

# CODEX ALIMENTARIUS COMMISSION



Food and Agriculture  
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Viale delle Terme di Caracalla, 00153 Rome, Italy - Tel: (+39) 06 57051 - E-mail: [codex@fao.org](mailto:codex@fao.org) - [www.codexalimentarius.org](http://www.codexalimentarius.org)

**CL 2022/44-MAS**  
**June 2022**  
**(English only)**

**TO:** Codex Contact Points  
Contact Points of international organizations having observer status with Codex

**FROM:** Secretariat, Codex Alimentarius Commission,  
Joint FAO/WHO Food Standards Programme

**SUBJECT:** **Request for comments on the review of CXS 234-1999: cereal, pulses and legumes workable package**

**DEADLINE:** **1 August 2022**

**REPLIES:** **To: Thea Rawn**  
Email: [thea.rawn@hc-sc.gc.ca](mailto:thea.rawn@hc-sc.gc.ca)

## **BACKGROUND**

1. CCMAS41 agreed to establish an electronic working group (EWG), led by Canada to continue the review on the cereals, pulses and legumes workable package. Considerable work has been undertaken in the EWG since CCMAS41 in May 2021, and taking advantage of the time available before CCMAS42 meets in June 2023, an interim report of the EWG and its recommendations are being made available for comments (See Annex to this CL).
2. The EWG will consider the comments submitted to this CL, and prepare recommendations and report to CCMAS42.

## **REQUEST FOR COMMENTS**

3. Codex members and observers are invited to submit comments on:
  - (i) On the proposals recommended in Appendix I to the report of the WG attached to this CL;  
and
  - (ii) Whether methods for moisture determination should be prescribed for other proximate analyses (e.g. ash, etc.) (see para. 16 of the Annex to this CL).
4. In submitting comments on the above, Codex members and observers are invited to consider the background information and conclusions provided in the report of the EWG in the Annex to this CL.

**REVIEW AND UPDATE OF METHODS IN CXS 234****Recommended methods of analysis for cereals, pulses and legumes and derived products***(Prepared by the EWG led by Canada)***Interim Report****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 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<sup>1</sup> (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 group workable 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 methods, 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 for consideration.
6. CCMAS40 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<sup>2</sup> were being reviewed by relevant SDOs. It was clarified that the purpose 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, 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).

**CPL EWG PROCESS**

8. As stated in the report of the 41<sup>st</sup> session of CCMAS, 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.<sup>3</sup>

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<sup>1</sup> Now known as Cereals and Grains Association (C & G)

<sup>2</sup> Workbooks is the term used to describe the compiled spreadsheets of method information, comments (from both the SDOs and EWG experts) and citations.

<sup>3</sup> REP21/MAS, paras 53 - 55

9. 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.
10. 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.
11. The EWG was initiated and operated through the on-line Codex forum. The list of participants in the EWG is at Appendix IV.
12. 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.
13. 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, AACC) 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.
14. 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 CCMAS working group on endorsement and plenary meetings.

#### **RESULTS OF THE EWG CONSULTATION**

15. Appendix I lists the methods of analysis for proximate analysis of cereals, pulses and legumes and derived products, as identified in CXS 234-1999. It is noteworthy that all the proximate methods should be considered Type I, therefore, it is important to evaluate whether methods are identical in cases where more than one method is listed for a particular 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 not been reviewed as part of the current EWG effort.
16. 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.
  - Many of the current 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. Nonetheless, 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. Questions remain as to whether moisture methods should be prescribed in CXS 234 or left to the discretion of analysts.
  - 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. Recognizing that 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, changes should be proposed through the appropriate commodity committee or, if adjourned, directly to the CCMAS for consideration by the WG on Methods Endorsement.

#### **RECOMMENDATIONS**

17. Appendix I was prepared based on the feedback received from EWG members during the review, and 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 methods that do not require any change from what is currently listed in CXS 234.
  - Underlined text indicates some insertion into CXS 234 and represents a change from the current CXS 234.
  - Text that has been struck through indicates deletion.
  - Appendix II contains Group 1 and Group 2 methods listed in CXS 234 that have not been examined and will be addressed in the next round of the EWG.
18. Appendix III contains a list of possible additional or replacement methods for inclusion into CXS 234, which may change during the next phase of the EWG-CPL.

#### **CONTINUED ACTIVITY**

19. The EWG will continue its work to review methods for the analysis of cereals, pulses, legumes and derived products, and during 2022, the review will focus on methods in Appendix II.
20. Feedback is being sought related to whether methods for moisture determination should be prescribed for other proximate analyses (e.g. ash, etc.).

## APPENDIX I

## Group 1. Methods reviewed by CPL EWG (for comment)

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	Gravimetry	I	CCCPL	<i>Method scope only mentions soybeans</i>
Degermed maize (corn) meal and maize (corn) grits	Ash <sup>1</sup>	CXS 155-1985 (2019)	AOAC 923.03 / ISO 2171 <del>ICC Method No 104/1 – 900°C</del>	Gravimetry	I	CCCPL	
Degermed maize (corn) meal and maize (corn) grits	Fat, crude <sup>1</sup>	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)	<del>ISO 712</del> ICC Method No 110/1	Gravimetry	I	CCCPL	Not applicable to maize
Degermed maize (corn) meal and maize (corn) grits	Protein <sup>1</sup> (N x 6.25)	CXS 155-1985 (2019)	ICC Method No 105/4 2	Titrimetry, Kjeldahl digestion	I	CCCPL	Provision in standard is 6.25, concern over N factor in method is 5.7 for wheat, rye and 6.25 for compound feeds
Durum wheat semolina and durum wheat flour	Ash <sup>1</sup> ( <del>semolina</del> )	CXS 178-1991 (2019)	AOAC 923.03 / ISO 2171	Gravimetry	I	CCCPL	
Durum wheat semolina and durum wheat flour	Moisture	CXS 178-1991 (2019)	ISO 712 / ICC 110/1	Gravimetry	I	CCCPL	
Durum wheat semolina and durum wheat flour	Protein <sup>1</sup> (N x 5.7)	CXS 178-1991 (2019)	ICC 105/4 2	Titrimetry, Kjeldahl digestion	I	CCCPL	
Instant Noodles	Moisture	CXS 249-2006 (2019)	described in the standard	Gravimetry	I	CCCPL	
Maize (corn)	Moisture	CXS 153-1985 (2019)	ISO 6540	Gravimetry	I	CCCPL	
Pearl millet flour	Ash <sup>1</sup>	CXS 170-1989 (2019)	AOAC 923.03 / ISO 2171	Gravimetry	I	CCCPL	
Pearl millet flour	Fat, crude <sup>1</sup>	CXS 170-1989 (2019)	AOAC 945.38F; and 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Pearl millet flour	Moisture	CXS 170-1989 (2019)	ISO 712 / ICC 110/1	Gravimetry	I	CCCPL	

**Group 1. Methods reviewed by CPL EWG (for comment)**

<b>Cereals, Pulses and Legumes and Derived Products</b>							
Quinoa	Moisture	CXS 333-2019 (2020)	ISO 712 <del>/</del> AACCI 44-15.02	Gravimetry	I	CCCPL	Methods <b>not</b> equivalent Must choose one Type I
Quinoa	Protein (N x 6.25 <del>in dry weight</del> basis) <sup>1</sup>	CXS 333-2019 (2020)	ISO 1871	Titrimetry, Kjeldahl digestion	IV	CCCPL	No N conversion factor identified in Standard
Pearl millet flour	Protein <sup>1</sup> (N x 5.7)	CXS 170-1989 (2019)	AOAC 920.87	Titrimetry, Kjeldahl digestion	I	CCCPL	Recommend revoke method and replace – mercury used
Sorghum flour	Ash <sup>1</sup>	CXS 173-1989 (2019)	AOAC 923.03 / ISO 2171 <del>ICC 104/1 – 900°C</del>	Gravimetry	I	CCCPL	
Sorghum flour	Fat, crude <sup>1</sup>	CXS 173-1989 (2019)	AOAC 945.38F; <u>and</u> 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Sorghum flour	Moisture	CXS 173-1989 (2019)	ISO 712 / ICC 110/1	Gravimetry	I	CCCPL	
Sorghum flour	Protein <sup>1</sup> (N x 6.25)	CXS 173-1989 (2019)	ICC 105/4 <u>2</u>	Titrimetry, Kjeldahl digestion	I	CCCPL	
Sorghum grains	Ash <sup>1</sup>	CXS 172-1989 (2019)	AOAC 923.03 / ISO 2171 <del>ICC 104/1 – 900°C</del>	Gravimetry	I	CCCPL	
Sorghum grains	Fat, crude <sup>1</sup>	CXS 172-1989 (2019)	AOAC 945.38F; <u>and</u> 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Sorghum grains	Moisture	CXS 172-1989 (2019)	ISO 6540	Gravimetry	I	CCCPL	
Sorghum grains	Protein <sup>1</sup> (N x 6.25)	CXS 172-1989 (2019)	ICC 105/4 <u>2</u>	Titrimetry, Kjeldahl digestion	I	CCCPL	
Soy protein products	Ash <sup>1</sup>	CXS 175-1989 (2019)	AOAC 923.03 / ISO 2171: ( <del>Method B</del> )	Gravimetry	I	CCVP	<i>Consideration of crossover pulse/oilseed product: soybeans.</i>
<del>Soy protein products</del>	<del>Fat</del>	<del>CXS 175-1989 (2019)</del>	<del>CAC/RM 55 – Method 1</del>	<del>Gravimetry (extraction)</del>	<del>I</del>	<del>CCVP</del>	Standard has no limit value, compatible with Good Manufacturing Processes, method is not widely available Recommend removal

**Group 1. Methods reviewed by CPL EWG (for comment)****Cereals, Pulses and Legumes and Derived Products**

Soy protein products	Moisture	CXS 175-1989 (2019)	AOAC 925.09	Gravimetry (vacuum oven)	I	CCVP	
Soy protein products	Protein <sup>1</sup> ; <u>excluding added vitamins, minerals, amino acids and food additives (N x 6.25)</u>	CXS 175-1989 (2019)	AOAC 955.04D (using factor 6.25)	Titrimetry, Kjeldahl digestion	# I	CCVP	Kjeldahl – Type I  Recommend revoke method and replace – mercury used
Vegetable protein products	Ash <sup>1</sup>	CXS 174-1989 (2019)	AOAC 923.03 / ISO 2171 (Method B)	Gravimetry, Direct	I	CCVP	Scope extension, AOAC 923.03 for flour, ISO 2171 for flours, semolinas, cereal grains, other milled products, mixed cereals, cereal by-products, pulses and pulse by-products
Vegetable protein products	Fat	<del>CXS 174-1989 (2019)</del>	<del>CAC/RM 55 – Method 1</del>	<del>Gravimetry (extraction)</del>	<del>†</del>	<del>CCVP</del>	Standard has no limit value, compatible with Good Manufacturing Processes, method is not widely available Recommend removal
Vegetable protein products	Moisture	CXS 174-1989 (2019)	AOAC 925.09	Gravimetry (vacuum oven)	I	CCVP	No limit value identified in CXS 174, note regarding microbiological stability – Suggest removal
Vegetable protein products	<u>Crude Protein<sup>1</sup>; excluding added vitamins, minerals, amino acids and food additives (N x 6.25)</u>	CXS 174-1989 (2019)	AOAC 955.04D (using factor 6.25)	Titrimetry, Kjeldahl digestion	# I	CCVP	Recommend revoke method and replace – mercury used
Wheat flour	Ash	CXS 152-1985 (2019)	AOAC 923.03 / ISO 2171 <del>ICC 104/1 – 900°C</del>	Gravimetry	I	CCCPL	Standard Limit is Buyer preference - Suggest removal
Wheat flour	Fat acidity <sup>1</sup>	CXS 152-1985 (2019)	AOAC 939.05	Titrimetry	I	CCCPL	Recommend revoke and replace - benzene used

**Group 1. Methods reviewed by CPL EWG (for comment)**

<b>Cereals, Pulses and Legumes and Derived Products</b>							
Wheat flour	Moisture	CXS 152-1985 (2019)	ISO 712 / ICC 110/1	Gravimetry	I	CCCPL	
Wheat flour	Protein <sup>1</sup> (N x 5.7)	CXS 152-1985 (2019)	ICC 105/4 2	Titrimetry, Kjeldahl digestion	I	CCCPL	
Wheat protein products including wheat gluten	Crude Protein <sup>1</sup> , <u>excluding added vitamins, minerals, amino acids and optional ingredients (N x 6.25) (N x 5.7)</u>	CXS 163-1987 (2001)	Vital wheat gluten and devitalized wheat gluten AOAC 979.09 Protein in grains <del>(wheat protein in grain N x 5.7)</del>	Titrimetry, Kjeldahl digestion	I	CCVP	Recommend revoke method and replace - mercury catalyst used AOAC 979.09 references AOAC 920.87 and 976.05, both methods specify N x 5.7 AOAC 976.05 states, "Adopted as a Codex Reference Method (Type II) for Kjeldahl digestion of protein in wheat gluten (using factor 6.25)."
			Solubilized wheat protein AOAC 920.87 Protein in flour <del>(wheat protein in flour N x 5.7)</del>	<del>Kjeldahl</del> Titrimetry, Kjeldahl digestion (wheat protein in flour N x 5.7)	I	CCVP	Recommend revoke method and replace - mercury catalyst used <i>Wheat protein in flour N x 5.7, not 6.25</i>
Wheat protein products including wheat gluten	Ash <sup>1</sup>	CXS 163-1987 (2001)	AOAC 923.03 / ISO 2171 <del>(Method B)</del>	Gravimetry	I	CCVP	
Whole and decorticated pearl millet grains	Ash <sup>1</sup>	CXS 169-1989 (2019)	AOAC 923.03 / ISO 2171 <del>(Method B)</del>	Gravimetry	I	CCCPL	
Whole and decorticated pearl millet grains	Fat, <del>crude</del> <sup>1</sup>	CXS 169-1989 (2019)	AOAC 945.38F <sub>2</sub> and 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Whole and decorticated pearl millet grains	Moisture	CXS 169-1989 (2019)	ISO 712 / ICC 110/1	Gravimetry	I	CCCPL	
Whole and decorticated pearl millet grains	Protein <sup>1</sup> (N x 5.7)	CXS 169-1989 (2019)	AOAC 920.87 <del>(wheat protein in flour N x 5.7)</del>	Titrimetry, Kjeldahl digestion	I	CCCPL	Recommend revoke method and replace - mercury catalyst used
Whole maize (corn) meal	Ash <sup>1</sup>	CXS 154-1985 (2019)	AOAC 923.03 / ISO 2171 <del>ICC 104/1 - 900°C</del>	Gravimetry	I	CCCPL	



**Group 1. Methods reviewed by CPL EWG (for comment)**

Cereals, Pulses and Legumes and Derived Products							
Whole maize (corn) meal	Crude fat <sup>1</sup>	CXS 154-1985 (2019)	AOAC 945.38F; <u>and</u> 920.39C	Gravimetry (ether extraction)	I	CCCPL	
Whole maize (corn) meal	Moisture	CXS 154-1985 (2019)	<del>ISO 712</del> ICC 110/1	Gravimetry	I	CCCPL	Not applicable to maize
Whole maize (corn) meal	Protein <sup>1</sup> (N x 6.25)	CXS 154-1985 (2019)	ICC 105/4 <u>2</u>	Titrimetry, Kjeldahl digestion	I	CCCPL	

<sup>1</sup>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 II

## Group 2. Methods not reviewed during EWG (for information)

Cereals, Pulses and Legumes and Derived Products							
Commodity	Provision	Codex Standard	Method	Principle	Type	Committee	Comments
Degermed maize (corn) meal and maize (corn) grits	Particle size (granularity)	CXS 155-1985 (2019)	AOAC 965.22	Sieving	I	CCCPL	
Degermed maize (corn) meal and maize (corn) grits	Protein <sup>1</sup> (N x 6.25)	CXS 155-1985 (2019)	ISO 1871	Titrimetry, Kjeldahl digestion	I	CCCPL	ISO 1871 listed in CXS 155, not CXS 234
Durum wheat semolina and durum wheat flour	Protein <sup>1</sup> (N x 5.7)	CXS 178-1991 (2019)	ISO 1871	Titrimetry, Kjeldahl digestion	I	CCCPL	ISO 1871 listed in CXS-178, not CXS 234
Instant Noodles	Extraction of oil from instant noodles	CXS 249-2006 (2019)	described in the standard	Gravimetry	I	CCCPL	
Instant Noodles	Acid Value	CXS 249-2006 (2019)	described in the standard	Titrimetry	I	CCCPL	
Peanuts (raw)	Aflatoxins, total	CXS 200-1995 (2019)	AOAC 991.31	Immunoaffinity column (Aflatest)	II	CCCPL	
Peanuts (raw)	Aflatoxins, total	CXS 200-1995 (2019)	AOAC 993.17	Thin layer chromatography	III	CCCPL	
Peanuts (intended for further processing)	Aflatoxins, total	CXS 200-1995 (2019)	AOAC 975.36	Romer minicolumn	III	CCCPL	
Peanuts (Cereals, shell-fruits and derived products (including peanuts))	Sum of aflatoxins B <sub>1</sub> , B <sub>2</sub> , G <sub>1</sub> and G <sub>2</sub>	CXS 200-1995 (2019)	EN 12955 ISO 16050	HPLC with post column derivatization and immunoaffinity column clean up	III	CCCPL	
Peanuts (intended for further processing)	Aflatoxins, total	CXS 200-1995 (2019)	AOAC 979.18	Holaday-Velasco minicolumn	III	CCCPL	

**Group 2. Methods not reviewed during EWG (for information)**

<b>Cereals, Pulses and Legumes and Derived Products</b>							
Pearl millet flour	Colour	CXS 170-1989 (2019)	<i>Modern Cereal Chemistry</i> , 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	
Pearl millet flour	Fibre, crude	CXS 170-1989 (2019)	ISO 5498: (B.5 Separation)	Gravimetry	I	CCCPL	
Sorghum flour	Colour	CXS 173-1989 (2019)	<i>Modern Cereal Chemistry</i> , 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	
Sorghum flour	Fibre, crude	CXS 173-1989 (2019)	ICC 113 ISO 6541	Gravimetry	I	CCCPL	
Sorghum flour	Particle size (granularity)	CXS 173-1989 (2019)	AOAC 965.22	Sieving	I	CCCPL	
Sorghum flour	Protein <sup>1</sup> (N x 6.25)	CXS 173-1989 (2019)	ISO 1871	Titrimetry, Kjeldahl digestion	I	CCCPL	<i>ISO 1871 listed in CXS-173, not CXS 234</i>
Sorghum flour	Tannins	CXS 173-1989 (2019)	ISO 9648	Spectrophotometry	I	CCCPL	
Sorghum grains	Protein <sup>1</sup> (N x 6.25)	CXS 172-1989 (2019)	ISO 1871	Titrimetry, Kjeldahl digestion	I	CCCPL	<i>ISO 1871 listed in CXS-172, not CXS 234</i>
Sorghum grains	Tannins	CXS 172-1989 (2019)	ISO 9648	Spectrophotometry	I	CCCPL	
Soy protein products	Fibre, crude	CXS 175-1989 (2019)	ISO 5498	Gravimetry	I	CCVP	
Vegetable protein products	Fibre, crude	CXS 174-1989 (2019)	AACC 32-10.01	Ceramic fibre filtration	I	CCVP	

**Group 2. Methods not reviewed during EWG (for information)**

<b>Cereals, Pulses and Legumes and Derived Products</b>							
Wheat flour	Fat acidity <sup>1</sup>	CXS 152-1985 (2019)	ISO 7305	Titrimetry	I	CCCPL	<i>ISO 7305 listed in CXS-152, not CXS 234</i>
Wheat flour	Particle size (granularity)	CXS 152-1985 (2019)	AOAC 965.22	Sieving	I	CCCPL	
Wheat flour	Protein <sup>1</sup> (N x 5.7)	CXS 152-1985 (2019)	ISO 1871	Titrimetry, Kjeldahl digestion	I	CCCPL	<i>ISO 1871 listed in CXS-152, not CXS 234</i>
Wheat protein products including Wheat gluten	Fibre, crude	CXS 163-1987 (2001)	AOAC 962.09	Ceramic fibre filtration	I	CCVP	
Wheat protein products including wheat gluten	Moisture	CXS 163-1987 (2001)	AOAC 925.09	Gravimetry	I	CCVP	<i>AOAC 925.09 listed in CXS-163, not CXS 234</i>
Whole and decorticated pearl millet grains	Fibre, crude	CXS 169-1989 (2019)	ISO 5498 (B.5 Separation)	Gravimetry	I	CCCPL	
Whole maize (corn) meal	Particle size (granularity)	CXS 154-1985 (2019)	AOAC 965.22	Sieving	I	CCCPL	

## APPENDIX III

## Methods suggested to update and/or replace those currently in CXS 234 – Under Development (for information)

Cereals, Pulses and Legumes and Derived Products							
Commodity	Provision	Codex Standard	Original Method entry	Original Principle	Type	Committee	Comments
Certain pulses	Moisture	CXS 171-1989 (2019)	ISO 665	Gravimetry	I	CCCPL	<i>ISO recommends replacement of method with ISO 24557 C&amp;G recommends AACC 44-17.01</i>
Degermed maize (corn) meal and maize (corn) grits	Ash <sup>1</sup>	CXS 155-1985 (2019)	AOAC 923.03 / ISO 2171	Gravimetry	I	CCCPL	<i>C&amp;G recommends addition of AACC 08-01.01</i>
Degermed maize (corn) meal and maize (corn) grits	Fat, crude <sup>1</sup>	CXS 155-1985 (2019)	AOAC 945.38F <sub>7</sub> and 920.39C	Gravimetry (ether extraction)	I	CCCPL	<i>ISO recommends addition of ISO 11085 C&amp;G recommends addition of AACC 30-25.01</i>
Degermed maize (corn) meal and maize (corn) grits	Moisture	CXS 155-1985 (2019)	ICC Method No 110/1	Gravimetry	I	CCCPL	<i>ISO recommends addition of ISO 6540</i>
Degermed maize (corn) meal and maize (corn) grits	Protein <sup>1</sup> (N x 6.25)	CXS 155-1985 (2019)	ICC Method No 105/4 <u>2</u>	Titrimetry, Kjeldahl digestion	I	CCCPL	<i>ISO recommends addition of ISO 20483 C&amp;G recommends addition of AACC 46-16.01 (copper sulfate catalyst)</i>
Durum wheat semolina and durum wheat flour	Ash <sup>1</sup> ( <del>semolina</del> )	CXS 178-1991 (2019)	AOAC 923.03 / ISO 2171	Gravimetry	I	CCCPL	<i>C&amp;G recommends addition of AACC 08-12.01 (semolina)</i>

Cereals, Pulses and Legumes and Derived Products							
Durum wheat semolina and durum wheat flour	Protein <sup>1</sup> (N x 5.7)	CXS 178-1991 (2019)	ICC 105/4 2	Titrimetry, Kjeldahl digestion	I	CCCPL	<i>ISO recommends addition of ISO 20483 C&amp;G recommends addition of AACC 46-16.01 (copper sulfate catalyst)</i>
Pearl millet flour	Ash <sup>1</sup>	CXS 170-1989 (2019)	AOAC 923.03 / <u>ISO 2171</u>	Gravimetry	I	CCCPL	<i>C&amp;G recommends addition of AACC 08-01.01</i>
Pearl millet flour	Fat, crude <sup>1</sup>	CXS 170-1989 (2019)	AOAC 945.38F; and 920.39C	Gravimetry (ether extraction)	I	CCCPL	<i>ISO recommends addition of ISO 11085</i>
Quinoa	Protein (N x 6.25 in dry weight basis) <sup>1</sup>	CXS 333-2019 (2020)	ISO 1871	Titrimetry, Kjeldahl digestion	IV	CCCPL	<i>ISO recommends addition of ISO 20483 C&amp;G recommends addition of AACC 46-16.01 (copper sulfate catalyst)</i>
Pearl millet flour	Protein <sup>1</sup> ( <u>N x 5.7</u> )	CXS 170-1989 (2019)	AOAC 920.87	Titrimetry, Kjeldahl digestion	I	CCCPL	<i>ISO recommends addition of ISO 20483 C&amp;G recommends replacement with AACC 46-16.01 (copper sulphate catalyst)</i>
Sorghum flour	Ash <sup>1</sup>	CXS 173-1989 (2019)	AOAC 923.03 / <u>ISO 2171</u>	Gravimetry	I	CCCPL	<i>C&amp;G recommends addition of AACC 08-01.01</i>
Sorghum flour	Fat, crude <sup>1</sup>	CXS 173-1989 (2019)	AOAC 945.38F; and 920.39C	Gravimetry (ether extraction)	I	CCCPL	<i>ISO recommends addition of ISO 11085</i>
Sorghum flour	Protein <sup>1</sup> ( <u>N x 6.25</u> )	CXS 173-1989 (2019)	ICC 105/4 2	Titrimetry, Kjeldahl digestion	I	CCCPL	<i>ISO recommends addition of ISO 20483 C&amp;G recommends addition of AACC 46-16.01 (copper sulphate catalyst)</i>

Cereals, Pulses and Legumes and Derived Products							
Sorghum grains	Ash <sup>1</sup>	CXS 172-1989 (2019)	AOAC 923.03 / ISO 2171	Gravimetry	I	CCCPL	<i>C&amp;G recommends addition of AACC 08-01.01</i>
Sorghum grains	Fat, crude <sup>1</sup>	CXS 172-1989 (2019)	AOAC 945.38F, <u>and</u> 920.39C	Gravimetry (ether extraction)	I	CCCPL	<i>ISO recommends addition of ISO 11085 C&amp;G recommends addition of AACC 30-25.01</i>
Sorghum grains	Protein <sup>1</sup> (N x 6.25)	CXS 172-1989 (2019)	ICC 105/4 <u>2</u>	Titrimetry, Kjeldahl digestion	I	CCCPL	<i>ISO recommends addition of ISO 20483 C&amp;G recommends addition of AACC 46-16.01(copper sulphate catalyst)</i>
Soy protein products	Ash <sup>1</sup>	CXS 175-1989 (2019)	AOAC 923.03 / ISO 2171: ( <del>Method B</del> )	Gravimetry	I	CCVP	<i>C&amp;G recommends addition of AACC 08-01.01</i>
Soy protein products	Moisture	CXS 175-1989 (2019)	AOAC 925.09	Gravimetry (vacuum oven)	I	CCVP	<i>ISO recommends addition of ISO 771 AACC recommends addition of 44-40.01</i>
Vegetable protein products	Moisture	CXS 174-1989 (2019)	AOAC 925.09	Gravimetry (vacuum oven)	I	CCVP	<i>AACC recommends addition of 44-40.01</i>
Wheat flour	Ash	CXS 152-1985 (2019)	AOAC 923.03 / ISO 2171	Gravimetry	I	CCCPL	<i>C&amp;G recommends addition of AACC 08-01.01</i>
Wheat flour	Fat acidity <sup>1</sup>	CXS 152-1985 (2019)	AOAC 939.05	Titrimetry	I	CCCPL	<i>C&amp;G recommends addition of AACC 02-01.02, and AACC 02-02.02 as alternate rapid method</i>

Cereals, Pulses and Legumes and Derived Products							
Wheat flour	Protein <sup>1</sup> (N x 5.7)	CXS 152-1985 (2019)	ICC 105/4 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	Crude Protein <sup>1</sup> ; <u>excluding added vitamins, minerals, amino acids and optional ingredients (N x 6.25) (N x 5.7)</u>	CXS 163-1987 (2001)	Vital wheat gluten and devitalized wheat gluten AOAC 979.09 Protein in grains (wheat protein in grain N x 5.7)	Titrimetry, Kjeldahl digestion	I	CCVP	ISO recommends replacement with ISO 20483 C&G recommends replacement with AACC 46-16.01(copper sulphate catalyst)
			Solubilized wheat protein AOAC 920.87 Protein in flour (wheat protein in flour N x 5.7)	<del>Kjeldahl</del> Titrimetry, Kjeldahl digestion (wheat protein in flour N x 5.7)	I	ISO recommends replacement with ISO 20483 C&G recommends replacement with AACC 46-11.02 (copper catalyst)	
Wheat protein products including wheat gluten	Ash <sup>1</sup>	CXS 163-1987 (2001)	AOAC 923.03 / ISO 2171 (Method B)	Gravimetry	I	CCVP	C&G recommends addition of AACC 08-01.01
<u>Wheat protein products including wheat gluten</u>	<u>Moisture</u>	<u>CXS 163-1987 (2001)</u>	<u>AOAC 925.09 listed in CXS -163</u>	<u>Gravimetry</u>	<u>I</u>	<u>CCVP</u>	C&G recommends addition of AACC 44-40.01
Whole and decorticated pearl millet grains	Ash <sup>1</sup>	CXS 169-1989 (2019)	AOAC 923.03 / ISO 2171: (Method B)	Gravimetry	I	CCCPL	C&G recommends addition of AACC 08-01.01
Whole and decorticated pearl millet grains	Fat, crude <sup>1</sup>	CXS 169-1989 (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							
Whole and decorticated pearl millet grains	Protein <sup>1</sup> (N x 5.7)	CXS 169-1989 (2019)	AOAC 920.87 ( <del>wheat protein in flour N x 5.7</del> )	Titrimetry, Kjeldahl digestion	I	CCCPL	<i>ISO recommends addition of ISO 20483 C&amp;G recommends replacement with AACC 46-16.01(copper sulphate catalyst)</i>
Whole maize (corn) meal	Ash <sup>1</sup>	CXS 154-1985 (2019)	AOAC 923.03 / ISO 2171	Gravimetry	I	CCCPL	<i>C&amp;G recommends addition of AACC 08-01.01</i>
Whole maize (corn) meal	Crude fat <sup>1</sup>	CXS 154-1985 (2019)	AOAC 945.38F; and 920.39C	Gravimetry (ether extraction)	I	CCCPL	<i>ISO recommends addition of ISO 11085 C&amp;G recommends addition of AACC 30-25.01</i>
Whole maize (corn) meal	Moisture	CXS 154-1985 (2019)	<del>ISO 712</del> ICC 110/1	Gravimetry	I	CCCPL	<i>ISO recommends addition of ISO 6540</i>
Whole maize (corn) meal	Protein <sup>1</sup> (N x 6.25)	CXS 154-1985 (2019)	ICC 105/1 2	Titrimetry, (I) Kjeldahl digestion	IV	CCCPL	<i>ISO recommends addition of ISO 20483 C&amp;G recommends addition of AACC 46-16.01(copper sulphate catalyst)</i>

<sup>1</sup> 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

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	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-Frányó	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	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	songkhla@gmail.com
Yannick Weesepeol	The Netherlands	yannick.weesepeol@wur.nl
Heather Selig	USA	heather.selig@usda.gov
Thomas Weber	USA	thomas.a.weber@usda.gov
Timothy Norden	USA	timothy.d.norden@usda.gov
Giancarla Tresso	Uruguay	gtresso@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