Empowering smallholder farmers and rural communities by linking agriculture, nutrition and entrepreneurship around sorghum and millet value chains in the semi-arid-tropics

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We believe all people have a right to nutritious food and better livelihoods.

ICRISAT works in the dryland tropics of sub-Saharan Africa and Asia to:

- Alleviate Poverty
- Reduce Hunger
- Prevent Environmental degradation
- Reduce Malnutrition

Our research activities are focused on crops of immense value to the nutrition and economics of the semi-arid tropics – dryland cereals (sorghum and millets) and grain legumes (chickpea, pigeonpea and groundnut).
Background

• Smallholder farmers least benefitted in the present crop production and utilization system
• No value addition to the produce done by the farmer
• Lack of:
  ✓ Access to basic primary processing technologies
  ✓ Scientifically validated value added products
  ✓ Access to market information
  ✓ Business development support
• Value capture in the existing value-chain by middlemen and traders.
Potential of Value addition and Market Linkages

Primary processing and value addition to Sorghum and Millets:

✓ Additional income generation for the smallholder farmers

✓ Employment generation in smallholder farming communities

✓ Improved livelihood of the smallholder farming communities

✓ Promote food and nutritional security in the drylands.
Tapping the potential of value addition and market Linkages

• Efficient-cost effective primary processing technologies need to be developed

• Demonstrate sustainability through pilot projects involving establishment of processing facilities to be run by local communities

• Create local entrepreneurs involving youth and women self-help groups (SHGs).

• Create a sustainable “Demand Pull”
Creating sustainable “Demand pull” for sorghum and millets

- Demand pull for sorghum and millets is linked to identification of market/consumer demand
- Key market/consumer demand/need: “Health and Wellness” v/s “Malnutrition”
- Deliver market driven/scientifically validated value added food products
- Providing farmers access to primary processing facilities to be established at the community level
- Incubate local entrepreneurs (youth), women SHGs or Farmer Producer Organizations (FPOs) etc. in managing the processing facilities/enterprises
- Ensure inclusiveness and market orientation of the farming communities and ultimately enhancing their income.
ICRISAT's Approach

- **Agribusiness and Innovation Platform (AIP) of ICRISAT** works towards enhancing farmers income through a *value chain approach*:

  **ABI:** Improving well-being of resource-poor smallholder farmers through **creation of competitive agribusiness enterprises** by technology development and its commercialization.

  **INP:** Developing **collaborative research partnerships** with public, private and allied sectors to benefit smallholder farmers across agricultural and agribusiness value chain.

  **NPK:** Value addition, post harvest management, nutritional and food safety awareness in agri-food sector through innovative processing, product/technology development and capacity building.

  **IPFC:** Single window for **IP protection, advisory, and technology transfer services** for SMEs, and help strengthen its competitiveness.
Intervention Model for promoting sorghum and millets

**Small Holder Farmers**

**Farmer Producer Organizations (FPOs)**

**Business Incubation Support**

- Planning and Execution
- Farm level interventions (Seed, Crop management)
- **Processing and Value Addition**
- Training and capacity building
- Production
- Entrepreneurship Development
- Marketing and Business development
- ICT

**SMEs**

- Value added Produce

**Wholesale /Retail Marketing**

**Nutrition Feeding programs**

**Enhanced Income to Smallholder Farmers**
Farmer Producer Organizations (FPOs) to strengthen the Sorghum/Millet value chain

Existing Value chain

Inputs → Produce → Value-addition → Distribution → Market

FPOs & Value chain

FPO managed Input sources → Procurement from FPO members → Processing unit of FPO → FPO managed centers → Market

Start-ups & FPOs

Agro-companies, Direct procurement, Food based start-ups, Warehouse management, Procurement start-ups

Agri start-ups (Inputs, custom-hiring etc.)

Food based start-ups
“Demand-driven” product concepts to develop and sustain small scale enterprises

- Value-added products for commercialization developed and validated by the NPK program
- R&D for post-harvest and value addition to FPOs and SMEs
- Service set-up for food Quality Control and Food Safety support

Products to address lifestyle diseases

Multigrain meal
Energy Dense Spread
Sorghum Crispies
Energy bar
Sorghum and Millet Flakes
RTS Beverage

Products to address malnutrition

Jowar meal
Sorghum Crispies
Sweet Sorghum Jam
Instant Millet Porridge
Sweet Sorghum Toffee
Waffle Syrup

Nutri-Cookies (gluten free)
Healthy Nut treat
Sorghum and Millet Flakes
Sweet Sorghum Jam
Energy bar
Sorghum Crispies

Tamarind-Sweet Sorghum Sauce

Waffle Syrup

FPOs: Farmer Producer Organizations
SMEs: Small and Medium Enterprises
Case study -1 : Ind-Millet Foods Pvt.Ltd

Agribusiness Incubation - Entrepreneurship

- Identifying the market
- Development of product formulations based on the market demand
- Development of product prototypes
- Nutritional profiling
- Shelf life analysis
- Identification of suppliers
- Labelling and packaging
- Test marketing
- Identification of 3rd party manufacturing
- Scale-up
- Market linkages
- Providing business opportunities

IND-MILLET FOODS (Start-up company)
Success Story of Ind-Millet foods

Ind-Millet Foods

- Formed by three first-generation women entrepreneurs in 2014
- Product range: extruded sorghum snacks, jowar/ragi/bajra cookies and jowar/ragi roasted flakes.
- Has about 10,000 paying customers, employs 20, and has an estimated annual turnover of US$ 35,000.

AIP-ICRISAT support:
- Technology and product development services of its healthy snack-food
- Facilitate raw material sourcing and processing equipment
- Business/Market development and fund facilitation
- Legal registration/regulatory support
Case study – 2: Mathesis Engineers Pvt. Ltd.

NPK of AIP ICRISAT

Product formulation

Validating the nutritional claims

Packaging and Branding support

Test marketing support

Providing various market linkages – supply of ready to cook food products through Government schemes, schools and hostels

Mrs. Annapurna, Mathesis Engineers Pvt. Ltd
Linking Agriculture-Undernutrition- Entrepreneurship

Local crops:
- Enhance agricultural productivity
- Identify appropriate nutritional traits

Design and validate food products for nutritional recovery using food based approaches, for severe underweight children using locally available crops.

Facilitate establishment of small-scale processing units at the village level.

Supplementary food to underweight children at appropriate locations.

Create demand for the local crops.

Address undernutrition.

Promote entrepreneurship among the local women (SHGs) and youth through business incubation support to ensure sustainability.

Ensure food safety and generate awareness on food safety and nutrition.
Aspirator-sorter and grader (Sorting and grading).

Dehuller: Used to remove the bran

Peanut deskinner and splitter

Roaster (Roasting the peanuts and millets)

Peanut butter making machine

Planetary mixer

Blender

Flour sifter (segregates coarse and fine flour)

Baking oven

Millet Mill

Machines designed locally

Efficient machines made available for processing

Machines made available at community level

Processing machinery empowering rural communities
Primary Processing: Benefit to Farmers

INCREMENTAL REVENUE ANALYSIS: Graded, cleaned and packed sorghum grain

Compressing the Value Chain

Mini Sorghum Processing unit at Wankidi (a Tribal Hamlet in the Telangana State, India)
Product formulated to address undernutrition

Upma mix (Jowar meal)

Packed in 2 pack sizes – 500 g & 1.5 kg
Serving size : 150 g of the cooked product

Ingredients

Sorghum (70%), Bengal gram, Ground nut, Cumin, Red chilli, Mustard, Curry leaves, Salt

Nutritional composition (per 100 g)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Value</th>
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<tbody>
<tr>
<td>Protein (g)</td>
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<tr>
<td>Total fat (g)</td>
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<td>Carbohydrate (g)</td>
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<td>Energy (kcal)</td>
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<td>Fiber (g)</td>
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<td>Calcium (mg)</td>
<td>54.32</td>
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<tr>
<td>Iron (mg)</td>
<td>2.81</td>
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Flow-chart:

Making malted Sorghum grits

Mixing malted sorghum grits with roasted peanuts and Bengal gram, dehydrated curry leaves and spices.

Packaging.

Cooking method: Cook Mix 1 part of the above mixture by adding 4 parts of water for 15 minutes.
Product formulated to address undernutrition

Kichidi mix (Multigrain meal)

Packed in 2 pack sizes – 500 g & 1.5 kg
Serving size: 150 g of the cooked product

Ingredients

Sorghum (38%), Foxtail millet, Green gram, Curry leaves, cumin, Salt, pepper, Red chilli, Coriander, Sugar.

Nutritional composition (per 100 g)

<table>
<thead>
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<th>Value</th>
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<tbody>
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<td>Carbohydrate (g)</td>
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<td>88.11</td>
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<td>Iron (mg)</td>
<td>3.69</td>
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</table>

Flow-chart:

Making malted Sorghum grits

Mixing malted sorghum grits with foxtail millet, green gram, dehydrated curry leaves and spices.

Packaging.

Cooking method: Cook Mix 1 part of the above mixture by adding 4 parts of water for 15 minutes.
Product formulated to address undernutrition

**EDNF (Energy and Nutrient Dense Food)**

Pack sizes – 500 g & 2 kg; Serving size : 50 g

**Ingredients**
- Sorghum (23%), Peanut, Chick pea, Sugar, Vegetable oil, Emulsifier

**Nutritional composition (per 100 g)**

<table>
<thead>
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<th>Value</th>
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<tbody>
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<tr>
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<td>Carbohydrate (g)</td>
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<td>Energy (kcal)</td>
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<td>Fiber (g)</td>
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<tr>
<td>Calcium (mg)</td>
<td>69.33</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>2.81</td>
</tr>
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**Flow chart:**

1. Peanuts - Roasting & deskinning
2. Peanut paste
3. Blending peanut paste with vegetable oil and emulsifier
4. Addition of dry mix flours (malted sorghum, chick pea and sugar) and mixing
5. Bottling and sealing

**Flowchart Diagram:**

- Peanuts → Roasting & deskinning → Peanut paste → Blending peanut paste with vegetable oil and emulsifier → Addition of dry mix flours (malted sorghum, chick pea and sugar) and mixing → Bottling and sealing

**Ingredients:**
- Peanuts, Sorghum, Chickpea, Sugar, Vegetable oil (refined sorghum oil & Emulsifier (E471))
Product formulated to address undernutrition

Nutri-Cookies
Packed in 500g pack
Serving size: 3-4 cookies per head

Flow chart:
- Mixing fat and sugar
- Addition of Flour mixture (previously mixed with raising agent and cinnamon powder and blending)
- Rolling, sheeting, and cutting
- Baking at 220°C

Ingredients:
- Sorghum, Finger millet, Barley, Soya, Fat, sugar, custard powder, Cinnamon & Raising agent

Nutritional composition (per 100 g):

<table>
<thead>
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<th>Value</th>
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<td>Carbohydrate (g)</td>
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<td>Energy (kcal)</td>
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<tr>
<td>Calcium (mg)</td>
<td>69.92</td>
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<tr>
<td>Iron (mg)</td>
<td>1.89</td>
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Nutritional and health status of tribal population

Source: NFHS-4 data**

- 35.8% children below 5y underweight (weight-for-age)
- 38.3% children under 5y stunted (height-for-age)
- 22.1% children under 5y wasted (weight-for-height)
- 67.8% children under 5y with Haemoglobin <11g/dl
- 63.4% non-pregnant women aged between 15-49 with Haemoglobin <11g/dl
- 28.8% men aged between 15-49 with Haemoglobin <13g/dl

Iron deficiency causes anaemia
As per WHO standards
- Pregnant women with Haemoglobin <11g/dl are anaemic.
- Adolescent girls and lactating mothers with <12g/dl are anaemic.

The Intervention NUTRI-FOOD BASKET

Target category:
- Children (3-5 y age)
- Adolescent girls (12-18 y)
- Pregnant women
- Lactating women

NUTRI-FOOD BASKET PRODUCTS

- Multigrain Meal (RTC)
- Jowar Meal (RTC)
- Nutri-cookies
- EDNF
Implementation plan of Nutri-Food Basket

Products served as breakfast

Through Anganwadi centers

Breakfast per person:
- 150 gm of cooked Jowar Meal
- 50 gm of Energy Dense Nutrient Food
- 20 gm of Cookies
- 150 gm of cooked Multigrain Meal

* Combination of any two items on alternate days

# RDA as per ICMR guidelines

Evaluation to assess impacts

Recommended dietary allowance (\%) fulfilled by nutri-food basket products

<table>
<thead>
<tr>
<th></th>
<th>Children (3-5 y)</th>
<th>Adolescent girls</th>
<th>Lactating mothers</th>
<th>Pregnant women</th>
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</thead>
<tbody>
<tr>
<td>Iron</td>
<td>14</td>
<td>9</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Calcium</td>
<td>15</td>
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<td>6</td>
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<tr>
<td>Energy</td>
<td>20</td>
<td>16</td>
<td>10</td>
<td>10</td>
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<tr>
<td>Fat</td>
<td>42</td>
<td>48</td>
<td>23</td>
<td>35</td>
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<tr>
<td>Protein</td>
<td>36</td>
<td>17</td>
<td>15</td>
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</tbody>
</table>

Non-invasive haemoglobin measurement device

Baseline measurements taken for haemoglobin count, weight, height and mid-upper arm circumference

Plan to supply for 9 months

5069 beneficiaries
- 28 tons Jowar Meal
- 28 tons Multigrain Meal
- 28 tons EDNF
- 11 tons Cookies

Final assessment to analyze impacts post 9 months
The Delivery Mechanism

ICRISAT

Project Steering Committee

Department of Tribal Welfare

Department of Health and Family Welfare

4 ITDAs*

Primary Schools, Hostels, Mini Centres, Anganwadis

Department of Women and Child Development

Local Partner

Nutritional intervention product variants (1 Breakfast meal & 1 snack) on a daily basis

Food products distribution & consumption

Social & behavior change communication

Pregnant women

Lactating women

Adolescent girls

Children (3-5 yrs)

*Integrated Tribal Development Agency

Use of ICT Platform

Convergence in service delivery
The Impact: Farmers, Women SMEs and Youth empowered

Nutri-Food Basket storage area

Barcode scanning

Distribution of Nutri-Food Basket products to Anganwadi centers
Key Recommendations

• Compress the “Sorghum/Millet Value Chain” by empowering farmers and rural communities with efficient processing technologies

• Promote development of low cost and efficient sorghum processing machinery

• Revolutionize “Sorghum/Millet value chain” through establishment of Farmer Producer Organizations (FPOs) and small scale and medium scale enterprises (SMEs)

• Empower the FPOs/SMEs with the appropriate technologies, business development and marketing skills

• Provide an eco-system to support “demand driven innovation” by SMEs- “SORGHUM/MILLET VALUE CHAIN BUSINESS INCUBATORS”

• Promote Sorghum and Millets as an healthy ingredient in foods to address “Lifestyle diseases” and “Malnutrition”.
Publications


Partners & Networks Ecosystem of AIP
Thank You

‘The children of today will make the India of tomorrow’ Pandit Jawaharlal Nehru