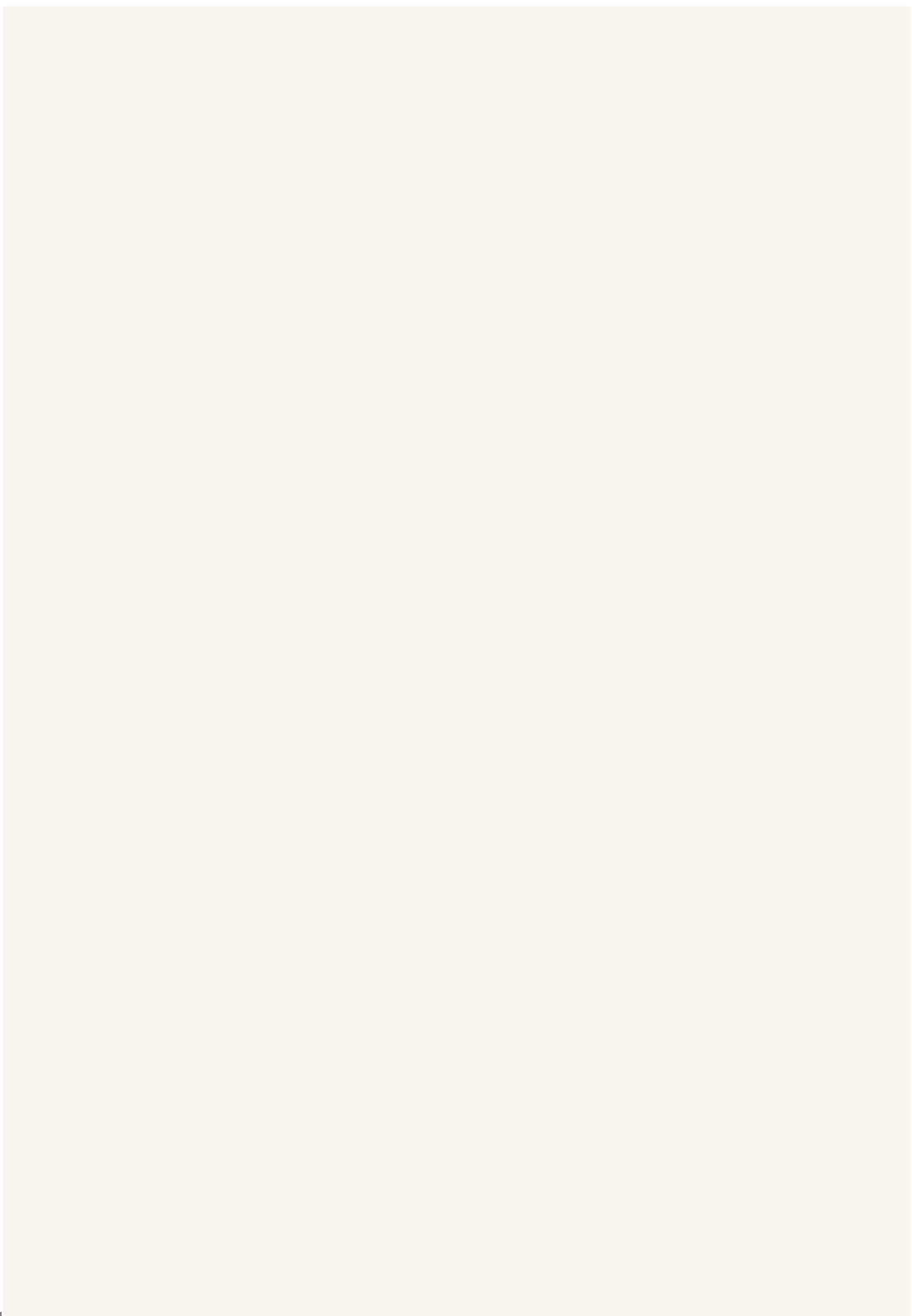


DIETARY DIVERSITY THROUGH INTEGRATED AGRICULTURE

A COOKBOOK FOR
SUSTAINABLE NUTRITION

IIHS, KENGERI CAMPUS
JANUARY 2024



CONTENTS

Preface	5
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RECIPE LIST*

1 <i>Brahmi</i> Juice	11
2 Vegetable <i>Ragi</i> (Finger millet) Soup	13
3 <i>Saame</i> (Little millet) <i>Tikki</i>	15
4 Steamed <i>Ragi</i> (Finger millet) Sprout Salad	17
5 <i>Akki Rotti</i>	19
6 <i>Boodu Kumbalakai</i> (Ash Gourd) <i>Majjige Huli</i>	21
7 Banana Stem <i>Poriyal</i>	23
8 Moringa Leaf Dal	25
9 Palak <i>Raita</i>	27
10 Raw Carrot <i>Halwa</i>	29

**All the recipes can have variation in ingredients depending on individual taste preferences.
Measurements used in the recipes: Cup = 250 g | Teaspoon = 5 g | Tablespoon = 15 g*

PREFACE

At the landscape level, systems integration involves a holistic approach to managing and coordinating multiple interconnected systems within a geographic region to achieve sustainability goals. Systems integration is not only discussed in the classrooms at IIHS, we incorporate it actively in our practice at the Kengeri Campus. Recognising that landscapes are complex mosaics of natural and human-modified systems and that their ecological, social and economic dimensions are intricately linked, is integral to the agricultural activities planned at IIHS, utilising the systems integration approach. Agriculture practices that use chemicals intensively have not only caused economic problems, but also ecological problems such as biodiversity loss, soil and water pollution, and soil erosion. Adoption of integrated agriculture production systems that require reduced inputs and pesticides, fertiliser, and growing techniques help mitigate the environmental and economic issues related to farming and food systems. Agro-ecological practices offer an alternative, low-input management of agroecosystems and hold promise for addressing sustainability issues in agriculture¹.

Such integrated agriculture systems depend on a good understanding of the interactions in nature between the four main components of such systems – fertilisers, pesticides, cultivation, and rotations, and how these interactions influence crop yields and other economic benefits from farming. Alternatives to energy-based inputs include legume (nitrogen fixing) rotations, use of organic matter from waste as well as that from animals and crops, integrated pest management, pest and disease forecasting, biological and cultural pest control, living mulches, mechanical weed control, conservation tillage, specialised innovative cultural techniques, including intercropping, strip cropping, under sowing, trap crops, and double-row cropping².

Mixed cropping, also known as intercropping, is an agricultural practice where two or more crops are grown simultaneously on the same plot of land. Mixed cropping introduces diversity and complexity to the farm ecosystem, and offers a sustainable and productive approach to agriculture, promoting ecological balance, soil health, and farm resilience. While it requires careful planning and adaptation, the potential benefits for the health of both farmers and the environment are significant, and helpful for building a more sustainable food system.

¹ Altieri, M.A. 1989. Agroecology: A new research and development paradigm for world agriculture, *Agriculture, Ecosystems & Environment*, Volume 27, Issues 1–4: 37-46.

² Edwards, C.A. 1989. The importance of integration in sustainable agricultural systems, *Agriculture, Ecosystems & Environment*, Volume 27, Issues 1–4:25-35.

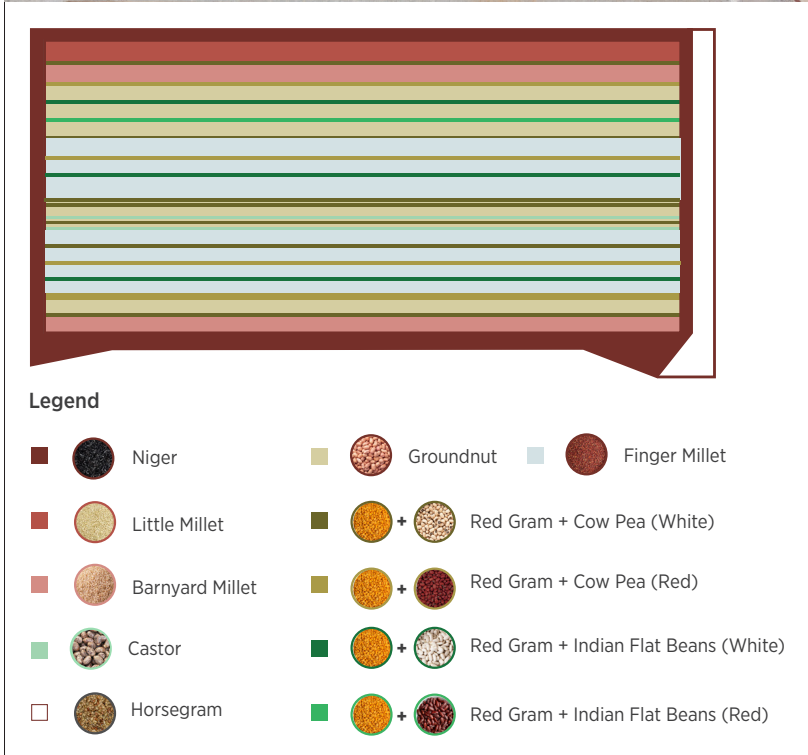


Figure 1 - Mixed cropping system at IIHS Campus, Kengeri

Note: Names on the right side indicate crops in multiple sequential rows, and on the left are crops in a single row in between them. The entire circumference of the plot had an oilseed, and on the right, one strip of pulse crop adjoined a concrete road.

Setting an example for mixed cropping at IIHS, Kengeri Campus

At IIHS, Kengeri Campus, a plot measuring 0.3 hectares cultivated using mixed cropping method. After the harvest of the cover crop, the plot was ploughed twice. A mix of millets, pulses and oilseeds were sown in the plot. Each set of crop seeds was sown according to its spacing. Pulses like red gram were sown at approximately 30 cm spacing and the millets were sown at 15 cm spacing. In total, the plot was covered with 10 different crops – 4 millets, 4 pulses and 2 oil seeds (see Figure 1). After the harvest of one type of millet, another type of oilseed (groundnut) was added to the same plot.

At the time of crop planning on this plot, all functional elements of each crop were considered. For instance, Niger (oilseed) on the periphery served as a trap crop that attracted pests, usually insects, away from nearby target crops. Similarly, two rows of castor plants in the centre provided the same function. Interspersed rows of leguminous crops like pulses (cow pea, pigeon pea, and flat beans) helped in soil nitrogen fixation that benefitted all the surrounding crops. The plot was not watered even once throughout the cropping season. The precipitation was measured to be 403 mm. Other organic nutrient input was added in the form of organic compost from food waste and *Jeevamrutha*³. Many crops were being pollinated by insects, and diverse varieties of insects were observed on this plot.



³ *Jeevamrutha* is a natural, fermented, microbial preparation that enriches the soil and helps plant growth promotion. Key ingredients of *Jeevamrutha* are cow dung (10 kg), cow urine (10 lit), jaggery (2 kg), pulse flour (2 kg), and a handful of garden soil. See details here.

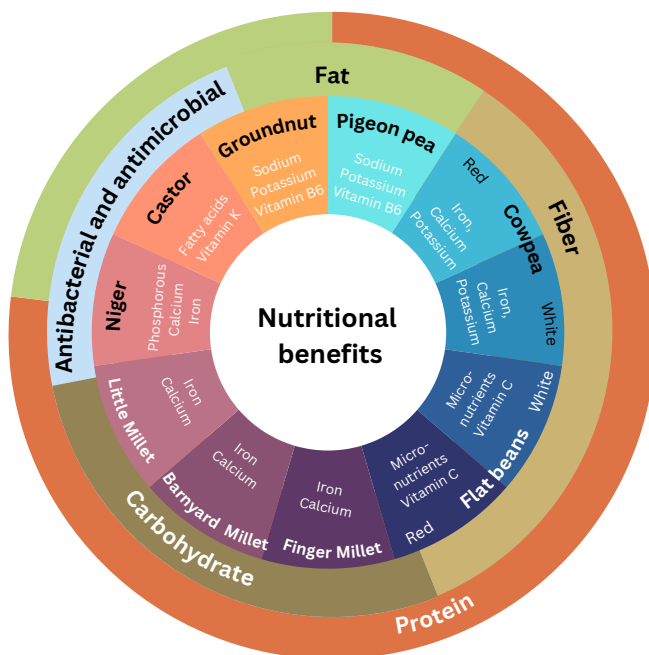


Figure 2 – Key dietary nutrients from each crop category on the Campus

Apart from maintaining the soil nutrient status and bio-pest control, this system of cropping also helped in improved diet diversity. The intermittent harvesting of crops enhanced the nutrient intake of the Campus inhabitants (see Figure 2).

Each recipe in this cookbook features a key ingredient grown on the Campus using sustainable practices. Reducing food miles is one of the objectives, but another is essentially, to create integrated systems of food, water, energy, biodiversity, and health.

RECIPES





INGREDIENTS

1. 1 cup of Brahmi leaves
2. 1 tsp roasted cumin seeds
3. A pinch of black salt
4. A pinch of pepper
5. ½ cup of coconut water or grated coconut
6. Buttermilk or lemon juice
7. Jaggery or 2 tsp honey
8. Salt as per taste

Source of key ingredients

Brahmi

IHS, Kengeri Campus

Pollinated by

Insects

Water usage

(per 1 kg of Brahmi)

1500 litres

Nutritional value

(per 100 g of Brahmi)

<i>Energy</i>	<i>38 Kcal</i>
<i>Protein</i>	<i>2.1 g</i>
<i>Carbohydrates</i>	<i>0.6 g</i>
<i>Fat</i>	<i>5.9 g</i>
<i>Dietary fibre</i>	<i>1.05 g</i>
<i>Other micronutrients</i>	<i>Calcium, Phosphorus, Iron</i>

BRAHMI JUICE

INSTRUCTIONS

- Chop the Brahmi leaves and put them in a juicer along with cumin seeds, pepper and half cup grated coconut.
- Boil this mixture in 4 glasses of water.
- Strain the juice and add buttermilk or juice of half a lemon. Add jaggery or salt as per taste.
- This juice can also be prepared as a hot drink or tea during winter and rainy seasons.



INGREDIENTS

1. 1 cup ragi flour
2. 10 cups water
3. 4 tsp oil
4. 2 inch cinnamon
5. 10 cloves garlic, sliced
6. 4 chillies, finely chopped
7. 1 onion, finely chopped
8. 1 carrot, finely chopped
9. 10 beans, finely chopped
10. 6 tbsp peas
11. 4 tbsp sweet corn
12. 4 tbsp cabbage, shredded
13. 2 tsp salt
14. 1 tsp pepper powder
15. 4 tbsp lemon juice
16. 4 tbsp spring onion, chopped

Source of key ingredients

Ragi (Finger millet)

IIHS, Kengeri Campus

Water usage

(per 1 kg of Ragi)
771.77 litres

Nutritional value

(per 100 g of Ragi)

Energy	328 Kcal
Protein	7.30 g
Carbohydrates	72 g
Fat	1.30 g
Dietary fibre	11.50 g
Other micronutrients	Iron, Sodium, Calcium, Potassium, Carotene

VEGETABLE RAGI (FINGER MILLET) SOUP

INSTRUCTIONS

- In a bowl, take ½ cup ragi flour and mix with 1 cup water.
- Make sure there are no lumps in the ragi slurry. Keep aside.
- Heat 2 tsp oil. Add 1 inch cinnamon, 5 cloves garlic, 2 chillies, and saute till they turn aromatic.
- Add ½ onion, ½ carrot, 5 beans, 3 tbsp peas, 2 tbsp sweet corn, 2 tbsp cabbage, and stir fry for 2 minutes.
- Also, add 2 tbsp cabbage and stir fry without overcooking the vegetables.
- Now add 4 cups of water, 1 tsp salt, and ½ tsp pepper powder.
- Mix well and boil for 3 minutes, until the water turns flavourful.
- Now add the ragi slurry and stir continuously for 2 minutes.
- Boil for 3 minutes or until the ragi is cooked well and turns glossy.
- Turn off the flame and add 2 tbsp lemon juice.
- Enjoy the ragi soup, topped with 2 tbsp spring onion or coriander.



INGREDIENTS

1. ½ cup Little millet
2. 1.25 cups water
3. 2 potatoes, boiled mashed/
grated
4. 2 green chillies, finely
chopped
5. 1 inch ginger, grated
6. 1 tsp red chilli powder
7. ½ tsp chaat masala
8. 4 tbsp coriander leaves,
chopped

Source of key ingredients

Saame (Little millet)

IHS, Kengeri Campus

Water usage

(per 1 kg of Little millet)
1800 litres

Nutritional value

(per 100 g of Little millet)

Energy	378 Kcal
Protein	9.7 g
Carbohydrates	60.9 g
Fat	5.2 g
Dietary fibre	7.6 g
Other micronutrients	Calcium, Iron, Thiamine (B1), Riboflavin (B2), Niacin (B3)

SAAME (LITTLE MILLET) TIKKI

INSTRUCTIONS

- Wash the Little millet 3-4 times. Add drained millet and water in the pressure cooker.
- Cover with lid and pressure cook on high flame for 2-3 whistles. Switch off the flame and let it cool.
- Remove the cooked millet in a mixing bowl. Add boiled potatoes, green chillies, ginger, red chilli powder, chaat masala, salt and coriander leaves. Mix well.
- Make small balls from the mixture. Take each ball and flatten it.
- Shape each ball into a patty/ tikki.
- Heat oil on tawa/ pan. Slow the flame and place patty/ tikki on it.
- Shallow fry on medium flame until both sides are golden and crispy.
- Remove it from the pan and place it on the serving plate.
- Serve hot with mint chutney and chai (tea).



INGREDIENTS

1. 1 cup ragi sprouts
2. ½ cup chopped onion
3. ½ cup chopped tomato
4. ½ cup chopped cucumber
5. 1 tbsp lemon juice
6. ½ tsp black pepper powder
7. ½ tsp chaat masala
8. ½ tsp black salt

Source of key ingredients

Ragi

IIHS, Kengeri Campus

Water usage

(per 1 kg of Ragi)
771.77 litres

Nutritional value

(per 100 g of Ragi)

Energy	328 Kcal
Protein	7.30 g
Carbohydrates	72 g
Fat	1.30 g
Dietary fibre	11.50 g
Other micronutrients	Iron, Sodium, Calcium, Potassium, Carotene

STEAMED RAGI (FINGER MILLET) SPROUT SALAD

INSTRUCTIONS

- Soak the ragi seeds in water for 24 hours.
- After 24 hours, drain the water and tie the ragi in a cloth. Hang it in a warm place for the next 48 hours.
- After 48 hours, the ragi seeds should have sprouted.
- Steam the sprouted ragi until they are cooked.
- In a bowl, mix the steamed ragi sprouts, chopped onion, tomato, and cucumber.
- Add lemon juice, black pepper powder, chaat masala, and black salt.
- Mix well and serve



INGREDIENTS

1. 2 cups rice flour
2. 1 onion, finely chopped
3. 2 tbsp dill leaves
4. 2 tbsp coriander, finely chopped
5. 2 tbsp curry leaves, finely chopped
6. 1 inch ginger, grated
7. 2 chillies, finely chopped
8. 1 tsp cumin
9. 1 tsp salt
10. water, as required
11. oil, for roasting

Source of key ingredients

Rice

Farmers from neighbouring district in Karnataka

Water usage

(per 1 kg of Rice)
1000 litres

Nutritional value

(per 100 g of Rice)

Energy	366 Kcal
Protein	5.95 g
Carbohydrates	80.1 g
Fat	1.42 g
Dietary fibre	2.4 g
Other micronutrients	Calcium, Magnesium, Phosphorus, Potassium

AKKI ROTTI

INSTRUCTIONS

- Take 2 cups of rice flour in a large bowl. Make sure to use fine rice flour and not coarse rice flour.
- Add 1 onion, 2 tbsp dill leaves, 2 tbsp coriander and 2 tbsp curry leaves.
- Also add 1 inch ginger, 2 chilli, 1 tsp cumin and 1 tsp salt.
- Squeeze and mix well until onions release all the moisture.
- Now add $\frac{3}{4}$ cup water and start to mix the flour.
- Add more water as required and knead the smooth and soft dough without putting much pressure. Akki rotti dough is ready, keep aside.

To prepare in a banana leaf:

- Grease the banana leaf. If the banana leaf is not tender, heat slightly and then grease with oil.
- Take a ball-sized dough and tap gently to spread it on the leaf.
- Make 3 holes on the thinly-spread dough; this will help in roasting as we can add oil in the centre.
- Now flip over to hot tawa and press gently.
- After a minute, gently peel the banana leaf.
- Flip over once the base is cooked.
- Now add oil and roast both sides until it turns slightly golden.

To prepare on tawa:

- Grease the heavy-bottomed tawa with 1 tsp oil.
- Take ball-sized dough and tap gently to spread it on the tawa.
- Place the tawa on medium flame.
- Cook on both sides and add a tsp of oil until it turns golden brown.
- Enjoy the akki rotti with a spicy chutney.



INGREDIENTS

1. 2 cups ash gourd (white pumpkin), seeds and skin removed, cut into cubes.
2. 1 tbsp chana dal
3. 1 cup fresh coconut, grated
4. 3 green chillies
5. 1 inch ginger
6. Salt, to taste
7. 1 cup curd, churned with 1 cup of water

For Tempering:

1. 2 tsp coconut oil
2. ½ tsp mustard seeds
3. 1 tsp cumin seeds
4. ¼ tsp asafoetida
5. 4-5 curry leaves

Source of key ingredients

Ash Gourd, Buttermilk

Farmers from neighbouring district in Karnataka

Water usage

(per 1 kg of Ash Gourd)
240 litres

Pollinated by

Bees

BOODU KUMBALAKAI (ASH GOURD) MAJJIGE HULI

INSTRUCTIONS

- To begin making Kumbalakai Majjige Huli, first soak the chana dal in ¼ cup of water for 20 minutes.
- Steam the ash gourd either using the pressure cooker or a steamer.
- Add the coconut, soaked chana dal, green chillies, ginger and salt into a mixer grinder and make a smooth paste. Keep aside.
- In a saucepan, stir together the cooked pumpkin and the ground coconut mixture. Stir in 1 cup of water, turn on the heat and allow the mixture to come to a boil.
- The Majjige Huli will begin to thicken. At this point stir in the buttermilk and boil for another minute. Turn off the heat.
- Now temper the Kumbalakai Majjige Huli.
- Heat oil in a small saucepan, add mustard seeds and allow it to crackle.
- Add cumin seeds and saute for 5 seconds, then add the curry leaves and asafoetida and turn off the heat. Add this tempering to the Majjige Huli.
- Serve Kumbalakai Majjige Huli Recipe with Steamed Rice.

Nutritional value

(per 100 g of Ash Gourd and 100 ml of buttermilk)

	Ash Gourd	Buttermilk
Energy	92 Kcal	40 Kcal
Protein	6.7 g	3.26 g
Carbohydrates	13.4 g	4.89 g
Fat	1.7 g	1.22 g
Dietary fibre	0.9 g	0 g
Other major micronutrients	Calcium, Magnesium, Phosphorus, Potassium, Vitamin B, Vitamin C	Calcium, Sodium, Phosphorus, Riboflavin, Vitamin B12



INGREDIENTS

1. 1 ¼ cups of banana stem, cut into small dices and soaked in buttermilk
2. ¼ cup pearl onions (sambar onions), finely chopped
3. 2 green chillies, finely chopped
4. 1 sprig curry leaves, finely chopped
5. ½ tsp turmeric powder
6. ½ tsp mustard seeds
7. 2 tbsp fresh coconut, grated
8. Oil for cooking
9. Salt to taste

Source of key ingredients

Banana stem

IIHS, Kengeri Campus

Water usage

(per 1 kg of Banana)

107.5 litres

Pollinated by

Bats & Birds

Nutritional value

(per 100 g of Banana stem)

<i>Energy</i>	<i>14 Kcal</i>
<i>Protein</i>	<i>1.3 g</i>
<i>Carbohydrates</i>	<i>2.6 g</i>
<i>Fat</i>	<i>0.15 g</i>
<i>Dietary fibre</i>	<i>1.1 g</i>
<i>Other micronutrients</i>	<i>Sodium, Potassium</i>

BANANA STEM PORIYAL

INSTRUCTIONS

- To begin making the Vazhathandu (Banana stem) Poriyal, pressure cook the banana stem along with buttermilk, salt and turmeric powder for 1 whistle. Release the pressure and drain the water out.
- Heat a skillet with oil. Add mustard seeds and curry leaves and let the mustard seeds crackle.
- Once done, add the cooked Banana stem and mix everything properly.
- After a minute, add in the green chillies, salt and give it a mix. Let it cook for 2 minutes.
- Then, add grated coconut and stir fry for 5 minutes. Switch off the stove.
- Serve the Vazhathandu Poriyal Recipe with Steamed Rice and Rasam.



INGREDIENTS

1. 1 cup pink masoor dal (split)
2. 1 cup drumstick leaves (moringa), cleaned and chopped
3. ¼ tsp asafoetida (hing)
4. 1 tsp cumin seeds
5. 1 inch ginger, finely chopped
6. 1 dry red chilli
7. 1 tomato, chopped
8. 1 green chilli, slit
9. 2 tsp coriander powder
10. ½ tsp turmeric powder
11. ½ tsp red chilli powder
12. salt, to taste
13. 1 tbsp ghee
14. 1 lemon, juice extracted

Source of key ingredients

Moringa leaves, Masoor dal
IIHS, Kengeri Campus

Water usage

(per 1 kg of Moringa and
Masoor Dal)

Moringa: 243 litres

Masoor Dal: 1011 litres

Pollinated by

Carpenter bee

MORINGA LEAF DAL

INSTRUCTIONS

- To prepare the Moringa Masoor Dal, first wash and soak the masoor dal in 3 cups of water for at least 30 minutes. While the dal is soaked clean, wash and pat dry the drumstick leaves.
- Next, finely chop the drumstick leaves. Heat a teaspoon of oil in a wok or kadai and add the chopped drumstick leaves.
- Sprinkle some salt, cover the pan and cook the Moringa leaves until soft and tender. It takes no longer than 2 to 3 minutes. Once done, turn off the heat and keep the cooked moringa leaves aside.
- Then cook the masoor dal with the spices. Heat ghee in a pressure cooker over medium heat. Add asafoetida and cumin seeds and allow it to crackle.
- Add the chopped tomato, ginger, green chillies along with coriander powder, turmeric powder, red chilli powder and saute for a minute or so over medium heat.
- Add soaked masoor dal along with the soaked water to the onion-tomato mixture. Close the lid of the pressure cooker and put the weight on.
- Cook masoor dal for 3 whistles. Turn the heat to low and let the dal simmer for about 5 minutes. Turn off the heat. Let the pressure settle.
- Once the pressure has released, open the cooker and stir in the sautéed moringa leaves, squeeze juice from one lemon.
- Serve the Moringa Masoor Dal with Steamed Rice.

Nutritional value

(per 100 g of Masoor dal and Moringa)

	<i>Moringa</i>	<i>Masoor dal</i>
Energy	92 Kcal	356 Kcal
Protein	6.7 g	24.44 g
Carbohydrates	13.4 g	64.44 g
Fat	1.7 g	0 g
Dietary fibre	0.9 g	11.1 g
Other major micronutrients	Calcium, Magnesium, Phosphorus, Potassium, Vitamin B, Vitamin C	Calcium, Potassium, Vitamin C



INGREDIENTS

1. 4 cup yoghurt (curd)
2. ½ cup chopped tomato
3. ½ cup chopped onion
4. 1 pinch black salt
5. 2 green chillies
6. 2 bunch spinach (grown in hydroponic system)
7. Salt as required
8. 2 tsp roasted cumin seeds
9. Water as required
10. 2 tbsp vegetable oil

Source of key ingredients

Hydroponics palak

IIHS Annex 2

Water usage

(per 1 kg of Palak)

Normal grown: 200 litres

Hydroponics palak: 40 litres

Nutritional value

(per 100 g of Palak)

<i>Energy</i>	<i>23 Kcal</i>
<i>Protein</i>	<i>2.9 g</i>
<i>Carbohydrates</i>	<i>3.6 g</i>
<i>Fat</i>	<i>0.4 g</i>
<i>Dietary fibre</i>	<i>2.2 g</i>
<i>Other micronutrients</i>	<i>Sodium, Potassium, Vitamin C, Iron, Vitamin B6, Magnesium, Calcium</i>

PALAK RAITA

INSTRUCTIONS

- Wash and chop the green chillies and spinach* (palak). Keep it aside in a bowl.
- Place a pan on medium heat, add oil. Once the oil is heated, add the cumin seeds and let them sputter. Then add the spinach/ palak and saute for 5 minutes. Let it cool.
- Take a big bowl, beat the yogurt in it till smooth. You can add some water to maintain consistency.
- Now add all the ingredients and the sauteed spinach to the yogurt and mix well. Garnish with coriander leaves. You can refrigerate the raita for 5-10 minutes. Serve chilled.

*Palak is harvested from hydroponics system at IIHS, Annex 2



INGREDIENTS

1. ½ cup finely-grated, unpeeled carrots
2. ¼ tsp green cardamom powder
3. ½ cup grated fresh coconut
4. ¼ cup pitted soft black dates, ground between fingers, a few at a time
5. Few roasted cashews

Source of key ingredients

Carrot

IHS, Kengeri Campus

Water usage

(per 1 kg of Carrot)

222 litres

Pollinated by

Honey bees

Nutritional value

(per 100 g of Carrot)

Energy	41 Kcal
Protein	0.9 g
Carbohydrates	9.6 g
Fat	0.2 g
Dietary fibre	2.8 g
Other micronutrients	Vitamin A, Biotin, Potassium, Vitamin K1, Vitamin B6

RAW CARROT HALWA

INSTRUCTIONS

- Put carrots, cardamom powder and coconut in a bowl and mix well.
- Knead the ground dates into the carrot coconut mixture.
- Repeat this process until all the dates are kneaded into the mixture.
- Transfer to a serving bowl and chill in the refrigerator for 2 hours.
- Decorate with roasted cashews and serve.

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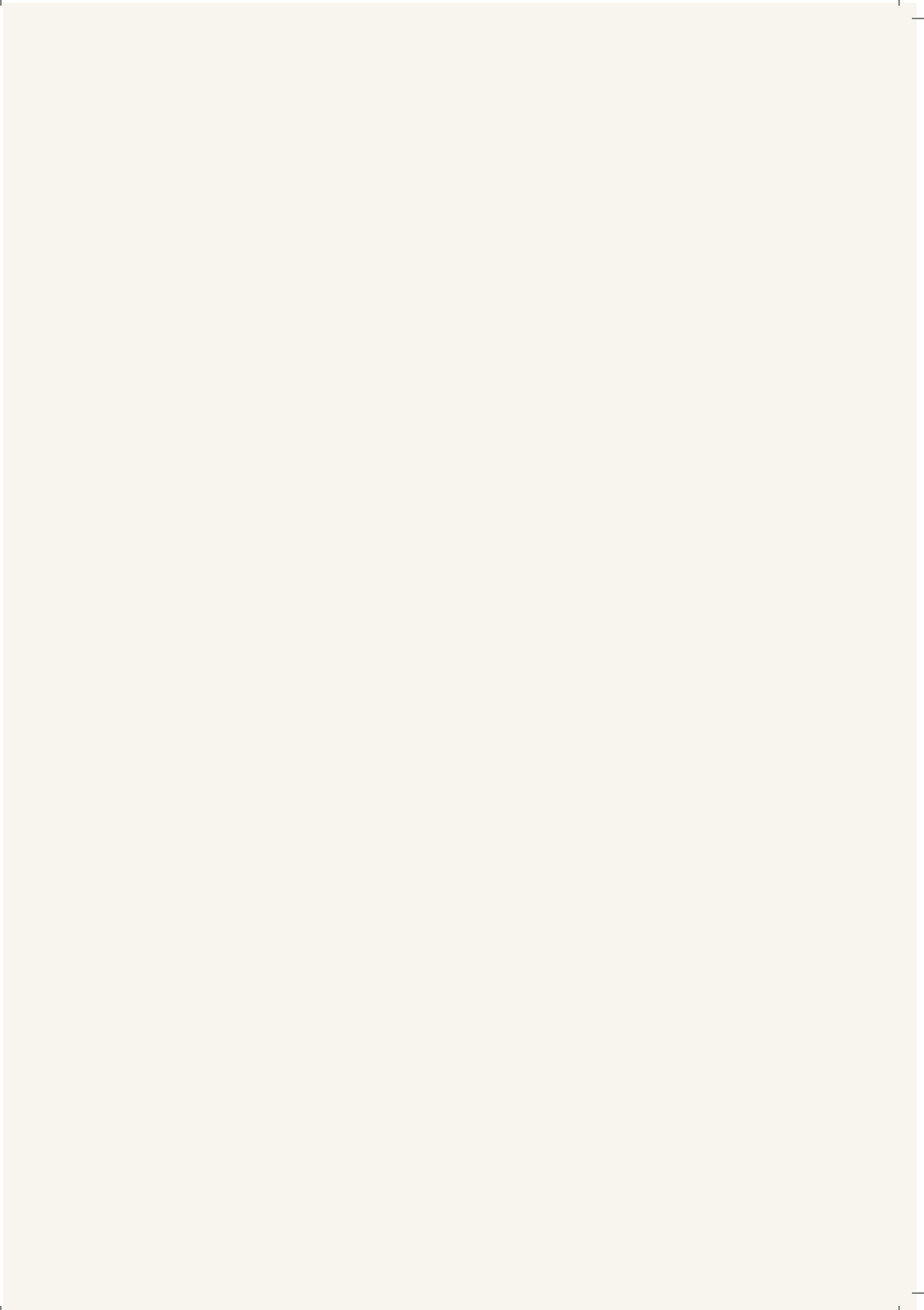
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