SOME PHYSIOLOGICAL ASPECTS OF DEVELOPMENT AND GROWTH OF *EUCALYPTUS TERETICORNIS* SM (SYN *EUCALYPTUS HYBRID*)

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The genesis of *Eucalyptus hybrid* can be traced to a group of species of the same genus, in Nandi hills (elevation 1280 m, annual rainfall 750—1000 mm), Mysore in South India. Originally believed to be a stable and intimate interspecific mixture of *E. tereticornis* Sm with three other species (12) the hybrid, later on has, in fact, been found to be a phenotype of *E. tereticornis* (9,27,28) and of an Australian provenance yet unrecognised (11). It was little realised earlier that the word 'hybrid' had connotation which was too important to associate in error. Neither in growth and vigour nor in other characteristics that should segregate through generations, the species could develop into a true hybrid. The confusion arose as a result of visible polymorphism and arrangement in leaves-in the juvenile and mature stages, and inadequate studies of progenies with the help of established taxonomy.

However, the remarkable performance of *E. tereticornis* all over India in various sites ranging from about 30°N latitude down to the South of the country from sea level to 2200 m elevation in a variety of climate in tropical to warm temperate with annual rainfall range 400mm—4000mm (12) has led to its extension as the largest single species in the past one and half decade. It has come to stay in some of the most difficult sites to afforest the shifting sand dunes, the deep cut-up ravines, skeletal rocky and murummy soils, the laterities, the denuded hill slopes and the coastal sea lands (39). Besides, it has become a great favourite with gardeners, both lay and professionals, as an ornamental tree.

Kozlowski (22) writes : 'Afforestation involves a broad spectrum of problems *including* selecting good seed of the right species, germinating the seed, developing planting stock with the potential for survival and growth, field planting and carrying selected trees through to maturity.'

It may, therefore, be worthwhile characterising some of the physiological qualities of *E. tereticornis* namely, that of reproduction and seeding, moisture relations especially at the time of planting, nutrition and soil etc. and the causes for successes and failures. An evaluation of this nature, no doubt, must be linked with basic research. The support from this source is yet inadequate. The inferences drawn or the observation made, have therefore, to be tentative.

Reproduction and seeding

In nature, *E. tereticornis* reproduces both sexually and asexually. It can be induced to propagate asexually through root and shoot cuttings (8,12) and in a suitable condition by airlayering and growth hormone induced rooted lignotubers (8). But seedsource is the principal practised method of regeneration so far. This species is, however, a good coppicer

and is capable of doing so even at the age of 22 years (11). The flowering and fruiting are regular, taking place plentifully from about the 5th/6th year of growth in monsoon and autumn respectively.

The hermaphrodite flowers, occurring in umbellate clusters, do not mature together. The pollens being shed earlier, the transference of pollens by the insects to the receptive stigma of the same flower to bring about self pollination does not take place. The indications are that outcrossing may be common, but this species is also not self-incompatible. The time of flowering and innate genetical traits rule out outcrossing with every other species of the same genus. In Nandi hills, Mysore-the nucleus seed source from which it has spread all over India, only *E. propinoua* Deane and Maiden and *E. comaldulensis* Dehn have breeding affinities with *E. tereticornis* (9). But there is no evidence, as seen in the field observation of provencies, that hybridisation has actually taken place. The impurity that have appeared in *E. tereticornis* seeds is considered now mostly a mechanical mixture and hybridisation, if at all, is nominal (9,27,28).

The differential time of maturity of male and female sexes within the flowers and the individual trees leave many ovules unfertilised. The dark seeds get mixed with a lighter coloured material, known as chaff, of such unfertilised ovules (1). An ounce of seeds and chaff together may number about 28,000; but the number of viable seeds may be only about 13,000 on an average within a range of about 3100 and 26000 (23). The germinative capacity too has been most varied. There are reports of an ounce of seeds producing seedlings between about 1,000 and 3,000 (24,34). The germinative capacity cannot be rated high but on the whole seeding being plentiful and regular, there is no question of dearth of seeds or necessity for storage. The seeds have a thin testa and are practically non-dormant-the plumule emerges readily within about a week of sowing. The presowing treatments of 12-hour soaking, followed by a dipping in organic manure for a similar period in West Bengal for breaking the testa have reduced both the periods of commencement and completion of germination from 6 days to 3 and about 3 weeks to 2 respectively, but there is no record to show that this treatment has increased the capacity. Viability has been found high and a year old stock germinates as good as fresh collection. Viability appears to be lost only gradually and *E. tereticornis* showed 8.2 per cent germination after a lapse of ten years (26).

The most important concern for seedlings in the nursery is the disastrous rotting at the surface by the minute parasitic fungi which cause notorious damping off. The sown seeds also seem to be affected. There are instances of total or partial failures to germinate from the same seed lot which has some up successfully even within the same nursery or elsewhere. Excessive watering of the seed bed is the reason attributed in India (18,34), but in addition to this cause, Australian experience reports of similar effects even at the time of high relative humidity and temperature and poor light (1). Mortality due to fungi is invariably proceded by critical disruption of physiological processes which have not yet been pinpointed. Either a raised bed or preparation of permeable soil with addition of sand, silt or organic manure seem to be an essential prerequisite for successful nursery management. Underwatering, causing desiccation of seedlings, can be equally harmful.

A balance, has therefore, been struck on the quantum of watering by experience. The lowering of ground temperature and frost also kill the seedlings in the very young stage. In areas, winter appearing in a relatively pronounced way (UP, West Bengal) either spring or autumn sowings are only resorted to whereas in Mysore with very mild winter, sowing in December is giving good results (18,24,34).

Moisture relations

The question of watering remains a critical point in the transplant beds or in containers in which the high density sown seedlings are dispersed. More than one author have mentioned watering coupled with atmospheric toughening outside the cosy comfort of the nursery as the means of building up of planting stock (24,34) In most areas organic manure too is invariably added in the beds or in pots but its precise benefit on the growth of the seedlings, has not been stated. Before planting root pruning or knotting (4–1 month before planting) is done in some cases (18,34). Therefore, while steps are taken to prevent desiccation of nursery stock to critical limits on the one hand, by putting the seedlings in the polythene containers, root pruning or knotting, on the other, tends to upset the internal water balance. Planting naked transplants is also practised in Mysore & Goa (11). This species also seems to have capacity to develop root system rapidly within the given soil mass. The remarkable prolification of the root system of 1–2 month old seedlings and appearance of a hemispherical mass at the collar region, as an organ of food storage (30) and the growth of secondary roots near the collar of the transplant seedlings in the field (34) tell about the efficiency of the root system. Success with root and shoot cuttings also points to quick root regrowth (12). A natural association of a Gastoromycetous fungus of the genus, *Scleroderma*, without inoculation, may be another point for efficiency of the root system (36). Detailed studies are, however, called for examining the exact natural rooting behaviour with time in the conditions to which it is subjected.

What effects the transplanting too have on the internal water balance from the time they are lifted from the nursery till they are established after replanting are not known. Polypot planting invariably increases success, so also grading of the nursery stock to proper heights under the most congenial environmental conditions after the break of monsoon. It has been observed that there is a rapid rate of growth of secondary and tertiary roots from 7–8 months with decline in tap root height growth (30)—an arrangement possibly connected with deriving maximum moisture at the top soil surface.

Apart from rooting habits mentioned earlier which contribute to restoration and maintenance of internal water balance at the time of planting, the most unusual feature of the *Eucalyptus* stomata is the presence of one or more large calls in the air chamber immediately below the guard cells, called obdurating cells; the constant feature of the presence of cellulose thickenings on the cell walls nearest to the stomatal aperature and distribution of stomata on the lower surface of the juvenile leaves, leaving only few on the upper surface. The functions of the obdurating cells are not clear. According to some, these cells supplement the functions of the guard cells in regulating gaseous exchange and evaporation while others feel that the stomata are degenerate and functionless (26). The remarkable ease with which the transplanted seedlings get established in the field and

start growing after about seven to ten day's break from the date of planting, should make anyone link the physiological adaptability of this species at the time of water stress to the functions of obdurating cells, possibly as a second line of defence against transpiration, to the cell wall thickenings near the stomatal aperture and to stomatal distribution mostly on the lower surface of juvenile leaves.

In the laterite areas of West Bengal the plantable seedlings are graded to 45 cm to 60 cm height in 120 days in 17.5 cm size polypots; in Mysore the same height is achieved in about 210 days from autumn and about 150 days from spring sowings (18,24,34). Dealing with the problem of grading and ascertaining the best height of transplants, in a condition which can neither be called either as bagged or as open rooted by allowing the roots to penetrate beyond the polythene bag into the nursery soil, it was found that between the initial planting heights of two transplants viz $\geq 15 - < 55$ cm and $> 55 - < 95$ cm the advantage with the tall ones was sustained upto the first six months, but this advantage had no influence on the plantation height after 37 months (29).

The criteria for outplanting are adequate soil moisture and humid atmospheric condition, as prevail at the break of monsoon. But a continuous break of rain for even a week just after planting has been proved to be fatal in Mysore (18). In Uttar Pradesh, the transplants are thoroughly irrigated before taking them out for field planting (34). Making studies on the soil-moisture relations with the growth of *Eucalyptus hybrid* in Uttar Pradesh, North Bihar, West Bengal, Haryana and Punjab, several authors have shown that morphological characters of the soil including its texture may or may not have direct bearing on the growth response, but the drainage condition that governs the moisture availability is determining the growth status of *E. hybrid.* The depth and thickness of hard, incrusted laterite pan plays a pivotal role in deliminating rooting in red, ferruginous soils of West Bengal. The presence of this horizon obstructs movement of water during rains and prevents fluctuation of water table having deprocatory effect on roots through lack of root respiration. This fluctuation wherever occurs results in root growth in post raining season after stagnation during rains, chlorosis, restricted crown development and paucity of leaves and only heavy soil working can make root extension in such a situation (6). Poor root development has been caused by occurrence of underground clay & kankar pans resulting in defective drainage; dry climatic conditions in tracts characteristic of infertile sandy soils with deep water table has also caused poor growth of plants (31). The soil profiles carrying better growth of *Eucalyptus* possesses medicum internal drainage while profile with inferior growth are either associated with rapid to excessive drainage or with impeded drainage leading to pronounced mottling (21, 37, 38): See also table—1).

Table 1

Effect of drainage on the growth status. Locality :—Terai-Bhabar of Uttar Pradesh (Table based on reference 37, Grading of growth status by the author)

Profile No.	Topography	Soil type	Rainfall (mm)	Water holding capacity (%)	Internal drainage	Growth status grade (height)
1	Alluvial plain	Bhabar	1500	24.3	Excessive	4
2		Bhabar	1000	23.6	Rapid	5
3		Terai	1395	44.1	Impeded	6
4		Terai	1650	55.1	Medium	1
5		Bhabar	1000	44.9	Medium	2
6		Bhabar	1650	33.9	Medium	3

Nutrition and soil

The crops are found to grow best in soil in the moderately good physical characteristics. The top root terminates in shallow loamy soil underlined by laterite and throws out side roots, while it continues to grow in deep loamy soil (6). In general, for *Eucalyptus*, it has been observed that addition of fertilisers may have little effect on growth increase in soils with poor soil characteristics although there may be intake of nutritients (7). Humification and nutrient cycling are faster under *E. tereticornis* than under natural *sal*; the tentative findings are that the replaced crop by the former may be favourable for sustained production (32).

The presence of injurious salts in the soil sometimes resulting in saline and alkaline conditions limit growth, as also excessive salt contents in water used from irrigation of seedlings. The growth of plants in private from lands in Punjab where water supply, fertilisers and weeding are assured along with agricultural crops is 25—30% higher than Government plantations (31). Top drying and chlorosis have been noticed in lime induced iron deficient soils in some areas (11).

The soils showing varying potential reserves of the elements like K, P, Ca, Mg, Fe and Al did not show any definite correlation with the growth status of the plantations: in general, however, the deficiency in organic matter or in nitrogen needed attention when deciding on the application of fertilizers and manures. It also needs to be probed if effect of P is evident only after crossing the threshold as suggested (7). The amount of exchangable Ca or Mg owing to calcareous nature of the soil may not be limiting factor for raising *Eucalyptus*. A good growth has been shown in pH between 4 8 and 7 3. The critical point lies at <10. The limit for soluble salt stands at 0 7% but upto 0.3% or slightly lower only satisfactory growth is visible (21).

The physiological quality is also markedly influenced by the fertiliser regime. The application must cover the deficiencies of the site, ascertain the requirement of the species and boost its growth.

In the laterite areas of West Bengal, often grossly deficient in organic matter, addition of organic manure in various combinations of oowdung, compost and municipal *sludge in a 'core' of 15 cm diameter and 45 cm length* in the centre of the planting pit before transplanting has resulted in greater growth than the control upto the age of 3 years (14). The efficiency of the use of 'core' manuring over diffused one has, however, been questioned from the point of growth in personal discussions and may not be as much beneficial as made out to be initially.

The chief findings from various studies on the macronutrient requirements in soil and sand culture in pots, boxes, or jars are as follows: (16, 19, 20).

(1) Noticeable symptoms of light chlorosis, necrosis of leaves and browning of the base of the stems were observed in N and P deficient seedlings.

(2) The data on absolute height increment and total dry matter production reveal that the growth of the seedlings in height was definitely changed by the deficiencies of essential elements N, P, K, Ca and Mg, but the growth was not stunted except to some extent by N and P deficient seedlings; K, Ca and Mg deficient seedlings are apparently not much affected. S deficiency has given variable results. Soils in N and P deficiencies may not be very suitable for the growth of the species, so far as height and dry matter production go. (see the diagrams 1 and 2).

(3) The N, P, K requirements of seedlings when added in combination exhibit phenomenon of antagonism or synergism. With the increase in dose of K or N, the uptake of N increases: P intake too increases with higher doses of P application but this element acts independent of concentration of either N or K. With the increase of the dose of K, its concentration in the plant too is increased, but varying levels of N show no specific trend of influence on the uptake of K. It is, therefore, essential that for optimum results the doses of different nutrients should be balanced.

Diagram 1

Glazed pot culture in sterile sand. Solution composition after Hoagland and Arnon. Experimental time from 20.1.1964 to 25.9.1964.

Height growth and dry matter production
(Prepared from reference—19)

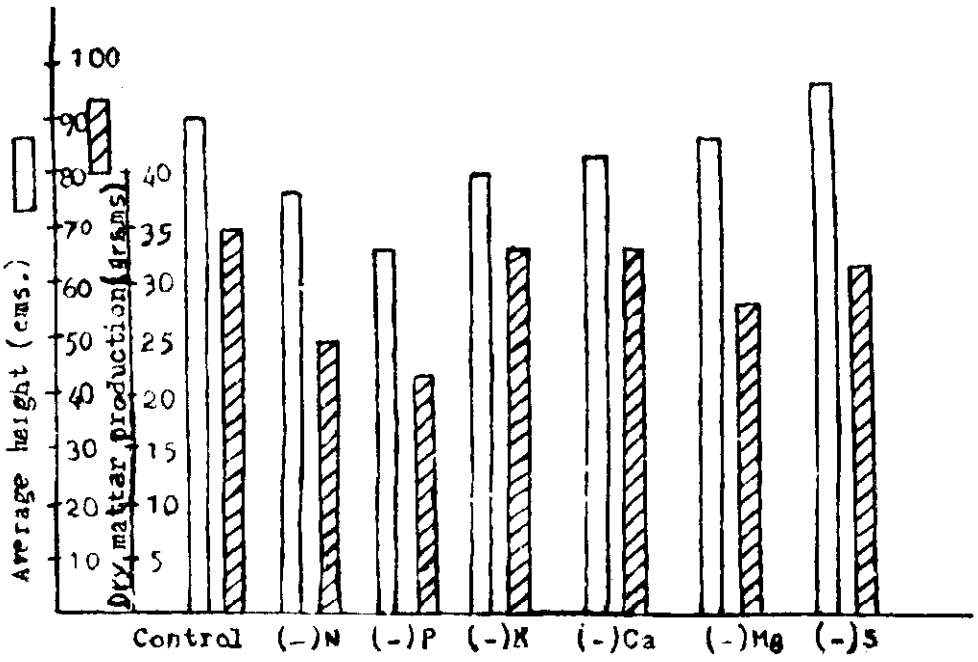
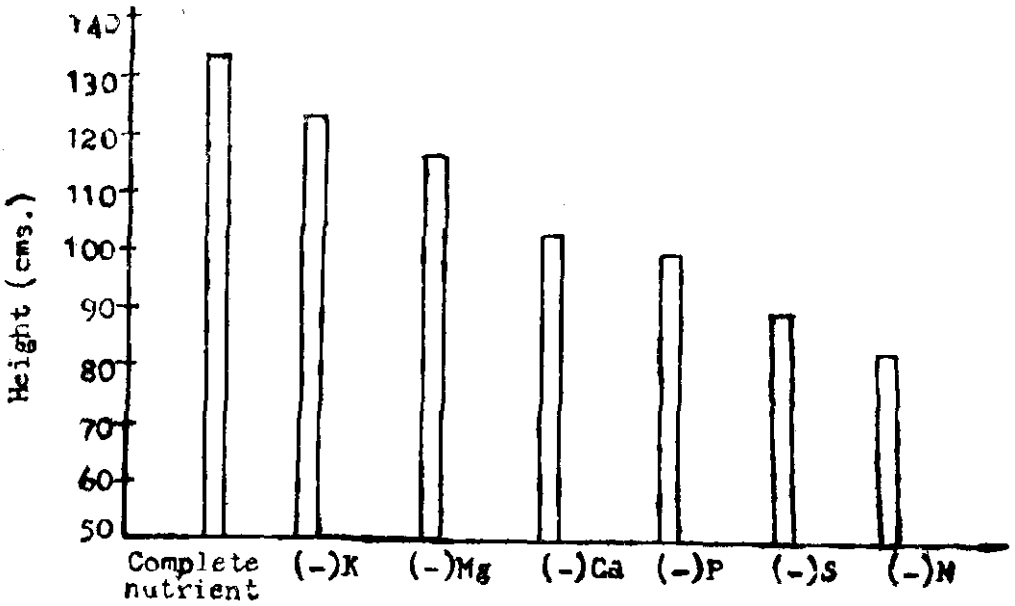


Diagram 2

Glass jar culture in sterile sand. Solution composition after Hoagland and Arnon. Experiments commenced on 20.9.1963.

Height growth after 245 days.
(Prepared from reference—16)



(4) For red soils in Northern India, deficient in C, N and P using shall doses in the first year, at the time of planting and first weeding, the effects of N, P and K were not found to be significantly different from each other in one site; in another, however, small doses Ammonium sulphate and single superphosphate applied at the time of planting followed by repetition of another dose superphosphate at the time of first weeding gave the best results (13). In a similar soil in Central India an experiment showed the effect of N in a pronounced way and that of P even at low levels when applied as Potasium instead of Dicalcium phosphate (33). In the laterites of South Western Bengal, also deficient in organic C,N and P, the usual practice in the application of mixed N, P, K at the level of 15 : 5 : 15 lbs. per acre at the time of planting for a mesotroph like *Eucalyptus* has been found out to be a wrong choice as more of K, already in excess, is being added while P in short supply, is being given a low dose (4). At the end of two growing seasons, a combination of 50:5:15 lbs/acre of N : P : K in one site, 50:0:0 in another and 100:50:50 in the third sites have given the best results so far (2). These findings are different from tentative indications in favour of 50:50:50 in the similar forest and in matching glass house conditions (4,5).

It is, however, clear from the experiments that (a) combination dose may vary from site to site, as is to be expected and (b) increased nitrogen dose results in increased height

growth and only this element has been found to be most decisive in growth at the time of plantation with some effect from phosphorous also. One of the current trends in forestry is to fertilise the established crops. Again in West Bengal laterites, an application at the level of 60:20:60 lbs/acre in several sites in a 4 year old crop (planting stock of 875 stems/acre) seem to show better results both in height and girth than 60:10:60 treatment and control after two years of application (29).

There is only one known work on the effect of micronutrient on sand culture of *E. tereticornis* (3). Some significantly better evidence of growth by increase in height has been achieved with Molybdenum and Boron, the best coming from treatment level of 3×10^{-6} gm of Mb O_3 and 18×10^{-4} gm of H_2BO_3 per pot.

Conclusion and discussion

The differential time of flowering of the male and female sexes indicate different internal requirements for each sex. The hormonal requirement too for each may be different. A low output of fertilised material from seeding is evident and it may be worthwhile studying the functions of endogenous regulators and their role in the physiology of reproduction.

On simple physiological criterion of internal water balance alone, polypot planting does not appear to be indispensable. It is, however, important to know how the balance is maintained. Whether it is due to anatomical features or for hasty root formation or both, are matters to be probed.

Rooting with or without hormones as a means for asexual made of production too deserves more attention.

The application of physiology of reproduction in tree improvement works in a species like *E. tereticornis* which is one of the most widely planted species, is an inescapable necessity. Little work is known yet on basic works of selection and breeding—a essential prerequisite for further physiological research.

On the whole, the effects of various macronutrients on the growth of *Eucalyptus* seem to be still uncertain except for organic N, P and C, K, usually existing on the forest floor can play a part in combination. It is, therefore, more important to determine the levels of these fertilizers in mixture with one another in different sites. S has shown varied results—its role may vary according to site. Ca and Mg deficiencies had not shown effect in a pronounced way. Micronutrients Mb and B have shown significant improvements in growth. Besides, decisions on the time of application and quantum of fertilisers, both in young and established crop to boost growth, are necessary.

The principal use of *Eucalyptus tereticornis* is as a pulpwood. In pulping tests strength proportion have been found to improve upto the 9th year of growth; the pulp yield, however, decreases with increase in the rate of growth (15). The darker colour of the wood from the 5th year also affects pulpmaking (10). The decision on fertilisation for growth promotion should be influenced by these findings. Little is yet known yet on coppice growth and its impact on further physiological research in the field of fertilisation and irrigation.

Initially *Eucalyptus tereticornis* was taken as the most cosmopoliton species capable of growing in wide and varied conditions of climate and soil. Though the species is capable adopting itself in divergent habitats, failures in many areas have shown that it is not as universal as was made out to be initially. It is in this context its physiological behaviour and requirements need a more correct assessment.

SUMMARY

Some of the physiological qualities of *Eucalyptus tereticornis* (Syn. *E. hybrid* namely, that of reproduction and seeding, moisture relations, nutrition, etc., have been characterised in this paper.

The propagation is carried out through seeds. Out crossing may be common, but it is also not self-incompatible. The time of flowering and innate genetical trait rule out outcrossing with every other species of the same genus. The impurity in *Eucalyptus tereticornis* seeds is considered mostly a mechanical mixture and hybridisation, if at all, is nominal. The germinative capacity cannot be rated high. Viability appears to be lost gradually. The important concern for seedlings and seeds in the nursery is the damping off disease attributed to excessive watering, high relative humidity and temperature and poor light.

For planting, the desiccation of the nursery stock is prevented by putting them in the polythene containers. But root pruning or knotting, as practised, tends to upset the internal water balance. This species develops root system rapidly.

The species grows well in soils with good physical characteristics. The laterite or kankar pan limits root growth as also strong alkaline and saline conditions. The critical PH is UO. High water table causes inhibited root growth, chlorosis, poor crown development and paucity of leaves. The limit for soluble salt stands at 0.7%.

The addition of organic matter results in greater growth. The effects of various macro nutrients on the growth are still uncertain, except for organic C, N and P. It is more important to determine the levels of these fertilizers in mixture with one another for optimum results.

***E. tereticornis* is not as cosmopolitan as made out initially through it can grow in divergent habitats. Its physiological behaviour and requirements need a more correct assessment.**

युकेलिप्टस टेरेटिकार्निस एस० एम० (पूर्व *यु० हाइब्रिड*) के विकास और वृद्धि के कुछ शरीर क्रियात्मक पक्ष

लेखक पी० गुहाठाकुर्टा

सारांश

युकेलिप्टस टेरेटिकार्निस (पूर्व *यु० हाइब्रिड*) के कुछ शरीरक्रियात्मक गुणों नामतः पुनरुत्पादन और बीजन, नमी से संबंध, पोषण आदि को इस अभिपत्र में लक्षित किया गया है।

इसका प्रवर्धन बीज बोकर किया जाता है। बहिर् संकरण आम हो सकता है किन्तु यह स्वतः असंगत भी नहीं है। पुष्पन का समय और अन्तर्निहित आनुवंशिकीय विशेषताएं उसी प्रजाति की अन्य जातियों के साथ बहिर् संकरण की संभावनाएं समाप्त कर देते हैं। *यु० टेरेटिकार्निस* के बीजों में पाई जाने वाली अशुद्धता अधिकतर संघारी मिश्रण ही मानी जाती है और संकरण है भी तो नाममात्र का है। अंकुरण क्षमता ज्यादा अच्छी नहीं कही

जा सकती। बीजों की जीविष्णुता धीरे-धीरे समाप्त हो जाती लगती है। रोपणी में बीजांकुरों और बीजों की अधिक समस्या आर्द्रमरण रोग से बचाने की है जो अत्यधिक सिंचन, अधिक आपेक्षिक नमी और तापमान तथा प्रकाश की कमी के कारण पनपता है।

रोपते समय पौधों को पोलीथीन की थैलियों में रखकर लगाने से उन्हें सूखने से बचाया जा सकता है। परन्तु जड़ें कतरने या ग्रन्थन से, जैसा प्रायः किया जाता है, आंतरिक जल संतुलन बिगड़ने की आशंका रहती है। इस जाति की मूल संहति तेजी से बन जाती है।

यह जाति अच्छी भौतिक विशिष्टताओं वाली मृदाओं में भलीभांति बढ़ती है। इष्टकिज या कंकड़ स्तर जड़ों की वृद्धि रोकता है, अधिक क्षारीय या लवण मृदाएं भी यही करती हैं। इसका क्रांतिक पी एच 10 है। ऊंचा जल स्तर जड़ों की वृद्धि में बाधा, पीतिमा, घटिया छत्रविकास और पत्तियों में कमी लाता है। विलेय लवणों की सीमा 0.7 प्रतिशत है।

जैव खाद से वढ़वार अधिक होती है। कार्बन, नाइट्रोजन और फास्फोरस को छोड़कर अन्य बड़े पोष्याहारों से इसकी वृद्धि पर पड़नेवाला प्रभाव अभी अनिश्चित है। इन उर्वरकों को एक दूसरे के साथ मिलाकर कितने-कितने परिमाण में दिया जाए यह निश्चित करना इष्टतम परिणामों के लिए बहुत महत्व का है।

यु० टेरेटिकार्निस इतना सार्वदेशिक नहीं है जितना आरम्भ में इसे बताया गया था तथापि यह अनेक तरह के प्राकृतवासों में हो जाता है। इसके शरीरक्रियात्मक व्यवहार और इसकी आवश्यकताओं का अधिक सही-सही अनुमान लगाना अभी आवश्यक है।

Einigen physiologischen Ansehen der Entwicklung und des Wachstums der *Eucalyptus tereticornis* SM (Syn. *Eucalyptus hybrid)*

P.G. GUHATHAKURTA

ZUSAMMENFASSUNG

Einigen physioiogischen Qualitäten der *Eucalyptus tereticornis* (Syn. *E. hybrid)* nämlich, die Fortpflanzung und Besamung, feuchtigkeite Verwandtschaften, die Nahrungen usw. werden in diesem Artikel charakterisiert.

Die Fortpflanzung ist mit den Samen ausgeführt. Die Ausmischung mage gemein, aber das ist auch nicht selbst-unverträglich. Die Blumenzeit und die angeborene genetische Merkmale ausschließen die Ausmischung mit jeder andere Art selber Gattung. Die Unreinheit in den *E. tereticornis*—Samen ist meistens eine mechanische Mischung betrachtet, und die Hybridisierung, wenn die gefunden ist, ist nominell. Die Keimfähigkeit ist nicht hohe geschätzt. Die Keimfähigkeit erscheint allmählich zu verlieren. Die wichtige Angelegenheit um die Sämlingen und Samen in der Pflanzschule ist die Eingehen-Krankheit, die zur übermassige Wasserung, hohe relative Feuchtigkeit und Temperatur und zum schlechte Licht zugesellt ist.

Um Pflanzung, ist die Trockenung der pflanzschule Pflanzen, mit ihrer Setzung in den polythene Büchsen hindert. Die Wurzelschnittung oder die Verknüpfung, als geübt, neigt sich die innere Wasserbilanz zu umstüzen. Diese Art entwickelt das Wurzelnsystem schnell.

Diese Art wächst im Boden mit guten physische Eigentümlichkeiten wohl. Die lateritische oder kankare Kruste und auch die strenge alkalische und salzhaltige Lagen hinderen den Wurzelwuchs. Das kritische pH ist 10. Der hohe Wasserstand verursacht

den vergebotene Wurzelnwuchs, die Chlorosis, die schlechte Kroneentwicklung und den Mangel der Blätter. Die Grenze für lösliche Salze steht an 0,7%.

Die Addition des organische Stoffs ensteht sich in großeren Wuchs. Die Wirkung verschiedener Makronahrungen, der organische Kohlenstoff (C), der Stickstoff (N) und der Phosphor (P) auschließen, am Wuchs ist noch zu bestimmen geblieben. Zu erlangen die beste Resultäte, ist das die Bühenen dieser Düngemittel, in Mischung mit einanderen, mehr wichtig zu bestimmen.

E. tereticornis ist nicht kosmopolitisch als die anfänglich entziffert war, obgleich die in verschieden Verbreitunggebieten wachsen kann. Ihre physiologische Betragen und Forderungen brauchen eine mehr richtig Abschätzung.

Quelques aspects physiologiques d'évaluation et de croissance d'*Eucalyptus tereticornis* Sm (Syn. *Eucalyptus hybrid*)

par P. GUHATHAKURTA

Résumé

Cet ouvrage traite de quelques unes des qualités physiologiques d'*Eucalyptus tereticornis* (Syn *Eucalyptus hybrid*) telles que la reproduction et le semis, rapport d'eau, nutrition etc.

La reproduction se fait par graines. It est possible que le croisement avec d'autres espèces soit le procédé habituel mais celui-ci n'est pas incompatible en soi. La floraison et le trait génétique inné éliminent la possibilité de croisement avec chacune des autres espèces du genre. L'impureté chez les graines d'*Eucalyptus tereticornis* est considérée principalement comme une mélange mécanique et hybridation, si elle a lieu, est nominale. La capacité germinative des graines ne peut pas être classée comme bien élevée. Le pouvoir germinatif a l'air de se perdre par degrés. La maladie importante menaçant les semis et les graines en pépinière, c'est la pourriture humide, s'attribuant à l'arrosage excessif, forte humidité relative, température et éclairage insuffisant. Pour planter, la dessiciation des jeunes plants est empêché en les posant dans les réucieints en polythène, mais la taille des racine ou l'ébranchage comme l'on pratique, tendent a boulverser l'équilibre hydrique. L'appareil radiculaire de cette espèced éveloppe vite.

Cette espèce pousse bien sur des sols possédant de bonne caractéristiques physiques. La latérite ou le "Kankar pan" ainsi que les matières basiques et salines limitent la croissance des racines. La valeur de pH critique reste a UO. Le niveau d'eau haut placé provoque l'inhibition de la croissance des racines, la chlorose, le développement insuffisant de la cime et la manque de feuilles. La limite des sels solubles reste à 0.7%.

L'apport de la matière organique cause une amélioration de la croissance. A l'exception de c, N, et P organiques, l'effet de diverses matières nutritives (Macro) sur la croissance est encorc peu sûr. Il importe que, pour obtenir les résultats optimums, les niveaux d'apport de ces fertilisants en mélange soient déterminés. *Eucalyptus tereticornis*, quoiqu'il puisse croître dans des habitats divergents, n'est pas aussi cosmopolite qu'on avait pensé initialement. Son comportement et ses besoins physiologiques exigent une évaluation plus exacte.

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