The methodology for controlled pollination is already well defined and the systems involving interspecific hybridization were started in 1954.

Basic research on pollen dispersal, flowering and fructification ecology, influence of spacing, and the type of effects in the pollination are being developed. The aspects joined with the management are being studied mainly pursuing the propagation of the species in successive cuttings.

1. Historical

Due to the necessity of improving the productivity of the established forests, the CHAMPION PAPPEL E CELULOSE S.A. started a work of reestablishing species, looking for the substitution of possibly hybrid material which had been utilized in the program of reafforestation. Then, the well known species were reintroduced, as the others wanted yet, but potentially able to provide satisfactory results.

The trials were made in the region of Mogi-Guaçu - SP (Lat.22°20' and Long.46°50'), and the results showed Eucalyptus grandis, Coff's Harbour provenance, Australia, as the most adequate species. (Table I).

| TABLE I - Volumes obtained by the most recommended species reintroduced from Australia, expressed in cubic meters per hectare, at the age of 7 years |
|-----------------------|---------------------|---------------------|
| SPECIES               | VOLUME FOR HARVEST IN STEREOES | VOLUME FOR HARVEST IN STEREOES |
| E. grandis            | 400,75               | 55,49               |
| E. saligna            | 282,22               | 38,77               |
| E. rostrata           | 279,10               | 37,25               |
| E. robusta            | 263,02               | 35,69               |
| E. micrantha          | 191,27               | 30,19               |

* timber without bark and diameter above 6 cm

Adapted from "Apealamento das Benefícios da Peneira Florestal para uma Espécie" - Comunicação Técnica nº 9 - PMLET.

From these results based populations were established (about 1,300 ha) and the works of tree improvement and management were started.

2. Establishment of Seed Production Areas

Since E. grandis was considered as priority in the reforestation program of this company, has been defined the necessity of improved seed production to continue the works with the species. Seed Production Areas, then, were selected in the original population, removing a total about 100 ha. The selection criterion for the thinning in these areas, according to the priority given from I.P.E.F. (Forest Studies and Research Institute) and U.S.P. (State University of São Paulo), was made totally by the growth and the tree form. The first thinning was introduced at the age of 4 years and this treatment eliminated 70% of individual trees (See Table II). At the 6th year of age, a new selection thinning was made, removing around 10% of the original population. The last thinning was made at the age of 8 years. At this time about 10% of remaining trees were eliminated, being considered mainly the phytosanitary aspect in the selection.

| TABLE II - Differential of selection for diameter at breast height observed in the first thinning in seed production areas of E. grandis (4 years old) |
|----------------------|----------------------|----------------------|
| "GROWTH" | "ABOVE" DIS. OF THE ORIGINAL POPULATION | "SELECTED" DIS. | "DIFFERENTIAL OF SELECTION" |
| CM | CM | CM |
| 1 | 11,10 | 9,80 | 1,30 |
| 2 | 7,10 | 5,80 | 1,30 |

The initial mapping in these areas was of 8 m² per plant, reaching after the selection and thinning 50 m² per plant. This opening in the space produced, apparently, a circumscribed in the wind-generating power probably due to the pollination efficiency, when compared to areas already opened. Some aspects related with pollen dispersion has been studied by PADUÉ et allii. (1960), in work that has been developed in Champion, in collaboration with E.S.T.A. - Nuclear Energy Center in Agriculture, and U.P.S. through the mapping with radioisotopes, and assay measurements. The preliminary results of this trial have shown that the dispersion of pollen is very large reaching distances over 200 m, the highest concentration, however, seems to be placed about 100 m from the pollen source.

The studies about flowering of E. grandis have been made in very...
nious with State University of São Paulo (UNESP) and USP. The works had beg
in 1979, and according to Aguilar and Tagayasu (1980), the preliminary 12
sults showed that the fruiting season in Seed Production Areas of Champion
samples during the year. The biggest frequency occurs from July to January,
with peaks in August and December. Still according to these authors, the
variation tree to tree is very large. HUPA and HUPEMA (1978) got similar
results with E. grandis.

The seed yield in these areas (S.P.A.) has shown significant variations from
year to year, but there is a tendency to a gradual increase. In 1977 the average
production achieved 11.0 kg/ha, in 1978 the average dropped to 10.0 kg/ha;
finally in 1979, production reached 15.0 kg/ha. It was found that the relation
nutritive is about 14.0:1.0, and the num-
ber of harvested trees in each year is from 150 to 300 of the existing total,
resulting about 600 grams of seeds per tree, with about 800 fertile monopolar
grams. This small number of harvested trees per year is due to the
harvest system, which is characterized by the cutting of branches with fruits.
This practice eliminates the production in the following years.

3. Selection of Superior Trees and establishment of the Seed Orchard

To continue the progress with E. grandis, 140 superior trees were
selected. They have tested through their progeny, and reproduced vegetatively,
promoting the establishment of seed orchards. The criterion observed in
intensity the selection were mainly the growth, the form and phytosanitary
aspects. The intensity of selection adopted was 1:400.

The vegetative propagation of these selected trees was made
through grafting. The techniques called "hilling" and "cormeling" were used.
The number of replications was 15 per method from each selected tree.
Indeed, a very large individual variation in incompatibility in the grafts
has been observed varying from 0 to 100% the levels of success in grafting
individuals. In relation to the tested methods, the initial survival showed
markedly significant differences for the "hilling" to the "cormeling" regular.
The survival was 90% to the first year and 84% to the second year after
the orchard installation the survival average dropped about 45
and 36%, respectively, remaining the existing variations between clones.

In experimental, parallelly with the studies involving the Seed Orchard, as
proposed by KAYAMA and SILVA (1990), a special seed
production area was established with the direct utilization of the superior
selected trees. Forty (40) trees were located from selection intensity of
1:4000 and 5 dominant trees, located in a distance up to 6 m in relation
the family of the superior tree, were selected for the pollen production.

After the flowering of the other individual from the same family the
pollen was collected. The result was the establishment of 40 seed
producer groups, where each superior tree receives pollen from 5 dominant
trees near it. This experimental area has a target a short time seed production
with a significantly high yield per tree, in addition to a possibility to obtain
an estimation of gain probably superior than that obtained in usual seed
production areas and inferior to seed orchards.

4. Open Pollination Progeny Trials

Selected trees progeny studies has been conducted since 1976.
Basically, these trees are looking for obtaining estimates of general
tendency of combination of selected trees (parentage selection of clones
and installation of ancestors of 1,5 generations) and knowing the structure of
the progeny for the purpose of progeny 
progeny selection and determination.

KAYAMA et al. (1995), in their "Open Pollination Trials -
Seeds Production Areas", reported that at 12 months of age, the progeny of best
grown had an average height of 0.77 m, and the worst growth - 3.03 m. In
the city of São Paulo the average height was 1.05 m. Their results
show good possibilities for selection at progeny level in the trial. The
consider the growth, with the utilization of progeny of selected trees, are
according to the theoretical provisions. It corresponds to 0.5%, in height,
only with selection of the female side. It also shows that including the
selection of the male side, throughout the installation of the Clone Seed
Orchard, it's possible to predict the double of this gain, which is
equivalent to 11.0%, representing a very significant value.

The basic density of wood is another characteristic that has been
studied. The analysis with Eucalyptus grandis showed some unsatisfactory
results. This way it is in accordance with BRE and UEH, HUPA at all
(1980), studying the basic density of superior trees in the city of São
Paulo, the area from an average of 0.333 to 0.509 g/cm³, with the average of
0.420 g/cm³. It was not observed significant correlation between the basic
density and the vigor of selected trees, showing an independence for these characteristics. From these results the basic density began to be studied in a progeny level, looking for its
inclusion in the selection criteria in the second cycle. The characteristic as well as the potential of regeneration are also being studied in progenies.

Finally, still relative to progenies, it has been conducted a
trial with the purpose to obtain subsidies for checking the breeding
programme. The main objective is to analyze the performance of progeny from
trees with different selection intensity, looking for the efficiency of the selection in the population. The preliminary results, as the age of progeny has not shown still a defined
tendency as a progressive increasing in gain relative to a constant selection
intensity.

5. Management to Successive Cuts

In a comparative analysis, considering results obtained in several
years, for large commercial areas, Eucalyptus plants that in first rotation
showed low yield, in the second rotation showed a better productivity about
30% (average of 3 years) higher. These results, however, have been obtained
with possibly hybrid material, resorting to knowledge about the conduct of
populations of Eucalyptus grandis with genetic purity and high productivity
in the first rotation. Regeneration presents specially Eucalyptus grandis,
after successive cuttings, seems very significant. There is no doubt
about its high sensitivity, mainly, according to the cutting time in sandy
soils. In the region of Nogi-Daigu, there are experimental and practical evidence
that the best cutting time is situated in the months of higher rainfall, that is, from September to February (TABLE III).

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CUTTING TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MAY</td>
</tr>
<tr>
<td>Survival (%)</td>
<td>60</td>
</tr>
<tr>
<td>Height of the Sprouting (m)</td>
<td>0.54</td>
</tr>
</tbody>
</table>

The interplanting of seedlings in substitution to the dead stump is an alternative that has been studied for the regeneration of areas with
low quality after the cutting. Experimental results have shown, after an
initial phase, when the growth rhythm of the sprouting is more accentuated,
that there is an equalization in the development of the seedlings and the
regenerated stumps (TABLE IV).

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>3 MONTHS</th>
<th>6 MONTHS</th>
<th>12 MONTHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average height of the sprouting (m)</td>
<td>1.1</td>
<td>2.0</td>
<td>5.6</td>
</tr>
<tr>
<td>Average height of the Interplanted seedlings (m)</td>
<td>0.6</td>
<td>2.1</td>
<td>5.2</td>
</tr>
</tbody>
</table>

The reports of E. grandis with genetic purity have shown results for basic density, in average, inferior than that possibly
by E. grandis. The reproduction capacity of the stumps of this hybrid material has been also superior, showing a minor
susceptibility for the climatic variations.

6. Inter-specific Hybridization

The progenies of Eucalyptus grandis with genetic purity have shown
results for basic density, in average, inferior than that possibly
by E. grandis and E. grandis. The progeny capacity for the stumps of this hybrid material has been also superior, showing a minor
susceptibility for the climatic variations.

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>PROVENANCE</th>
<th>BASIC DENSITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. grandis</td>
<td>South Africa</td>
<td>0.450</td>
</tr>
<tr>
<td>E. grandis</td>
<td>Cape's Harbour (Australia)</td>
<td>0.450</td>
</tr>
<tr>
<td>E. grandis</td>
<td>Rio Claro (Brazil)</td>
<td>0.450</td>
</tr>
</tbody>
</table>
Considerando esses aspectos, e respondendo à necessidade de utilização de híbridos de eucalipto, e sendo a híbrida de E. grandis e E. urophylla um potencial alternativo, foi iniciado um programa de hibridação para produção de sementes. Os resultados preliminares estão sendo realizados em uma base experimental com E. grandis e E. urophylla. O objetivo principal é produzir híbridos de E. grandis e E. urophylla em uma planta de E. grandis x E. urophylla (0,05% de semente) em Brasil e Fazenda Belo Horizonte (1960).

Estudos sobre regeneração de plantas são conduzidos paralelamente com o trabalho de controle de regeneração e noite. Não há nenhum significado, principalmente com E. grandis. Desde 1958, a CHAPPIN PALPEL E CELULOSE S.A. iniciou uma série de estudos sobre a regeneração de plantas de E. grandis e E. urophylla. Os primeiros trabalhos realizados em 1958, e envolvem a regeneração de plantas de E. grandis e E. urophylla. O objetivo principal é produzir híbridos de E. grandis e E. urophylla em uma planta de E. grandis x E. urophylla (0,05% de semente) em Brasil e Fazenda Belo Horizonte (1960).

7. Considerações finais

Os resultados de experimentos com hibridação, e da regeneração de plantas de E. grandis e E. urophylla, têm sido significativos, principalmente com E. grandis. Desde 1958, a CHAPPIN PALPEL E CELULOSE S.A. iniciou uma série de estudos sobre a regeneração de plantas de E. grandis e E. urophylla. Os primeiros trabalhos realizados em 1958, e envolvem a regeneração de plantas de E. grandis e E. urophylla. O objetivo principal é produzir híbridos de E. grandis e E. urophylla em uma planta de E. grandis x E. urophylla (0,05% de semente) em Brasil e Fazenda Belo Horizonte (1960).

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UM NOVO MÉTODO DE MELHORAMENTO EM EUCALIPTO: "Área de Produção de Sementes Especial".

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Summary

A new method of tree improvement, the 'special seed production area', is discussed in this paper. The proposed method is being studied in a Eucalyptus grandis mill and other species, in the region of Mogi Guaçu (S.P.).

The main objective of this area is associated with the production, in a short period of time, of seeds of high genetic quality. The estimated genetic gain in this method is superior than those of the seed production areas.

Different selection intensities are utilized on both seed for the establishment of the special seed production area. The selected trees with a high selection intensity, which function as female trees, are surrounded by a group of trees selected under a low selection intensity, which function as male trees.

Introdução

Métodos de melhoramento em espécies florestais têm sido bem desenvolvidos; os esquemas generalizados não têm sido geralmente utilizados em diferentes países, baseando-se no método proposto por alguns pesquisadores, podendo ser aplicados para melhoramento de árvores com seleção apropriada e genética.

SHERBURN (1973), em descrição dos diferentes métodos de melhoramento, mostra as diversas possibilidades de utilização e combinação de seleção para a produção de sementes de várias espécies de eucalipto.

Aqui, o método proposto por SHERBURN (1973), para os eucaliptos, de volume de madeira, não é de aproveitamento, mas é praticamente indiscutível para o sucesso.

Especificamente para o eucalipto, SHERBURN (1973) relata os métodos usuais de melhoramento, destacando as particularidades existentes. O método proposto por SHERBURN (1973) para os eucaliptos, de volume de madeira, não é de aproveitamento, mas é praticamente indiscutível para o sucesso.

9. Conclusão

O método de melhoramento em espécies florestais é uma ferramenta importante para o desenvolvimento da silvicultura. Através do uso adequado de métodos de melhoramento, é possível aumentar a produtividade e a qualidade das espécies florestais.