Agronomy Research **1**, 69–74, 2003

Influence of different planting material on production of stawberry runner plants

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Abstract. The reproductive growth intensity of micropropagated (MP) strawberry plants of cultivars Bounty, Jonsok and Senga Sengana, their three subsequent generations of runner plants (RP), two-year-old conventionally propagated runner (RP) plants, and micropropagated plants of different *in vitro* ages and origins were evaluated in two field experiments conducted in South Estonia in 1997 and 2001.

The following conclusions may be drawn on the basis of these experiments: 1. Of the three cultivars included in the experiment, cv. Jonsok gave the highest number of runner plants. 2. The micropropagated runner plant generations of cv. Senga Sengana and the two- year-old conventionally propagated plants did not show reliable difference in their runner plant production. 3. Reproduction rate was influenced rather by the age of the plantation than by the age of micropropagation material. 4. A three-year-old plantation is not suitable for collecting material for further propagation. 5. Younger mericlones produce plants with higher runner production rates than older ones.

Key words: *Fragaria x ananassa,* cultivars, *in vitro* planting material, runner plants

INTRODUCTION

The two major propagation methods for strawberry plants are conventional propagation by runner plants in the field and micropropagation in a laboratory, using sterile tissue culture techniques. The later is considered one of the most effective methods of obtaining healthy plants. On the other hand, there are controversial statements about the yield potential of micropropagated plants. There are considerations that micropropagated plants do not have any significant advantages in comparison with the traditional runner-plants if we look at the yield potential and fruit quality (Cameron et al., 1989; Damiano, 1980). Other authors have reported that micropropagated plants have given higher yields (Theiler-Hedtrich & Woltenberger, 1987) and significantly more runners than conventional plants (Boxus et al., 1984; Dijkstra, 1994; Thuesen, 1984). Therefore it is not known, how long the micropropagated plants could be propagated in the field without losses in yield potential of the progeny and how their ability of producing runners changes in time. In trials performed in Poland, micropropagated plants gave more runners than the conventionally propagated plants but in subsequent field generations this effect disappeared (Szczygiel et al., 2002).

Vegetative reproduction ability and yield potential also depend on the conditions were plants are grown prior to their planting out in the field. While growing plants in a plant bed or a plug tray, even the size of the pot and duration of the rooting period may influence the result. In Norway it has been shown that plants grown on trays with smaller plugs and shorter rooting period gave more runners and had higher yield potential than plants grown on trays with bigger plugs and for a longer rooting period (Nes, 1999).

Field performance of the plants obtained via tissue culture depends on the selection of initial material, media composition, number of transfers in culture, the cultivar and many other factors. Several authors have noted that cultivars responded differentially to micropropagation (Dalman & Matala, 1997; Swartz et al., 1981). A too high number of subcultures deteriorates the quality of micropropagated plants (Kinet & Parmentier, 1989), therefore it is suggested to limit the number of transfers to 5–10 times.

The aim of the present study was to determine how the intensity of runner plant formation in micropropagated plants differs from that of the subsequent field generations, and if there any differences in the reproductive growth of micropropagated plants of different origins and different mericlone ages.

MATERIALS AND METHODS

Survey was done on the basis of two trials. Both trials were carried out at Oru-Nõlvaku farm in Viljandi County. The first trial was established in 1997 and the second one in 2001. Cultivars included in the trials were 'Jonsok', 'Bounty' and 'Senga Sengana'. In the first experiment, the runner plant formation of micropropagated (MP) plants, the three subsequent field generations of MP plants and two-year-old conventional runner-propagated (RP) plants were compared in the autumn of the year the plantation was established. The following variants were included:

M_I – the first generation of runner plants from micropropagated mother plants (origin: MTT Laukka Research and Elite Plant Station, Finland) collected from a three-year-old plantation (control);

M_{II} – the second generation of runner plants from micropropagated mother plants collected from a two-year-old plantation;

M_{III} – the third generation of runner plants from micropropagated mother plants obtained from a one-year-old plantation;

M_0 – micropropagated plants (Plant Biotechnological Research Centre EVIKA, EAU);

M_2 – two-year-old strawberry plants, obtained from a two-year-old plantation of MP plants and further grown in a plant bed during one season.

All the cultivars in the trials were represented with four similar variants (the first four in the list above), in addition, cultivars 'Jonsok' and 'Senga Sengana' had the fifth variant with two-year-old RP plants.

The experiment was established with four repetitions of 25 plants. Rows were covered with a 1.0-m wide black piece of plastic. Plants were transplanted in rows, with spacing 30 cm in a row. The distance between the rows was 1.40 m.

Table 1. Cultivars and mericlones used in the second experiment.

Jonsok	Bounty	Senga Sengana
1997	1996	1996
2000	1997	2000
1999 OÜ Mikrotaim clone (H)	1998	R
	2000	1999 (H)
	Swedish clone (R)	

In the second trial, the runner plant formation of MP plants from different mericlones was assessed in the autumn of the first year of growth. The mericlones were established in different years and those included in the trial are listed in Table 1. In addition to MP plants from The Plant Biotechnological Research Centre EVIKA (8 mericlones, plants grown in peat rolls), there were MP plants of two cultivars 'Bounty' and 'Senga Sengana' from The Elite Plant Station in Bålsgard, Sweden (plants grown in peat cubes wrapped in thin decomposable tissue) and MP plants of cultivars 'Jonsok' and 'Senga Sengana' from OÜ Mikrotaim laboratory in Räpina. The latter were delivered as *in vitro* rooted plants and were planted into peat rolls, acclimatised and grown into suitable size on the farm.

The experiment was established with three repetitions of 25 plants. Rows were covered with a 1.0-m wide black plastic. Plants were transplanted in double rows at distances 30 cm between and 40 cm within rows. The distance between double rows was 80 cm. Mericlones established in year 2000 were taken as control plants

Both experimental fields were located on sandy-clay soils. Before planting 100 t/ha of cattle manure, phosphorus 50 kg/ha and potassium 100 kg/ha were applied to the plot (the amounts of fertilisers are given in active ingredients).

In order to evaluate the intensity of runner plant formation, the runner plants were counted on all the plots of both experiments in the September of the first year of growth. In 1997 runners were also counted separately. In the experiment established in 2001, the growth and uniformity of the plants from different mericlones were estimated visually. ANOVA was used for statistical treating of the data.

RESULTS AND DISCUSSION

In the experiment established in 1997, the highest number of runner plants developed on the plants of cv. 'Jonsok' (Fig. 1). The smallest number of runner plants developed on control plants (M_I) of cvs. 'Jonsok' and 'Bounty'. In all the cultivars, the MP plants produced the highest number of runner plants.

The two-year-old RP plants of cv. 'Jonsok' and the third and second generations of MP plants of cvs. Cvs. 'Jonsok' and 'Bounty' produced more runner plants than control plants, at a level reliably similar to that of MP plants. In cv. 'Senga Sengana', only MP plants produced more runner plants than the control plants. Several authors have noted that the runner plant production of 'Senga Sengana' MP plants and conventional RP plants is similar (Borkowska et al., 1999), or does not reveal any

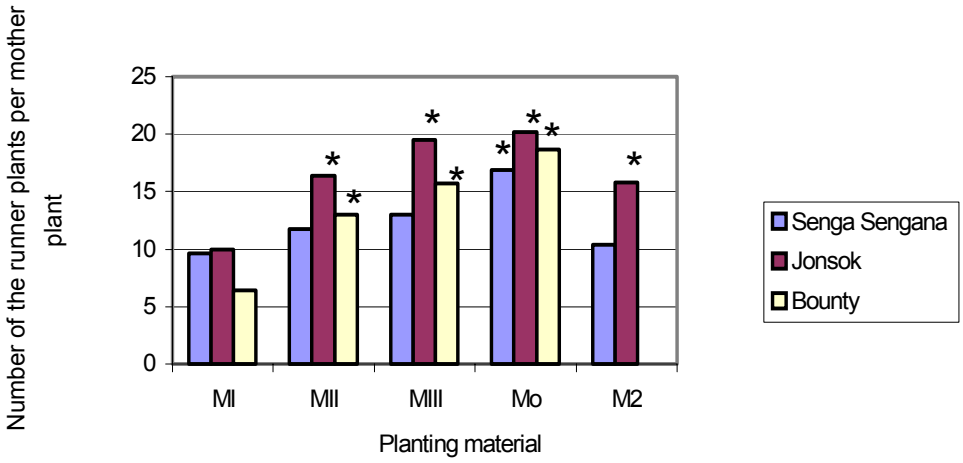

Fig. 1. Influence of the planting material on strawberry runner plant production, in 1997. * significant ($P < 0.05$) differences from the control.

remarkable differences (Dalman & Matala, 1997; Merkle, 1993). Different responses of cultivars to micropropagation have also been noted by other authors (Dalman & Matala, 1997; Karhu & Hakala, 2002; Szczygiel et al., 2002; Swartz et al., 1981).

The experiments revealed that MP plants have good vegetative reproduction ability but the RP plants of the third generation after micropropagation originating from a young plantation ($M_{III,}$ originated from the one-year-old plantation) have also good vegetative reproduction ability. K. Karp (1998) has also studied strawberry runner plant formation on different planting material. In her trials, the MP plants did not produce more runner plants in comparison with the first generation of RP plants. The origins of micropropagated plants used in the two studies were different, the plants used by K. Karp in her experiment were obtained from AS Pühajõe Talu, whereas we used in our trials plants from the Plant Biotechnological Research Centre EVIKA and the MTT Laukka Research and the Elite Plant Station, Finland.

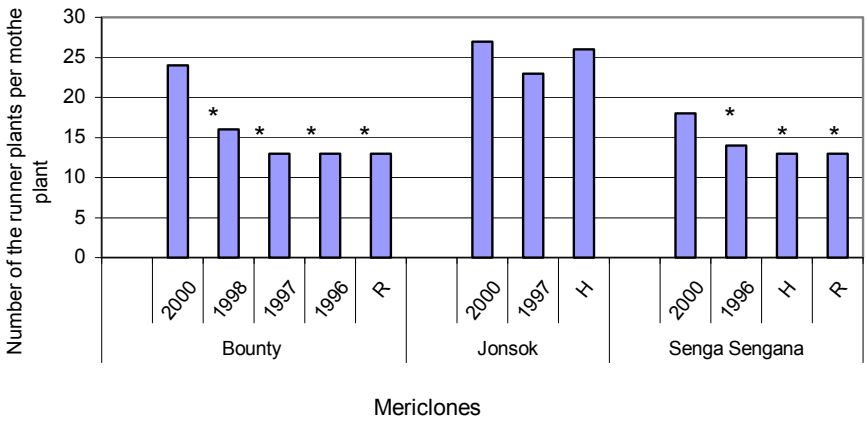

Fig. 2. Influence of the planting material on strawberry runner plant production in 2002. * – significant ($P < 0,05$) differences from the control.

Visual observations showed that, in the experiment established in 2001, the MP plants of Swedish origin had the most vigorous and uniform growth. There were no differences in the growth and uniformity of the plants from mericlones of different ages. The plants of cv. 'Jonsok' produced a lot of runner plants in all variants, with no reliable differences between variants. The number of runner plants produced by control plants in cvs. 'Senga Sengana' and 'Bounty' (the youngest mericlones in the experiment), was reliably higher than that of the older mericlones: MP plants of Swedish origin and Senga Segana MP plants of the OÜ Mikrotaim mericlone (Fig. 2). Similary to the results of our experiments, in studies conducted by other researchers (Jemmali et al., 1995), younger mericlones have given more runner plants than the older ones. At the same time, there have been studies revealing opposite results (Vasar & Kotkas, 2002).

CONCLUSIONS

- The vegetative reproduction ability of MP plants is good, as it has been shown in earlier studies.
- Cv. 'Senga Sengana' runner plant generations succeeding micropropagation and the two-year-old conventionally propagated plants did not show reliable differences in runner plant production.
- The third generation of MP plants also produced runner plants in quantities equal to the runner plant production of the MP plants, thereby the reproduction rate was affected more by the age of the plantation than the age of micropropagation material.
- A three-year-old plantation is not suitable for collecting material for further propagation.
- Younger mericlones produce plants with higher runner production rates than older ones.
- The ages of mericlones do not have influence on the growth and uniformity of plants.

ACKNOWLEDGEMENTS. This study was carried out with the financial support from the Estonian Science Foundation (grant no. 4731).

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