MULCHING EFFECTS ON TRANSPIRATION OF A NECTARINE ORCHARD

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Mulching systems are becoming important in the modern fruit orchard cropping systems. In climates of high evaporative demand, mulches are used to reduce evaporation losses from the soil surfaces. Other possible benefits are acceleration of crop development by increasing soil temperature and erosion prevention among others.

Previous studies on horticultural crops have shown an increase of transpiration rates under different mulching systems. To our knowledge, no works have been reported on the effect of mulching on transpiration rates of fruit orchards.

Then, the main goal of this work was to study the transpiration rates of a drip-irrigated nectarine crop under 3 mulching treatments and compare them to a bare soil reference.
LAYOUT OF THE EXPERIMENT

Repetition 1

- Control trees (numbers 1 to 16)
- O: Organic mulching: pine bark
- D: Bare soil
- G: Mulching with geotextil (jute)
- P: Mulching with black plastic

Repetition 2

- Distances:
  - a=6 m
  - b=2 m

Repetition 4

Repetition 3
SAP FLOW METHODOLOGY

- Measurement period was from 12 May to 8 August, 2010
- Due to the pruning of nectarine trees, equipment was installed in the two main branches of each experimental tree
- **Compensation heat pulse method** used. Each sensor has a heater and two temperature probes asymmetrically located from the heater ($x_D$ and $x_U$). Each probe had three thermocouples (5, 12, 21 mm).
- **Time delay** ($t_z$) for the temperatures at the two points to become equal were recorded every 2s during 10 min following the heat pulse, twice per hour.
Recorded raw data was analysed following (Green et al., 2003):

- Corrected heat pulse velocity, \( V \), in cm h\(^{-1} \) obtained from \( t_z \) values

\[
V = a_0 + a_1 \left[ \frac{(x_D + x_U)}{(2 \, t_z)} \right] + a_2 \left[ \frac{(x_D + x_U)}{(2 \, t_z)} \right]^2
\]

- \( a_0, a_1, a_2 \), calibration factors to correct error due to wound width

- Sap flow at each measuring depth, \( J_s \), in cm h\(^{-1} \) was obtained:

\[
J_s = (k \, F_M + F_L) \, V
\]

- \( F_M, F_L \), volume fractions of wood and water
  - Mean volume fraction of wood 0.45 ± 0.016
  - Mean volume fraction of water 0.27 ± 0.072

- Finally, sap flow at these different depths were integrated following (Hatton et al., 1990) to get transpiration rates of each branch and then corresponding tree transpiration
Compared to bare soil, cumulative average transpiration rates increased by:

- Black plastic 33%
- Geotextil 30%
- Pine bark 19%
### RESULTS

**ANOVA**
Cumulative mean transpiration rates [mm/day]

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>BLACK PLASTIC</th>
<th>GEOTEXTIL</th>
<th>PINE BARK</th>
<th>BARE SOIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>51.05 a</td>
<td>52.81 a</td>
<td>48.02 a</td>
<td>42.47 a</td>
</tr>
<tr>
<td>June</td>
<td>85.84 a</td>
<td>85.67 a</td>
<td>77.99 a</td>
<td>65.49 a</td>
</tr>
<tr>
<td>July</td>
<td>95.10 a</td>
<td>89.00 a</td>
<td>83.08 a</td>
<td>64.13 a</td>
</tr>
<tr>
<td>Sum</td>
<td>246.51 a</td>
<td>241.16 a</td>
<td>220.75 a</td>
<td>184.78 a</td>
</tr>
</tbody>
</table>
• On average transpiration rates have increased by the use of different mulching treatments. These increases have been 33% for black plastic, 30% for geotextile, 19% for pine bark.

• These results should be considered as preliminary due to relative high variability observed among the different blocks of the same treatment.

• Second experimental campaign should be performed in order to confirm the results.
Thanks for your attention