MAIZE PROCESSING

AATMANIRBHAR BHARAT

PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)
MAIZE/CORN

- World no. 1 & India ranked 3rd
- Diverse type: SC, BC, PC, QPM, etc
- Diversified food products
- Health cautious food for nutritional security & vulnerable society
- Can be grown round the year
- Raw material available whole year
- Today maize has turned industrial crop
- Value added products export potential
- Employment generation
- Revenue generation and forex earning
MAIZE AVAILABILITY IN INDIA ENHANCED SIGNIFICANTLY

Maize is no. 1 in productivity and no. 3 in production in India.
MAIZE PRODUCTION ENHANCEMENT NEEDED FOR INDIA

- No more demand of other crop
- Climate change resilient and natural resource efficient
- Most diverse uses in the present and future
- Ethanol for future energy security
- Carbon trading
- Easier production technology
- Demand of value added products: national and international market; starch, chips, feed, baby corn, etc
- Highest yield potential suited to climate change and natural resource saving crop.
- Advantage of market demand nationally and internationally
140 countries maize export, major are USA (~40%), Brazil (13.5%), Argentina (13.4%) and Ukraine (12.4%)

- Indian export was at peak in 2012-13

- It can be increased again by production enhancement as importing countries are in our vicinity like Bangladesh, Nepal, Vietnam, Indonesia, Malaysia, Sri Lanka, Bhutan, Myanmar, China, Thailand, etc
MAIZE STARCH INDUSTRY: PROCESSING

1. **Corn** → **Purifying** → **Counter** → **Counter**
   - **Evaporation**
   - **Steeping**
     - **1st degemring**
     - **Separating**
   - **Impurity remove**
     - **Drying**
     - **Squeezing**
   - **Fiber Washing**
   - **Fiber milling**
   - **Clarification**
     - **Concentration**
   - **Dewatering**
   - **Drying**

2. **Germ washing**
   - **Dewatering**
   - **Drying**
   - **Compressing**
     - **Corn Oil**
     - **Germ Cake**
     - **Mixing**
     - **Drying**
     - **Feed**

3. **Screening**
   - **Filtration**
   - **Separating**
     - **12-stage washing**
     - **Refrined starch milk**
     - **Dewatering**
     - **Drying**
     - **Corn Starch**
     - **Gluten meal**
MAIZE PROCESSING: STARCH INDUSTRIES

Shelled maize

Maize cleaners

Steeping tanks

Coarse grinders

Grinding mills

Washing screens

Centrifugal separators

Starch washing hydro clones

Starch

Germ separation

Germ oil expelling

Germ oil

Steep water

Evaporators

Gluten

Gluten feed

Gluten meal

Corn steep concentrate

Corn germ meal
USES OF CORN STARCH

- Corn starch powder: soups, sauces, gravies & custard
- Liquid glucose: to keep food products soft and fresh
- High Maltose Corn Syrup (HMCS): sweetener & preservative
- Dextrose Monohydrate: food industry
- Maltodextrine: pharmaceutical & confectionery industries as coating material
CORN STARCH IN FOOD INDUSTRY

- Thickening sauces, gravies, puddings and pie fillings
- Makes hard wheat flour preferred for cakes
- To give proper strength to ice cream cones
- Syrups & artificial honey
- Moisture holding agent in breads
- Dispersing agent in instant drink concentrates
CORN FLOUR

- Bakery Dusting
- Breads and Batters
- Pancake and Waffle Mixes
- Beverages, Alcohol
- Confectionery Toppings
- Confections
- Baby Foods
- Snacks, Cereal

India exports corn flour to South Korea, Thailand and Angola
CORN FLOUR

Selection & Cleaning → Threshed Corn Kernels

Cooking @ 92° for 60 minutes (50% Moisture)
Maize (1kg), Water (3L)

Steeping (60% Moisture FOR 4 Hours)

Drained Step

Wet Milling

Dough

Arepa
Grilled: 200-300° C
Time: 5-8 min

Drying Stage

Dry Milling

Instant Flour
CORN PUDDS/KURKURE/CURLS

Machines are available in Indian market ranges from Rs 3-10 lakhs with capacity of 100-500 kg/hr
CORN PUDDS/KURKURE/CURLS- FLOW CHART

- Raw material receiving system → Proportion System (Optional) → Milling System
  - Extrusion System ← Conveying System ← Drying System
- Flavoring System → Cooling → Packing System
Corn flakes, choco flakes, honey flakes, etc. are being made in small-scale. Makka Poha, used in snack industries like mixture namken. Corn grits can also be produced through this machine, which is in high demand for export. India can become a big cornflakes exporter.
CORN FLAKES

Cooking with steam (1-2 kg/cm² pressure for 2-2.5 h)

Drying at 66°C

Flaking

Roasted flakes

Sifting and inspection

Spray of enriched solution (vit, minerals, flavouring agent)

Maize grits (4-6 mesh)

Agitation and mixing

Tempering for 6-24 h

Roasting (300° for 50 sec or 288°C for 2-3 min)

Tempering (6-8 h)

Packaging

Addition of flavouring agent
CORN CANNING FLOW CHART

Corn dump
↓
Preliminary Corn Cleaning
↓
Automatic Husking
↓
Trimming and Inspection
↓
Corn Cutting
↓
Silkers
↓
Washing and Inspection
↓
Can Filling
↓
Seamimg and Cooling
↓
Labelling and Ware housing
CANNING MACHINERY

Canning Machine

Can Filling Machine
BABY CORN

- Nutritional quality of BC at par with other major vegetables
- Richest sources of phosphorus
- Good source of fibrous protein
- Easily digestible
- Free from residual effects of pesticides
- It is like an organic food
BABY CORN - PRODUCTS

- Soups and various dishes
- Pickle, murraba, veg-recepies
- Baby corn pakora
- Canning & pakaging Industry
- Export potential
STABILIZED MINIMALLY PROCESSED BABY CORN

Methodology

1. Select mature baby corn cobs
2. Dehusk
3. Pretreat with 1.5% citric acid or 0.5% ascorbic acid
4. Air dry
5. Place in PP trays
6. Shrink wrap using 9µ cryovac film
7. Store under 10°C

Equipment/ Machinery required
- Shrink wrapping machine
- Soaking tank
- High speed fans

Storage life: 9 days
CANNED BABY CORN

1. Peeled corn
2. Blanching for 3-4 min in boiling water
3. Filling in cans
4. Brining (3% salt + 2% sugar + 0.3% citric acid)
5. Exhausting (82-85°C)
6. Processing at 100°C for 35 min
VALUE ADDED BABY CORN PRODUCTS IN DAILY USE
VALUE ADDED PRODUCTS OF BABY CORN FOR COMMERCIAL AND EXPORT

Canned and pickle  Murraba  Chutney  Jam  Baby Corn Candy
FROZEN AND DEHYDRATED BABY CORN FOR COMMERCIAL AND EXPORT

Frozen baby corn

Dehydrated baby corn
FROZEN CORN- FLOW CHART

Harvest and Transport
↓
Sorting and Grading
↓
Washing-Peeling- Cutting
↓
Calibration
↓
Blanching
↓
Freezing- Packing
↓
Frozen Storage
SWEET CORN FOR PERI – URBAN AGRICULTURE: PROMOTION OF SMALL SCALE INDUSTRIES

- Nutritious snack/fast food
- Anti-cancerous: Ferulic acid
- Low cost of production
- Internal and External Consumptions
- High Profitability
- Green fodder
VALUE ADDED PRODUCTS OF SWEET CORN

- Condiments, soup, desserts, salads, snacks
- Canning industry
- Roasted green cob
- Export potential
CANNED SWEET CORN

Dehusked sweet corn cobs

Blanching in boiling water for 3 min.

Separate kernels from cob

Brining
(3% salt+2% sugar)

Exhausting

Processing at 12psi for 55min.
NIXTAMALIZATION OR ALKALI TREATMENT PROCESS FOR MAIZE KERNEL TO INCREASE QUALITY AND SHELF LIFE OF CORN

Maize grain
↓ Cleaning
Soak maize grains in 1% lime water
(10 g of lime/litre water)
↓ Heat treatment at simmering temperature for 30 minutes
↓ Leave it for overnight
↓ Wash 3 – 4 times to remove lime
↓ Drying and bring down moisture level to 9-10%
↓ Store in air tight container

MAIZE KERNEL TO INCREASE QUALITY AND SHELF LIFE OF CORN

MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

NIFTEM
KNOWLEDGE • INNOVATION • OUTREACH
• The initial step for manufacture of corn syrup is to gelatinize the obtained starch under heat and pressure.

• The application of high temperature and pressure further helps to liquefy the starch by breakdown of glycosidic bonds.

• Addition of acids and enzymes further adds to the liquefaction process to yield a starch slurry.

• Enzymes maybe employed to obtain a mixture of short, medium and long chain saccharides in the slurry.
CORN SWEETENERS – FLOW CHART

1. Starch obtained from wet milling
2. Starch gelatinization
3. Liquefaction
4. Saccharification
5. Purification and Decolourization
6. Concentration
QUALITY PROTEIN MAIZE (QPM) 
MERITS OVER NORMAL MAIZE

- QPM products are nutritionally superior and healthy
- The products are with high biological value and digestibility
- Dietary diversification
- QPM green cob better than normal maize
- Export potential
- Products suits to all age group
TRADITIONAL PRODUCTS DEVELOPED FROM QPM

LADOO
(70 % QPM+30 % Soya bean)
QPM+bengalgramflour
- Crude protein-11.64-22.76 g/100g
- Crude fat-30.00-33.30 g/100g
- Energy-536.28-555.58 kcal.

POPPED LADOO
- Crude protein-10.83-13.45 g/100g
- Crude fat-4.71-5.89 g/100g
- Energy-392.33-413.33 kcal.

HALWA
- Crude protein-4.54-5.73 g/100g
- Crude fat-27.24-34.50 g/100g
- Energy-457.70-65.24 kcal.
**BURFI**
- Crude protein-7.96-15.67 g/100g
- Crude fat-24.53-33.45 g/100g

**KHEER**
- Crude protein-7.28-8.26 g/100g
- Crude fat-9.51-10.67g/100g
- Energy-430.25-442.95 kcal.

**SATTU**
(70 % QPM+30 % Soya bean)
- Crude protein-8.25-18.20 g/100g
- Iron-1.49-3.92 mg/100 g
CHEELA
- Crude protein: 12.08-22.87 g/100g
- Crude fat: 10.37-14.19 g/100g
- In vitro protein digestibility: 55.99-73.82 g/100g

PURI (70 % QPM+30 % Bengal gram flour)
- Crude protein: 10.60-12.88 g/100g
- Crude fat: 42.06-3.62 g/100g
- Energy: 1.23-2.00 kcal.

NAMAKPARA
(70 % QPM+30 % Soyabean)
- Crude protein: 8.71-12.83 g/100g
- Crude fat: 17.51-24.93 g/100g
- In vitro protein digestibility: 68.43-72.57 g/100g
PAKORA
- Crude protein: 11.53-14.74 g/100g
- Crude fat: 19.12-21.31 g/100g
- Energy: 483.60-500.11 kcal.

UPMA
(70 % QPM+30 % Soyabean)
- Crude protein: 7.01-23.73 g/100g
- Crude fat: 15.81-21.42 g/100g
- Iron: 1.15-2.32 mg/100g

SEV
- Crude protein: 19.58-23.22 g/100g
- Crude fat: 19.58-23.22 g/100g
- Energy: 490.54-507.62 kcal.
BAKED PRODUCTS

**BREAD**
- Crude protein-10.83-13.45 g/100g
- Crude fat-4.71-5.89 g/100g
- Energy-392.33-413.33 kcal.

**BISCUIT**
(70 % QPM+30 % Soya bean)
- QPM
- Normal maize
- Crude fat-4.71-5.89 g/100g
- Energy-392.33-413.33 kcal.

**CAKE**
(70 % QPM+30 % Soyabean)
- Crude protein-11.40-25.51 g/100g
- Crude fat-13.26-14.86 g/100g
- In vitro protein digestibility-72.55-79.12 g/100g
EXTRUDED PRODUCTS

PASTA
- Crude protein-8.49-9.80 g/100g
- Energy-415.11-420.57 kcal
- Calcium-35.59-38.54 mg/100g

VADI
(70 % QPM+30 % Soyabean)
- Crude protein-13.97-25.28 g/100g
- Crude fat- 3.09-14.06 g/100g
- Iron-3.85-4.51 mg/100g

VERMECELLI
- Crude protein-8.00-9.71 g/100g
- Crude fat- 4.03-5.77 g/100g
- Energy-415.54-427.41 kcal
INFANT’S FOODS

SWEET DALIA
(70 % QPM+30 % Soyabean)
- Crude protein-10.22-23.19 g/100g
- Crude fat- 3.29-12.25 g/100g
- In vitro protein digestability-76.92-81.96 g/100g

KHICHIARI
- Crude protein-9.44-16.19 g/100g
- Crude fat- 13.13-20.20 g/100g
- In vitro protein digestability-72.02-79.29 g/100g
WEANING FOOD

- Crude protein: 19.151-19.795g/100g
- Energy: 571.46-584.36 kcal
- Calcium: 364.13-364.49 mg/100g

SALTED DALIA

(70 % QPM+30 % Soya bean)

- Crude protein: 9.83-11.04 g/100g
- Crude fat: 1.56-4.38 g/100g
- Calcium: 26.65-28.09 mg/100g
CONVENIENCE PRODUCTS

DHOKLA mix
- Crude protein-12.26-15.15 g/100g
- Crude fat-6.53-9.48 g/100g
- Energy-403.35-426.72 kcal.

IDLI mix
- Crude protein-11.70-13.45 g/100g
- Crude fat-2.67-3.88 g/100g
COMMERCIAL PRODUCT
QPM CHAPATTI FOR FAST FOOD INDUSTRIAL GROWTH

• Nutri-cereal
• Mid day meal scheme
• Disaster management
• Army personnel in remote areas
• Fast food
• Dietary diversification
• Better shelf life than normal chapattis from different cereals
QPM CHIPS: HEALTH CAUTIOUS SNACKS INDUSTRIAL GROWTH

- Chips are common
- Liked by children

QPM chips: Merits

- 40% oil saving in fry
- Nutritionally superior
- Non-sticky and crispy
- Easily digestible
- For all group: Old, young and children
Presently most of bakery products are from wheat.

If switched to QPM the products will address human health due to...

- High fibrous and Crispy
- Non-sticky
- High biological value
- Easily digestibility
- Nutritious
- Less cholesterol content
- Suits to the patients and children
QPM PORRIDGE (DALIYA): HEALTHY FOOD

- Low cost nutritiously superior natural lysine rich food
- Suits in mid-day meal
- Easily digestible
- Prepared like Upma: good breakfast healthy food
- Mixed with milk as kheer
- Sweet recipes like wheat daliya
- For all: Pregnant ladies, weaning food, Old
NUTRITIVE SNACKS INDUSTRY

- Roasted dried maize cobs
- Roasted Sweet corn cobs
- Babycorn pakora
- Popcorn
- QPM biscuits, Kurkure, chips, pasta, mathi, chakli, etc.
- Corn flakes
MACHINERIES

Corn Dehusker

Maize Sheller
MACHINERIES

Maize Husker Sheller
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