Review Article

Bulletin of Pure and Applied Sciences.
Vol.36 B (Botany), No.2. Jul-Dec 2017: P.78-81
Print version ISSN 0970 4612
Online version ISSN 2320 3196
DOI 10.5958/2320-3196.2017.00011.8

CONCERNS OF THE SOUTH AFRICAN FORESTRY INDUSTRY

Rishan Singh*

Author's Affiliation: Discipline of Biological Sciences, University of KwaZulu-Natal, Durban, 4001, South Africa.
.

***Corresponding Author:**
Mr. Rishan Singh,
Discipline of Biological Sciences,
University of KwaZulu-Natal, Durban, 4001,
South Africa.
Email:
rshnsingh1@webmail.co.za,
rshnsingh1@yahoo.com

Received on 26.11.2017,
Accepted on 15.12.2017

Abstract

The South African Forestry Industry is a large enterprise that utilizes many vegetative and micropropagation methods. However, like international forestry industries, there are factors, ranging from soil to climate change, that affect plant yield. Some of the concerns may be related to particular plant species, like *Eucalyptus grandis x nitens* hybrids. In this mini-paper, some factors that are of concern to the South African Forestry Industry are discussed. Although some points may be general in nature, they are necessary since such concerns have implications for natural plant growth, harvesting, and greenhouse plants.

Keywords: micropropagation, auxin, shoot production, fertilizers, hydraulic conductivity, rainfall, embolisms

INTRODUCTION

The concerns of the South Africa Forestry Industry cannot be completely discussed, because the problems in all forestry industries are varied and overlapping. These concerns are usually found in the field where plants, like eucalyptus, grow, but there is a lot of concern pertaining to micropropagation of plant organs, and, thus, plantlets (Singh, R., 2017). Although the concerns of the South African Forestry Industry are known, not all of them can be reported in this mini-paper because there aren't sufficient reports available on this topic. Therefore, an extensive review of these concerns cannot be assumed as being of the same magnitude as those in international forestry industries, but neither can the concerns be an oversimplification of the situation in forestry business in South Africa.

FACTORS OF THE EXTERNAL AND LAB ENVIRONMENT

i. Temperature differences

There is a subtle difference when growing plants using heat sources inside an enclosed environment, compared to natural sunlight (Singh, R., 2017). It's obvious that natural sunlight stimulates gaseous exchange channels in plants, causing optimum photosynthesis, however, in the absence; dark respiration is possible (Fila *et al*., 1998; Pospilsilova *et al*., 1992). The difference in responses of plants kept in an enclosed environment (except the greenhouse) compared to those kept *ex vitro* differ, due to the extent at which sodium and potassium channels control the opening an closing of the stomata (Singh, R., 2017; read Fila *et al*., 1998). In aloe plants, like cactus for example, survival in an enclosed environment isn't possible since these plants thrive on sunlight. Therefore, a concern is the problem in trying to optimize the growth of in-house cactus plants using low, or artificial, light sources (Singh, R., 2017). This concern is the same with hydrophytes, mesophytes and halophytes, since often these plants require natural sunlight to activate the thylakoid membranes (Singh, R., 2017). This is a concern because the photosynthetic activation centres in plants need different temperature requirements between genera and among species (Singh, R., 2017). Unlike the greenhouse where the temperature for acclimitisation is optimum, enclosed environments may harm plants due to detrimental effects on the plants (read Jourdan *et al*., 2000). Since the climate in SA is between average and above average, enclosed environments may cause plants to transpire excessively and wilt (Thorpe *et al*., 1991), in the case of mesophytes. Xerophytes may enjoy the external environments, but too much rainfall can damage the photosynthetic apparatus due to cooling of plants (Singh, R., 2017).

ii. Medium influences

The external environment in which plants grow is made up of soil and administered nutrients, in the form of fertilizers (Fanning and Fanning, 1989). In the *in vitro* environment, however, the growing environment is jelly-like and contains nutrients of specific quantities that desired plant species, or genera require (Pospisilova *et al*., 1992). A concern however, is whether or not established plants and growing plantlets of the same species differ in growing capacities, since although the nutrients in the media may be the same, in the forestry industry, the sources or form of chemicals administered may be different (Singh, R., 2017). In the *in vitro* setting, plant organs and plantlets grown in media are well-protected and, thus, well-fed (Pospisilova *et al*., 1992; Newell *et al*., 2003). On the other hand, this isn't always possible to achieve through nutrient analysis in the ex vitro environment, since aspects of rainfall, water run-off and soil erosion are matters of concern in SA forestry industries, and other forestry industries (Singh, R., 2017). Since auxins, used for enhanced phototropic activity in plants, can be added to *in vitro* media and soil, shoot production in both environments is possible (Singh, R., 2017), but it is achieved much more easily in vitro media (read Mokotedi et al., 2000; Glasovskaya, 1987). However, a concern is that although this aberration is clear, it's not always appropriate to make this deduction, because the readability of shoot production is dependent on the nature of berbaceous, species and genera of plants being tested (Singh, R., 2017). Thus, medium influences on plants is definite in that plantlets in the *ex vitro* environments would probably struggle to thrive, a major concern with the abundance of invasive plant species colonizing vacant grounds in South Africa.

FACTORS OF PLANT ESTABLISHMENT AND GROWTH

i. Hardening-off of plantlets

In the South African Forestry Industry, the hardening-off of plants usually involve the use of inserts (Glasovskaya, 1987). Although the inserts vary in shape and size, the degree of rootability of different plants must first be known. Since length of growing roots, and their architecture, determines the inserts to be used, optimum acclimatization conditions is still a concern (Singh, R., 2017). In *Eucalyptus grandees x niters*, for example, hydrids are difficult to harden-off since this species is difficult to root, and requires optimum rooting protocols prior to establishing them in forests, or places suitable for growth. Another limiting factor here is water retention. Specific plant species, like hydrophytes, need longer water retention times (Singh, R., 2017). Therefore, length, width and sizes of pores and slits on inserts wouldn't necessarily correlate with the growth of the plant species tested, due to their rooting capacity (Karrenberg et al., 2000; LaMotte and Pickard, 2004). Root curvature and expansion may be more limited in inserts as compared to the natural environment, because inserts may induce abnormal root shapes, which may be avoided completely in the ground (Preece and Sutter, 1991). Therefore, plant selection for rooting within inserts and in the ground is of vast concern.

ii. Nutrient depletion and bacteria

In the forestry industry, nutrient utilization and bacterial infection becomes a concern when plants stop growing optimally. In the case of commensals, nutrient depletion can be considered a critic hindrance to plant growth. However, in the case of parasitic infections, it becomes difficult to deduce that nutrient depletion is having an effect on plant growth. Therefore, a concern is that in order to maintain growth of healthy plants, foresters must first try to identify bacterium species for different plant species (Singh, R., 2017). Some fertilizers, plant hormones and chemical substances, like auxin, gibberillins, ethylene, e.t.c., have been found to have an antagonistic, or vice versa, effect on soil nutrient content. Further to this, these substances also stimulate bacterium growth in soils. These bacteria include, amongst others, nitrifying and denitrifying bacterium, which are central to the nitrogen cycle (Singh, R., 2017). A concern is whether the mentioned substances effect nitrogen bases in the soil, since soil requires humus content for proper rooting to occur (Fanning and Fanning, 1989; Glasovskaya, 1987). A limited humus content implies that abnormal rooting and, thus, obstructed hydraulic efficiency would occur (read Fila *et al*., 1998).

HYDRAULIC CONDUCTIVITY, RAINFALL AND WATER

There's an abundance of rainfall throughout the year in South Africa, but as of lately, there's a decline in the annual rainfall in parts of SA (Singh, R., 2017). This has impacted greatly on crop production, causing farmers to search for new harvesting strategies. Although this isn't necessarily a concerted effort, the attempts made are labour-intensive, and may require additional costs. Water, a biological solvent, isn't as 'nutritious' to plant life compared to rainfall because the latter is a natural form of water. However, the elements of rainfall are the same, with the exception that tap water contains phosphorous and chlorine due to the decontamination process (Singh, R., 2017). A concern, however, is when plants utilize water, and in the process, embolisms form. Identification of these hydraulic obstructions are possible, but difficult, since embolisms aren't always localized, and never are, in (and for) particular plant species (read Mokotedi *et al*., 2000). Often dye-staining of the tracheids, the xylem, and the phloem are used to identify hydraulic conductivity problem, but a limitation is that embolisms may exist due to many factors, viz., sunlight intensity, transpiration pull, contamination soil, and even, excessive drought conditions.

CONCLUSIONS OR PERSPECTIVE

There are many factors that impose restrictions on proper farming practices in SA. Rainfall, hydraulic conductivity, hardening-off and climate change of plants had been discussed. Although this mini-paper hadn't taken into account all the concerns of the SA forestry industry, those listed, may also be applicable to international forestry businesses. Perhaps a critical concern is the difference between *in vitro* and *ex vitro* environments, however, problems viz. hydraulic conductivity may also occur with the use of *in vitro* media. The use of inserts may not necessarily be reliable during the rooting of plantlets from *in vitro* cultures, or field specimens. It can thus be deduced that the limitations for optimum yield of vegetation and ornamental plant species in the SA forestry industry are widespread and prevalent.

REFERENCES

1. Fanning, D.S., Fanning, M.C.B. (1989). Soil: Morphology, Genetics and Classification, USA, Canada: John Wiley and Sons Inc.
2. Fila, G., Ghashghaie, J., Hoarau, J., Cornic, G. (1998). Photosynthesis, leaf conductance and water relations of in vitro cultured grapevine rootstock in relation to acclimatization. *Physiology of Plants* 102: 411-418.
3. Jourdan, C., Michaux-Farriere, N., Perbal, G. (2000). Root system architecture and gravitropism in the oil palm. *Annals of Botany* 85: 861-868.
4. Karrenberg, S., Blaser, S., Kollmann, J., Speck, T., Edwards, P.J. (2003). Root anchorage of saplings and cuttings of woody pioneer species in a riparian environment. *Functional Ecology* 17: 170-177.
5. La Motte, C.E., Pickard, B.G. (2004). Control of gravitropic orientation II. Dual receptor model for gravitropic. *Functional Plant Biology* 31: 109-120.
6. Mokotedi, M.E.O., Watt, M.P., Pammenter, N.W. (2000). *In vitro* rooting and subsequent survival of two clones of a cold-tolerant *Eualyptus grandis x nitens* hybrids. *HortScience* 35 (6): 1163-1165.
7. Glasovskaya. (1987). Soils of the world: Soil families and types (Volume 1), AA BLKEMA/ROTTERDAM, Moscow: Moscow University Publishers.
8. Newell, C., Growns, D., McComb, J. (2003). The influence of medium aeration on in vitro rooting of Australian microcuttings. *Plant, Cell, Tissue and Organ Culture* 78: 131-142.
9. Pospisilova, J., Salarova, J., Catsky, J. (1992). Photosynthetic responses to stresses during in vitro cultivation. *Photosynthesis* 26: 3-18.
10. Preece, J.E., Sutter, E.G. (1991). Acclimatisation of micropropagated plants to the greenhouse and field, Dordrecht: Kluwer Academic Publishers.
11. Thorpe, T.A., Harry, I.S., Kumar, P.P. (1991). Application of micropropagation to forestry. In Debergh PC and Zimmerman RH (eds). Micropropagation: Technology and Applications, Dordrecht: Kluwer Academic Publishers, pp 311-335.
12. Singh, R. (2017). Personal writing and statement, Representing the Republic of South Africa, my country.