

Part A: SUMMARY

1. NOMINATING PARTY: AUSTRALIA

2. NAME AS PER NAMING CONVENTION (Section 3.5.2 of this Handbook)

AUS02 CUN19 Soil Strawberry Runners

3. BRIEF DESCRIPTIVE TITLE OF NOMINATION:

Re-application by the strawberry runner industry of Victoria, Australia, for critical use exemption in 2019 from the phase-out of methyl bromide (MB).

4. SOIL SITUATION OR STRUCTURE, COMMODITY OR OBJECT TREATED:

Soil fumigation for the production of strawberry runners in Victoria, Australia.

5. QUANTITY OF METHYL BROMIDE REQUESTED IN EACH YEAR OF NOMINATION:

2019 – 28.98 tonnes

6. SUMMARY OF ANY SIGNIFICANT CHANGES SINCE SUBMISSION OF PREVIOUS NOMINATIONS:

This nomination is for 28.98 tonnes of MB for soil disinfestation in the Victorian Strawberry Runner Industry at Toolangi in 2019. The nomination is made under Decision IX/6 because there are ‘no technically and economically feasible alternatives or substitutes available to the user’.

Recent research and development (R&D) has resulted in soil-less technologies for the economic production of runners of Mother stock (third generation) without the use of MB from 2019, but not of Certified runners (fourth generation). Currently registered substitute fumigants to MB do not provide sufficient control of soil-borne pathogens for the Certification Authority to allow their use under the rules of the Certification Scheme. Therefore, any runners grown in soil treated with substitute fumigants would be unmarketable, and this would result in a complete economic loss to growers using these treatments.

The current nomination represents the first step in industry’s new transition plan away from MB. It is based on industry adopting soil-less technologies for production of all Mother stock without the use of 750 kg of MB by 2019. This is a highly significant step towards final phase-out of MB in the strawberry runner industry in Victoria because growers will have adopted alternatives in three of the four multiplication generations in the runner Scheme. The move allows industry to concentrate all resources and R&D on MB substitutes for the final generation of Certified runners.

Further research and development is necessary to improve the technical and economic feasibility of substitute soil fumigants for production of Certified runners. Several trials have

already been established to address the issue of better control of soil-borne pathogens (especially at greater soil depth) and weeds without using MB. Results of these trials and ones to be undertaken in 2018/19 will be critical to enable the Certification Authority to have sufficient confidence in substitute technologies/practices to change the rules of the Scheme for production of Certified runner crops.

Other significant developments since submission of AUS02 CUN18 include:

TriForm 80 registered.

The soil fumigant TriForm 80 (1,3-D/Pic, 20:80) was registered for use in Australia at the end of 2016. TriForm 80 co-applied with herbicides potentially forms a key component of the Victorian runner industry's strategy to phase out MB. This is because research in the runner industry at Toolangi shows that the TriForm 80 formulation of 1,3-D/Pic has a lower risk of causing phytotoxicity in strawberry runner crops than formulations containing higher concentrations of 1,3-D (e.g. 40:60 and 65:35) [AUS02 CUN18, A25]. However, research also showed that TriForm 80 does not control pathogens as effectively as MB/Pic at greater soil depths (30 - 40 cm) (see Part C 8a). Pathogens that survived at these depths re-colonised the upper soil in plots treated with TriForm 80. By the time of runner harvest, soils treated with TriForm 80 had equivalent concentrations of soil-borne pathogens as untreated soil. In addition, trials in the strawberry fruit sector showed that runners from soil treated with TriForm 80 in the nursery produced 15% less fruit yields than runners from soil treated with MB/Pic in the nursery (see Part C 8a).

Current research on TriForm 80 in the Victorian runner industry is aimed at improving its ability to control pathogens. In 2015/16, results showed that deeper injection (25 cm compared with the standard of 15 cm) of TriForm 80 under VIF did not improve control of pathogens at greater soil depths (see Part C 8a). In 2016/17, trials have been established examining deeper injection (30 cm compared with the standard of 15 cm) of higher rates (500 kg/ha compared with the registered rate of 400 kg/ha) of TriForm 80 under TIF, integrated with the use of biofumigants or microwave soil treatments. Results from this work are anticipated to be available in October 2017.

In addition, TriForm 80 does not control weeds adequately unless integrated with the use of pre- (isoxaben) and post- (phenmedipham and fluzifop-p) emergent herbicides. Currently, isoxaben and phenmedipham are not registered for use in strawberry runner crops. TriForm 80 is not yet approved for use in the Victorian runner Scheme under the rules of Certification (see above). Therefore, any runners grown in soil treated with TriForm 80 are unmarketable and would result in a complete loss to growers using this treatment.

Facilities constructed to commercially evaluate production of mother stock runners using soil-less technologies

Recent research [A28, A29] and analysis (see Part E 16) indicates that improved soil-less technologies (involving the use of hydroponics and plug plants) are economically and technically feasible for production of Mother stock runners (the third generation in the Scheme). As a result of this research, the runner industry constructed two screened facilities

to conduct commercial evaluations of soil-less methods for production of Mother stock in 2016/17. It is anticipated that these evaluations will prove successful, and industry plans to scale-up infrastructure for full production of mother stock in soil-less systems by 2019. This move allows industry to phase-out 750 kg of MB that was previously used to treat 3 ha of soils for the production of mother stock. Although this move will result in a modest reduction in MB use in 2019, it is still a significant step towards final phase-out of MB. This is because growers will have ceased the use of MB in three of the four multiplication generations in the Scheme. The move allows industry to concentrate its resources and effort into research to address phase-out of MB in the final generation of runners, as soon after 2019 as possible. To achieve this, research in 2016/17 is evaluating methods to improve pathogen control with substitute fumigants at greater soil depths, such as deeper injection of fumigants, use of higher application rates, use of TIF films, and integration of fumigants with the use of biofumigants and microwave treatments.

Prototype machine developed to disinfest soil with microwave technologies.

The University of Melbourne, Victoria has recently designed and constructed a prototype machine to disinfest soil with microwave technology (Figure 1). This prototype is currently being evaluated for use in the runner industry at Toolangi, integrated with the use of other alternative soil fumigants (particularly TriForm 80). Results from this study will be available in October 2017.

Diseases caused by *Macrophomina* and *Fusarium* spp. have continued to spread and are serious threats to the strawberry fruit industry since MB was phased out.

Macrophomina phaseolina and *Fusarium oxysporum* f.sp. *fragariae* are soil-borne pathogens of strawberry that cause wilt diseases and plant deaths. Prior to 2006, these pathogens were well controlled in the strawberry fruit industry by MB/Pic-fumigation. By 2014, serious disease outbreaks caused by *Macrophomina* and *Fusarium* spp. occurred in the strawberry fruit industry in southern Victoria and on the Sunshine Coast in Queensland [AUS02 CUN17 A22, A23]. In Western Australia, the incidence of *Fusarium* wilt in strawberries has steadily increased since the phase-out of MB (<https://www.agric.wa.gov.au/strawberries/crown-and-root-rot-diseases-strawberries>). Infected sites have increased in 2015 and 2016, with *M. phaseolina* now confirmed in strawberries on fruit farms just 15 km from the Toolangi Plant Protection District (where Certified strawberry runners are grown). Similar outbreaks of crown rots caused by *Macrophomina* and *Fusarium* spp. have occurred in strawberries in other regions of the world where MB has been phased-out (e.g. Avilés et al., 2008; Zveibil et al., 2012; Koike et al., 2013).

Currently, MB/Pic is the only fumigant proven to eradicate *M. phaseolina* in infected strawberry debris in soil in Australia (Hutton et al., 2013). Therefore, the continued critical-use of MB in the Victorian strawberry runner industry is considered more important than ever, until new treatments are developed that can control *M. phaseolina* and *F. oxysporum* to equivalent levels as MB/Pic. Note that although *M. phaseolina* is primarily transmitted in soil, infected runners may also transmit the pathogen, and the use of clean runners is considered critical in managing the disease (Koike et al., 2013). This is especially the case given that *Macrophomina* outbreaks in the strawberry fruit industry are so close to the

strawberry runner industry (15 km), and the potential for this pathogen to be carried in soil attached to vehicles etc.

Changes in the status of key alternatives and emission reduction strategies are summarised below, and further detailed in the main document.