Risk Management Proposal:
Importation of Dried hops from all countries

FOR PUBLIC CONSULTATION

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Purpose

The purpose of this document is to:

- summarise the biosecurity risks associated with the importation of dried hops (*Humulus lupulus*) from all countries for beer brewing;
- recommend measures for the effective management of these risks; and,
- seek stakeholder feedback on the recommended measures as outlined in the draft import health standard entry for dried hops.

This import health standard (IHS) has been developed in accordance with Section 22 of the Biosecurity Act (1993).

Background

Hop plants (*H. lupulus*) are herbaceous plants which grow annual shoots forming climbing vines. Hop plants are commercially grown for their unique secondary plant metabolites, which are primarily used in brewing beer for their flavour and aromatic attributes, but are also now finding increasing uses for its health benefits. The main hop growing regions are the United Kingdom, Czechoslovakia, China, Germany and USA.

Hops were first grown in New Zealand approximately 150 years ago. The hop growing industry in New Zealand has doubled its area of production over the last 25 years. In this time, it has gone from a small industry supplying domestic markets, to an export-oriented industry producing unique hops primarily for niche markets overseas. The hop growing area in New Zealand is centred around the Nelson area, and the specific regions of Motueka, Riwaka, the Motoure, Waimea Plains and Tapawera. Currently New Zealand produces less than 1% of the world hop production from approximately 400 hectares, with production having an export value of about $16 million (Stade, website).

New Zealand is in the fortunate position of being free of the significant pests and diseases that afflict the major hop growing countries. Most hop-producing countries have their own breeding programmes, mainly because of the need to produce cultivars that are adapted to local environmental conditions such as latitude, disease or pest pressure. In New Zealand, the breeding of genetically seedless (triploid) hop cultivars remains the main focus of the long-term research programme. There is a need to import germplasm to continue the genetic improvement of hops that are adapted to New Zealand’s environmental conditions. (The New Zealand Hops Ltd website provided information for the above two paragraphs.)

The import requirements for *Humulus* nursery stock (whole plants and plants in tissue culture) are set out in MAF’s import health standard (IHS) “Importation of Nursery Stock”: http://www.biosecurity.govt.nz/files/ihs/155-02-06.pdf. Imported plants must meet the general requirements (sections 1-3) and the additional specific requirements detailed in the *Humulus* schedule. In summary, an import permit is required and a phytosanitary certificate must accompany all consignments certifying that the nursery stock has been inspected and found to be free of any visually detectable regulated pests, and has been treated for regulated insects and mites (whole plants). On arrival in New Zealand, the nursery stock must be grown for a minimum period of 3 months in a Level 3 post-entry quarantine facility where it will be inspected, treated and/or tested for regulated pests.

The import requirements for *Humulus* seed for sowing are set out in MAF’s import health standard “Importation of Seed for Sowing”: http://www.biosecurity.govt.nz/files/ihs/155-02-
Imported seed must meet the general requirements (sections 1-2) and the specific requirements detailed in the *Humulus* schedule in section 3. In summary, an import permit is required and a phytosanitary certificate must accompany all consignments certifying that the seeds have been inspected and found free of any visually detectable regulated pests. On arrival in New Zealand, the seed must be grown for a minimum period of 1 growing season in a Level 3 post-entry quarantine facility where the seedlings will be inspected, treated and/or tested for regulated pests.

Whole dried hops, in either pelleted or non-pelleted form, are not considered propagable material and are imported for the purpose of beer brewing. The majority of imported dried hops into New Zealand have been pelleted products, which are ground dried hops pelleted under high pressure. However, over the past several years, MAF has also permitted the importation of whole dried hops in the form of compressed bales into MAF-approved transitional facilities for the purpose of beer brewing. It has been previously considered that the brewing process, involving boiling of the dried hops to high temperatures in accordance with the operating methods in the transitional facility, would mitigate any biosecurity risks.

The import requirements for dried hops are set out in the import health standard for Dried and Preserved Plant Material: [http://www.biosecurity.govt.nz/imports/plants/standards/bnz-dppp-imprt.htm](http://www.biosecurity.govt.nz/imports/plants/standards/bnz-dppp-imprt.htm). This standard was issued in June 2010, and included a specific entry for commercially packaged, pelleted hops in Section 3.5. As per the usual import health standard development process, a draft version of the IHS was consulted with stakeholders and other interested parties in early 2010.

In addition within the above IHS, Section 3.2.3 was included to allow for a range of dried plant material to be imported for further processing in a MAF-approved transitional facility where MAF considers that the risks will be adequately managed. This section was included because of the frequent requests received by MAF for the importation of various types of dried plant material for further processing. Any applications for a permit to import are assessed to ensure that the proposed processing, usually involving high temperature processing, will mitigate any risks associated with the plant material, including the handling of remaining residues. It has been under this section that MAF has approved importation of non-pelleted, whole dried hops in sealed packs of bales.

However, this specific provision for the importation of whole dried hops in the non-pelleted form into a MAF-approved transitional facility should have been included under the specific entry for dried hops in section 3.5 of the import health standard issued in June 2010. Due to stakeholder concerns over the biosecurity risk of the importation of dried hops in various forms, MAF have decided to review the options for risk mitigation for this commodity to ensure that the management of these risks have been appropriately considered, before amending the dried hops entry.

The importation of the different hop commodities can be summarized as follows:

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Relevant IHS for importation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursery stock</td>
<td>Importation of Nursery Stock</td>
</tr>
<tr>
<td>Seed for Sowing</td>
<td>Importation of Seed for Sowing</td>
</tr>
<tr>
<td>Dried hops</td>
<td>Dried and Preserved Plant Material</td>
</tr>
<tr>
<td>- commercially packaged pelleted hops</td>
<td>- Section 3.5</td>
</tr>
<tr>
<td>- dried hops for further processing</td>
<td>- Section 3.2.3 (now proposed for inclusion in Section 3.5)</td>
</tr>
</tbody>
</table>
Objective
The objective is to effectively manage biosecurity risks posed by the importation of dried hops in a way that is consistent with New Zealand’s domestic legislation and international obligations.

Commodity
Harvested hops are dried female flower clusters or catkins known as cones from the *Humulus lupulus* species. When harvested, the hops are largely cleaned free of leaf and stalk fragments prior to drying, but some pieces may remain. There is also the possibility that these hops may contain very low percentages of seed prior to processing.

For commercial production, hops are harvested and dried in forced-air kilns heated by methane, propane, or fuel oil. Depending on the drying system, cones are normally dried at 50–70°C for 4–10 hours, reducing the moisture content from approximately 80% to 8–12% (Mahaffee *et al.*, 2009). Drying is essential for long-term storage since it reduces spoilage from decay organisms. Mahaffee *et al.*, 2009). After sufficient cooling, the dried hops are compressed into bales or pellets.

Dried hops may then be developed into a variety of product forms which will help prevent deterioration of the desirable characteristics: whole ‘cones’ or ‘leaf’ hops compressed into plugs or vacuum sealed small bales/bricks; pellets; extracts; and a range of downstream products. Increasingly, hops are being used as the latter category where the hop-derived products, which are now commonly extracted using super-critical CO₂ methods, can be isomerised (to make them light and heat stable) and also split into various fractions to create a larger variety of products (MAF, 2010).

Pelleted hops are hop cones which have been ground to a fine powder and then extruded under pressure into the processed pellets. Krofta *et al.* (2008) states that in the first phase of production of pellets, raw hops are ground to a fine powder with a prevailing particle size of 0.5mm notably smaller than hop seeds which average between 2 and 4mm. The company Hopunion states that cone hops are milled until they pass through a sieve which is commonly of a 9-12mm mesh for production of their pellets. This may indicate a larger maximum particle size. The different types of mill used to pulverize the dried hops will result in differing particle sizes. In their website Indie Hops compare two pellet diameters, finding that in the larger diameter less grist was exposed to heat during pelleting, producing a content that had a more oily feel, and broke into clumps rather than deconstructing into a powder. Indie Hops stated that temperatures reached range from 43°C to 55°C.

Currently dried hops are imported mostly as milled extruded pellets packaged in commercial retail packaging. Only a small amount is imported as whole dried hops pressed in to packs of sealed bales. These consignments are well-packaged in vacuum aluminium foil packages enclosed inside cardboard cartons.
Management of Risk Organisms

PRESENCE OF SEEDS IN DRIED HOPS

Before further analysis, it will be worth considering the likelihood of the presence of seeds in dried hops. Dried hops for brewing generally come from plants specifically grown to produce cones with the most desired characteristics for adding aroma and bitterness to the brew. It had long been considered desirable for a cone to have a low percentage of seed. Rabak (1943) stated that low seed content is associated with high alpha-resin content and high brewing value, but the presence of a larger proportion of seeds lowers the resin content and impairs the value of hops for brewing purposes. However, seedless hops are now more likely to be considered superior for brewing purposes. Hautke (1965) stated that seeds produce substances that when extracted during brewing have an unfavourable effect on beer quality. Trials at Wye and Cambridge showed the difficulty of adequate isolation to produce seedless hops. In 3 commercial gardens, in which no male plants were growing, samples contained 2, 4 and 6% of seeds (Neve 1963). In more recent years, first in New Zealand, triploid varieties have been developed, producing virtually sterile seedless fruits whilst retaining all the flavour and composition of the original (NZ Hops website).

MAF considers the likelihood of seeds being present as low.

MANAGEMENT OF RISKS BY PROCESSING

A number of groups of organisms can be associated with live hop plants and fresh material. Most of these are not associated with the dried commodity because they are associated with other parts of the plant, or with live on fresh material. Records of border and post-border interceptions of organisms on specific commodities can provide direct evidence of association with the pathway, but do not provide a complete list of potential hazards. Only one historic interception record has been identified for hops and this was from fresh hops. The insect belonged to the Macrosiphini tribe of aphids.

No pests or disease have been found on dried hops imported into New Zealand.

The following section outlines the steps in the pathway, how the pathway manages the risk of organisms associated with commodity, and uses examples including some regulated pests.

Firstly, organisms associated only with plant roots and soil, such as soil dwellers and root feeders, can be dismissed because they have no association with dried hop cones.

THE KILN DRYING STAGE

In the first stage of post-harvest processing, hops are air-dried (50-70°C for 4-10 hours) in a kiln before being incorporated into dried hop bales.

It is not likely that any arthropods would survive the heating and drying process because very few insects are capable of surviving temperatures in excess of 50°C for more than a few minutes. (Exceptions are those which tolerate extreme temperatures in their natural habitat but this is not relevant for hops.)

Stored product pests may access the commodity after the drying but this is dependent on the handling and storage conditions. For example, product that is immediately sealed in plastic is likely to have a lower risk of infestation than product wrapped in burlap. No specific stored product pests associated with hops are known (Mahaffee et al. 2009), but potential pests are...
likely to be similar to those on other stored product pathways. Some of these are in New Zealand and some are not.

Dried hops that are further compressed into bales under some pressure and immediately sealed can be expected to remain free of insects and other arthropods providing the bag seals remain intact.

Many fungi associated with plants, either inside or on the plant surface, are unlikely to survive the drying process. However, some mycelia inside plant tissues and some spores may survive. Although data on the efficacy of heat against individual fungal species is sparse, information available indicates that there is considerable variation in the temperatures required to kill different fungal species. For instance, the temperatures and exposure times to eliminate 10 fungal species in wood range from 40-70°C for 10 - 40 minutes (Ridley and Gardner, 2004). Other studies report treatment times to kill wood decay fungi ranging from 75 minutes at 66°C to 5 minutes at 100°C (Chidester, 1939; Newbill and Morrell, 1991). In laboratory heating tests of seven species of fungi cultures on agar, four of which were plant pathogens, all species were killed by exposure to 60°C for ten minutes, except Schizophyllum commune, which required 70°C for ten minutes (Ridley and Crabtree cited in Hosking, 2001b).

Ramsfield et al. (2010) showed that the tolerance of fungal isolates to heat treatment was variable, but heating to a core temperature of at least 70°C for 30 minutes exposure would achieve 99.99% mortality. However, for a range of fungal genera, the most heat tolerant was killed at 60°C for 30 minutes. On the basis of this evidence, it is likely that treatment at a core temperature of between 60°C and 70°C for 30 minutes would effectively treat all fungal contaminants on dried plant material.

Two fungi that are regulated pests, Podosphaera macularis and Pseudoperonospora humuli, are discussed here, as they will be affected to a large extent by the kiln heated drying.

Podosphaera macularis (hop powdery mildew) is the oldest known fungal disease of cultivated hops (Mahaffee et al. 2009). The disease can infect leaves and petioles, but economic losses are associated primarily with infection of inflorescences and developing cones (Gent et al. 2006). According to Mahaffee et al. (2009), powdery mildew can occur on all green tissues. The fungus survives in infected buds by producing survival structures called chasmothecia. Given that these survival structures are formed in sheltered crevices in the hop cones, there is a small likelihood of some surviving the heated air temperature regime (50-70°C for 4-10 hours) depending on the amount of hops being air dried. However, chasmothecia are normally produced in absence of a favourable host and can only occur through two mating forms. An evaluation of over 1 million leaves and 300,000 cones assessed in Oregon and Washington during 1999-2006 did not have any chasmothecia indicating that there was only one mating type prevalent in the Pacific Northwest (Gent et al. 2008). A conidia viability test conducted by Mahaffee et al. (2003) also indicated that exposure of conidia to temperatures >30°C for 6 hours or more reduced the infection frequency by at least half with no infection occurring when conidia were exposed to temperatures greater than 36°C for as little as 3 hours. Cones are very susceptible to infection and can be infected at all stages of development. If they are infected late in development, visible symptoms are often not observed until near harvest or drying in the kiln. The fungus survives in infected material as mycelium (Liyanage and Royle 1976). However, temperature impacts on sporulation, germination and risk of infection at the time of these events with germination and risk of
infection reducing when temperatures are 26°C and higher during germination (Peetz et al. 2009).

*Podosphaera macularis* is not likely to survive the drying process and it is unlikely that the survival structures will either survive drying or have the opportunity of survival.

*Pseudoperonospora humuli* (hop downy mildew) is among the most important diseases of hop and is a major disease in many hop growing areas of the world (Mahaffee et al. 2009). Economic damage from the disease may occur in numerous ways because *P. humuli* can infect cones, leaves, and shoots (Gent and Ocamb 2009; Mahaffee et al. 2009). Survival structures known as oospores are produced but are usually soil-borne, although seed harvested from infected cones may become contaminated by fungal oospores. Some oospores can be found associated with the cones. However, their likelihood of survival is not proven and the role of oospores in the disease cycle is considered circumstantial as attempts to induce consistent germination of oospores in the laboratory or under field conditions have failed (Chee et al. 2006).

It is unlikely that *Pseudoperonospora humuli* would survive the drying process.

Consideration will now be given to examples of two regulated organisms, *Verticillium albo-atrum* (progressive wilt) and *Humulus japonicus latent virus* (HJLV), which could be transmitted externally or internally by seed, and might survive the heating, drying and storage process for whole dried hops.

*Verticillium albo-atrum* (progressive wilt) is reported as present in New Zealand, but the severe strain is not present in New Zealand. *Verticillium* species are soil-borne or debris-borne pathogens. According to Mahaffee et al. (2009), resting structures are released into soil as the plant materials decompose thus providing initial inoculum for the next disease cycle. There is currently no published evidence that *Verticillium* species are seed-borne in hops. Seed transmission in the genus is uncommon (Sackston and Martens 1959); however, *V. albo-atrum* has been reported to be seed-borne on lucerne (Huang et al. 1985), so there is a small likelihood of seed transmission. This species is unlikely to be exposed to the wider environment through aerial dispersal.

*Humulus japonicus latent virus* (HJLV) is considered by the Australia Quarantine and Inspection Service (AQIS) (2010) as capable of being transmitted by hop seeds (Adams et al. 1989). HJLV can be transmitted by mechanical inoculation to *H. lupulus*, and has been shown to be seed transmissible in *H. japonicus* (Mahaffee et al. 2009). *H. japonicus* is not currently an approved species for importation by MAF. Most virus particles are borne externally as with others in the ilarvirus group, such as *Prunus necrotic ringspot virus* (Mahaffee et al. 2009).

**THE PELLETING STAGE**

The production of pelleted hops has been described in the commodity description above. The prevailing particle size of 0.5mm is notably smaller than hop seeds which average between 2 and 4mm. This should ensure that any seeds still present after the kiln drying, will be destroyed along with the likelihood of establishment of any associated diseases. It is not known what effect the pressure and extra heating to up to 55°C would have on the potentially aerially transmitted diseases, but it has been assumed this will reduce the risk to negligible for pelleted hops.
Imported pellets receive clearance at the border before they reach the boiling stage. The main points of difference between pelleted hops and whole dried hops are the milling and extra heating for the pelleted product.

THE BOILING STAGE
Imported hops are stored (in a transitional facility in the case of non-pelleted material) until transfer from their packaging to the brewing vat to be boiled.

Although there may still be viable micro-organisms associated with the dried and processed hops before boiling, most of these are no longer considered a risk. While bacteria and viruses can remain present in dried plant material for up to a number of years, there is generally no means of transmission (e.g. propagative material, insect transfer) to enable the spread of such pathogens. For example, the means by which hop viruses can spread is linked strongly to infected propagative plant material, insect vectors (e.g. aphids), and mechanical operations and physical contact between healthy and infected plant material (Pethybridge et al. 2009). The risk from other viable microorganisms associated with hop material that are not seed transmissible or are not aerially transmitted (e.g. are dispersed by water, contact, movement of vegetative material) is considered to be negligible. Only organisms that can be aerially transmitted or transmitted by seed and that have not been killed by the kiln drying process are considered risks before the dried hops are boiled.

In a transitional facility, the organisms that pose a risk during transfer between packaging and boiling vat are those that are aerially dispersed and may still have viable spores associated with the dried hops. For example, some *Podosphaera macularis* spores that are hidden in sheltered crevices of the hop cones may survive the earlier heating and drying process. However, the amount is likely to be small therefore there is a lower risk of dispersal by air currents. Given that *Pseudoperonospora humuli* oospores are usually soilborne, rather than associated with hop cones, the risk of aerial dispersal is also likely to be low for this species.

Boiling will kill any remaining viable organisms associated with the dried hops, including any aerially dispersed pathogens, seed transmitted viruses, and the seeds themselves. For example, *Pseudoperonospora humuli* mycelia, which might survive the earlier heating and drying process inside plant tissue, cannot withstand the boiling temperatures used in the brewing process. *Podosphaera macularis* conidia cannot survive temperatures greater than 36°C for as little as 3 hours. Therefore, the likelihood of any aerially transmitted hop pathogens posing a risk after boiling at 100°C will be negligible.

As well as destroying hop seeds, boiling will impact on any remaining diseases which might have been associated with seeds before boiling. Effects of heating on the germination and viability of seeds are discussed by Riemens (2003) who noted that in experiments by some research groups on controlling soil borne pathogens, weeds were never observed after treatment at 70°C or higher for 30 minutes. Riemans also references a study by Melander et al. that identifies treatment with steam at a maximum soil temperature of 80°C. The amount of emerging seedlings after treatment was nil for all species tested.

PROCESSING/BREWING IN A MAF-APPROVED TRANSITIONAL FACILITY
Table 1 below provides a summary of the control points for the dried hop transitional pathway. MAF will only allow whole dried non-pelleted hops to be imported where the brewing process effectively manages biosecurity risk and where it is performed at a MAF-approved transitional facility for holding risk goods. In any application, MAF is required to
evaluate any transitional facility and its suitability for the processing of dried hops, including the evaluation of the brewing system, final products, by-products, and the facility operators. This is a well developed system used by MAF to manage biosecurity risks wherein commodities are not given a clearance but are further processed into other products by methods that mitigate biosecurity risks.

All MAF-approved transitional facilities are currently assessed for the following purposes:
- assessment of applications to operate facilities
- accreditation and assessing against relevant facility standards;
- to ensure that the requirements specified in the importing standards are met;
- approval and training of facility operators and accredited persons;
- police check of operators;
- monitoring the performance of individual facility operation;
- carrying out enforcement activities for non-compliance;
- cancellation of approvals as required or where there is a significant level of non-compliance.

These requirements are outlined in the Standard for General Transitional Facilities forUncleared Goods (TF Gen) which is available on the MAF website: http://www.biosecurity.govt.nz/border/transitional-facilities/bnz-std-tfgen

Facilities must have an Operator to ensure that the requirements of the transitional facility standard are being met, and that agreed operating processes to manage any risk goods are being followed. This is the person who is responsible for activities relating to the operation of the facility. The Operator must provide MAF Inspectors access to the facility, records and documents for inspection and audit to confirm compliance with the facility standard or to investigate non-compliances in accordance with the Biosecurity Act. Under this standard, MAF reserves the right to audit at any time and these audits may be unscheduled.

Each transitional facility must develop an operating manual which outlines the processes required in the management of any risk goods, such as whole dried hops. The scope of an operating manual defines what a facility is approved for and where applicable should include:
- the types of goods that will be held in the facility and the activities that will be conducted.
- the names of the Operator, deputy Operators, Accredited Persons, and their responsibilities.
- procedures for operating the facility in relation to uncleared goods including procedures for holding, storage and containment of uncleared risk goods.
- procedures to prevent spillage of uncleared goods and the escape of pests or other contaminants. This may include requiring secure locks and labelling for store rooms.
- procedures for the secure and contained transfer of uncleared goods between facilities by named, trained personnel only.
- procedures identifying how pests, weeds and vermin will be managed or excluded from the facility to mitigate against the spread of biosecurity risk material. If applicable this includes requirements to ensure vegetation adjacent to any facility is controlled so that pests do not have any nearby habitat or places of refuge, and to ensure that pest control is undertaken on a regular basis, and records of controls are kept.
- the regime and procedures for regular inspection and internal audit of the facility by the Operator
• procedures for holding and disposing of biosecurity waste

The operator and any accredited persons must have completed the appropriate operator and accredited persons training packages in relation to biosecurity awareness. Any facility operator must also have a MAF approved operating procedure to clarify the procedures for handling any whole dried hops. The Operator must have authority to receive risk goods intended for their facility. Written documentation authorising this will include a permit to import, and a biosecurity authorisation clearance certificate (BACC). Any risk goods, such as dried hops, are required to be unloaded within a controlled and managed area. In order to address the risk that all material may not be used in the brewing process, records are kept of all material that is used which can be verified with the amount imported. These records include:

- handling and processing details.
- all arrivals and movement of commodities.
- all quantities of material used and remaining
- all dates of use of material
- all disposal arrangements of packaging

Under the current TF-GEN standard, where a facility is not compliant with the standard, the MAF Inspector may recommend that approval for that facility and Operator be cancelled. Where non-compliances are found but cancellation is not initially recommended, audit frequencies will increase until the MAF Inspector is confident the facility is compliant. Under section 122 of the Act, Inspectors have the power to give directions regarding Transitional Facilities or risk goods. Failure to act on a lawful direction from a MAF Inspector may lead to cancellation of approval for the facility and/or Operator and prosecution under the Act.

It is proposed that all groups of potential hazards, including the regulated organisms described above, can be effectively managed under the MAF-approved transitional facility system.

The transitional facility system is sufficient to manage the very small likelihood of viable spores associated with hop cones dispersing from the transitional facility and reaching a host plant. Although large numbers of *P. humuli* and *P. macularis* spores could be present on hop cones harvested for brewing, it is unlikely that they would survive being dried at 50–70°C for 4–10 hours. In the small chance that organisms do survive and spores were present in high numbers on the cones, some could be aerially transmitted off the dried hops into the facility during handling before brewing. However, the likelihood of this event occurring is very low and will depend on the amount of handling that occurs. Handling between transfer from a package to the brewing vat is very limited and very manageable. Given the packaging of dried hops and the unsuitable environment for spore dispersal (e.g. protected from direct exposure to the outdoors), this risk is considered to be negligible.

It is extremely unlikely that seeds, or any disease organisms they contain, will survive the boiling section of the brewing process. The beer making process involves boiling the starch source cereal, usually malted barley, followed by fermenting this with yeast. Dried hops are normally added during the boiling process, which takes place in the industrial “kettle”. The alpha acids in hops are the essential ingredient that gives beer its bitter taste and together with the aroma of hops from hop oils help create the beer's differing flavours and desired balance of bitterness and aroma. Dried hops are added for various boil times. Most brewers are content to use pelleted hops, finding the product more convenient and generally more suitable, but occasionally a skilled brewer may wish to use whole dried hops for a particular purpose.
Temperatures currently applied in the brewing process for dried hops are known to be at least 100°C. MAF considers that a minimum boiling time at 100°C for 30 minutes after the hops have been added must be given for MAF confidence that all risks will be mitigated, and the residual risk is considered negligible. Imported whole dried hops would not be approved for dry hopping use (addition of hops at the fermentation stage), as the minimum boiling temperature-time combination may not be reached. For the above regulated organisms that may be able to be aerially transmitted, the brewing process at temperatures exceeding 100°C will render these risks as negligible.

At the finish of the brewing, spent hops in the form of a sludge remains at the bottom of the kettle (i.e. hops that have gone through the brewing process). This is often used as a compost or mulch. No evidence has been found that hop plants have germinated from this material. As discussed above, there is no likelihood of regulated organisms surviving the boiling process during brewing.
Table 1: Summary of Control Points for the Dried Hops Transitional Facility Pathway
This summary identifies points, steps or procedures where control is applied to prevent or minimise biosecurity risk to an acceptable level.

<table>
<thead>
<tr>
<th>Pathway Step</th>
<th>Description of Measures</th>
<th>Hazard Group Targeted</th>
<th>Hazard Management Outcomes</th>
<th>Monitoring procedures (who, what, when, how)</th>
<th>Verification procedures i.e. objective evidence (who, what, other)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inspection of documentation on arrival</strong></td>
<td>Clean, secure packaging; directed for processing in transitional facility</td>
<td>All pests and pathogens, and viable seed that have survived the drying process.</td>
<td>Correct procedure to be followed</td>
<td>MAF’s authorisation records</td>
<td>Permit to import</td>
</tr>
<tr>
<td><strong>Transport to transitional facility</strong></td>
<td>Secure packaging required; transported via MAF authorised movement</td>
<td>Aerially transmissible pathogens and stored product pests</td>
<td>Product kept secure in sealed packages.</td>
<td>MAF’s authorisation records</td>
<td>Inspection of documentation by MAF inspector</td>
</tr>
<tr>
<td><strong>Storage in TF</strong></td>
<td>Under transitional facility procedures</td>
<td>Aerially transmissible pathogens and stored product pests</td>
<td>Recorded weight of product kept secure</td>
<td>Procedures monitored by facility operator or any other authorised person</td>
<td>Transitional facility operator’s records</td>
</tr>
<tr>
<td><strong>Brewing process</strong></td>
<td>Under transitional facility procedures; brewing conducted at a minimum of 100°C for 30 minutes</td>
<td>All surviving pests and pathogens, and viable seed.</td>
<td>Any surviving pests and diseases destroyed, any remaining seed rendered non-viable</td>
<td>Procedures monitored by facility operator or any other authorised person</td>
<td>MAF inspector authorises movement</td>
</tr>
<tr>
<td><strong>Post-brewing process</strong></td>
<td>Not required</td>
<td>No hazards remaining</td>
<td>No hazards remaining</td>
<td>Procedures monitored by facility operator or any other authorised person</td>
<td>MAF’s authorisation records which give biosecurity clearance</td>
</tr>
</tbody>
</table>

MAF Biosecurity New Zealand
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MAF Proposal

MAF currently allows dried hops to be imported in two forms, pelleted and non-pelleted. Having reviewed the import process, MAF considers that the risks of allowing the non-pelleted whole dried hops to be imported into a transitional facility for the boiling process are no greater than allowing pelleted products clearance at the border.

The figure below shows the different production pathways between the two imported products, whole dried hops and pelleted hops.

MAF proposes no changes for the pelleted products. The processing involved in the development of pelleted products suggests that viability for seeds is highly unlikely and the risk from regulated pests, such as fungal organisms, is negligible after the milling and pelleting process. Pelleted products will continue to receive biosecurity clearance at the border.

MAF proposes two options for non-pelleted dried hops be available in the Import Health Standard: import into a MAF-approved transitional facility for beer-brewing (with appropriate controls developed under a permit), or heat treatment.

Where there is insufficient information to determine the type of product being imported (i.e. pelleted or non-pelleted form), visual inspection by a MAF inspector can be used to determine the product and the import requirements that apply.

Conclusion

MAF proposes to amend the entry for dried hops under the sub heading “Brewing Products” in section 3.5 of the MAF standard: Importation of Dried and Preserved Plant Material. The proposed measures listed in the draft IHS are considered to effectively manage the risks associated with imports of dried hops.
References

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Keller, K. R. Seed germination in hops, Humulus lupulus L. Agronomy Journal. 1953. 45: 146-50


MAF Hops Post Entry Quarantine Testing Manual:

MAF Standard For Approved Biosecurity Treatments (BNZ-STD-ABTRT):


