

Part A: SUMMARY

1. NOMINATING PARTY: AUSTRALIA

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

AUS02 CUN21 Soil Strawberry Runners.

3. BRIEF DESCRIPTIVE TITLE OF NOMINATION:

Re-application by the strawberry runner industry of Victoria, Australia, for critical use exemption in 2021 from the phase-out of methyl bromide (MB).

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

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

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

2021 – 28.98 tonnes. The Australian Government will reduce the amount allocated to 14.49 tonnes if methyl iodide is registered for strawberry runner propagation or if other substitutes prove successful.

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

Executive Summary

This nomination is for 28.98 tonnes of methyl bromide (MB) for soil disinfestation in the Victorian strawberry runner industry at Toolangi in 2021. The nomination is made under Decision IX/6 because there are currently ‘no technically and economically feasible alternatives or substitutes available to the user’. However, the Australian Government will approve a reduced quantity of 14.49 tonnes of MB in 2021 if methyl iodide (MI) is registered or research shows that there is a registered substitute product(s) that is as effective as MB/Pic in controlling soil-borne pathogens. This is consistent with the transition strategy away from MB as described in AUS02 CUN20.

Previous research in the strawberry runner and fruit sectors has proven that MI/Pic is a one-to-one replacement for MB/Pic. Research showed that soil treatment with MI/Pic controlled pathogens as effectively as MB/Pic. It was the industry’s key strategy for phasing out MB until it was withdrawn from registration in Australia in 2012 and worldwide by Arysta LifeSciences due to economic reasons. The strawberry runner industry is now leading the process for registration of MI in Australia. Significant progress has been made, including permission from Arysta LifeSciences to use their registration data, and discussions with the Australian Pesticides and Veterinary

Medicines Authority (APVMA) that have resulted in a registration plan and estimated timeframe for assessment (18 months).

The strawberry runner industry in Victoria is funding the process to register MI in Australia and a comprehensive research, development and extension (RD&E) program to develop other substitutes to MB. This program has made considerable progress despite challenging soil conditions in the runner production area.

Recent results confirm that control of pathogens at greater soil depths is inadequate using the most promising substitutes (*viz.* ethanedinitrile (EDN), EDN + chloropicrin (Pic), Pic, and TF-80® (80% Pic:20% 1,3-dichloropropene (1,3-D)). Further research is therefore required from 2019 to 2021. Current trials are investigating the use of EDN + Pic and TF-80® applied using improved application technologies (Figure 1), and outdoor systems for soil-less production of runner tips.

The Board of the Victorian Strawberry Industry Certification Authority (VSICA) needs to have confidence in the effectiveness of a substitute treatment(s) in controlling soil-borne pathogens in runner crops before changing the rules of the Certification Scheme to accept these treatment(s). This is necessary for the Board of VSICA to meet its legal responsibilities of due diligence and care to prevent the dissemination of pathogens to strawberry fruit growers, and to minimise the risk of exposing the organisation to litigation. Previous experience demonstrates that litigation is a real and on-going threat to VSICA and the Toolangi runner industry. The Board will change the rules to accept MI/Pic as alternative to MB because extensive research at Toolangi clearly shows that it controls soil-borne pathogens as effectively as MB/Pic.

Industry's strategy for transitioning away from MB/Pic is to register and adopt MI/Pic and/or other substitutes identified through new research, which is anticipated by 2022.

Progress of the RD&E program and new research

Recent R&D has resulted in soil-less technologies for the economic production of runners of Mother stock (third generation in the Certification Scheme) without the use of MB from 2019. However, production of Certified runners (fourth generation) using soil-less technologies is not economically or technically feasible (see Part E 16). Soil-less systems for production of Certified runners are expensive due to the high cost of labour and infrastructure (protected structures). Previous research showed that outdoor production of runner tips using hydroponics was not technically or economically feasible because yields were significantly lower than in protected systems (Milinkovic et al., 2017). Current research is evaluating other outdoor methods of tip production (strip-fumigated beds covered with permanent plastic and substrate bags placed at ground level on plastic) with the aim of increasing yields and lowering the cost of production compared with protected systems.

Results of recent research also showed that substitute fumigants (*viz.* Pic, TF-80®, EDN and EDN + Pic) do not provide sufficient control of soil-borne pathogens for production of Certified runners (Appendix I). The latest findings indicate that the use of higher application rates, barrier films (TIF), deeper injection, and co-application of fumigants has not increased control of pathogens using key substitute fumigants (Appendix I), and R&D needs to identify other strategies to make these chemicals more effective. In view of these results VSICA does not currently allow the use of substitute fumigants under the rules of the Certification Scheme. Consequently, any runners grown in soil treated with substitute fumigants are

unmarketable, and this would result in a complete economic loss to growers using these treatments.

In 2018 a new rig was designed and constructed to apply fumigants at greater depths in the soils at Toolangi (Figure 1). In addition, the rig incorporates swept-back tynes and small duck-feet to reduce the losses of volatile EDN from soils during its application. It also includes a hot-glue system for joining sheets of totally impermeable film (TIF) on a broad-acre scale. Current trials are evaluating the effectiveness of this rig for applying EDN, EDN+Pic and TF80®, compared with standard application of MB/Pic. In addition, a current trial is evaluating the use of TF-80® applied under TIF with LDPE edges, which allows gluing of these films for use on a larger scale.

An analysis is completed on the economic feasibility of using microwave and steam for soil disinfestation at Toolangi [A31]. Results showed that microwave (Figure 2) is less costly than MB/Pic and steam for treating soil, but further work is needed to develop and test a prototype unit that is capable of treating soils to the depths required in the runner industry. Trials with a small steam unit (Figure 3) at Toolangi have not resulted in significant control of soil-borne pathogens and weeds (Appendix I). Given the favourable cost of microwave, researchers have prioritised this method of heat disinfestation of soils for future trials at Toolangi.

Mixtures of methyl iodide (MI) and chloropicrin (Pic) have previously been shown to consistently control soil-borne pathogens as effectively as MB/Pic in runner trials at Toolangi, Victoria. There have been some new developments in relation to MI (see below), and it has re-emerged as a real possibility for registration and adoption for control of soil-borne pathogens and weeds of runner crops. Current trials are evaluating the effectiveness of MI for control of *Macrophomina phaseolina* and on accumulation of iodine species in soil, which is required to support the environmental safety aspects for registration of the product.

The runner industry's plan to transition away from MB in 2022 is therefore based on gaining registration and adoption of MI/Pic and/or improving the efficacy of other substitute fumigants for controlling pathogens at greater soil depths in trials from 2019 to 2021.

Developments with methyl iodide

Extensive R&D in the runner industry at Toolangi, Victoria between 2006 and 2012 proved that soil disinfestation with MI/Pic: (1) controls soil-borne pathogens as effectively as MB/Pic, including at greater soil depths, (2) controls weeds as effectively as MB/Pic, and (3) produces equivalent runner yields to MB/Pic in commercial trials conducted over five consecutive years (AUS 02 CUN14, CUN15). Based on this research, the runner industry's original transition plan away from MB was to adopt MI/Pic following its registration and commercialisation (AUS 02 CUN13, CUN14). This plan collapsed in 2012 when Arysta LifeSciences withdrew its application to register MI in Australia and other countries around the world. In Australia, registration of MI was close to approval when the product was withdrawn and, unlike in the US, commercial trials with MI/Pic were well advanced and there was strong demand for the product by industry.

One of the reasons for the withdrawal of the registration application was the price of iodine, affecting the economics of the manufacture of MI. The price of iodine has fallen dramatically since 2012 (<https://minerals.usgs.gov/minerals/pubs/commodity/iodine/mcs-2017-iodin.pdf>), and this makes the importation of MI and its use in Australia a more economical proposition.

Chemical registration is managed in Australia by the Australian Pesticides and Veterinary Medicines Authority (APVMA). The APVMA is the independent statutory authority responsible for assessing and registering pesticides and veterinary medicines proposed for supply in Australia. The APVMA's role is to ensure chemicals work, and are also safe for humans, non-target animals and plants, and the environment.

The runner industry is prepared to be the registrant for MI in Australia. It has engaged a chemical registration consultant (T&S Consulting), which has identified several potential manufacturers and suppliers of MI. Industry has sought and gained permission from Arysta LifeSciences to use all its previous registration data for MI. A pre-application meeting for MI was recently held between representatives of the runner industry, the Commonwealth Department of the Environment and Energy, and the Australian Pesticides and Veterinary Medicines Authority (APVMA). The APVMA does not require additional information to support the efficacy of MI or MI/Pic for registration purposes in Australia. However, it indicated that reports from overseas research on MI since 2012 are required to progress the application under an Item 25 Technical Assessment. Since previous trials showed that only 6% of MI was emitted from soils to the atmosphere at Toolangi, further information is also required on the accumulation of iodine species in soils to support the environmental safety of the product. This work will commence in early 2019. Also, six-batch analysis of the final commercialised product will be required before full registration could be granted.

Provided all further data and research can be completed in a timely manner, the APVMA estimated that a decision on the technical assessment of MI could occur in 18 months. Industry is aiming to achieve registration of MI by 2021 and full commercial use by 2022, but this is subject to the independent processes of the APVMA.

On-going risk of litigation

The threat of litigation is a reality in Australia for pathogen-tested nursery schemes that produce Certified plants. Currently, a move away from MB/Pic in the runner industry would significantly increase this risk. This is because research conducted at Toolangi, Victoria shows that substitute fumigants tested do not control soil-borne pathogens as effectively as MB/Pic (except for MI/Pic). Moreover, recent research from Europe shows that lethal soil-borne pathogens such as *Macrophomina phaseolina* and *Phytophthora* spp. are prevalent in Spanish strawberry nurseries that have transitioned away from MB/Pic, and that infected runners are a potential source of infection in fruit growing regions (Pastrana et al., 2017). In view of the potential consequences of dissemination of pathogens via the Certification Scheme on strawberry fruit production in Australia, including the risk of litigation, the Board of VSICA needs scientific evidence that substitute treatments for MB are as effective as MB/Pic in controlling soil-borne pathogens. The Board requires two years of data proving a

substitute is as efficacious as MB/Pic before changes to rules of the Scheme can be made. This is essential to demonstrate appropriate governance and best practice of the Board in any future litigation cases.

The integrity of the Certification Scheme has previously been challenged in court. The plaintiff alleged that the soil-borne pathogen, *Rhizoctonia fragariae*, was carried from Victoria to South Australia in or on Certified runners produced through the Scheme. Judgement was ultimately in favour of the runner industry and vindicated the integrity of the Certification Scheme. The use of MB/Pic in the runner industry was an important factor in the court's final decision in the case. If judgement was in favour of the plaintiff it was expected that costs to the runner industry following further legal challenges would have totalled more than A\$4M. This would have closed the Victorian runner industry, and possibly the Australian fruit industry valued at \$450M p.a.

Increased importance of charcoal rot in the Victorian strawberry fruit industry and international runner industries that have phased-out MB

Macrophomina phaseolina and *Fusarium oxysporum* f.sp. *fragariae* are significant soil-borne pathogens of strawberry crops, causing wilt diseases and plant deaths. Prior to 2006, these pathogens were well controlled in the strawberry fruit industry by fumigation with MB/Pic. In 2017, an extensive survey showed that *M. phaseolina* (the cause of charcoal rot) was present in soil or plants at 80% of fruit farms across Victoria. *M. phaseolina* was present in strawberry plants on fruit farms just 10 km from the Toolangi Plant Protection District (where Certified strawberry runners are grown). *M. phaseolina* was **not** detected, however, in soil or in plants in the nursery industry, where MB/Pic is still used. However, there is a significant risk of it being introduced into runner crops through mechanical transfer of infested soil (via vehicles, or wind-borne in dust).

Currently, MB/Pic is the only fumigant proven to eradicate *M. phaseolina* in infected strawberry debris in soil in Australia (Hutton et al., 2013). In Europe where MB/Pic is phased-out, Pastrana et al. (2017) showed that 47% soils treated with substitute fumigants in strawberry nurseries in Spain contained *M. phaseolina*. They concluded that '*ineffectively fumigated soils in nurseries..., along with infected runner plants, can be inoculum sources of soilborne strawberry pathogens in Spain*'.

A national research project is underway to identify better fumigant and cultural practices for managing charcoal rot, including an evaluation of MI/Pic.