EFFECT OF PHOTOSYNTHETICALLY ACTIVE RADIATION ON THE *in vitro* INITIAL DEVELOPMENT OF BANANA CULTURES

EFEITO DA RADIAÇÃO FOTOSSINTETICAMENTE ATIVA NO DESENVOLVIMENTO INICIAL DE BANANEIRA in vitro

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- NOTA TÉCNICA -

ABSTRACT

Based on the evidence that the initial development of banana lateral buds in vivo occur in the absence of Photosynthetically Active Radiation (PAR), an attempt was made to evaluate this phenomenon under in vitro conditions. Thus, the hypothesis that PAR does not affect the initial development of banana explants in vitro was considered and confirmed. That means that light is not necessary during the first stage of in vitro culture. Reduction in the final cost of micropropagated plantlets is foreseen.

Key words: Photosynthetically Active Radiation, ***Musa acuminata****, banana, micropropagation,* ***in vitro****.*

Micropropagation of economically important plants has been successfully used in several countries, including Brazil. In the case of banana, there is presently a great demand for mass production of micropropagated plants, but the production costs are still high. These plants are intended both for the renewal of existing and the establishment of new plantings. One alternative to assure that the demand is met would be large-scale production through tissue culture techniques using cost-effective approaches. Many studies have been carried out with the purpose of reducing the costs of micropropagated production, mainly at the laboratory level (MORAES CEDREIRA et al., 1995). Another alternative for cutting costs would be to make a better use of light energy in growing rooms, since this item affects directly the final production costs.

Light influences plant growth and development because it is directly related to photosynthesis, phototropism and morphogenetic processes; light quality and intensity, direction and duration are properties that alter and interfer in plant development and metabolism responses (CHORY, 1997). In the present work we evaluated the *in vitro* development of lateral buds of *Musa acuminata* Colla cultivar Nanicão in response to different PAR intensities.

The explants were obtained from mother plants of *M. acuminata*, cultivar Nanicão, grown under field conditions. Lateral shoots measuring about 20-30 cm were used as explants. In the field, the shoots were reduced to 3-4 cm, carrying the apical bud and equal portions of the rhizome and the pseudo-stem. These were reduced to 2-3 cm in the laboratory, and disinfested in fresh water and in 3% sodium hypochorite solution for 20 minutes. The plant material was kept in sterilized distilled water until the next stage. A new disinfestation was performed in the laminar flow hood, using immersion in 3% sodium hypochlorite solution for 20 minutes, and 70% alcohol solution for 90 seconds. The material was kept in sterilized distilled water, reduced to a final 5 x 5 x 10 mm size, then transferred to the initial basal culture medium MS (MURASHIGE & SKOOG, 1962), with 5.75 µmol/L of indole-3-acetic acid (IAA), 3.32 µmol/L of N^6-benzyladenine (BA), 30 g/L sucrose, 7 g/L agar, MS vitamins and 5.8 pH. The cultures were maintained in a growth room for 50 days at 28°C ± 1 °C, under different PAR intensities: T_1= 0 µmol.m^{-2}.s^{-1} ;T_2 = 25 µmol.m^{-2}.s^{-1} ;T_3 = 50 µmol.m^{-2}.s^{-1} ;T_4 = 70 µmol.m^{-2}.s^{-1}. PAR values were established with the help of a Ceptometer.

The different morphogenetic expressions observed were directly related to the regulatory factors involved in a photomorphogenic system. Thus, the intensity patterns of PAR applied to cultures in the growth room were the factors determining the differences observed in the treatments and recorded in Figure 1 and Table 1.

Table 1 - Scale of color of banana explants exposed to different PAR intensities after 50 days in culture.

PAR	Days			
(µmol.m^{-2}.s^{-1})	15	30	40	50
0	w	w	w	w
25	w	w	cg	cg
50	w	cg	cg	g
75	w	cg	g	ig

w =white; cg = clear green; g = green; ig = intense green

The results of statistical analysis did not detect significant differences among the treatments. However, some studies have reported an increase in fresh weight and/or plant height when plants were exposed to low intensity light, as for example *Cordyline terminalis* (MILLER & MURASHIGE, 1976) and *Phalaenopsis* spp. (TANAKA et al., 1988c). On the other hand, studies performed with Begonia x hiemalis (WELANDER, 1978a) and with azalea (ECONOMOU & READ, 1986), recorded an increase in fresh weight and/or height when plants

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were exposed to high light intensity. Therefore, it may be concluded that different PAR intensities applied to the material did not affect the initial development of buds.

Figure 1 - Effect of PAR intensity on banana explants after 50 days in culture.

Although light may be essential, in some cases darkness is also beneficial for plant growing and morphogenesis, mainly at its initial stage of development *in vitro.* Some studies on *Heloniopsis*, *Lilium longiflorum* (LESHEM et al.,1982) and *Freesia hybrida* (BACH, 1987) emphasized the beneficial effects of darkness on plant development.

The visual analysis of plant development patterns associated with the pigmentation exhibited by buds in the different treatments revealed significant differences (Table 1 and Figure 1). The results seemed to vary according to the performing receiver pigment (chlorophyll, phytochrome, flavin, carotenoids and anthocyanins) absorbing the specific wave length to which they were exposed, followed by light intensity and duration. It is known that for photosynthesis it is necessary to have a large-scale conversion of light into chemical energy, while for photomorphogenesis, a lower scale conversion is needed for the production of messengers or regulatory signs. The application of 70 $\mu mol.m^{-2}.s^{-1}$ light intensity turned buds greenish, thus suggesting that the chlorophyll pigment had been activated and was acting in phytochrome system. As PAR was reduced to 50 and 25 $\mu mol.m^{-2}.s^{-1}$, this greenish color was lower. In the absence of light, buds became completely whitish, suggesting non-activation of the chlorophyll pigment. This leads to the supposition that PAR intensity affects pigment activation in banana explants *in vitro.*

These results support the hypothesis that the explants cultivated in the darkness can be submitted to the next micropropagation stage, cultivated under regular light intensities, have its phytochrome system reactivated and the tissue re-pigmented.

In conclusion, these results lead us to suggest that the PAR does not affect the initial development patterns of banana cv Nanicão, cultivated *in vitro,* as for the fresh weight, basal diameter and height of explants. Further work will be conducted out with exempt pigments buds and subsequently sub-cultivated into proliferation medium, as a means of estimating the PAR effect on the morphogenesis *in vitro.*

RESUMO

*Baseado na evidência de que o desenvolvimento inicial das gemas laterais da bananeira em condições **in vivo** ocorre em total ausência da Radiação Fotossinteticamente Ativa (PAR), buscou-se avaliar este fenômeno em condições **in vitro**. Assim, a hipótese que o PAR não afeta o desenvolvimento inicial de explantes de bananeira **in vitro** foi considerada e confirmada. Isso significa que essa luz não é necessária durante o primeiro estágio da cultura **in vitro**. Com isso, a redução no custo final da micropropagação da bananeira é prevista.*

*Palavras-chave: Radiação Fotossinteticamente Ativa, **Musa acuminata**, banana, micropropagação, **in vitro**.*

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