PHC ASSIGNEMENT REPORT

FOOD FORTIFICATION IN BURUNDI

REQUIREMNTS FOR PRODUCERS

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Contents

1. Introduction

Project Healthy Children (PHC) requested the consultant to travel to Bujumbura in October 2014 and review a number of food processors to determine their preparedness to adopt fortification of their products. The visit was meant to provide indication of the cost implications for each producer and provide a tentative plan for monitoring the fortified foods by Burundi Bureau of Standards (BBN) and the Ministry of Health. Burundi has legislation for making food fortification mandatory and this is expected to come into force by November 2014.

2. Objective

The visit was aimed at looking at what is required for the producers to fortify. Specifically to conduct the following

1. Assess eight staple food producing industries in Burundi (Sosumo, Minolac, Savonor, Farisana, Pembe, Azam, Musalac, and Cafloquabo) for requirements needed to scale-up for fortification including premix and equipment procurement, installation requirements, process and storages changes, training, quality assurance and control measures, and associated costs and relevant sources;
2. Consultations with the Burundi Bureau of Standards (BBN) to discuss sampling plan and testing methodology for the national fortification program;
3. Consultations with the Ministry of Health's Unit to discuss sampling plan at the market and household levels and appropriate testing methods;
4. Compile a document which provides industry evaluations including recommendations for equipment, processes, training and other improvements as needed to begin fortification presented to PHC and each individual industry;
5. Compile a document outlining preliminary sampling and testing plan to BBN, MoH, and PHC.

3. Producers to be visited & dates

Eight producers, the Burundi Bureau of Standards and the Ministry of Health were targeted but due to limited time and closure of some production plants during the time of the visit, the following were the actual visits conducted:

	Dates Visited	Organization	People Met
1	7th October 2014	Arrived in Bujumbura	
2	8th October 2014	Visited Savonor Oil Refinery in Bujumbura	**Rama Kant Pandey**, Managing Director, +25722223860, +25778603305,pandey@savonor.com **Ninkingiye Djibril**, Head Quality Assurance, +25778838782, djibrilninkingiye@yahoo.fr
		Visited Bakhresa Wheat Flour Mill in Bujumbura	**Tuli Yahya**, Project Manager, +25778111184 **Peter Ambaisi**, Miller, +25778575687
3	9th October 2014	Travelled to Rutana and visited Sosumo Sugar Factory	**Philippe Niyitunga**, Sosumo Quality Controller, +25777746848 or 71912232, Email: prudimba@yahoo.fr
5	10th October 2014	Travelled to Muramvya and visited Minolac Wheat Flour Mill	
6	10th October, 2014	Burundi Bureau of Nationalization (BBN)	**Damien Nakoberetse**, Director, BBN, Bujumbura. +25722221815; +25722221577. md@bbn.bi Erice Ruracenyeka, Head of Training and Technical Services. +25778849402. ruraeric@yahoo.fr
7	Not visited	Cafloquabo Cassava	
8	Not visited, closed	Farisana - Wheat/Maize	
9	Not visited, closed	Musalac Wheat Flour	
10	Not visited, closed	Pembe Wheat Flour	

4. Findings

a) Savonor

The oil refinery produces “Cooki” brand of oil and has a market share estimated at 30%. The available production capacity is 30 tons per day and the oil is packed in various pack sizes namely 1L, 3L, 5L, 10L, and 20L. The refinery has recently installed packing machine for 50mL for the low end market. Burundi consumes 600 to 700 tons of oil per month with an estimated per capita consumption of 30-40mL. Of this monthly figure, 400-500 tons is believed to be imported from Uganda especially where the oil is already fortified.

The marketing of refined oil in Burundi is hampered by a national preference for “virgin oil” (palm oil) which is cold pressed and not refined. Savonor would be interested to refine the virgin oil produced in the country to improve its quality and fortify it. It is accepted the quality of the virgin oil usually not good for health and refining it would make the product expensive for most users. Savonor has at some point been involved in exportation of Virgin oil to Rwanda but this was discontinued following a ban by the Rwanda Government.

b) Premix Requirements at Savonor

The actual production is estimated at 15 tons per day and this is done in batches of about 7-8 tons at a time. The East African Standard recommends addition between 21 and 28mg/kg which translates to a target addition of 25mg/kg. Vitamin A for oil fortification is sold as Retinyl Palmitate 1.0 million IU/g or 1.7 million IU/g which a more concentrated version. Producers are allowed to use any of these two forms sourced from reputable suppliers with the top two being BASF[1] and DSM[2]. Other reputable suppliers can be found on the website for the Global Alliance for Improved Nutrition (GAIN)[3]. The addition rates to satisfy this standard for Burundi[4] are as follows

Table 1: Use of vitamin A premix to satisfy target addition of 25mg/kg vitamin A

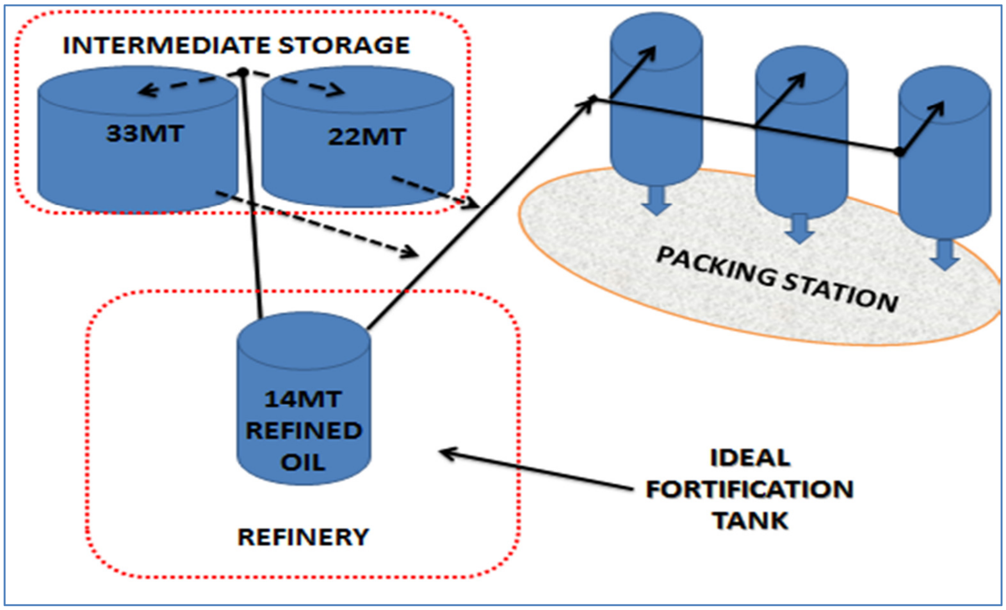
Vitamin A as Retinyl Palmitate	Target Vit. A Addition	Vit. A premix per ton oil	Vit. A used[5] per day in Kilograms	Cost[6] of Vit. A premix/day
1.7million IU/gram	25mg/kg	49grams	0.74	US$64
1.0million IU/gram	25mg/kg	83grams	1.25	US$105

[1] Contact Marco Sterz at marco.sterz@basf.com
[2] Contact Brian Kritzinger at brian.kritzinger@dsm.com
[3] http://gpf.gainhealth.org/suppliers/current-suppliers
[4] Refer to Appendix at end of document
[5] Assumes daily production of 15 tons at Savonor
[6] Assumes Vitamin A premix cost of $86 and $84 per kilogram for 1.0mio and 1.7mio IU/g

c) Addition Point for the Vitamin A

The best fortification point is just before packing. At Savonor, after the final process of refining the oil (filtration), the oil is collected in a 14 tons holding tank within the refinery area an illustration of the tank setup is provided in Figure 1.

Figure 1: A sketch of the layout of refinery, storage tanks and packaging



The oil is refined in batches of 7-8tons and from this transit tank **(Figure 2(3)),** the oil is pumped to the packing station and stored in 3 tanks each with 7.5 ton capacity **(Figure 3(4))**. It is from these three tanks that oil is packed into the various pack sizes. The plant has 2 buffer storage tanks for intermediate storage with capacities 33tons and 22 tons for storing excess refined oil **(Figure 2(6))**. The three tanks in the packaging area could, in principle be used for fortification where every time a specific amount is loaded into a tank; an amount of vitamin A is added as per specified rate in Table 1. The oil and vitamin A would then be mixed pending packaging. This process would be repeated for the other two tanks from time to time. However this process would require careful monitoring to make sure the amount of oil loaded is measured accurately and fortified oil is packed before filling up the tanks again. It is a possible plan but requires extra care and installation of pumps for circulation the oil for mixing.

Alternatively, and much easier to control, is to fortify the oil within the refinery area. Every time a batch of oil filtered and loaded into the 14 ton tank, the weight would be recorded and appropriate vitamin A premix amount added to the tanks and mixed. Mixing can be done through circulation of the oil. A closer look at the tank indicated that there is adequate space around the tank for inclusion of an extra circulation system. The fortified oil would thus be transferred either directly to the packaging area or to the intermediate storage.

Figure 2: Photos of some sections of Savonor Oil refinery, Bujumbura - Burundi

		
1. Refined oil is filtered on 1st floor of refinery and run down into a holding tank below	The 14 tons holding tank below the filters. Can be used for mixing the oil with vitamin A before transfer to packing station	3. A closer look at the 14 ton tank to be used for blending vitamin A with refined oil to produce batches of fortified oil
		
4. The three holding tanks in the packaging area where fortified oil would be stored pending packing into various sizes	5. Packing area showing the three 7.5 ton tanks in the background	6. Intermediate storage tanks where fortified refined oil could be kept before packing

d) Costs

The production of 15 tons per day would translate to about 4000[7] tons per year which would have value of $8,000,000 ($2000 per ton). Oil sells at BF57, 000 ($36) per 20 liters and density oil estimated at 0.9kg/L.

Using an estimated cost of vitamin A of $80 per kilogram, and production of 15 tons per day, the addition of 25grams per ton (25mg/kg) would translate into $30 worth vitamin A per day. The 15 tons of oil for the day would have a value of $30,000. Addition of vitamin A would increase the cost by 0.1%. The annual cost of vitamin A fortification is estimated at $8000 for vitamin A only. In calculating annual fortification costs, the premix cost would usually be 80% of the cost of fortification with the rest going to equipment costs and quality assurance and quality control at production. In this case $2000 would be estimated costs for internal monitoring the oil produced at this plant which is 0.04% of the cost of the oil packed.

[7] Estimating 280 days of production

e) Training at Savonor

The fortification of oil is one of the easiest process and the personnel will mainly need training in understanding the following

1. The role that fortified oil plays in addressing vitamin A deficiency and the fortification agenda in general for Burundi
2. The legislation used in Burundi and other countries in the region for oil fortification and its limitations
3. The target addition level, vitamin A fortificant available, sources and how to calculate addition amount depending on amount of oil to be fortified
4. Quality Assurance for the process and quality control issues related to the final fortified oil

The production personnel and laboratory personnel will have to familiarize themselves with the internal monitoring processes for fortified oil. This training would take 1-2 days with practical sessions especially in determining the appropriate mixing procedure to obtain adequately fortified oil. It will also include qualitative test methods and, if possible, testing with the iCheck for quantitative results.

Qualitative tests are relatively simple and cheap and only require two reagents (Dichloromethane, dichloroacetic acid) and simple test tubes. The laboratory at Savonor is capable of conducting such test based on the observations during this visit.

5. Bakhresa Grain Milling Company

The mill is new and it has a very impressive setting with the installed mill bought from Italy. The mill runs for 8hours and has capacity to produce 360 tons every 20 hours. The mill is also exporting flour to Congo because the demand is not very high in the country especially during seasons when other foods are available such as sweet potato and Cassava. Milling is usually on demand and no flour spends more than 1 week in the mill before dispatch. Bakhresa packs in 25kilogram bags and the price fluctuates between a high of BF37, 000 per 25kg and BF25, 000 per 25kg. This is a low of $16 and a high of $23 per 25kg depending on the season. The mill packs in 25kg and the brands are ***Ngano Bora*** which is for Home baking and ***Special Baking Flours*** (SBF) for bakery use. The extraction rate for these flours is 78% and the shelf life provided is 6 months. In terms of raw material storage, the mill has four silos that can take 1,300 tons per silo.

f) Premix requirements

The mill already has installed a feeder for improvers and what is required is to procure a second feeder for adding the vitamin/mineral premix. The plant has a buhler feeder which costs about $8000 to buy. According to the East African Standard which Burundi adopted, the premix used can either contain a combination of Iron EDTA and Ferrous Fumarate with an addition rate of

500g per ton. Or the premix may contain Iron EDTA only and the addition rate of the prescribed premix is 600grams per ton.

Assuming a daily production rate of 360 tons wheat per day, the annual production of the flour is estimated at 78,000tons[8]. This would translate to about 39tons or 47 tons of premix depending on the type of iron in the premix. This premix would cost close to US$780,000[9].

g) Addition Point

The addition point for the fortification premix shall be next to the feeder for improver because this point has proved adequate for mixing of improves with the flour. Unless new information from calibration proves otherwise.

h) Cost

The extra cost as described above relates to the purchase of a feeder and premix for fortification

Feeder $8,000

Premix $780,000

Estimates value of 78,000tons of flour = 62,400,000[10]

Annual costs of fortification = $780,000 premix+800 (10years span of feeder) +20% QAQC costs internally = US$937,000

Cost of fortification about 1.5%.

i) Training

The personnel in the wheat mill are already conversant with addition of premixes to the flour. The mill has a well-stocked laboratory for testing wheat and wheat flour. They already have a sampling plan and so fortification premix will easily be handled. They will need training in understanding the following;

1. The role that fortified wheat flour plays in addressing micronutrient deficiencies and the fortification agenda in general in Burundi
2. The legislation used in Burundi and other countries for wheat flour fortification and limitations
3. The target addition levels , premixes available and how to calculate addition amount depending on the flow of wheat flour in the mill
4. Quality Assurance and quality control issues related to fortified wheat flour

[8] Assuming 280 production days per year and 78% extraction.
[9] Assumes every ton requires premix with $10
[10] Assumes flour cost $800 per ton on average.

The production personnel and laboratory personnel will have to familiarize themselves with the internal monitoring processes for fortified wheat flour. This training would take 1 day with practical aspects conducted within the mill. It will also include qualitative test methods and, if possible, testing with the iCheck for quantitative determination of vitamin A and iron.

Qualitative tests are relatively simple and cheap and only require two reagents (Dilute hydrochloric acid and a 10% solution of Potassium Thiocyanate) in simple test tubes. The laboratory at Bakhresa is capable of conducting such test based on the observations during this visit.

6. Minolac Wheat Flour Mill, Muramvya

Minolac produces wheat flour and maize meal in one establishment based in Muramvya. The maize flour production is smaller than wheat flour production. The mill has just concluded the installation of a new wheat flour mill with capacity of 150 tons per day and this will increase their capacity from the current 45tons per day. The new mill is expected to be functional by November 2014 and the extraction rate at the mill is about 80%. The maize mill produces 30 tons per day of maize meal. Both products from the mill are sold in Burundi.

Minolac has been the number one mill in terms of production until recently when Bakhresa installed the 350 tons per day mill. However, the two brands from Minolac namely ***Ngoma*** for home baking and ***Minolacs*** for bakery are well established on the market. Ngano represents 70% of their flour production at the mill. The Mill Manager believes that consumption of flour in Burundi is growing fast and that “fortification is a must for Burundi” where malnutrition cases evident at hospital establishments and in the community.

The flour costs BIF 35,000 ($22) per 25kg bags and the mill has four silos with capacity 2500 tons and ample space for storing premix.

j) Premix Requirements

With a total milling capacity of 195tons per day the annual production would be expected to be about 44,000tons[11] wheat flour and maize meal production would be 6,700 tons. The extraction rate used for wheat flour is 80%.

The mill already has installed feeders for improvers on the two wheat flour mills and has one old feeder available for the maize mill. The plant has installed a buhler feeder for the new wheat mill which costs about $8000 to buy. According to the East African Standard, the premix used

[11] Assumes 80% extraction and 280 days of production

can either contain a combination of Iron EDTA and Ferrous Fumarate with an addition rate of 500g per ton. Where the premix only contains Iron EDTA, the addition rate of the prescribed premix is 600grams per ton.

Assuming the annual production of 44,000tons this would translate to about 22tons or 26.4 tons of premix depending on the type of iron in the premix. This premix would cost close to US$440,000.

k) Addition Point

The addition point for the fortification premix shall be next to the feeder for improver because this point has proved adequate for mixing with the flour. Unless further calibration proves otherwise.

l) Costs

The extra cost as described above relates to the purchase of premix for fortification. There were suggestions by the mill that the old feeder for maize may have to be replaced in the near future, thus 2 Feeders at $8,000, one for wheat and the other for maize meal are considered.

2 feeders $16,000

Premix for wheat flour $440,000. Maize meal premix would cost about $67,000

Estimate value of 44,000tons of flour = $39,000,000[12]

Annual costs (wheat) = 440,000+800 (10years span of feeder) +20% QAQC costs internally = US$530,000. This cost of fortification about 1.4%.

Estimated total cost to fortify flour at Minolac is ($16000 - feeders + $507,000 - premix) = $523,000 per year.

m) Training

The personnel in the wheat and maize mills are already conversant with addition of premixes to wheat flour. The process is similar for the maize flour. The mill has laboratory space for testing micronutrients in wheat and maize flour and with acquisition of appropriate equipment the tests can be conducted. Qualitative tests would cost an estimated $2500 for the two mills per year whereas inclusion of iCheck for quantitative test would require an extra $11,000[13] for the two mills in first year. In subsequent years the testing costs would be reduced as iCheck would be available. They will need training in understanding the following

1. The role that fortified flour plays in addressing micronutrient deficiencies and the fortification agenda in general

[12] Assumes cost of flour is $880 per ton

[13] Assumes daily tests for composite samples at $5 per test and acquisition of iCheck at $8000

2. The legislation used in Burundi and other countries for wheat/maize flour fortification and limitations
3. The target addition levels premixes available and how to calculate addition amount depending on the flow of wheat flour in the mill
4. Quality Assurance and quality control issues related to fortified wheat flour

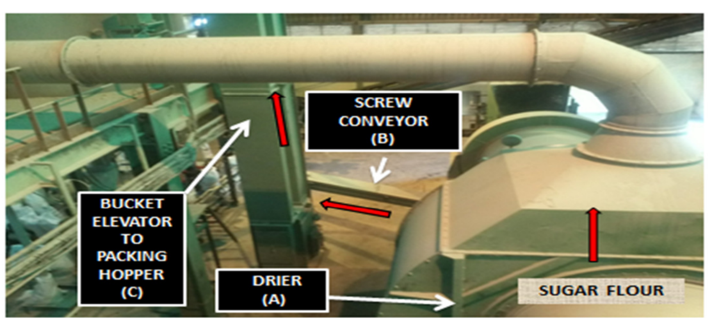
The production personnel and laboratory personnel will have to familiarize themselves with the internal monitoring processes for fortified wheat/maize flour. This training would take 1 day with practical aspects conducted within the mill. It will also include qualitative test methods and, if possible testing with the iCheck for quantitative determination of vitamin A.

Qualitative tests are relatively simple and cheap and only require two reagents (Dilute hydrochloric acid and a 10% solution of Potassium Thiocyanate) in simple test tubes. The laboratory at Minolacs is capable of conducting such test based on the observations during this visit.

7. Sosumo Sugar Factory, Rutana

This Government owned plant only makes one type of sugar which is raw sugar - from sugarcane. The plant produces 120-150 tons a day and production only runs from June to November each year. The daily production is in batches of 20-22 tons with an hour between each batch. The plant has 4 centrifuges but only two are used to separate the final sugar from molasses and transfer to a dryer. Addition of vitamin A into the centrifuges is not recommended as the flow is not consisted. From the dryer, the sugar is offloaded onto a screw conveyor which takes the sugar to a bucket elevator which in turn raises the sugar to a 5tons holding bin used for packing as shown in the diagram, **figure 3**.

Figure 3: Sugar plant at Sosumo showing sugar flow from dryer to packing station



Sugar from drier (A) and falls into the screw conveyor (B) which transfers the sugar to the bottom of a bucket elevator (C) . The sugar is elevated to a holding bin for packing

The plant only packs its sugar in 50 kilogram lined polypropylene bags. The mill has plans to pack in smaller sizes in future. The sugar produced is stored in buffer reserves across the country for use during periods of no production (December to May). The sugar is stored as follows; Gihogi (4,000tons), Bujumbura (4,000tons), Ngozi (2,000tons), Gitenge (2,000tons) and Cankuzo (500tons). When fortification starts and fortified sugar is stored in these buffer centers, there is need to effect a first-in-first-out system in these buffer stations to reduce vitamin A loses. The buffer stocks are likely to spend 6 months in storage if stored in November and released by May the following year. Otherwise if the stock is not rotated sugar can spend up to 12 months in storage. This is development that needs to be considered by Sosumo with the advent of sugar fortification.

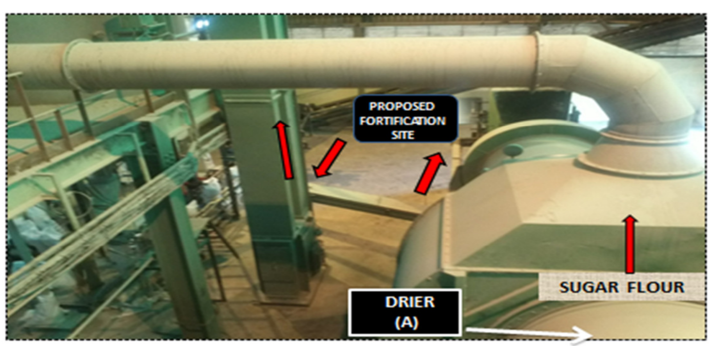
n) Premix requirements

The annual production of sugar is 24,000 tons and this would require 24 tons of premix (1kg per ton) of the Vitamin A Palmitate 50. This is the form that does not require dilutions and costs $15 per kilogram. As such Sosumo will have to procure premix worth US$360,000 for its annual use. The value of the 24,000 tons is US$28.8million[14] and the premix cost is 1.3% of the sugar value.

o) Addition Point

Based on the findings during the visit, the fortification will have to take place before the sugar is loaded into the 5tons holding bin in the packing section. This would involve tapping the sugar from the screw conveyor into a new bucket elevators into a sugar bin used for fortification and offloading the fortified sugar into the existing bucket elevator for packing. There is adequate room in the plant for installation of the new bucket elevator, sugar hopper and vitamin A hopper. A description is provided here **Figures 4 & 5**.

Figure 4: Picture of Sosumo sugar plant showing proposed site where fortification equipment can be installed



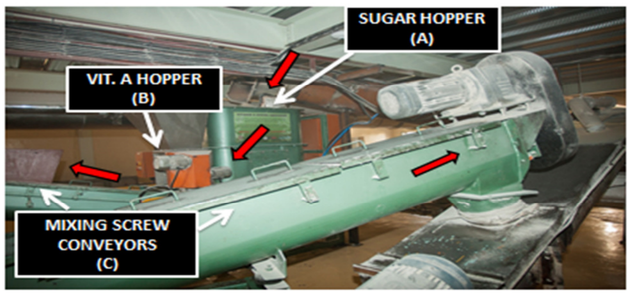
Proposed Fortification site: Will require new screw conveyor, new bucket elevator and fortification unit (sugar hopper + vitamin A hopper+ dosing control system)

Sugar would be diverted to the open space using a screw conveyor and lifted into a sugar holding bin for fortification using a new bucket elevator. After fortification the sugar would be transported to the existing bucket elevator for lifting to the current packing bin

[14] 1kilogram of sugar costs US$1.2

The sugar will have to be fortified between the drier and the packing station. This would require diverting the sugar immediately after the drier, fortify it and return to the packing station through the existing bucket elevator. A possible fortification unit is provided in Figure 5. This machine can be provided in 20tons per hour and 10 tons per hour configuration. The Malawi equipment was supplied by a company in South Africa. Though the original company closed, service can be provided through Mr. Keith Truter[15]

Figure 5: Sugar fortification equipment used in Malawi which can be adopted for the Burundi case



Possible fortification system

Picture shows two doing systems situated in one fortification center.

Sugar from factory enters sugar holding hopper (A) and vitamin A is added from vitamin A hopper (B). Based on approaprate weights measured using load cells, the measured sugar and vitamin A are mixed in screw conveyor (C) and as it is transported to packing station.

p) Cost

The cost for fortification will relate to the installation of the following

1. A screw conveyor (at least 5 meters) to take sugar back to the existing bucket elevator ($8,000)
2. A new bucket elevator to take sugar from existing screw conveyor to sugar hopper ($10000 estimate)
3. Sugar dosing equipment (sugar bin/dosing equipment/mixer unit) ($60,000 depending on technology)

The premix cost is $360,000 a year. If the equipment cost is spread over 10 years, the annual cost is about $367800 per year, $15 per ton. This is about 1.3% of the value of sugar produced.

Testing equipment in the form of iCheck which costs about $8000 and vials for testing at a cost of $8 per day would cost $2000[16] for the year. The plant will have to buy reagents for qualitative tests to use regularly for the daily batches.

[15] Kieth.truter@gmail.com Cell +27826767360

[16] 300 vials with one box costing about $600 per 100 tests. Plus reagents for qualitative tests

q) Training

The personnel in the sugar factory will relate to the following

1. The role that fortified sugar plays in addressing vitamin A deficiency and the fortification agenda in general
2. The legislation used in Burundi and other countries for sugar fortification and limitations
3. The target addition level and how to calculate addition amount depending on the sugar production
4. Quality Assurance and quality control issues related to fortified sugar

The production personnel and laboratory personnel will have to familiarize themselves with the internal monitoring processes for fortified sugar. This training would take 1 day and practical aspects conducted when the mill is function. It may be appropriate to take the Quality Controller to a sugar plant either in Malawi or Zambia where sugar fortification is taking place for first-hand information. Malawi would be a preferred destination because of the more up to date technology being used.

Qualitative tests are relatively simple and cheap and only one chromogenic reagent (A solutions of trifluoroacetic acid, dichloroacetic acid or antimonyl Chloride in dichloromethane). The laboratory at Sosumo has adequate space as observed during this visit. They would require an icheck for quantitative testing and reagents for qualitative tests.

8. Burundi Bureau of Standards (BBN)

Discussions were held with the Director of BBN (Damien Nakoberetse) and Mr. Eric Ruracenyeka who is Head of Training and Technical Assistance. This was mainly on the role that BBN would play in the monitoring of fortified foods. The Director pledged BBN support to the monitoring of the program but no concrete plans were developed for monitoring. This exercise of developing a monitoring plan requires input from various sections of BBN including Certification, Laboratory and Standards development and it was not possible to arrange the meetings during this short visit. These will be priority meetings during the next in country visit to Burundi.

In terms of training for BBN, a wide selection of officials within BBN will have to undergo training in general food fortification and inspection of the various foods. They will be vital in the design of the monitoring program since they are aware of challenges and option for inspecting food in Burundi. This training and planning for inspection can take place 1 to 2 days.

9. Recommendations

Specific recommendations have been provided for each of the producers but in general the following are also import

- BBN personnel from all key section (Certification, Standards, laboratory and Training) will need to undergo an information session to provide them with latest fact on food fortification and emphasize the role that BBN has to play to ensure success. The officers will be involved in drafting of the monitoring plan based on their knowledge of the local situation. Guidance will be provided to develop a plan that is sustainable but provides meaningful data with minimal resources
- Producers should obtain latest costs for the equipment suggested and quantify as soon as possible (including any taxes) and lead times. Equipment for production is usually imported and this can take time. The sooner the producers review the fortification plans and obtain relevant equipment the better for implementation
- Laboratories that will support national monitoring should be identified and equipment as soon as possible.

10. Conclusion

Based on the discussions held during this visit, the producers in Burundi welcome this food fortification agenda especially since it is mandatory. The costs may seem high for producers initially but the figures indicate that fortification should not increase production costs above 2% of the current cost. The installation of necessary equipment will determine how soon fortification can be adopted in the country. This is more especially for sugar fortification where the equipment is bulky and the process will requires more restructuring to accommodate the machines. The period for such reconstruction is when production is halted and this is between December and May. It is important therefore for Sosumo to act on the recommendation with urgency.

Wheat millers are experienced in adding of premixes and implementation will only depend on how soon the feeders can be produced and installed. In the oil industry, the recommended pumps for circulation are equipment that is regularly used in oil production and should be easy to identify and install.

The success of the program depends on adequate monitoring and support from knowledgeable BBN inspectors and so providing appropriate training prior to implementation is a key aspect of the preparations for fortification in Burundi.

11. Appendix: Summary of Fortification specification as per East African Community (EAC) Standards

Food Vehicle	Micronutrient	Nutrient Form	Recommended Factory Level , mg/kg	Regulatory Levels, mg/kg	
				Minimum	Maximum
Edible Oil EAS 769:2012	Vitamin A	Retinyl Palmitate 1.7 mio UI/g or 1.0mio IU/g	35±5	20	40
Sugar EAS 770:2012	Vitamin A	250CWD/CWS /SN & VAP50	10±5	2	15
Wheat Flour EAS 767:2012	Iron(either)	Sodium Iron EDTA	30±10	20	40
		Ferrous Fumarate	40±10	30	50
	Total Iron		30±10	20	N/A[17]
	Vitamin A	Vitamin A (Retinyl) Palmitate , spray- dried or equivalent, 0.075 % retinol, min.	1.0±0.4	0.5	1.4
	Folate	Folic Acid, 100%	2.3±1	1.1	3.2
	Zinc	Zinc Oxide, Activity >80%	60±20	40	80
Maize Flour EAS768:2012	Iron	Sodium Iron EDTA	20±10	10	30
	Vitamin A	Vitamin A (Retinyl) Palmitate , spray- dried or equivalent, 0.075 % retinol, min.	1.0±0.4	0.5	1.4
	Folate	Folic Acid, 100%	1.2±0.5	0.6	1.7
	Zinc	Zinc Oxide, Activity >80%	49±16	65	30

[17] Questionable why this is N/A. To be verified with EAC final document