FACULTY OF
BIOSCIENCE ENGINEERING

DEPARTMENT OF APPLIED BIOSCIENCES (BW15)

LABORATORY OF CEREAL TECHNOLOGY

INTRODUCTION TO THE WORKSHOP:

THE BASICS OF FLOUR FORTIFICATION

Filip Van Bockstaele, QAQC training, Plenary session 1, 15-05-2017

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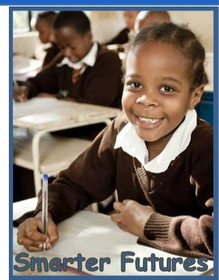

FORTIFICATION

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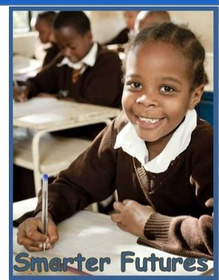

FOOD FORTIFICATION

Food fortification has been defined as the addition of one or more essential nutrients to a food, whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups (FAO/WHO 1994).

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RATIONALE – WHY?

- Vitamins and minerals = **micro**-nutrients
  - Low presence in foods
  - Play an essential role in biochemical reactions in human body
- Deficiencies in micronutrients
  - Often related to malnutrition
  - Cause diseases, birth defects, reduced immunity, reduced growth and cognitive development

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RATIONALE – WHY?

Table 1 **Overview of the health consequences of the most common micronutrient deficiencies (Allen *et al*, 2006)**

Micronutrient	Health consequences
Iron	reduced cognitive performance lower work performance and endurance impaired iodine and vitamin A metabolism anaemia increased risk of maternal mortality and child morality (with more severe anaemia)
Zinc	non-specific if marginal deficiency possibly poor pregnancy outcomes impaired growth (stunting) decreased resistance to infectious diseases severe deficiency results in dermatitis, retarded growth, diarrhoea, mental disturbance, delayed sexual maturation and/or recurrent infections
Iodine	birth defects increased risk of stillbirth and infant mortality cognitive and neurological impairment including cretinism impaired cognitive function hypothyroidism goitre
Vitamin A	increased risk of mortality in children and pregnant women night blindness, xerophtalamia
Folate (vitamin B9)	megaloblastic anaemia risk factor for: neural tube defect and other birth defects (oro-facial clefts, heart defects) and adverse pregnancy outcomes, elevated plasma homocysteine, heart disease and stroke, impaire cognitive function, depression
Vitamin D	Severe forms result in rickets in children and osteomalacia in adults

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RATIONALE - WHY

- Levels of deficiencies around the world

Country	Neural tube defects per 10,000 births	% Anemia in non-pregnant women of reproductive age	% Anemia in pre-school children	% Population at risk of inadequate zinc intake
Afghanistan	20	31	44	20.2
Belgium	9	18	13	6.8
Uganda	13	26	56	20.5
Zimbabwe	23	28	59	48.4
South-Africa	23	27	41	20.0
USA	4.6	12	6	5.0
Tanzania	13	38	61	34.1
DR Congo	20	49	67	54.3
Brazil	38	19	24	7.3

SOURCE: http://www.ffinetwork.org/

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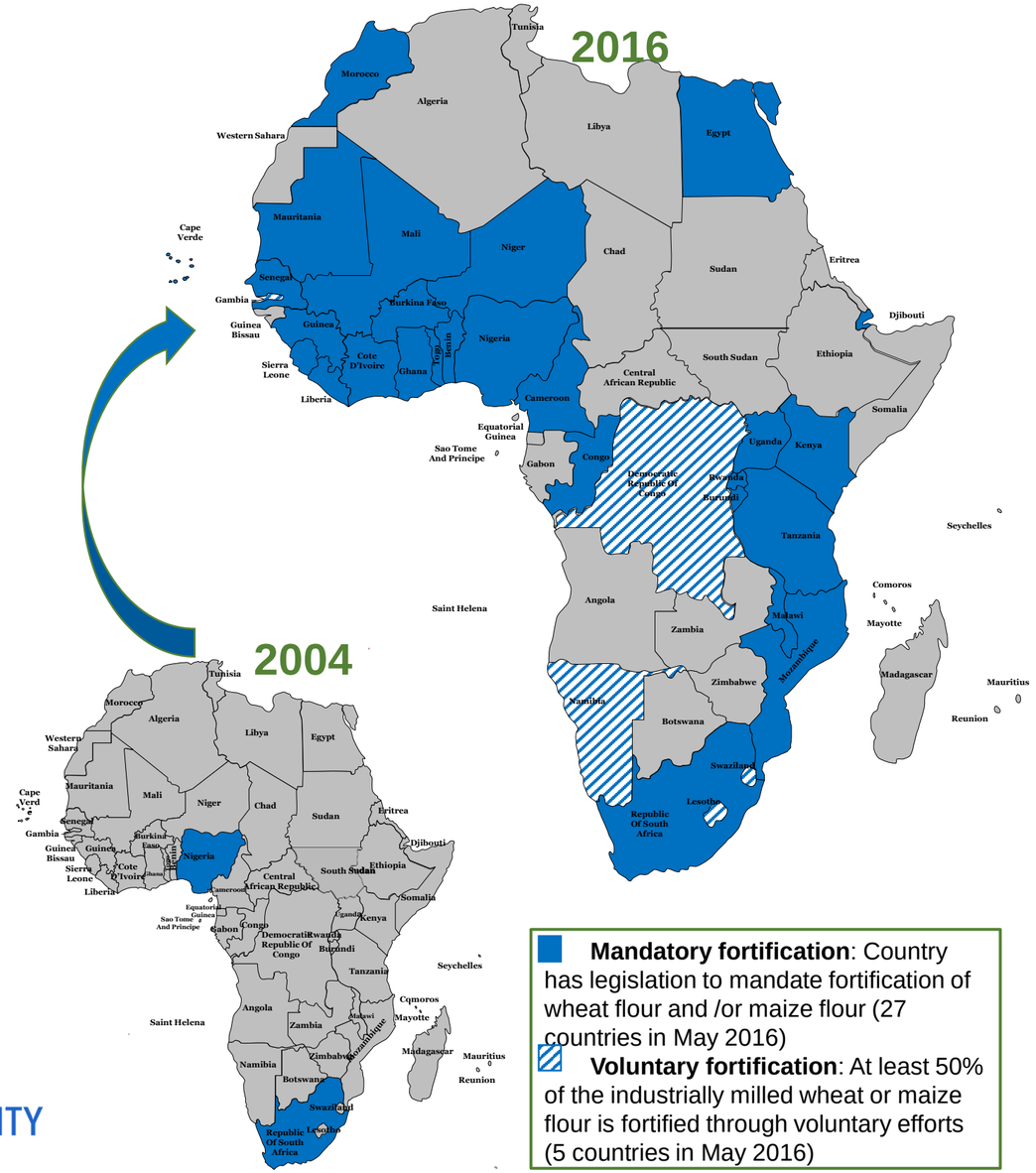
Flour Fortification in Africa: 12 Years of Progress



Mandatory fortification: Country has legislation to mandate fortification of wheat flour and /or maize flour (27 countries in May 2016)

Voluntary fortification: At least 50% of the industrially milled wheat or maize flour is fortified through voluntary efforts (5 countries in May 2016)

Maize availability and Fortification Legislation

- Mandatory fortification legislation
- Voluntary legislation
- No availability or legislation data
- 75 or more grams available per person per day
- Less than 75 grams available per person per day

Source: www.FFInetwork.org

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DAY 1: Monday 15 May 2017		
	Plenary Session 2: Rationale for fortification	
11:00–11:30	Faces of Anemia	Ronald Afidra, FFI
11:30–12:00	Folic acid and neural tube defects: what do we actually prevent?	Lieven Bauwens and Ewa Kampelmann, IF
12:00-12:30	Flour Fortification Overview- Global and Regional Update	Ronald Afidra, FFI

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AN EFFICIENT STRATEGY?

Copenhagen Consensus

	Solution	Challenge
1	Micronutrient supplements for children (A & Zn)	Malnutrition
2	The Doha development agenda	Trade
3	**Micronutrient fortification**	Malnutrition
4	Expanded immunization coverage for children	Diseases
5	Biofortification	Malnutrition
6	Deworming, other nutrition programs in school	Malnutrition
7	Lowering the price of schooling	Education
8	Increase and improve girl's schooling	Women
9	Community-based nutrition programs	Malnutrition

Nobel Prizewinning Economists: Finn Kydland, Robert Mundell, Douglass North, Thomas Schelling, Vernon L. Smith

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AN EFFICIENT STRATEGY?

- It works!

  eg. NTD's prevelance reduced with 40% upon folic acid fortification in Chile

- Cost efficient:

1:12	Chile
1:30	South Africa
1:48	United States

Llanos, A., et. al., Cost-effectiveness of a Folic Acid Fortification Program in Chile. Health Policy 83 2007:295-303.
Sayed, A., et.al., Decline in the Prevalence of Neural Tube Defects Following Folic Acid Fortifcation and Its Cost-Benefit in South Africa. Birth Defects Research 82 2008:211-216.
Grosse, Scott, et. al., Reevaluating the Benefits of Folic Acid Fortification in the United States: Economic Analysis, Regulation, and Public Health. American Journal of Public Health 95 2005:1917-1922.

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DAY 1: Monday 15 May 2017

	Plenary Session 3: Cost-Benefit of Flour Fortification	
13:30- 14:00	Economic consequences of deficiencies- Potential economic benefit of fortification	Quentin Johnson
14:00– 14:45	Introducing a modeling tool for Cost Benefit Analysis -Reporting on an exercise using country data and experiences- the case of Zambia	Zambia team and Quentin Johnson

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FOOD FORTIFICATION VEHICLES

OIL

Vitamin A,E

MILK

Vit A,D
Ca

CEREALS

Fe, Zn
Vit. B1, B2, B3, B6
Folic acid
Vitamin A

SALT

Iodine

SUGAR

Vitamin A

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WHY ARE CEREALS A GOOD VEHICLE?

- Staple food
  - Carbohydrate source
  - Daily consumed
  - High consumption levels
- Cereal processing industry
  - Well established world-wide
  - Large scale operations

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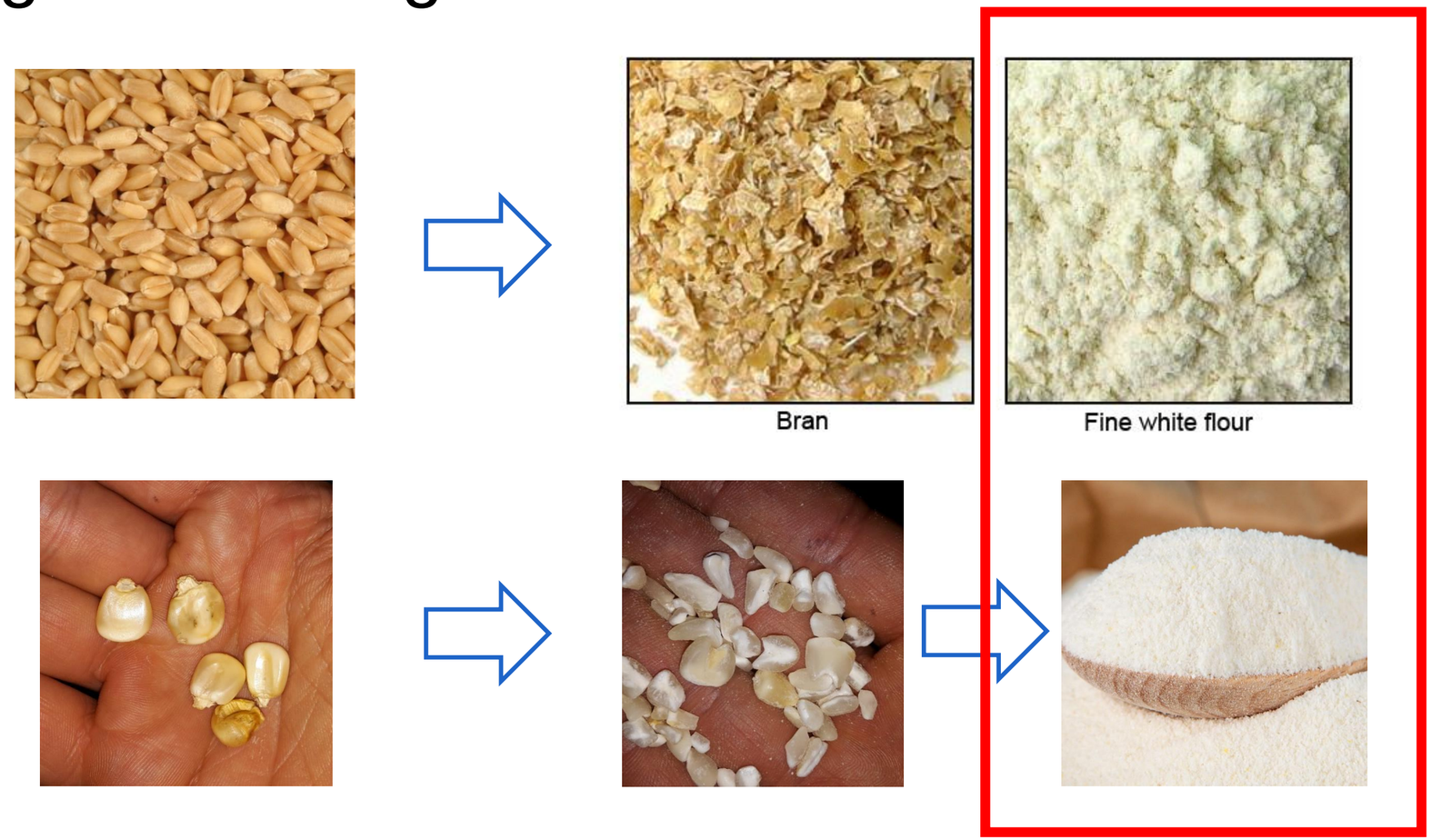
HOW ARE CEREAL PRODUCTS FORTIFIED?

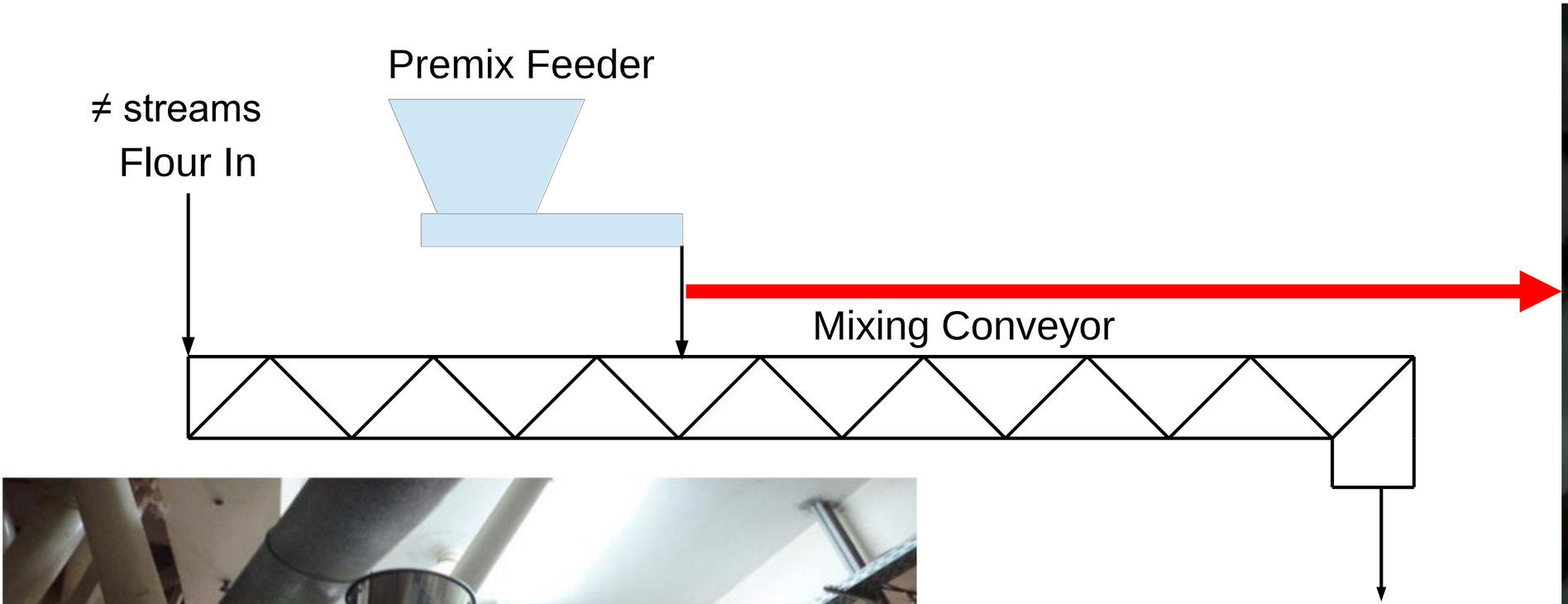
- Cereal processing
  - Milling and sieving



Fortification is performed at the level of the flour/meal

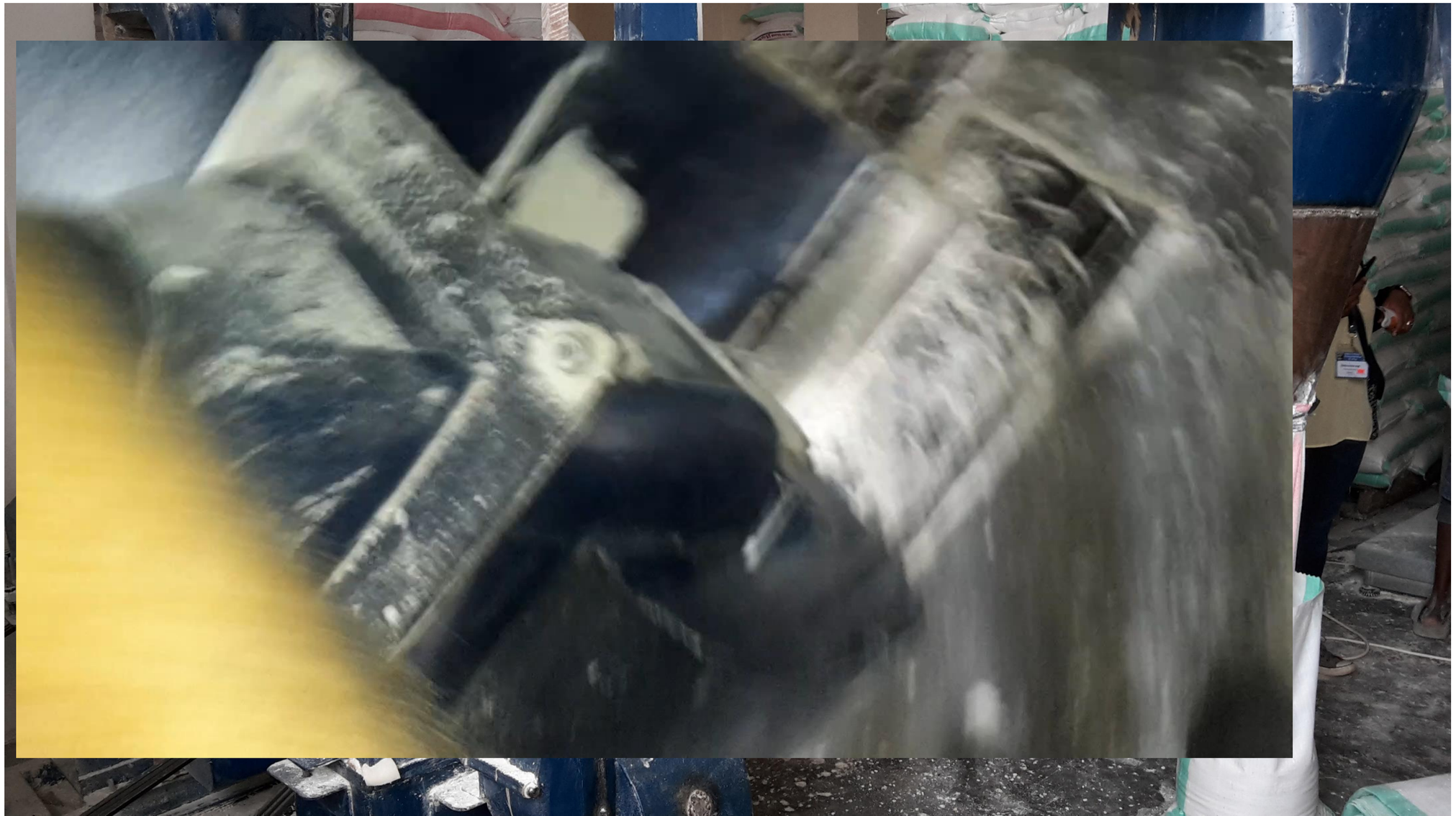
HOW ARE CEREALS FORTIFIED?

– Flour fortification: large scale operations



HOW ARE CEREAL PRODUCTS FORTIFIED?

- Flour or meal fortification: small scale hammer mills



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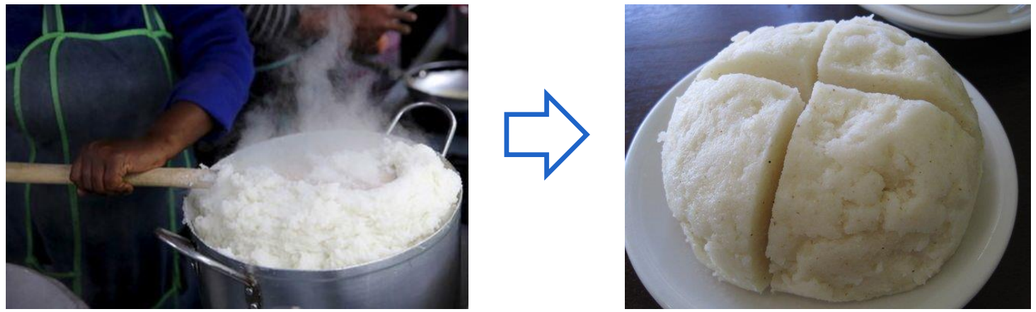
HOW ARE CEREAL PRODUCTS FORTIFIED?

- Cereal processing
  - Milling and sieving
  - End products: white flour or meal, bran, germ
  - Intermediate products -> food products
    - Wheat flour -> bread

    - Maize meal -> porridge



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DAY 2: Tuesday 16 May 2017		
	Plenary Session 6: Fortification in practice: production and distribution	
8:30–9:00	Milling technology for cereals	Filip van Bockstaele, Ghent University
9:00-9:30	Flour fortification at the mill – Premix and feeders	Quentin Johnson and Philip Randall

DAY 3: Wednesday 17 May 2017		
	Plenary Session 10: Premix suppliers	
16:00–17:30	Presentations and Q&A for Premix and milling equipment industry representatives.	All premix suppliers present

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BUILDING EFFICIENT FORTIFICATION PROGRAMMES

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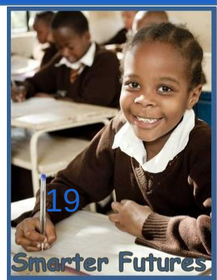

FORTIFICATION: CHALLENGES

- Fortification operation: relatively easy
- Setting up national fortification programmes: challenge!

gouvernement

Legislation

Technical standards

Inspection/audits

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DAY 1: Monday 15 May 2017		
	Plenary Session 5: Food Fortification Legislation and Standards	
16:45–17:15	Food Fortification legislation and standards: theory	Quentin Johnson
17:15–17:45	Food Fortification legislation and standards: in practice	Philip Randall
17:45-18:00	Country teams affix copies of their legislation, standards and regulations to the flipcharts provided	All

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DAY 1: Monday 15 May 2017		
	Plenary Session 9: National food control systems	
14:00–14:30	Opportunities and Constraints that affect national food control systems effectiveness in Africa	Philip Randall
14:30-15:00	Performing audits – stock control as control measure	Philip Randall
15:00-15:30	Laboratory requirements for external monitoring	Quentin Johnson
15:30-16:00	Discussions	All

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FORTIFICATION: CHALLENGES

- Fortification operation: relatively easy
- Setting up national fortification programmes: challenge!

gouvernement

Legislation
Technical standards
Inspection/control
Information

industry

Feeder technology
Premix
Quality assurance **(QA)**
Quality control **(QC)**
(intermediate and end products)

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DAY 2: Tuesday 16 May 2017

	Plenary Session 7: Quality assurance in the milling industry	
9:30–10:00	Milling industry quality assurance principles and practices	Philip Randall
10:00-10:30	Quality control at the mill (general)	Milling industry repr. (tbd) or Quentin Johnson

	Plenary Session 8: Fortification quality control	
11:00–11:30	Quality control test for iron, vit A and folic acid: theory	Filip van Bockstaele, Ghent University
11:30-12:00	Chemical assays for fortificants: method validation and examples	Anna Zhenchuk, Bioanalyt
12:00-12:30	End product quality: baking trials on wheat flour and maize cooked porridge	Filip van Bockstaele

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DAY 3: Wednesday 17 May 2017

	Mill and government laboratory visits
8:30–13:00	1. **PARTICIPANTS from GOVERNMENT/NGO's Visit to Flour Mill:** In 3 or 4 small groups rotating through the mill, QA/QC laboratory, covering the following areas: • Premix storage • Feeder calibration • Fortification Process • Check weighing or computer control system • QA/QC procedures in the laboratory and Premix utilization and reconciliation calculations 2. **PARTICIPANTS from MILLING INDUSTRY, PREMIX SUPPLIERS** **Visit to a government analytical laboratory** • Briefing on government regulatory system • Facilities and equipment • Guidelines/ protocols Both visits include practical demonstrations of spot test, iCheck and other testing methods

FORTIFICATION: CHALLENGES

- Fortification operation: relatively easy
- Setting up national fortification programmes: challenge!

gouvernement

Legislation
Technical standards
Inspection/control
Information

industry

Quality assurance
Quality control (fast methods)
Premix/feeder technology

distribution

fortified

consumer

Are products accepted?
Are products bought?
Are products consumed?
Micronutrient status?
=> Continuous **monitoring** system needed!

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DAY 1: Monday 15 May 2017

	Plenary Session 4: Monitoring, surveillance and evaluation of food fortification programmes	
14:45-15:15	FACT (Fortification Assessment Coverage Tool)	Felistus Mugambi,GAIN
15:15-15:45	Government regulatory monitoring	Mulonda Mate, Ministry of Health, Zambia
15:45-16:15	***Tea Break***	
16:15-16:45	FORTIMAS Programme monitoring and surveillance	Anna Verster, Smarter Futures

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GOALS OF THE WORKSHOP

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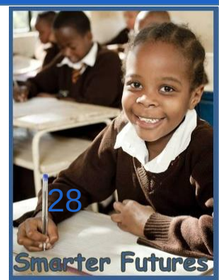

1. KNOWLEDGE TRANSFER

- Presentations/demonstrations
- Online: Zephyr.ugent.be -> QAQC Zambia

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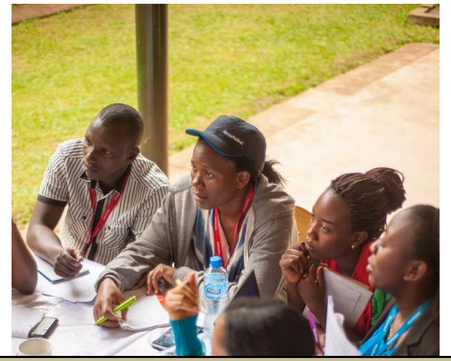
2. NETWORKING

- Lunches & coffee breaks
- Market place and coctail party

DAY 3: Wednesday 17 May 2017		
18:00-20:00	**Market Place:** exhibition of materials by partners from public and private sectors, discussion corners, getting acquainted **Followed by a Cocktail Party**	Smarter Futures participants

3. INTERACTION



DAY 4: Thursday 18 May 2017		
	Parallel working group sessions **Fortification programmes: current status and challenges**	
8:15-10:30	**Parallel working group sessions: Part 1** Participants are divided in three working groups according to their background/profession WG1: production and distribution TASKS: Review of current systems, common challenges to QA/QC and needs analysis at the mill level. WG2: National food control systems TASKS: Review of current systems, strengths and weaknesses WG3: Standards and technical regulations TASKS: Review of current status, outstanding requirements, recommendations	All facilitators
11:00–13:00	**Parallel working group sessions: Part 2** Participants are now divided in several working groups according to their nationality (country working groups). Information from the previous session is incorporated into a national report on the current status of flour fortification practices; strengths, weaknesses, challenges and future perspectives. Strengths of programme: What are they Constraints: Preventing implementation to scale Future action plans identifying milestones within 6 months, within 1 year within 2 years.	

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