CODEX ALIMENTARIUS COMMISSION

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Food and Agriculture Organization of the United Nations

World Health Organization

Viale delle Terme di Caracalla, 00153 Rome, Italy - Tel: (+39) 06 57051 - E-mail: codex@fao.org - www.codexalimentarius.org

Agenda Item 4.2

CX/MAS 23/42/5
March 2023

JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON METHODS OF ANALYSIS AND SAMPLING

42nd Session

Budapest, Hungary

13 – 16 June 2023 with report adoption on 20 June 2023 (virtual)

REVIEW OF METHODS OF ANALYSIS IN CXS 234 CEREALS, PULSES AND LEGUMES WORKABLE PACKAGE

(Prepared by the EWG led by Canada)

Codex members and Observers wishing to submit comments on the recommendations in this document should do so as instructed in CL 2023/13/OCS-MAS available on the Codex webpage/Circular Letters: http://www.fao.org/fao-who-codexalimentarius/resources/circular-letters/en/

INTRODUCTION

1. CCMAS38 (2017) agreed to continue efforts on the workable packages for the review and update of the *General Standard for Methods of Analysis and Sampling* (CXS 234-1999) as described in CX/MAS 17/38/6. The Committee also agreed to pilot this effort through an update of all methods related to milk and milk products (Dairy package) with the assistance of IDF, ISO and AOAC.

2. CCMAS39 (2018) agreed to proceed with the update on workable packages for (i) cereals, pulses and legumes and (ii) fats and oils. These revisions would be led by AACCI[1] (cereals, pulses and legumes and derived products, CPL) and AOCS (fats and oils). All interested members and Standards Development Organizations (SDOs) were invited to assist in this work, as appropriate. The protocol followed by IDF, ISO and AOAC in the revision of the Dairy package would be followed for the CPL package. The initial work to organize and establish a review of the CPL methods was led by AACCI.

3. AACCI reviewed the methods of cereals, pulses and legumes in CXS 234-1999 as follows:

- AACCI followed the work of the electronic working group (EWG) reviewing the Dairy package, noted the questions arising from the review and that some methods present in the commodity standards were not included. In anticipation of similar issues, AACCI decided to start with all methods in CXS 234 that are applicable to CPL matrices.
- AACCI noted the development of the Method Review sheets by New Zealand that included the review questions, information from the commodity standards, and additional relevant information. AACCI concluded that this approach would provide a basic framework for CPL method reviews across multiple analytes and matrices.

4. While waiting for the resolution of issues arising from the review of the Dairy package, AACCI identified CPL methods in CXS 234.

5. AACCI presented the report of their work from 2018 (CX/MAS 19/40/3 Add.2) to CCMAS40 (2019) for consideration.

6. CCMAS40 (2019) agreed that AACCI, together with AOAC and ISO, would continue working on the CPL package and report back to the next session of CCMAS.

7. CCMAS41 (2021) noted the report from the observer from AACCI (CX/MAS 21/41/6) describing the progress made and that workbooks[2] were being reviewed by relevant SDOs. It was clarified that the purpose

[1] Now known as Cereals and Grains Association (C&G)
[2] Workbooks is the term used to describe the compiled spreadsheets of method information, comments (from both the SDOs and EWG experts) and citations.

of the review is to ensure that the methods of analysis listed in CXS 234 are fit-for-purpose and to re-type if necessary, but to facilitate the review process, not to add new methods unless necessary. CCMAS noted that good progress had been made on the workbooks by the relevant SDOs and, in line with previous processes for the review of workable packages, agreed with the proposal of the Chairperson that the continued review of the CPL workable package should continue through an EWG. In conclusion, CCMAS agreed to establish an EWG chaired by Canada (EWG-CPL), working in English only, to continue the review on the cereals, pulses and legumes and derived products workable package, and to work in close coordination with the relevant SDOs (AACCI, AOAC and ISO).

8. This report is based on the responses to the Circular Letter (CL 2022/44-MAS) describing the first round of the EWG effort and the EWG review comments during the second round of activity.

EWG-CPL PROCESS

9. As stated in the report of CCMAS41, the terms of reference of the EWG review were to ensure that the methods of analysis listed in CXS 234 are fit-for-purpose and to re-type if necessary, but to facilitate the review process, not to add new methods unless necessary[3].

10. In preparing for the EWG, the Chair of the EWG noted the extensive work already completed by AACCI in coordination with other SDOs, namely AOAC, ICC and ISO. It was noted in the report from the observer from AACCI (CX/MAS 21/41/6), that methods from different SDOs are considered equivalent, although equivalency has not been reviewed for many years. As a result, a review of the methods necessitated the confirmation of methods that are identical and indicated as such in CXS 234.

11. The EWG review was based on the workbooks prepared by AACCI, as completed by all relevant SDOs and included methods referred to in commodity standards including minor differences between those standards and CXS 234.

12. The EWG was initiated and operated through the on-line Codex forum. The list of participants in the EWG is presented in Appendix IV.

13. In view of the number of methods involved, the methods were divided into groups of methods covering proximate analyses (Group 1) and other analyses (Group 2). EWG experts considered the proximate analysis methods (moisture, ash, protein, and fat – Group 1) in the first round of the review. In round two of the review, the EWG considered outstanding issues from round one and considered methods present in Group 2 (colour, fibre, etc).

14. All Codex participants were welcome and, as a first step, EWG participants were asked to provide a list of methods (e.g. ISO, ICC, AOAC, AACCI) to which they had access. Based on their responses, each participant was assigned methods to review, reminding participants of the guidelines for the work and general guidance on how to proceed. The Chair of the EWG expressed the desire to have each method assigned to two independent experts. Members of the EWG were then asked to review a small number of methods for all appropriate commodities and to provide feedback.

15. The Chair circulated the workbooks prepared by AACCI to relevant participants, collected responses, collated them, and prepared a summary of progress. This review process also identified some issues that will require further deliberation by the EWG and possibly further discussion at forthcoming meetings of the CCMAS working group on endorsement of methods of analysis (WG) and plenary meetings.

RESULTS OF THE EWG CONSULTATION

16. Appendix I lists the methods for analysis of cereals, pulses and legumes and derived products, as identified in CXS 234-1999 and/or relevant commodity standards considered by the EWG. Where methods should be considered Type I (e.g. proximate analysis), it is important to evaluate whether they are identical in cases where more than one of them is listed for the same commodity and provision. Evaluation of multiple Type I methods requires consideration of all parameters in the method including sample weights, grind size, time, temperature and other conditions (e.g. reagents, solutions, solvents). In addition, Appendix II contains the list of methods that have been reviewed by the EWG, but require additional consideration by the CCMAS WG on methods endorsement and the plenary meeting.

17. From the responses of the EWG experts, the following observations were made:

- Methods for proximate analyses tend to be of considerable age and were developed by SDOs to meet the needs of industry in assessing the quality of traded cereals, pulses and legumes at the time of development.

[3] REP21/MAS, paras 53 - 55

- Many of the currently-traded commodities were yet to be commercialized at the time methods were developed, hence many of the commodities covered in the CPL standards are not mentioned within the method scope.
- Owing to the timing of the original method development, validation data are scant, where available. As a result, the validation data reported do not meet with current precision data requirements. None-the-less, most of the methods have received positive reviews from the experts. Many of the reviewed methods are in use globally and are the subject of regular proficiency testing.
- Some methods have been endorsed for matrices that are not included in the method scope.
- A correction for moisture content is frequently required for reporting results of the proximate methods (i.e. ash, protein and fat). No moisture methods have been identified to correspond with the proximate methods in the current version of CXS 234. The EWG considered that the moisture methods used should correspond to matrices being tested, as listed in CXS 234. This question as to whether moisture methods should be prescribed in CXS 234 or left to the discretion of analysts was also considered as part of the CL responses. There was no consensus, and the question remains outstanding.
- In the determination of ash content, ashing at 900°C is performed in some methods. This procedure, while technically acceptable, requires the use of expensive platinum dishes and hence was not supported. This position is consistent with reminders from the Dairy workable package EWG that CCMAS (the Committee) should consider "applicability, availability and cost of methods in line with the criteria for selection of methods set out in the Procedural Manual" during the discussion of moisture in milkfat.
- Some expert reviewers recommended replacement of methods currently in commodity standards or CXS 234 with alternate, additional or revised methods of analysis.
- Methods identified as possible replacements for those methods identified as requiring replacement during round one of the review were considered in round two.
- Recognizing that, unless necessary, the addition of methods to CXS 234 is currently outside the scope of this EWG, and to ensure that SDO and EWG efforts related to additional relevant methods are not lost, the list of methods suggested for inclusion has been added as Appendix III to this report. In addition, the participants are reminded that according to CCMAS guidance[4], changes should be proposed through the appropriate commodity committee or, if adjourned, directly to the CCMAS for consideration by the WG on methods endorsement.

18. Appendix I was prepared based on the feedback received from CCMAS members on the CL and EWG members during the review. The appendix explains and tracks proposed changes to CXS 234. For ease of review and comparison, the table provides the information (Commodity, Provision, Codex Standard, Method, Principle, Type, Committee) following the new format for CXS 234. A column has been added to identify comments for consideration.

- Unformatted text indicates that no change was required from the current listing in CXS 234.
- Underlined bold text indicates an insertion into CXS 234 and represents a change from the current CXS 234.
- Text that has been struck through indicates items to be deleted.

19. Appendix II contains methods listed in CXS 234 that have been examined, but for which conclusions could not be made due to lack of suitable methods or a requirement for further consideration.

20. Appendix III contains a list of methods proposed by SDOs for possible inclusion in CXS 234 but were not added to Appendix I.

ITEMS FOR FURTHER CONSIDERATION

21. The following items require further consideration by the Committee:

i. whether moisture methods should be prescribed in CXS 234, or whether identification of the requirement for use of a commodity-specific moisture method could be achieved using a footnote with an explanation to address the requirement. A proposed footnote was introduced into Appendix I.

ii. how best to address provisions where methods could not be found to replace methods identified for replacement (Appendix II).

[4] Comprehensive guidance for the process of submission, consideration and endorsement of methods for inclusion in CXS 234

iii. the inclusion of general guidance instead of a prescribed method, to allow for classification of products (Appendix II).

RECOMMENDATIONS

22. The Committee is invited to:

i. Consider Appendix I and endorse the proposed changes to CXS 234.

ii. Consider “Items for Further Consideration” and provide guidance on the approach to identifying the need for moisture methods to establish other provisions.

iii. Consider whether methods listed in Appendix II and Appendix III should be reviewed at a future WG on methods endorsement.

Group 1. Methods reviewed by CPL EWG with decisions (for comment through CL 2023/13/OCS-MAS)

Cereals, Pulses and Legumes and Derived Products							
Commodity	Provision	Codex Standard	Method	Principle	Type	Committee	*Comments*
Certain pulses	Moisture	CXS 171-1989 (2019)	~~ISO 665~~ **ISO 24557 / AACC 44-17.01**	Gravimetry **(oven drying)**	I	CCCPL	
Degermed maize (corn) meal and maize (corn) grits	Ash~~[1]~~	CXS 155-1985 (2019)	AOAC 923.03 **/** ISO 2171 ~~ICC Method No 104/1~~	Gravimetry **(incineration)**	I	CCCPL	
Degermed maize (corn) meal and maize (corn) grits	Fat, crude~~[1]~~	CXS 155-1985 (2019)	AOAC 945.38F~~;~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Degermed maize (corn) meal and maize (corn) grits	Moisture	CXS 155-1985 (2019)	~~ISO 712~~ ~~ICC Method No 110/1~~ ICC 110/1	Gravimetry **(oven drying)**	I	CCCPL	
Degermed maize (corn) meal and maize (corn) grits	Particle size (granularity)	CXS 155-1985 (2019)	AOAC 965.22 **and ISO 3310-1**	Sieving	I	CCCPL	
Degermed maize (corn) meal and maize (corn) grits	Protein~~[1]~~	CXS 155-1985 (2019)	~~ICC Method No 105/1~~ **ICC 105/2**	Titrimetry (Kjeldahl digestion)	I	CCCPL	
Durum wheat semolina and durum wheat flour	Ash~~[1]~~ ~~(semolina)~~	CXS 178-1991 (2019)	AOAC 923.03 **/** ISO 2171	Gravimetry **(incineration)**	I	CCCPL	
Durum wheat semolina and durum wheat flour	Moisture	CXS 178-1991 (2019)	ISO 712 **/** ICC 110/1	Gravimetry **(oven drying)**	I	CCCPL	
Durum wheat semolina and durum wheat flour	Protein~~[1]~~ ~~(N x 5.7)~~	CXS 178-1991 (2019)	ICC 105/~~1~~**2**	Titrimetry (Kjeldahl digestion)	I	CCCPL	Suggest that N factor be prescribed in commodity standards if internationally agreed, but not in CXS 234.

							N methods are only validated for N content determination not the accuracy of the conversion factor
~~Instant Noodles~~	~~Extraction of oil from instant noodles~~	~~CXS 249-2006 (2019)~~	~~described in the standard~~	~~Gravimetry (ether extraction)~~	~~I~~	~~CCCPL~~	No limit, method description only, **recommend removal** as separate line and add to Acid value
Instant Noodles	Acid Value	CXS 249-2006 (2019)	described in the standard	Titrimetry (ether extraction)	I	CCCPL	
Instant Noodles	Moisture	CXS 249-2006 (2019)	described in the standard	Gravimetry **(oven drying)**	I	CCCPL	
Maize (corn)	Moisture	CXS 153-1985 (2019)	ISO 6540 **/ ICC 110/1**	Gravimetry **(oven drying)**	I	CCCPL	
Peanuts (raw)	Aflatoxins, total	~~CXS 200-1995 (2019)~~ **CXS 193-1995 (2019)**	AOAC 991.31 **(A – G)**	Immunoaffinity column-(**IAC)**, (Aflatest), **fluorometry**	~~II~~ **III**	CCCPL/CCCF	
Peanuts (raw)	Aflatoxins, total **as Σ of aflatoxins, B1 B2 G1 and G2**	~~CXS 200-1995 (2019)~~ **CXS 193-1995 (2019)**	AOAC 991.31 **(A – F, H)**	~~Immunoaffinity column (Aflatest)~~ **IAC (Aflatest) and HPLC-Post column derivatization (PCD)**	II	CCCPL/CCCF	
Peanuts ~~(raw)~~ **(intended for further processing)**	Aflatoxins, total	~~CXS 200-1995 (2019)~~ **CXS 193-1995 (2019)**	AOAC 993.17	Thin layer chromatography	~~III~~ **IV**	CCCPL/CCCF	Method uses hazardous reagents (benzene/chloroform) not all aflatoxins captured by method, **recommend removal**
Peanuts (intended for further processing)	Aflatoxins, total	~~CXS 200-1995 (2019)~~ **CXS 193-1995 (2019)**	AOAC 975.36	**IAC** (Romer minicolumn)	~~III~~ **IV**	CCCPL/CCCF	Qualitative/ semi-quantitative screening method; does not meet performance criteria in Procedural Manual; **recommend removal**
Peanuts	Sum of aflatoxins B_1, B_2, G_1 and G_2	~~CXS 200-1995 (2019)~~ **CXS 193-1995 (2019)**	~~EN 12955 /~~ ISO 16050	**IAC**, HPLC-PCD	III	CCCPL	EN 12955 withdrawn

(Cereals, shell-fruits and derived products (including peanuts)							
Peanuts (intended for further processing)	Aflatoxins, total	~~CXS 200-1995 (2019)~~ **CXS 193-1995 (2019)**	AOAC 979.18	**IAC** (Holaday-Velasco minicolumn)	~~III~~ **IV**	CCCPL/CCCF	Qualitative/ semi-quantitative screening method; does not meet performance criteria in Procedural Manual; **recommend removal**
Pearl millet flour	Ash~~1~~	CXS 170-1989 (2019)	AOAC 923.03 **/ ISO 2171**	Gravimetry **(incineration)**	I	CCCPL	
Pearl millet flour	Colour	CXS 170-1989 (2019)	*Modern Cereal Chemistry*, 6th Ed., D.W. Kent-Jones and A.J. Amos (Ed.), pp. 605-612, Food Trade Press Ltd, London, 1969.	Colorimetry ~~using~~ (specific colour grader)	IV	CCCPL	Colour-grading equipment used in method is no longer available, possible use of other item capable of results of the *style* of the original; sample is affected by bleach and method requires benzene; there does not appear to be a conversion factor from Kent-Jones units to the more commonly used CIELab color space, making it difficult to determine whether or not the products comply with the limit/range listed in the Standard. **reconsideration of provision/method suggested by reviewers**
Pearl millet flour	Fat, crude~~1~~	CXS 170-1989 (2019)	AOAC 945.38F~~;~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Pearl millet flour	Fibre, crude~~1~~	CXS 170-1989 (2019)	ISO 5498 ~~(B.5 Separation)~~	Gravimetry (**extraction and filtration**)	I	CCCPL	
Pearl millet flour	Moisture	CXS 170-1989 (2019)	ISO 712 ~~:~~**/** ICC 110/1	Gravimetry **(oven drying)**	I	CCCPL	
Pearl millet flour	Protein~~1~~	CXS 170-1989 (2019)	~~AOAC 920.87~~ **ISO 20483**	Titrimetry (Kjeldahl digestion)	I	CCCPL	

Quinoa	Moisture ~~content~~	CXS 333-2019 (2020)	ISO 712 ~~/ AACCI 44-15.02~~	Gravimetry **(oven drying)**	I	CCCPL	
Quinoa	Protein[1] ~~(N x 6.25 in dry weight basis)~~[1]	CXS 333-2019 (2020)	**ISO 20483** ~~ISO 1871~~	Titrimetry (Kjeldahl digestion)	~~IV~~ **I**	CCCPL	Suggest that N factor be prescribed in commodity standards if internationally agreed, but not in CXS 234.
Sorghum flour	Ash[1]	CXS 173-1989 (2019)	AOAC 923.03 **/** ISO 2171 ~~ICC 104/1~~	Gravimetry **(incineration)**	I	CCCPL	
Sorghum flour	Colour	CXS 173-1989 (2019)	*Modern Cereal Chemistry*, 6th Ed., D.W. Kent-Jones and A.J. Amos (Ed.), pp. 605-612, Food Trade Press Ltd, London, 1969.	Colorimetry ~~using~~ (specific colour grader)	IV	CCCPL	Colour-grading equipment used in method is no longer available, possible use of other item capable of results of the *style* of the original; sample is affected by bleach and method requires benzene; there does not appear to be a conversion factor from Kent-Jones units to the more commonly used CIELab color space, making it difficult to determine whether or not the products comply with the limit/range listed in the Standard. **reconsideration of provision/method suggested by reviewers**
Sorghum flour	Fat, crude[1]	CXS 173-1989 (2019)	AOAC 945.38F~~;~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Sorghum flour	Fibre, crude[1]	CXS 173-1989 (2019)	ICC 113 **/** ISO 6541	Gravimetry **(separation, incineration)**	I	CCCPL	Difference in crucible type (ICC 113 = quartz or glass, ISO 6541 = silica), same reagents/steps
Sorghum flour	Moisture	CXS 173-1989 (2019)	ISO 712 **/** ICC 110/1	Gravimetry **(oven drying)**	I	CCCPL	
Sorghum flour	Particle size (granularity)	CXS 173-1989 (2019)	AOAC 965.22 **and ISO 3310-1**	Sieving	I	CCCPL	
Sorghum flour	Protein[1]	CXS 173-1989 (2019)	ICC 105/~~1~~**2**	Titrimetry (Kjeldahl digestion)	I	CCCPL	

~~Sorghum flour~~	~~Protein[1] (N x 6.25)~~	~~CXS 173-1989 (2019)~~	~~ISO 1871~~	~~Titrimetry (Kjeldahl digestion)~~	~~I~~	~~CCCPL~~	ISO 1871 Type IV listed in CXS-173, not CXS 234, **review of ICC 105/2 completed in 2021/22 and accepted**
Sorghum flour	Tannins[1]	CXS 173-1989 (2019)	ISO 9648	Spectrophotometry	I	CCCPL	Method established for sorghum grains, samples to be crushed, not milled as occurs for flour
Sorghum grains	Ash[1]	CXS 172-1989 (2019)	AOAC 923.03 **/** ISO 2171 ~~ICC 104/1~~	Gravimetry **(incineration)**	I	CCCPL	
Sorghum grains	Fat, crude[1]	CXS 172-1989 (2019)	AOAC 945.38F~~,~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Sorghum grains	Moisture	CXS 172-1989 (2019)	ISO 6540	Gravimetry **(oven drying)**	I	CCCPL	
Sorghum grains	Protein[1]	CXS 172-1989 (2019)	ICC 105/~~1~~**2**	Titrimetry (Kjeldahl digestion)	I	CCCPL	
~~Sorghum grains~~	~~Protein[1] (N x 6.25)~~	~~CXS 172-1989 (2019)~~	~~ISO 1871~~	~~Titrimetry, Kjeldahl digestion~~	~~I~~	~~CCCPL~~	ISO 1871 Type IV listed in CXS-172, not CXS 234, **review of ICC 105/2 completed in 2021/22 and accepted**
Sorghum grains	Tannins[1]	CXS 172-1989 (2019)	ISO 9648	Spectrophotometry	I	CCCPL	
Soy protein products	Ash[1]	CXS 175-1989 (2019)	AOAC 923.03 **/** ISO 2171~~: (Method B)~~	Gravimetry **(incineration)**	I	CCVP	
Soy protein products	Fibre, crude[1]	CXS 175-1989 (2019)	ISO 5498	Gravimetry ~~(separation)~~**(extraction and filtration)**	I	CCVP	
Soy protein products	Moisture	CXS 175-1989 (2019)	AOAC 925.09	Gravimetry (vacuum oven)	I	CCVP	
Vegetable protein products	Ash[1]	CXS 174-1989 (2019)	AOAC 923.03 **/** ISO 2171 ~~(Method B)~~	Gravimetry **(incineration)**	I	CCVP	
Vegetable protein products	Fibre, crude[1]	CXS 174-1989 (2019)	AACC ~~32-17~~ 32-10.01	**Gravimetry** (Ceramic filter filtration)	I	CCVP	

Vegetable protein products	Moisture	CXS 174-1989 (2019)	AOAC 925.09	Gravimetry (vacuum oven)	I	CCVP	
Wheat flour	Ash	CXS 152-1985 (2019)	AOAC 923.03 **/** ISO 2171 ~~ICC 104/1~~	Gravimetry **(incineration)**	I	CCCPL	
Wheat flour	Fat acidity~~[1]~~	CXS 152-1985 (2019)	~~AOAC 939.05~~ **ISO 7305**	Titrimetry **(extraction)**	I	CCCPL	
Wheat flour	Moisture	CXS 152-1985 (2019)	ISO 712~~:~~ **/** ICC 110/1	Gravimetry **(oven drying)**	I	CCCPL	
Wheat flour	Particle size (granularity)	CXS 152-1985 (2019)	AOAC 965.22 **and ISO 3310-1**	Sieving	I	CCCPL	
Wheat flour	Protein~~[1]~~	CXS 152-1985 (2019)	ICC 105/~~1~~**2**	Titrimetry (Kjeldahl digestion)	I	CCCPL	
~~Wheat flour~~	~~Protein[1] (N x 5.7)~~	~~CXS 152-1985 (2019)~~	~~ISO 1871~~	~~Titrimetry (Kjeldahl digestion)~~	~~I~~	~~CCCPL~~	ISO 1871 Type IV listed in CXS-152, not CXS 234, **review of ICC 105/2 completed in 2021/22 and accepted**
Wheat protein products including wheat gluten	Fibre, crude~~[1]~~	CXS 163-1987 (2001)	AOAC 962.09	~~Ceramic fibre~~ **ceramic fibre filtration**	I	CCVP	
Wheat protein products including wheat gluten	**Moisture**	**CXS 163-1987 (2001)**	**AOAC 925.09**	**Gravimetry (vacuum oven)**	**I**	**CCVP**	
Wheat protein products including wheat gluten	Crude Protein~~[1]~~; excluding added vitamins, minerals, amino acids and optional ingredients	CXS 163-1987 (2001)	Vital wheat gluten and devitalized wheat gluten ~~AOAC 979.09 (wheat protein in grain N x 5.7)~~ **ISO 20483**	Titrimetry (Kjeldahl digestion)	I	CCVP	Suggest that N factor be prescribed in commodity standards if internationally agreed, but not in CXS 234.
			Solubilized wheat protein ~~AOAC 920.87 (wheat protein in flour N x 5.7)~~ **ISO 20483**	~~Kjeldahl~~ Titrimetry (Kjeldahl digestion) (~~wheat protein in flour N x 5.7~~)	I	CCVP	

Wheat protein products including wheat gluten	Ash[1]	CXS 163-1987 (2001)	AOAC 923.03 **/** ISO 2171~~: method B~~	Gravimetry **(incineration)**	I	CCVP	
Whole and decorticated pearl millet grains	Ash[1]	CXS 169-1989 (2019)	AOAC 923.03 **/ ISO 2171**	Gravimetry **(incineration)**	I	CCCPL	
Whole and decorticated pearl millet grains	Fat, crude[1]	CXS 169-1989 (2019)	AOAC 945.38F~~;~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Whole and decorticated pearl millet grains	Fibre, crude[1]	CXS 169-1989 (2019)	ISO 5498 ~~(B.5 separation)~~	Gravimetry **(filtration through filter paper)**	I	CCCPL	
Whole and decorticated pearl millet grains	Moisture	CXS 169-1989 (2019)	ISO 712 **/** ICC 110/1	Gravimetry **(oven drying)**	I	CCCPL	
Whole and decorticated pearl millet grains	Protein[1]	CXS 169-1989 (2019)	~~AOAC 920.87~~ **ISO 20483**	Titrimetry (Kjeldahl digestion)	I	CCCPL	
Whole maize (corn) meal	Ash[1]	CXS 154-1985 (2019)	AOAC 923.03 **/** ISO 2171 ~~ICC 104/1~~	Gravimetry **(incineration)**	I	CCCPL	
Whole maize (corn) meal	~~Crude~~ Fat, crude[1]	CXS 154-1985 (2019)	AOAC 945.38F~~;~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Whole maize (corn) meal	Moisture	CXS 154-1985 (2019)	~~ISO 712~~ ICC 110/1 **/ ISO 6540**	Gravimetry **(oven drying)**	I	CCCPL	
Whole maize (corn) meal	Particle size (granularity)	CXS 154-1985 (2019)	AOAC 965.22 **and ISO 3310-1**	Sieving	I	CCCPL	AACC 66-20.01 not identical, uses a very specific nest of sieves and sieve apertures not consistent with the CXS 154 limits
Whole maize (corn) meal	Protein[1]	CXS 154-1985 (2019)	ICC 105/~~1~~**2**	Titrimetry (Kjeldahl digestion)	I	CCCPL	
Gari	**Total acidity[1]**	**CXS 151-1989 (2019)**	**ISO~~/DP~~ 7305** ~~**AOAC 1975 14.064 – 14.065 (AOAC 939.05)**~~	**Titrimetry (ethanol extraction)**	**I**	**CCCPL**	**AOAC 1975 14.064 – 14.065 is AOAC 939.05, using an earlier numbering system. AOAC 939.05 reviewed 2021/2022 and proposed for wheat flour, but was**

							recommended for replacement due to hazardous chemical usage
Gari	Crude fibre[1]	CXS 151-1989 (2019)	ISO 5498	Gravimetry (separation)	I	CCCPL	General method
Gari	Ash[1]	CXS 151-1989 (2019)	ISO 2171	Gravimetry (incineration)	I	CCCPL	
Gari	Moisture	CXS 151-1989 (2019)	~~ICC 109/1~~ ISO 712	Gravimetry **(oven drying)**		CCCPL	No method given in CXS 151, listed in CXS 234: ISO 712 accepted for other commodities, ICC 109/1 states not to be used for commercial disputes
Edible Cassava flour	Moisture	CXS 176-1989 (2019)	ISO 712	Gravimetry **(oven drying)**	I	CCCPL	No method given in CXS 176, listed in CXS 234: ISO 712 accepted for other commodities
Edible Cassava flour	Crude fibre	CXS 176-1989 (2019)	ISO 5498 ~~(B.5 separation)~~	Gravimetry (separation)	I	CCCPL	General method
Edible Cassava flour	Ash[1]	CXS 176-1989 (2019)	ISO 2171	Gravimetry (incineration)	I	CCCPL	

[1] A correction for moisture content is frequently required for reporting results of the proximate methods (i.e., ash, protein and fat). No moisture methods have been identified to correspond with the proximate methods in the current version of CXS 234. Moisture methods should correspond to those endorsed for the matrices being tested.

Group 2. Methods requiring additional follow up action

Cereals, Pulses and Legumes and Derived Products							
Commodity	Provision	Codex Standard	Method	Principle	Type	Committee	*Comments*
Soy protein products	Fat	CXS 175-1989 (2019)	CAC/RM 55 - Method 1	Gravimetry (extraction)	I	CCVP	Method is not available, CAC abolished CAC/RM numbering system in 1997 Replacement requested, none identified to date
Soy protein products	Protein; excluding added vitamins, minerals, amino acids and food additives	CXS 175-1989 (2019)	AOAC 955.04D ~~(using factor 6.25)~~	Titrimetry (Kjeldahl digestion)	I	CCVP	Recommend revoke method and replace – mercury used Replacement requested, none identified to date
Vegetable protein products	Fat	CXS 174-1989 (2019)	CAC/RM 55 - Method 1	Gravimetry (extraction)	I	CCVP	Method is not available, CAC abolished CAC/RM numbering system in 1997 Replacement requested, none identified to date
Vegetable protein products	Crude Protein; excluding added vitamins, minerals, amino acids and food additives	CXS 174-1989 (2019)	AOAC 955.04D ~~(using factor 6.25)~~	Titrimetry (Kjeldahl digestion)	~~II~~ I	CCVP	Recommend revoke method and replace – mercury used Replacement requested, none identified to date
Gari	~~Granularity~~ **Particle size (classification)**	CXS 151-1989 (2019)	ISO 2591-1	Sieving	I	CCCPL	Recommended for removal, however, classification determined by sieve size used. ISO 2591 provides general guidance on sieving protocols, but is not specific to CPL.
Edible Cassava flour	~~Granularity~~	CXS 176-1989 (2019)	ISO 2591-1	Sieving	I	CCCPL	Recommended for removal, however, classification

	Particle size	determined by sieve size used. ISO 2591 provides general guidance on sieving protocols, but is not specific to CPL.

Appendix III

Methods proposed by SDOs as updates and/or replacements for methods currently in CXS 234

Cereals, Pulses and Legumes and Derived Products

Commodity	Provision	Codex Standard	Original Method entry	Original Principle	Type	Committee	*Comments*
Degermed maize (corn) meal and maize (corn) grits	Ash[1]	CXS 155-1985 (2019)	AOAC 923.03 **/** ISO 2171 ~~ICC Method No 104/1~~	Gravimetry **(incineration)**	I	CCCPL	*C&G recommends addition of AACC 08-01.01*
Degermed maize (corn) meal and maize (corn) grits	Fat, crude[1]	CXS 155-1985 (2019)	AOAC 945.38F~~;~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	*ISO recommends addition of ISO 11085* *C&G recommends addition of AACC 30-25.01*
Degermed maize (corn) meal and maize (corn) grits	Moisture	CXS 155-1985 (2019)	~~ISO 712~~ ~~ICC Method No 110/1~~ ICC 110/1	Gravimetry **(oven drying)**	I	CCCPL	*ISO recommends addition of ISO 6540*
Degermed maize (corn) meal and maize (corn) grits	Protein[1]	CXS 155-1985 (2019)	ICC 105/~~1~~**2**	Titrimetry (Kjeldahl digestion)	I	CCCPL	*ISO recommends addition of ISO 20483* *C&G recommends addition of AACC 46-16.01 (copper sulfate catalyst)*
Durum wheat semolina and durum wheat flour	Ash[1] ~~(semolina)~~	CXS 178-1991 (2019)	AOAC 923.03 **/** ISO 2171	Gravimetry **(incineration)**	I	CCCPL	*C&G recommends addition of AACC 08-12.01 (semolina)*
Durum wheat semolina and durum wheat flour	Protein[1] ~~(N x 5.7)~~	CXS 178-1991 (2019)	ICC 105/~~1~~**2**	Titrimetry (Kjeldahl digestion)	I	CCCPL	*ISO recommends addition of ISO 20483* *C&G recommends addition of AACC 46-16.01 (copper sulfate catalyst)*
Pearl millet flour	Ash[1]	CXS 170-1989 (2019)	AOAC 923.03 **/** ISO 2171	Gravimetry **(incineration)**	I	CCCPL	*C&G recommends addition of AACC 08-01.01*
Pearl millet flour	Fat, crude[1]	CXS 170-1989 (2019)	AOAC 945.38F~~;~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	*ISO recommends addition of ISO 11085*

Cereals, Pulses and Legumes and Derived Products							
Sorghum flour	Ash[1]	CXS 173-1989 (2019)	AOAC 923.03 **/** ISO 2171	Gravimetry **(incineration)**	I	CCCPL	*C&G recommends addition of AACC 08-01.01*
Sorghum flour	Fat, crude[1]	CXS 173-1989 (2019)	AOAC 945.38F, **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	*ISO recommends addition of ISO 11085*
Sorghum flour	Protein[1] (N x 6.25)	CXS 173-1989 (2019)	ICC 105/12	Titrimetry (Kjeldahl digestion)	I	CCCPL	*ISO recommends addition of ISO 20483* *C&G recommends addition of AACC 46-16.01 (copper sulfate catalyst)*
Sorghum grains	Ash[1]	CXS 172-1989 (2019)	AOAC 923.03 **/** ISO 2171 ICC 104/1	Gravimetry (incineration)	I	CCCPL	*C&G recommends addition of AACC 08-01.01*
Sorghum grains	Fat, crude[1]	CXS 172-1989 (2019)	AOAC 945.38F, **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	*ISO recommends addition of ISO 11085* *C&G recommends addition of AACC 30-25.01*
Sorghum grains	Protein[1] (N x 6.25)	CXS 172-1989 (2019)	ICC 105/12	Titrimetry (Kjeldahl digestion)	I	CCCPL	*ISO recommends addition of ISO 20483* *C&G recommends addition of AACC 46-16.01(copper sulfate catalyst)*
Soy protein products	Ash[1]	CXS 175-1989 (2019)	AOAC 923.03 **/** ISO 2171: (Method B)	Gravimetry **(incineration)**	I	CCVP	*C&G recommends addition of AACC 08-01.01*
Soy protein products	Moisture	CXS 175-1989 (2019)	AOAC 925.09	Gravimetry (vacuum oven)	I	CCVP	*ISO recommends addition of ISO 771* *AACC recommends addition of 44-40.01*
Vegetable protein products	Moisture	CXS 174-1989 (2019)	AOAC 925.09	Gravimetry (vacuum oven)	I	CCVP	*AACC recommends addition of 44-40.01*

Cereals, Pulses and Legumes and Derived Products							
Wheat flour	Ash	CXS 152-1985 (2019)	AOAC 923.03 **/** ISO 2171 ~~ICC 104/1~~	Gravimetry **(incineration)**	I	CCCPL	*C&G recommends addition of AACC 08-01.01*
Wheat flour	Protein[1] ~~(N x 5.7)~~	CXS 152-1985 (2019)	ICC 105/1**2**	Titrimetry (Kjeldahl digestion)	I	CCCPL	*ISO recommends addition of ISO 20483* *C&G recommends addition of AACC 46-16.01(copper sulfate catalyst)*
Wheat protein products including wheat gluten	Ash[1]	CXS 163-1987 (2001)	AOAC 923.03 **/** ISO 2171	Gravimetry **(incineration)**	I	CCVP	*C&G recommends addition of AACC 08-01.01*
Wheat protein products including wheat gluten	Moisture	CXS 163-1987 (2001)	AOAC 925.09	Gravimetry **(vacuum oven)**	I	CCVP	*C&G recommends addition of AACC 44-40.01*
Whole and decorticated pearl millet grains	Ash[1]	CXS 169-1989 (2019)	AOAC 923.03 **/** ISO 2171	Gravimetry **(incineration)**	I	CCCPL	*C&G recommends addition of AACC 08-01.01*
Whole and decorticated pearl millet grains	Fat, crude[1]	CXS 169-1989 (2019)	AOAC 945.38F~~;~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	*ISO recommends addition of ISO 11085*
Whole maize (corn) meal	Ash[1]	CXS 154-1985 (2019)	AOAC 923.03 **/** ISO 2171	Gravimetry **(incineration)**	I	CCCPL	*C&G recommends addition of AACC 08-01.01*
Whole maize (corn) meal	~~Crude~~ Fat, crude[1]	CXS 154-1985 (2019)	AOAC 945.38F~~;~~ **and** 920.39C	Gravimetry (ether extraction)	I	CCCPL	*ISO recommends addition of ISO 11085* *C&G recommends addition of AACC 30-25.01*
Whole maize (corn) meal	Moisture	CXS 154-1985 (2019)	ICC 110/1	Gravimetry (oven drying)	I	CCCPL	*ISO recommends addition of ISO 6540*

Cereals, Pulses and Legumes and Derived Products							
Whole maize (corn) meal	Protein[1] ~~(N x 6.25)~~	CXS 154-1985 (2019)	ICC 105/~~1~~**2**	Titrimetry, (~~I~~) Kjeldahl digestion)	I	CCCPL	*ISO recommends addition of ISO 20483* *C&G recommends addition of AACC 46-16.01(copper sulfate catalyst)*

[1] A correction for moisture content is frequently required for reporting results of the proximate methods (i.e., ash, protein and fat). No moisture methods have been identified to correspond with the proximate methods in the current version of CXS 234. Moisture methods should correspond to those endorsed for the matrices being tested.

Appendix IV

List of Participants

Chair
Thea Rawn
thea.rawn@hc-sc.gc.ca
Canada

Participant	Country	Email
Richard Coghlan	Australia	richard.coghlan@measurement.gov.au
Nancy Ing	Canada	nancy.ing@hc-sc.gc.ca
Sue Quade	Canada	sue.quade@hc-sc.gc.ca
Rodrigo Jeria Alvarez	Chile	r.jeria@granotec.cl
Jean-Luc Deborde	France	jean-luc.deborde@scl.finances.gouv.fr
Dr. Christina Vlachou	Greece	x.vlachou@aade.gr
Dr. Attila Nagy	Hungary	nagyattila@nebih.gov.hu
Krisztina Bakó-Fányó	Hungary	hu-codexcp@nebih.gov.hu
Sándor Lorentsik	Hungary	klorentsiks@nebih.gov.hu
Codex India	India	codex-india@nic.in
Dr Lingamallu Jaganmohanrao	India	ljnatpro@yahoo.com
Samaneh Eghtedari	Iran	seghtedaryn@gmail.com
Lee Geun Pil	Korea	lgf2112@korea.kr
Young Jun Kim	Republic of Korea	yjkim0915@korea.kr
Azalina Binti Othman	Malaysia	azalina@kimia.gov.my
Tania D. Fosado Soriano	Mexico	tania.fosado@economia.gob.mx
Joseph Gallardo	Panama	codexpanama@mici.gob.pa
Rungrassamee Mahkhaphong	Thailand	mahakhaphong@gmail.com
Dr. Songkhla Chulakasian	Thailand	songkhlac@gmail.com
Yannick Weesepoel	The Netherlands	yannick.weesepoel@wur.nl
Heather Selig	USA	heather.selig@usda.gov
Patrick Gray	USA	patrick.gray@fda.hhs.gov
Thomas Weber	USA	thomas.a.weber@usda.gov
Timothy Norden	USA	timothy.d.norden@usda.gov
Giancarla Tresso	Uruguay	gtresso@latu.org.uy
Laura Flores	Uruguay	lflores@latu.org.uy

Participant	Organization	Email
Dr. Anne Bridges	Cereals and Grains Association/AACC	annebridges001@earthlink.net
Jody Brunette	Cereals and Grains Association/AACC	jbrunette@scisoc.org
Paul Wehling	Cereals and Grains Association/AACC	paul@chemstats.com
Tom Phillips	Association of American Feed Control Officials (AAFCO)	tom.phillips@maryland.gov
Darryl Sullivan	AOAC International	darrylsullivan@eurofinsUS.com
Amine Jbeily	ICC	a.jbeily@iri.org.lb
Zhang Yan	ISO	isotc34sc4@163.com