later date since neither the rice hulls nor the MC deteriorate.

**LITERATURE CITED**


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**Seeding Annuals and Perennials in Natural Desert Range**

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**Highlight**

Seeding of pasture plants in a desert in a 78-mm rainfall year resulted in complete failure of all perennials to establish themselves. Annuals, on the other hand, in spite of stunted growth, completed their life cycle and produced seed. Water-spreading is a prerequisite for successful establishment of perennial pasture plants under desert conditions.

In many desert environments the pasture vegetation has been destroyed by overgrazing so that range seeding is necessary to reclaim the pasture resources. To that end, a range research program was initiated at the Avdat Desert Research Center in the central Negev of Israel (30° 47' N lat., 35° 46' E long., alt. 550 m). This program deals mainly with range development under water-spreading conditions, and has been reported elsewhere (Evenari et al., 1963, 1964, 1965; Tadmor et al., 1966). A preliminary investigation, carried out in 1960–61 to study range seeding under the natural desert conditions, i.e., without supplementary water, is reported here. Annual rainfall averages 86 mm, from November to April, with wide interseasonal fluctuations (Shanan et al., 1967). The period from May to October is usually completely dry. Mean daily, mean maximum and mean minimum temperatures for the hottest month (August) are 25.0 C, 32.4 C, and 18.2 C, and those for the coldest month (January) are 10.5, 15.0, and 5.3 C, respectively.

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**Table 1. Development of pasture plants under natural desert conditions. AVDAT 1960/61. Seeded January 26, 1961. Total rainfall 78 mm.**

<table>
<thead>
<tr>
<th>Species</th>
<th>Origin</th>
<th>Height of leaves (cm)</th>
<th>Stalks per plant (No.)</th>
<th>Height of stalks (cm)</th>
<th>Depth of roots (cm)</th>
<th>Dry weight (g/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annuals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Avena sterilis</em> L.</td>
<td>local</td>
<td>6.5</td>
<td>3</td>
<td>24</td>
<td>15</td>
<td>36.4</td>
</tr>
<tr>
<td><em>Lolium rigidum</em> Gaud.</td>
<td>local</td>
<td>10</td>
<td>3</td>
<td>12</td>
<td>18</td>
<td>7.6</td>
</tr>
<tr>
<td><em>Medicago polymorpha</em> L.</td>
<td>local</td>
<td>4</td>
<td>–</td>
<td>–</td>
<td>12</td>
<td>3.0</td>
</tr>
<tr>
<td><em>M. polymorpha</em> L.</td>
<td>local</td>
<td>3</td>
<td>–</td>
<td>–</td>
<td>13</td>
<td>6.5</td>
</tr>
<tr>
<td><em>Vicia dasycarpa</em> Ten.</td>
<td>California</td>
<td>13</td>
<td>–</td>
<td>–</td>
<td>16</td>
<td>14.0</td>
</tr>
<tr>
<td><strong>Perennials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Agropyrum elongatum</em> (Host.) P. B.</td>
<td>local</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>0.5</td>
<td>4.7</td>
</tr>
<tr>
<td><em>Dactylis glomerata</em> L.</td>
<td>local</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td><em>Festuca arundinacea</em> Schreb. (Tall fescue)</td>
<td>local</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td><em>F. arundinacea</em> Schreb. Morocco</td>
<td>7</td>
<td>1</td>
<td>–</td>
<td>5</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td><em>Oryzopsis holciformis</em> (M.B.) Richt. (mountain ricegrass)</td>
<td>local</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>11.0</td>
</tr>
<tr>
<td><em>O. miliacea</em> (L.) Benth. et Hook (smilo)</td>
<td>local</td>
<td>7</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>1.5</td>
</tr>
<tr>
<td><em>Phalaris tuberosa</em> L. (Harding grass)</td>
<td>California</td>
<td>14</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>5.5</td>
</tr>
<tr>
<td><em>P. tuberosa</em> L.</td>
<td>Cyprus</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>12</td>
<td>6.8</td>
</tr>
<tr>
<td><em>P. tuberosa</em> L. (Moledet)</td>
<td>local</td>
<td>7</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>8.2</td>
</tr>
<tr>
<td><em>P. tuberosa</em> L. (Yoqne'am)</td>
<td>local</td>
<td>7</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>2.6</td>
</tr>
<tr>
<td><em>Sanguisorba minor</em> Seop. (Burnct) Neve Ya’ar</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

* Very patchy development, isolated plants only.
Methods

The soil is a non-saline, deep light sandy loam (loess). The seedbed was prepared by plowing 25 cm, and then raking. Sixty kg/ha of nitrogen was applied as ammonium sulphate and 120 kg/ha P.O_4_3- as superphosphate. Seeding was carried out with a planet hand-seeder on January 26, 1961, when the soil was wet to a depth of 15 cm. Two to four replicates of 16 m² each, of each species, were then drilled in 1-m spaced rows to 2 to 4 cm depth at a seed rate of ca. 10 kg/ha.

Results and Conclusions

Total annual rainfall in the winter of 1960–61 was 78 mm, which is close to the long-term seasonal average. Prior to seeding, 36 mm rain had fallen, including 8.4 mm during the preceding week; 13 mm fell immediately following seeding, and 26 mm more within one month. Most species germinated and emerged satisfactorily, more within one month. Most species developed mature seedlings that produced seed. This shows the greater flexibility of annuals under the extreme conditions described, and also why ephemeral annuals constitute a major component of the native vegetation in many semi-deserts and deserts.

LITERATURE CITED


