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Identification of Grafted Grapevines by RFID

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Abstract: The unmistakeable recognition of grafted grapevines is of essential significance for breeders. Different clones of a variety or plants from various origins have identical appearance and cannot be distinguished by traditional ampelographic methods. Valuable propagation material is under constant threat of being mixed up with other batches and becoming lost. A marking system to tag vines permanently during the grafting process could overcome this problem and provide breeders with the required safety in their motherblocks. In addition a permanent tagging system for grafted vines may also be used to back-track propagation material and e.g. identify time and place of a virus infection and take measures to protect other valuable breeding stock from the same origin.
Such a tagging system may provide a high safety level in the production of elite, base or pre-base material and protect breeders and nurseries from liability charges.
Key words: RFID, Grafted Grapevines, Traceability

INTRODUCTION

Electronic marking systems have a long tradition in the management of commodities. Once a tag is applied to the article the respective read-out system can read the data at any time. Thus an unmistakeable and unalterable recognition of the goods is always possible. These systems are called RFID = Radio Frequency Identification. They are very reliable and they can perform further tasks, e.g. survey the production and transport chain of critical products. Integrated temperature sensors are able to detect deviations of default temperatures during storage and transport.

Aside from these well-known possibilities other types called transponder are used for the identification of pets and farm animals. They are only 1-2 mm in diameter and have a length of 10-30 mm. Compared with classical RFID, transponder are still relatively expensive.

The unmistakeable recognition of grafted vines may be of essential importance for the grapevine breeder. Base populations grown from pre-grafted vines form the basis for any grapevine propagation. In these plantations mix-ups and errors have to be avoided at any rate, since the blending with potentially virus-infected seed stock may result in serious recourse claims against the breeder, nursery or grafter.

Different clones of a variety or plants from various origins have an identical appearance and cannot be distinguished by traditional ampelographic methods. Consequently the breeder needs a reliable marking system that can be used shortly after or during planting in the nursery which can guarantee that no vines that do not belong to designated lot are mixed up or have been mixed up with the existing propagation material. Such a system is required to provide the necessary safety for the base or pre-base propagation of grapevine material. It protects nurseries and grafters from problems and it does not constitute a monitoring system for the nursery.

The breeder can thus definitely track back each single vine to its motherblock and, in the case of disease caused by grafting, he is able to identify the time and place of the infection. And thus it is also possible to detect and weed out vulnerable plants or propagation material stemming from the same motherblocks.

MATERIALS and METHODS

The aim of this study is to develop basic principles for the marking of grafted grapevines by RFID-transponder.

When the transponder are inserted it is important that they cannot be detached from the grapevine afterwards and that they are attached to the grafted grapevine as early as possible. After some deliberations, the pith of 1-year old cane proved to be ideal to place the tags. Reasons are:

1) The inject was already inserted into the pith at the time of grafting which ensures, even in the consecutive grafting process, that the grapevines can be identified at any time and thus the risk of being mixed up is excluded.
2) After grafting, the inject cannot be removed or exchanged without destroying the plant.
3) The inject is sheltered from environmental effects while being invisible at the same time.

In order to investigate transponder and types of transponder for their applicability, the following types were tested:

a) Inject Type 1: Glass Tag, 3.15 mm * 13.30 mm, Hitag S 2048 (134.2 kHz), P/N 624240
b) Inject Type 2: Glass Tag, 4.0 mm * 22.0 mm, Hitag S 256 (134.2 kHz), P/N 623250 (Fig.: 1)

Fig. 1. Inject size compared to scion and rootstock (photograph C. Fischer)

The transponder are programmed by 7-digit numerical sequences. The data recording device is a Milan MPX Fa. Mannebeck, Type 121, Serial number 31193 Fig.: 2).

There were four types of grafting experiments:

1. Inject Type 1 (3.15 mm * 13.30 mm) in the scion.
2. Inject Type 1 (3.15 mm * 13.30 mm) in the rootstock.
3. Inject Type 2 (4.0 mm * 22.0 mm) in the rootstock.
4. Control group: standard grafting without inject.

Fig. 2. Read-out device Milan MPX Mannebeck, Type 121 (photograph C. Fischer)

In order to place the transponder at the designated positions in the scion and the rootstock we used a scion of approximately 6 cm length underneath the bud in Type 1. With a drill the pith was enlarged to the size needed and the transponder were positioned so deep in the cavity that they would not be touched by the grafting machine in the consequent grafting process. After the grafting process the graft material was covered with paraffin and packed into grafting boxes. The callusing was followed by the planting in the grapevine nursery.

RESULTS

During all stages of the experiment the functioning and the verifiability of the transponder was constantly monitored. After callusing the vines were planted in a nursery covered with plastic foil. There as well the functioning of all transponder could be confirmed. After digging up the rooted vines the transponder were examined again. Before and after sorting all transponder but one could be read out.

These are the results of the grafting experiments:

- Group 1: 18 grapevines planted, 12 grapevines saleable, 66% take.

- Group 2: 24 grapevines planted; 23 grapevines saleable, 95% take. (One drop-out due to failure of the inject)
- Group 3: 40 grapevines planted, 38 grapevines saleable, 95% take.
- Control group: 290 grapevines planted, 227 grapevines saleable, 78% take.

Only one grapevine of group 2 had to be separated due to failure of the inject. Since the inject showed no mechanical damage this grapevine was also counted among the basically saleable grafted grapevines.

In group 1, inject in the scion, the take rate was a little lower. The groups inject in the rootstock showed comparable results for both inject types. The take rate was on a high level which was in accordance with the general grafting success in that year.

Overall it can be stated at this stage:

- The marking of grafted grapevines with RFID-transponder which is common practice in animal husbandry works without difficulties. The transponder can be positioned either in an elongated scion or in the rootstock.The transponder have no negative effect on the grafting success. The groups - inject in the rootstock showed better results than the group - inject in the scion. Consequently transponder will be positioned in the rootstock in future experiments.
- Almost all transponder could be read out and were fully functional after digging out and sorting.

OUTLOOK

Planting of these vines in the vineyard and their further observation will show how the performance of the transponder changes and whether they can be read-out over several years. Particularly the read-out results obtained at ground level and under a minor soil coverage will strongly influence the usability of this method.

Fig. 3. Drilled rootstocks (photograph C. Fischer)

Fig. 4. Positioning of transponder in the rootstock (photograph C. Fischer)