THE COMPOST FROM THE WINE INDUSTRY AS A SOURCE OF NITROGEN IN VULNERABLE AREAS.

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• Spain is the third producer of wine of the world (44.4 Mill.hl) and the country with more vineyard area (969,000 ha).

• The large quantity of organic wastes generated by winery industry (2-3 Mill Mg year) constitutes a serious environmental concern.

• Spain is the ninth producer of melon in Europe (46%).
Wastes generation

White wines

100 Kg grapes
65-70 l Wine
20-25 Kg (EC 1493/1999)

Red wines

Stalk
5-7 Kg

Grape marc

Alcohol - Distilleries

Fermented Grape marc

Ethyl Alcohol

Fermented Grape marc

Exhausted grape marc

18 - 23 kg
COMPOST FROM WINE INDUSTRY: VALORIZATION

Circular Economy

Agricultural application
VULNERABLE ZONE

Water $NO_3^-$ concentration: 200 ppm

- Fertirrigation $NH_4NO_3$
- Compost of wine industry
- Agronomic assessment
- Environmental assessment
- Residual effect

SOIL
OBJECTIVE

✓ Could compost from the wine industry be an alternative to traditional fertilization (fertirrigation), in a vulnerable area?

✓ What agronomic and environmental consequences would have its application in vulnerable areas?

✓ What residual effect does nitrogen have on a subsequent crop, wheat?
EXPERIMENTAL DESIGN

- Field trials: ‘La Entresierra’ Field Station (Ciudad Real).
- Petrocalcic Palexeralfs soil with a very low vertical variability up to 60 cm of depth from which there is a fragmented petrocalcic horizon.
- **Cucumis melo** L., cv Trujillo “Piel de sapo” (1.5 x 1.5 m², 4,444 plant ha⁻¹).
- Fertilization: mineral and compost derived from winery wastes.
- Melon crop period from May to August.
- Random blocks, four replicates.
- Drip irrigation with plastic mulch: 100% ETc.
- Plastic mulch.
- **Triticum aestivum** L., cv Garcia (0.15 m between rows, 400 seeds m⁻²).
- Wheat crop period from November to July.
- Fertirrigation **NH₄NO₃** : from 11 to 393 (kg N ha⁻¹).
- Compost from the wine industry: doses \((D₁)\) 6.7, \((D₂)\) 13.3 and \((D₃)\) 20.0 (Mg ha⁻¹).
## EXPERIMENTAL DESIGN

### CHARACTERISTICS OF

<table>
<thead>
<tr>
<th></th>
<th>Compost</th>
<th>Irrigation water</th>
<th>Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity (%)</td>
<td>16.4</td>
<td>7.9</td>
<td>8.4</td>
</tr>
<tr>
<td>pH</td>
<td>9.8</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>EC (mS m⁻¹)</td>
<td>1.0</td>
<td>0.1</td>
<td>24.1</td>
</tr>
<tr>
<td>C/N ratio</td>
<td>12</td>
<td>125.2</td>
<td></td>
</tr>
<tr>
<td>N organic (%)</td>
<td>2.8</td>
<td>1214.6</td>
<td></td>
</tr>
<tr>
<td>N Kjeldahl (%)</td>
<td>3.0</td>
<td>194.6</td>
<td></td>
</tr>
<tr>
<td>N-NH₄⁺ (mg kg⁻¹)</td>
<td>1.5</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>N-NO₃⁻ (mg kg⁻¹)</td>
<td>283.0</td>
<td>172.0</td>
<td></td>
</tr>
<tr>
<td>Organic C (%)</td>
<td>31.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total P (%)</td>
<td>0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total K (%)</td>
<td>3.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Available Ca (%)</td>
<td>0.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Available Mg (%)</td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- pH: 7.9, 8.4
- EC (mS m⁻¹): 2.9, 0.2
- N-NH₄⁺ (mg kg⁻¹): 0.1
- N-NO₃⁻ (mg kg⁻¹): 125.2
- OM (g kg⁻¹): 24.1
- N-NH₄⁺ (mg kg⁻¹): 1.5
- N-NO₃⁻ (mg kg⁻¹): 283.0
- Available P (mg kg⁻¹): 22.1
- Available K (mg kg⁻¹): 410.7
- Available Ca (mg kg⁻¹): 1649.3
- Available Mg (mg kg⁻¹): 461.2
RESULTS: MELON CROP YIELD

Fertirrigación: Maximum relative yield with 315 kg available N total

Compost: Maximum relative yield with 267 kg available N total
RESULTS: NITROGEN MINERALIZATION INDEX (NMI)

\[ y = 2.3936e^{-0.01x} \]

\[ R^2 = 0.77 \]

\[ NMI = \frac{NM}{N_{av}} \]

\( NM \), Nitrogen mineralized (Kg ha\(^{-1}\))

\( N_{av} \), N available (kg ha\(^{-1}\))
RESULTS: MANAGEMENT EFFICIENCY (ME)

\[
y = 0.0018x^2 - 0.6105x + 60.793
\]

\[
y = 0.0003x^2 - 0.0595x + 4.9912
\]

\[R^2 = 0.80\]

\[R^2 = 0.96\]

\[\text{ME} = \frac{FY}{N_i}\]

FY, Fruit yield (Mg ha\(^{-1}\))

\[N_i\], N leaching (kg ha\(^{-1}\))
RESULTS: RESIDUAL EFFECT IN WHEAT

Wheat Grain yield (kg ha⁻¹)

- Fertirrigación
- Compost D1
- Compost D2
- Compost D3

Uptake N (kg ha⁻¹)

- Fertirrigación
- Compost D1
- Compost D2
- Compost D3
CONCLUSIONS

✓ The amount of leached nitrogen decreased considerably with the use of compost with respect to fertirrigation.
✓ Improved the production and extraction of nitrogen by the crop proportionally to the dose of compost added with respect to fertirrigation.
✓ With the application of compost, 15% less N is needed to obtain the highest relative production.
✓ The environmental risk decreases with the application of compost against fertirrigation.
Thank you for your attention!!