[PleaseReview document review. Review title: 2024 Second consultation: Draft annex International movement of fresh Mangifera indica fruit (2021-011) to ISPM 46. Document title: 2021-011\_DraftAnnex\_ISPM46\_IntMovMango.docx]

***[1]*****DRAFT ANNEX TO ISPM 46: International movement of fresh *Mangifera indica* fruit (2021-011)**

***[2]*Status box**

|  |  |
| --- | --- |
| ***[3]***This is not an official part of the standard and it will be modified by the IPPC Secretariat after adoption. | |
| ***[4]*Date of this document** | ***[5]***2024-06-03 |
| ***[6]*Document category** | ***[7]***Draft annex to ISPM 46 |
| ***[8]*Current document stage** | ***[9]****To* second consultation |
| ***[10]*Major stages** | ***[11]***2021-04 CPM-16 added topic Annex *International movement of mango (*Mangifera indica*) fruit* (2021-011) to ISPM 46 (*Commodity-specific standards for phytosanitary measures*) to the work programme, priority 1.  ***[12]***2022-11 Standards Committee (SC) approved Specification 73 (*International movement of fresh mango (*Mangifera indica*) fruit*).  ***[13]***2023-01 Technical Panel on Commodity Standards (TPCS) drafted.  ***[14]***2023-02 TPCS revised and recommended to SC for approval for consultation.  ***[15]***2023-05 SC revised and approved for first consultation.  ***[16]***2023-07 First consultation.  ***[17]***2024-05 SC-7 revised and approved for second consultation. |
| ***[18]*Steward history** | ***[19]***2022-05 SC Joanne WILSON (NZ, Lead Steward)  ***[20]***2022-05 SC Hernando MORERA-GONZÁLEZ (CR, Assistant Steward) |
| ***[21]*Notes** | ***[22]***2023-01 TPCS removed common name “mango” from title (as per IPPC style to use scientific names)  ***[23]***2023-02 Edited  ***[24]***2023-05 Edited  ***[25]***As per new FAO style, references cited in tables listed below tables rather than in References  ***[26]***2024-01 Edited  ***[27]***2024-06 Edited (references cited in tables moved to References section, following change in FAO style that permits this) |

***[28]***Adoption

***[29]***[Text to this paragraph will be added following adoption.]

***[30]***1. Scope

***[31]***This commodity standard provides guidance for national plant protection organizations (NPPOs) on pests associated with fresh *Mangifera indica* (mango) (Sapindales: Anacardiaceae) fruit and options for phytosanitary measures for the international movement of mango fruit.

***[32]***2. Description of the commodity and its intended use

***[33]***This commodity standard applies to the fresh fruit of all cultivars and varieties of *M. indica*. It applies to fresh whole *M. indica* fruit, with or without a section of fruit stalk attached but without leaves or stem. The standard applies to fruit that has been produced for international trade and is intended for consumption or processing in an importing country. It does not apply to fruit that has already been processed (e.g. sliced, dried, frozen, canned).

***[34]***3. Pests associated with fresh *Mangifera indica* fruit

***[35]***The pests included in Table 1 are considered to be associated with fresh *M. indica* fruit and are regulated in international trade by at least one contracting party based on technical justification. The list of pests is not exhaustive, nor country specific.

***[36]***The list of pests does not consider factors that may influence pest infestation of fruit in the country of origin (e.g. fruit cultivar or variety, geographical and ecological factors, general agricultural practices and production procedures).

***[37]***Inclusion of a pest in Table 1 does not constitute technical justification for its regulation. When determining whether to regulate a pest listed in this commodity standard, an importing country should base its decision on technical justification using either a pest risk analysis or, where applicable, another comparable examination and evaluation of available scientific information.

***[38]*Table 1.** Pests considered to be associated with fresh *Mangifera indica* fruit\*

| ***[39]*Pest group** | ***[40]*Family** | ***[41]*Species (scientific name and authority)†** |
| --- | --- | --- |
| ***[42]***Weevils (Coleoptera) | ***[43]***Curculionidae | ***[44]****Sternochetus frigidus* (Fabricius, 1787) |
| ***[47]****Sternochetus mangiferae* (Fabricius, 1775) |
| ***[50]****Sternochetus olivieri* (Faust, 1892) |
| ***[51]***Fruit flies (Diptera) | ***[52]***Tephritidae | ***[53]****Anastrepha distincta* Greene, 1934 |
| ***[56]****Anastrepha fraterculus* (Wiedemann, 1830) |
| ***[59]****Anastrepha ludens* (Loew, 1873) |
| ***[62]****Anastrepha obliqua* (Macquart, 1835) |
| ***[65]****Anastrepha serpentina* (Wiedemann, 1830) |
| ***[68]****Anastrepha striata* Schiner, 1868 |
| ***[71]****Bactrocera aquilonis* (May, 1965) |
| ***[74]****Bactrocera carambolae* Drew & Hancock, 1994 |
| ***[77]****Bactrocera caryeae* (Kapoor, 1971) |
| ***[80]****Bactrocera correcta* (Bezzi, 1916) |
| ***[83]****Bactrocera curvipennis* (Froggatt, 1909) |
| ***[86]****Bactrocera dorsalis* (Hendel, 1912) |
| ***[89]****Bactrocera facialis* (Coquillett, 1909) |
| ***[92]****Bactrocera frauenfeldi* (Schiner, 1868) |
| ***[95]****Bactrocera jarvisi* (Tryon, 1927) |
| ***[98]****Bactrocera kirki* (Froggatt, 1911) |
| ***[101]****Bactrocera melanotus* (Coquillett, 1909) |
| ***[104]****Bactrocera neohumeralis* (Hardy, 1951) |
| ***[107]****Bactrocera occipitalis* (Bezzi, 1919) |
| ***[110]****Bactrocera passiflorae* (Froggatt, 1911) |
| ***[113]****Bactrocera psidii* (Froggatt, 1899) |
| ***[116]****Bactrocera tryoni* (Froggatt, 1897) |
| ***[119]****Bactrocera tuberculata* (Bezzi, 1916) |
| ***[122]****Bactrocera umbrosa* (Fabricius, 1805) |
| ***[125]****Bactrocera xanthodes* (Broun, 1904) |
| ***[128]****Bactrocera zonata* (Saunders, 1842) |
| ***[131]****Ceratitis capitata* (Wiedemann, 1824) |
| ***[134]****Ceratitis cosyra* (Walker, 1849) |
| ***[137]****Ceratitis rosa* Karsch, 1887 |
| ***[140]****Zeugodacus cucurbitae* (Coquillett, 1899) |
| ***[143]****Zeugodacus tau* (Walker, 1849) |
| ***[144]***Mealybugs (Hemiptera) | ***[145]***Pseudococcidae | ***[146]****Dysmicoccus neobrevipes* Beardsley, 1959 |
| ***[149]****Ferrisia malvastra* (McDaniel, 1962) |
| ***[152]****Formicococcus robustus* (Ezzat & McConnell, 1956) |
| ***[155]****Maconellicoccus hirsutus* (Green, 1908) |
| ***[158]****Nipaecoccus nipae* (Maskell, 1893) |
| ***[161]****Planococcus lilacinus* (Cockerell, 1905) |
| ***[164]****Planococcus minor* (Maskell, 1897) |
| ***[167]****Pseudococcus cryptus* Hempel, 1918 |
| ***[170]****Pseudococcus jackbeardsleyi* Gimpel & Miller, 1996 |
| ***[173]****Pseudococcus solenedyos* Gimpel & Miller, 1996 |
| ***[176]****Rastrococcus iceryoides* (Green, 1908) |
| ***[179]****Rastrococcus invadens* Williams, 1986 |
| ***[182]****Rastrococcus rubellus* Williams, 1989 |
| ***[185]****Rastrococcus spinosus* (Robinson, 1918) |
| ***[186]***Whiteflies (Hemiptera) | ***[187]***Aleyrodidae | ***[188]****Aleurodicus dispersus* Russell, 1965 |
| ***[189]***Other Hemipterans | ***[190]***Coreidae | ***[191]****Acanthocoris scabrator* (Fabricius, 1803) |
| ***[194]****Amblypelta nitida* Stål, 1873 |
| ***[196]***Pentatomidae | ***[197]****Bathycoelia thalassina* (Herrich-Schäffer, 1844) |
| ***[198]***Moths (Lepidoptera) | ***[199]***Crambidae | ***[200]****Deanolis sublimbalis* Snellen, 1899 |
| ***[202]***Geometridae | ***[203]****Biston suppressaria* (Guenée, 1858) |
| ***[205]***Limacodidae | ***[206]****Darna trima* (Moore, 1859) |
| ***[207]***Thrips (Thysanoptera) | ***[208]***Thripidae | ***[209]****Retithrips syriacus* (Mayet, 1890) |
| ***[212]****Rhipiphorothrips cruentatus* Hood, 1919 |
| ***[215]****Scirtothrips aurantii* Faure, 1929 |
| ***[218]****Thrips palmi* Karny, 1925 |
| ***[219]***Fungi | ***[220]****Incertae sedis* | ***[221]****Cytosphaera mangiferae* Died., 1916 |
| ***[222]***Bacteria | ***[223]***Lysobacteraceae | ***[224]****Xanthomonas citri* pv. *mangiferaeindicae* (Patel, Moniz & Kulkarni, 1948) Constantin *et al.*, 2016 |

***[225]****Notes:* \* Information used to compile this list was supplied by at least one contracting party and may be provided by the IPPC Secretariat upon request.

***[226]***† Scientific names used in this table are based on the submissions by contracting parties, except for *Zeugodacus cucurbitae* and *Zeugodacus tau* (submitted as *Bactrocera cucurbitae* and *Bactrocera tau*, respectively) and *Bactrocera dorsalis* (which includes submissions for *Bactrocera philippinensis*).

***[227]***4. Options for phytosanitary measures

***[228]***This section provides options for phytosanitary measures that may be relevant for the pests listed in Table 1. The options presented are not exhaustive and contracting parties may consider other options.

***[229]***[Contracting parties shall institute only phytosanitary measures that are technically justified (Article VII.2 (g) of the IPPC).

***[230]***Table 2 provides some options for phytosanitary measures that may be relevant to pests considered to be associated with the international movement of fresh *M. indica* fruit.

***[231]***Table 3 provides some pest-specific options for phytosanitary measures that may be relevant for the pests listed in Table 1, with further details being provided in Table 4 to Table 8. When applying phytosanitary measures, NPPOs should consider the parameters that are critical for the successful application of the measures. The NPPOs of importing countries should determine the level of risk reduction required to manage the general pest risk posed by regulated pests and evaluate whether options provided in this commodity standard meet this level before instituting these options as phytosanitary measures. National plant protection organizations should also consider whether applying a measure to manage the pest risk posed by a specific pest may manage the pest risk posed by other pests.

***[232]***When considering the use of methyl bromide (Table 7), NPPOs should refer to the Commission on Phytosanitary Measures (CPM) recommendation on the *Replacement or reduction of the use of methyl bromide as a phytosanitary measure* (R-03). Where possible, alternative options to methyl bromide fumigation that are more environmentally friendly should be selected and applied by NPPOs.

***[233]***Measures included in this commodity standard may be effective at managing pest risk when used alone or may only be effective when integrated with other measures in a systems approach as described in ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*).

***[234]***Options for phytosanitary measures included in this commodity standard meet the criteria in the core text of ISPM 46 (*Commodity-specific standards for phytosanitary measures*). Phytosanitary treatments (PTs) that have been adopted by the CPM as annexes to ISPM 28 (*Phytosanitary treatments for regulated pests*) are shown in bold in Table 3 to Table 8.

***[235]*Table 2.** General options for phytosanitary measures

|  |  |
| --- | --- |
| ***[236]*Options for phytosanitary measures** | ***[237]*References** |
| ***[238]***Pest free areas | ***[239]***ISPM 4 (*Requirements for the establishment of pest free areas*)  ***[240]***ISPM 26 (*Establishment of pest free areas for fruit flies (Tephritidae)*) |
| ***[241]***Pest free places of production and pest free production sites | ***[242]***ISPM 10 (*Requirements for the establishment of pest free places of production and pest free production sites*) |
| ***[243]***Areas of low pest prevalence | ***[244]***ISPM 22 (*Requirements for the establishment of areas of low pest prevalence*) |
| ***[245]***Systems approaches | ***[246]***ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*) |
| ***[247]***Phytosanitary treatments | ***[248]***ISPM 28 (*Phytosanitary treatments for regulated pests*) |
| ***[249]***Inspection | ***[250]***ISPM 23 (*Guidelines for inspection*) |
| ***[251]***Testing and pest identification | ***[252]***ISPM 27 (*Diagnostic protocols for regulated pests*) |
| ***[253]***Phytosanitary certification | ***[254]***ISPM 7 (*Phytosanitary certification system*)  ***[255]***ISPM 12 (*Phytosanitary certificates*) |

***[256]*Table 3.** Pest-specific options for phytosanitary measures

| ***[257]*****Pest species** | ***[258]*Options for phytosanitary measures** |
| --- | --- |
| ***[259]*Weevils** | ***[260]*** |
| ***[261]****Sternochetus frigidus* | ***[262]*IRDN 6**; SA 1 |
| ***[263]****Sternochetus mangiferae* | ***[264]***IRDN 9; SA 1 |
| ***[265]****Sternochetus olivieri* | ***[266]***IRDN 9; SA 1 |
| ***[267]*Fruit flies** | ***[268]*** |
| ***[269]****Anastrepha distincta* | ***[270]***HWIT 2; **IRDN 1**; SA 2 |
| ***[271]****Anastrepha fraterculus* | ***[272]***HWIT 1, 2; **IRDN 1**; SA 2;VHT 2 |
| ***[273]****Anastrepha ludens* | ***[274]***HWIT 1; **IRDN 1**; SA 2 |
| ***[275]****Anastrepha obliqua* | ***[276]***HWIT 1, 2; **IRDN 1**; SA 2; VHT 2 |
| ***[277]****Anastrepha serpentina* | ***[278]***HWIT 1, 2; **IRDN1**; SA 2 |
| ***[279]****Anastrepha striata* | ***[280]***HWIT 1, 2; **IRDN 1**;SA 2;VHT 2 |
| ***[281]****Bactrocera aquilonis* | ***[282]*IRDN 5**; SA 2; **VHT** 5, **6** |
| ***[283]****Bactrocera carambolae* | ***[284]***HWIT 4; **IRDN 5**; SA 2; VHT 4, 7, 9 |
| ***[285]****Bactrocera caryeae* | ***[286]***HWIT 4; **IRDN 5;** SA 2 |
| ***[287]****Bactrocera correcta* | ***[288]***HWIT 4; **IRDN 5**; **SA 2**; VHT 4, 7, 9 |
| ***[289]****Bactrocera curvipennis* | ***[290]*IRDN 5**; SA 2; VHT 7 |
| ***[291]****Bactrocera dorsalis* | ***[292]***HWIT 3, 4, 5, 6**; IRDN 4**; MB 1; **SA 2**; VHT 1, 4, 7, 9 |
| ***[293]****Bactrocera facialis* | ***[294]*IRDN 5**; SA 2; VHT 8 |
| ***[295]****Bactrocera frauenfeldi* | ***[296]*IRDN 5**; SA 2; **VHT**5, **6** |
| ***[297]****Bactrocera jarvisi* | ***[298]*IRDN 3**; SA 2; **VHT** 5, **6** |
| ***[299]****Bactrocera kirki* | ***[300]*IRDN 5**; SA 2; VHT 8 |
| ***[301]****Bactrocera melanotus* | ***[302]*IRDN 5**; SA 2; VHT 8 |
| ***[303]****Bactrocera neohumeralis* | ***[304]*IRDN 5**; SA 2; VHT 4, 5 |
| ***[305]****Bactrocera occipitalis* | ***[306]*IRDN 5**; SA 2; VHT 1 |
| ***[307]****Bactrocera passiflorae* | ***[308]*IRDN 5**; SA 2; VHT 8 |
| ***[309]****Bactrocera psidii* | ***[310]***VHT 8; **IRDN 5**; SA 2 |
| ***[311]****Bactrocera tryoni* | ***[312]*IRDN 3**; SA 2; **VHT** 5, **6**, 8 |
| ***[313]****Bactrocera tuberculata* | ***[314]*IRDN 5**; SA 2; VHT 4, 7, 9 |
| ***[315]****Bactrocera umbrosa* | ***[316]***VHT 6 |
| ***[317]****Bactrocera xanthodes* | ***[318]*IRDN 5**; SA 2; VHT 8 |
| ***[319]****Bactrocera zonata* | ***[320]***HWIT 4; **IRDN 5**; SA 2; VHT 4, 7, 9**;** |
| ***[321]****Ceratitis capitata* | ***[322]***HWIT 1, 2, 3, 6; **IRDN 3**; MB 1; SA 2; **VHT**2, **3**, 5 |
| ***[323]****Ceratitis cosyra* | ***[324]***HWIT 3, 6; **IRDN 5**; MB 1; SA 2 |
| ***[325]****Ceratitis rosa* | ***[326]***HWIT 3, 6; **IRDN 5**; MB 1; SA 2 |
| ***[327]****Zeugodacus cucurbitae* | ***[328]*IRDN 5**; SA 2; VHT 2, 4, 7, 9 |
| ***[329]****Zeugodacus tau* | ***[330]*IRDN 2**; SA 2; VHT 4, 7 9 |
| ***[331]*Mealybugs** | ***[332]*** |
| ***[333]****Dysmicoccus neobrevipes* | ***[334]*IRDN 8**; export inspection\* |
| ***[335]****Ferrisia malvastra* | ***[336]***IRDN 10; export inspection\* |
| ***[337]****Formicococcus robustus* | ***[338]***IRDN 10; SA 1; export inspection\* |
| ***[339]****Maconellicoccus hirsutus* | ***[340]***SA 1; export inspection;\* official laboratory analysis† |
| ***[341]****Nipaecoccus nipae* | ***[342]***Export inspection\* |
| ***[343]****Planococcus lilacinus* | ***[344]*IRDN 8**; SA 1; export inspection\* |
| ***[345]****Planococcus minor* | ***[346]*IRDN 8**; SA 1; export inspection\* |
| ***[347]****Pseudococcus cryptus* | ***[348]***IRDN 10; SA 1; export inspection\* |
| ***[349]****Pseudococcus jackbeardsleyi* | ***[350]*IRDN** 7; SA 1; export inspection\* |
| ***[351]****Pseudococcus solenedyos* | ***[352]***IRDN 10; SA 1; export inspection\* |
| ***[353]****Rastrococcus iceryoides* | ***[354]***IRDN 10; SA 1; export inspection\* |
| ***[355]****Rastrococcus invadens* | ***[356]***IRDN 10; SA 1; export inspection\* |
| ***[357]****Rastrococcus rubellus* | ***[358]***IRDN 10; SA 1; export inspection\* |
| ***[359]****Rastrococcus spinosus* | ***[360]***IRDN 10; SA 1; export inspection\* |
| ***[361]*Whiteflies** | ***[362]*** |
| ***[363]****Aleurodicus dispersus* | ***[364]***Export inspection\* |
| ***[365]*Other hemipterans** | ***[366]*** |
| ***[367]****Acanthocoris scabrator* | ***[368]***Export inspection\* |
| ***[369]****Amblypelta nitida* | ***[370]***Export inspection\* |
| ***[371]****Bathycoelia thalassina* | ***[372]***Export inspection\* |
| ***[373]*Moths** | ***[374]*** |
| ***[375]****Biston suppressaria* | ***[376]***Export inspection\* |
| ***[377]****Darna trima* | ***[378]***Export inspection\* |
| ***[379]****Deanolis sublimbalis* | ***[380]***IRDN 10; export inspection\* |
| ***[381]*Thrips** | ***[382]*** |
| ***[383]****Retithrips syriacus* | ***[384]***Export inspection\* |
| ***[385]****Rhipiphorothrips cruentatus* | ***[386]***Export inspection\* |
| ***[387]****Scirtothrips aurantii* | ***[388]***Export inspection\* |
| ***[389]****Thrips palmi* | ***[390]***Export inspection\* |
| ***[391]*Fungi** | ***[392]*** |
| ***[393]****Cytosphaera mangiferae* | ***[394]***SA 1 |
| ***[395]*Bacteria** | ***[396]*** |
| ***[397]****Xanthomonas citri* pv. *mangiferaeindicae* | ***[398]***SA 1 |

***[399]****Notes:* Options in bold are annexes toISPM 28 (*Phytosanitary treatments for regulated pests*): these annexes are adopted by the Commission on Phytosanitary Measures (CPM); other treatments included in the table meet the criteria in ISPM 46 (*Commodity-specific standards for phytosanitary measures*) but are not adopted by the CPM.

***[400]***\* Export inspection targeting the pest of concern and the application of a remedial action if the pest is detected.

***[401]***† Samples taken during inspection are sent to an official laboratory for analysis and identification to species. If the pest is detected, a remedial action is applied to the affected consignment or the consignment is rejected for export.

***[402]***HWIT, hot water immersion treatment (see Table 4); IRDN, irradiation (see Table 6); MB, methyl bromide fumigation (see Table 7); SA, systems approach (see Table 8); VHT, vapour heat treatment (see Table 5).

***[403]*Table 4.** Options for hot water immersion treatment (HWIT)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***[404]*Measure number** | ***[405]*Fruit weight (g)** | ***[406]*Water temperature (°C)** | ***[407]*Immersion time (minutes)** | ***[408]*References\*** |
| ***[409]***HWIT 1 | ***[410]***0–375  ***[411]***376–500  ***[412]***501–700  ***[413]***701–900 | ***[414]***46.1  ***[415]***46.1  ***[416]***46.1  ***[417]***46.1 | ***[418]***65  ***[419]***75  ***[420]***90  ***[421]***110 | ***[422]***APHIS-PPQ-ISMU (2023) |
| ***[423]***HWIT 2 | ***[424]***0–425  ***[425]***426–650 | ***[426]***46.1  ***[427]***46.1 | ***[428]***75  ***[429]***90 | ***[430]***MERCOSUR (2006)  ***[431]***MPI (n.d.) |
| ***[432]***HWIT 3 | ***[433]***0–500  ***[434]***501–700  ***[435]***701–900 | ***[436]***46.1  ***[437]***46.1  ***[438]***46.1 | ***[439]***75  ***[440]***90  ***[441]***110 | ***[442]***Armstrong and Mangan (2007)  ***[443]***DAFF (n.d.) |
| ***[444]***HWIT 4 | ***[445]***0–500  ***[446]***501–700  ***[447]***701–900 | ***[448]***48.0  ***[449]***48.0  ***[450]***48.0 | ***[451]***60  ***[452]***75  ***[453]***90 | ***[454]***APQA (2012, 2016)  ***[455]***DAFF (n.d.) |
| ***[456]*Measure number** | ***[457]*Fruit weight (g)** | ***[458]*Fruit pulp temperature (°C)** | ***[459]*Time (minutes)†** | ***[460]*References** |
| ***[461]***HWIT 5 | ***[462]***All | ***[463]***46.0 | ***[464]***10 | ***[465]***Srikachar, Damrak and Promkum (2018) |
| ***[466]***HWIT 6 | ***[467]***All | ***[468]***50.0 | ***[469]***11 | ***[470]***Zakariya and Alhassan (2014) |

***[471]****Notes:* National plant protection organizations should also refer to ISPM 42 *(Requirements for the use of temperature treatments as phytosanitary measures*).

***[472]***\* For each option, references listed in alphabetical order. Specific supporting information is not publicly available for all options listed. Where this information is not publicly available, related references are provided.

***[473]***† Length of time that fruit pulp temperature should be maintained regardless of fruit size.

***[474]*Table 5.** Options for vapour heat treatment (VHT)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***[475]*Measure number** | ***[476]*Minimum pulp temperature (°C)** | ***[477]*Minimum relative humidity (%)** | ***[478]*Minimum exposure time (minutes)** | ***[479]*References** |
| ***[480]***VHT 1 | ***[481]***46.0 | ***[482]***95 | ***[483]***10 | ***[484]***APHIS-PPQ-ISMU (2023) |
| ***[485]***VHT 2 | ***[486]***46.0 | ***[487]***90 | ***[488]***20 | ***[489]***MAFF (2021) |
| ***[490]*VHT 3** | ***[491]*46.5** | ***[492]*95** | ***[493]*10** | ***[494]*PT 30 (Vapour heat treatment for *Ceratitis capitata* on *Mangifera indica*)** |
| ***[495]***VHT 4 | ***[496]***46.5 | ***[497]***95 | ***[498]***30 | ***[499]***APPPC (2021) |
| ***[500]***VHT 5 | ***[501]***47.0 | ***[502]***90 | ***[503]***15 | ***[504]***DAFF (n.d.) |
| ***[505]*VHT 6** | ***[506]*47.0** | ***[507]*95** | ***[508]*15** | ***[509]*PT 31 (Vapour heat treatment for *Bactrocera tryoni* on *Mangifera indica*)** |
| ***[510]***VHT 7 | ***[511]***47.0 | ***[512]***95 | ***[513]***20 | ***[514]***APPPC (2021)  ***[515]***APQA (2019) |
| ***[516]***VHT 8 | ***[517]***47.2 | ***[518]***60 | ***[519]***20 | ***[520]***APPPC (2021)  ***[521]***MPI (n.d.)  ***[522]***Waddell *et al.* (1993) |
| ***[523]***VHT 9 | ***[524]***47.5 | ***[525]***95 | ***[526]***20 | ***[527]***APPPC (2021) |

***[528]****Notes:* **PT**, phytosanitary treatment (annex to ISPM 28 (*Phytosanitary treatments for regulated pests*)): PTs are adopted by the Commission on Phytosanitary Measures (CPM); other treatments included in the table meet the criteria in ISPM 46 (*Commodity-specific standards for phytosanitary measures*) but are not adopted by the CPM.

***[529]***National plant protection organizations should also refer to ISPM 42 *(Requirements for the use of temperature treatments as phytosanitary measures*).

***[530]***For VHT 1–6 and VHT 8, fruit is treated in a vapour heat chamber, whereas for VHT 7 fruit is treated in a high temperature forced air chamber.

***[531]*Table 6.** Options for irradiation (IRDN)

|  |  |  |
| --- | --- | --- |
| ***[532]*Measure number** | ***[533]*Minimum absorbed dose (Gy)** | ***[534]*References** |
| ***[535]*IRDN 1** | ***[536]*70** | ***[537]*PT 39 (Irradiation treatment for the genus *Anastrepha*)** |
| ***[538]*IRDN 2** | ***[539]*72 or 85** | ***[540]*PT 42 (Irradiation treatment for *Zeugodacus tau*)** |
| ***[541]*IRDN 3** | ***[542]*100** | ***[543]*PT 4 (Irradiation treatment for *Bactrocera jarvisi*)**  ***[544]*PT 5 (Irradiation treatment for *Bactrocera tryoni*)**  ***[545]*PT 14 (Irradiation treatment for *Ceratitis capitata*)** |
| ***[546]*IRDN 4** | ***[547]*116** | ***[548]*PT 33 (Irradiation treatment for *Bactrocera dorsalis*)** |
| ***[549]*IRDN 5** | ***[550]*150** | ***[551]*PT 7 (Irradiation treatment for fruit flies of the family Tephritidae (generic))** |
| ***[552]*IRDN 6** | ***[553]*165** | ***[554]*PT 43 (Irradiation treatment for *Sternochetus frigidus*)** |
| ***[555]*IRDN 7** | ***[556]*166** | ***[557]*PT 45 (Irradiation treatment for *Pseudococcus jackbeardsleyi*)** |
| ***[558]*IRDN 8** | ***[559]*231** | ***[560]*PT 19 (Irradiation treatment for *Dysmicoccus neobrevipes*, *Planococcus lilacinus* and *Planococcus minor*)** |
| ***[561]***IRDN 9 | ***[562]***300 | ***[563]***APHIS-PPQ-ISMU (2023) |
| ***[564]***IRDN 10\* | ***[565]***400 | ***[566]***APPPC (2021) |

***[567]****Notes:* **PT,** phytosanitary treatment (annex to ISPM 28 (*Phytosanitary treatments for regulated pests*)): PTs are adopted by the Commission on Phytosanitary Measures (CPM); other treatments included in the table meet the criteria in ISPM 46 (*Commodity-specific standards for phytosanitary measures*) but are not adopted by the CPM.

***[568]***National plant protection organizations should also refer to ISPM 18 (*Requirements for the use of irradiation as a phytosanitary treatment*).

***[569]****\** IRDN 10 treatment excludes pupae and adults of the order Lepidoptera.

***[570]*Table 7.** Options for methyl bromide fumigation (MB) (applied under normal atmospheric pressure)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***[571]*Measure number** | ***[572]*Minimum temperature (°C)** | ***[573]*Minimum dose (g/m3)** | ***[574]*Minimum time (hours)** | ***[575]*Reference** |
| ***[576]***MB 1 | ***[577]***21 | ***[578]***32 | ***[579]***2 | ***[580]***DAC (2003) |

***[581]****Note:* National plant protection organizations should also refer to ISPM 43 (*Requirements for the use of fumigation as a phytosanitary measure*).

***[582]*Table 8.** Options for systems approaches based on ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*)

|  |  |  |
| --- | --- | --- |
| ***[583]*Systems approach number** | ***[584]*Independent measures** | ***[585]*Reference** |
| ***[586]***SA 1 | ***[587]****Pre-harvest control measures*(e.g. pest-specific field management using pest control, disposal of fallen and infested fruit)  ***[588]****Harvest control measures* (e.g. field sanitation such as removal of infested fruit)  ***[589]****Post-harvest control measures* (e.g. washing and brushing; chemical dipping; treatment, targeted inspection and remedial action to remove external pests) | ***[590]***APQA (2016) |
| ***[591]***SA 2 | ***[592]****Pre-planting control measures* (e.g. area of low pest prevalence)  ***[593]****Growing period control measures* (e.g. chemical controls, sterile insect technique, mass trapping)  ***[594]****Harvest control measures* (e.g. harvest at mature green stage)  ***[595]****Post-harvest and handling control measures* (e.g. activities to prevent infestation, treatments)  ***[596]****Transportation and distribution control measures* (e.g. activities to prevent infestation)  ***[597]****Control measures applied at several or all stages* (e.g. community awareness programme, control on movement of host fruit into the area) | ***[598]***ISPM 35 (*Systems approach for pest risk management of fruit flies (Tephritidae)*) |

***[599]****Note:* National plant protection organizations should also refer to ISPM 14.

***[600]***5. References

***[601]***The present annex may refer to ISPMs. ISPMs are available on the International Phytosanitary Portal (IPP) at <https://www.ippc.int/core-activities/standards-setting/ispms>.

***[602]***5.1 Main text

***[603]*CPM R-03**. 2017. *Replacement or reduction of the use of methyl bromide as a phytosanitary measure*. CPM Recommendation. IPPC Secretariat. Rome, FAO. Adopted 2008. <https://www.ippc.int/en/publications/84230>

***[604]*IPPC Secretariat**. 2024. *International Plant Protection Convention (1997)*, 2nd edn. IPPC Secretariat. Rome, FAO. Adopted 1997. <https://doi.org/10.4060/cd0175en>

***[605]***5.2 Tables

***[606]*APHIS-PPQ-ISMU (Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Manuals Unit)**. 2023. *Treatment manual*, interim edn. Washington, DC., United States Department of Agriculture, Government Printing Office. <https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf>

***[607]*APQA (Animal and Plant Quarantine Agency)**. 2012. [*Import requirement for fresh mango fruits from Pakistan into Korea.*] Republic of Korea (in Korean). <https://www.qia.go.kr/bbs/lawAnn/viewLawWebAction.do?id=190958&type=0>

***[608]*APQA**. 2016. [*Import requirement for fresh mango fruits from India into Korea.*] Republic of Korea (in Korean). <https://www.qia.go.kr/lawAnn/viewLawWebAction.do?id=190961&type=0>

***[609]*****APQA.** 2019. [*Import requirement for fresh mango fruits from Cambodia into Korea*.] Republic of Korea (in Korean).<https://www.qia.go.kr/bbs/lawAnn/viewLawWebAction.do?id=201720&type=0>

***[610]*APPPC** **(Asia and Pacific Plant Protection Commission)**. 2021. *International movement of fresh mango (*Mangifera indica*) fruit*. Regional Standard for Phytosanitary Measures (RSPM) 11. APPPC. Bangkok, FAO. 12 pp. <https://openknowledge.fao.org/handle/20.500.14283/cb5357en>

***[611]*Armstrong, J.W. & Mangan, R.L.** 2007. Commercial quarantine heat treatments. In: J. Tang, E. Mitcham, S. Wang & S. Lurie, eds. *Heat treatments for postharvest pest control – Theory and practice*, pp. 311–340. Wallingford, UK, CABI. 349 pp.

***[612]*DAC (Department of Agriculture and Cooperation)**. 2003. *Plant Quarantine (Regulation of Import into India) Order, 2003.* New Delhi. 105 pp. <https://www.ppqs.gov.in/acts>

***[613]*DAFF (Department of Agriculture, Fisheries and Forestry)**. n.d. Manual of import country requirements. In: *Australian Government Department of Agriculture, Fisheries and Forestry*. Canberra. [Cited 1 June 2024]. <https://micor.agriculture.gov.au/Pages/default.aspx>

***[614]*MAFF (Ministry of Agriculture, Forestry and Fisheries)**.2021. *Work plan for the export of mango from the Republic of Colombia*. Bogotá. 9 pp. <https://www.ica.gov.co/getattachment/9bace868-59ec-4202-bcf3-381dc1897cce/Mango.aspx>

***[615]*MERCOSUR (Southern Common Market)**. 2006. [*Phytosanitary requirements for* Mangifera indica *(mango), according to country of destination and origin, for MERCOSUR member states.*] MERCOSUR/GMC/RES. No 61/06, sub-standard 3.7.45 (in Spanish). Brasília. 9 pp. <https://faolex.fao.org/docs/pdf/mrc104485.pdf>

***[616]*MPI (Ministry for Primary Industries)**. n.d. Requirement documents for importing fresh fruit and vegetables. In: *Ministry for Primary Industries*. Wellington, New Zealand Government. [Cited 1 March 2023]. <https://www.mpi.govt.nz/import/food/fresh-fruit-vegetables/requirements>

***[617]*Srikachar, S., Damrak, K. & Promkum, W.** 2018. Hot water immersion treatment of Nam Dorkmai mango infested with Oriental fruit fly, *Bactrocera dorsalis* (Hendel) for export. 24 pp. <https://drive.google.com/drive/folders/1vBPyhmVCU_BjJidt59xqnec79ix1rjct>

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***[620]***Potential implementation issues

***[621]***This section is not part of the standard. The Standards Committee in May 2016 requested the secretariat to gather information on any potential implementation issues related to this draft. Please provide details and proposals on how to address these potential implementation issues.