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Micropropagation in viticulture: twenty years of experience

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Vitroplant began as a micropropagation laboratory in the early 1980's to respond to a growing need for hybrid peach-almond GF677 rootstocks that were particularly suited to excessively dry or soils inducing chlorosis and for replanting. This rootstock, selected in France, is relatively simple to propagate *in vitro* while it is more difficult to carry out multiplication by cuttings. In subsequent years the range of *in vitro* propagated species grew and, in addition to other peach rootstocks, self-rooting peach, apricot, kiwi, artichoke and pear rootstocks started being multiplied. Today, micropropagation is the most advanced agamic multiplication technique allowing an elevated number of genetically identical plants to be obtained in a short time due to an exponential growth rate of the number of individuals with each subculture step. *In vitro* culture offers the advantage of high quality and health safety of the plant material as it not subject to an accumulation of pathogens or viruses over the years, as can occur with other agamic *in vivo* propagation techniques. Moreover, *in vitro* procedures pass on to plants a physiologic equilibrium that is comparable to that of seed-grown individuals, demonstrating good vigor of the aerial structures and notable rhizogenic exploratory ability in roots. These behaviors can be associated with a "rejuvenation" of the plant material. For example, the majority of grapevine cultivars have been, over the millennia, vegetatively propagated and for this reason they present important problems from a health standpoint. Toward the end of the 1980's Prof. Carmine Liuni, director of the Viticulture Institute of Turi (Bari), proposed a collaboration with Vitroplant for *in vitro* propagation with the aim of resolving some of the numerous problems found in viticulture nurseries. Initially the idea was to use this propagation technique to multiply some known rootstocks and new seedless table grape varieties. The results obtained from field tests were very satisfactory. The micropropagated plants were very vigorous and demonstrated excellent development of rooting structures, highlighting the potential of this propagation technique also in grapevine. This type of development, comparable to seed-grown plants, is not due to genetic mutation but rather to phenotypic manifestations that come from the rejuvenation of *in vitro*-produced plants. Juvenile phases are recognizable in some arboreal species thanks to specific morphological, cellular or physiological traits such as a particular leaf size, shape or phyllotaxis, the presence of thorns or ability to root. Plants do not however undergo genetic variations as they pass from the juvenile to the adult phase, instead these morpho-physiologic differences are expressions of the genotype. Juvenile as well as adult tissues can be present on the same plant at the same time, a phenomenon called heteroblasty, and leaves on a single plant can have different forms. Juvenile tissues are generally found in the lower portion of the trunk and branches. To lower the point of transition from juvenile to adult tissues, it is possible to make a cut near ground-height, avoiding the risk of juvenile tissues in the shoots intended for production. Micropropagation has shown to be an essential technique for the production of healthy material in quantity and rapidly, two aspects that are very useful for clonal selection or genetic improvement programs, providing nurseries with sufficient starting material in a timely manner. Micropropagated plants, as self-rooted plants not needing rootstock, can be subject to phylloxera attack. With careful attention to the selection of soil for mother plant fields and suitable preventative measures, it is possible to keep this pathogen under control. In any case, after five or six years micropropagated mother plants have fulfilled their purpose: they have provided quickly healthy buds for propagation. Today it is increasingly difficult to keep mother plants healthy in open fields and a reduction of their useful period with frequent renewal can be predicted for the future. A new frontier for nurseries in coming years may be the use of rootstocks amenable to genic silencing to induce resistance to viruses or other pathogens of the varieties onto which they are grafted. Unfortunately considerable difficulty can be expected with regard to the spread of this technique in Europe where there is deep aversion toward biotechnology, while in other emerging, future-competitor grape-growing countries the technique has a better chance of taking hold.