Synergic Effects of Salinity and alkalinity stresses on Palestinian Barely Cultivars During seed Germination and Growth Stages

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OUTLINE

✓ INTRODUCTION:

❖ PLANT STRESSES.

❖ SALINITY AND ALKALINITY STRESS (SAS).

❖ SOURCES OF (SAS).

❖ EFFECTS ON VEGETATION.

❖ BARLEY.

✓ AIMS AND OBJECTIVES.

✓ METHODOLOGY.

✓ RESULTS.

✓ DISCUSSION AND CONCLUSION.
Plant Stresses

Biotic stresses

Viruses

Bacteria

Insect
Plant Stresses

Abiotic stresses

Abiotic stresses are more severe than Biotic stresses

- Drought
- Salinity
- cold
- Alkalinity
Salinity stress:

- **Salinity stress**: is the accumulation of excessive salt contents in the soil which eventually results in the inhibition of crop growth and leads to crop death.

**Source of Salinity**

- Chemical fertilizers
- Heavy evaporation and low precipitation
Alkalinity stress

➢ **Alkalinity stress**: is the increasing of the soil pH to more than 7, due to the accumulation of alkaline salts.

**Source of Alkalinity**

- Reduced uptake of calcium
- Sodium carbonate (Na$_2$CO$_3$) and bicarbonate (NaHCO$_3$) upon weathering.
- Quarries
EFFECTS OF SALINITY AND ALKALINITY ON PLANTS

Response to salinity and alkalinity

- Osmotic pressure
  - Inhibits basic metabolic pathway

- Ion toxicity
  - Inhibits cellular enzymes and prevents cellular water uptake

- High pH
  - Availability of CaCO$_3$
Barley “Hordeum vulgare “

is an angiosperm and monocot plant, and is annual, and is the oldest substance used by humans in food, and animal feed.
Barley properties

- Can grow well at 6-8 pH.
- Can grow very well in sandy soil.
- Barley has a short life and it’s a winter crop plant.
- Barley has better resistance to salinity and alkalinity compared to wheat.
Aims and objectives

The aim :

- To look into the effects of (SAS) in Palestinian barley cultivars.

Objectives:

- To see how (SA) affects seed germination, early growth stages, and harvest yield.
- To Analyze the cultivars that are most resistant to SA in the soil.
- To describe how the quarries' and landfill's production can be improved.
- To find out how much CaCO3 there is.
- To determine the pH of 16 distinct quarries soils.
METHODOLOGY

✓ SOIL ANALYSIS:

- pH measurement (Calculate the amount of alkalinity).
- Electrical conductivity (Calculate the amount of salinity).
- % CaCO₃ (Using titration technique).
METHODOLOGY

✓ SEED GERMINATION:

THE 10 CULTIVARS (BALADI, IMPROVED BALADI, RIHANE, ICARDA 1 AND 15, ACSAD 68, 176, 1417, 1732 AND 1744) PROVIDED BY NARC WERE CULTIVATED ON THE 4 CONCENTRATIONS OF (CACO₃/NACL) (0MM, 50MM, 85MM AND 120MM).

Media preparation.

Seed disinfection.
METHODOLOGY

- **Seed planting** (Under the hood)
- Experimental conditions (were cultivated in culture room)
- Morphological and biomass analysis
METHODOLOGY

Growth parameters

- Shoot system
  - Length
  - Biomass
  - Total water content

- Seed germination

- Time of G50
  - Length
  - Biomass

- Root system
  - Total water content
  - Number of root
RESULTS

Soil analysis:

<table>
<thead>
<tr>
<th>Name</th>
<th>electrical conductivity (mS/m)</th>
<th>pH</th>
<th>CaCO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bani Naim</td>
<td>466.2±136.5</td>
<td>9.07±0.4</td>
<td>49.79±0.0154</td>
</tr>
<tr>
<td>Taffouh</td>
<td>365.6±117.3</td>
<td>8.63±0.04</td>
<td>47.92±0.0060</td>
</tr>
<tr>
<td>Sa’ir</td>
<td>460±242.1</td>
<td>8.06±0.55</td>
<td>46.44±0.0733</td>
</tr>
</tbody>
</table>

Electrical conductivity (EC) levels in the soil range from 110-570 mS/m
pH levels in the soil range 5.8.
<table>
<thead>
<tr>
<th>CaCO₃ %</th>
<th>Soil pH</th>
<th>TSS -Total Soluble Salts (ppm)</th>
<th>Electrical conductivity at 25 c° (dS/m)</th>
<th>Soil Electrical conductivity at T c° (µS/cm)</th>
<th>Conductivity of Soil &amp; D.water</th>
<th>Measured Temperature (°C)</th>
<th>Soil specimen name</th>
</tr>
</thead>
<tbody>
<tr>
<td>47.45%</td>
<td>8.43</td>
<td>0.443</td>
<td>6.923×10⁻⁴</td>
<td>667</td>
<td>702</td>
<td>23.1</td>
<td>أحمر وسط 15cm شمالي غرب الخليل</td>
</tr>
<tr>
<td>51.509%</td>
<td>8.83</td>
<td>0.202</td>
<td>3.152×10⁻⁴</td>
<td>309</td>
<td>344</td>
<td>24</td>
<td>بنى نعم (1) 15cm عاشور</td>
</tr>
<tr>
<td>50.156%</td>
<td>9.10</td>
<td>0.251</td>
<td>3.927×10⁻⁴</td>
<td>382</td>
<td>417</td>
<td>23.6</td>
<td>بنى نعم (1) وسط الحجر ثلج عاشور</td>
</tr>
<tr>
<td>50.617%</td>
<td>9.7</td>
<td>0.306</td>
<td>4.782×10⁻⁴</td>
<td>458</td>
<td>493</td>
<td>22.8</td>
<td>بنى نعم (2) عاشور</td>
</tr>
<tr>
<td>49.254%</td>
<td>8.66</td>
<td>0.338</td>
<td>5.274×10⁻⁴</td>
<td>515</td>
<td>550</td>
<td>23.8</td>
<td>بنى نعم (3)</td>
</tr>
<tr>
<td>33.469%</td>
<td>8.92</td>
<td>0.581</td>
<td>9.071×10⁻⁴</td>
<td>879</td>
<td>914</td>
<td>23.4</td>
<td>سعير جمال 15cm في خاصة 220m عمق</td>
</tr>
<tr>
<td>50.156%</td>
<td>9.26</td>
<td>0.163</td>
<td>2.547×10⁻⁴</td>
<td>243</td>
<td>278</td>
<td>22.6</td>
<td>ربو ناعم أبيض تم الخليل 2m عمق</td>
</tr>
<tr>
<td>50.607%</td>
<td>9.10</td>
<td>0.204</td>
<td>3.193×10⁻⁴</td>
<td>313</td>
<td>348</td>
<td>24</td>
<td>طرف المحجر 2m عمق</td>
</tr>
<tr>
<td>51.509%</td>
<td>9.72</td>
<td>0.206</td>
<td>3.221×10⁻⁴</td>
<td>330</td>
<td>356</td>
<td>26.2</td>
<td>أبو بسام حجر أبيض في تحت الآلة في نفس موعد النشر</td>
</tr>
<tr>
<td>------</td>
<td>8.25</td>
<td>0.057</td>
<td>0.891×10⁻⁴</td>
<td>184</td>
<td>219</td>
<td>25.8</td>
<td>حجر أبيض 15cm</td>
</tr>
<tr>
<td>------</td>
<td>9.41</td>
<td>0.154</td>
<td>2.412×10⁻⁴</td>
<td>511</td>
<td>546</td>
<td>26.4</td>
<td>حجر أحمر ووسط المحجر ثلث</td>
</tr>
<tr>
<td>51.156%</td>
<td>9.35</td>
<td>0.119</td>
<td>1.855×10⁻⁴</td>
<td>368</td>
<td>403</td>
<td>24.8</td>
<td>حجر أحمر تحت الآلة في نفس موعد النشر</td>
</tr>
<tr>
<td>49.775%</td>
<td>8.29</td>
<td>0.155</td>
<td>2.428×10⁻⁴</td>
<td>508</td>
<td>543</td>
<td>26.1</td>
<td>أحمر فاتح جمال 15cm في فوق المحجر</td>
</tr>
<tr>
<td>38.43%</td>
<td>8.30</td>
<td>0.248</td>
<td>3.875×10⁻⁴</td>
<td>804</td>
<td>839</td>
<td>25.9</td>
<td>أحمر جمال 15cm في سطح المحجر</td>
</tr>
<tr>
<td>47.5%</td>
<td>8.60</td>
<td>0.258</td>
<td>4.037×10⁻⁴</td>
<td>448.6</td>
<td>461</td>
<td>30</td>
<td>طريق المحجر فوق</td>
</tr>
<tr>
<td>48.352%</td>
<td>8.66</td>
<td>0.021</td>
<td>0.328×10⁻⁴</td>
<td>282.6</td>
<td>295</td>
<td>30.8</td>
<td>آخر المحجر فوق</td>
</tr>
</tbody>
</table>
Results

Fig 1: The total percentage of germination of ten barley cultivars growing in under the effect of 0Mm, 50Mm, 85Mm, 120Mm of SAS.

Ten cultivars of barley was germinated at 4 different concentration in 3 specimen for each conc. the sum. Is 120 plates.
Results

The average time of $G_{50}$

Fig 2: The average time of $G_{50}$ of ten barley cultivars growing under the effect of 0Mm, 50Mm, 85Mm, 120Mm of SAS.

$G_{50}$ is the time needed for 50% seed germination.
Results

The average number of roots

Fig 3: The average number of root of ten barley cultivars growing under the effect of 0Mm, 50Mm, 85Mm, 120Mm of SAS.

There is 85% of results are between 5 and 6.
Results

Fig 4: The average length of root of ten barley cultivars growing under the effect of 0Mm, 50Mm, 85Mm, 120Mm of SAS.

Generally, As the SA conc. Increase the length of root increase
Results

Fig 5: The average length of shoot of ten barley cultivars growing under the effect of 0Mm, 50Mm, 85Mm, 120Mm of SAS.

As the conc. increase the avg. length of shoot decrease.
Results

Fig 6: The total percentage of dry weight of the root system of ten barley cultivars growing under the effect of 0Mm, 50Mm, 85Mm, 120Mm of SAS.

Dry weight refers to the weight of tissue after it has been dried in an oven at 60°C.
Results

Fig 7: The biomass of shoot of ten barley cultivars growing under the effect of 0Mm, 50Mm, 85Mm, 120Mm of SAS.

As the biomass of shoot increase, it refers to high rate of photosynthesis rate.
Results

**Fig 8**: The total percentage of total water contents of root system of ten barley cultivars growing under the effect of 0Mm, 50Mm, 85Mm, 120Mm of SAS.

It increases the amount of water in the root in order to resist the osmosis resulting from the accumulation of ion.
Results

Fig 9: The percentage of water contents of shoot system of ten barley cultivars growing under the effect of 0Mm, 50Mm, 85Mm, 120Mm of SAS.

Water content is the amount of water contained in a material. 
Water content = (fresh – dry)/fresh *100%.
The response to SA can differ among barley cultivars, Rihan consider a resistant plant, due its high % seed germination, appropriate average G50 time, shoot length and biomass stability in high concentration, and high total water content of root system.

On another hand, ACSAD1417 seems to be a sensitive cultivar due to its low% of seed germination, no G50, decreasing of its shoot length & biomass.

Icarda1 is a moderate, with a moderate% of seed germination, a reasonable average G50, a moderate percentage of dry biomass in the shoot system, and a high total water content in the root system.

In Conclusion the result show there is a certain cultivar(s) can be resistant to Salinity and alkalinity stress that can be cultivated in nearby area of quarries.
Recommendations

The highest biomass is good to use as animal fodder.

The maximum percentage of seed germination will be suited for economic benefits, such as human commerce.

The lowest average time of G50 could be used for Palestinian’s farmers.
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