DEVELOPMENT OF SMALL MILLET PROCESSING TECHNOLOGY BY TNAU

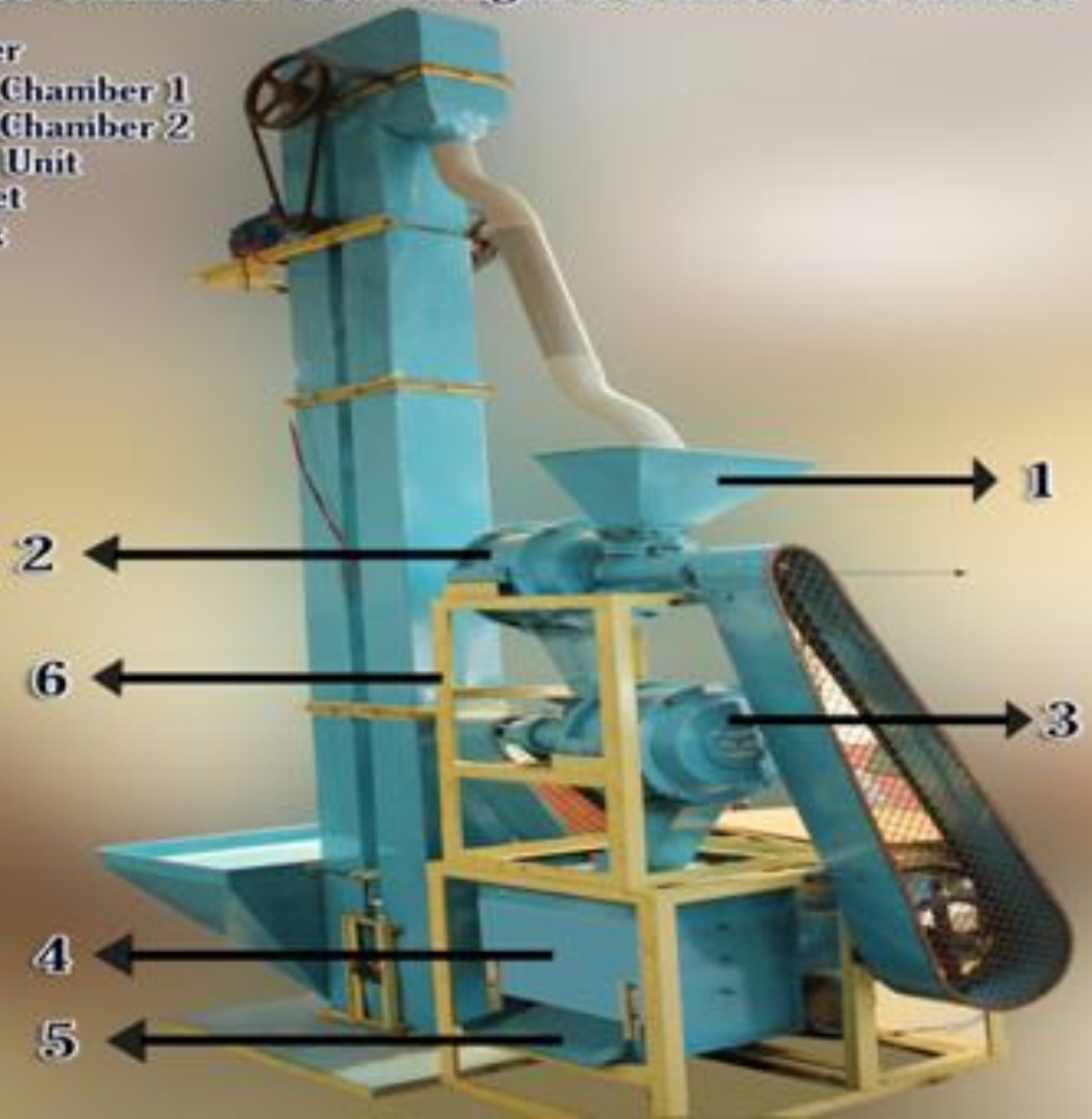
Dissemination meeting 15.02.2018

Dr. N. Varadharaju
Professor & Head
Post Harvest Technology Centre
Tamil Nadu Agricultural University
Coimbatore

Double chamber centrifugal de-huller for millets

Double Chamber Centrifugal De-huller for Millets

1. Feed Hopper
2. De-hulling Chamber 1
3. De-hulling Chamber 2
4. Separation Unit
5. Grain Outlet
6. Framework



Special features

- 10 % more recovery (since the bran is retained in the kernel)
- Suitable for little millet, proso millet, foxtail millet, barnyard millet and kodo millet.
- Capacity of the de-huller is 300 kg of per hour.
- Efficiency of the unit is 95%
- Breakage of 4-5%.
- Labour required: one person
- Cost of the unit Rs.1,20,000
- Cost of operation Rs.5 per/kg

- The **Double chamber centrifugal de-huller** developed by Tamilnadu Agricultural University has been licensed to **M/s Perfura Technologies, Coimbatore**

- ICAR is making efforts to purchase the double chamber centrifugal de-huller under **AICRP** on Post Harvest Technologies for popularization and establishing the millet processing units in different states.

- The Millet processing machinery manufactured by **M/s AVM Industries, Salem and M/s Victor Engineering, was evaluated for performance** and some suggestions were made to improve the efficiency.

Licensing of the Double chamber centrifugal de-huller to M/s Perfura Technologies, Coimbatore

TANII Project – Promotion of millets by govt. of TN

-No.of locations – 12

- Cost of the millet machinery – 5 lakhs /location

Machinery

-Pre-cleaner

-Double chamber centrifugal de-huller

- Grader

-Pulverizer

-Packaging unit

S. No	Districts	Blocks
1.	Dharmapuri	Pennagaram, Dharmapuri
2.	Krishnagiri	Veppanapalli, Soolagiri
3.	Tiruvannamalai	Jamunamarathur, Chengam
4.	Madurai	Kallikudi, Tirumangangalam
5.	Viruthunagar	Watrap, M. Reddiyarpatti
6.	Vellore	Alangayam, Jolarpettai

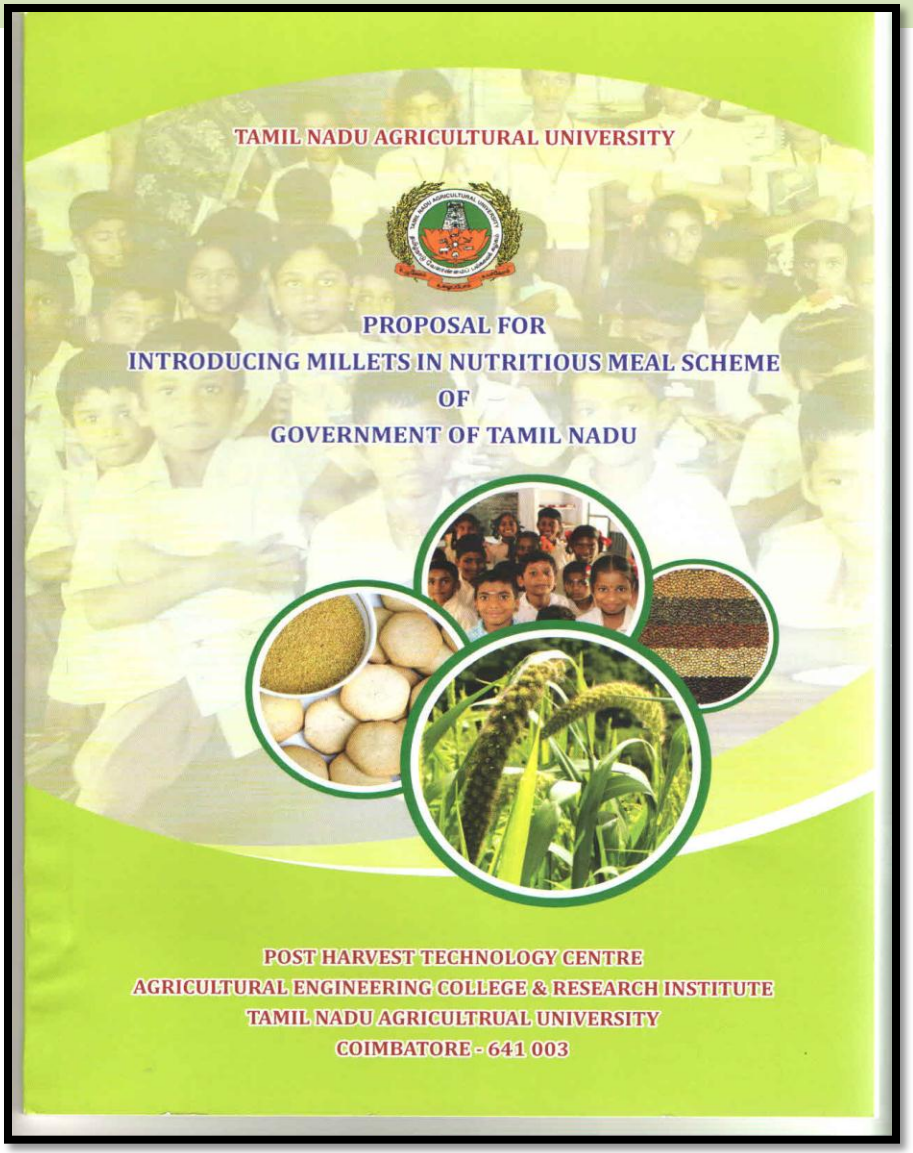

ஜெயம் சிறுதானிய மகத்துவ மையம்
மாநில திட்ட ஆணையம், தமிழ்நாடு புதுமை முயற்சி திட்டம்,
சென்னை.
ஜெயம்
3480530408


Vigyan Kendra, Papparapatty, Dharmapuri
நாடு புதுமை முயற்சி திட்டம் 2016-17,
திட்ட ஆணையம், சென்னை.

Mission on Sustainable Dryland Agriculture

Total outlay	**Rs. 20 crores**
No. of clusters	**200**
Amount allotted	**Rs. 10 lakh/cluster**
Implementing Agency	**Primary Agricultural Co-operative Society (PACS)** **Agriculture Engineering Department (AED), Govt. of Tamil Nadu**
Crops under MSDA	**Pulses , Oil seeds and Millets**

TNAU submitted the proposal on “Introducing millets in nutritious noon meal scheme” of Government of Tamil Nadu

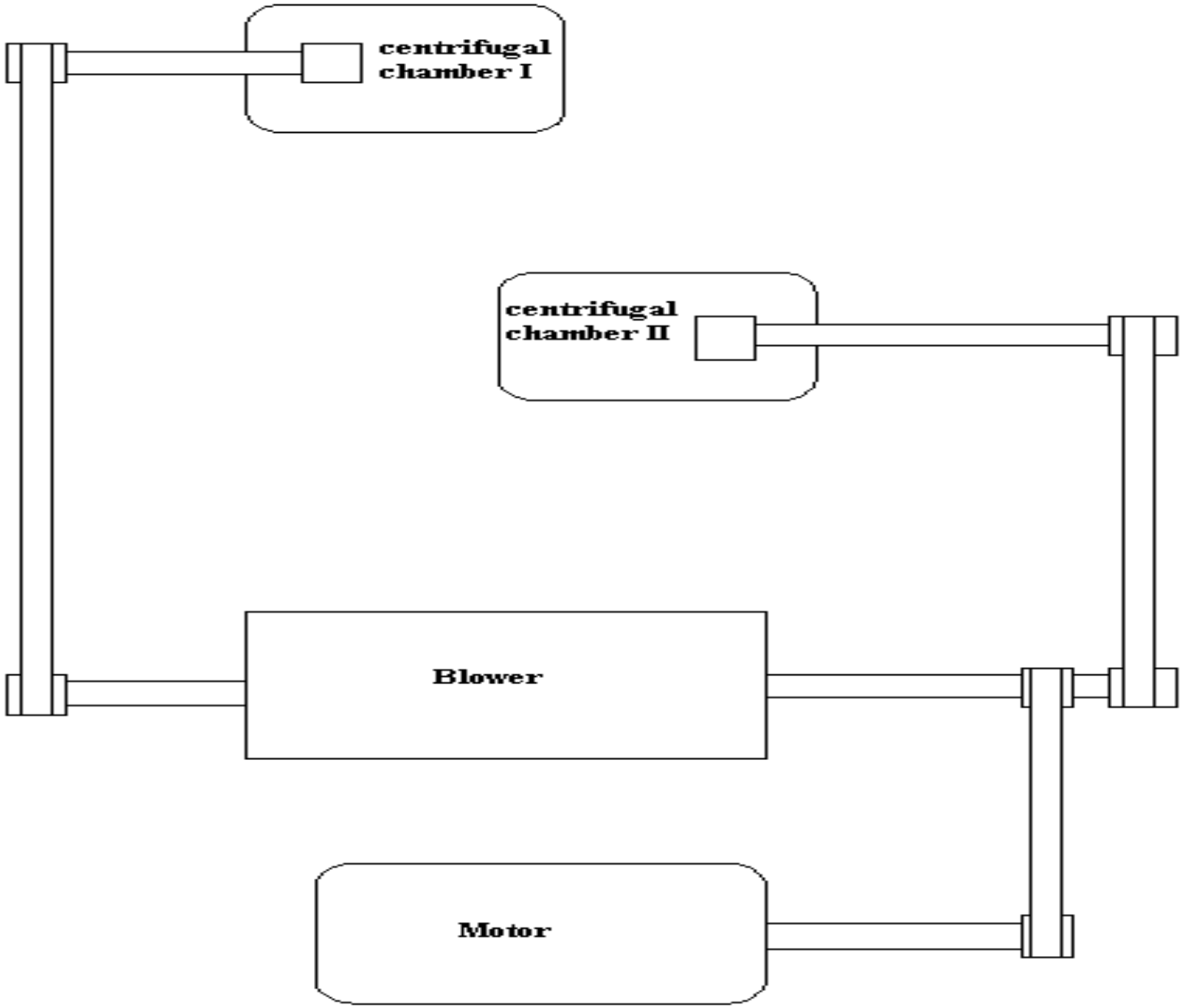


REMOVAL OF UNHULLED GRAINS FROM DEHULLED GRAINS

Improving hulling efficiency

- Force required to split the husk - $\mathbf{F = mv^2/r}$
- Depends on
  - Dia of impeller
  - Peripheral velocity of the grain- rpm of the impeller

Millet	Hardness (N)	Force required (N) (To split the husk)
Kodo	25.5	18.5
Barnyard	23.8	17.3
Little millet	22.8	16.4
Foxtail millet	21.5	16.0
Proso millet	18.5	14.3



DOUBLE CHAMBER CENTRIFUGAL DE-HULLER
POWER TRANSMISSION SYSTEM

- Maximum force in the first impeller
- 75 % of the maximum force in the second impeller
- The impellers and rpm of the de-hullers are not uniform – varies with the manufacturers
- Manufacturers of the machinery have to be trained

REMOVAL OF UNHULLED GRAINS FROM DEHULLED GRAINS

- Specific gravity separator - Westrup model

Parameters	Variables
Feed Rate	2 kg, 3 kg, 4 kg
Angle of Deck (Vertical)	0, 10, 20
Angle of Deck (Horizontal)	0, 10, 20
Frequency of Oscillation/minute	250, 300, 350
Air Velocity	2 m/s, 3 m/s, 4 m/s

No of expts. to be conducted – 243

Reduced to - 46

(RSM-Box Behnken Method)

Specific gravity separator

Specific gravity separator

Specific gravity separator

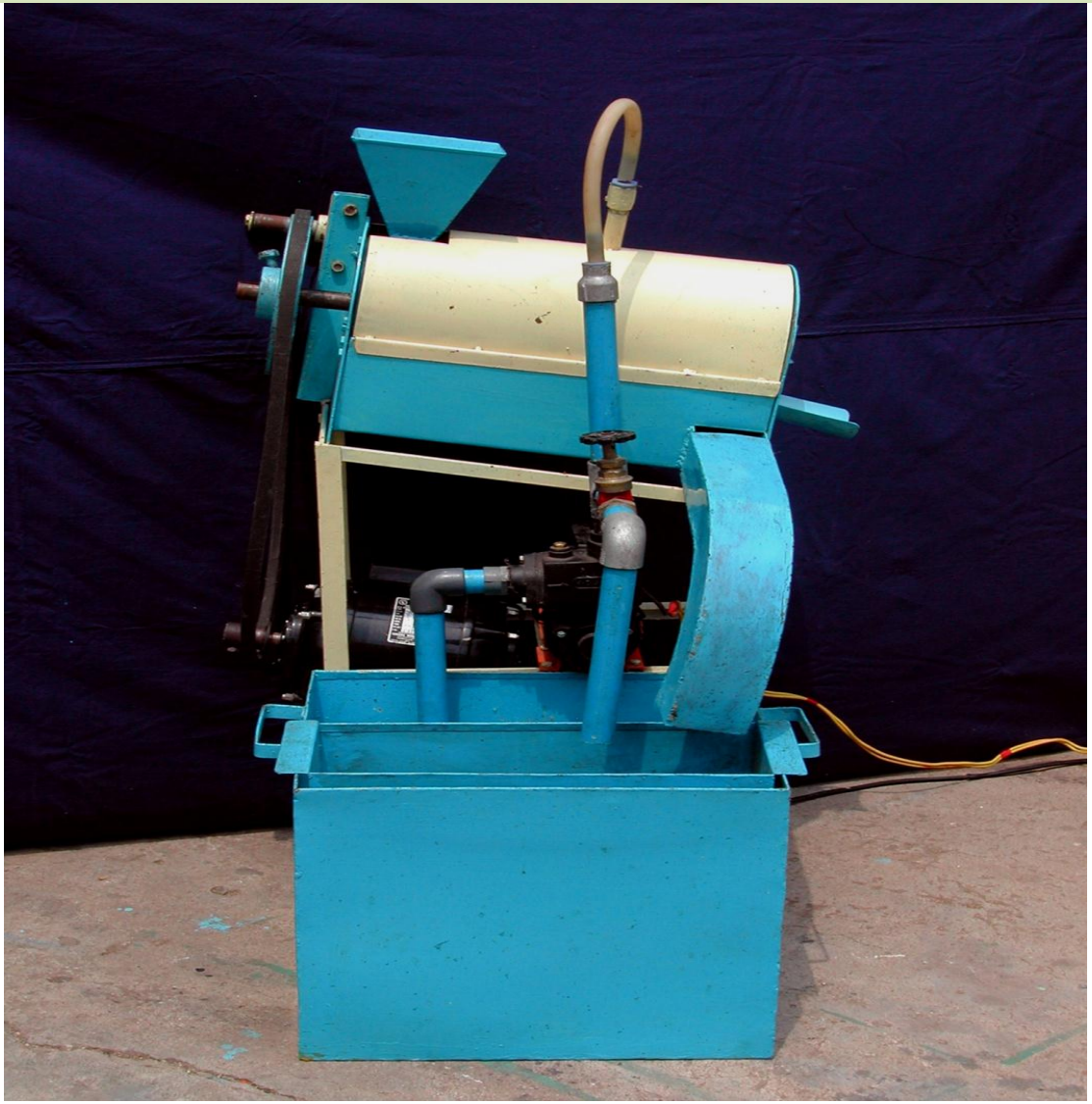
Optimized parameters

De-hulled millets	Deck angle (Vertical)	Deck angle (Horizontal)	Freq. of Oscillation	Air velocity m/s	Separation Efficiency
Kodo	10	20	350	4	98
Barnyard	0	30	300	3	98.5
Little millet	20	20	250	2	98.5
Foxtail	10	20	350	4	97
Proso millet	20	10	250	3	98

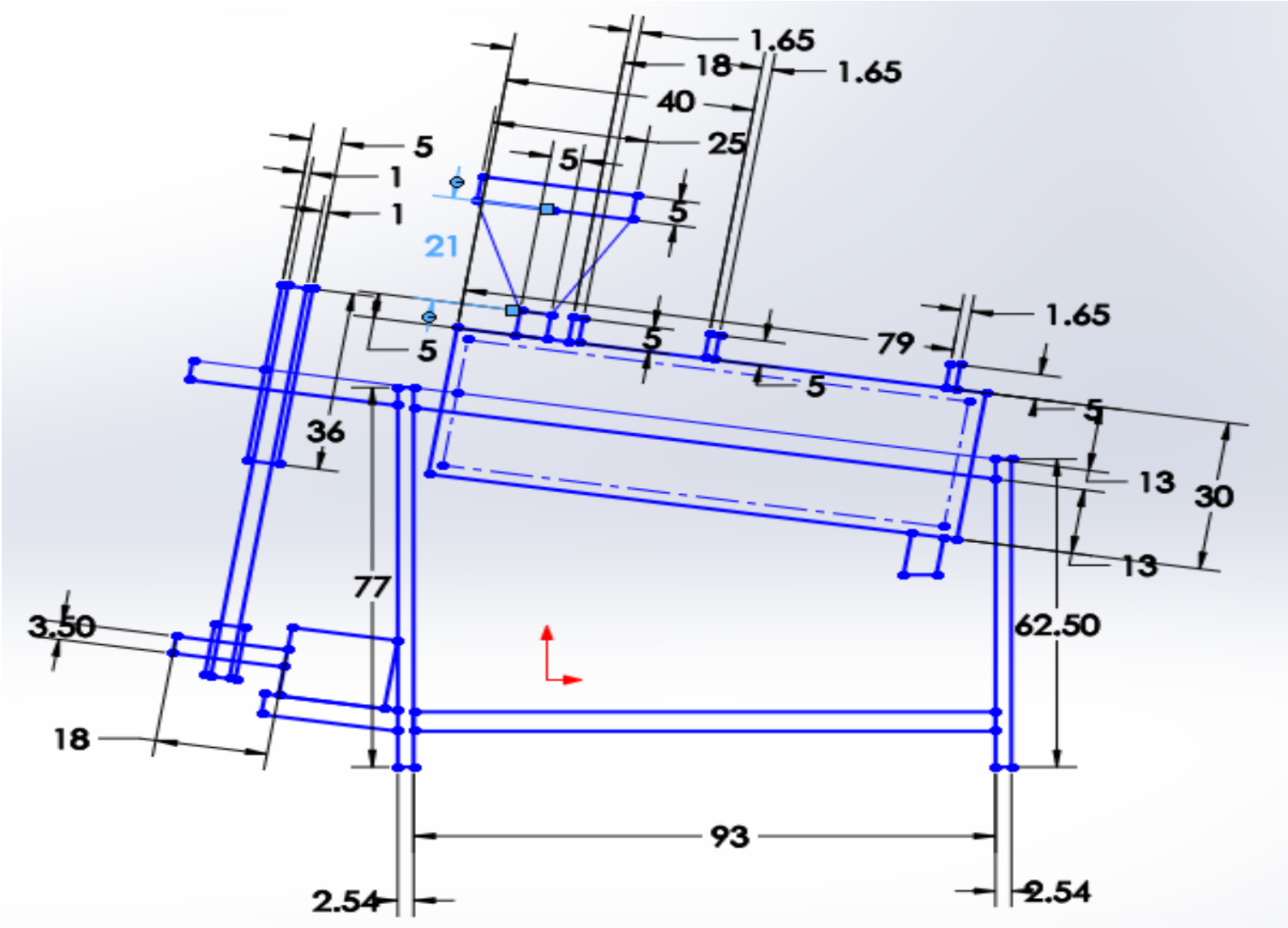
Increasing the Separation efficiency of De-hulled grains

- Terminal velocity of grains 2.45 – 3.75 m/s
- Velocity of air in the blower 9.5 m/s
- Anemometer

Millet washer



Schematic Diagram of Millet Washer



ENHANCING THE SHELF LIFE OF DE-HULLED MILLETS

Independent variables

Type of millet

- Kodo millet - CO 3(*Paspalum scrobiculatum*)
- Little millet - CO 4(*Panicum sumatrense*)
- Foxtail millet- CO7(*Setaria italica*)

Storage container

- Tin container (Hermetic storage)
- Polypropylene film (Vacuum & MAP)
- Super grain bag (Flexible packaging)

Methods attempted

- Vacuum packaging
- Modified Atmosphere Packaging
- Hermetic storage
- Flexible packaging (Super grain bag)

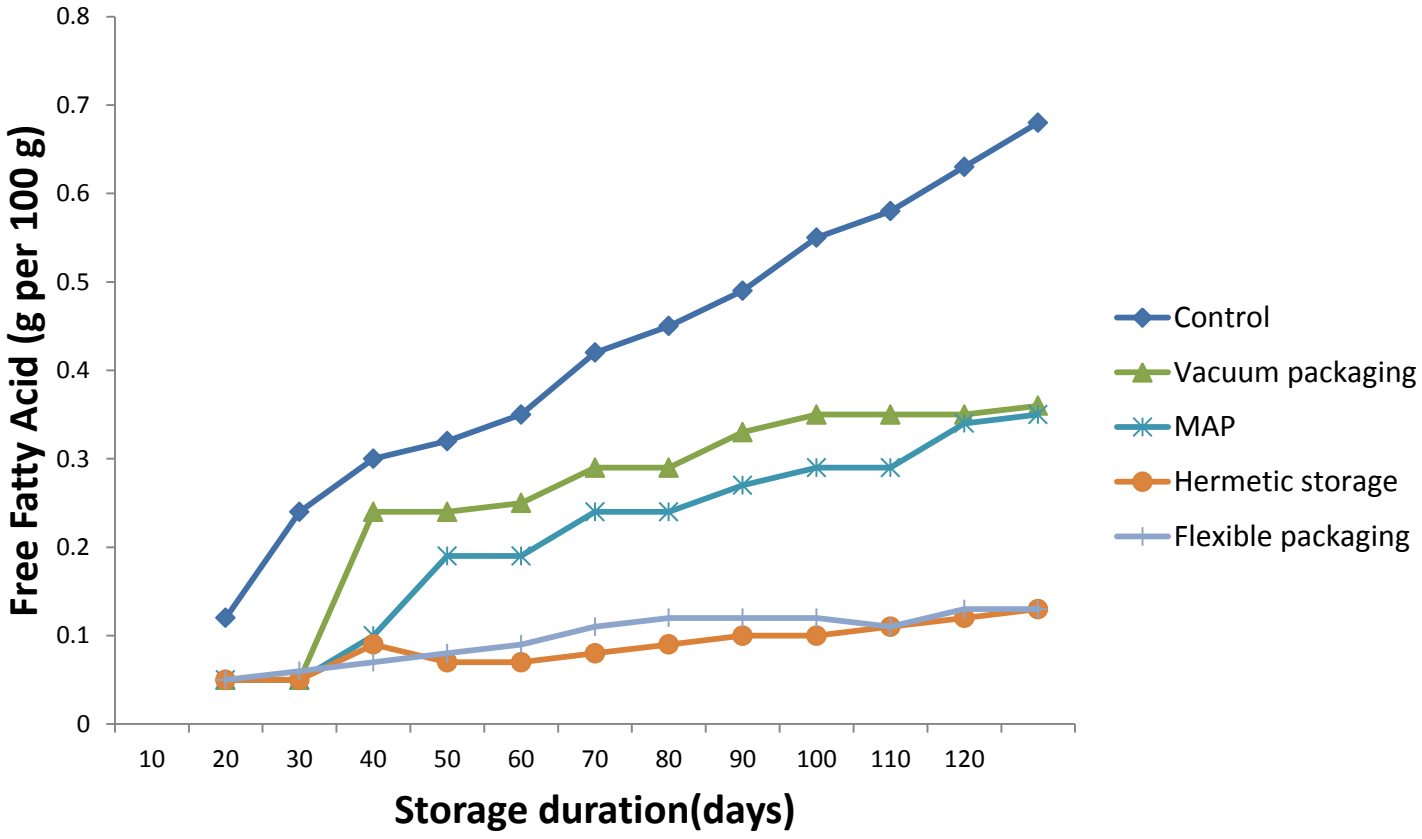
Vacuum package of de-hulled millet

Hermetic storage of de-hulled millet

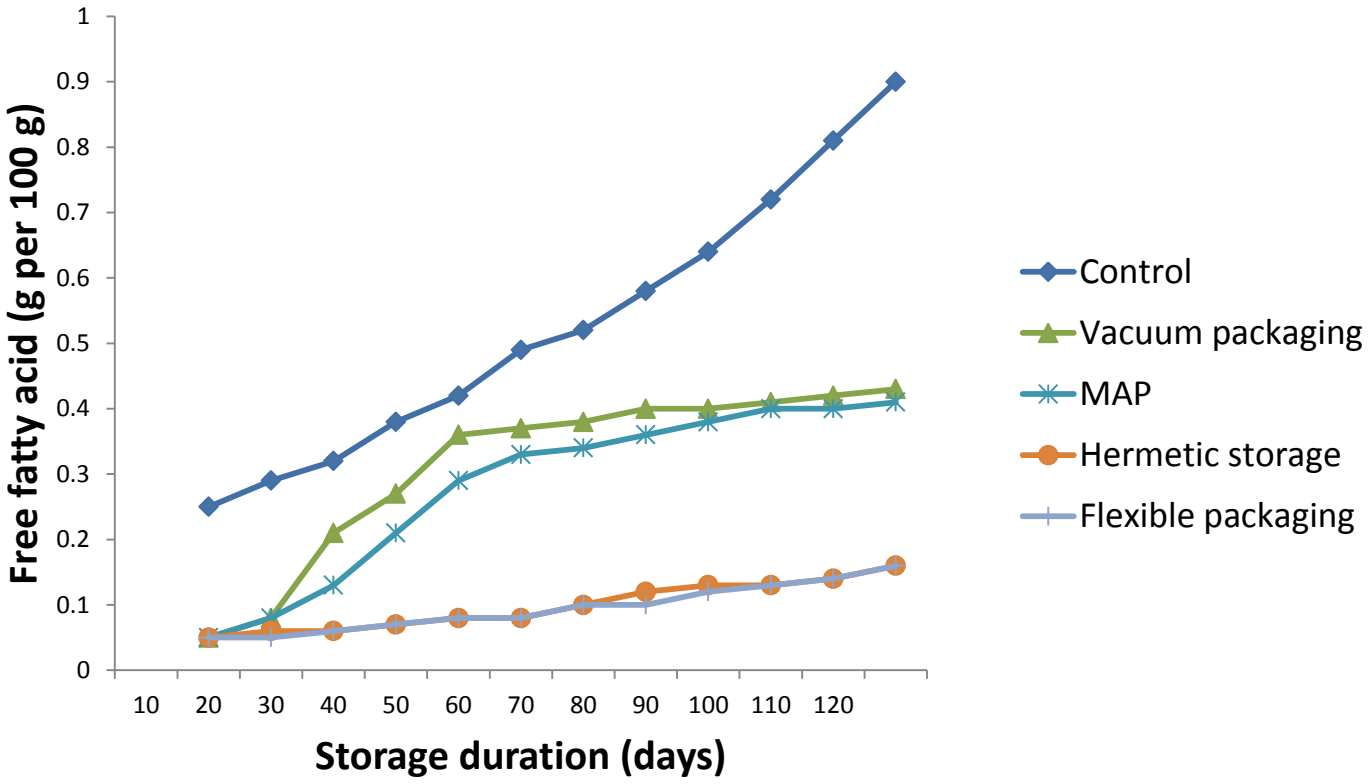
Initial values of nutrient content after de-hulling

Parameters	Kodo millet	Little millet	Foxtail millet
Starch (g per 100g)	66.6	60	63.2
Protein (g per 100g)	9.8	9.7	12.3
Free fatty acid (g per 100g)	0.02	0.03	0.02
Crude fibre (g per 100g)	6.6	4.2	4.2
Phenols (mg/g)	362	143	103

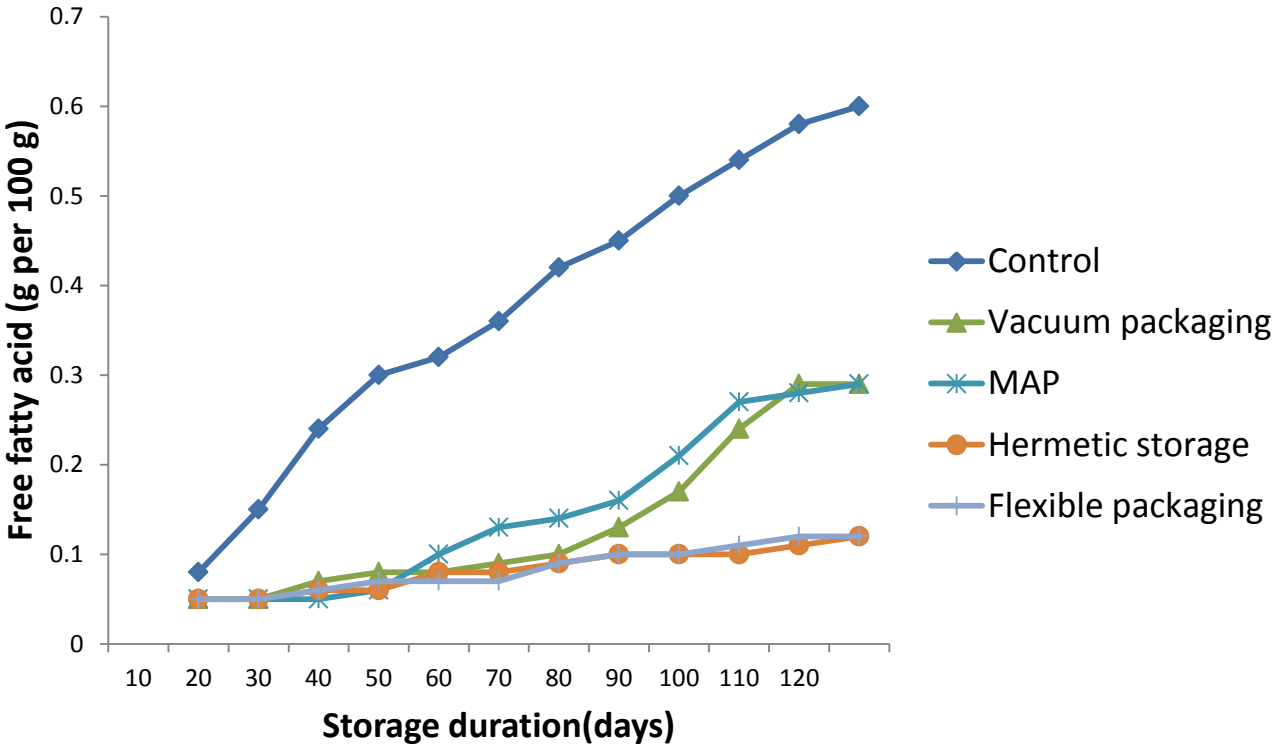
Changes in the free fatty acid content of kodo millet during storage



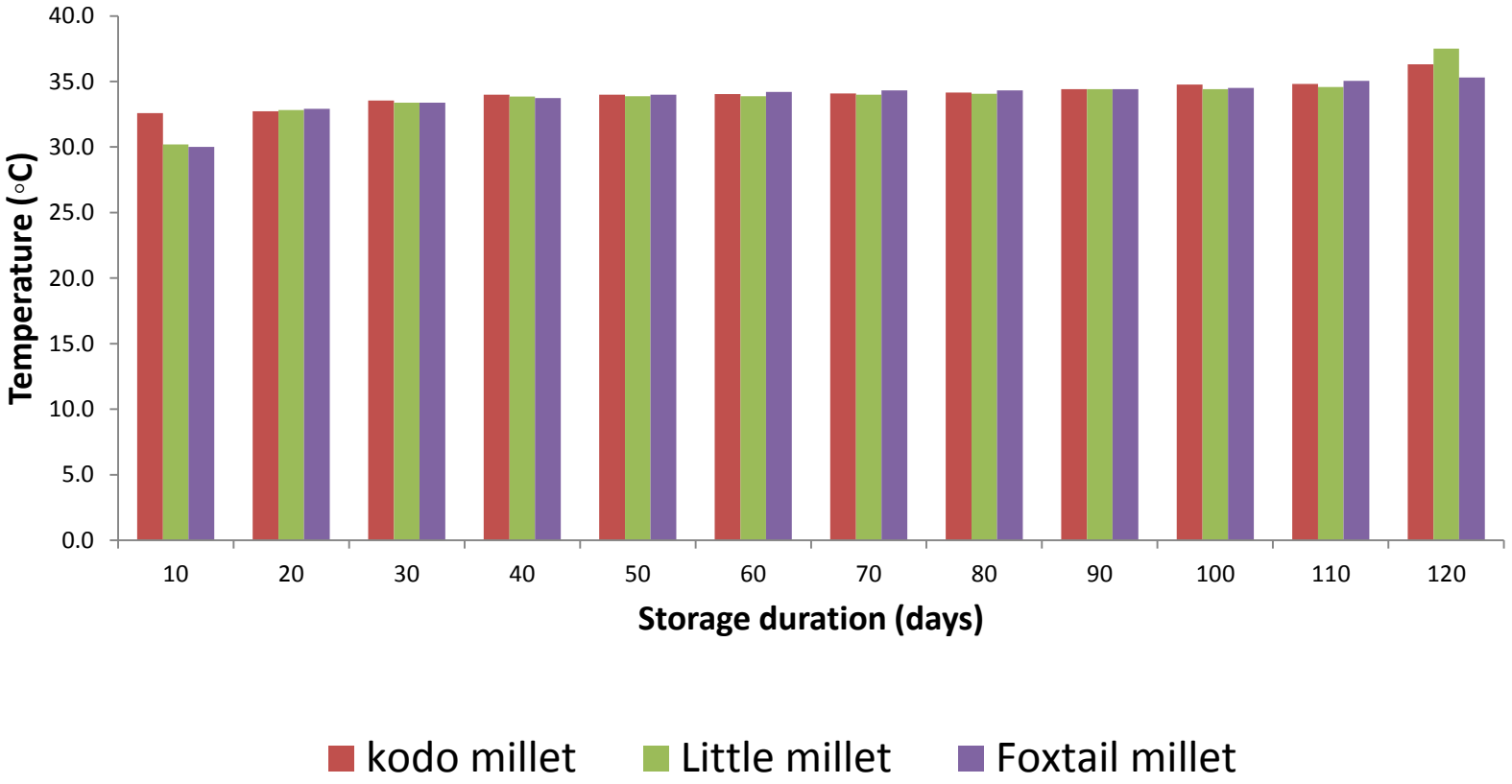
Changes in the Free fatty acid content of little millet during storage



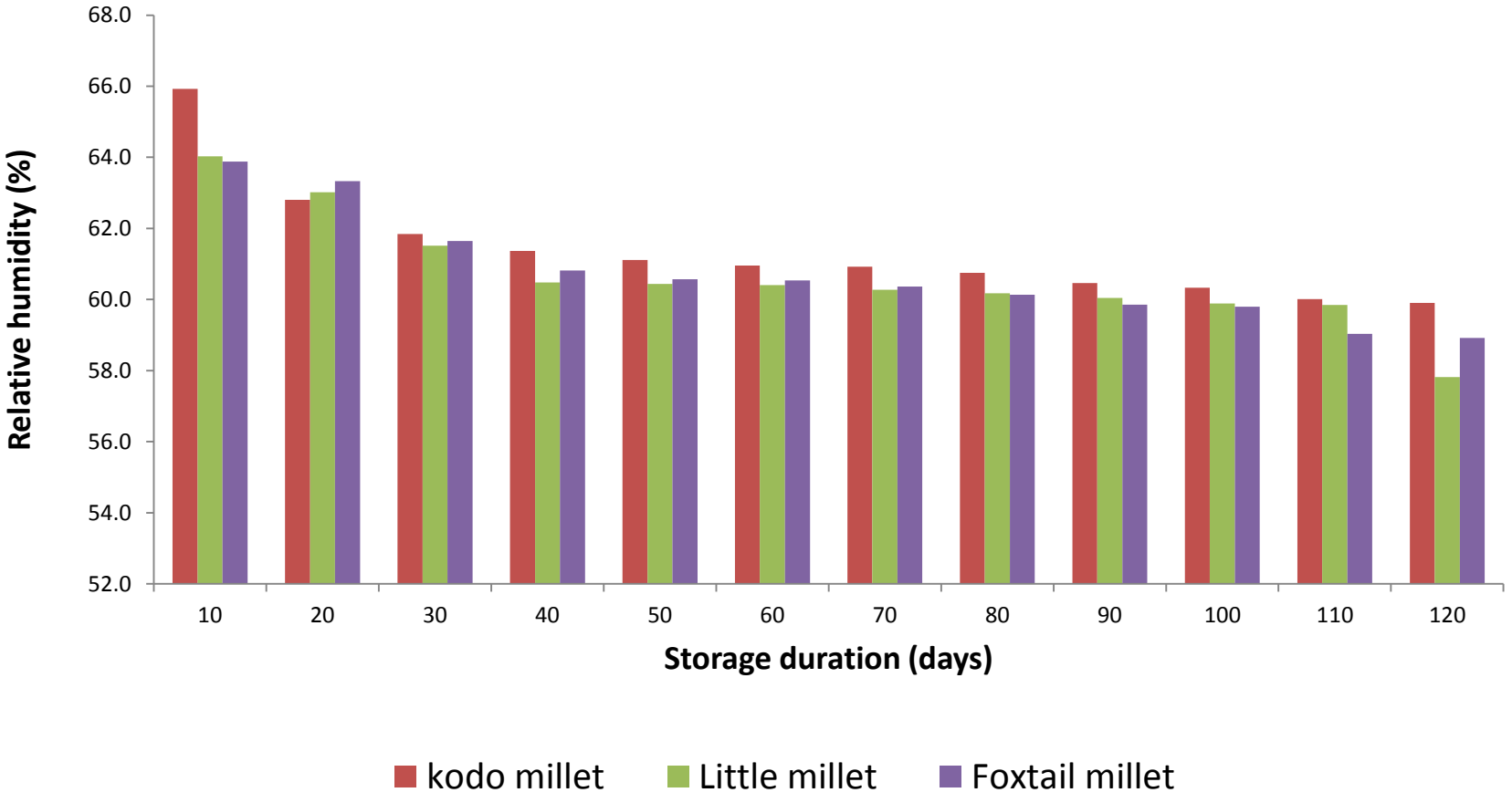
Changes in the Free fatty acid content of foxtail millet during storage



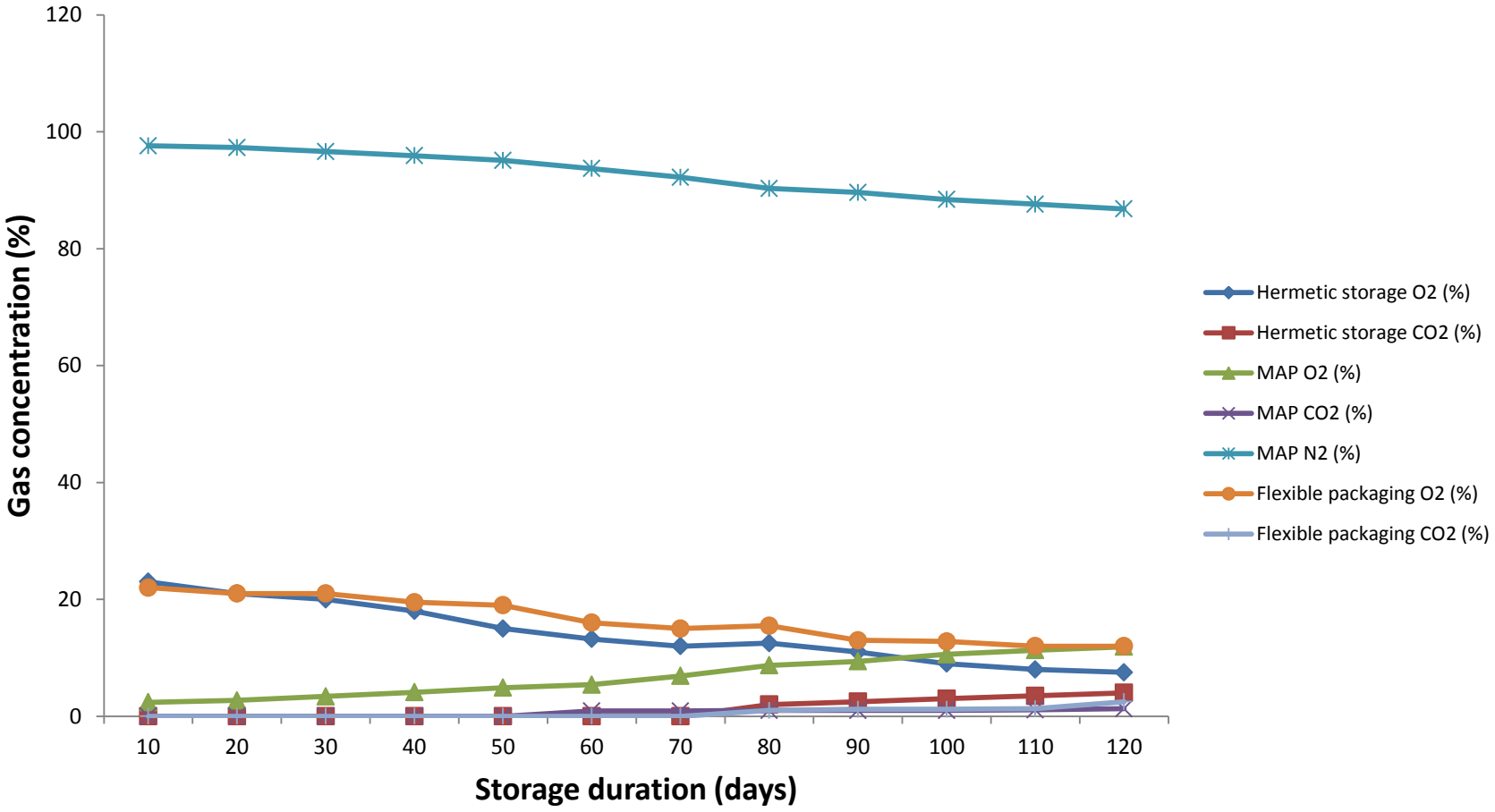
Changes in the temperature of the de-hulled millets during storage



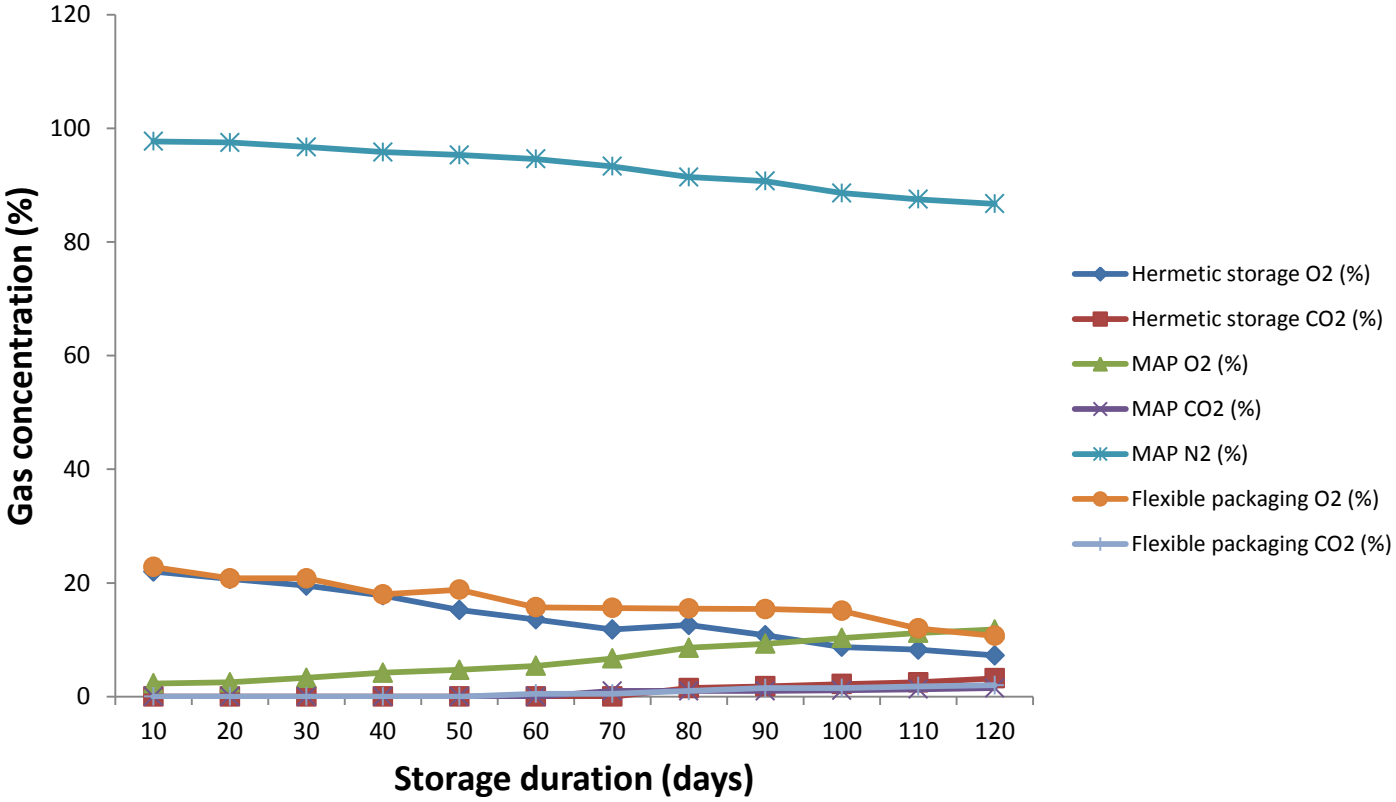
Changes in the relative humidity of the de-hulled millets during storage



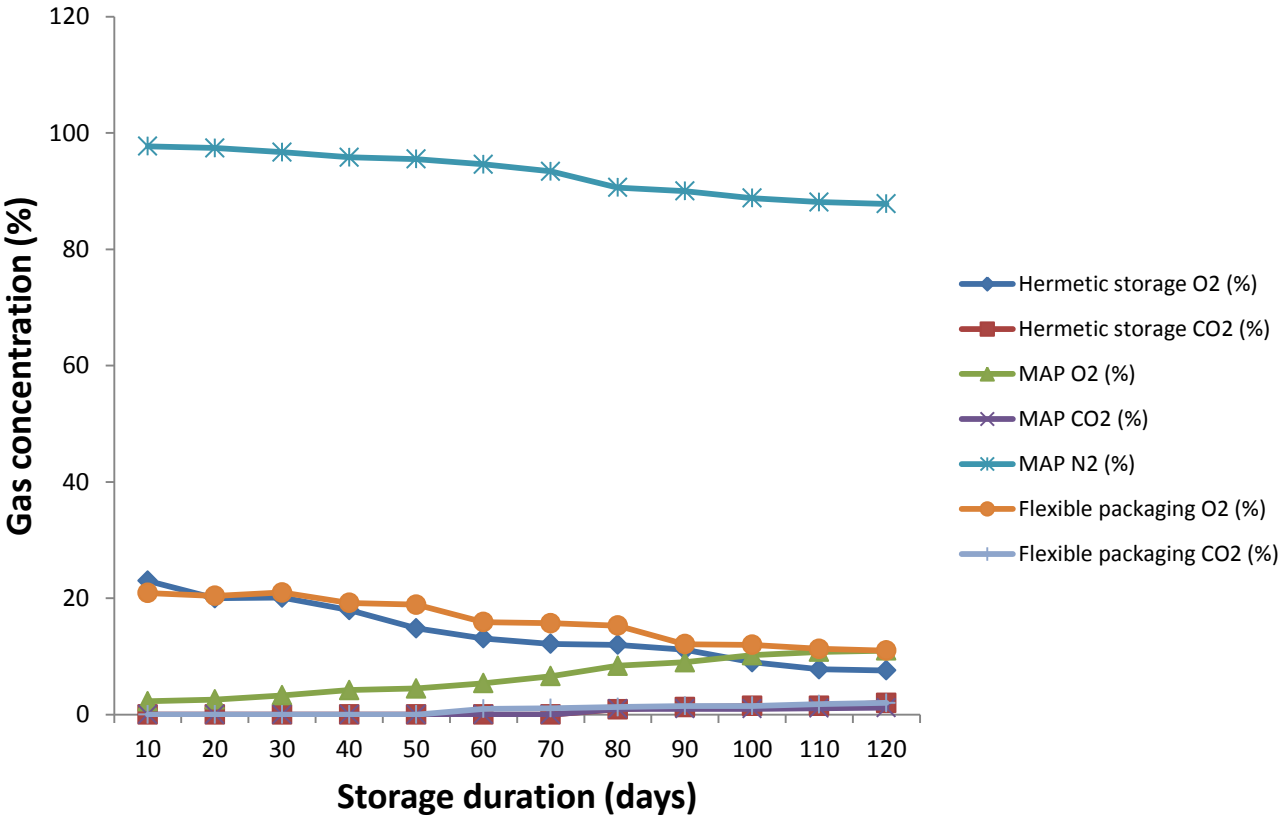
Changes in the gas concentration of kodo millet during storage



Changes in the gas concentration of little millet during storage



Changes in the gas concentration of foxtail millet during storage



Inference

Hermetic storage

- Retained higher amount of phenols
- Production of fatty acid was lower
- No peroxide formation
- No permeability
- Desirable

Thank you