

GB 2763—2021 中果品农药最大残留限量标准解析

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摘要:农药残留是影响果品质量安全的重要因素,其最大残留限量(maximum residue limit, MRL)是评价果品质量安全状况和实施质量安全监管的重要技术指标。“十三五”期间,我国农药残留国家标准体系建设取得了积极进展,尤其是(GB 2763—2021)《食品安全国家标准 食品中农药最大残留限量》的颁布,实现了我国农药残留国家标准体系建设的历史性跨越。笔者在本文中着重梳理我国农药残留限量标准发展历程,剖析我国果品中农药残留限量标准现状,厘清GB 2763—2021对果品规定MRL的农药品种及其MRL基本情况,比较果品中农药残留限量标准的主要变化,并归纳出果品中农药MRL标准特征,以期为我国果品中污染物限量标准制(修)订提供依据。GB 2763—2021规定了326种农药在果品中的2768项MRL。相比GB 2763—2019,GB 2763—2021针对果品新增62种农药、新增722项限量标准,修订9种农药残留物定义及4种农药的每日允许摄入量(allowable daily intake, ADI),新增3种果品名称,修订3种果品名称,修订16种农药54项MRL,调整部分配套农药残留检测方法。总体来说,我国果品中农药MRL标准体现了“四个最严”的要求,具有涵盖农药品种多和限量标准数量大、标准制定更加科学严谨并与国际接轨、农药残留物监测定义和ADI值更科学以及配套检测方法更加完善等特点,更有利果品生产中农药的安全使用和监管,更能促进果品质量安全水平的提高。

关键词:果品;农药;最大残留限量;质量安全

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Analysis of the maximum residue limits of pesticides in fruits according to GB 2763—2021

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Abstract: Pesticide residue is an important factor affecting the quality and safety of fruit, and its maximum residue limit (MRL) is an important technical means to evaluate the quality and safety of fruit and implement quality and safety supervision. “National Food Safety Standard-Maximum Residue Limits of Pesticides in Foods” (GB 2763) is a mandatory national standard in China that uniformly stipulates the maximum residue limits of pesticides in foods (fruits are complied with). This paper focused on the development history of pesticide residue limit standards in China analyzed the current situation of pesticide residue limit standards in fruits in my country, clarified the types of pesticides and the basic situation of the maximum residue limits for fruits stipulated in GB 2763—2021, and compared the pesticide

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residue limit standards in fruits, in order to provide a basis for the formulation and revision of the limit standards for pollutants in fruits in my country, and provide technical support for scientific guidance on the safe use of pesticides in fruit production. The previous versions of GB 2763 included GB 2763—1981, GB 2763—2005, GB 2763—2012, GB 2763—2014, GB 2763—2016 [including the supplementary version “National Food Safety Standard for Maximum Residue Limits of 43 Pesticides Including Paraquat in Foods” (GB 2763.1—2018)], GB 2763—2019 and GB 2763—2021. The promulgation of GB 2763—2021 has achieved a historic leap in the construction of China’s national pesticide residue standards system. The number of pesticide residue limits in food stipulated by my country has exceeded 10,000 for the first time, and the number of pesticide types and limit standards has reached the International Codex Alimentarius Commission (CAC) nearly twice that of the relevant standards, and the number of pesticide varieties and residue limit standards in fruits has also greatly increased. 2768 MRLs for 326 pesticides in fruits were formulated in GB 2763—2021. According to the pesticide use specification, there were 277 conventional pesticides (2417 MRLs), such as 2,4-D and 2,4-D sodium salt, abamectin and fenflurone, which were allowed to be used, accounting for 85.0% of the total number of pesticide varieties with MRL in fruits (MRL accounted for 87.3% of the total number of MRL in fruits); 29 banned pesticides (195 MRLs), such as 666, DDT and toxaphene, were banned in my country, accounting for the current 64.4% of the banned pesticides (MRL accounted for 7.0% of the total number of MRL in fruits); there were 20 restricted pesticides such as carbocarb, omethoate, methomyl, etc. (156 MRLs), accounting for the current 71.4% of the restricted pesticides (MRL accounted for 5.7% of the total number of MRL in fruits). By fruit category, the most types of pesticides with MRL for pome fruit (246 pesticides, 432 MRLs), berries and other small fruits (245 pesticides, 521 MRLs) and citrus fruits (217 pesticides, 534 MRLs), followed by melons and fruits (196 pesticides, 234 MRLs), stone fruits (193 pesticides, 374 MRLs) and tropical and subtropical fruits (188 pesticides, 377 MRLs), while there were relatively few pesticides with residue limit standards in dried fruits (123 pesticides, 152 MRLs) and nuts (118 pesticides, 148 MRLs). In terms of pesticide use, the insecticides (122 pesticides, 1117 MRLs) and fungicides (113 pesticides, 1011 MRLs) with MRLs were the most, followed by herbicides (42 pesticides, 259 MRLs), acaricides (25 pesticides, 246 MRLs), and plant growth regulators again (9 pesticides, 47 MRLs). In addition, insecticides/acaricides (5 pesticides, 42 MRLs), nematicides (3 pesticides, 12 MRLs), fumigants (2 pesticides, 10 MRLs), synergists (1 pesticide, 3 MRLs), molluscicide (1 pesticide, 2 MRLs), moluskocdy dict (1 pesticide, 3 MRLs), insecticides/herbicides (1 pesticide, 8 MRLs), acaricides/fungicides (1 pesticide, 8 MRLs) were less. Compared with the previous version, GB 2763—2021 has been revised in terms of pesticide types, limit standards, residue definitions, ADI values, and supporting testing methods. In GB 2763—2021, 62 new pesticides were added such as patophos and phenoxy carb, and 722 maximum residue limits were worked out in fruits, the definitions of 9 pesticide residues were revised including fluazifop and fluazifop-P-butyl, Jinggangmycin, spirotetramat, cyazofamid, zinchiazole and triadimefon, and the allowable daily intake (ADI) of four pesticides was revised including quizalofop-ethyl, quizalofop-P-ethyl, fenpropimorph and teflubenzuron. 3 fruit names were added including cantaloupe eggplant, dried citrus and dried apple, and the names of 3 fruits were revised including berries and other small fruits, tropical and subtropical fruits, mango, and the food category of wolfberry (dried) was adjusted from dried fruit to the flowers and fruits of medicinal plants. 51 MRLs of 13 pesticides were modified including benomyl, diafenthiuron, boscalid from temporary limit to formal limit, and the MRL of quizalofop-ethyl and quizalofop-P-ethyl in watermelon from the formal limit to the temporary limit, and the values of 54 MRLs for 16 pesticides were adjusted including dimethoate, dicofol, dimethoate, methyl bromide, prothioconazole, prosenzinc, disenzinc, car-

bendazim, fumezinc, cyhalothrin, beta-cyhalothrin in citrus, tangerine, orange and other fruits, and the quantification limit levels of the detection methods of the banned pesticides were formulated such as dicofol, chlorfenaphos, endosulfan and methyl bromide, as well as the restricted pesticides such as dimethoate and acephate as the maximum residue limit value, and the limits of some banned and restricted pesticides for a single fruit were revised to the limits of major groups of fruits. Four supporting pesticide residue testing methods were added including GB 23200.116, GB 23200.117, SN/T 4066, SN/T 4591, SN/T 0654 was modified, and GB/T 5009.110 was deleted. Anyhow, the maximum residue limits for pesticides in fruits in my country, covered a large number of pesticide varieties and a large number of MRL, manifesting the “four strictest” requirements, and the standard formulation was more scientific, rigorous and in line with international standards, the definition of pesticide residue monitoring and the ADI value were more scientific and perfect to support detection methods, etc., and the supporting detection method was more perfect, which was more conducive to the safe use and supervision of pesticides in fruit production, and can promote the improvement of fruit quality and safety level.

Key words: Fruit; Pesticide; MRL; Quality safety

中国是世界果品生产大国,自1993年开始,水果栽培面积和产量均已超过印度、巴西和美国,位居世界第一^[1-2]。发展水果产业是农民增收的主要途径,在农业生产中占据举足轻重的地位,同时果品又是重要的出口创汇农产品^[3-5]。农药残留是影响食品(包括果品等食用农产品)质量安全的重要因素,其最大残留限量(maximum residue limit, MRL)标准是评价食品质量安全状况和实施质量安全监管的重要技术手段,也是各国政府和有关国际组织加强食品中农药残留风险管理的通行做法^[6-7],在保障食品安全消费和发展国际贸易中发挥着重要的作用^[8-9]。近年来,特别是“十三五”期间,农业农村部将加强农药残留国家标准体系建设作为重要任务,我国农药残留国家标准体系建设取得了积极进展,尤其是(GB 2763—2021)《食品安全国家标准食品中农药最大残留限量》的颁布,实现了我国农药残留国家标准体系建设的历史性跨越,果品中农药品种和残留限量标准数量也得到大幅度提升^[7,10]。因此,对强制执行的现行有效国家标准GB 2763—2021中果品相关农药及限量标准进行系统比较分析,掌握我国果品中规定MRL的农药品种,弄清我国果品中农药MRL标准的现状,不仅为我国的食品中污染物限量标准制(修)订提供依据,同时对科学、合理地指导我国果品生产中农药的安全使用及提高果品质量安全水平有重要意义。

1 我国果品中农药残留限量标准发展历程

我国食品中农药MRL标准最早可以追溯至我

国制定的第一项食品中农药MRL标准GBn 53—1977,该标准于1981年被(GB 2763—1981)《粮食、蔬菜等食品中六六六、滴滴涕残留量标准》替代,此后不断加强修订和完善。2005年1月25日,我国颁布GB 2763—2005,同时废止和代替所有此前发布实施的农药MRL国家标准,自此(GB 2763)《食品安全国家标准 食品中农药最大残留限量》成为我国统一规定食品中农药MRL的强制性国家标准(果品遵照执行)。由此认为,GB 2763主要历次版本有GB 2763—1981^[3]、GB 2763—2005^[11]、GB 2763—2012^[12]、GB 2763—2014^[13]、GB 2763—2016^[14][含补充版本(GB 2763.1—2018^[15])《食品安全国家标准 食品中百草枯等43种农药最大残留限量》]、GB 2763—2019^[16]、GB 2763—2021^[17]。GB 2763—2021由我国国家卫生健康委员会、农业农村部和国家市场监督管理总局联合发布,并于2021年9月3日起正式实施,是我国目前唯一现行有效的食品中农药残留限量国家标准,规定了2,4-滴等564种农药在376种(类)食品中10 092项残留限量标准,至此我国规定的食品中农药残留限量标准数量首次突破10 000项,全面覆盖了我国批准使用的农药品种和主要植物源性农产品,完成了国务院批准的《加快完善我国农药残留标准体系的工作方案》规定的目标任务,农药种类和限量标准数量达到国际食品法典委员会(Codex Alimentarius Commission, CAC)相关标准的近2倍,标志着我国农药残留标准制定工作迈上了新台阶,将为我国规范科学合理用药、加强农产品质量安全监管、促进农产品国际贸易健康发展发挥重

要作用^[7, 10]。与此同时,我国果品MRL标准也由GB 2763—2005中的70种农药107项限量标准增加至GB 2763—2021中的326种农药2768项限量。GB 2763历次版本中规定的果品中农药种类及MRL标准数量分布见图1。

2 我国果品中农药残留限量标准现状

2.1 果品中规定MRL的禁限用农药

为了界定农药MRL的应用范围,GB 2763—2021将果品主要分为8类,即柑橘类水果、仁果类水果、核果类水果、浆果和其他小型类水果、热带和亚热带类水果、瓜果类水果、干制水果和坚果。该标准对果品中2,4-滴等326种农药规定有MRL标准,豁免了低聚糖素等44种低风险农药制定MRL标准,基本覆盖了我国批准使用的农药品种,缓解了“有农药登记、无限量标准”的历史遗留监管难题,有力地促进果品生产中农药科学规范使用,切实保障果品等食用农产品质量安全。在规定的

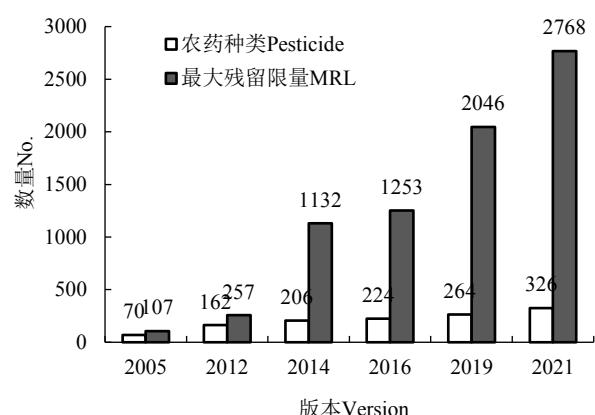


图1 GB2763历次版本果品中农药及MRL标准数量分布

Fig. 1 Distribution of pesticide pesticides and MRL in previous versions of GB 2763

326种农药中(表1),允许使用的常规农药有2,4-滴和2,4-滴钠盐、阿维菌素和胺苯吡菌酮等277种,占果品中规定MRL农药品种总数的85.0%;我国或全球范围的禁用农药有六六六、滴滴涕和毒杀芬等29种,占我国禁用农药的64.4%;限用农药有克百威、

表1 制定MRL标准的禁限用农药
Table 1 Set maximum residue limit of banned and restricted pesticides

农药种类 Pesticide type	农药名称 Pesticide name
禁用农药 Banned pesticides	六六六,滴滴涕,毒杀芬,杀虫脒,艾氏剂,狄氏剂,甲胺磷,对硫磷,甲基对硫磷,久效磷,磷胺,苯线磷,地虫硫磷,甲基硫环磷,硫线磷,蝇毒磷,治螟磷,特丁硫磷,氯磺隆,胺苯磺隆,甲磺隆,三氯杀螨醇,硫丹,百草枯,杀扑磷, ^A 氯丹, ^A 灭蚁灵, ^A 七氯, ^A 异狄氏剂HCH, DDT, Camphechlor, Chlordimeform, Aldrin, Dieldrin, Methamidophos, Parathion, Parathion-methyl, Monocrotophos, Phosphamidon, Fenamiphos, Fonofos, Phosfolan-methyl, Cadusafos, Coumaphos, Sulfotep, Terbufos, Chlorsulfuron, Ethametsulfuron, Metsulfuron-methyl, Dicofol, Endosulfan, Paraquat, Methidathion, Chlordane, Mirex, Heptachlor, Endrin
限用农药 Restricted pesticides	^B 甲拌磷, ^B 甲基异柳磷, ^B 水胺硫磷, ^B 灭线磷, ^C 溴甲烷,克百威,氧乐果,灭多威,涕灭威,内吸磷,硫环磷,氯唑磷,丁硫克百威,乙酰甲胺磷,乐果,毒死蜱,三唑磷,氰戊菊酯和S-氰戊菊酯,氟虫腈,氟苯虫酰胺Phorate, Isofenphos-methyl, Isocarbophos, Ethoprophos, Methylbromide, Carbofuran, Omethoate, Methomyl, Aldicarb, Demeton, Phosfolan, Isazofos, Carbosulfan, Acephate, Dimethoate, Chlorpyrifos, Triazophos, Fenvalerate and esfenvalerate, Fipronil, Flubendiamide

注:表中字母A表示氯丹、灭蚁灵、七氯、异狄氏剂等4种农药属于全球范围内禁用农药,虽然不在我国禁用农药目录中,但仍一并列入禁用农药;字母B表示甲拌磷以及甲基异柳磷、水胺硫磷、灭线磷等4种农药已被列入我国禁用农药目录,将于2024年9月1日起禁止使用;字母C表示溴甲烷仅可用于“检疫熏蒸处理”。

Note: Letter A indicates that four pesticides such as chlordane, mirex, heptachlor, and endrin are banned pesticides in the world. Although they are not included in the list of banned pesticides in my country, they are still included in the list of banned pesticides; Letter B indicates that four pesticides such as phorate, isofenphos-methyl, isocarbophos and ethoprophos have been included in the list of banned pesticides in my country and will be banned from September 1, 2024; Letter C indicates that methyl bromide can only be used for “quarantine fumigation”.

氧乐果和灭多威等20种,占我国目前限用农药的71.4%。

2.2 果品中农药MRL标准基本情况

在GB 2763—2021对果品规定的326种农药2768项MRL中,临时残留限量(temporary maxi-

mum residue limit, TMRL)650项,再残留限量(extraneous maximum residue limit, EMRL)55项。按照果品类别来说(图2),柑橘类水果(217种农药、534项限量)及浆果和其他小型类水果(农药245种、限量521项)规定最多,其次为仁果类水果(246种农药、

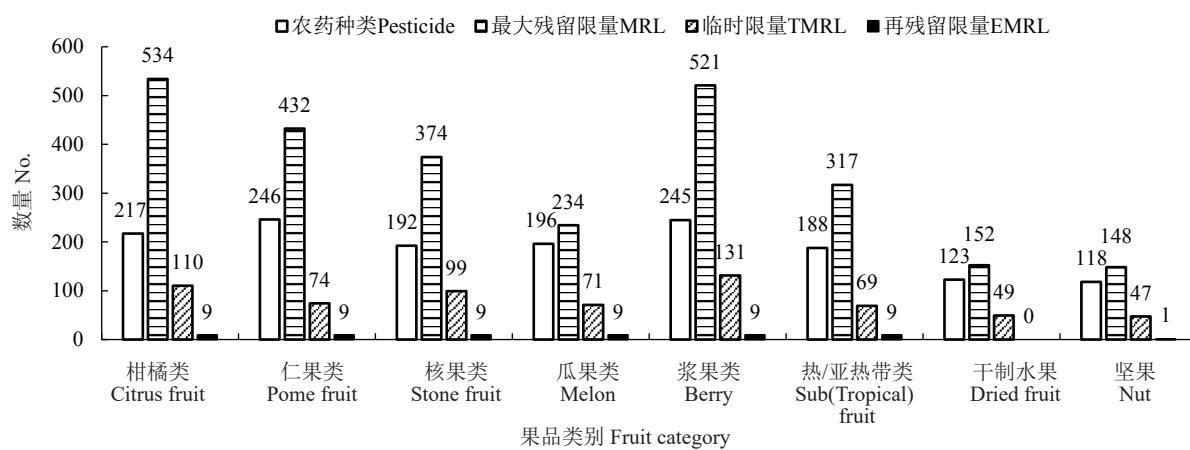


图2 果品中农药及MRL标准数量分布

Fig. 2 Distribution of pesticide pesticides and maximum residue limit standards

432项限量)、热带和亚热带类水果(188种农药、377项限量)及核果类水果(农药193种、限量374项),而瓜果类水果、干制水果和坚果中规定的农药MRL标准相对较少。按照农药用途来说(表2),杀虫剂(122种农药、1117项限量)和杀菌剂(113种农药、1011项限量)最多,其次为除草剂(42种农药、259项限量)、杀螨剂(25种农药、246项限量),再次为植物生长调节

剂(9种农药、47项限量)和杀虫/杀螨剂(5种农药、42项限量),另外杀线虫剂、熏蒸剂、杀虫/除草剂、杀螨/杀菌剂、杀软体动物剂和增效剂相对较少。按照农药使用规范来说(表3),常规农药277种制定残留限量2417项,占果品中限量标准总数量的87.3%;禁用农药29种制定的残留限量195项,占7.0%;限用农药20种制定的残留限量156项,占5.7%。

表2 MRL标准在不同类别果品中分布

Table 2 The distribution of MRL in different categories of fruit products

农药(限量) Pesticide(MRL)	总体 Total	柑橘类 Citrus fruit	仁果类 Pome fruit	核果类 Stone fruit	瓜果类 Melon	浆果类 Berry	热/亚热带类 Sub(Tropical) fruit	干制水果 Dried fruit	坚果 Nut
杀虫剂 Insecticide	122(1117)	104(235)	104(165)	91(168)	80(95)	94(179)	81(164)	46(56)	45(59)
杀菌剂 Bactericide	113(1011)	48(138)	77(169)	53(144)	69(88)	85(229)	60(150)	40(53)	30(40)
杀虫/除草剂 Pest/Herbicide	1(8)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)
杀虫/杀螨剂 Pest/Miticide	5(42)	5(11)	5(6)	3(3)	3(3)	4(10)	4(4)	2(2)	3(3)
杀螨/杀菌剂 Miti/Bactericide	1(8)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)
除草剂 Herbicide	42(259)	28(56)	30(35)	26(27)	22(22)	30(46)	24(31)	17(17)	22(25)
杀螨剂 Miticide	25(246)	22(76)	21(48)	14(26)	10(12)	19(40)	9(12)	13(17)	13(15)
杀线虫剂 Nematocide	3(12)	1(1)	1(1)	1(1)	3(4)	2(3)	2(2)	0(0)	0(0)
熏蒸剂 Fumigant	2(10)	1(1)	1(1)	1(1)	2(2)	2(2)	1(1)	1(1)	1(1)
植调剂 PGR	9(47)	5(13)	5(5)	2(2)	3(4)	5(8)	4(10)	1(3)	1(2)
杀软体动物剂 Molluscicide	1(3)	/	/	/	1(1)	1(1)	/	/	1(1)
增效剂 Synergist	1(3)	1(1)	/	/	1(1)	/	/	1(1)	/
杀螺剂 Molluscicide	1(2)	/	/	/	/	1(1)	1(1)	/	/
合计 Total	326(2768)	217(534)	246(432)	193(374)	196(234)	245(521)	188(377)	123(152)	118(148)

注:表中括号内数字为限量标准数量,括号外数字为农药种类数量。下同。

Note: Numbers inside () are the standard quantity of the limit and numbers outside the () are the quantity of pesticide types. The same below.

表3 果品中不同类型农药规定的MRL标准数量分布

Table 3 Standard quantity distribution of MRL for different types of pesticides in fruits

限量类别 MRL type	总体 Total	柑橘类 Citrus fruit	仁果类 Pome fruit	核果类 Stone fruit	瓜果类 Melon	浆果类 Berry	热/亚热带类 Sub (Tropical) fruit	干制水果 Dried fruit	坚果 Nut
常规农药 CP	277(2417)	169(472)	197(376)	145(323)	151(189)	197(467)	140(323)	110(138)	107(133)
禁用农药 BUP	29(195)	29(32)	29(30)	29(29)	28(28)	29(29)	29(31)	6(6)	8(10)
限用农药 RUP	20(156)	19(30)	20(26)	19(22)	17(17)	19(25)	19(23)	7(8)	3(5)
合计 Total	326(2768)	217(534)	246(432)	193(374)	196(234)	245(521)	188(377)	123(152)	118(148)

3 果品中农药残留限量标准GB 2763—2021主要变化

3.1 新增农药62种、新增限量标准722项

与GB 2763—2019相比,GB 2763—2021针对果品制定限量标准的农药增加了62种(表4),主要包括巴毒磷、苯氧威等杀虫剂14种,胺苯吡菌酮、毒菌酚等杀菌剂13种,草枯醚、草芽畏等除草剂20种,格螨酯、环螨酯等杀螨剂7种,氟噻虫砜等杀线虫剂1种,氟节胺、烯效唑等植物生长调节剂2种,四聚乙醛等杀螺剂1种,戊硝酚等杀虫/除草剂1种,速灭磷、消螨酚等杀虫/杀螨剂2种,乐杀螨等杀螨/杀菌剂1种,果品中相应限量标准增加了380项;另外,在针对果品制定有残留限量的已有农药基础上,水果限量新增359个;同时,由于枸杞(干)不再归为干制水果之列、个别单个果品限量标准统一按照果品大类别设定残留限量等,其限量标准数量相应减少。总体来说,GB 2763—2021针对果品新增62种农药、722项限量标准。

新增的62种农药中,苯氧威、二溴磷等27种农药没有配套农药残留检测方法;巴毒磷、丙酯杀螨醇等14种农药没有每日允许摄入量(acceptable daily intake,ADI)值,而庚烯磷、灭草环2种农药仅有临时ADI值;巴毒磷、丙酯杀螨醇等37种农药尚未在我国取得登记;苯并烯氟菌唑、吡氟禾草灵和精吡氟禾草灵、二甲戊灵、二氯喹啉酸、甲磺隆、四聚乙醛等7种农药虽然已在我国取得登记,但尚未在果树或水果中取得登记。新增的62种农药中已在果树或水果中取得登记的农药所占比例不足30%。

3.2 修订9种农药残留物定义及4种农药ADI值

为保证膳食风险评估数据的科学性,参考FAO/WHO农药残留专家联席会议(JMPR)评审结果,与GB 2763—2019相比,GB 2763—2021针对果品修订了吡氟禾草灵和精吡氟禾草灵、井冈霉素等9种农药残留物监测定义(表5)^[7,10];同时,还修订了喹禾

灵和精喹禾灵、丁苯吗啉、氟苯脲等4种农药的ADI值(表6)。

3.3 新增3种果品名称,修订3种果品名称

根据商品果品形态、主要用途及相关农药残留限量制定等情况,与GB 2763—2019相比,GB 2763—2021修订了规范性附录A(食品类别及测定部位),针对果品增加了香瓜茄、柑橘肉(干)和苹果干3种果品名称,修订了浆果和其他小型水果、热带和亚热带水果、杧果3种果品名称,同时将枸杞(干)的食品类别从干制水果调整为药用植物的花及果实类(表7)。

3.4 修订部分农药MRL

与GB 2763—2019相比,GB 2763—2021针对果品规定的农药MRL,除了在限量标准数量上大幅新增之外,在限量类别、限量值及规定类别等方面也修订较多(表8)。

(1)限量类别的改变。由于配套农药残留检测方法的推荐增补,将果品中苯菌灵、丁醚脲和啶酰菌胺等13种农药的51项限量由临时限量修改为正式限量。例如苯菌灵在柑、橘、橙和苹果中的限量 $5 \text{ mg} \cdot \text{kg}^{-1}$ 、在梨中限量 $3 \text{ mg} \cdot \text{kg}^{-1}$ 和在香蕉中限量 $2 \text{ mg} \cdot \text{kg}^{-1}$,以及丁醚脲在柑、橘、橙和苹果中的限量 $0.2 \text{ mg} \cdot \text{kg}^{-1}$ 等,均由原来的临时限量修订为正式限量。同时由于缺乏配套检测方法,喹禾灵和精喹禾灵在西瓜中的限量 $0.2 \text{ mg} \cdot \text{kg}^{-1}$ 由正式限量修改为临时限量。

(2)限量值的改变。由于禁用管理政策的实施、新的农药登记残留实验数据的获得以及残留定义的规范统一等,并基于膳食风险评估结果,对乐果、三氯杀螨醇等16种农药在柑、橘和橙等果品中的54项限量标准值进行了修订^[7,10]。例如丙硫菌唑在越橘中的限量由原来的 $0.15 \text{ mg} \cdot \text{kg}^{-1}$ 修订为 $1.5 \text{ mg} \cdot \text{kg}^{-1}$,丙森锌在柑、橘、橙中的 $3 \text{ mg} \cdot \text{kg}^{-1}$ 以及杧果中的 $2 \text{ mg} \cdot \text{kg}^{-1}$ 修订为 $5 \text{ mg} \cdot \text{kg}^{-1}$ 。

(3)部分禁限用农药按照定量限水平设置限量,

表4 新增62种农药及相应限量标准
Table 4 Added 62 pesticides and corresponding MRL

农药名称 Pesticide	允许摄入量 ADI/(mg·kg ⁻¹)	限量数 MRL	登记状态 Registered	农药名称 Pesticide	允许摄入量 ADI/(mg·kg ⁻¹)	限量数 MRL	登记状态 Registered
巴毒磷 Crotoxyphos	/	8	无 No	三氟硝草醚 Fluorodifen	/	8	无 No
丙酯杀螨醇 Chloropropylate	/	8	无 No	特乐酚 Dinoterb	/	8	无 No
毒虫畏 Chlorfenvinphos	0.000 5	8	无 No	抑草蓬 Erbon	/	8	无 No
[^] 二溴磷 Naled	0.002 0	8	无 No	茚草酮 Indanofan	0.003 5	8	无 No
庚烯磷 Heptenophos	0.003 0	8	无 No	胺苯磺隆	0.200 0	8	无 No
甲氧滴滴涕 Methoxychlor	0.005 0	8	无 No	Ethametsulfuron			
杀虫畏 Tetrachlorvinphos	0.002 8	8	无 No	氯磺隆 Chlorsulfuron	0.200 0	8	无 No
[^] 烯虫炔酯 Kinoprene	/	8	无 No	[^] 格螨酯 Phenol	/	8	无 No
[^] 烯虫乙酯 Hydroprene	0.100 0	8	无 No	[^] 环螨酯 Cycloprate	/	8	无 No
[^] 胺苯吡菌酮 Fenpyrazamine	0.300 0	13	无 No	[^] 螺甲螨酯 Spiromesifen	0.030 0	4	无 No
[^] 毒菌酚 Hexachlorophene	0.000 3	8	无 No	灭螨酮 Acequincyl	0.023 0	8	无 No
活化酯 Acibenzolar-S-methyl	0.080 0	10	无 No	乙酯杀螨醇	0.020 0	8	无 No
氯苯甲醚 Chloroneb	0.013 0	8	无 No	Chlorobenzilate			
[^] 异丙噻菌胺 Isofetamid	0.050 0	6	无 No	[^] 氟噻虫砜 Fluensulfone	0.010 0	4	无 No
[^] 草枯醚 Chlornitrofen	/	8	无 No	四聚乙醛 Metaldehyde	0.100 0	2	是 Yes
[^] 草芽畏 2,3,6-TBA	/	8	无 No	[^] 戊硝酚 Dinosam	/	8	无 No
[^] 氟除草醚 Fluoronitrofen	/	8	无 No	速灭磷 Mevinphos	0.000 8	8	无 No
[^] 氯酞酸 Chlorthal	0.010 0	8	无 No	[^] 消螨酚 Dinex	0.002 0	8	无 No
氯酞酸甲酯	0.010 0	8	无 No	乐杀螨 Binapacryl	/	8	无 No
Chlorthal-dimethyl				灭草环 Tridiphane	0.003 0	8	无 No
[^] 茅草枯 Dalapon	0.030 0	8	无 No	二甲戊灵	0.100 0	2	是 Yes
甲磺隆 Metsulfuron-methyl	0.250 0	8	是 Yes	Pendimethalin			
精(毗氟禾草灵) Fluazifop-(P-butyl)	0.004 0	16	是 Yes	二氯喹啉酸 Quinclorac	0.400 0	1	是 Yes
[^] 唑虫酰胺 Tolfenpyrad	0.006 0	1	柑橘树 Citrus tree	[^] 四霉素 Tetramycin	0.390 0	1	苹果树 Apple tree
[^] 苯氧威 Fenoxtcarb	0.053 0	3	柑橘树 Citrus tree	十三吗啉	0.010 0	1	枸杞 Wolfberry
[^] 氟吡呋喃酮 Flupyridafurone	0.080 0	15	柑橘树 Citrus tree	Tridemorph			
[^] 硝虫硫磷 Xiaocongliulin	0.010 0	3	柑橘树 Citrus tree	[^] 申嗪霉素 PCA	0.002 8	1	西瓜 Watermelon
[^] 氟噻唑乙酮 Oxathiapiprolin	4.000 0	2	荔枝 Lychees	喹螨醚 Fenazaquin	0.050 0	2	苹果树 Apple tree
抑霉唑硫酸盐 Imazalil sulfate	0.030 0	3	柑橘(果实) Citrus(fruit) 香蕉 Banana	烯效唑 Uniconazole	0.020 0	3	柑橘树 Citrus tree
[^] 烯肟菌胺 Fenaminstrobin	0.069 0	3	柑橘树 Citrus tree 西瓜 Watermelon 香蕉 Banana	甜菜安	0.040 0	1	草莓田
吡蚜酮 Pymetrozine	0.030 0	2	柑橘树 Citrus tree 桃树 Peach tree 桑树 Mulberry tree 苹果树 Apple tree 西瓜 Watermelon	Desmedipham			Strawberry field
除草定 Bromacil	0.100 0	4	柑橘园 Citrus orchard 菠萝田 Pineapple field	[^] 苯并烯氟菌唑 Benzovindiflupyr	0.050 0	4	/
				[^] 辛菌胺醋酸盐 Xinjunanacetate	/	1	苹果树 Apple tree
				[^] 乙唑螨腈 Cyetpyrafen	0.100 0	4	柑橘树 Citrus tree 苹果树 Apple tree 草莓 Strawberry
				氟节胺 Flumetralin	0.500 0	4	杨梅 Bayberry tree 柑橘树 Citrus tree 荔枝树 Lychee tree

注:表中字母 A 表示该农药没有推荐检测方法;字母 T 表示该农药仅有临时 ADI 值;“No”表示该农药在我国没有登记;“Yes”表示该农药虽然已在我国取得登记,但尚未在果树或水果中取得登记。

Note: Letter A indicates that there is no recommended detection method for this pesticide. Letter T indicates that the ADI value of the pesticide is temporary. “No” indicates that the pesticide has not been registered in China. “Yes” means that although the pesticide has been registered in China, it has not yet been registered in fruit trees or fruits.

表5 修订9种农药残留物监测定义

Table 5 9 pesticides with revised monitoring residue definitions

农药名称 Pesticide	GB 2763—2021	GB 2763—2019
精(吡氟禾草灵) Fluazifop-(P-butyl)	吡氟禾草灵和吡氟禾草酸之和,以吡氟禾草酸表示 Sum of fluazifop and fluazifop acid, expressed as fluazifop acid	吡氟禾草灵及其代谢物吡氟禾草酸之和,以吡氟禾草灵表示 Sum of fluazifop and fluazifop acid, expressed as fluazifop
井冈霉素 Jiangangmycin 喹禾灵和精喹禾灵 Quizalofop-(P)-ethyl	井冈霉素 A Jiangangmycin A 喹禾灵与喹禾灵酸之和,以喹禾灵酸表示 Sum of quizalofop-p-ethyl and quizalofop-ethyl acid, expressed as quizalofop-p-ethyl	井冈霉素 Jiangangmycin 喹禾灵 Quizalofop-ethyl
螺虫乙酯 Spirotetramat	螺虫乙酯及其代谢物顺式-3-(2,5-二甲基苯基)-4-羧基-8-甲氧基-1-氮杂螺[4.5]癸-3-烯-2-酮之和 Sum of spirotetramat and cis-3-(2,5-dimethylphenyl)-4-carbonyl-8-methoxy-1-azaspiro[4.5]dec-3-en-2-one	螺虫乙酯及其烯醇类代谢产物之和 Sum of spirotetramat and its enol metabolites
氰霜唑 Cyazofamid	氰霜唑 Cyazofamid	氰霜唑及其代谢物4-氯-5-(4-甲苯基)-1H-咪唑-2-腈之和 Sum of cyazofamid and 4-Chloro-5-(4-methylphenyl)-1H-imidazole-2carbonitrile
噻唑锌 Zinthiazole	2-氨基-5-巯基-1,3,4-噻二唑,以噻唑锌表示 2-Amino-5-mercapto-1,3,4-thiadiazole, expressed as zinthiazole	2-氨基-5-巯基-1,3,4-噻二唑 3-2-Amino-5-mercapto-1,3,4-thiadiazole
三唑醇 Triadimenol	三唑醇 Triadimenol	三唑酮和三唑醇之和 Sum of triazolone and triadimenol

表6 修订4种农药每日允许摄入量

Table 6 4 pesticides with revised acceptable daily intake

(mg·kg⁻¹)

农药名称 Pesticide name	GB 2763—2021	GB 2763—2019
喹禾灵和精喹禾灵 Quizalofop-(P)-ethyl	0.009	0.003 0
丁苯吗啉 Fenpropimorph	0.004	0.010 0
氟苯脲 Teflubenzuron	0.005	0.000 9

表7 新增或修订食品名称

Table 7 Added or amend food names

GB 2763—2021		GB 2763—2019	
果品名称 Fruit name	类别 Type	果品名称 Fruit name	类别 Type
香瓜茄 Ginseng fruit	瓜果类水果 Melons	/	/
柑橘肉(干)Dried citrus	干制水果 Dried fruit	/	/
苹果干 Dried apples	干制水果 Dried fruit	/	/
杧果 Mango	热带和亚热带类水果 Sub(tropica)fruits	杧果 Mango	热带和亚热带水果 Sub (tropical) fruits
枸杞(干) Wolfberry (dried)	药用植物中“花及果实类” “Flowers and Fruits” in medicinal plants	枸杞(干) Wolfberry (dried)	干制水果 Dried fruit
浆果和其他小型类水果 Berries fruits	浆果和其他小型类水果 Berries fruits	浆果和其他小型水果 Berries fruits	浆果和其他小型水果 Berries fruits
热带和亚热带类水果 Sub (tropical) fruits	热带和亚热带类水果 Sub (tropical) fruits	热带和亚热带水果 Sub (tropical) fruits	热带和亚热带水果 Sub (tropical) fruits

并将单个果品限量修订为组限量。此次修订涉及的三氯杀螨醇、杀扑磷、硫丹和溴甲烷等禁用农药以及乐果、乙酰甲胺磷等限用农药均按照检测方法的定量限水平设置限量,并将单个果品限量修订为组限量。同时需要指出的是,本次修订的限量,有要求更严格的,也有要求变宽的,在实际应用时应特别关注。例如三氯杀螨醇在柑、橘、橙、柠檬和柚中的限量 $1 \text{ mg} \cdot \text{kg}^{-1}$ 修订为柑橘类水果 $0.01 \text{ mg} \cdot \text{kg}^{-1}$,在苹果、梨中的限量 $1 \text{ mg} \cdot \text{kg}^{-1}$ 修订为仁果类水果 $0.01 \text{ mg} \cdot \text{kg}^{-1}$,降幅 100 倍;溴甲烷在草莓中的限量

由 $30 \text{ mg} \cdot \text{kg}^{-1}$ 修订为 $0.02 \text{ mg} \cdot \text{kg}^{-1}$,降幅 1500 倍。另外,丙森锌在柑、橘和橙中的限量 $3 \text{ mg} \cdot \text{kg}^{-1}$ 在杧果中的限量 $2 \text{ mg} \cdot \text{kg}^{-1}$ 修订为 $5 \text{ mg} \cdot \text{kg}^{-1}$;代森锌在柑、橘和橙中的限量由 $3 \text{ mg} \cdot \text{kg}^{-1}$ 修订为 $5 \text{ mg} \cdot \text{kg}^{-1}$ 等,均有不同程度的变宽。

3.5 调整部分配套农药残留检测方法

与 GB 2763—2019 相比,GB 2763—2021 调整的检测方法标准中(表 9),增加 4 项即 GB 23200.116、GB 23200.117、SN/T4066 和 SN/T 4591,修订 1 项 SN/T 0654,删除 1 项 GB/T 5009.110。配套

表 8 修订的限量标准

Table 8 Revised maximum residue limits for pesticides

农药名称 Pesticide name	限量 MRL/(mg·kg ⁻¹)	
	GB 2763—2021	GB 2763—2019
苯菌灵 Benomyl	柑 Tangerin, 橘 Citrus, 橙 Orange, 苹果 Apple: 5; 梨 Pear: 3; 香蕉 Banana: 2	柑 Tangerin, 橘 Citrus, 橙 Orange, 苹果 Apple: 5*; 梨 Pear: 3*; 香蕉 Banana: 2*
啶酰菌胺 Boscalid	坚果(开心果除外)Nuts(except pistachios): 0.05; 开心果 Pistachio: 1	坚果(开心果除外)Nuts (except pistachios): 0.05*; 开心果 Pistachio: 1*
喹啉铜 Oxine-copper	苹果 Apple: 2; 葡萄 Grape: 3; 杨梅 Bayberry: 5; 荔枝 Litchi: 5; 山核桃 Pecan: 0.5	苹果 Apple: 2*; 葡萄 Grape: 3*; 杨梅 Bayberry: 5*; 荔枝 Litchi: 5*; 山核桃 Pecan: 0.5*
氰霜唑 Cyazofamid	葡萄 Grape: 1; 荔枝 Litchi: 0.02; 西瓜 Water melon: 0.5	葡萄 Grape: 1*; 荔枝 Litchi: 0.02*; 西瓜 Watermelon: 0.5*
杀螟硫磷 Fenitrothion	柑橘类水果 Citrus fruit: 0.5; 仁果类水果 Pome fruits: 0.5; 核果类水果 Stone fruits: 0.5; 瓜果类水果 Melon fruits: 0.5; 浆果和其他小型类水果 Berries fruits: 0.5; 热带和亚热带类水果 Sub (Tropical) fruit: 0.5	柑橘类水果 Citrus fruit: 0.5*; 仁果类水果 Pome fruits: 0.5*; 核果类水果 Stone fruits: 0.5*; 瓜果类水果 Melon fruits: 0.5*; 浆果和其他小型类水果 Berries fruits: 0.5*; 热带和亚热带水果 Sub (Tropical) fruit: 0.5*
丁醚脲 Diafenthuron	柑 Tangerin, 橘 Citrus, 橙 Orange, 苹果 Apple: 0.2	柑 Tangerin, 橘 Citrus, 橙 Orange, 苹果 Apple: 0.2*
氯化苦 Chloropicrin	草莓 Strawberry、甜瓜类水果 Melon: 0.05	草莓 Strawberry、甜瓜类水果 Melon: 0.05*
杀虫双 Thiosulfatap-disodium	苹果 Apple: 1	苹果 Apple: 1*
四螨嗪 Clofentezine	坚果 Nuts: 0.5	坚果 Nuts: 0.5*
烯啶虫胺 Nitenpyram (精)喹禾灵 Quizalofop-(P)-ethyl	柑 Tangerin, 橘 Citrus, 橙 Orange: 0.5 西瓜 Watermelon: 0.2*	柑 Tangerin, 橘 Citrus, 橙 Orange: 0.5* 西瓜 Watermelon: 0.2
乐果 Dimethoate	柑橘类水果 Citrus fruit: 0.01 仁果类水果 Pome fruits: 0.01 核果类水果 Stone fruits: 0.01 热带和亚热带类水果 Sub (Tropical) fruit: 0.01	柑 Tangerin, 橘 Citrus, 橙 Orange, 柠檬 Lemon, 柚 Pomelo: 2* 苹果 Apple, 梨 Pear: 1* 桃 Peach, 油桃 Nectarine, 李子 Plum, 杏 Apricot, 鲜枣 Fresh date: 2* 橄榄 Olive: 0.5*; 杧果 Mango: 1*
硫丹 Endosulfan	瓜果类水果 Melon fruits: 0.05 仁果类水果 Pome fruits: 0.05 热带和亚热带类水果 Sub (Tropical) fruit: 0.05	瓜果类水果 Melon fruits: 0.05* 苹果 Apple: 0.05*; 梨 Pear: 0.05* 荔枝 Litchi: 0.05*
三氯杀螨醇 Dicofol	柑橘类水果 Citrus fruit: 0.01 仁果类水果 Pome fruits: 0.01	柑 Tangerin, 橘 Citrus, 橙 Orange, 柠檬 Lemon, 柚 Pomelo: 1 苹果 Apple, 梨 Pear: 1
杀扑磷 Methidathion	柑橘类水果 Citrus fruit: 0.05	柑 Tangerin, 橘 Citrus, 橙 Orange: 2; 柑橘类水果(柑、橘、橙除外)Citrus fruit (Excl single): 0.05
溴甲烷 Methylbromide	浆果和其他小型类水果 Berries fruits: 0.02*	草莓 Strawberry: 30*
乙酰甲胺磷 Acephate	柑橘类水果 Citrus fruit: 0.02 仁果类水果 Pome fruits: 0.02 核果类水果 Stone fruits: 0.02 浆果和其他小型类水果 Berries fruits: 0.02 热带和亚热带类水果 Sub (Tropical) fruit: 0.02 瓜果类水果 Melon fruits: 0.02	柑橘类水果 Citrus fruit: 0.5 仁果类水果 Pome fruits: 0.5 核果类水果 Stone fruits: 0.5 浆果和其他小型类水果 Berries fruits: 0.5 热带和亚热带水果 Sub (Tropical) fruit: 0.5 瓜果类水果 Melon fruits: 0.5
丙森锌 Propineb	柑 Tangerin, 橘 Citrus, 橙 Orange, 杧果 Mango: 5	柑 Tangerin, 橘 Citrus, 橙 Orange: 3; 杧果 Mango: 2
多菌灵 Carbendazim	猕猴桃 Kiwi: 5; 杧果 Mango: 2	猕猴桃 Kiwi, 杧果 Mango: 0.5
福美锌 Ziram	橙 Orange: 5; 杧果 Mango: 5	橙 Orange: 3; 杧果 Mango: 2
(高效)氯氟氰菊酯 (Lambda-)Cyhalothrin	柠檬 Lemon: 1; 金橘 Kumquat: 2	柠檬 Lemon, 金橘 Kumquat: 0.2
丙硫菌唑 Prothioconazole	越橘 Milberry: 1.5*	越橘 Milberry: 0.15*
代森锌 Zineb	柑 Tangerin, 橘 Citrus, 橙 Orange: 5	柑 Tangerin, 橘 Citrus, 橙 Orange: 3
吡虫啉 Imidacloprid	柠檬 Lemon: 2	柠檬 Lemon: 1
代森锰锌 Mancozeb	柑 Tangerin, 橘 Citrus, 橙 Orange: 5	柑 Tangerin, 橘 Citrus, 橙 Orange: 3
代森联 Metiram	柑 Tangerin, 橘 Citrus, 橙 Orange: 5	柑 Tangerin, 橘 Citrus, 橙 Orange: 3
丁硫克百威 Carbosulfan	柑橘类水果 Citrus fruit: 0.01 仁果类水果 Pome fruits: 0.01	柑 Tangerin, 橘 Citrus: 1, 橙 Orange, 柠檬 Lemon, 柚 Pomelo: 0.1 苹果 Apple: 0.2

注：“*”表示该限量为临时限量。

Note: “*” indicates that the MRL is temporary.

表 9 调整的检测方法标准
Table 9 Adjustment method standard for adjustment

方法标准 Standard	农药残留 Pesticide residue	备注 Note
GB 23200.116	乙酰甲胺磷,乐果,杀扑磷,巴毒磷,丙溴磷,毒菌酚,毒死蜱,甲拌磷,甲基异柳磷,乐果,三唑磷,速灭磷,亚胺硫磷 Acephate, Dimethoate, Methidathion, Crotoxyphos, Profenofos, Hexachlorophene, Chlorpyrifos, Phorate, Isofenphos-methyl, Dimethoate, Triazophos, Mevinphos, Mhosmet	新增 New
GB 23200.117	喹啉铜 Oxine-copper	新增 New
SN/T 4066	灭螨酮 Acequincyl	新增 New
SN/T 4591	氟苯脲,氟啶胺,特乐酚 Teflubenzuron, Fluazinam, Dinotero	新增 New
SN/T 0654	克菌丹 Captan	修订 Revise (SN 0654)
GB/T 5009.110	氯氰菊酯,氰戊菊酯,溴氰菊酯 Cypermethrin, Fenvalerate, Deltamethrin	删除 Delete

农药残留检测方法标准的调整,有效解决了部分农药残留标准“有限量、无方法”的问题^[7,10]。

4 我国果品中农药MRL标准特征

与GB 2763—2019相比,GB 2763—2021的颁布,极大程度上改善了以往果品中规定残留限量标准的农药种类少^[1]、个别农药残留物监测定义和ADI值不够科学^[7]、限量标准数量不足且与国际接轨不够紧密等现状^[9],更有利果品生产中农药的安全使用和监管,更能促进果品质量安全水平的提高,标志着我国农药残留标准制(修)订迈上了新台阶。总体来说,我国果品中农药MRL标准有如下特征。

4.1 涵盖农药品种和限量标准数量大幅增加

农药品种增加62种,增幅23.5%,现有的326种农药加上豁免制定MRL的44种低风险农药,基本涵盖了我国批准在果品生产中允许使用的绝大多数农药;农药残留限量标准数量增加722项,增幅35.3%,现有的2768项限量标准占食品总限量数的27.4%。基本解决了相关部门对农产品安全监管时部分登记农药、部分果品“无标可依”的难题。

4.2 限量值的设置体现了“四个最严”的要求

针对社会关注度高的果品,设定了29种禁用农药195项限量标准、20种限用农药156项限量标准,并将部分禁限用农药按照检测方法的定量限水平设置限量值,同时将部分农药单个果品限量修订为组限量,很大程度上扩大了果品质量安全监管的范围,实现了对相应禁限用范围果品种类的全覆盖,强化了违规使用禁限用农药的监管。

4.3 标准制定更加科学严谨并与国际接轨

GB 2763—2021是基于我国农药登记残留试验、市场监测、居民膳食消费和农药毒理学等数据制定的,遵照CAC通行做法开展风险评估,广泛征求

专家、社会公众、相关部门和机构等利益相关方意见,并接受世界贸易组织成员的评议。采用的风险评估原则、方法和数据等要求与CAC和发达国家接轨。将苯菌灵、丁醚脲和啶酰菌胺等13种农药的51项限量由临时限量修改为正式限量,将喹禾灵和精喹禾灵在西瓜中的限量由正式限量修改为临时限量,修订乐果、三氯杀螨醇和杀扑磷等16种农药在柑、橘和橙等果品中的54项限量值。

4.4 农药残留物监测定义和ADI值更科学

与果品有关的农药中,修订吡氟禾草灵和精吡氟禾草灵、井冈霉素等9种农药残留物定义及喹禾灵和精喹禾灵、丁苯吗啉等4种农药ADI值,使得这些农药膳食风险评估数据更可靠,在一定程度上保证了膳食风险评估数据的科学性。

4.5 配套检测方法进一步完善

与果品有关的配套农药残留检测方法标准中,增加4项即GB 23200.116、GB 23200.117、SN/T 4066和SN/T 4591,修订1项SN/T 0654,删除1项GB/T 5009.1102。GB 2763—2021规定的农药残留检测方法具有法定性,配套检测方法标准的调整与完善,有效解决了部分农药残留标准“有限量、无方法”的问题。

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