Effect of Trace Quantity Irrigation (TQI) on Wine Grape Culture in Arid Region in China

Double-layer Structure of TQI

Cutaway view of water control tip

Flow rate 1-500 mL/h without clogging. Used 6 years without clogging problem in field trial, result from lab test showed more than 20 years life.
Materials and methods

Experimental site
Changyu grapevine farm in Xixia district, Ningxia province, China.

aeolian sandy soil, Soil bulk density : 1.42 g/cm$^2$

Plant material
wine grape (variety : ‘cabernet sauvignon’)

Experimental design

Measurement
Irrigation amount, Soil water content, Grapevine growth.

Results

Irrigation amount

<table>
<thead>
<tr>
<th>Month</th>
<th>Trace quantity irrigation (m$^3$/hm$^2$)</th>
<th>Drip irrigation (m$^3$/hm$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td>June</td>
<td>300</td>
<td>720</td>
</tr>
<tr>
<td>July</td>
<td>300</td>
<td>600</td>
</tr>
<tr>
<td>August</td>
<td>300</td>
<td>600</td>
</tr>
<tr>
<td>September</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td>Total</td>
<td>1200</td>
<td>2520</td>
</tr>
</tbody>
</table>

Irrigation uniformity
Single trace quantity irrigation line was extended 350m long. The irrigation uniformity was 90% in the range of 350m.

Soil moisture

Changes of soil moisture during grapevine growth period
Results

**Wetting front**

Single TQI water control tip

Multiple TQI water control tip

**Crop growth**

Conclusions

52.4% water could be saved compared with drip irrigation for same yield; uniformity in flow rate was 90% when extended 350m.

Wetted perimeter was from 20cm to 80 cm in depth when lateral lines were buried 40 cm deep, and width of wetness was 50 cm to 60 cm.

Plants grew vigorously under trace quantity irrigation and 20% more yield was achieved compared with drip irrigation.

Note: A commercial scale trial, 30 Ha. (500m*600m), laterals extended 500m long, uniform soil moisture; irrigated simultaneously in comparison of 2-3 ha. rotation area of drip irrigation; 1-2 valves for 30 Ha. easy for automation.