Variability reduction using variable rate drip irrigation (VRDI) in Vineyard

Dr. Itamar Nadav, R&D Netafim, ISRAEL

Itamar.Nadav@Netafim.com
IRRIGATION DILEMMAS:

1. When?
2. How much?
3. Where???
OVER AND UNDER IRRIGATED VINES

Well watered Vine

Stressed Vine

40 m
Not achieving the full yield potential or quality
OBJECTIVES

- VRDI aims to eliminate/reduce spatial variability
- Variability in yield (increase yield)
- Variability in quality

Causes for variability:
- Sloped plots
- Different types of soils
- Soil depth
- other
WHAT’S THE INCENTIVE TO DEVELOP VRDI?

- In an ideal world, all the plants in the plot are at the same size and give the same yield (they’re not!), plots are highly variable.

- The ideal irrigation system would give the exact amount of water for each plant according to its size and needs.

- In an ideal drip irrigation system, each tree/plant has its own dripper, giving him the right amount of water (too expansive-not practical).

- A more reasonable solution is to control small subplots in a given plot and give this subplot the right amount of water.
CASE STUDY: VINEYARD

- 2006 Syrah variety vineyard.
- 1.2 hectare.
- Variable vegetation, yield and quality at the same plot.

- Low vegetation
- Low yield
- High quality

VRDI - the next Generation of drip irrigation
EXPERIMENT DURATION

- 2014- conventional drip irrigation (one zone)
- 2016- VRDI irrigation (12 zones)
- 2017- VRDI irrigation (12 zones)
- 2018- conventional drip irrigation (one zone)
THE PROBLEM: VARIABILITY

The solution: VRDI

Pixel size <30 X 30 m

1 irrigation zone

12 irrigation zones
VRDI SUB PLOTS

- Dividing the plot into 12 sub irrigation zones (A1...A6; B1...B6).
- Each subplot can be irrigated separately.
- Each irrigation subplots is irrigated to achieve goal yield and quality.
MODEL DESCRIPTION

- **NDVI** → **Kc** → **ETc** → **ETo** → **SWP (Thermal)** → **Stress Factor** → **IRRI(pi)** → **IRRI(pi)** → **Controller**

- Pre-season irrigation
NDVI MAPS: BEFORE AND AFTER VRDI

VRDI (2016)  

Uniform irrigation (2014)
NDVI MAPS: BEFORE AND AFTER VRDI

NDVI MAPS: BACK TO VARIABLE GROWTH

Uniform irrigation (2018)

Uniform irrigation (2014)
YIELD RESULTS

VRDI (2016)

Uniform irrigation (2014)

Yield (tons/ha)

Pixel No.

South  |  North

2  |  4  |  6

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YIELD RESULTS

VRDI (2017)

Uniform irrigation (2014)

South → North

South → North
YIELD RESULTS

Uniform irrigation (2018)

Uniform irrigation (2014)

South  →  North

South  →  North
IRRIGATION SCHEDULING

VRDI 2016

Date

irrigation (mm)

North

South

Date

Accum. irrigation (mm)

Total applied water

South

North

Pixel No.

Northeast
IRRIGATION SCHEDULING

VRDI 2017

Total applied water

Date

South

North

Applied water (mm)

Pixel No.

A1
A2
A3
A4
A5
A6

0
20
40
60
80
100

0
2
4
6
8
10

25.4.17 7.5.17 21.5.17 7.6.17 25.6.18 10.7.17 6.8.17 20.8.17

IRRIGATION SCHEDULING

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CONCLUSIONS

- VRDI system has increased yield in the vineyard by 17%
- VRDI system has saved water by 20%
- VRDI system has reduced variability in yield and quality
- When not using the VRDI system the variability comes back
- Use the VRDI for variable rate fertigation (VRF)
OPEN FOR COLLABORATION

VRDI-the next Generation of drip irrigation
Thank you!

Itamar.Nadav@Netafim.com