

## **Part A: SUMMARY**

### **1. NOMINATING PARTY: AUSTRALIA**

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

AUS02 CUN24 Soil Certified Strawberry Runners.

### **3. BRIEF DESCRIPTIVE TITLE OF NOMINATION:**

Re-application by the strawberry runner industry of Victoria, Australia, for critical use exemption in 2024 from the phase-out of methyl bromide (MB). Note the Australian government will withdraw this application if methyl iodide is registered for strawberry runner use in July 2022.

### **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:**

2024 – 14.49 tonnes.

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

Saluterra Pty Ltd applied to the Australian Pesticides and Veterinary Medicines Authority (APVMA) in 2020 for approval to use methyl iodide (MI) as a fumigant to replace methyl bromide (MB) for soil disinfection in strawberry runners (<https://apvma.gov.au/application-summaries/2020/2020-08#as-next-step>). In 2021, the APVMA requested additional data to assess MI, and this resulted in a delay in the date for a decision on its registration from 17 January 2022 to 17 July 2022. It is important to note that this timeline depends on the independent process of the APVMA, and neither the runner industry, registrant nor Australian government can predict the outcome of the registration application. A permit was recently approved by the APVMA to allow MI trials to proceed in 2022 for the purpose of validating the efficacy of new application methods (co-injection of MI and Pic) and generating data to support State Biosecurity Agency's acceptance of MI + Pic as a treatment to allow domestic trade of runners (see Part A 6 (c) below).

The current critical-use nomination is being submitted under Decision IX/6 because there are currently 'no technically and economically feasible alternatives or substitutes available to the user'. The runner industry is committed to the adoption of MI/chloropicrin (Pic) because it is the only alternative that has proven as effective as MB/Pic for soil disinfection at Toolangi (see below & Part C 8a). If MI is registered by July 2022 and commercially available by 2024, Australian government would either withdraw the current nomination or not approve its use. This approach is consistent with the transition schedule for MB originally proposed

in AUS02 CUN20 and adjusted in light of new APMVA timelines (see Table 1 & Part B).

The Australian strawberry runner industry continues to fund a comprehensive research, development and extension (RD&E) program to develop substitutes for soil fumigation with MB, and this program has made progress in 2020/21 (see Appendix) despite the challenge of COVID-19 restrictions. Results from recent trials confirmed that the next best substitutes to MI/Pic (i.e., TF-80® (80% Pic:20% 1,3-dichloropropene (1,3-D)) + herbicides and ethanedinitrile (EDN)) do not adequately control pathogens at greater soil depths, irrespective of application timing through the season or the use of totally impermeable film (TIF). This resulted in pathogen recolonisation of the upper profile to levels equivalent to those in untreated soils, and high incidences of disease in strawberry plants (Appendix 1.7 & 2.7). Research also recommenced on the substitute dimethyl disulphide (DMDS), with this active showing good control of the strawberry pathogen *Macrophomina phaseolina* when applied in mixture with Pic (Appendix 3.7). Additionally, research on microwave continued and the method showed strong ability to control of pathogens (*M. phaseolina* and *Fusarium oxysporum* f.sp. *fragariae*) in strawberry debris in the soil (Appendix 4.7). Despite this, the technique still requires considerable work to improve its consistency, practicality and to commercialise.

Continued research on improving pathogen control with substitutes at greater soil depths, together with the anticipated registration of MI/Pic, form the industry's strategy for phasing out MB/Pic, which is expected between 2023 and the end of 2024 (based on the APVMA's latest date for a decision on the registration of MI).

#### ***(a) Developments with methyl iodide***

##### **2021/22 UPDATE SUMMARY**

- The APVMA approved the residue and trade assessment of MI in June 2021 [A37].
- The APVMA has approved a trial permit for MI use in 2022.
- The APVMA delayed a decision on the final registration of MI by six months due to the requirement for additional data.
- The APVMA is currently evaluating the final modules on MI needed for registration, with a decision required by 17 July 2022 [A38].

Extensive RD&E 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). However, in 2012 Arysta LifeSciences withdrew its application to register MI in Australia and other countries around the world.

In 2019, the runner industry completed an investigation on the feasibility of registering MI in Australia. This included a pre-application assistance meeting and assessment by the APVMA

on the possible registration of MI in Australia. The assessment identified further research and information that the APVMA required for the evaluation of MI, and that a chemical registrant for MI was required. Subsequently, Saluteria Pty Ltd took responsibility for the registration of MI in Australia and has identified an overseas manufacturer of MI and supply chain options. The registration application passed preliminary assessment by the APVMA on 20 August 2020 [AUS02 CUN23 A35] and the registrant submitted a draft label to the APVMA [AUS02 CUN23 A36]. Originally, the APVMA set a date of 17 January 2022 for a decision on the application. However, the APVMA requested further data from overseas research from the registrants, and this resulted in a delay in the date of decision to 17 July 2022. Currently, the registration application has passed residue and trade requirements [A37] and review of the remaining assessment modules are underway [A38].

In 2020, the Victorian Strawberry Industry Certification Authority (VSICA) engaged an independent consultant to review the data on the efficacy of MI/Pic for soil disinfestation and production of strawberry runners. The consultant concluded:

*‘Considerable R&D has clearly demonstrated that MI/Pic (30:70 at 500kg/ha) is as efficacious as MB/Pic (50:50 at 500kg/ha) in controlling weeds and the major pathogens of strawberry runners at Toolangi. If efforts to register MI for use in Australia are successful, the Board of VSICA can have confidence that MI/Pic is a suitable replacement for MB/Pic for the production of Certified runners. Under these circumstances, the Board will meet its due care and diligence responsibilities if it changes the rules of the Certification Scheme to require fumigation of soil with MI/Pic instead of MB/Pic.’*

Subsequently, the Board of VSICA decided to accept the use of MI/Pic for soil disinfestation into the rules of Certification Scheme for runner production as soon as its registration is approved by the APVMA. This means the runner industry is ready to adopt MI/Pic to replace MB/Pic as soon as it is registered and commercially available.

### ***(b) Progress of the RD&E program and new research***

#### **2021/22 UPDATE SUMMARY**

- Details of data from recently completed research in 2021/22 are provided in the Appendix.
- Data continue to show that substitute fumigants (other than MI/Pic) do not control soil-borne pathogens at greater depths. Pathogens surviving at greater depths recolonise the upper profile and populations can reach levels equivalent to those in untreated soil.
- Soil-less production systems remain viable for the early generations of runner multiplication, but are not economically or technically feasible for the final generation of runner production.
- Research on microwave continues to show promise for control of soil-borne pathogens but requires considerably more work to improve consistency and to commercialise.
- Research on DMDS has recommenced and has controlled the strawberry pathogen *M. phaseolina* when applied in mixture with Pic.

RD&E has resulted in soil-less technologies for the economic production of runners of Mother stock (third generation in the Certification Scheme) and an associated reduced use of MB from 2019. However, partial-budget analysis shows that production of Certified runners (fourth generation) using soil-less technologies is still not economically or technically feasible (see Part E 16).

- The high costs of soil-less systems for production of Certified runners relate to labour, infrastructure (protected structures) and transport requirements.
- Plug plants produced in soil-less systems yield less or equal fruit to bare-rooted runners produced in MB/Pic-treated soil (Menzel & Waite, 2006; Menzel & Toldi, 2010; McFarlane et al. 2021). Therefore, the increased cost of plug plants (at least twice as expensive) is not economically viable in the fruit sector.

Recent research showed that commercial soil-less substrate from accredited sources can contain significant concentrations of soil-borne pathogens, including *M. phaseolina* (AUS02 CUN22). For this reason, VSICA does not currently allow Certification of plug plants unless the substrate used in their production has been disinfested. Analysis is underway to identify and evaluate other substitutes to MB for disinfesting soil-less substrates, such as MI, EDN, and microwave, and media that does not require disinfestation (i.e., wood fibre blends that are thermally defibrated at temperature above 100°C)

Results from recent research showed that the next-best substitute fumigants to MI/Pic (1,3-D/Pic + herbicides, EDN) do not provide sufficient control of soil-borne pathogens for production of Certified runners (Table 2, Appendix 1.7 & 2.7). Research has considered the use of much higher application rates (double label rates), barrier films (totally impermeable film), deeper injection, different application times through the season, integration with rotation crops and/or co-application of fumigants to improve pathogen control, but these strategies have so far been unsuccessful. Therefore, given these results, VSICA does not currently allow the use of substitute fumigants (other than MI/Pic when registered) under the rules of the Certification Scheme.

In the longer-term, the runner industry aims to transition to non-fumigant methods for disinfesting soil to safeguard it against possible pesticide withdrawals in the future. For example, trials are continuing on the use of microwave for soil disinfestation for this purpose. Recent results with a new 5 kW automated unit showed that microwave does not control pathogens adequately at greater soil depths. However, microwave effectively killed inoculum of *M. phaseolina* and *F. oxysporum* in infected crown tissue of old strawberry plants (Appendix 4.7). Further research is needed on the use of different wavelengths of microwave that may penetrate and heat soil at greater depths.

Research in 2022 will concentrate optimising application technologies for co-injection of MI and Pic, and verifying its effectiveness for controlling soil-borne pathogens at greater depths. Research on MI will also consider its ability for controlling regulated pests to allow possible changes in state regulations mandating the need for soil disinfestation with MB/Pic to support trade of runners to some states (see below). Field research is also set to recommence on dimethyl disulphide (DMDS)/Pic following a commercial decision to register the active in Australia. In addition, work has commenced on a meta-analysis on the effectiveness of different substitute fumigants using data from field trials conducted at Toolangi since 1996.

It is anticipated that this analysis will be available by July 2022 and is expected to provide strong scientific evidence in support of the transition from MB/Pic to MI/Pic.

***(c) On-going risk of litigation***

**2021/22 UPDATE SUMMARY**

- A legal case against the Toolangi Certified Strawberry Runner Growers Co-operative (TCSRGC) for an alleged breach of the *Tasmania Plant Quarantine Act (1997)* remains adjourned.
- Biosecurity Tasmania enforce the use of MB/Pic for soil disinfestation for production of strawberry runners exported from Victoria to Tasmania. This is to reduce the risk of potato cyst nematode (PCN) and phylloxera in soil on runners.

The potential dissemination of soil-borne pathogens and pests in runners or in soil on runners to strawberry fruit growers around Australia is a litigation risk to the nursery industry and VSICA. For example, in a long legal case (2004-2015) costing more than AU\$2.5 M, a strawberry grower alleged that the soil-borne pathogen, *Rhizoctonia fragariae*, was carried from Victoria to South Australia into their fruiting fields in or on Certified runners produced through the Scheme (see AUS02 CUN22 for details). During the court case, national and international expert witnesses provided strong evidence to support the use of MB/Pic for soil disinfestation in the Certification Scheme, based on published research. 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 integral to the court's final decision in the case.

Again, in late 2018, the runner industry was issued a Summons for an alleged breach of the *Tasmanian Plant Quarantine Act (1997)* relating to the alleged movement of contaminated soil on runners from Victoria to Tasmania, and therefore soil-borne pathogens. A key defence in the case is the substantial evidence that fumigation with MB/Pic reduces the risk to negligible levels of soil being contaminated with pathogens and pests. Based on this evidence, the Tasmanian government issued import regulations in 2019 for runners from Victoria that mandate the use of MB/Pic for soil disinfestation [AUS02 CUN22 A33, A34]. The perceived risk is that soil on runners may contain the regulated pests, phylloxera and potato cyst nematode. Strawberry is not a host of these pests, but areas adjacent to Toolangi have crops and soils that are infested with these organisms. In 2020, the court agreed to adjourn the case indefinitely provided the runner industry fully comply the new export regulations, including the use of MB/Pic and annual testing for regulated pests. This highlights the need for on-going research to identify substitutes that not only control pathogens of strawberry to equivalent levels as MB/Pic, but also regulated pests of other crops.

The threat of litigation and its economic impact are a reality in Australia for nursery schemes that produce Certified plants. Currently, a move away from MB/Pic in the runner industry would significantly increase this risk because currently registered substitutes do not effectively control soil-borne pathogens. Recent research from Europe shows that lethal soil-

borne pathogens such as *M. 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 inoculum in fruit growing regions (Pastrana et al., 2017). In view of the potential consequences and the risk of litigation, the Board of VSICA needs scientific evidence that substitute treatments are as effective as MB/Pic in controlling soil-borne pathogens. VSICA requires two years of data proving a substitute is as effective as MB/Pic before changes to rules of the Certification Scheme can be made. MI/Pic meets this requirement and has been accepted as a treatment by VSICA as soon as it is registered.

***(d) Increased importance of containing new and emerging soil-borne diseases***

**2021/22 UPDATE SUMMARY**

- Epidemics of *M. phaseolina* and *F. oxysporum* continue to devastate the strawberry fruit industry across Australia that have phased-out MB/Pic.
- Therefore, the use of effective fumigants like MB/Pic and MI/Pic for production of certified runners is vitally important, so that fruit growers receive healthy plants to ensure early productivity before they become infected and succumb to disease on their farms later in the season.

Evidence from the Australian strawberry fruit sector and international runner industries shows that the premature phase-out of MB can lead to new diseases or the increased occurrence of previously obscure diseases that can devastate commercial production.

*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 MB/Pic-fumigation. By 2014, serious disease outbreaks caused by *M. phaseolina* and *Fusarium* spp. occurred in the strawberry fruit industry in southern Victoria and on the Sunshine Coast in Queensland [AUS02 CUN17 A22, A23]. A survey in 2020 showed that more than 95% of strawberry fruit farms are now infected with *M. phaseolina*, including farms only 6 km from Toolangi. However, it was not detected in soil or in plants in the nursery industry at Toolangi, where MB/Pic is still used (Mattner et al. 2021a).

Currently, MB/Pic is the only registered 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% of soils treated with substitute fumigants in strawberry nurseries in Spain contained *M. phaseolina*. 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).

A national research project was recently completed (Oag et al., 2021) to identify better fumigant, cultural and hygiene practices for managing charcoal rot, including an evaluation of MI/Pic (Mattner et al., 2021b; McFarlane et al., 2019a; McFarlane et al., 2019b; Gomez et

al., 2019). Results proved that: (1) infested crowns in soil are an inoculum source for charcoal rot, (2) it is difficult to eradicate inoculum of *M. phaseolina* in infested crowns in the soil with substitute fumigants, (3) the use of TIF can improve the effectiveness of some substitute fumigants for control of *M. phaseolina* but not eradicate it, and (4) the Australian strawberry industry has adopted improved practices of farm biosecurity to minimise the spread of *M. phaseolina* and charcoal rot.

The research program showed that in Victoria early production (October to December) of strawberry fruit is crucial because plants become infected on fruit farms and succumb to charcoal rot from mid-way through the season (January to March). The high incidence of the pathogen on strawberry fruit farms (95% of farms contain soils infested with *M. phaseolina*) makes charcoal rot inevitable for most growers. For fruit production to remain viable, it is imperative that growers plant healthy runners to prevent early plant and yield losses from disease. Evidence currently shows that MB/Pic and MI/Pic are the only fumigants that can reliably disinfest soils against *M. phaseolina* for production of healthy plants in strawberry nurseries (Hutton *et al.*, 2013).