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https://doi.org/10.15017/15829

出版情報：演習林集報. 11, pp.83-90, 1958-12-20. Kyushu University Forests
バージョン：
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On the Growth of *E. rostrata*

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I Introduction

The author has described the growth of *E. rostrata* during a year after planting in the Bulletin of the Kyushu University Forests No. 27, December 1956, and in which he explained also the atmospheric phenomena and forest stands of each plantation.

Now, the author is going to state about the growth of *E rostrata* during 2 years after the first period.

The author expresses his hearty gratitude to Mr. G. J. RODGER who furnished him with the useful seeds of these *Eucalypts* for his study in 1954, and to Engineer YAMANOUCHI who has given him in 1958 the results of experiments with *E. rostrata* at the Kuhara Plantation attached to Fukuoka Prefecture.

II Results of Investigation and Considerations

Arahira (H. L.) is the highest plantation of all, its altitude being 240 m and Kuhara Plantation ranks next, being 160 m above the sea level. Though both the plantation are strong windy spots, *E. rostrata* has as strong resistance to wind as no damage by typhoons. The author also observed that this plant had the same resistance to heat in summer, on the contrary of this facts a part of the leaves withered in some degree by the abs. min. temperature in winter, but there was no damage to the parts of branches and stem of this plant at all the plantations during the past two years, in consequence of which *E. rostrata* has been keeping the growth in safety.

Though he generally observed three good characteristics above mentioned about this plant at each plantation, the following factors are particularly important in case of planting in mountains, but for carefulness, the forestation of this plant would prove unsuccessful.

(I) Growth of *E. rostrata* and Lighting Hours of the Sun

Arahira (L. L.) is situated at 110 m above the sea level along the valley stream, in consequence of which the lighting hours of the sun are relatively short, 3 hours in January and 5 hours in July. On the other hand, Shogatani (II) is situated at 70 m, the plantation being open all around, the lighting hours here are 5 hours longer in summer, 3 hours in winter than at. Arahira (L. L.).

The growth of *E. rostrata* at the fertile plane of Arahira (L. L.) has attained an average height of 3.85 m and an average diameter of 5.1 cm at 10 cm above the land in the past three years the result of which is relatively good for the shadowy spot. On the contrary, its growth at poor land of the slope here was measured 2.35 m in the average height of tree and 2.5 cm in the average diameter.

On the other hand, the growth of *E. rostrata* planted at the poorer and open spot of Shogatani (II) in the same season was 2.73 m measured in the average height and 3.6 cm in the average diameter.

Generally speaking the more fertile the land is, the better growth follow even in the shadowy spot, but if here is the short lighting hours of the sun. and further in the poorer soil, the growth is restricted not only in height, but also in diameter.

(II) Growth of *E. rostrata* and Drainage of Soil

The plantation of Shogatani (II) which is open in all the directions and sunny is partially divided into the following zones.

(1) Damp Zone

If it rains for long time, here is fully water logged.

(2) Sub Damp Zone

If it rains for long time, here is a bit water-logged.

(3) Non-Damp Zone

Even if it rains for long time, here is not absolutely water logged.

They are situated in series, zone (2) beeing 50 cm higher than zone (1), and zone (3) is 2 m higher than zone (2), and every zone is poor soil covered with grasses.

The growth of *E. rostrata* at the plantation in these zones is as follows:

Growth/Zone	Average height of tree (m)	Average diameter (cm)
Damp Zone	1.24	1.40
Sub-Damp Zone	2.09	2.40
Non-Damp Zone	2.68	3.47

Judging from the above mentioned, the good growth of *E. rostrata* depends upon the drainage in soil.

(III) Growth of *E. rostrata* and Clayey Soil

Arahira (H. L.) in the Kasuya Experimental Forest attached to Kyushu University is generally fertile. The soil contains pebbles, but no clay in subsoil in spite of special demand of *E. rostrata*, in consequence of which, holding of humidity is almost impossible for a long time, so that the growth of *E. rostrata* is extremely unsuccessful for the fertilized soil and the other favorable circumstance, but on the contrary the growth of grasses or shrubs is vigorous here. The growth of *E. rostrata* in three years from 1955 is 1.14m in the average height and 0.78 cm in the average diameter.

Comparison with the Kuhara Experimental Spot which is similar to the forest stands of Arahira (H. L.), shows that the former has relatively poor soil and contains more clay in subsoil than the latter so that when *E. rostrata* gets somewhat the fertile soil, its growth is successful as the author has observed it at the foot of the same mountain of the Kuhara Experimental Spot.

Judging from this fact, it is necessary for the growth of *E. rostrata* that the subsoil contains clay in some degree.

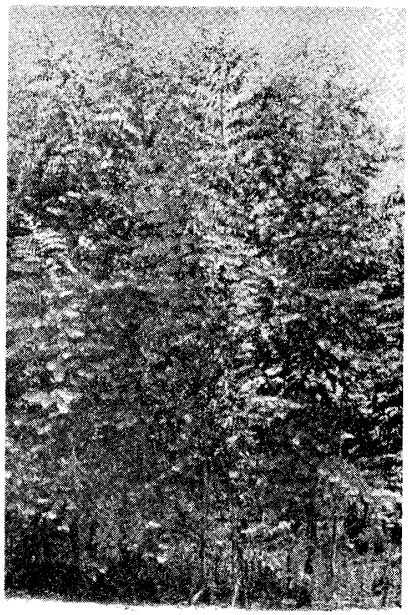
(IV) Growth of *E. rostrata* and Effect of Fertilization

E. rostrata and *E. cinerea* have been planted with fertilization in March 1956 in the ground of the Kasuya Experimental Forest Office attached to Kyushu University, at 50 m above the sea level.

When planting, the author prepared the planting holes about 30 cm in depth, and put the compost, 10 cm in thick on the bottom and filled the hole with soil, and then planted afterwards *E. rostrata* and *E. cinerea.* They were 30 cm in height at that time. Without fertilization *E. rostrata* is now 4.93 cm in height and 9.5 cm in diameter, near the root. *E. cinerea* is 6.2 m in height and 8.0 cm in diameter near the root, and the growth in height is more than 2 m per year with both *E. rostrata* and *E. cinerea.*

He also planted the same species of *Eucalypts* in the same season on the hill of Shogatani II (70 m. above the sea level) situated 150 m away from the Kasuya Experimental Forest Office. Though *E. rostrata* and *E. cinerea* planted here were given oil cakes (38 g. per tree) every year after planting, the highest tree among *E. rostrata* is 3.98 m in height and 7.0 cm in diameter of near the root and the highest tree among *E. cinerea* is 3.84 m in height and 5.0 cm in diameter.

When these plantations are compared the former is a plane in the office ground and the latter is a gentle slope of the hill-side covered with grasses. Though there is such a difference between stands; the author recognized the remarkable difference in growth of *Eucalypts*, so he should consider that the fertilize effect of the compost fertilization combined with the efforts of the improvement of soil is more favorable than that of oil cakes.



(Fig. 1)
E. cinerea in the ground of the Kasuya
Experimental Forest Office
Height of tree: 6.2m
Diameter near the root: 8.0 cm
Plantied: April 10, 1956.
Measured: July 20, 1958.

He will also consider on the results of the comparative examination at two divisions done by the Forestry Experimental Station attached to Fukuoka Prefecture.

(A) The foot of mountain (gentle slope)

1) Cultured and fertilized division

Fertilizer: Solid manure was used at a rate of 50 g. per tree.

2) Ordinary division (Non cultured and non fertilized division)

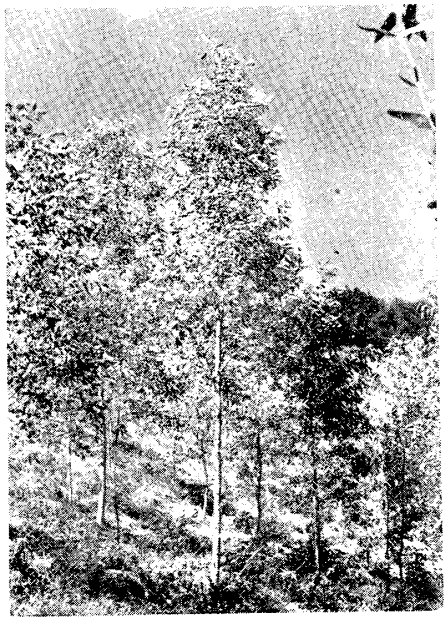
(B) The middle height of mountain (Steep slope)

1) The same as above-mentioned (A)−1)

2) The same as above-mentioned (A)−2)

Divisions (A) and (B) consist of clay in the subsoil, but not fertile soil. Growth of *E. rostrata* in three years after planting at Divisions (A) and (B) were as follows.

Division/Growth	Average Height of Tree (m)	Average Diameter (cm)
(A) 1)	3.38	4.56
(A) 2)	1.89	2.33
(B) 1)	2.05	1.99
(B) 2)	2 04	2.37



(Fig. 2)

E. rostrata at the foot of mountain of the the Kuhara Experimental Spot attached to Fukuoka Prefecture
Fertilizer: Solid manure
Average height of tree: 3.38m
Average diameter: 4.56cm
Planted: March 1955.

The growth of *E. rostrata* in the cultured and fertilized division of the middle height of mountain is relatively good at first, but as time passes, the fertilizer composition gradually flows down out of the soil along the steep slope in consequence of which, its growth is not so successful as that in ordinary division. Contrary to this matter, the growth of *E. rostrata* in the cultured and fertilized division at the foot of mountain situated 140 m above the sea level is a great success.

Judging from the above mentioned, the effect of fertilization for *E. rostrata* planted on the mountain has been relatively recognized for a long time after its planting done at a plane or a very gentle slope, but that at a steep slope is only temporary.

(V) *E. rostrata* showing the best growth in the Kasuya Experimental Forest attached to Kyushu University.

As the above mentioned, the author come to know the necessary factors for the growth of *E. rostrata* from the results of his examination, then he tries to consider about *E. rostrata* which shows the best growth at Takatsuji of the Kasuya Experimental Forest attached to Kyushu University.

This plantation consists of a gentle slope and a plane; the most part of the

plane is poorer soil as compared with the gentle slope, but there is relatively fertile part at the boundary-line between the two divisions because of flowing down of the fertilizer composition along the slope, so the author planted here 9 plants of *E. rostrata* on November 30, 1954, the seeds were a part of the seeds sent by Mr. Rodger in 1954.

According to the investigation on July 3. 1958, the growth of *E. rostrata* is very successful and its results are as follows:

Max. height of tree: 8.15 m
Its diameter near the root: 10.4 cm
Min height of tree: 4.85 m
Its diameter near the root: 6.0 cm
Average height of tree: 6.34 m
Average diameter: 8.6 cm
Average growth in length per year: 1.8 m
Average growth in diameter per year: 2.5 cm.

The author believes that such a successful growth is done to the following various essential factors:

(Fig. 3)
E. rostrata showing the best growth at the fertile soil at Takatsuji in the Kyushu University Forest:
Max. height of tree: 8.15m
Diameter near the root: 10.4cm.
Sown: May 1954.
Planted: November 1954.
measured: July 1958.

I) Altitude is not so high and the temperature is moderate. Temperature observation done by the Kasuya Experimental Forest Office in 1958 is as follows:

Min. (°C)	Max. (°C)	Abs. Min. (°C)	
2.0	9.9	−2.5	January
23.6	33.0	36.0	July

2) Lighting hours of the sun is relatively long.
Summer: 12 hours
Winter: 6 hours

3) Soil is relatively fertile.
Both ammonia-type nitrogen and caustic-type nitrogen are contained, effective potassium is extremly scarce, but effective phosphate is contained richly.

4) Soil is well drained.

5) Subsoil contains clay moderately

6) Tending is sufficient. Only, grasses grow so luxuriantly that they used to be cut in twice a year.

If we wish to plant *E. rostrata* in mountain, we are to care of the above mentioned important factors (1–5), and further it is necessary that the trees should be tended carefully for some time.

(VI) A Factor of Difference in Growth of *E. rostrata*

E. rostrata at each plantation shows the remarkable difference in growth in spite of the fact that they are almost the same size when planted at the plantation. The author states the growth conditions of *E. rostrata* planted at the plane of Takatsuji, as an example. *E. rostrata* here planted in 1955 and the number of tree is 78 in all. The plane here is not fertile on the whole. The relation between the number and the size of *E. rostrata* is as follows:

Height of tree (class)	Number of tree	Diameter (class)	Number of tree
1 (m)	8	1 (cm)	12
2—3	49	2—3	33
4—5	15	4—5	27
6	7	6—7	7

Though there are almost similar the physical and chemical characters of soil, the author found a large difference in growth among the trees as mentioned above, and he supposes that the reason is concerned with the habitat of the seed, the growth conditions or ages of the mother trees,

III Summary

1) *E. rostrata* at each plantation was not damaged by heat in summer. Though a part of leaves withered owing to the cold in winter, there was no harm to the branches and the stem, and they are growing soundly at present. These plants have also a strong resistance to wind, so that even the typhoons did no damage to them.
2) Generally speaking, the longer the lighting hours are, the better *E. rostrata* grows. Even if the lighting hours are less than 10 hours in summer and less than 5 hours in winter, the growth of *E. rostrata* is fairly good if the soil is fertile, but in case of bad soil, neither growth in length nor growth in diameter is good.
3) Good drainage brings a successful growth; average height of tree and average diameter at 3 zones are as follows:
   (1) Damp zone
   Average height of tree: 1.24 m Average diameter: 1.4 cm
   (2) Sub-damp zone
   Average height of tree: 2.09 m Average diameter: 2.4 cm

(3) Non-damp zone

Average height of tree: 2.68 m Average diameter: 3.48 cm

4) Even if the soil at the plantation of *E. rostrata* is relatively fertile, it does not hold water well, if its subsoil does not contain clay in some degree, in consequence of which, the growth of *E. rostrata* is not good.

5) The more the soil at mountain is fertlie, the better growth of *E. rostrata* is. In case of fertilization at the poorer soil of the steep slope, the fertilizer composition is used to flow down along the slope, in consequence of which, the successful growth of *E. rostrata* is only temporary. When we plant *E. rostrata*, if we dig deeply a planting holes and use the compost at its bottom, the growth of *E. rostrata* is more successful on account of both the effect of the fertilizer and improvement of soil than the chemical fertilizer.

6) Only when the above-mentioned various conditions are satisfied, the growth of *E. rostrata* is successful, and the typical growth is found at Takatsuji, where the average height of tree in 3 years after planting is 6.34 m, and the average diameter near the root 8.6 cm.

7) In spite of the fact that the plants were almost the same size when they were planted at the similar forest stand of a plantation, *E. rostrata* showed the remarkable growth differences among themselves, and hence, the author supposes that the reason is connected with the habitat of the seeds, and the growth conditions and ages of the mother trees.

Resumen

(El español)

Según la examinación de autor, particularmente queremos cuidar a los negocios bajo mencionados para plantar *E. rostrata* en montañas. Si no, la forestación de esta planta no concluirá a suceso en Japón.

1) En resumen, cuantas más largo as están las iluminadas horas, tanto más el cultivo de *E. rostrata*. Aún cuando las iluminandas horas están menos que diez horas en el verano y menos que cinco horas en el invierno, si la tierra está fértil, la crecencia de *E. rostrata* está relativamente bien, pero en caso de que esté mala, la tierra, está mala la crecencia de la longitud y del diámetro, particularmente éste.

2) Bueno avenamiento lleva una buena crecencia.

Ejemplo del examinamiento:

a) Húmeda zona:

La mediana altura del árbol: 1.24 m

El mediano diámetro del árbol: 1.40 cm

b) Algo húmeda zona:

La mediana altura del árbol: 2.09 m

El mediano diámetro del árbol: 2.40 cm

c) No húmeda zona:

La mediana altura del árbol: 2.68 m

El mediano diámetro del árbol: 3.50 cm

3) Aunque la tierra en la plantación de *E. rostrata* esté relativamente fértil, cuando su subsuelo más o menos no contena la arcilla, no puede preservar la humedad, consequente está no favorable la crecencia de *E. rostrata.*

Ejemplo del examinamiento:

a) La mediana altura del árbol: 1.14 m

El mediano diámetro: 0.78 cm

b) La mediana altura del árbol: 1.89 m

El mediano diámetro: 2.33 cm

Reparo: a) No contena la arcilla en subsuelo

b) Contena la arcilla en subsuelo

4) Cuanta más está fértil la tierra de la montaña, tanta más la crecencia de *E. rostrata.* En caso de la fertilización para la pobre tierra de la inclinación intensa, la abonada composición usualmente fluye abajo a lo largo la inclinación, por consecuencia temporal está la buena crecencia de *E. rostrata.* Cuando plantemos *E. rastrata,* si cavemos profundamente una hoya para plantación y usemos el estiércol en el fondo, la crecencia de *E. rostrata* está más bien que el químico-abono por el efecto del abono y la mejora de la tierra.

Ejemplo del examinamiento:

a) La mediana altura del árbol: 4.93 m

El mediano diámetro: 9.5 cm

b) La mediana altura del árbol: 3.98 m

El mediano diámetro: 7.0 cm

Reparo: a) Uso del estiércol

b) Uso del químico abono

5) Solamente cuando las varias condicionas sobre mencionadas están contentadas, la crecencia de *E. rostrata* está bien, y su crecencia típica es visto en Takatsuji (tierra de plantación), y la mediana altura del árbol de tres años detrás de plantación es 6.34 m, el mediano diámetro en cerca de la raiz es 8.6 cm.