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# Growth of Some Ornamental Eucalyptus Species During Nursery Stage

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## ABSTRACT

Eight Eucalyptus species (1 and 2 years old) were tested at the Faculty of Agriculture, Tripoli, during the period 1977–1979. The species tested included: *E. caesia*; *E. preissiana*; *E. leucoxylon*; *E. cinerea*; *E. kitsoniana*; *E. strucklandii*; and *E. erythrocorys*, which were newly introduced from Australia; and *E. camaldulensis*, a commonly planted species in Libya. Plants of *E. camaldulensis* of 2 years old, had produced the longest stem (239.00 cm), the largest stem diameter (15.13 mm), a greater number of leaves (170.00), and the longest leaves (19.08 cm) of all Eucalyptus species under evaluation. On the other hand, *E. cinerea* had developed short plants (46.75 cm) with small stem diameter (3.83 mm) and great number (186.00) of small leaves (7.60 $cm^2$). Stem and leaf characteristics of the other six species were intermediate.

## INTRODUCTION

Eucalypts are becoming more extensively planted and cultivated, particularly in the warm regions of the globe, including arid zones. They are planted mainly for sand dune fixation and windbreaks, especially on roadsides. It is a genus offering a wide range of ornamental characteristics, with an equally wide choice of decorative species, suitable for practically any application in any type of soil or climate. In fact, since their original discovery by Banko and Solander in 1770, in Australia, the variety, adaptability and usefulness of the Eucalypts, have caused them to be widely planted throughout the world (5).

According to Penford and Willis (5), *E. camaldulensis*, *E. gomophocephala* and *E. resinifera* are the only species which have so far been successfully introduced to Libya. *E. globulus* failed to survive in the dry climate.

Heith (3) reported that *E. rosso* was one of the earliest introductions of the genus Eucalyptus into Libya. Thirteen trees were surviving in 1954, planted at Sidi Mesri near the small lake. It appears to have been introduced in the early 1900s. Further introductions were made in 1913 and 1917. He also reported that Fenzi, in 1915, had recorded that in 1913 the Italian authorities imported 100 seedlings of this species from Palermo. New importations of seeds from Australia were made in 1954. *E. camaldulensis* shows great variation in leaf, fruit and bark as well as in general growth forms.

The aim of this investigation is to study the possibility of introducing some ornamental species of Eucalyptus into Libya. However, there are many species among the ornamental Eucalyptus from which a selection may be made. But even if all the theoretical requirements have been fulfilled, and a certain species has been found

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suitable for growth in a given area, no definite conclusions should be reached as to its practical suitability until the tree has been actually planted in the area and has survived for a considerable time. This study included eight Eucalyptus species out of which one or more species might possibly be recommended as ornamental trees for gardens, or as a windbreak for agricultural projects. Although *E. camaldulensis* is not one of the ornamental species, it was included in this study because, so far, it is the most successful Eucalyptus species in Libya. For this reason it was used as a yardstick to compare the growth of the other species.

## MATERIALS AND METHODS

This experiment was conducted in the nursery of the experimental farm of the Faculty of Agriculture, University of Al-Fateh, Tripoli, S.P.L.A.J., from April 1977–1979. The seeds of the following eight Eucalyptus species were imported from Canberra Botanical Gardens, Australia:

1. *E. Caesia*
   Is a small tree up to 9 m high thriving on most well-drained soil types. It is a well-shaped ornamental tree (1). *E. caesia* produces delicately-coloured pink flowers and equally attractive silvery seed capsules which hang like tiny bells (2).
2. *E. preissiana*
   Is a very attractive species with an abundance of large golden-yellow blossoms; it grows well in medium soils (2).
3. *E. leucoxylon*
   One of the valuable species in some areas; height may reach 17 m but, at least in sandy areas, the height does not exceed about 5 m. This makes it an excellent street tree. Flowers vary in colour from white, to a beautiful deep reddish-pink shade (2).
4. *E. cinerea*
   This is a medium-sized tree suited to cooler areas. The juvenile foliage, which is silvery-blue, may persist throughout the life of the tree; it produces cream-coloured flowers (2).
5. *E. camaldulensis*
   Is a common Eucalyptus species in Libya, thriving in different types of soil and climate. Holliday (4) mentions that it was found in many forms throughout dry and temperate mainland-Australia.
6. *E. kitsoniana*
   A small tree up to 9 m high found on marshy ground and at high elevations; it has smooth, grey bark (5).
7. *E. strucklandii*
   This species produces yellow flowers and in summer forms a handsome, rough-barked tree (2). It is of medium size, up to 12 m high, and is restricted to loamy flasts in dry regions. It produces red-brown, hard and durable timber (1).
8. *E. erythrocorys*
   Yellow flowers, 5 cm or more across, and bright-red, britta-like operculums make this one of the most spectacular of the eucalypts (4).

The seeds were sown on April 10, 1977 in a germination media composed of equal parts, by volume, of sand and peat moss. On June 10, 1977 the seedlings were transplanted into plastic bags of 40 × 25 cm filled with equal parts of organic fertilizer (Arvo-humus), peat moss and sand. A randomized complete block design with three replicates was used, each replicate consisting of five plants. Data on the height of the main stem, stem diameter, number of leaves, leaf area, leaf length (length of leaf blade), and leaf width were recorded twice on April 10, 1978—on the fifth leaf on the

main stem—and on April 10, 1979—on the tenth leaf on the main stem. Means were compared according to Duncan's multiple range test.

## RESULTS AND DISCUSSION

### 1. Height of main stem

Data recorded one year after seed sowing (Table 1), indicated that the mean height of the main stem of *E. camaldulensis* (mean plant height was 118.25 cm) was significantly larger than that of the other species. This was followed by *E. leucoxylon* (75.06 cm). No significant difference was observed in the height of the main stem between *E. preissiana*, *E. kitsoniana* and *E. strucklandii*; the average was 47.14, 58.08 and 58.08 cm for these three species, respectively. The shortest plants were *E. caesia*, *E. cinerea* and *E. erythrocorys*, the mean height of stem being 37.67, 28.33 and 34.33 cm, respectively.

In the second season of 1978/79, the data indicated that the plants of *E. camaldulensis* had developed the tallest stems, the mean height of the main stem being 239.00 cm. This was followed by *E. leucoxylon* (152.00 cm). The shortest plants were *E. cinerea* and *E. erythrocorys*, 46.75 and 39.00 cm, respectively.

The combined analyses revealed that there was a significant increase in plant height in *E. caesia*, *E. leucoxylon*, *E. cinerea*, *E. camaldulensis*, *E. kitsoniana* and *E. strucklandii* between seasons 1977/78 and 1978/79. However, there was no significant difference in plant height between the two seasons in *E. preissiana* and *E. erythrocorys*.

### 2. Stem diameter

Table 1 shows the means of stem diameter given by the different Eucalyptus species under evaluation in 1977/78 and 1978/79 seasons. In 1977/78, the mean stem diameter of *E. cinerea* (1.47 mm) was significantly lower than that of the other species. No significant differences were observed between the mean stem diameter of the other seven species. In 1978/79 season, the thicker stems were produced by *E. camaldulensis* (15.13 mm). This species was followed by *E. leucoxylon* and *E. kitsoniana* with no significant difference between them. The average stem diameter was 10.03 and 10.28 mm for these two species, respectively. The lowest mean of stem diameter

Table 1 Mean height of main stem and stem diameter of eight Eucalyptus species in two years.

| Species | Plant height, cm | | Stem diameter, mm | |
|---|---|---|---|---|
| | 1977–1978 | 1978–1979 | 1977–1978 | 1978–1979 |
| 1. *E. caesia* | 37.67 de | 69.00 e | 3.67 a | 6.93 c |
| 2. *E. preissiana* | 47.14 cd | 51.00 f | 4.10 a | 7.08 c |
| 3. *E. leucoxylon* | 75.06 b | 152.00 b | 3.63 a | 10.03 b |
| 4. *E. cinerea* | 28.33 e | 46.75 fg | 1.47 b | 3.83 e |
| 5. *E. camaldulensis* | 118.25 a | 239.00 a | 4.60 a | 15.13 a |
| 6. *E. kitsoniana* | 58.08 c | 139.50 c | 4.13 a | 10.28 b |
| 7. *E. strucklandii* | 58.08 c | 102.25 d | 3.92 a | 6.30 cd |
| 8. *E. erythrocorys* | 34.33 de | 39.00 g | 3.33 a | 4.75 de |
| | 16.60 | | 1.46 | |

L.S.D. (0.05) for Species X Years.
Means in a column followed by the same letter are not significantly different at 0.05 level.

(3.83 mm) was produced by *E. cinerea* plants. The combined analyses of the data of 1977/78 and 1978/79, indicated that there was a significant increase in stem diameter in all Eucalyptus species except *E. erythrocorys*; in this species the increase in stem diameter was not significant.

### 3. Number of leaves

The data of the 1977/78 season, indicated that the average number of leaves varied from 19.33 to 171.33 (Table 2). The smallest number of leaves was produced by the plants of *E. strucklandii*, while the largest was that of *E. cinerea*. Data of the second season 1978/79 showed that the average number of leaves ranged from 34.75 to 186.00. The lowest number of leaves was produced by the plants of *E. caesia*, *E. strucklandii* and *E. erythrocorys*, the mean number of leaves being 48.00, 34.75, and 39.00 for these three species, respectively. On the other hand, the largest number of leaves (186.00) was produced by *E. cinerea* plants. The combined analyses revealed that there was no significant increase in the number of leaves among the two seasons in *E. caesia*, *E. cinerea*, *E. strucklandii* and *E. erythrocorys*. However, there were significant differences in the other four Eucalyptus species.

### 4. Leaf area

Data of leaf area of 1977/78 and 1978/79 seasons are presented in Table 2. The mean area of leaf blade of *E. preissiana* (34.70 $cm^2$) was significantly larger than that of the other species. In the second order came *E. caesia*, *E. kitsoniana* and *E. strucklandii*, the mean leaf area being 21.50, 25.63 and 26.50 $cm^2$ respectively. The leaf area of *E. cinerea* (6.57 $cm^2$) was significantly smaller than that of the other species. The combined analysis of the data of the two seasons indicated that there was a significant increase in leaf area in *E. caesia*, *E. preissiana*, *E. leucoxylon*, *E. camaldulensis*, *E. kitsoniana* and *E. strucklandii*. The other two species showed no significant increase in leaf area.

Table 2 Mean number of leaves, and leaf area of eight Eucalyptus species in two years.

| Species | Number of leaves | | Leaf area, $cm^2$ | |
|---|---|---|---|---|
| | 1977–1978 | 1978–1979 | 1977–1978 | 1978–1979 |
| 1. *E. caesia* | 30.67 cd | 48.00 d | 21.50 b | 55.50 b |
| 2. *E. preissiana* | 42.22 bcd | 81.00 c | 34.70 a | 55.00 b |
| 3. *E. leucoxylon* | 72.58 b | 129.75 b | 14.33 c | 36.50 c |
| 4. *E. cinerea* | 171.33 a | 186.00 a | 6.57 d | 7.60 d |
| 5. *E. camaldulensis* | 73.83 b | 170.00 a | 16.10 c | 52.50 b |
| 6. *E. kitsoniana* | 62.83 bc | 115.00 b | 25.63 b | 79.00 a |
| 7. *E. strucklandii* | 19.33 d | 34.75 d | 26.50 b | 52.00 b |
| 8. *E. erythrocorys* | 56.67 bc | 39.00 d | 13.66 c | 13.00 d |
| | 18.41 | | 9.91 | |

L.S.D. (0.05) for Species X Years.
Means in a column followed by the same letter are not significantly different at 0.05 level.

Table 3 Mean leaf length, and leaf width of eight Eucalyptus species in two years.

| Species | Leaf length, cm | | Leaf width, cm | |
|---|---|---|---|---|
| | 1977–1978 | 1978–1979 | 1977–1978 | 1978–1979 |
| 1. *E. caesia* | 4.82 c | 5.28 d | 5.70 a | 6.18 ab |
| 2. *E. preissiana* | 8.85 b | 8.96 c | 5.00 a | 5.00 bc |
| 3. *E. leucoxylon* | 5.28 c | 10.33 b | 2.87 cd | 4.78 bc |
| 4. *E. cineria* | 1.66 d | 1.99 e | 1.70 e | 1.90 d |
| 5. *E. camaldulensis* | 11.65 a | 19.08 a | 1.87 de | 3.50 cd |
| 6. *E. kitsoniana* | 5.23 c | 12.38 b | 4.63 ab | 7.98 a |
| 7. *E. strucklandii* | 11.00 a | 11.70 b | 3.70 bc | 4.00 c |
| 8. *E. erythrocorys* | 5.90 c | 6.40 d | 2.60 cde | 3.20 cd |
| | 1.54 | | 1.25 | |

L.S.D. (0.05) for Species X Years.
Means in a column followed by the same letter are not significantly different at 0.05 level.

## 5. Leaf length

Data of the first season 1977/78 which were recorded on the fifth leaf on the main stem (Table 3), showed that *E. camaldulensis* and *E. strucklandii* had produced the longest leaves. The average leaf length was 11.65 and 11.00 cm for these two Eucalyptus species correspondingly; they were followed by *E. preissiana* (8.85 cm). Plants of *E. cinerea* had produced the shortest leaf length of 1.66 cm. Data of the second season 1978/79 were recorded on the tenth leaf on the main stem. The leaves of *E. camaldulensis* were the longest (19.08 cm), followed by *E. leucoxylon*, *E. kitsoniana*, and *E. strucklandii*, with an average of 10.33, 12.38, and 11.70 cm, respectively. The combined analyses of the data of the two seasons showed no significant increase in leaf length in *E. caesia*, *E. preissiana*, *E. cinerea*, *E. strucklandii*, and *E. erythrocorys*. The other three species showed significant differences in this characteristic between the two seasons.

## 6. Leaf width

Table 3 shows the means of leaf width given by the eight Eucalyptus species under evaluation in 1977/78 and 1978/79 seasons. In 1977/78 season the mean leaf width of *E. caesia*, *E. preissiana* and *E. kitsoniana* were significantly greater than that of the other species; the average leaf width being 5.70, 5.00 and 4.63 cm, respectively. The mean width of the leaf blade of *E. cinerea* (1.70 cm) was significantly lower than that of the other species. In the second season of 1978/79, data revealed that the leaves of *E. caesia*, and *E. kitsoniana* had produced the widest leaf blades; the mean leaf blade being 6.18 and 7.98 cm for these two species, respectively. The *E. cinerea* leaves had the narrowest leaf blades (1.90 cm) of the evaluated species. The combined analyses of the data obtained in 1977/78 and 1978/79 revealed that the mean leaf blade was significantly larger in the second season in *E. leucoxylon* and *E. kitsoniana*. No significant differences were observed between the two seasons in the other species.

Data of the present study, which was recorded on plants of two years old, indicated that the *E. camaldulensis* had developed the tallest plants, the mean stem length was 239.00 cm, and it was followed by *E. leucoxylon* (152.00 cm). The shortest plants were those of *E. cinerea* and *E. erythrocorys*, the other species were of intermediate stem height. Data recorded on stem diameter showed the same trend, *E. camaldulensis* developed the larger stem diameter of 15.13 mm and was followed by *E. leucoxylon*

(10.03 mm). *E. erythrocorys* which developed the shortest plants had the lowest mean of stem diameter (4.75 mm). Data collected on leaf characteristics revealed that *E. cinerea* and *E. camaldulensis* had developed the largest number of leaves—186.00 and 170.00, respectively. *E. caesia*, *E. strucklandii* and *E. erythrocorys* produced relatively low numbers of leaves—48.00, 34.75 and 39.00, respectively. *E. kitsoniana* produced leaves with the largest area (79.00 $cm^2$), while the mean leaf area of *E. cinerea* and *E. erythrocarys* was only 7.60 and 13.00 $cm^2$, respectively.

Measurements on leaf length indicated that *E. camaldulensis* produced long leaves of 19.08 cm, while the leaves of *E. cinerea* were only 1.90 cm long. Data on leaf width showed that wide leaf blades were developed by *E. caesia* and *E. kitsoniana* (6.18 and 7.98 cm) and *E. erythrocorys* were of relatively small leaf width (1.90, 3.50, and 3.20 cm).

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# دراسة على نمو أنواع كافور الزينة فى المشتل

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## المستخلص

أجريت هذه التجربة بكلية الزراعة جامعة الفاتح طرابلس فى الفترة من عام ٧٧ - ١٩٧٩ ، وذلك لدراسة نمو ثمانية أنواع من أشجار الكافور فى فترة وجودها بالمشتل وقد شملت التجربة الأنواع الآتية :

E. preissiana, E. caesia, E. kitsoniana, E. cinerea, E. leucoxylon, E. erythrocorys, E. strucklandii

وهذه الانواع تم استيرادها من استراليا . وقد شملت التجربة كذلك النوع E. camaldulensis وهو نوع شائع الزراعة فى الجماهيرية . وقد دلت نتائج التجربة على أن نباتات E.camaldulensis كانت أكثر النباتات ارتفاعا ( ٢٣٩٫٠٠ سم ) وسيقانها أكثر سمكا ( ١٥٫١٣ مم ) ، وكانت تحمل عددا كبيرا ( ١٧٠٫٠٠ ) من الأوراق ذات النصل الطويل ( ١٩٫٠٨ سم ) .

وعلى العكس فان نباتات E. cinerea كانت الأقل ارتفاعا ( ٤٦٫٧٥ سم ) وذات ساق رفيع ( ٣٫٨٣ مم ) وتحمل عددا كبيرا (١٨٦٫٠٠ ) من الأوراق الصغيرة ( ٧٫٦٠ سم$^{٢}$ ) .

أما باقى الأنواع فقد كانت متوسطة فى صفات الساق والاوراق .