Great excitement about ‘new’ eucalypt species

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Final measurement and assessment of the 1992 eucalypt site-species interaction trial series SGE.32 to SGE.34 in Zululand was carried out during 1999. Trees were then felled and wood samples from the six most promising new species were pulp tested by the laboratories of Mondi Kraft, Richards Bay. The new species showing most promise over all sites on a tree growth and kraft pulping basis were E. henryi and E. longirostrata (refer ICFR Bulletin 17/2001).

The two species are continuing to receive attention. The ICFR has accessed reasonably comprehensive seed collections of E. henryi and E. longirostrata from Australia and will be establishing breeding trials with these in Zululand during August 2001.

On the industry side, the obvious pulping merits of E. henryi and E. longirostrata are firing the imaginations of those in the wood-chip export business. The main reason for this is that in the kraft pulp tests, the species not only delivered excellent “screened pulp yield” figures, but also impressive “density x pulp yield” figures (kg pulp/m² wood). In other words, the basic wood density of each of these two new species is considerably higher than that for average E. grandis pulpwood. Proof of this interest was the recent request by Central Timber Co-operative (CTC)’s Japanese customers for chip samples of E. henryi and E. longirostrata to test in their own laboratories overseas.

To meet this request, Edwin Schramm (CTC), Craig Norris (NCT) and Robin Gardner, Denis Oscroft and Musa Mkhwanazi (ICFR) joined forces between 2 and 4 May this year in a collaborative effort to visit the trials at Terranera and False Bay to collect the necessary wood samples.

The trip started off with a visit to the intermediate site at Teza (left untouched and standing for germplasm conservation purposes), to observe 9-year old trees of E. henryi and E. longirostrata growing in un-thinned plots. Following this, the hard work of felling trees and cutting the necessary sample logs began. Nevertheless, after a reasonable amount of sweat and a few curses, the team emerged victorious and a day later they stood dusting their hands in front of the grouped piles of logs (replicates from each trial site) of each species laid out in front of the chipping machine at CTC, Richards Bay. A couple more hours work next to the big muncher and the bags of woodchip samples were packed and ready for transport to Pietermaritzburg. All in all, a good team effort and an interesting two days.

The first news trickling in regarding the overseas pulp tests is that the Japanese have found both species very impressive in the initial tests, regarding yield and density, with E. henryi being somewhat more impressive than E. longirostrata, as was the case in the local kraft pulp tests.
Farmer Freelances as Research Assistant

The ICFR has four E. nitens flowering trials situated across the country, from Blyfstaanhoogte near Sabie in the north to Tentkop near Maclear in the south. The trials were planted in 1996 at specifically chosen sites to allow studies pertinent to Robin Gardner’s MSc project “Initial investigations into the effects of cold temperatures on growth and flowering in E. nitens in South Africa”.

Since the first flower-buds appeared on the trees in 1998, the trials have been delivering an increasing amount of useful information. Initially, following trial establishment, only two trips per year to each trial site to interchange temperature loggers and carry out tree measurements and floral-bud crop scores have been necessary. However, since 2000 the trees began flowering more prolifically, and it became important to monitor floral-bud stage development at regular intervals through the months of May to September, the predominant flowering time for E. nitens in South Africa.

All sites are in relatively steep plantation terrain and generally none of them have been easy to get to if rain or snow has fallen within recent weeks. Nevertheless, access to the two KwaZulu-Natal trials near Boston and Bulwer has been relatively easy, mainly due to their closeness to the Pietermaritzburg office with the associated ability to choose suitable days to visit the trials. The Blyfstaanhoogte trial site is also within 45 minutes drive of the ICFR Sabie office and has therefore also not posed any particular problem.

However, the trial in the North Eastern Cape at Tentkop, a Mondi plantation, 8 hours drive from Pietermaritzburg or 1.5 hours drive into the mountains from Maclear posed somewhat of a bigger problem. This trial (2000 m altitude) is the coldest site of the four and good flowering has occurred here. The road to the trial is particularly bad for lengthy periods following regular rains and snows typical to the area, and the trees in the trial can surely tell many stories of vehicles and cursing researchers bogged down in snow and mud trying to reach or get away from them! The closest Mondi office is also 2 hours drive away.

Since the day the trial was planted, five years ago, Robin developed a friendship with a local sheep and cattle farmer, Donie Naude, whose land borders the Tentkop plantation. Because of the logistics and high costs of ICFR researchers getting to the site every two to three weeks to carry out floral development assessments, it made sense to enquire of the same farmer as to whether he knew of any research-minded person in the area who may be interested in helping out. The initial response was that there was someone doing crane monitoring in the area and that he may be suitable. Needless to say, one week later after he had received the response, “Rob, ek dink dit sal makliker wees as ek die blom-skattings self doen as ek woon reg lanks die treen”… Robin stood in front of the trial at Tentkop, ready to show Donie Naude what he wanted in the way of flowering assessments! Half an hour into the exercise he was overwhelmed by the enthusiasm of this man. In fact, Donie was so enthusiastic he even wanted to start looking for buds in trees where we had found none previously! Even after cooling down Donie’s enthusiasm and ensuring him they had searched the trees well, he still insisted he would probably check during his next visit just to make sure.

We need more people like Donie, who take an active and enthusiastic interest in research occurring in their region and make the life of the researcher that much easier!

Weed-induced eucalypt growth suppression: results from 22 trials linking the onset of tree growth suppression with management, physiographic and climatic factors

One of the greatest difficulties associated with controlling competitive vegetation during the establishment of eucalypts relates to the timing and planning of weed control operations. This may be due to large site related variability in terms of weed species composition, abundance and growth, local climatic conditions, as well as methods of site preparation. As a result, it is difficult to prescribe operational vegetation management standards which can be effectively applied to a wide range of sites, let alone determine the critical time at which the competing vegetation should be controlled. Since the early 1990’s the ICFR has planted a number of eucalypt vegetation management trials in KwaZulu-Natal. Being vegetation management trials, all had a weedy (no vegetation control was carried out) and weedfree (all vegetation kept below a sub-competitive level) check. From these trials, optimum tree performance in relation to the weedy check was recorded, together with site and climatic variables. Multivariate statistical techniques were used to determine if any of these site and climatic variables would be related to the time taken for weed-induced tree growth suppression to occur (as determined by the time to divergence of the tree growth curves).

Statistical analyses identified trends in the data which may in future help to understand factors related with early weed-induced tree growth suppression. Specifically, those environmental factors associated with changes in altitude (soil texture, MAP and MAT), method of site preparation (burning versus not burning) and the presence of woody vegetation are potentially good indicators of early and vigorous vegetation growth and hence early tree growth suppression. Regardless of whether or not burning is practised, the results indicate that the onset of weed-induced tree growth suppression is likely to occur sooner at lower altitudes where the vegetation is more diverse and grows vigorously. These are areas where early, planned weeding operations may be required to avoid the development of a critical weed biomass. As burning stimulates the germination of many weed seeds, this is likely to enhance the rate at which the onset of competition occurs at these sites. Historically, sites at higher altitudes (>1400 m) were grassland areas with lower overall species abundance. This, together with reduced growth rates due to cooler mean annual temperatures, could delay the onset of the development of a competitive weed biomass, in these areas, and weeding operations may be scheduled to be less intensive.

ICFR News - August 2001
Coppicing ability of 20 cold tolerant eucalypt species grown at two high altitude sites

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Twenty eucalypt species were planted in six high altitude site-species trials in South Africa in 1990. After the trees were felled at 10 years, their ability to coppice was assessed, 10 months after felling at two of these trial sites (Draycott and Broadholms). The decision to replant or coppice was based on the stocking and volume data from the parent crop, and the coppicing potential, stump grade that had coppice and the biomass index for the coppice. Periods of severe drought during establishment affected the growth and final stocking of the drought-sensitive species and provenances of E. delegatensis, E. regnans and E. nitens (Ebor) at Broadholms and E. glaucescens, E. elata and E. andrewsii at Draycott and these species would thus not be considered for coppicing. In terms of volume performance, E. nitens (Tallaganda) and E. benthamii were significantly better than all other species at Draycott, while at Broadholms E. fraxinoides outperformed all other species. For these two trials, the species that coppiced well were not the same species that performed well as the parent crop, with E. benthamii, E. smithii, E. quadrangulata, E. macarthurii, E. badjensis, E. dunnii, E. cypellocarpa, E. saligna and E. elata all recording coppiced stump figures greater than 80% at both sites. Although the planting of strongly coppicing species is generally advantageous as it is cheaper and possibly more productive to re-establish from coppice, a compromise would have to be reached whereby a lower yielding species is selected that also has the ability to coppice well. At the Draycott site both E. smithii and E. benthamii may be considered as potential alternatives to E. nitens (Tallaganda) as besides having good volume, both species coppiced well. When compared to E. fraxinoides at Broadholms, the 43 and 52% reduction in E. saligna and E. smithii volume would mean that a substantial saving in re-establishment costs would have to be made before one could consider re-establishment by coppice regeneration.

The latest ICFR bulletins

C W Smith, S Dovey and L J Esprey

13/2001: A review of factors affecting snow damage of commercial forest plantations in South Africa.
Richard Kunz and Robin Gardner

L J Esprey

15/2001: An initial assessment of drought risk for the forestry areas in the summer rainfall region of southern Africa.
Richard Kunz and Colin Smith

16/2001: A summary of the data collected by Northern Timbers in Eucalyptus sawtimber plantations, with a more indepth examination of the foliar nutrient levels.
Colleen A Carlson

R A W Gardner, D O Oscroft and K A Ntombela

Copies are available from the ICFR, and at http://www.icfrnet.unp.ac.za

A visit to the CSIRO and CRC-SPF, Australia

A full overview and details of this trip can be found in ICFR Bulletin 14/2001

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Since Colin Smiths’ visit to the CSIRO, Australia, in October 1999 and negotiations with the Co-operative Research Centre for Sustainable Production Forestry (CRC-SPF) during 2000, a collaborative agreement was drawn up between the ICFR and the CRC. As part of this collaborative research project Luke Esprey undertook a three-week visit to CSIRO, Australia and Tasmania, during which time he spent three days in Perth (Western Australia), two days in Canberra (ACT) and the remainder of the time with the CRC-SPF in Hobart, Tasmania. The primary aims of this trip were to:

- forge valuable relationships with scientists working in the arena and development of process based forest growth models (PBM’s);
- appraise important modelling issues from the standpoint of the CRC;
- look at and become acquainted with various PBM’s developed by the CRC;
- understand the importance and implementation of model calibration, parameterisation and validation; and
- consider some applications of these PBM’s as an aid in management and silvicultural decision making.

In Perth, Luke was hosted by Drs Tony O’Connel and Don White. They embarked on a two day field trip to visit a Centre for International Forestry Research (CIFOR) research trial and two trials established to explore the relationship between drought risk and forest productivity. The severe salinity problem was evident on the western seaboard, a result of salt carried in rainwater from the coastal regions and stored in the soil profile over millions of years. Over the last few decades indigenous forests and vegetation have been cleared, resulting in rising saline water tables. This saline water moves both vertically and laterally, forming saline seeps, later entering rivers downslope of the seep. As a result, approximately 2.5 million hectares of farming land in Australia are affected and this may increase six-fold over several decades, despite efforts to slow the spread.

In many areas there are pockets of dead trees - a result of high salinity soils.

The bulk of Luke’s trip was spent at the CRC-SPF in Hobart where he met up with Drs Peter Sands (mathematical modeller), Mike Battaglia (modeller, physiologist and ecologist), Chris Beadle (soil water), Geoff Downes (physiologist and wood quality), Philip Smethurst (nutritionist), Sigrid Resh (soil scientist) and Fredia Heskens (canopy processes).

Luke was introduced to three PBM’s called ProMod, Dynamic ProMod and Cabala, each developed at the CRC-SPF by Peter Sands and Mike Battaglia. These models have a physiological foundation. Data required for these models are soil factors (soil depth, texture,stoniness, pan evaporation and number of raindays). These models have been used to look at likely impacts of silvicultural management options such as stocking, fertilizer, weed control, irrigation, thinning and pruning on plantation productivity; drought risk analysis as a result of changing weather sequences; sustainability issues over successive rotations; and limits and controls of growth at different points during the rotation.

The final leg of Luke’s tour took him to Canberra where over a period of two days he met individually with Drs Sadanandan Namibari, Brian Meyers, Tivi Theiveyanathan, Keryn Paul, Peter Snowden, Trevor Booth and Phil Ryan, and he gained a good impression of the range of activities which are being undertaken by the CSIRO. Some activities include sustainable land use management, development of N-mineralisation models, linking empirical and PBM’s, the calibrating the Penman Monteith for eucalpts, matching trees to sites and remote sensing/spatial prediction techniques.
Wattle cuttings and seedlings at Bloemendal: how are they comparing?
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The seedlings versus cuttings trial, planted at Bloemendal in April 1999, is now 27 months old. The trial consists of the same 12 families propagated via cuttings and seedlings. The families are planted out in three replicates of 36 tree plots (6x6) of which the inner 4x4 trees are measured. Tree heights have been measured twice, at ten and seventeen months after planting, and at 24 months after planting diameter at breast height (dbh) was measured. In October 2000 the trial was inoculated by members of the TPCP with Ceratocytis albofilis, which is recognised as one of the most important pathogens of black wattle, causing the wattle wilt disease in South Africa. In each plot eight of the 16 measured trees were inoculated. Six weeks after inoculation, the lesions caused by the pathogen were measured from the point of inoculation. This is done by measuring the length of discolouration of the wood above and below the inoculation point. The dbh measured at 24 months and disease scores are shown in Figure 1.

From Figure 1 and other early data, it is clear that the families perform slightly differently as cuttings as opposed to seedlings as far as growth characteristics are concerned and that this may change over time. There are also clear differences between the families. The overall picture as far as disease tolerance is concerned is similar, with some families being more or less resistant as cuttings or as seedlings but with large differences between families.

This information will, however, be used to identify the best performing families as far as growth and disease tolerance is concerned. The best individuals from these families will be propagated via cuttings and planted into new trials. Some of the disease susceptible trees that have produced epicormic shoots will also be cloned so that we can check that the susceptibility is also under genetic control and not a chance event.

The trial will be monitored on a weekly basis to note if any further damage can be seen on the seedlings that are performing well. With the recent cold snaps, the seedlings have been exposed to some harsh temperature extremes. We hope some of the trees will survive for further testing!

A more comprehensive update on the performance of the other cuttings versus seedling trials will be published as an ICFR Innovation in the near future.

Wattle Frost Trial in the KwaZulu-Natal Midlands

Damage to wattle seedlings by frost is one of the main reasons for many farmers not using seedlings, which have improved characteristics, to establish their plantations. Instead they use either natural regeneration or line sowing techniques. Therefore the identification of frost tolerant families of black wattle is an important component of the wattle breeding programme at the ICFR. Over the months of December 2000 and January 2001 a small seed collection exercise was carried out in the Drakensberg and KwaZulu-Natal Midlands. Open pollinated seed was collected from individual trees in the Monks Cowl, Dragons Peak and Balgowan areas.

This seed, which included nine families from Monks Cowl, two families from Dragons Peak and three families from Balgowan, was sown along with five families of green wattle (one bulk seed lot and four individuals, all imported from Australia) in the ICFR nursery. Once the seedlings were big enough they were transplanted into 2.5 litre plastic bags. Commercially available black wattle seedlings of similar size were obtained from Sunshine Seedling Services and also transplanted into bags.

With the help of NCT, the trial was laid out on 24 July 2001 on the Ingwe plantation near Caversham, approximately 50 km from Pietermaritzburg, on a site prone to frost. The seedlings were not planted into the ground but rather left in their bags so that they could be retrieved if need be. The aim of the trial is to identify any frost tolerant families or individuals that can be used in the breeding programme. Another question that may also be answered by the trial is whether green wattle is inherently more frost tolerant than black wattle, as is suspected by many people.

The seedlings were arranged in a randomised block design with four replications and nine tree square plots. The trees were spaced at 1 m by 1 m. The trial was watered three days after planting and received a heavy frost the day after. On 30 July the trial was assessed and severe scorching could be seen on many of the trees. However, certain individuals showed no signs of frost damage and we hope to vegetatively propagate these “frost tolerant” individuals and re-test them at a later stage.

The trial will be monitored on a weekly basis to note if any further damage can be seen on the seedlings that are performing well. With the recent cold snaps, the seedlings have been exposed to some harsh temperature extremes. We hope some of the trees will survive for further testing!

Darren de Leur and Rob Dunlop
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Watering the frost trial three days after it was set out.
“WWW – Managing Woods, Water & Wetlands in harmony”
Symposium held on 26 July 2001

This successful symposium was organised by the KwaZulu-Natal branch of the SAIF in July 2001. The aim was to explore the relative value of water for forestry, social purposes and the environment and to examine how to manage these competing interests. Over 100 delegates heard a wide range of speakers talk on topics such as the role of South African plantation forests in a world context, water use of plantation forests, the hydrology of South Africa, social and community needs and the environmental importance of wetlands. The proceedings from the symposium will be available within the next two months. Enquiries should be directed to Colin Smith at the ICFR.

Topics covered were:
- South African Plantation Forestry in a Global Context
  - Dr Andrew Morris (Sappi Forests)
- The relationship between trees and water in the environment
  - Dr Bob Scholes (CSIR)
- Relating the value of wood to water use
  - Jackie Crafford, CSIR
- General overview of the water balance/hydrological systems in South Africa
  - Prof. Peter Roberts (Roberts Research)
- Managing the process of water allocation in forestry
  - Harrison Pienaar (DWAF)
- Ecology and Management of Wetlands
  - David Linley (Mondi Wetlands Project)
- Forestry, Society and Water
  - Zakhile Ngcobo (Mondi Forests)
- Summary/All sides of the picture
  - Dr Dave Everard (Sappi Forests)

Forthcoming events

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Anyone requiring information about the SAIF or its activities can call the National Secretary, Corine Viljoen (tel: 012-348 1745, email: forestry@mweb.co.za) or the KwaZulu-Natal branch co-ordinators Lolly Stuart/Sue James of Stuart communications (tel: 033-3425779; email: sc@futurenet.co.za) or Dr Colin Smith (KZN-SAIF Chairman) at the ICFR (tel: 033-3862314; email: colin@icfr.unp.ac.za)

ICFR News - August 2001
Bacterial blight on the increase

Currently two bacterial diseases of Eucalyptus spp. are known in South Africa. Bacterial wilt (ICFR Newsletter February 1998, TPCP Pamphlet) is a vascular wilt disease caused by Ralstonia solanacearum. This bacterium is common in the soil and on plant debris. It infects susceptible Eucalyptus trees through the roots resulting in a rapid wilt and death of trees. To date, it has only been found in the Zululand area in three isolated areas. More recently a second bacterial disease, caused by a Pantoea sp., has been identified in South Africa (ICFR Newsletter August 2000). This bacterium results in leaf and shoot blight of susceptible Eucalyptus spp.

Bacterial blight emerged as a potential concern to South African Eucalyptus forestry in the late 1990’s after it caused problems in cuttings nurseries in KwaZulu-Natal. Since then, it has been reported from most parts of this Province, the Piet Retief area and Swaziland from both nurseries and the field. Infection results from both nurseries and the field. Infection results in leaf and shoot blight of susceptible Eucalyptus spp.

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In moist weather, white to cream coloured bacterial exudates can be found on stems and leaves. Leaf spots often start as watery lesions at the base or edge of the leaves (see TPCP website for colour photographs of symptoms - http://fabinet.up.ac.za/tpcp/).

In the relatively short time that we have known bacterial blight disease it has already resulted in the termination of some clones from planting programmes. Subsequent to its first report in South Africa, the disease has also been found in South America and other African countries, where it has an equally devastating result on susceptible trees. Bacteria are commonly spread with water, infected soil and plant material, equipment and insects. Results from Colombia indicate a possible connection between the bacterial blight pathogen and insects in the family Miridae. The TPCP has recently initiated a programme to consider the possible role of insect vectors in the spread and infection biology of this pathogen in South Africa. This programme will include several field trips to areas that have experienced outbreaks of bacterial blight. It will also provide valuable information relating to the impact of climate and other silvicultural practices on the occurrence and severity of bacterial blight.

In June 2001, TPCP team members conducted the first survey to investigate the role of insects in bacterial blight. This winter survey will be followed up later in the year, during warmer, more moist conditions. The survey included Highflats as well as Melmoth, Mtunzini and Kwambonambi and involved both day and night collections of insects. During the day surveys, foresters were amused by “crazy” scientists running after insects with nets, while at night we made use of white bed sheets and lights to attract insects. This resembled alien landing sites and saw us shivering of cold in the early hours of the morning. In the late 1990’s after it caused problems in cuttings nurseries in KwaZulu-Natal. Since then, it has been reported from most parts of this Province, the Piet Retief area and Swaziland from both nurseries and the field. Infection results in leaf and shoot blight of susceptible Eucalyptus spp.

Leaf blisters and blights on the increase

Some of the most damaging Eucalyptus leaf pathogens are fungi in the genus Mycosphaerella Johans. At present 28 Mycosphaerella spp. have been identified as causing Mycosphaerella Leaf Blotch (MLB) disease on Eucalyptus spp. Some species of Mycosphaerella cause serious damage to juvenile leaves whereas others predominantly infect adult foliage. In severe cases trees can become stunted and eventually die. A study was conducted to determine which species of Mycosphaerella are most important in causing MLB on Eucalyptus spp. in South African plantations. To achieve this goal, we collected samples from trees showing severe symptoms and used ascospore germination patterns and DNA sequence data to distinguish between species.

Surveys of diseased Eucalyptus spp. were conducted in plantations close to three cities in South Africa, i.e. Pietermaritzburg, Tzaneen and Umtata. Leaves showing MLB symptoms were collected and ascospores discharged onto 2% (wt/v) Malt Extract Agar (MEA) from pseudothecia located on lesions. Permanent microscope slides were prepared to record germination patterns and ascospores with the same patterns were transferred onto MEA in Petri dishes. Pure cultures were incubated at 25°C for 1-2 months.

Ascospore germination patterns and sequence data showed that Mycosphaerella nubilosa (Cooke) Hansf. is the dominant species on leaves in the Pietermaritzburg and Umtata areas. Ascospore germination patterns of these isolates showed typical type C patterns. Isolates from Tzaneen showed similar, but different germination patterns with larger ascospore dimensions. Sequence data of Tzaneen isolates showed that predominant isolates formed a unique group within the larger Mycosphaerella clade. An apparently undescribed species was also collected from Tzaneen and is currently being described. Mycosphaerella marksii Carnegie & Keane and M. lateralis Crous & M.J. Wingf. were also identified during this study. These species were found only in Pietermaritzburg. The incidence of these two species was substantially lower than that of M. nubilosa.

Mycosphaerella Leaf Blotch was first identified in South Africa in 1926 where M. molleriana was found infecting E. globulus. Previous studies conducted on MLB showed that a new species, M. juvenis Crous & M.J. Wingf., was dominant on Eucalyptus. Results from our study indicate M. nubilosa as a main causal agent of MLB. Our results also suggest that dominant species causing individual disease epidemics can change and might not be the same in all situations. These findings suggest that M. nubilosa is presently the dominant pathogen in commercial Eucalyptus plantations in South Africa, specifically E. nitens Deane et Maiden, and that several other species are also present. The discovery of apparently two undescribed species in areas that have been relatively well surveyed in the past suggests that additional surveys of Eucalyptus plantations will be necessary in order to gain a more thorough understanding of MLB in South Africa.

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