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

***[2]***

***[3]*Status box**

|  |  |
| --- | --- |
| ***[4]***This is not an official part of the standard and it will be modified by the IPPC Secretariat after adoption. | |
| ***[5]*Date of this document** | ***[6]***2023-05-18 |
| ***[7]*Document category** | ***[8]***Draft annex to ISPM 46 |
| ***[9]*Current document stage** | ***[10]****To* first consultation |
| ***[11]*Major stages** | ***[12]***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.  ***[13]***2022-11 SC approved Specification 73.  ***[14]***2023-01 Technical Panel on Commodity Standards (TPCS) drafted.  ***[15]***2023-02 TPCS revised and recommended to SC for approval for consultation.  ***[16]***2023-05 SC revised and approved for first consultation.  ***[17]*** |
| ***[18]*Steward history** | ***[19]***2022-05 SC Joanne WILSON (NZ, Lead Steward)  ***[20]***2022-05 SC Hernando MORERA-GONZÁLEZ (CR, Assistant Steward)  ***[21]*** |
| ***[22]*Notes** | ***[23]***2023-02 Edited  ***[24]***2023-05 Edited  ***[25]***As per new FAO style, references cited in tables are listed below tables rather than in References.  ***[26]*** |

***[27]***Adoption

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

***[29]***1. Scope

***[30]***This commodity standard clearly describes the commodity (including, when relevant, the botanical name and part of the plant as well as its intended use) for which a list of associated pests and related options for phytosanitary measures are identified.

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

***[32]***This commodity standard provides guidance for national plant protection organizations on options for phytosanitary measures for the international movement of fresh *Mangifera indica* (mango) fruit.

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

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

***[35]***The pests included in Table 1 are known to be associated with *M. indica* and are regulated by at least one contracting party. The list of pests is not intended to be exhaustive.

***[36]***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.

***[37]*Table 1.** Pests associated with fresh *Mangifera indica* fruit

| ***[38]*Pest group** | ***[39]*Family** | ***[40]*Species** |
| --- | --- | --- |
| ***[41]***Weevils (Coleoptera) | ***[42]***Curculionidae | ***[43]****Sternochetus frigidus* (Fabricius, 1787) |
| ***[44]*** | ***[45]*** | ***[46]****Sternochetus mangiferae* (Fabricius, 1775) |
| ***[47]*** | ***[48]*** | ***[49]****Sternochetus olivieri* (Faust, 1892) |
| ***[50]***Fruit flies (Diptera) | ***[51]***Tephritidae | ***[52]****Anastrepha distincta* Greene, 1934 |
| ***[53]*** | ***[54]*** | ***[55]****Anastrepha fraterculus* (Wiedemann, 1830) |
| ***[56]*** | ***[57]*** | ***[58]****Anastrepha ludens* (Loew, 1873) |
| ***[59]*** | ***[60]*** | ***[61]****Anastrepha obliqua* (Macquart, 1835) |
| ***[62]*** | ***[63]*** | ***[64]****Anastrepha serpentina* (Wiedemann, 1830) |
| ***[65]*** | ***[66]*** | ***[67]****Anastrepha striata* Schiner, 1868 |
| ***[68]*** | ***[69]*** | ***[70]****Bactrocera aquilonis* (May, 1965) |
| ***[71]*** | ***[72]*** | ***[73]****Bactrocera carambolae* Drew & Hancock, 1994 |
| ***[74]*** | ***[75]*** | ***[76]****Bactrocera caryeae* (Kapoor, 1971) |
| ***[77]*** | ***[78]*** | ***[79]****Bactrocera correcta* (Bezzi, 1916) |
| ***[80]*** | ***[81]*** | ***[82]****Bactrocera curvipennis* (Froggatt, 1909) |
| ***[83]*** | ***[84]*** | ***[85]****Bactrocera dorsalis* (Hendel, 1912) |
| ***[86]*** | ***[87]*** | ***[88]****Bactrocera facialis* (Coquillett, 1909) |
| ***[89]*** | ***[90]*** | ***[91]****Bactrocera frauenfeldi* (Schiner, 1868) |
| ***[92]*** | ***[93]*** | ***[94]****Bactrocera jarvisi* (Tryon, 1927) |
| ***[95]*** | ***[96]*** | ***[97]****Bactrocera kirki* (Froggatt, 1911) |
| ***[98]*** | ***[99]*** | ***[100]****Bactrocera melanotus* (Coquillett, 1909) |
| ***[101]*** | ***[102]*** | ***[103]****Bactrocera neohumeralis* (Hardy, 1951) |
| ***[104]*** | ***[105]*** | ***[106]****Bactrocera occipitalis* (Bezzi, 1919) |
| ***[107]*** | ***[108]*** | ***[109]****Bactrocera passiflorae* (Froggatt, 1911) |
| ***[110]*** | ***[111]*** | ***[112]****Bactrocera psidii* (Froggatt, 1899) |
| ***[113]*** | ***[114]*** | ***[115]****Bactrocera tryoni* (Froggatt, 1897) |
| ***[116]*** | ***[117]*** | ***[118]****Bactrocera tuberculata* (Bezzi, 1916) |
| ***[119]*** | ***[120]*** | ***[121]****Bactrocera xanthodes* (Broun, 1904) |
| ***[122]*** | ***[123]*** | ***[124]****Bactrocera zonata* (Saunders, 1842) |
| ***[125]*** | ***[126]*** | ***[127]****Ceratitis capitata* (Wiedemann, 1824) |
| ***[128]*** | ***[129]*** | ***[130]****Ceratitis cosyra* (Walker, 1849) |
| ***[131]*** | ***[132]*** | ***[133]****Ceratitis rosa* Karsch, 1887 |
| ***[134]*** | ***[135]*** | ***[136]****Zeugodacus cucurbitae* (Coquillett, 1899) |
| ***[137]*** | ***[138]*** | ***[139]****Zeugodacus tau* (Walker, 1849) |
| ***[140]***Mealybugs (Hemiptera) | ***[141]***Pseudococcidae | ***[142]****Dysmicoccus neobrevipes* Beardsley, 1959 |
| ***[143]*** | ***[144]*** | ***[145]****Ferrisia malvastra* (McDaniel, 1962) |
| ***[146]*** | ***[147]*** | ***[148]****Formicococcus robustus* (Ezzat & McConnell, 1956) |
| ***[149]*** | ***[150]*** | ***[151]****Maconellicoccus hirsutus* (Green, 1908) |
| ***[152]*** | ***[153]*** | ***[154]****Nipaecoccus nipae* (Maskell, 1893) |
| ***[155]*** | ***[156]*** | ***[157]****Planococcus lilacinus* (Cockerell, 1905) |
| ***[158]*** | ***[159]*** | ***[160]****Planococcus minor* (Maskell, 1897) |
| ***[161]*** | ***[162]*** | ***[163]****Pseudococcus cryptus* Hempel, 1918 |
| ***[164]*** | ***[165]*** | ***[166]****Pseudococcus jackbeardsleyi* Gimpel & Miller, 1996 |
| ***[167]*** | ***[168]*** | ***[169]****Pseudococcus solenedyos* Gimpel & Miller, 1996 |
| ***[170]*** | ***[171]*** | ***[172]****Rastrococcus iceryoides* (Green, 1908) |
| ***[173]*** | ***[174]*** | ***[175]****Rastrococcus invadens* Williams, 1986 |
| ***[176]*** | ***[177]*** | ***[178]****Rastrococcus rubellus* Williams, 1989 |
| ***[179]*** | ***[180]*** | ***[181]****Rastrococcus spinosus* (Robinson, 1918) |
| ***[182]***Whiteflies (Hemiptera) | ***[183]***Aleyrodidae | ***[184]****Aleurodicus dispersus* Russell, 1965 |
| ***[185]***Other hemipterans (Hemiptera) | ***[186]***Coreidae | ***[187]****Acanthocoris scabrator* (Fabricius, 1803) |
| ***[188]*** | ***[189]*** | ***[190]****Amblypelta nitida* Stål, 1873 |
| ***[191]*** | ***[192]***Pentatomidae | ***[193]****Bathycoelia thalassina* (Herrich-Schäffer, 1844) |
| ***[194]***Moths (Lepidoptera) | ***[195]***Crambidae | ***[196]****Deanolis sublimbalis* Snellen, 1899 |
| ***[197]*** | ***[198]***Geometridae | ***[199]****Biston suppressaria* (Guenée, 1858) |
| ***[200]*** | ***[201]***Limacodidae | ***[202]****Darna trima* (Moore, 1859) |
| ***[203]***Thrips (Thysanoptera) | ***[204]***Thripidae | ***[205]****Retithrips syriacus* (Mayet, 1890) |
| ***[206]*** | ***[207]*** | ***[208]****Rhipiphorothrips cruentatus* Hood, 1919 |
| ***[209]*** | ***[210]*** | ***[211]****Scirtothrips aurantii* Faure, 1929 |
| ***[212]*** | ***[213]*** | ***[214]****Thrips palmi* Karny, 1925 |
| ***[215]***Fungi | ***[216]****Incertae sedis* | ***[217]****Cytosphaera mangiferae* Died., 1916 |

***[218]***

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

***[220]***This section provides options for phytosanitary measures that may be relevant for the pests listed in Table 1. The options presented are not intended to be exhaustive.

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

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

***[223]***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 9.

***[224]***Use of methyl bromide (Table 8) should take into account the Commission on Phytosanitary Measures recommendation on the *Replacement or reduction of the use of methyl bromide as a phytosanitary measure* (R-03). Alternative treatments that are more environmentally friendly are being pursued.

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

***[226]***Integrated measures may also include general agricultural practices and production procedures. Examples of these include the following:

* ***[227]***production practices and procedures, such as:
* ***[228]***orchard hygiene practices,
* ***[229]***monitoring for pests, and
* ***[230]***pest management;
* ***[231]***handling, grading and packing practices and procedures, such as:
* ***[232]***pest management in the packing house,
* ***[233]***packing fruit in material that is clean and either new or refurbished,
* ***[234]***storing and transporting fruit in a secure manner to prevent contamination and infestation (e.g. use of insect-proof packaging), and
* ***[235]***grading fruit to provide assurance that it is free from damage, symptoms of pests, and contamination (e.g. contamination with soil or plant debris); and
* ***[236]***secure management of treatment facilities to prevent contamination and infestation.

***[237]***

***[238]*Table 2.** Options for phytosanitary measures that may be relevant to all pests associated with fresh *Mangifera indica* fruit

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

***[256]****Sources:* ISPMs are available at [www.ippc.int/core-activities/standards-setting/ispms](https://www.ippc.int/core-activities/standards-setting/ispms).

***[257]***

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

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

***[395]****Notes:* \* Pre-export inspection targeting the pest of concern and the application of a remedial action if the pest is detected.

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

***[397]***HTFA, high temperature forced air (see Table 6); HWIT, hot water immersion treatment (see Table 4); IRDN, irradiation (see Table 7); MB, methyl bromide (see Table 8); SA, systems approach (see Table 9); VHT, vapour heat treatment (see Table 5).

***[398]***

***[399]*Table 4.** Schedules for hot water immersion treatment

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***[400]*Schedule number**  ***[401]*** | ***[402]*Fruit weight (g)**  ***[403]*** | ***[404]*Water temperature (°C)**  ***[405]*** | ***[406]*Immersion time (minutes)**  ***[407]*** | ***[408]*References\***  ***[409]*** |
| ***[410]***HWIT 1 | ***[411]***0–375  ***[412]***376–500  ***[413]***501–700 | ***[414]***46.1  ***[415]***46.1  ***[416]***46.1 | ***[417]***65  ***[418]***75  ***[419]***90 | ***[420]***USDA (2016) |
| ***[421]***HWIT 2 | ***[422]***0–425  ***[423]***426–650 | ***[424]***46.1  ***[425]***46.1 | ***[426]***75  ***[427]***90 | ***[428]***MERCOSUR (2006)  ***[429]***MPI (2023) |
| ***[430]***HWIT 3 | ***[431]***0–500  ***[432]***501–700  ***[433]***701–900 | ***[434]***46.1  ***[435]***46.1  ***[436]***46.1 | ***[437]***75  ***[438]***90  ***[439]***110 | ***[440]***Armstrong and Mangan (2007)  ***[441]***DAFF (2023) |
| ***[442]***HWIT 4 | ***[443]***0–500  ***[444]***501–700  ***[445]***701–900 | ***[446]***48.0  ***[447]***48.0  ***[448]***48.0 | ***[449]***60  ***[450]***75  ***[451]***90 | ***[452]***APQA (2012, 2016)  ***[453]***DAFF (2023) |
| ***[454]*Schedule number** | ***[455]*Fruit weight (g)** | ***[456]*Fruit pulp temperature (°C)** | ***[457]*Immersion time (minutes)** | ***[458]*References** |
| ***[459]***HWIT 5 | ***[460]***All | ***[461]***50.0 | ***[462]***11 | ***[463]***Zakariya and Alhassan (2014) |

***[464]****Note:* \* References listed in alphabetical order, not by weight of fruit.

***[465]****Sources*:

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

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

***[468]***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.

***[469]***DAFF (Department of Agriculture, Fisheries and Forestry). 2023. Australian Biosecurity Import Conditions. In: *Australian Government Department of Agriculture, Fisheries and Forestry*. Canberra. [Cited 29 January 2023]. [https://bicon.agriculture.gov.au/BiconWeb4.0](https://bicon.agriculture.gov.au/BiconWeb4.0/)

***[470]***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>

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

***[472]***USDA (United States Department of Agriculture). 2016. *Treatment manual*, 2nd edn. Animal and Plant Health Inspection Service, USDA. 968 pp. [www.aphis.usda.gov/import\_export/plants/manuals/ports/downloads/treatment.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf)

***[473]***Zakariya, A.A.-R.M. & Alhassan, N. 2014. Application of hot water and temperature treatments to improve quality of Keitt and Nam Doc Mai mango fruits. *International Journal of Scientific and Technology Research*, 3: 262–266. [www.ijstr.org/final-print/sep2014/Application-Of-Hot-Water-And-Temperature-Treatments-To-Improve-Quality-Of-Keitt-And-Nam-Doc-Mai-Mango-Fruits.pdf](https://www.ijstr.org/final-print/sep2014/Application-Of-Hot-Water-And-Temperature-Treatments-To-Improve-Quality-Of-Keitt-And-Nam-Doc-Mai-Mango-Fruits.pdf)

***[474]***

***[475]*Table 5.** Schedules for vapour heat treatment

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***[476]*Schedule number** | ***[477]*Minimum pulp temperature (°C)** | ***[478]*Minimum relative humidity (%)** | ***[479]*Minimum exposure time (minutes)** | ***[480]*References** |
| ***[481]***VHT 1 | ***[482]***46.0 | ***[483]***95 | ***[484]***10 | ***[485]***Dohino *et al.* (2017)  ***[486]***USDA (2016) |
| ***[487]***VHT 2 | ***[488]***46.5 | ***[489]***95 | ***[490]***10 | ***[491]*PT 30 (Vapour heat treatment for *Ceratitis capitata* on *Mangifera indica*)** |
| ***[492]***VHT 3 | ***[493]***46.5 | ***[494]***95 | ***[495]***30 | ***[496]***APPPC (2021) |
| ***[497]***VHT 4 | ***[498]***47.0 | ***[499]***90 | ***[500]***15 | ***[501]***DAFF (2023) |
| ***[502]***VHT 5 | ***[503]***47.0 | ***[504]***95 | ***[505]***15 | ***[506]*PT 31 (Vapour heat treatment for *Bactrocera tryoni* on *Mangifera indica*)** |
| ***[507]***VHT 6 | ***[508]***47.0 | ***[509]***95 | ***[510]***20 | ***[511]***APPPC (2021) |
| ***[512]***VHT 7 | ***[513]***47.5 | ***[514]***95 | ***[515]***20 | ***[516]***APPPC (2021) |

***[517]****Note:* **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.

***[518]****Sources:* ISPMs are available at [www.ippc.int/core-activities/standards-setting/ispms](https://www.ippc.int/core-activities/standards-setting/ispms).

***[519]***APPPC (Asia and Pacific Plant Protection Commission). 2021. *International movement of fresh mango (*Mangifera indica*) fruit*. Regional Standard for Phytosanitary Measures (RSPM) 11. Bangkok, APPPC, FAO. 12 pp. [www.fao.org/3/cb5357en/cb5357en.pdf](http://www.fao.org/3/cb5357en/cb5357en.pdf)

***[520]***DAFF (Department of Agriculture, Fisheries and Forestry). 2023. Australian Biosecurity Import Conditions. In: *Australian Government Department of Agriculture, Fisheries and Forestry*. Canberra. [Cited 17 May 2023]. [https://bicon.agriculture.gov.au/BiconWeb4.0](https://bicon.agriculture.gov.au/BiconWeb4.0/)

***[521]***Dohino,T., Hallman, G.J., Grout, T.G., Clarke, A.R., Follett, P.A., Cugala, D.R., Tu, D.M. *et al*. 2017. Phytosanitary treatments against *Bactrocera dorsalis* (Diptera: Tephritidae): current situation and future prospects. *Journal of Economic Entomology*, 110(1): 67–79. <https://doi.org/10.1093/jee/tow247>

***[522]***USDA (United States Department of Agriculture). 2016. Treatment manual, 2nd edn. Animal and Plant Health Inspection Service, USDA. 968 pp. [www.aphis.usda.gov/import\_export/plants/manuals/ports/downloads/treatment.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf)

***[523]***

***[524]*Table 6.** Schedules for high temperature forced air treatment

|  |  |  |  |
| --- | --- | --- | --- |
| ***[525]*Schedule number** | ***[526]*Minimum pulp temperature (°C)** | ***[527]*Minimum exposure time**  ***[528]*(minutes)** | ***[529]*References** |
| ***[530]***HTFA 1 | ***[531]***47.2 | ***[532]***20 | ***[533]***APPPC (2021)  ***[534]***MPI (2023) |

***[535]****Sources*:

***[536]***APPPC (Asia and Pacific Plant Protection Commission). 2021. *International movement of fresh mango (*Mangifera indica*) fruit*. Regional Standard for Phytosanitary Measures (RSPM) 11. Bangkok, APPPC, FAO. 12 pp. [www.fao.org/3/cb5357en/cb5357en.pdf](http://www.fao.org/3/cb5357en/cb5357en.pdf)

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

***[538]***

***[539]*Table 7.** Schedules for irradiation

|  |  |  |
| --- | --- | --- |
| ***[540]*Schedule number** | ***[541]*Dose (Gy)** | ***[542]*References** |
| ***[543]***IRDN 1 | ***[544]***70 | ***[545]*PT 1 (Irradiation treatment for *Anastrepha ludens*)**  ***[546]*PT 2 (Irradiation treatment for *Anastrepha obliqua*)**  ***[547]*PT 39 (Irradiation treatment for the genus *Anastrepha*)** |
| ***[548]***IRDN 2 | ***[549]***100 | ***[550]*PT 3 (Irradiation treatment for *Anastrepha serpentina*)**  ***[551]*PT 4 (Irradiation treatment for *Bactrocera jarvisi*)**  ***[552]*PT 5 (Irradiation treatment for *Bactrocera tryoni*)**  ***[553]*PT 14 (Irradiation treatment for *Ceratitis capitata*)** |
| ***[554]***IRDN 3 | ***[555]***116 | ***[556]*PT 33 (Irradiation treatment for *Bactrocera dorsalis*)** |
| ***[557]***IRDN 4 | ***[558]***150 | ***[559]*PT 7 (Irradiation treatment for fruit flies of the family Tephritidae (generic))** |
| ***[560]***IRDN 5 | ***[561]***165 | ***[562]*PT 43 (Irradiation treatment for *Sternochetus frigidus*)** |
| ***[563]***IRDN 6 | ***[564]***231 | ***[565]*PT 19 (Irradiation treatment for *Dysmicoccus neobrevipes*, *Planococcus lilacinus* and *Planococcus minor*)** |
| ***[566]***IRDN 7 | ***[567]***300 | ***[568]***USDA (2016) |
| ***[569]***IRDN 8\* | ***[570]***400 | ***[571]***APPPC (2021) |

***[572]****Notes: \** IRDN 8 treatment excludes pupae and adults of the order Lepidoptera.

***[573]*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.

***[574]****Sources:* ISPMs are available at [www.ippc.int/core-activities/standards-setting/ispms](https://www.ippc.int/core-activities/standards-setting/ispms).

***[575]***APPPC (Asia and Pacific Plant Protection Commission). 2021. *International movement of fresh mango (*Mangifera indica*) fruit*. Regional Standard for Phytosanitary Measures (RSPM) 11. Bangkok, APPPC, FAO. 12 pp. [www.fao.org/3/cb5357en/cb5357en.pdf](http://www.fao.org/3/cb5357en/cb5357en.pdf)

***[576]***USDA (United States Department of Agriculture). 2016. *Treatment manual*, 2nd edn. Animal and Plant Health Inspection Service, USDA. 968 pp. [www.aphis.usda.gov/import\_export/plants/manuals/ports/downloads/treatment.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf)

***[577]***

***[578]*Table 8.** Schedules for methyl bromide fumigation (applied under normal atmospheric pressure)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***[579]*Schedule number** | ***[580]*Minimum temperature (°C)** | ***[581]*Minimum dose (g/m3)** | ***[582]*Minimum time (hours)** | ***[583]*Reference** |
| ***[584]***MB 1 | ***[585]***21 | ***[586]***32 | ***[587]***2 | ***[588]***DAC (2003) |

***[589]****Source:*

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

***[591]*Table 9.** Systems approaches based on ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*)

|  |  |  |
| --- | --- | --- |
| ***[592]*Systems approach number** | ***[593]*Independent measures** | ***[594]*Reference** |
| ***[595]***SA 1 | ***[596]****Pre-harvest control measures*(e.g. targeted field management using pest control)  ***[597]****Harvest control measures* (e.g. field sanitation, removal of infested fruit)  ***[598]****Post-harvest control measures* (e.g. washing and brushing; chemical dipping; targeted inspection and remedial action to remove external pests) | ***[599]***Lun (2017)  ***[600]*** |

***[601]****Source:* ISPMs are available at [www.ippc.int/core-activities/standards-setting/ispms](https://www.ippc.int/core-activities/standards-setting/ispms).

***[602]***Lun, V. 2017. Case study on Cambodian fresh mangos export to Korea. Presentation, 7 September 2017, Yogyakarta, Indonesia. [www.unescap.org/sites/default/files/4.1%20Case%20Study%20on%20Cambodian%20Fresh%20Mango%20Export%20to%20Korea\_L.%20Vanny.pdf](https://www.unescap.org/sites/default/files/4.1%20Case%20Study%20on%20Cambodian%20Fresh%20Mango%20Export%20to%20Korea_L.%20Vanny.pdf)

***[603]***

***[604]***5. References

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

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

***[607]*IPPC Secretariat**. 1997. *International Plant Protection Convention*. Rome, IPPC Secretariat, FAO. [www.ippc.int/en/core-activities/governance/convention-text](https://www.ippc.int/en/core-activities/governance/convention-text/)

***[608]***Potential implementation issues

***[609]***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.

***[610]***