PERFORMANCE OF PLUG PLANTS AND FUMIGANTS FOR STRAWBERRY RUNNER PRODUCTION IN AUSTRALIA

S.W. Mattner*, M. Milinkovic, F.C. Greenhalgh
Victorian Strawberry Industry Certification Authority, Australia

Introduction

The strawberry nursery industry in Australia produces 90 million bare-rooted transplants (runners) per annum through pathogen-tested schemes. The schemes involve four generations (each generation takes one year) of vegetative multiplication of pathogen-tested Nucleus stock. Production in the later generations of multiplication (third and fourth generations) relies on soil fumigation, which safeguards against the build-up of soil-borne pathogens and weeds, and is a phytosanitary requirement of pathogen-tested schemes (Mattner et al., 2014). Mixtures of methyl bromide (MB) and chloropicrin (Pic) have been effective fumigants for controlling soil-borne pathogens and weeds over an extended period, but MB is being withdrawn. Soil-less techniques, such as plug plants (containerized transplants produced in soil-less media), avoid the need for fumigation, and therefore may offer an alternative to MB.

Analysis in Australia has shown that soil-less techniques (including substrates, hydroponics, aeroponics, and plug plants) would increase the cost of transplants for strawberry fruit growers by 4–15 fold compared with runners produced in fumigated soil (Mattner et al. 2016). Unlike other regions of the world, research in Australia has shown that plug plants do not consistently yield higher or earlier fruit than runners produced in fumigated soil (Menzel & Toldi, 2010; Mattner et al., 2016). The increased cost and inconsistent performance of plug plants has so far prevented their adoption by the fruit industry (Menzel & Toldi, 2010; Mattner et al., 2016). However, the use of soil-less techniques for production of the early generations of strawberry transplants (first and second generations) has shown greater promise (Mattner et al., 2016; Milinkovic et al., 2016).

This paper reports on research trials to evaluate the performance of third-generation plug plants for production of fourth-generation runners in the field in soils treated with different fumigants.

Methods

Field trials were conducted at Toolangi, Victoria in 2014/15 and 2015/16 in a brown ferrosol soil. Planting material in the trials (transplant treatments) consisted of plug plant mothers or bare-rooted mothers of the strawberry cultivars San Andreas (2014/15) and Monterey (2015/16). Plug plants were produced from runner tips (nodes) grown in a hydroponic system in a screenhouse following the method described by Milinkovic et al. (2016). Bare-rooted mothers were produced in commercial fields treated with MB/Pic (50:50, 500kg/ha).

Soil at the trial sites were treated in October with different fumigants (fumigant treatments), including MB/Pic (50:50, 500 kg/ha); 1,3-dichloropropene (1,3-D)/Pic (20:80, 400 kg/ha); Pic (350 kg/ha); dimethyl disulfide (DMDS)/Pic (79:21,

600 kg/ha); or left untreated (control). All fumigants were shank-injected to a soil depth of 20 cm, under LDPE or TIF (DMDS/Pic only) barrier film by a contractor (R&R Fumigation, Bayswater, Victoria). Films were removed from soil after 1-2 weeks. Plug plants and bare-rooted mothers were planted in the soils at 4 weeks after fumigation (November) in single rows, with plants spaced 50 cm apart. All agronomy through the trials followed standard industry practices. Yields of bare-rooted runners (commercial grade) per meter of row were determined in May the following year.

The trials were conducted as randomized split-plot designs, with four blocks. Fumigant treatments formed the main-plots and transplant treatments formed the split-plots. Data were analyzed using ANOVA as performed on Genstat (VSN International).

Results

Runner yields from plug plant mothers were significantly higher (up to double) than those from bare-rooted mothers in all soil treatments, except the MB/Pic treatment where they produced equivalent yields (Figures 1 & 2). Plug plants grown in soils treated with 1,3-D/Pic (20:80) or DMDS/Pic (79:21) produced equivalent runner yields to bare-rooted mother plants grown in soils treated with MB/Pic.

Discussion

Previous research in Australia has evaluated the suitability of plug plants for strawberry fruit production (Menzel et al., 2010; Mattner et al., 2016), but not for strawberry runner production. The current trials showed that plug plants produced higher runner yields than bare-rooted mother plants, when grown in soils treated with substitute fumigants to MB/Pic. This was most likely due to the earlier stolon growth of plug plants compared with bare-rooted runners, which provided cover and competed better with the higher populations of weeds in soils treated with substitute fumigants (unpublished data). Plug plants grown in soils treated 1,3-D/Pic (20:80) and DMDS/Pic (79:21) produced equivalent runner yields to bare-rooted mother plants grown in soils treated with MB/Pic (50:50). However, further research is needed on methods and integrated treatments to improve soil-borne pathogen and weed control with 1,3-D/Pic (20:80) and DMDS/Pic (79:21) to levels equivalent to MB/Pic.

Soil-less methods of production have so far proven too costly, compared with bare-rooted runner production in the field, for widespread adoption by the Australian strawberry nursery industry (Menzel & Toldi, 2010; Mattner et al., 2014; Mattner et al., 2016). However, soil-less technologies have greater potential for application in the early generations of runner multiplication, where plants have their highest value (Milinkovic et al., 2016). The use of third-generation plug plants combined with substitute fumigants and other integrated treatments, such as herbicides, shows promise as an alternative system to soil fumigation with MB/Pic for production of fourth-generation runners.

References:

Mattner et al. (2014). Critical challenges for the phase out of methyl bromide in the Australian strawberry industry. Acta Hort. 883: 99-106.

Mattner et al. (2016). Evaluation of soil-less systems for strawberry transplant production in Australia. Acta Hort. (in press).

Menzel & Toldi (2010). An evaluation of containerized plants for strawberries growing in a subtropical environment. HortTech. 20: 746-793.
Milinkovic et al. (2016). Development and performance of soil-less systems for strawberry transplant production in Australia. Acta Hort. (in press).

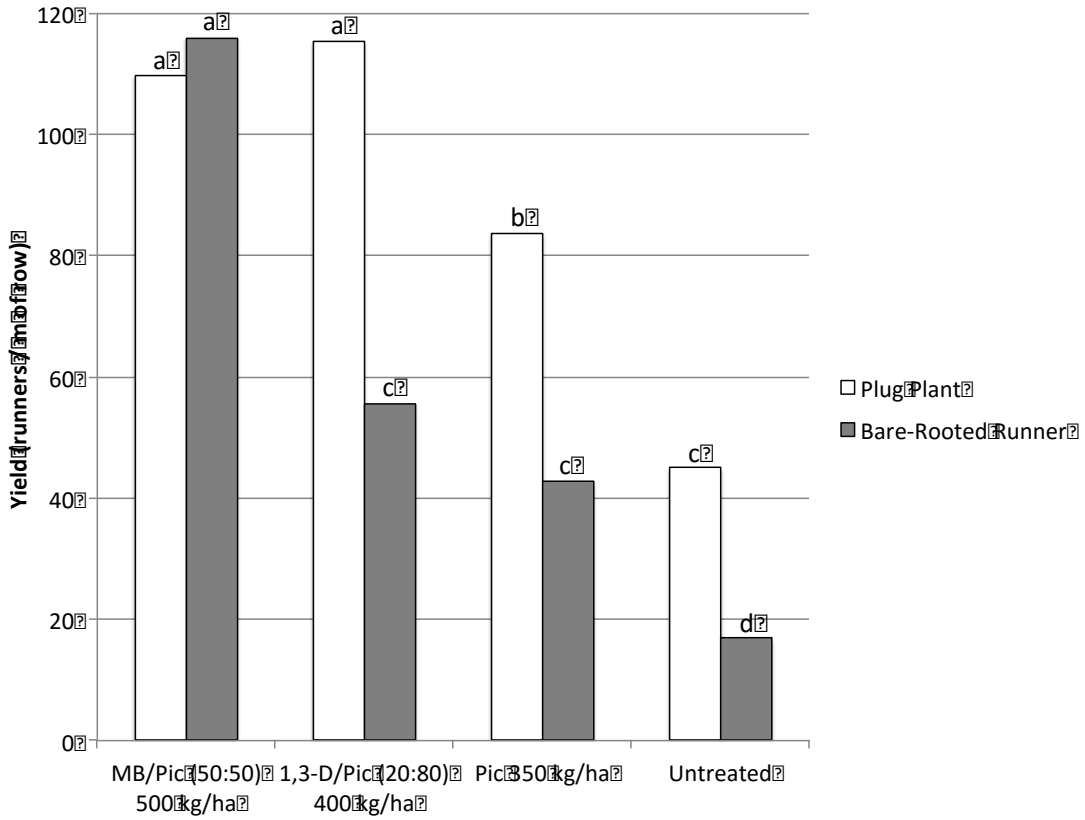

Figure 1. Commercial runner yields (runners / m of row) from plug plant and bare-rooted mothers of strawberry (cv. San Andreas) grown in soils treated with different fumigant treatments at Toolangi, Victoria (2014/15). Bars with different letters are significantly different, where $p \leq 0.05$.

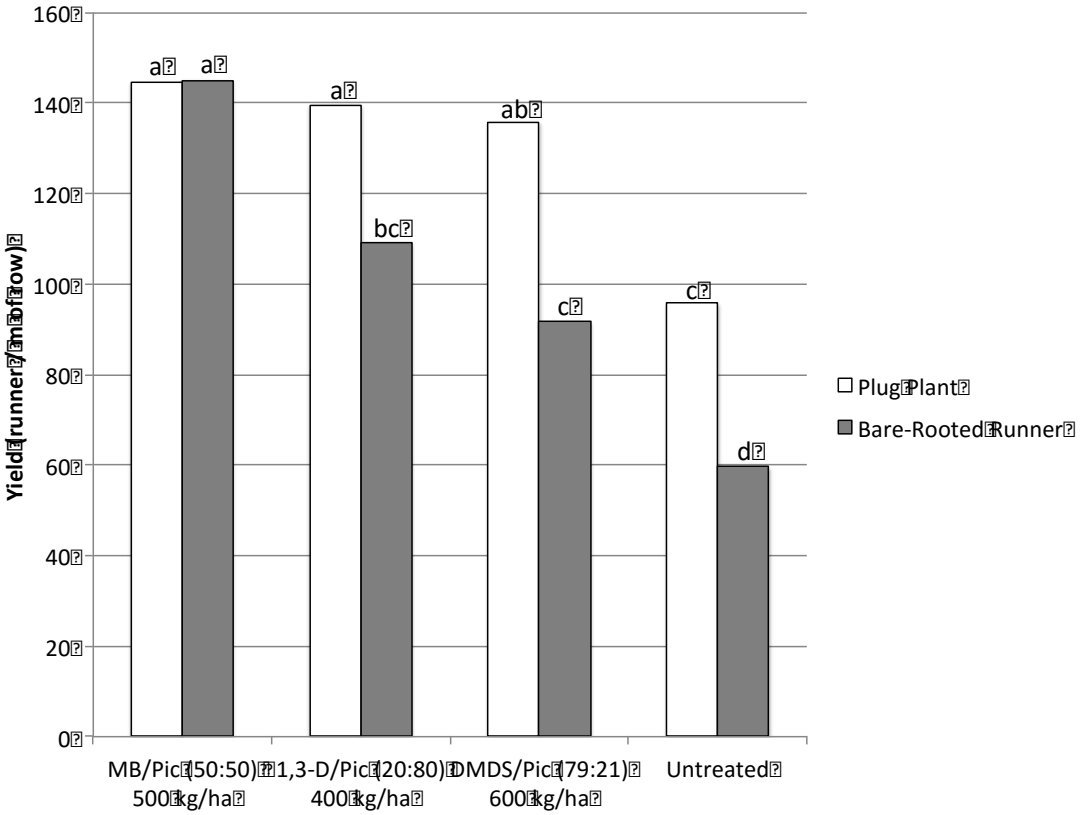

Figure 2. Commercial runner yields (runners / m of row) from plug plant and bare-rooted mothers of strawberry (cv. Monterey) grown in soils treated with different fumigant treatments at Toolangi, Victoria (2015/16). Bars with different letters are significantly different, where $p \leq 0.05$.