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PRE – BID MEETING NOTICE

EMPANELMENT OF PRIVATE RICE MILLS FOR PRODUCTION OF FORTIFIED RICE FOR DISTRIBUTION UNDER ICDS SCHEME OF HARYANA.

Hafed intends to implement the decision of the Govt. of Haryana for providing Fortified Rice with multiple micronutrients as per FSSAI norms for distribution under ICDS scheme for Women and Child Development Department, Haryana. The Interested private rice millers of Haryana who are doing the work of Custom Milled Rice for FCI are invited to attend the pre bid meeting to discuss the operational and technical guidelines and terms & conditions for empanelment of Rice Mills. The Rice Millers have to process the paddy and supply Fortified Rice to FCI on the pattern of CMR. The document containing detailed operational guidelines and terms & conditions, specifications, etc. can be downloaded from the Hafed's website **www.hafed.gov.in.** The Pre-bid meeting will be held at 12:00 noon on 24.12.2020 at Hafed Corporate Office Sector-5, Panchkula.

Interested Rice Millers may attend in person or join through video conferencing, for which the parties may send their request through their official e-mail to hafed@hry.nic.in the link for the same will be sent to them timely before pre bid meeting date.

Managing Director

Hafed, Panchkula.

Pilot Pre bid meeting for Rice Fortification and its Distribution under ICDS Scheme of Haryana

Introduction:

Government of Haryana is committed to improve the health and nutritional status of women and children in the State. Micronutrient deficiency has been identified as a major underlying cause of many health and nutritional disorders including stunting, anemia and some congenital birth defects (including Neural Tube Defects). The latest NFHS-4 data for Haryana shows high prevalence of anemia among children i.e. 71.7% while for non-pregnant and pregnant women is 63 % and 55% respectively which is higher than the national average.

Since food fortification is one of the most cost-effective strategies to address micronutrient deficiencies, Haryana has taken a proactive approach and used this as one of the key strategies to address the issue of hidden hunger. The state started Food Fortification through various vehicles. Milk is being fortified with Vit. A and D, Edible oil is fortified with Vit. A and D and being used in PDS, ICDS and MDM, double fortified salt in ICDS and MDM and distribution of fortified wheat flour through PDS in 5 districts reaching around 3.3 million beneficiaries. Fortified wheat flour is also being distributed in ICDS and MDM in 15 districts. In line with this Govt. of Haryana is planning to start rice fortification under ICDS across the entire state.

Milled Rice is generally is low in micronutrient content because its nutrient-rich superficial layer is removed during rice milling and polishing operations. This makes the grain taste better and visually appealing but less nutritious. Rice fortification is a cost effective, culturally appropriate strategy to address micronutrient deficiencies in countries with high per capita rice consumption. Fortification of rice makes it more nutritious by adding vitamins and minerals, many of which are lost during the milling and polishing process. Rice fortified with the fortificant mix through extruded fortified kernels mixed with non-fortified rice in a ratio of 1:100 is called Fortified Rice.

Rice Flour is pulverized and mixed with a premix containing vitamins and minerals. Fortified Rice Kernels are produced from this mixture using an extruder machine. Fortified Rice Kernels resembles milled rice in size, shape, and colour but contain additional vitamins and minerals that retain their micronutrient content when washed and boiled in water. When these kernels are blended with non- fortified rice, typically at a ratio of 1:100, the result is Fortified Rice that is nearly identical to non- fortified rice in aroma, taste, and texture. It is then distributed for regular consumption

The Fortified Rice Kernels (FRK) and Fortified Rice production facility is like any other food-processing facility. All standard manufacturing, quality-control, and food-safety guidelines should be followed during FRK production. Guidelines on good manufacturing practices (GMPs) should be mandatorily followed during Fortified Rice production. The manufacturing and food safety practices must comply with all the statutory and regulatory guidelines of FSSAI as provided in the FSS Act, 2006 and Regulations.

TERMS AND CONDITIONS

1. DEFINITIONS

a) Fortified Rice Kernel (FRK) is a reconstituted rice grain made from rice flour, vitamins, and minerals using hot extrusion technology and micronutrients such as iron, folic acid, Vitamin B12 as mandatory and zinc, vitamin A, thiamine (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), and pyridoxine (vitamin B6) as optional micronutrients.

b) **Social safety schemes** include the Public Distribution Scheme (PDS), Mid-day meal (MDM) anD Integrated Child Development Services (ICDS) under Food and Civil Supplies, Education Department and WCD department respectively.

c) **Miller** means an individual/firm/registered company etc. who has submitted the application to process the Fortified Rice.

d) **Specifications** means the specifications of the Fortified Rice, micronutrients and packing bags, etc. as mentioned at **Annexure-I** and any modification or addition made by Hafed/Govt.

e) **FCI** means Food Corporation of India.

f) **MDM** means Mid-Day-Meal.

g) **ICDS** means Integrated Child Development Services.

h) **Hafed** means The Haryana State Cooperative Supply & Marketing Federation Ltd.

i) **WCD** means Women & Child Development Department, Haryana.

j) **EED** means Elementary Education Department, Haryana.

k) **Food & Supplies** means Food, Civil Supplies & Consumer Affairs Department, Haryana.

Operational Guidelines

1. PROJECT MANAGEMENT STRUCTURE

It is necessary to have a Technical Expert Team for providing technical support in operationalization, management and monitoring of scheme for rice fortification in the concerned Schemes, facilitate creation of effective Management Information System for centralized monitoring, coordination with FSSAI and other technical agencies to ensure effective quality control and assurance, facilitate impact assessment. This project management team will be constituted by Hafed and will include representatives of the concerned departments, District officials and Technical/developmental agencies.

Component I: Fortification of rice under various social safety schemes at the State level

The core elements for production of fortified rice are the Fortified Rice Kernels and its blending with regular rice in a ratio of 1:100. Fortification should not in any way interfere with the regular supply and availability of rice at Fair price shops, Schools and Anganwadi Centers and this Scheme will therefore involve Supply Chain Management as well.

In Haryana procurement of paddy and its milling is handled mostly by the State Government agencies on behalf of FCI and the expenses borne by them are reimbursed by the Central Government. Rice so procured is handed over to FCI, which becomes part of Central Pool. Under this Programme, fortification of rice will be done at milling stage. This will enable the District level committees to visit the mills frequently to ensure better implementation and quality control. Further, it would be easier to track the source of fortified rice with appropriate markings when the fortification is undertaken at the milling stage. For purposes of systemic efficiencies and cost effectiveness, the blending of the fortified rice kernels with the rice will take place as a continuous process during the rice milling stage, FCI will, however, make arrangements to keep the fortified rice separately in its godowns for distribution under various schemes of the Govt.

Component II: Capacity building and Training

Capacity building and training will be needed not only for the rice millers and their staff on the specifics of fortification, quality control etc. but also for the officials of the concerned department on their roles/responsibilities vis-à-vis the mainstreaming of fortified foodgrains in the welfare schemes.

Component III: Information, Education and Communication

Given that the concept of availability of fortified foods especially through safety net programs will be new to the community; and that the success of the intervention is in the regular consumption of fortified rice; information, education and communication campaigns with the community is much needed.

Component IV: Quality Control (QC) and Quality Assurance (QA)

This will be an extremely important component of the Scheme and will need to be integrated at several levels. For purposes of efficiency and better control, it is advisable to focus up-stream on QC/QA during procurement of the Fortified Rice Kernels. The millers will procure the FRK directly from, FSSAI licensed/registered FRK manufacturers who will be required to submit Certificate of Analysis (CoA) from independent third party FSSAI-notified NABL laboratories for FRK to respective State Food Safety Authorities and its district officers before the FRK is moved to the mills for blending. Only upon validation of the CoA of FRK in terms of appropriate micronutrient levels and microbiological specifications, should their use for blending with regular rice be permitted. At the level of the rice mill, QA/QC can be done through blending efficiency counts. Along with the same, samples of fortified rice can be lifted by the Food Safety Officers for analysis at independent third-party NABL laboratories already empanelled by the State. Lastly, to be able to produce fortified rice, the rice miller should have a valid milling license and a valid license for processing of fortified rice under Category 6.0 of Indian Food Categorization System (Food Safety & Standards Act, 2006) and should get the fortified logo endorsed by FSSAI.

Component V: Monitoring and Evaluation

Monitoring and Evaluation are essential components of any programme. Monitoring and Evaluation provide an opportunity not only to assess the quality of implementation and delivery of a programme, but also the degree to which it reaches its targeted households and individuals and achieves its nutritional goals. More importantly, the results of monitoring and evaluation exercise will provide programme planners and policy-makers with the necessary information to take decisions about whether to continue or modify the programme.

Cost for Rice Fortification:

Govt. of India has fixed an incremental cost @ 60 paise per kg for the fortified rice that would be paid to the rice millers under this program.

Blending of rice with FRK for production of fortified rice

1. **Blending Efficiency:**

   Fortified rice is produced by blending fortified rice kernels with regular rice through use of various blending solutions in the ratio of 1:100.

2. **Point of blending FRKs with rice:**

   Fortification of rice in the Scheme has been approved to be done at source i.e. blending at milling stage. All rice that is passed through the stages of milling and processing, must also be fortified by blending with FRKs before bagging rice for further distribution to the respective districts.

3. **Packaging and Distribution of fortified rice:**

   Fortified rice will bagged in the HDPE bags of 50 kg specified by HAFED Govt./FCI with proper labeling as per FSSAI guidelines to distinguish fortified rice from regular rice.

Quality Assurance mechanism

Quality Assurance mechanism will operate at following levels:

1. **At the District level** – Miller will have to provide certificate of analysis of FRK procured from FRK manufacturer. Rice millers will have to maintain batch wise record of FRK procurement and its usage for rice fortification. The committee constituted by HAFED will have to verify the 'Certificate of Analysis' in respect of every FRK consignment/batch

2. **At every blending point** – The quality control method to test the homogeneity of blended rice will be done by the rice miller with the help of a toolkit **Annexure-II** Blending Efficiency Test).

3. **Post blending** – Random sampling of fortified rice will be done at the source / rice mills at least one sample in a month by the competent official in the committee constituted by HAFED for quality control, from each blending point and will be sent for analysis at independent third-party NABL laboratory. Cost of Lab charges will be borne by Rice Miller.

4. **Once the fortified rice is distributed:** to the respective Districts, the concerned authorities may consider collection of random sample each quarter from selected Fair Price Shops, Schools and Anganwadis for its analysis through NABL laboratory.

5. As per Clause no. 2.4.1 of the Food Safety and Standards (Laboratory and Sample Analysis) Regulations, 2011, the sample shall be dispatched forthwith in the following manner:

a) The sealed container/packet of one part of sample for analysis along with memorandum in Form VI shall be sent in a sealed packet to food analyst under appropriate condition to retain the integrity of the sample.

b) The sealed container/packet of second and third parts of the sample and two copies of memorandum in Form VI shall be sent to Designated Officer by any suitable means.

c) The sealed container/packet of the remaining fourth part of the sample and a copy of memorandum in Form VI shall be sent to an accredited laboratory along with fee prescribed by Authority, if so requested by the Food Business Operator, under intimation to the Designated Officer, provided that the fourth part also shall be deposited with Designated Officer if FBO does not request to send the sample to an accredited lab.

6. **Samples collected should be sent to NABL Accredited labs** for testing within a week of sample collection

7. **If required, random samples of FRK supplied** by FRK producers can also be sent for testing to NABL Accredited Labs. Samples to be collected from rice millers before FRK is used for fortification. (For more details on QA & QC, please refer to the chapter on the same – section 6 of Technical Guidelines and Annexure-XXVII)

Investment required by the Miller:

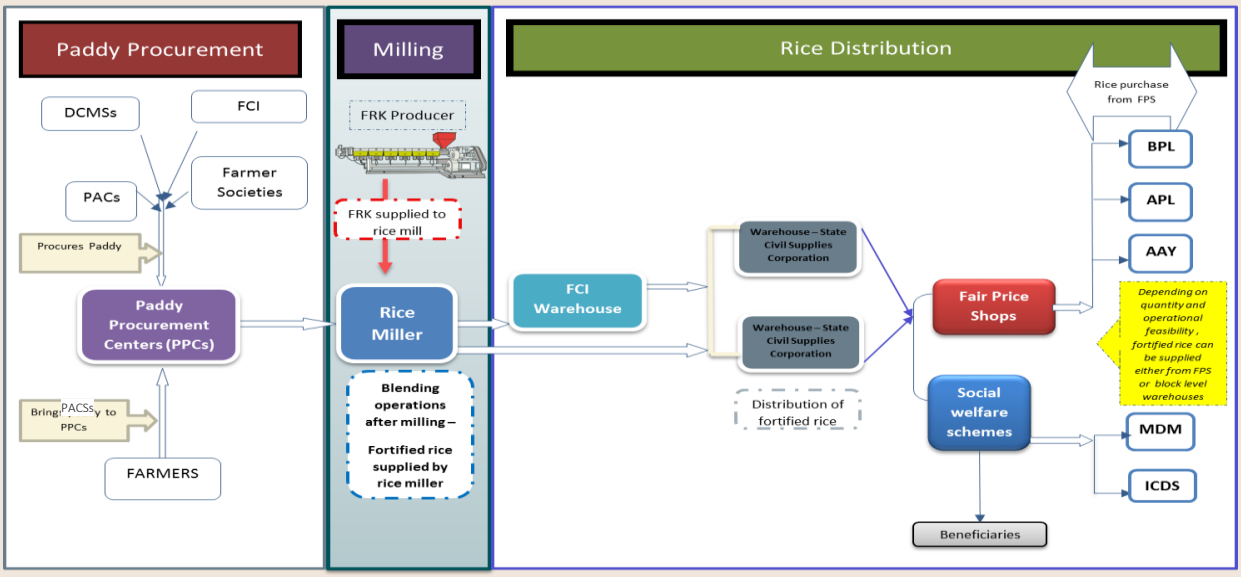
A miller is expected to make an investment between Rs.10-20 lakh at a rice mill with operating capacity of 4-5 MT/Hr for up gradation of the existing facility for rice fortification operations. The cost, however, will vary from mill to mill depending on the volume of fortified rice

produced. The miller is expected to recover its investment during the project period with an incremental cost of Rs. 0.60 per Kg (all inclusive and includes cost of FRK (with three micronutrients – Iron, Folic Acid and Vitamin B12) procured by rice miller for rice fortification) paid by the HAFED towards procurement of fortified rice. The rice millers will be paid the incremental charges on per kg basis for the fortified rice produced.

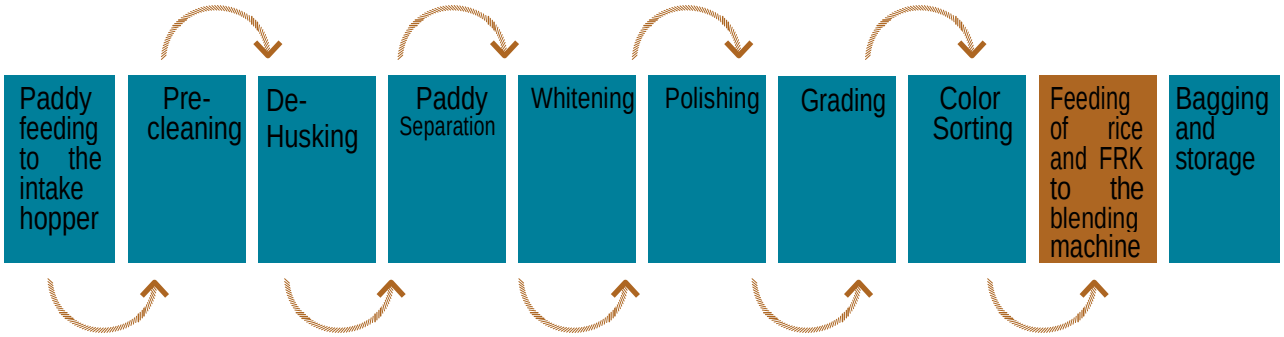
Fortification of rice during milling of paddy

In the existing arrangement for paddy processing at the rice mill, the milled rice can be blended with fortified rice kernels (FRK) in a ratio of 100:1 to produce the fortified rice in a single continuous line without any break in the process.

Figure 4: Model- fortification of rice at rice mills



Process flow of a rice mill with blending operations for rice fortification



Delivery mechanism for Fortified Rice Kernels (FRK) to the miller:

FRK should be procured from the FRK producers, who should be licensed/registered with FSSAI for the same.

Criteria for procurement of premix for FRK production:

FRK manufacturer should procure the premix for FRK production from the vendors having valid FSSAI license of 99.5 category. The chemical salt of the vitamin and minerals, used for FRK production, should be in line with the ones mentioned in FSSAI guidelines. Certificate of Analysis (CoA) of the premix to be used for FRK production should also be shared with the respective State Food Safety Authorities and its District Officers for the final approval for its use for FRK production. FRK should be packaged in Highdensity polyethylene (HDPE) laminated bags of 20/25 Kg with the mandatory information printed on the bag based on the FSSAI guidelines on labelling of fortified foods. FRK should be delivered to the rice mill once the satisfactory COA is received from the 3rd party NABL accredited laboratory and the COA has been approved by the Committee at the District/State level so constituted under the chairmanship of Food Secretary/District Collector (refer section 7.1 and 7.2 trailing below). The report should mention the levels of all micronutrients which were added for FRK production. FRK should resemble the regular rice in its colour, sheen, consistency and texture. The sample of FRK should also be shared with Committee at State level for reference and record. Mode of delivery of FRK should be such that the material is delivered in the bags which are intact and without any physical damage.

Existing equipment at the mill which can be used for blending of Fortified rice:

Following is the list of equipments which is available at the rice mill and can be used for in- line blending:

(1) 2-3 nos. Bucket elevators with pits

(2) 2-3 nos. Silos (with slider)

(3) Storage hopper for Milled rice/FRK (with slider)

(4) 1 no. Weighing balance for weighment of rice/FRK/fortified rice (Least count:10g)

(5) 1 no. Weighing balance for conducting Blending efficiency test (Least count:0.1g)

Note: Modification of cylindrical grader (where ever available): Cylindrical grader already available with the rice mills could be modified to a rotary blender by replacing the mesh of the grader with the solid non-porous metal sheet at the outer circumference and should be placed after the sortex step of the milling process

Additional equipment to be procured by the miller for blending of rice for proper and continuous operations:

(1) Few storage bins depending on the existing setup

(2) Load cells/flow balancers

(3) Flow balancer

(4) Vibratory feeder (Calibrated as per the desired quantity)

(5) Elevators

(6) Blender (for the mills where the modification of cylindrical grader is not feasible or cylindrical grader is not available)

(7) Programmable logical Controls - PLC (electrical) Vendors for the additional equipments needed for in-line blending are available in the Indian market and terms of reference for its specification based on the type of the equipment needed, minimum guarantee period (as one year), Renewable Annual Maintenance contract (AMC) valid for 1-2 years post guarantee period should be shared with the vendor at the time of purchase.

Criteria for procurement of the blending equipment:

(1) Milling capacity of the Rice mill – The capacity of the blending unit procured should be aligned to the milling capacity of the rice mill.

(2) Tonnage of fortified rice to be produced.

All the equipment used in the rice fortification process should be of food grade mild steel with the enamel finish and should provide a blending efficiency of at least 90%. Supporting equipment/devices such as compressor, voltage stabilizer would be required for functioning of the blender / feeders. Specification of the same will depend on the capacity of the equipments for which it is required.

Production, Packaging and Quality Assurance of Fortified rice:

The milled rice will be tested for its compliance with Fair Average Quality (FAQ) specification. Post its conformation to FAQ standards, it will be blended with FRK. Milled rice and FRK stored in silo/ storage hoppers are discharged in the ratio of 100:1 through flow balancer/ vibratory feeders over the conveyer belt followed by blending in the continuous blender and then blended material is conveyed through the bucket elevator to the storage silo. The material is packaged, labeled and stitched. The fortified rice should be packaged in 50 kg HDPE bags. All the mandatory information as per FSSAI guidelines should be printed on hdpe bags as per details given in Annexure V. (For more details please refer the chapter on Manufacturing Process). Post its conformation to FAQ standards, it is blended with FRK. During the production of fortified rice, the blending efficiency test is performed to ensure the blending ratio of milled rice to FRK as 100:1.

Standards of rice fortification

The Food Safety and Standards Authority of India (FSSAI) has released regulations called Food Safety and Standards (Fortification of Foods) Regulations, 2018. in the Gazette of India, Extraordinary, Part III, Section 4.

Institutional support and role of other Departments

Roles and responsibilities of the various stakeholders vis-à-vis Rice Fortification:

Food Corporation of India and State agencies (as the case may be):

1. Arrange for receipt of fortified rice from State Govt./Agencies.

2. Arrange for separate and safe storage of fortified rice in its godown.

3. Release of fortified rice back to the State for distribution under the given safety net program.

4. In order to address the issue of Shelf Life of Fortified Rice, FCI to undertake a study in association with Indian Grain Storage Management & Research Institute (Hapur) and FSSAI by actual storage of Fortified Rice in different geographical conditions.

5. Mechanism to be followed in the acceptance of fortified rice stocks during Kharif Marketing Season shall be done as per the FCI letter dated 25.09.2020. Annexuare-II.

Rice specifications as per FCI norms:

Rice shall be in sound merchantable condition, sweet, dry, clean, wholesome, of good food value, uniform in colour and size of grains and free from moulds, weevils, obnoxious smell, admixture of unwholesome poisonous substances, Argemone Mexicana and Lathyrus sativus (Khesari) in any form, or colouring agents and all impurities except to the extent in the schedule below. It shall also conform to prescribed norms under Food Safety & Standards Act, 2006/Rules prescribed here under:

SCHEDULE OF SPECIFICATION

SN	Refractions		Maximum Limit (%)	
1.	Broken*	Raw	Grade 'A'	Common
		Parboiled/single parboiled rice		
2.	Foreign Matter**	Raw / Parboiled/ single parboiled rice		
3.	Damaged # / Slightly Damaged Grains	Raw Parboiled/ single parboiled rice		
4.	Discoloured Grains	Raw Parboiled/ single parboiled rice		
5.	Chalky Grains	Raw		
6.	Red Grains	Raw/ Parboiled/ Single parboiled rice		
7.	Admixture of lower	Raw/ Parboiled/		

	class	Single parboiled rice		
8.	Dehusked Grains	Raw/ Parboiled/ Single parboiled rice		
9.	Moisture content @	Raw/ Parboiled/ Single parboiled rice		
10.	FRK (Fortified Rice Kernal)	In case of procurement of Fortified Rice stock, 1% of FRK (w/w) should be blended with normal rice stock.		

* Not more than 1% by weight shall be small broken.

**Not more than 0.25% by weight shall be mineral matter and not more than 0.10% by weight shall be impurities of animal origin.

Including pin point damaged grains.

@ Rice (both Raw & Parboiled/Single Parboiled) can be procured with moisture content upto a maximum limit of 15% with value cut. There will be no value cut upto 14%. Between 14% to 15% moisture, value cut will be applicable at the rate of full value.

Role of HAFED:

1. In order to meet-out the yearly requirement of fortified rice, rice millers with proper milling capacity and blending facilities are to be identified by Hafed
2. A proper milling agreement is to be executed between Hafed and rice millers for milling of paddy with a separate clause to be inserted regarding packaging and stenciling of '+F' logo on HDPE bag and rexin slip.
3. Provide a list of certified FRK suppliers as well as NABL laboratories to the rice millers
4. To coordinate and ensure that required quantity of FRK is supplied to the identified millers for fortification of CMR stock as per the required proportion of 1:100
5. Ensuring fortification of the rice at the mills
6. Lifting of samples of Fortified Rice from every blending point (and end distribution point of the social safety net program), at least once in a month for quality analysis through NABL laboratory; 7. Linking of the identified millers to a particular district to deliver the fortified custom milled rice stock
8. Monitoring of the scheme
9. Conducting periodic evaluation.
10. Conduct information, education and communication campaigns. IEC Campaigns may converge with POSHAN Abhiyaan as Fortification is a vital part of the Mission.

FSSAI and FDA, Haryana

1. FFRC, set up by FSSAI, which functions as a resource hub for fortification may provide technical and procurement assistance, and facilitate training and capacity building workshops and provide support to States to undertake IEC activities and monitoring and evaluation with support from development partners

2. Stipulate Quality Control and Quality Assurance Standard Operating Procedures on rice fortification.

3. To ensure that there are independent NABL accredited labs in the State who could test Quality control of FRKs and fortified rice and mapping of NABL labs and building linkages with State and selected Districts

4. Support the designated committee in lifting of samples from the empanelled FRK manufacturers and rice mills for micronutrients analysis

5. Capacity building of the rice millers and their staff, FPS owners, Food Safety Officers on fortification.

6. Periodic evaluation of impact of fortification in coordination with Ministry of Health & Family Welfare, with concurrent modification, using NFHS-4 and Comprehensive National Nutrition Survey (CNNS) supported by MoHFW as baseline data for iron deficiency anemia, FSSAI may extend support to SPMU to facilitate impact assessment and centralized monitoring of the scheme.

7. Design Information, Education and Communication campaigns on fortified rice with the community in consultation with the concerned department and Development Partners.

8. Monitoring for compliance on labeling and use of +F logo.

9. To organize periodic multi-stakeholder Workshops at National/State level to discuss on all issues related to rice fortification.

Concerned social safety net scheme (PDS, MDM and ICDS):

Rice Millers/Mills:

1. Rice mills who are already registered Food & Civil Supplies Department will be used for Fortification at source

2. Rice millers will invest towards up gradation of existing milling line for performing blending and fortification operations

3. Paddy will be supplied to rice millers by State food grain procuring agencies or designated department/agencies for custom milling of rice.

4. The millers will procure the FRK directly from the FSSAI empanelled/authorized FRK manufacturers who will be required to submit Certificate of Analysis from independent third-party NABL laboratories for the FRK to the respective State Food Safety Authorities and its District officers before the FRK is moved to the mills for blending

5. Only upon validation of the Certificate of Analysis of FRK State Civil Supplies Departments, in terms of appropriate micronutrient levels and microbiological specifications, should use for blending with regular rice.

6. Custom milled rice will be fortified by rice millers. Paddy will be converted to rice and blending operations will be carried out immediately after it at the rice mill itself using a blending machine. FRK and CMR will be mixed in a ratio of 1:100 by rice millers.

7. Rice millers will get incremental cost of rice fortification @ 60 paise per kg for the total quantum of fortified rice produced.

8. They will be responsible for maintaining quality of fortified rice and packing of fortified rice

9. QA/QC should be done at the rice mills through blending efficiency counts - for which the millers and their staff should be trained

10. To be able to produce fortified rice the rice miller should have a valid milling license and a valid license for processing of fortified rice under category 6.0 of Indian Food Categorization System (Food Safety & Standards Act, 2006) and should get the fortified logo endorsed by FSSAI.

11. +F logo to be used per the FSSAI standards and gazette notification on food fortification

12. Rice millers will be the key stakeholders in this whole initiative and will drive this initiative. In short they will be responsible for fortification and quality of fortified rice supplied.

The technical guidelines of manufacturing process: blended fortified rice, Process of rice fortification, Choice of blending machine, Maintaining overall safety and hygiene during the manufacturing of blended fortified rice and Quality Assurance and Quality Control are placed at **Annexure-III.**

Annexure-I

FrequentlyAsked Questions (FAQs)

Q: What is Food Fortification?

A) Food fortification refers to adding vitamins and minerals missing in the daily diet to commonly consumed foods to prevent nutritional deficiencies. Food fortification has shown to have a positive impact on the micronutrient status of the vulnerable population particularly when implemented in conjunction with other public health measures and strategies.

Q: What is Rice Fortification?

A) Rice fortification is the process of increasing the nutritional content of rice by adding essential micronutrients to it. The micronutrients are chosen keeping in mind various public health concerns.

Q: Why fortify rice?

A) India is a leading rice producer and consumer, with 22 percent of the total global rice production and 65% of India's population consumes rice on a daily basis; the per capita rice consumption in India is 6.8 kilogram per month. Rice is a good source of carbohydrates; however, core component of agriculture and nutrition in most of India is low in micronutrients. Milling of rice removes certain key nutrients like fat and the micronutrient-rich bran layer to produce commonly consumed white rice. Polishing further removes 75-90% of Vitamin B_1, Vitamin B_6, Vitamin E, and Niacin. Fortifying rice provides an opportunity to add back the lost micronutrients like Iron, Zinc, Folic acid, Vitamin B_{12}, and Vitamin. A.

Q: Does fortified rice improve people's health and nutritional status?

A) There are more than 17 scientific publications in over 25 countries including India which demonstrate that consumption of extruded fortified rice is safe and effective in women and children. It can also significantly address hemoglobin status, iron-deficiency anemia, iron deficiency (i.e., ferritin levels), and improve status of other critical micronutrients including Vitamin A, Zinc, Folic Acid, Vitamin B_{12}, among others. It is also known to improve cognition and physical performance.

Q: What is a Fortified Rice Kernel (FRK)?

A) Rice, when extruded with a premix containing vitamins and minerals is shaped into partially cooked grain-like structures that resemble rice grains, which are called FRKs.

Q: Can any variety of rice be fortified?

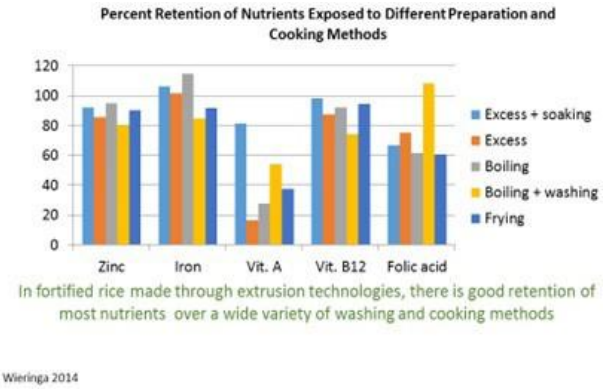
A) All varieties of rice can be fortified. However, it will require tailoring of fortified rice kernels accordingly.

Q: What is the level of acceptance of fortified rice among consumers?

A) The graph below shows that there are no significant differences between the acceptance levels of fortified and non-fortified rice among consumers.

Q: Are the nutrients in fortified rice retained after cooking?

A) The graph below indicates the percentage-wise retention of nutrients in fortified rice after cooking:



Q: What are the standards that have been put in place by FSSAI for fortified rice?

A) Raw Rice, when fortified, must contain added Iron, Folic Acid and Vitamin B^{12} at the levels given in the table below:

S.No.	Nutrient	Level of Fortification per Kg
	Iron - (a) Ferric pyrophosphate	28 mg - 42.5 mg*
	(b) Sodium Iron (III) Ethylene diamine tetra Acetate, Trihydrate (Sodium Feredetate-Na Fe EDTA)	14 mg - 21.25 mg
	Folic acid - Folic acid;	75 µg - 125 µg
	Vitamin B_{12}- cyanocobalamin or hydroxocobalamin;	0.75 µg - 1.25 µg

*Note: added at a higher level to account for less bioavailability

In addition, rice may also be fortified with following micronutrients, singly or in combination, at the level given in the table below:

S.No.	Nutrient	Level of Fortification per kg
1.	Zinc - Zinc Oxide	10 mg - 15 mg
2.	Vitamin A- Retinyl Palmitate;	500 µg RE - 750 µg RE
3.	Thiamine (Vitamin B_1)- Thiamine hydrochloride, Thiamine mononitrate;	1 mg - 1.5 mg
4.	Riboflavin (Vitamin B_2)- Riboflavin or Riboflavin 5'-phosphate sodium	1.25 mg - 1.75 mg
5.	Niacin (Vitamin B_3) - Nicotinamide or Nicotinic acid	12.5 mg - 20 mg
6.	Pyridoxine(Vitamin B_6)-Pyridoxine hydrochloride;	1.5 mg - 2.5 mg

Note – In the Pilot Scheme only three micronutrients – Iron, Folic Acid & Vit.B_{12} approved

Q: What are the various technologies available for fortification of rice?

A) There are various technologies available to produce fortified rice, namely, Coating, and Dusting.

In the Coating method, the nutrient (vitamin or mineral mix) is combined with ingredients such as waxes and gums. It is then sprayed on the surface of rice grains in several layers. This is then blended with polished rice at a ratio of about 1:100.

In the Dusting method, micronutrients in the form of fine particles are blended with bulk rice. This method makes use of the electrostatic forces between the rice's surface and the micronutrients.

Q: What is the best technology to fortify rice in India?

A) In India, rice is primarily fortified using extrusion technology. In this technology, milled rice or broken rice is pulverized and mixed with a premix containing selected vitamins and minerals. Fortified rice kernels (FRK) are produced from this mixture using an extruder

machine. The extrusion technology for production of Fortified Rice Kernels (FRKs) is the technology of choice given the stability of micronutrients in the rice kernels across processing, storage, washing, and cooking. It is also the preferred method because of its financial feasibility.

Q: What are the different types of extrusion technology available for fortification of rice?

A) Depending on the temperature at which extrusion is done, the extrusion may be referred to as hot or cold. Hot extrusion (7° - 110° C) produces the highest quality kernels. Cold extrusion (70^{o} C) is less expensive but might not have a high level of acceptability among consumers demanding uniformity in each grain's shape, color, translucency, size, and texture. A hybrid method called warm extrusion is also used by various manufacturers.

Q: What is the equipment required for the production of fortified rice kernels through extrusion technology?

A) Extrusion processing requires an extrusion assembly with a dryer to produce fortified rice kernels (FRKs). The function of various parts of extrusion set-up is as follows:

- Blender/Mixer: To uniformly blend the rice flour and premix.
- Preconditioning Unit: To hydrate the raw material and help in maintaining the homogeneity of raw materials.
- Extruder Barrel: To heat and cook the dough. Ideally, a twin-screw extruder is the most suitable for this purpose.
- Knife Assembly and Die Plate: To cut the dough/pre-blend and facilitate movement to the die plate, which is responsible for the formation of FRKs.
- Vibratory Conveyor: To separate kernels from each other.
- Dryer: To dry the end product to the desired moisture content.
- Cooling : To cool FRK by passing it over a conveyer

Q: What would be the approximate cost of an extruder line?

A) A good quality extrusion line may cost up to INR 13.5 crores. Utility costs like purified water plant, steam generator, air compressor, and packaging lines are not included here.

Q: How are FRKs blended with normal rice?

A) Two types of blending are applicable for the production of fortified rice – Continuous and Batch.

1. **Continuous Blending:** This form of blending is applicable for large scale blending of the fortified rice. A typical continuous

blending assembly involves bins/hoppers for fortified rice kernels and normal rice, bucket elevators for transport, blending, air locks/flow balancers to regulate the flow or Fortified Rice Kernels/Regular Rice.

2. **Batch Blending:** Batch blending is mixing of pre-weighed 1 part of FRK and 100 parts of regular rice in a blender and blending both the rice for a fixed time to produce one batch of 101 parts Fortified Rice.

Q. How is fortified rice produced?

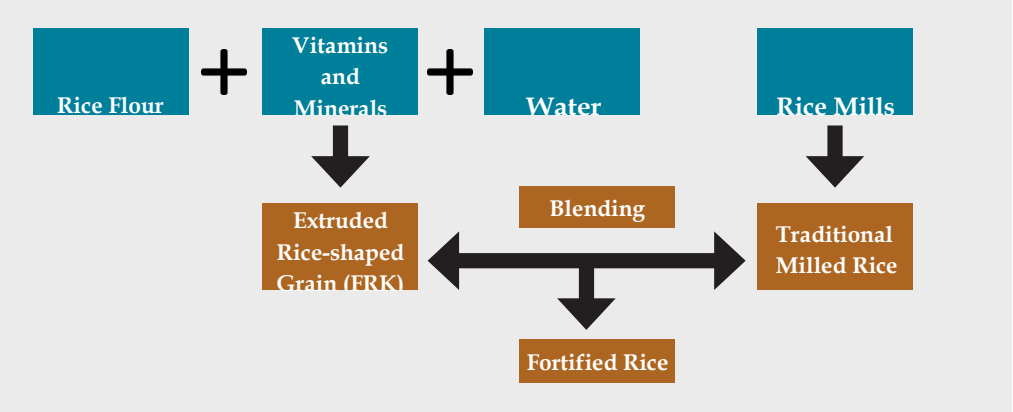
A) Production of Fortified Rice is a two-staged process:

In stage 1, the rice shaped grains will be produced using rice flour, vitamins & minerals and water passing the dough through an extrusion machine.

In stage 2, FRK (rice shaped grain) is added to traditional rice in ratio ranging from 1:50 to 1: 200 resulting in fortified rice nearly identical to traditional rice in aroma, taste, and texture. It is then distributed for regular consumption.

The blended rice is called fortified rice which includes the prescribed amounts of nutrients. The production of fortified rice is explained pictorially below:

Q: What are the factors to be considered while selecting a blending system?



A) The following factors need to be considered while selecting a blending system:

1. Quantity of rice to be fortified
2. Feasibility of installation
3. The blending unit should ensure that the FRKs are not broken in the process
4. Cost of the blending unit

Q: What are blender options available for uniform blending of FRK with regular rice?

A) Equipment with variable flow mechanisms and modern mixing systems guarantee uniform mixing of the FRKs with rice and are used for blending. The different blenders available are – Ribbon/Paddle blenders, Rotary Batch Blenders, Vee Cone Blenders and Fluidized Bed Blenders.

Q: What is the per kg incremental cost on account of fortification?

A) The cost of fortification is determined by a multitude of context-specific variables such as the structure and capacity of the rice industry, the complexity of the supply chain, the policy and regulatory environment, and the scale of the relevant programme. The retail price increase for fortified rice ranges from an additional 1% to 10%. As rice fortification expands, production and distribution achieve economies of scale, and costs are expected to reduce. Rice fortification is cost-effective - the additional cost to the consumer inclusive of all associated costs is expected to vary between INR 0.3 - 0.4 per kg depending on the above factors as well as the nutrients added.

Q: When can the premix be blended into regular rice?

A) Blending of premix with rice can be done at various stages in the supply chain, depending on the type of programme. The optimal blending method will vary from government safety net programmes to a commercial retail store distribution. However, blending of rice can be done during the milling process in large centralized mills, which are well-equipped for blending operations. Blending can also happen at large warehouses, where rice is stored prior to distribution.

Q: Are there any other countries where fortified rice is consumed?

A) There are five countries where rice is mandated to be fortified by law, namely, Costa Rica, Nicaragua, Panama, Papua New Guinea, and the Philippines. Costa Rica has implemented the most successful rice fortification programme. In addition to these countries, rice is also fortified voluntarily in Brazil, Dominican Republic, Colombia, South Africa and the United States of America.

Q: What could be the delivery options for fortified rice?

A) Fortified rice could be delivered through the social safety nets programmes of the government, namely Targeted Public Distribution System, Mid-day Meal scheme, and Integrated Child

Development Services (ICDS). Additionally, fortified rice can also be made available in the open market.

Q: What is the shelf life of premix?

A) According to studies done across various countries the shelf life of premix is between 3 months and 2 years,

Q: What is the shelf life of fortified rice?

A) The shelf life of fortified rice is at least 12 months.

FAQs on Labeling of Fortified Rice

Q: Is it mandatory to declare the micronutrients levels in Nutritional Information?

A) Yes, it is mandatory to declare the levels of Iron, Folic Acid, and Vitamin B_{12} in Nutritional Information for Fortified Raw Rice. Additionally, any commodity fortified with Iron carry a statement, "Not recommended for people with Thalassemia and people on low iron diet."

Q: Which unit should be used to declare the levels of vitamins and minerals?

A) Units such as milligram (mg), and microgram (µg) can be used to declare the level of vitamins and minerals used for fortification of rice.

Nutrient		Level of Fortification per Kg
Iron (a) or (b)	(a) Ferric pyrophosphate Or,	28 mg - 42.5 mg*
	(b) Sodium Iron (III) Ethylene diamine tetra Acetate, Trihydrate (Sodium Feredetate-Na Fe EDTA)	14 mg - 21.25 mg
Folic acid	- Folic acid	75 µg - 125 µg
Vitamin B_{12}	cyanocobalamin or hydroxocobalamin	0.75 µg - 1.25 µg

*Note: added at a higher level to account for less bioavailability (Or as specified by FSSAI)

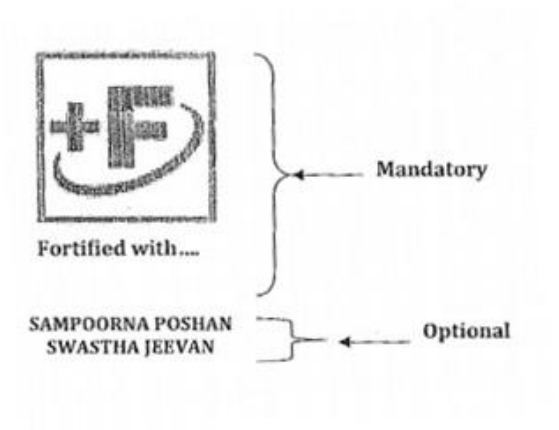
◊ **Details about the +F logo on fortified products pack:**

- +F logo and "**Fortified with Iron, Folic Acid, and Vitamin B_{12}**" to be mandatorily displayed on the pack and to be used as indicated below.
- Every package of food fortified with Iron shall carry a statement "**Not recommended for people with Thalassemia and people on low iron diet.**"
- The tagline "**Sampoorna Poshan, Swastha Jeevan**" is optional and may be displayed under the logo.

Q: How to mention the micronutrients below the +F logo?

A) Added micronutrients to be mentioned in the "Fortified with Iron, Folic Acid, and Vitamin B_{12}" statement and can be written in any format, keeping intact the position i.e. below the +F logo

Below is the suggested usage:



Fortified with Iron, Folic Acid,

and Vitamin B_{12}

Q: What are the color variations to be used for the +F logo?

A) The following norms should be followed for color variations for the +F logo:

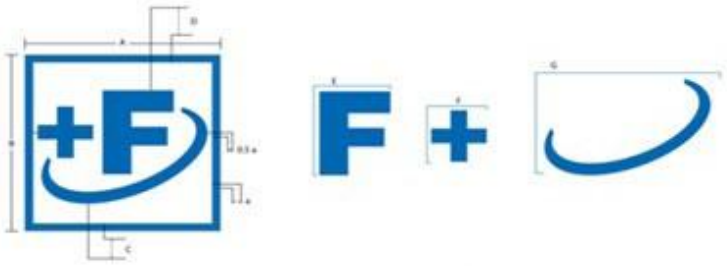
- The +F logo should be used only in blue color.
- "Fortified with Iron, Folic Acid, and Vitamin B_{12}" should be written

only in black color. Color Codes to be used as per the below table:

Fortified with Iron, Folic Acid, and Vitamin B_{12}

Q: What is the size of the logo including the minimal size that can be used?

A) Below is an indicative size of the logo. Keeping the aspect ratio intact it can be used in any size.



All dimensions in millimeters

A	B	C	D	a	E (w x h)	F (w x h)	G (w x h)
20	20	2.2	3.1	0.8	7.27 x 9.15	5.67 x 5.84	16.98 x 10.93
40	40	4.4	6.3	1.7	14.54 x 19.03	11.35 x 11.68	33.96 x 21.87
80	80	8.9	12.5	3.4	29.08 x 38.07	22.7 x 23.36	67.92 x 43.75
160	160	17.9	25.4	6.9	58.17 x 76.14	45.39 x 46.72	135.85 x 87.5
320	320	35.6	50.6	13.8	116.35 x 152.29	90.77 x 93.44	275.25 x 175.01

Q: What should be the placement of the +F logo?

A) The +F logo should be placed in a way to ensure high noticeability by the consumer. It should preferably be placed in the front of the pack (either on the top or middle).

Q: How to use the +F logo on a colored pack?

A) The logo unit has a transparent background and thus can be used on any packet.

Annexure II - Blending efficiency test

Quality Control (QC) method to test homogeneity of Blending at rice mill/ blending site - Instruction Manual

This quality control method tests the presence of fortified rice kernels in a blended batch of fortified rice and the homogeneity of the fortified rice.

What is in the kit?

1. 250 ml beaker
2. 50 ml beaker calibrated to measure 50 grams of rice depending on the variety being used for blending
3. 100 ml bottle of Chemical Reagent (Povidone Iodine solution)
4. Dropper
5. Tray
6. QC method instruction manual
7. Standard Operating Procedures
8. Bag

Who can use the kit?

1. Rice miller: to test the level of blending in different batches.
2. Regulatory Authorities: to monitor the blending homogeneity at rice mills/warehouses.

How to use the kit?

1. Collect a sample of 200-500 grams from 10% of the blended fortified rice consignment using the BIS method.
2. Take 50 grams of rice from the collected sample using standard sample reduction techniques
3. Spread the 50g rice sample onto the tray.
4. Prepare a 1% chemical reagent (Povidone Iodine solution) in water using these steps:
    a. Fill 250 ml beaker with 100 ml of water
    b. Add approximately 1 ml of the chemical reagent (Povidone Iodine solution) to the water, using the dropper.
    c. Stir until the solution turns bright orange in colour.
5. Pour the 1% chemical reagent (Povidone Iodine solution) into the tray and mix with the rice sample by tilting the tray or mixing with the dropper. Break-up any lumps that form.
6. Mix the sample until the solution turns from orange to violet-blue (10-15 seconds).

7. Carefully drain most of the chemical solution into the 250ml beaker. Keep the kernels in the tray.
8. Fill 50 ml beaker with water and add it to the kernels in the tray.
9. Count all of the discolored fortified rice kernels and document the findings. Re-count to confirm findings.
10. Discard the tested sample and wash hands.
11. Sign the records after noting the results.

Standard operating procedure to test the consistency of iron-fortified blended rice

Step 1 Collect 50 grams of blended fortified rice from the batch using the small beaker.

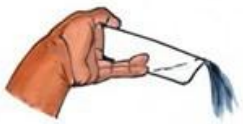
Step 2 Pour a 50 gram sample into the tray.

Step 3 Prepare 1% chemical solution in the large beaker by adding 1ml of Povidone-Iodine solution to 100ml of water until it turns an orange colour.

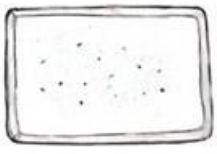
Step 4 Pour the chemical solution into the tray.

Step 5 Mix sample with the solution by tilting the tray for 10 to 15 seconds until it turns dark-violet in colour.

Step 6 Drain the solution keeping the rice in the tray.



Step 7 Count the discolored fortified grains and record the number.



Step 8 Throw away the sample after testing is complete.

Step 9 Wash your hands.

Pictorial representation is given below:

Homogeneity test (of fortified rice at Rice mill – template)

Sample number	Collected On		Tested by	Number of grains	Recorded by	
	Date	Time			Name	Signature

Annexure-III

Technical Guidelines

This section will cover technical guidelines of rice fortification.

1. **Manufacturing process: blended fortified rice**

The roles and responsibilities of the staff responsible for producing FR at the production unit.

Objectives:

• To familiarize the production staff on basic steps involved in production of Fortified Rice.

• To familiarize the employees of the concerned department and rice mills, with their roles and responsibilities.

What is Fortified Rice Kernel (FRK)?

Fortified Rice Kernel (FRK) is a reconstituted rice grain made from rice flour, vitamins, and minerals using hot extrusion technology. This process is relatively simple and comprises the following five steps: 1. Mixing of raw material 2. Passing raw material through extrusion process 3. Drying of finished product 4. Storage 5. Packaging

1. **Mixing of raw material:** FRK is a reconstituted rice grain made from rice flour, vitamins, and minerals. Rice flour, vitamins and minerals that form raw material for producing FRK along with specified additives are blended/ mixed together in appropriate proportions and the mixture is hydrated (using water treated by Reverse Osmosis process) for getting prescribed moisture content.

2. **Extrusion:** This uniformly hydrated mixture of raw material with agreed moisture content is passed through a twin-screw extruder where it takes the shape of tiny pellets resembling regular rice grains.

3. **Drying:** The next step in the production of FRK is slow drying at low temperature. This is done to bring down moisture to a safe level and production of high-quality FRK.

4. **Storage:** After the drying process is completed, the finished product (FRK) is stored in an intermediary storage bin before packing.

5. **Packaging:** FRK is packed in a special two-layer bag with inner poly lining (20/25/50 Kg bag depending on need). These bags are made up of two different layers to protect rice from moisture and rodents. The inner poly lining of this bag is made up of good quality food grade material.

2 Process of rice fortification

The major step for producing Fortified Rice include:

1. Sourcing/ Producing of Fortified Rice Kernels (FRK)
2. Blending FRK with 50 to 200 parts (generally 1:100) of raw milled rice polished raw or parboiled rice.
3. Quality assurance and control
4. Packaging

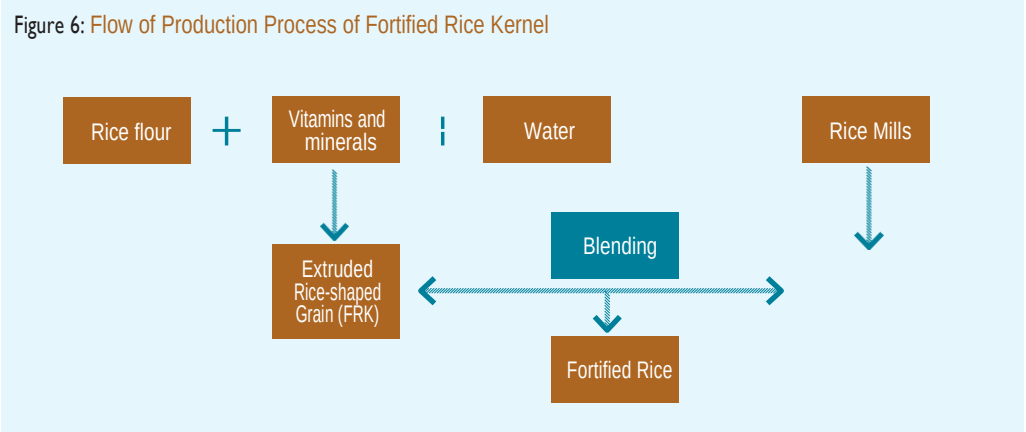
There are a number of ways in which rice can be fortified. Extrusion amongst dusting and coating is the most commonly used technology for fortification of rice. Extrusion technology provides the most robust method of adding additional vitamins and minerals to rice. Nutrients are added to kernels in a simple two - step process.

1. Broken rice grains are ground into rice flour and mixed with water and required micronutrients to produce a dough/pre-blend.
2. The fortified dough/pre-blend is then passed through an extruder to produce Fortified Rice Kernels (FRK) which are then blended with raw milled rice, most commonly in a ratio of 1% (1:100:: FRK:Raw Milled Rice).

These fortified kernels keep the nutrients intact even after cleaning, washing, and there are minimal nutrient losses in cooking as compared to other methods like dusting, coating etc. Rice, when fortified, should contain additional amounts of Iron, Folic Acid, and Vitamin B12. The nutrients are added in slightly increased amounts to compensate for nutrient losses due to cooking and storage. Additionally, rice can also be fortified with Zinc, Vitamin A, Thiamine (Vitamin B1), Riboflavin (Vitamin B2), Niacin, and Pyridoxine (Vitamin B6) at fortification levels directed by the Food Safety and Standards Authority of India (FSSAI).

The rice mill/warehouse, equipped with a dosing, and blending system, is essentially where fortified rice can be produced. These facilities shall comply with all Good Manufacturing Practices (GMP), and food-safety guidelines as FSSAI standard guidelines. The manufacturing and food safety practices must comply with all the statutory and regulatory guidelines of the country/state/region where the product is manufactured. Utmost care is to be taken in manufacturing and handling of fortified kernels as the finished product is mixed with rice and distributed for consumption to consumers.

Figure 6: Flow of Production Process of Fortified Rice Kernel



Raw Material Selection:

The first decisive step in making good fortified rice is the selection of appropriate raw material. The challenge in selecting a compatible specification of ingredients is very critical, as the rice produced should be strong enough to sustain the shelf life and meet the cooking quality of regular rice grains.

Major ingredients include:

i Rice Flour

ii. Food Grade Vitamin and Mineral Premix per FSSAI guidelines

iii. FSSAI approved Acid regulators and emulsifiers (Pentasodium Triphosphate – INS 451 (i), Citric Acid INS 330 etc.)

iv. Potable Water (IS 10500 : 2012)

Rice Flour:

Clean Broken Rice at an initial moisture content of 11-12% is ground to flour using 30-60 mesh sieve. Rice flour is very hygroscopic in nature; hence, the raw material and final produce need to be handled to control moisture as per Good Manufacturing Practices (GMP).

Vitamin and Mineral Premix:

Composition of vitamin premix has to meet the recommended specifications as per Food Safety Standards (Fortification of Food) Regulations, 20181. It can be of mandatory vitamins and minerals, namely, Iron, Folic Acid, and Vitamin B12, or the optional ones which comprise Zinc Oxide, Vitamin A, Thiamine, Riboflavin, Niacin - Nicotinamide, and Vitamin B6. The level of premix is determined in order to fulfil more than 30-50% of Recommended Dietary Allowance (RDA) or as recommended by FSSAI.

Emulsifier/ Acid regulator/ Antioxidants:

FSSAI approved emulsifiers/ acid regulators/ antioxidants (Pentasodium triphosphate IS 451 (i) / Citric Acid IS 330 etc.) shall be used as per the allowances prescribed in Food Safety Standards (Fortification of Food) Regulations, 2016.

Water:

Water is used in manufacturing of Fortified rice as a solute which penetrates the starch structure of the flour and helps in gelatinization of starch. Potable water2 shall be used for mixing of ingredients.

Role and responsibilities of plant manager responsible for production of fortified rice

1. Production plant head (GM) is responsible for adhering to all the guidelines specified in production manual in principle and practice.
2. He /she is responsible for machine operations and should prepare back-up plans for machine maintenance and spare parts.
3. He /she should prepare working instructions needed for machine operations based on details provided in machine operation manual supplied by machine manufacturer.
4. He / she should be able to run the plant in such a way that high-quality product is made, ensuring correct sampling and checking of final product for lab results and conforming to quality parameters.
5. He/ she should take decisions on quality of raw material, intermediate product, and final product, and should reject or reprocess or hold material for inspection and checking by laboratory.
6. He/ she should ensure that no product goes out from factory without appropriate quality checks.
7. He/ she should ensure that the final product meets all quality and food safety norms as prescribed by concerned authority, e.g., food safety and standards authority.
8. He/ she should ensure that environment health safety (EHS) norms are followed properly.
9. He/ she should prepare a preventive maintenance schedule to avoid major breakdown during production. 10. He/ she should ensure proper material, machine and product handling by the staff responsible for producing FR at the plant.

3 Choice of blending machine

Selection of blending equipment depends on a number of factors such as capacity of blending, type of pre-blending system i.e. Manual/ semi-automatic/ fully automatic rice cleaning and handling. Various blenders that tested, the efficient best unit selected

1. Stand-alone Blender
2. Batch type Blender
3. Continuous Blender

The detailed description of classified blender as below

Stand-alone blender

As per the application of blending requirement of a small decentralized kitchen or rice storage warehouse where there is a limited requirement of rice ranging from 400-2000 kg on daily basis, the best option is stand-alone blending system. Stand-alone is most economic semiautomatic blending system that required very minimal installation and operating cost. The standalone blending system is constructed with stainless steel mixing drum and works independently on the principles similar to concrete mixer. The regular rice and fortified kernels are added in the specified ratio and the blending operation completes within 5 minutes of rotary mixing. The mixing drum is made up of stainless steel and is capable of blending up to 150 kg of rice per batch. The stand-alone blender is easiest to operate and doesn't require much training, after feeding the required quantity of rice and respective FRK in the drum the operator need to rotate the steering wheel to adjust the angle of rotation of the drum and after completion of the batch time the drum is rotated back to release the rice using the same steering wheel.

Batch blender

Mechanically and ergonomically it is quite challenging for stand-alone blender to handle a large quantity of rice in a centralized kitchen and bigger warehouse sceneries. This arises the need of a medium capacity blending system (up to 500 kg / h) which is suitable for mixing in warehouse, centralized kitchens and small capacity rice mills. The Forsberg® Batch mixer is the most common and effective batch blending system suitable for such medium capacity environments, and is capable of producing the fortified rice in small batches ranging from 100 kg to 500 kg per hour. Forsberg blender is a paddle type mixer that mixes the two rice types inside a closed chamber. The blending system includes a horizontal mixing drum with paddle arrangement, vibratory dozer, bucket elevator and conveyor. Metered quantities of the rice and FRK are fed into the blender and mixing occurs for 1-2 min resulting in a uniform blend of fortified rice. Post completion of the blending stem the fortified rice is released for final packing as per the requirement. This is fully automatic system though requires limited intervention from the manual labor to feed the FRK on regular intervals but require a special training to execute the operation using the PLC panel.

Figure: Vibratory Feeder with Frequency Controller

Figure: Vibratory Feeder with Frequency Controller

Continuous blender To cater to huge demand there is a need to either enhance the capacity of the batch

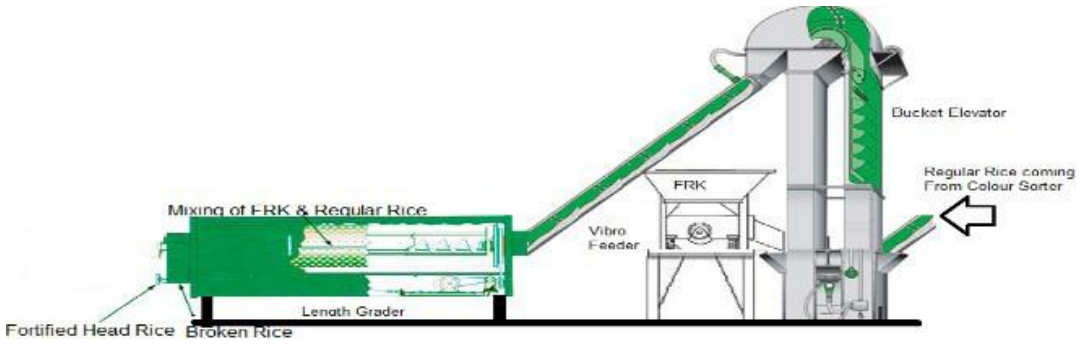


Figure: Rigorous churning of FRK with regular rice inside the grading cylinder

blending system or create a mechanism so that the blending operation can be accomplished at source. Possibility of capacity enhancement is very limited due to the mechanical and handling constraints. The other possibility is to develop a rice blending equipment that is compatible with the flow capacity of the modern rice milling system and also can produce the fortified rice which can meet the quality parameters of the blended fortified rice.

After several research trials few systems have been identified which can fit in the two conditions of the flow capacity and quality. The first type of system that has been identified is the simplest combination of industrial rice length grader (as Blender) and electronic dozer to handle the uniform feeding as per the gravity flow of rice mill. This system has been tested and the blending uniformity found satisfactory with a need to establish a system to match the flow inconsistency of rice during milling.

Blending is carried out with existing rice graders in the traditional rice-milling system. Because of the virtue of operation rice length-grading cylinders work as blenders. FRK is fed before the rice goes to grading cylinder using a pre-calibrated vibratory feeder (dozer) to the same rate of the flow

of regular rice that is flowing to the length grader, the mixture of rice and FRK stirs inside the length grader a number of times to properly intrude the fortified rice kernel in the rice mass. The most critical part of the mixing is calibrated feeding using the dozer and the agitating mechanism. The mixing mechanism makes this blending process the most economical and effective as well. Vibratory dozer/feeder needs to be calibrated to match the desired flow capacity of the regular rice. The outlet of vibratory feeder (FRK) is attached to one inlet of the bucket elevator.

Figure: Principle of Blending inside the Rice Length Grader

Figure: Principle of Blending inside the Rice Length Grader

FRK added through the vibratory feeder are mixed with regular rice flowing into the bucket elevator from the colour sorter, and the mix goes to the length grader. The length grader, by virtue of its grading mechanism, churns out the mix separating the broken grains from the mix, and this churning helps in the uniform distribution of FRK in the final fortified rice obtained at the head rice outlet of the length grader. The vibratory feeder should be synchronized with the flow of regular rice in the inlet bucket elevator. It is recommended to Pre-calibrate the vibratory feeder and assess the quality of blend regularly during operation to verify the blending homogeneity.

The second type of system that allows a high degree of blending homogeneity and is capable to handle extensively large quantities in a rice mill setting is continuous plow shear mixer. The stainless steel construction allows a rotating shaft fitted with a number of plow assemblies. The regular rice is fed through the rice bin and FRK through a vibratory feeder mounted below a FRK hopper. The operation is carried out for a specified time. The blended fortified rice will flow out of the blending system through an outlet at the other section of the equipment.

The other type of blending equipment is the zig-zag blender that allows a continuous mixing of fortified rice along with highest level of homogeneity. The said blender is under development stage and soon to be installed at various locations.Initially tests were carried out for one ratio in available blenders. The other ratios were tried in the identified efficient units. The following are the test parameters of the trials in order to achieve highest level of mixing efficiency:

• Standardization of rpm required for proper mixing

• Standardization flow rate.

• Increasing the capacity of mixing

Among various blenders that tested, the efficient best unit selected based on accuracy of Mixing index and It has been observed that the zig-zag blending system results in highest mixing index for Fortified rice blending. If required slight modifications made for further improvement.

4 Maintaining overall safety and hygiene during the manufacturing of blended fortified rice.

Several factors are involved in the processing of safe and hygienic food. The process involves all activities and responsibilities for preventing product adulteration, as well as the implementation of actions to prevent the occurrence of some of the hazards that can harm consumers. Providing a clean and sanitized environment and equipment for food processing is essential for producing safe foods, but that is not the limit of responsibility. Personnel practices, plant facilities, equipment and operations designed to prevent contamination, pest control and warehousing practices are all equally important. It is imperative that all of these considerations be addressed in the design of a comprehensive sanitation programme and a subsequent HACCP system. GMPs are intended to provide criteria for complying with the provisions of the government regulations requiring that all human foods be safe and free from adulteration. The requirements of the GMPs included in this section will help the staff responsible for producing FR to understand and ensure biological, chemical, and physical safety of the finished products.

The objectives of food safety are to help the staff who operate the plant to know and learn the following:

• The key steps to maintaining food hygiene and safety.

• The precautions they need to take whilst handling food ingredients.

• An understanding of the possible hazards that may occur whilst handling food ingredients.

• How to understand and exercise precautionary steps to maintain food safety.

In order to ensure high-quality production of FR, the standard food-safety guidelines will need to be followed stringently. The staff will need to know and learn the following in relation to food safety.

The most commonly reported food preparation practices that contributed to food borne disease are:

• Improper holding temperatures.

• Poor personal hygiene.

• Inadequate cooking.

• Contaminated equipment.

• Food from an unsafe source.

Food safety standards for producing Fortified rice (FR) FRK premix grain is produced using hot extrusion technology. Even though FRK and FR are safe products, as they are under the low

moisture category and are stable products, the manufacturing process needs to follow GMP/GHP principles prescribed under Schedule 4 of the FSS (Licensing and Registration of Food Businesses) Regulations, 2011, and should maintain HACCP.

5 Quality Assurance and Quality Control

Fortified rice should be regularly checked at a defined frequency and should be inspected at all levels. To ensure the quality of the fortified rice, controls need to be applied at various levels. It is also imperative to inspect the quality of the fortified rice throughout the supply chain.

1. Quality management of the FRK
2. Food Safety and Quality Management at the mill
3. External testing - Lab empanelment

1. Quality management of the FRK

As it has already been mentioned above that FRK should be procured from State empaneled manufacturer and the manufacturer should submit Certificate of Analysis (COA) for FRK and the premix used for production of the FRK before the dispatch of the consignment to the mill for fortification and before production of FRK respectively, to the State officials for clearance. The report should mention the levels of all micronutrients, along with salt names, which were added for FRK production. The chemical salt of the Vitamin and Minerals, used for FRK production, should be in line with the ones mentioned in FSSAI guidelines. Test parameters should be performed by NABL accredited laboratory external to both the FRK manufacturer as well as the premix producer. FRK should resemble the regular rice in its colour, sheen, consistency and texture. Thus, FRK supplier should submit the below documents before dispatching the consignment: • COA from an external NABL accredited laboratory, for each consignment • COA of the premix used for manufacturing FRK, for each consignment • Details of the quantity of FRK being supplied along with COA • Valid FSSAI license to be submitted annually.

2. Food Safety and Quality Management at the mill

Incoming Raw material and finished goods storage: a. All the incoming raw materials should be visually examined for any kind of abnormalities or deviation from the FAQ/FSSAI specification. It needs to be ensured that the FRK which is proposed to be mixed with the CMR rice exactly looks like a sound grain in size, shape, colour and texture so that during analysis they are treated as sound grains. b. At present the CMR is procured at up to 15% moisture content and its issuable limit is up to 16%. It therefore needs to be ensured that, the FRK remains stable/ does not disintegrate and does not absorb moisture at this moisture level. Since some of such fortified rice may be stored at areas having high rainfall or high humidity it also needs to be ensured that the FRK remains stable and does not become soft/ powdered at such atmospheric moisture.

- Blending Efficiency Test
- Food safety audits
- Storage of raw materials and finished goods

- Documentation system
- Licensing +F logo and regulatory compliance
- Iron Spot Test

c. During procurement of CMR, the rice grains having more than 2.5 length: breadth ratio is treated as Grade A rice and grains having less than 2.5 ratio is treated as Common rice. In case of Grade A rice as per uniform specification an admixture of lower class of rice kernel (common rice) of more than 6% is not allowed and such stocks are treated as BRL (beyond rejection limit) . To prevent such a situation, it is suggested that the length breadth ratio of FRK is kept at more than 2.5 in case of such FRK is to be mixed with Grade A CMR. d. COA of FRK, quality of FCI rice should be checked. The food material should not be stored directly over the floor, but it should be stored over the pallets or tarpaulin sheet. The material should be stacked away from the wall. Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) must be followed such as staff involved in manufacturing and packaging unit should use Personal Protective Equipment (PPE's) to prevent crosscontamination, pest control should be done on regular interval, special emphasis on cleaning of equipment's which are in direct contact with the food must be taken, Capacity building of the Mill staff should be done on Standard Operating procedures (SOP's). Food handlers should be vaccinated against specific diseases (communicable). Adequate numbers of hand washing area should be constructed in the facility to facilitate good hygiene practices. Designated areas for eating and drinking should be marked. SOPs for storage of FRK, raw FCI and fortified rice should be developed, displayed in local language and diligently followed.

Blending Efficiency Test (BET): To validate the effective mixing of FRK and raw rice, blending efficiency test should be performed every hour by preparing a composite sample. The composite sample should be collected from 10-15 bags randomly every hour during production and blending efficiency test should then be performed. BET is performed by segregating and counting the FRK from 100g of fortified rice.

BET = No. of FRK per 100g of Fortified rice

Note: Sample should always be taken before the weighment and stitching.

All the instruments before use should always be calibrated for better results. For better understanding, detailed procedure for blending efficiency test has been outlined at **Annexure-II**.

Iron Spot Test: Mill should have an in-house facility to perform test parameters and record daily data. In-house test such as iron spot test to be conducted on regular frequency to further validate the blending efficiency. A detailed procedure of iron spot test is placed at **Annexure-IV**

Regulatory compliance: The miller should comply to all the regulatory requirements for manufacturing and storing fortified rice. License should carry appropriate category. The package should contain +F logo and miller is required to get their product endorsed by +F logo through FSSAI's website. All the aspects regarding the food fortification standards should be met.

Documentation management: Log books should be well maintained to build a robust and transparent system. All records of incoming raw material and outgoing finished products should be maintained which includes COA and lab reports of FRK manufacturer. Test results of in-house lab and of external laboratory should also be documented and examined. Miller should maintain records of pest control and staff training. CAPA (Cause and Prevention Action) document format should be maintained and recorded whenever there is a deviation in finished product and root cause analysis should be identified and mentioned.

Food Safety Audits: Provision for internal audit on yearly basis will aid in maintaining the quality management system. The Food Safety Officer (FSO) should pick random samples from the mill and from fair price shops to ensure the quality of fortified rice (such that it covers all the shops and mills under his/her supervision in a quarter). Also, a surprise audit from an external body would further build a robust system to ensure that food quality is maintained throughout the supply-chain all year round.

3. **External testing -** Lab empanelment External Testing of fortified rice Vitamin and Mineral content of the fortified rice for defined parameters in FSSAI should be tested monthly from an external NABL accredited laboratory by the miller. On quarterly basis pathogenic microbial parameters should also be sent to NABL accredited laboratory to ensure the safety of the fortified rice. Miller would also be required to get the fortified rice tested for complete FSSAI parameters applicable to fortified rice half-yearly.

   Criteria for empanelment of external testing lab: For selection of an external testing lab for parameters related to food safety and quality, following criteria should be met:

   - The lab should hold a valid NABL license
   - Should be listed in FSSAI approved laboratories
   - Iron, folic acid and vitamin B12 should be covered under the NABL scope of the lab
   - Should have trained personnel for sample collection Technical documents and FAQs on rice fortification have been created by Food Fortification Resource Centre (FFRC) and are also available on the FFRC website http://ffrc.fssai.gov.in/ ffrc/home. This will assist businesses to ensure Quality Assurance (QA)/Quality Control (QC).

7 Packaging and stenciling of fortified rice bags While executing milling agreement by State Food Departments with rice millers for custom milling of paddy stock following clauses, as per FSSAI Packaging and Labelling Guidelines, related to packaging and stenciling for proper identification of fortified rice stock are to be inserted:

1. All fortified food shall be packaged in a manner that takes into consideration the nature of the fortificant added and its effect on the shelf life of such food.

2. Every package of fortified food shall carry the words “Fortified with (name of the fortificant)” and the +F logo, (specified in Schedule -II of these regulation), on its label. It may also carry a tag line “Sampoorna Poshan Swasth Jeevan” under the logo.

3. Provisions of the Food Safety and Standards (Packaging and Labelling) Regulations, 2011, shall also apply to the fortified foods.

4. Every package of food fortified with iron shall carry a statement “People with Thalassemia may take under medical supervision”.

5. All manufacturers and packers of fortified food complying with the provisions of the Act and rules or regulations made there under on fortified food shall be permitted to make a nutrition claim in relation to an article of fortified food under the Food Safety and Standards (Packaging and Labelling) Regulations, 2011.

6. Linking of depot/stack allocation In order to maintain proper identity of fortified rice stocks and to avoid any kind of mixing with the normal stock, the district head of the procuring agency should link the identified millers to a particular depot to deliver the fortified custom milled rice stock. A separate stack is to be allocated to all the millers identified and who executed the custom milling of fortified stock enabling them to deliver fortified stock without any mixing with the normal stock.

7. Acceptance of fortified custom milled rice the lot size of such stock will be same i.e. 540 Bags to be offered to procuring agencies for acceptance. The other instructions regarding delivery of fortified stock will remain the same as regular Custom Milled Rice (CMR).

8. Quality analysis of fortified rice consignments

   The fortified rice consignments are to be checked by the quality control personnel of procuring agencies as per the existing procedure for analysis of food grains (BIS methods with up to date amendments). The analysis of food grains may also include verification the proportion of fortification i.e. 1:100 (FRK:Raw Rice). During acceptance of such consignments, the officials should also check the stencil mark of +F on every bag and on its rexin slips as per existing instructions.

9. Record keeping The stack cards attached to fortified rice stacks should have an identification mark i.e. +F for maintaining separate identity. In the book of records stock position of fortified rice stocks (variety and grade-wise) is to be maintained separately for issuance under different schemes of Government of India.

10. Transportation of fortified rice stocks In case of dispatch/issue either through road or rail movement, separate loading of fortified rice bags in the trucks/wagons with clear demarcation is to be ensured to avoid any kind of mixing of stocks with the normal stock while transportation.

11. Creation of priority list for issuance of fortified rice stocks A separate priority list of fortified rice stock is to be drawn every month and to be followed for issuance under different schemes of Government of India.

    For successful monitoring of the pilot scheme, all stakeholders in the scheme will need to play their role as there are areas of monitoring and indicators which are beyond the mandate of the Department of Food & Public Distribution and Food Departments in the States.

Monitoring at the rice mill The monitoring at the rice mills where fortification of rice will be carried out along with paddy processing needs to be the joint responsibility of the State Food & Civil Supplies Department and Food Safety Officers. Regular visits to the rice mills; in some cases joint visits need to be made to ascertain the following:

1. Compliance to the standard operating procedures for procurement of the FRK, equipment used for the blending of rice fortification of rice (adherence to effective blending operations and related SOPs) and storage of FRK and fortified rice.

2. Compliance to the Quality Control and Assurance mechanism. Maintenance of the records of Certificate of Analysis of the premix used for production of the FRK as well as the FRK, in-house blending efficiency and qualitative testing reports, shelf life of the FRK procured etc.

3. Compliance to the FAQ standards new FAQ standards for rice will need to be devised in view of fortification. Check list can be prepared for these areas.

4. Information on the following indicators should be regularly reported by the millers to the Procurement authority and the Food Safety Officer depending on the frequency at which the fortified rice is provided to the FCI and State corporations:

a. Tonnage of rice fortified

b. Tonnage of fortified rice lifted and delivered to the storage godowns

c. Tonnage of FRK procured, date and source of procurement.

d. Tonnage of FRK used for fortification

e. Report of sample of fortified rice analyzed by an independent laboratory Monitoring at the Storage godowns

The monitoring of fortified rice at the storage godown should focus on the following:

1. Compliance to the storage SOPs for fortified rice. In case the concerned go-down is storing both fortified and non-fortified rice, monitoring for compliance to storage SOP as well as segregation of stock becomes all the more important.

2. Compliance to First in and First Out (FIFO) rule to ensure that fortified rice is delivered to the community within its shelf life period.

Monitoring of rice during lifting from the godowns, transit and at the community level Lifting of foodgrains by States: Aligned to the stipulations of the TPDS (Control) Order, 2015, the following need to be in place and further strengthened for delivery of fortified rice:

Before taking delivery of foodgrains, an officer of the State Government not below the rank of Food & Civil Supplies Inspector shall inspect the stocks of foodgrains intended for issue to ensure that the stocks conform to the prescribed quality specifications.

The following stipulations for monitoring of the TPDS scheme hold and will require quality implementation for fortified rice.

The State Government shall ensure regular inspections of fair price shops not less than once in three months by the designated authority. The State Government shall issue orders specifying the inspection schedule, list of check points and the authority responsible for ensuring compliance with the said orders.

Any authority or any person authorized by it in this behalf or any other person, who is engaged in the distribution and handling of foodgrains under the Targeted Public Distribution System.

The internal grievance redressal mechanism notified by the State Government which includes Toll Free Call Centres and use of State web portal shall also be used to register any acceptability or quality issues related to fortified rice. The same shall be widely publicized by the State Government. The State Government shall furnish a report on quarterly basis to the Central Government regarding the handling of any Grievances related to fortified rice.

The State Government shall ensure monitoring of the end-to-end operations of the Targeted Public.

Annexure IV - Iron spot test

Aim	To determine the presence of Iron in fortified rice
Apparatus required	Dropper, watch glasses
Reagents and Solutions	1. H_2O_2 - 3% : Add 9 ml concentrated H_2O_2 (30%) to 81 ml distilled water 2. Thiocyanate reagent - Dissolve 10 g KSCN in 100 ml water. Mix with equal volume 2N HCl just prior to use
Procedure for fortified rice	» Place at least 50 grams of fortified rice in a plastic cup, tray, or similar container. » Pour Reagent 1 (2N HCl) on the rice until all the rice kernels are wet. » Pour a similar amount of Reagent 2 (10% KSCN) on the wet rice sample. » Immediately, fortified kernels will turn red to dark red (black upon drying) indicating the presence of iron fortified kernels

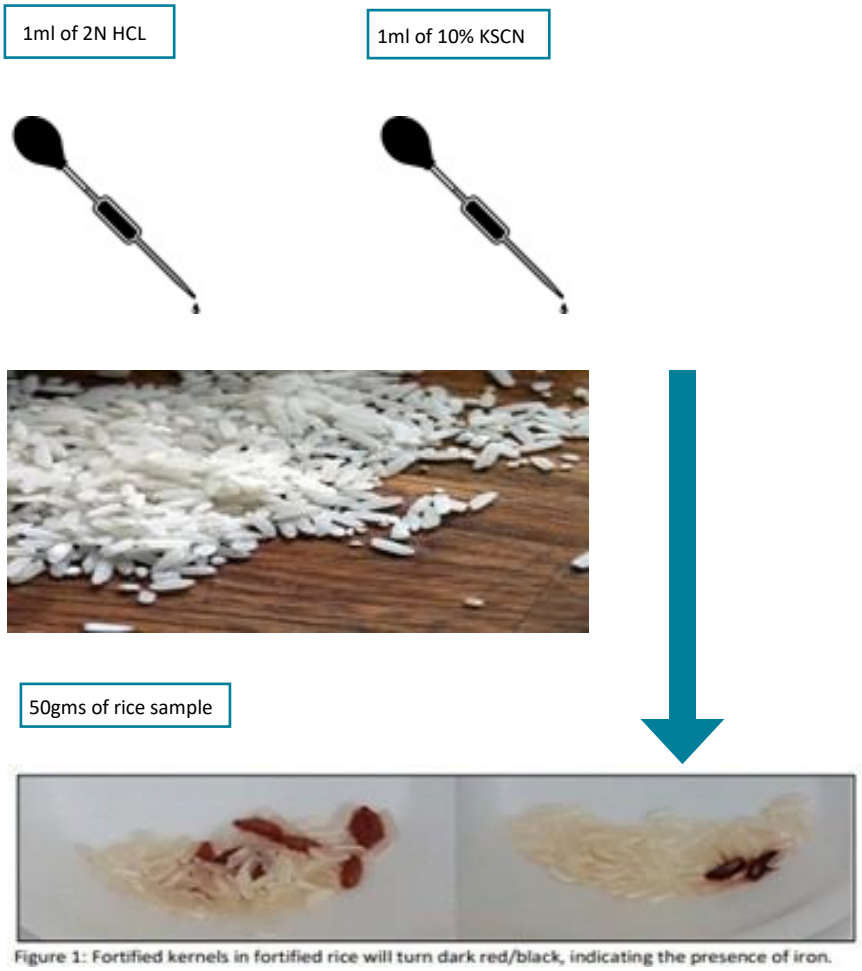


Figure 1: Fortified kernels in fortified rice will turn dark red/black, indicating the presence of iron.