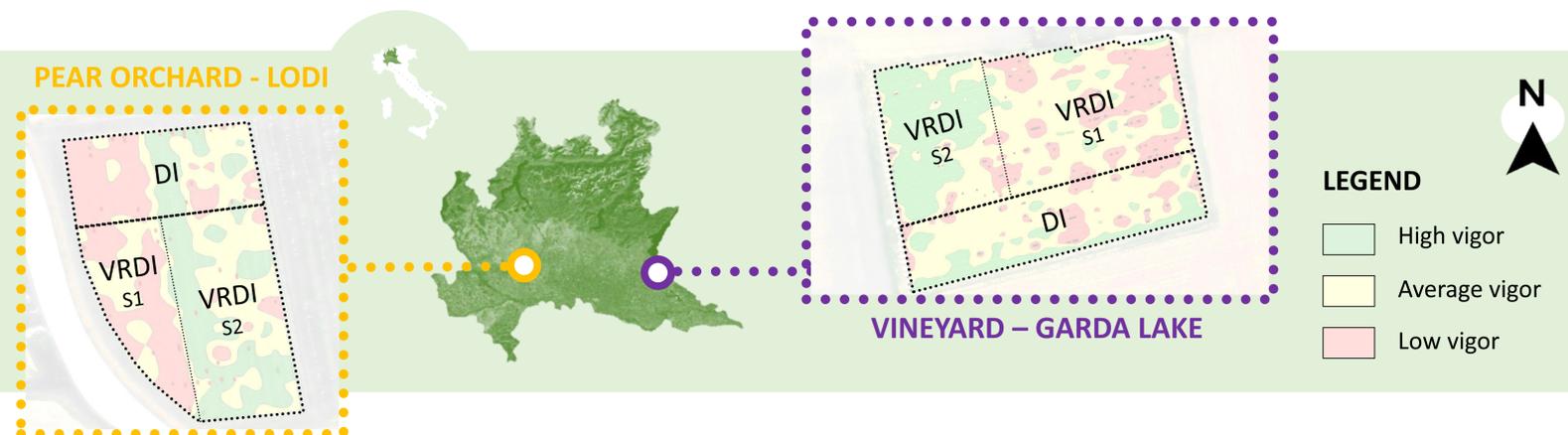
RESULTS OF AN EXPERIMENT OF VARIABLE RATE IRRIGATION IN A VINEYARD AND AN ORCHARD



Davide Bianchi, Bianca Ortuani, Alice Mayer, Davide Modena, Roberto Spadaccini, Lucio Brancadoro
Università degli Studi di Milano – Dipartimento di Scienze Agrarie e Ambientali (DiSAA)

Temperature rise and more exceptional rainfalls increasingly lead to water limited conditions for orchards and vineyards. Irrigation is ever more used to ensure production and quality of fruits and wine under drought conditions, nonetheless the availability of water is decreasing. In this perspective, high efficiency in water use is necessary to support the crop growth. One promising strategy to enhance the water management is represented by the precision irrigation, which allows to optimize the water distribution, considering the within-field variability. The aim of the present study is to compare the variable rate drip-irrigation system (VRDI) to a traditional drip-irrigation system (DI) in two case studies.

Fig. 1. Experimental design in the pear orchard and vineyard. Sectors VRDI-S1 and VRDI-S2 were defined according to soil characteristics and sector DI is the reference.



The experiment took place in 2018 in pilot vineyard (cv. Chardonnay) and pear orchard (cv. Conference, Abate Fetel and Kaiser) of about 1 ha, located in Lombardia, Italy (Fig. 1). Within-field variability was detected by soil electrical conductivity and two homogenous zones were defined by statistical clustering. Soil profiles were characterized in each homogenous zone. In each field, VRDI irrigation system was designed defining two sectors (VRDI-S1 and VRDI-S2) according to the soil zones, optimizing in each sector the flow rate and the distance between drippers (Fig. 1). In both fields, a transversal sector was managed according to the typical DI system as reference. During the season, precipitations, soil moisture and irrigation water were monitored. At the harvest, pear and grape productions were registered, as well as sugar content, pH, titratable acidity and pear firmness. Water productivity was calculated as the ratio between the unit production (kg ha^{-1}) and the unit water volume ($\text{m}^3 \text{ ha}^{-1}$).

Table 1. Yield and quality parameters in the PEAR ORCHARD

Parameter	Conference		Abate Fetel		Kaiser	
	DI	VRDI-S1	DI	VRDI-S1	DI	VRDI-S1
Production per plant (kg)	29.2 ± 4.3	16.8 ± 3.1	20.7 ± 1.8	23.3 ± 3.7	9.4 ± 1.9	12.9 ± 3.4
Number of fruits	235.7 ± 26.6	116.7 ± 19.1	92.7 ± 7.8	102.7 ± 16.7	49.3 ± 8.1	68.0 ± 16.6
Average fruit weight (g)	124.0 ± 14.4	143.9 ± 5.8	223.4 ± 2.1	227.2 ± 8.3	189.0 ± 8.3	189.4 ± 16.7
Firmness (kg cm^{-2})	2.7 ± 1.0	4.0 ± 0.3	3.1 ± 0.8	4.7 ± 0.1	5.0 ± 1.6	6.4 ± 0.9
Sugars ($^{\circ}\text{brix}$)	14.0 ± 1.0	15.8 ± 1.1	14.3 ± 0.7	14.7 ± 0.6	15.5 ± 1.6	15.7 ± 1.4
pH	4.8 ± 0.1	4.6 ± 0.1	4.1 ± 0.1	4.1 ± 0.1	4.4 ± 0.1	4.2 ± 0.1
Total acids (g L^{-1})	3.1 ± 0.6	3.7 ± 0.3	2.1 ± 0.3	2.3 ± 0.4	2.2 ± 0.9	2.9 ± 0.9
Water Productivity (kg m^{-3})	34.63	41.74	14.73	34.73	11.15	32.05

Table 2. Yield and quality parameters in the VINEYARD

Parameter	DI	VRDI-S1	VRDI-S2
Production per plant (kg)	3.7 ± 1.3	3.7 ± 0.4	3.5 ± 1.8
Number of bunches	42.7 ± 9.2	38.8 ± 5.1	36.7 ± 12.3
Average bunches weight (g)	85.1 ± 25.2	94.4 ± 5.3	89.5 ± 20.7
Average berry weight (g)	1.6 ± 0.2	1.7 ± 0.1	1.5 ± 0.1
Sugars ($^{\circ}\text{Brix}$)	21.4 ± 0.2	20.1 ± 0.9	21.1 ± 0.2
pH	3.4 ± 0.22	3.4 ± 0.01	3.3 ± 0.03
Total acids (g L^{-1})	5.5 ± 0.2	4.8 ± 0.2	5.0 ± 0.1
Water Productivity (kg m^{-3})	37.28	33.47	58.00

During the experimental year, the amount of irrigation water for VRDI respect to DI system was reduced of 20% in the vineyard and about of 50% in the pear orchard. No differences between the two systems were found in grape production (Table 1), whereas pear production reported interaction with the variety (Table 2). Slight differences were found in qualitative parameters (Table 1; Table 2). Precision irrigation increased the water productivity of pear-trees and grapevines (Table 1; Table 2). Therefore, this study shows that using VRDI system is possible to reduce the irrigation water, maintaining production and quality in vineyards and orchards.