The aim of the experiment was to increase the efficiency of bench grafting technology for walnut propagation.

The experiment was carried out with the walnut cultivar ‘Izvor 10’ grafted on common walnut rootstock (J. regia L.).

Two variants were compared: Variant I (Control) – the plants were put for callus formation in open box palettes and the place of grafting and the whole scion were coated with paraffin and Variant II – the plants were put for callus formation in box palettes firmly wrapped in plastic and the scion and the rootstock were loosely wound with a rubber tube.

The box palettes were stored in a room where the temperature was maintained at 27°C (± 1°C) for 25 days.

The survival rate in the control (Variant I) was 46.1% in average for the three years and in Variant II – 76.4%, the difference between the two variants being statistically significant.

The results obtained gave the
reason to conclude that the percentage of successfully propagated plants increased when the scion and the rootstock were fixed in a way providing good aeration at the grafting place and the plants were kept under conditions of high air humidity.

Key words: walnut (Juglans regia L.), bench grafting.

INTRODUCTION

Various methods of indoor walnut grafting have been used worldwide. The most popular and widely applied technology is putting the grafted plants in wooden containers and storing the containers in a room with controlled temperature. In our country the method is popular as indoor production of walnut planting material in a stratification chamber.

That method of propagation is known in the world as bench grafting. In Bulgaria bench grafting was studied by Anadoliev (1983). The author reported that the percentage of successfully propagated plants varied from 77.9% to 88.6%.

Contrary to those results, other authors (Tsurkan, 1990; Özkan and Gümüs, 2001; Terziiev, personal correspondence) obtained a significantly lower percentage of successfully propagated plants. Tsurkan (1990) reported a survival rate from 5% to 45%, explaining that the variation depended on the grafting method. According to
прихващането зависи от начина на присаждане. Според Özkan and Gümüs (2001) процентът на прихващане при отделните сорове е в границите от 33% до 53%. Терзиев (лична кореспонденция) получава около 40% калусообразуващи растения в три последователни години.

Целта на експеримента е да се повиши ефективността на технологията за размножаване на орех в стратификация.

МATERIAL И МЕТОДИ

Експериментът беше проведен с ореховия сорт Извор 10 през периода 2008 – 2010 г. За подложки се използваха семеначета от обикновен орех (J. regia L.). Присаждането се извърши на разцеп. Фиксирането между подложката и присадника се осъществи по два начина, които определяха първата разлика между прилаганата у нас технология (Анadoliev, 1983) и проведението на експеримент — фиксиране с парафин и завързване с гумен шлаук. В първия случай парафинирането се правеше на целият калем, включително и върху мястото на присаждане. При използването на гумен шлаук, само връхната част на калема се потапяше в разтопен

ÖZkan and Gümüs (2001) the survival rate in the different cultivars ranged from 33% to 53%.

Terziev (personal correspondence) obtained about 40% of callus-forming plants in three consecutive years.

The aim of the experiment was to increase the efficiency of bench grafting technology for walnut propagation.

МATERIAL AND METHODS

The experiment was carried out with the walnut cultivar ‘Izvor 10’ during the period 2008-2010. Seedlings of common walnut (J. regia L.) were used as rootstocks. Cleft grafting was applied.

Fixing between the rootstock and the scion was achieved in two ways, which determined the first difference between the conventional technology applied in our country (Anadoliev, 1983) and the present experiment, in which fixing was achieved with paraffin coating and binding with a rubber tube.

In the first case the whole scion was coated with paraffin, including the place of grafting. When using a rubber tube, only
парафин, за да се запази влагата му. Другата разлика беше начинът, по който се осигуряваше въздушна влага на присадените растения. При възприетата у нас технология, присадените растения се оставят в отворени бокс палети, като влажността в помещението и тази на стратификационната среда се поддържат чрез оросяване с лозарска пръскачка. В проведенния експеримент бокс палетите с присадените подложки бяха плътно обвити с полиетилен. Тези две различия определиха варианти на експеримента.

Варианти:

Вар. І. Присадени растения, поставени в открити бокс палети, като калема и мястото на присаждане са покрити с парафин (контрола);

Вар. ІІ. Присадени растения, поставени в плътно обвити с полиетилен бокс палети, като мястото на присаждане е завързано с рехаво намотан гумен шлаух.

Присадените подложки от двата варианта се поставиха в дървени бокс палети, като корените им бяха покрити с леко навлажнена смес, състояща се от борови стърготини, смесени с равно количество перлит. Бокс палетите бяха поставени в стратификационно помещение, където в the scion tip was dipped in liquid paraffin to protect its moisture.

The other difference was the way of providing air moisture to the grafted plants. In the technology adopted in our country, the grafted plants are stored in open box palettes and humidity in the premises and in the stratification medium is maintained by sprinkling with a backpack sprayer. In the present experiment the box palettes with the grafted plants were firmly wrapped in plastic. Those two differences determined the variants of the experiment.

Variants:

Var. І. The grafted plants stored in open box palettes, the scion and the place of grafting coated with paraffin (control);

Var. ІІ. The grafted plants put in box palettes, firmly wrapped in plastic and the place of grafting loosely bound with a rubber tube.

The grafted rootstocks of the two variants were put in wooden box palettes and the roots were covered with a moisturized mixture of fir sawdust mixed with the same amount of perlite. The box palettes were stored in the stratification premises where the temperature was maintained at
продължение на 25 дни се поддържащо температура от 27°C (±1°C). Откритите бокс палети се оросяваха ежедневно, до навлажняване на стратификационната им смес. По време на калусообразуването се отчиташе неколкократно въздушната влага в помещението (стратификалната) и тази в закритите с полиетилен бокс палети. След посочения по-горе срок, отоплението се изключи и два дни стратификалната беше оставена без отопление, след което прихванатите растения се засадиха в контейнери. Месец по-късно е отчетен процентът на прихващане.

Всеки вариант беше представен от по пет бокс палета, като във всеки бокс палет се нареждаха по 50 присадени растения. Всеки бокс палет се считаше за отделно повторение.

Получените данни от изследванията бяха обработени статистически, като за целта се използва тестът на Дънкан (Steele and Torrie, 1980).

РЕЗУЛТАТИ И ОБСЪЖДАНЕ

Представените резултати в Таблица 1 показват, че през 2008 г. от контролата (вар. І) са получени 44.8% успешно размножени растения, а от 27°C (±1°C) for 25 days.

The open box palettes were moisturized everyday to provide humidity to the stratification mixture.

Air humidity in the premises (the stratification chamber) and in the box palettes wrapped in plastic, was reported several times in the period of callus formation. After that period, heating was switched off and the stratification chamber was left without heating for two days and then the grafted plants were planted in containers.

A month later the survival rate of the grafted plants was reported.

There were five box palettes in each variant and 50 grafted plants were put in each box palette. Each box palette was taken as a separate replication.

Data obtained were statistically processed following Duncan’s test (Steele and Torrie, 1980).

RESULTS AND DISCUSSION

The results presented in Table 1 show that in 2008 the survival rate in the control (Var. 1) was 44.8% and in Var. 2 – 71.6%, the difference between
вар. ІІ – 71.6%, като разликата между двата варианта е статистически доказана. Подобни са и резултатите през 2009 г. – при вар. І са калусообразували е 54.0% от присадените растения срещу 82.8% при вар. ІІ. Установената закономерност се наблюдава и през 2010 година. Прихващането при вар. ІІ отново е по-голямо (74.8%) от това на вар. І (39.6%). Средно за трите години от контролния вариант (вар. І) са получени 46.1% успешно размножени растения, а от вар. ІІ – 76.4%, като разликата между двата варианта е статистически доказана и е в полза на присадените растения от вар. ІІ.

The results obtained in 2009 were similar: 54.0% of the grafted plants in Var. 1 formed callus, versus 82.8% in Var. ІІ.

The same tendency was observed in 2010.

Again the survival rate in Var. ІІ was higher (74.8%) compared to Var. І (39.6%). 46.1% successfully propagated plants were obtained in average for the three years in the control (Var. І) and 76.4% – in Var. ІІ, the difference being statistically significant in favour of the grafted plants in Var. ІІ.

Таблица 1. Процент на успешно размножени растения от сорт Извор 10 през периода 2008 – 2010 година
Table 1. Percentage of successfully propagated walnut plants of ‘Izvor 10’ cultivar in the period 2008 – 2010

<table>
<thead>
<tr>
<th>Варианти</th>
<th>Percentage of survival rate for the years of the experiment</th>
<th>Средно за трите години, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Парафинирани растения, поставени в открити бокс палети (контрола).</td>
<td>44,8 a</td>
<td>46,1a</td>
</tr>
<tr>
<td>I. Plants coated with paraffin and put in open box palettes (Control)</td>
<td>54,0 a</td>
<td></td>
</tr>
<tr>
<td>II. Завързани с гumen шлаух растения, поставени в обвити с полиетилен бокс палети</td>
<td>71,6 b</td>
<td>76,4 b</td>
</tr>
<tr>
<td>II. Plants bound with a rubber tube, put in box palettes wrapped in plastic</td>
<td>82,8 b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>74,8 b</td>
<td></td>
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The results presented in Table 1 differ from the data obtained by Anadoliev (1983), who applied the method used as a control variant in our experiment (Variant I), reported a survival rate of 77.9% in 1973 and 88.6% in 1974.

In the present experiment the survival rate in Variant I was 46.1% in average for the three years, which was almost twice lower than the above-mentioned data.

Our results confirmed the studies of Tsurkan (1990) and Özkan and Gümüş (2001) and they were also in conformity with data obtained by Terziev (personal correspondence) about the unsatisfactory percentage of survived plants obtained by bench grafting.

After applying that technology, Tsurkan (1990) announced a survival rate varying from 5% to 45%, and Özkan and Gümüş (2001) – from 33% to 53%.

The percentage variation in the experiments depended on the grafting method and on the genetic type of the cultivar. Terziev (personal correspondence) also obtained about 40% of callus formation after applying bench grafting.
According to a number of authors (Ferhatoğlu, 1997; Stansavljević and Mitrović, 1997; Germain et al., 1999; Achim and Botu, 2001; Özkan and Gümüs, 2001; Solar et al., 2001) the relative air humidity of about 80% (±10%) created favourable conditions for callus formation in walnut. In the present experiment, the reported relative humidity in the room where the open box palettes with the grafted plants were stored for callus formation (Variant I) varied within the optimal values mentioned in literature, i.e. from 72% to 85%.

In Variant II, the air humidity in the palettes wrapped in plastic was high – about 98% (± 1%). The results obtained showed that the high humidity provided to the plants in Variant II, did not compromise the callus formation process.

Obviously, there are differences between the two variants, concerning the humidity maintained at the place of grafting. It depends on the way of fitting the scion to the rootstock.

The excessive humidity in the control (Variant I) is retained at the grafting place thanks to the paraffin coating.
Pinghai and Rongting (1993) demonstrated that excessive sap bleeding at the place of grafting creates anaerobic conditions and decreases the survival rate percentage.

In variant II the loose winding with the rubber tube enables its evaporation. According to Pinghai and Rongting (1993) the excessive sap bleeding at the place of grafting creates anaerobic conditions and decreases the survival rate percentage.

CONCLUSIONS

Improvement of the bench grafting technology for walnut propagation is obtained by applying concrete practices – fitting the scion to the rootstock with a loosely wound rubber tube and putting the grafted plants in box palettes firmly wrapped in plastic.

The survival rate percentage in stratifying chambers is increased when fitting the scion to the rootstock in a way providing good aeration at the grafting place and storing the plants under conditions of high air humidity.

The provision of high air humidity (about 95%) at the grafting place does not compromise the callus formation process.

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