that were generally a great distance from the areas of suspected hybridization. Perhaps too little is known regarding the genetic variation within each of the species for such broad-based studies to be successful.

A third possible reason for the greater apparent differences between the reference populations in the present study compared to those of previous studies may be the existence of an elevational component of environmental variation in the present study. One interpretation of the greenhouse seedling study would be that genetic differences between the species were not nearly as large as indicated by the analysis of the parent trees, suggesting that elevational differences were relatively large. Although this may in part be true, two potential drawbacks of the seedling study need clarification. First, relatively few seedling traits were measured, so it is quite possible that more diagnostic traits were overlooked. For example, the three most diagnostic traits of mature trees were not examined in the seedlings. Second, it is also possible that juvenile morphological traits in blue and Engelmann spruce do not differ as greatly as mature traits, as the results of the seedling analysis could be interpreted to indicate. For these reasons a great deal of weight cannot be placed on the results of the seedling analysis.

One further note is that the elevational differences within the study area (~380 m) were relatively small compared to the elevational range of the combined species in this part of Colorado (~1500 m). Associated with this is that the blue spruce reference population was very near its altitudinal limit in this area, while the Engelmann spruce reference population occurred at a fairly low elevation for this species in this area. Again, this suggests that the differences exhibited by the species in this study were probably largely genetic. On this basis a poor separation of species within the area of range overlap in the drainage would suggest possible hybridization between blue and Engelmann spruce. A forthcoming paper will address this possibility.

References


Short Note: Increased Growth Rate of Uapaca kirkiana Muell. - Arg. by X-Rays and Gamma Rays

By A. S. Hans and E. S. Lingumbwanga

Tree Improvement Research Centre, P.O. Box 21210, Kitwe, Zambia

(Received 16th March 1994)

Summary

The preliminary experiments have revealed significant increased growth rate of Uapaca kirkiana seedlings exposed to X-rays and gamma rays. This has given fillip to the application of radiation-induced mutations on the slow growing indigenous, multipurpose fruit trees with possible large scale assistance and cooperation of the International Atomic Energy Agency.

Key words: X-rays, gamma rays, Roentgen, Uapaca kirkiana.

Silvae Genetics 34, 2–3 (1993)
Zusammenfassung


Introduction

In tree breeding, irradiation technology has been used in induction of mutations, improving disease and pest resistance, and isotopic tracer techniques in selection and evaluation of superior plant genotypes.

Although the wild, multipurpose forest fruit trees of Zambia have great potential, yet they have inherent defects of slow growth, low pulp percentage in fruits and susceptibility to pests and pathogens. Here, and for the first time in Zambian forestry, the application of irradiation induced mutation technique has been tried to improve the undesirable traits. This report embraces the early results of growth performance of Uapaca kirkiana (local name: musuku).

Materials and Methods

The germinating seeds, young, and old seedlings of Uapaca kirkiana were exposed to x-rays using Fedrex equipment with automatic control at the Zambia Airways, Technical Division at Lusaka. The exposure of ten minutes was equivalent to 3 Roentgens. The samples were exposed for 5, 10, 15 and 20 minutes which induced doses of 1.5, 3.0, 4.5 and 6.0 Roentgens respectively. A few germinating seeds were exposed to Radium gamma rays at dosage of 400mR per hour. The materials which were exposed to irradiations is given in Table 1. After exposure, the plants were planted near the Research Centre’s grounds for close observations.

Observations and Results

The plants started showing differential height growth after 4 months. Mean height and standard errors are given in Table 2. Germinating seeds were much more responsive to treatments than the young and old seedlings. The treatment 3.0 R proved best of all the treatments, and for germinating seeds it showed 6—7 times higher growth than the control. The dosage 6.0 R seemed to be toxic. Although the experiment was preliminary and unreplicated, yet from the layout of plantings, it was evident that the height differences were due to treatments and not to any soil or other factors.

Acknowledgement

We are grateful to the staff of Zambia Airways for use of their X-ray equipment and to Dr. Muhindo, Head Isotope Research Unit for guidance and cooperation.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of germinating seeds</th>
<th>Number of young seedlings (30 days old)</th>
<th>Number of old seedlings (90 days old)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>1.5 R</td>
<td>5</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>3.0 R</td>
<td>10</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>4.5 R</td>
<td>10</td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>6.0 R</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Radium gamma rays, 400mR/h</td>
<td>7</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Tab. 1. — Number of germinating seeds, young and old seedlings exposed to irradiations.

<table>
<thead>
<tr>
<th>Seedling stage</th>
<th>Treatment</th>
<th>1.5R</th>
<th>3.0R</th>
<th>4.5R</th>
<th>6.0R</th>
<th>Radium gamma rays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germinating seed</td>
<td>Control</td>
<td>9.6</td>
<td>53.3</td>
<td>62.0</td>
<td>41.5</td>
<td>18.1</td>
</tr>
<tr>
<td>Young seedling</td>
<td>20.6</td>
<td>-</td>
<td>35.0</td>
<td>21.2</td>
<td>17.1</td>
<td>-</td>
</tr>
<tr>
<td>Old seedling</td>
<td>18.1</td>
<td>5.3</td>
<td>17.6</td>
<td>-</td>
<td>5.5</td>
<td>-</td>
</tr>
<tr>
<td>Overall mean</td>
<td>15.44</td>
<td>29.30</td>
<td>38.20</td>
<td>31.35</td>
<td>13.58</td>
<td>59.30</td>
</tr>
</tbody>
</table>

Tab. 2. — Mean height (cm) of 18-month-old plants of U. kirkiana after irradiation treatments.

Short Note: Über mögliche Kriterien zur Frühselektion auf Trockniss-Resistenz bei Kiefern

Von L. A. Gallo


(Eingegangen: 30. Oktober 1984)

Summary

Two methods were used as possible early selection judgement for drought resistance on some species of the genus Pinus: The capacity of recovery of turgescence after artificial withering of leaves and the shoot/root-ratio of dryweight. Significant differences were found between species and provenances respectively. Two seed sources (P. nigra, Ankara and P. sylvestris, Catalic) were on the first rank in both methods. But otherwise the results are not correlated. They seem to be due to two independent

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Silvae Genetica 34, 2–3 (1985)