Native Agrobiodiversity for life and Environments

Madan R. Bhatta
Freelance plant breeder
(Former National Wheat Coordinator/Chief, NAGRC)
madanrajbhatta@gmail.com

Global population scenario

Year	population	Doubling year
AD 1	25 million	–
1650	50 million	1650
1850	1 billion	200
1930	2 billion	80
1975	4 billion	45
2011	7 billion	36
2022 Nov 15	8 billion (projected in 2027)	11 (47 yrs double)
2037	9 billion	15
2050	9.5 -10 billion	13

NEPAL- Present population = 29.4 million

At present birth rate, it will be 40.2 million in 2050

Global Population Explosion (Old projection)

Year	Population	Years to double
1 AD	250 million	
1650	500 million	1650 years
1850	1 billion	200 years
1930	2 billion	80 years
1975	4 billion	45 years
2011	7 billion	36 years
2027	8 billion	16 years
2050	9.5 billion	23 years

Global food production scenario (FAO, 2021)

Total food production 2813 million tons (annual growth rate 2.14%)

SN.	Crops	Production (million tons)	Remarks
1	Maize	1509.5	43 % global cereals used for animal feed
2	Wheat	778.92	
3	Rice (milled)	525..6	
4	Barley	147.05	
5	Oats	22.68	
	Rye	12.38 ?	
6	Finger Millet	3..83	
7	Buckwheat	2.29	
8	Sorgham	60.06	

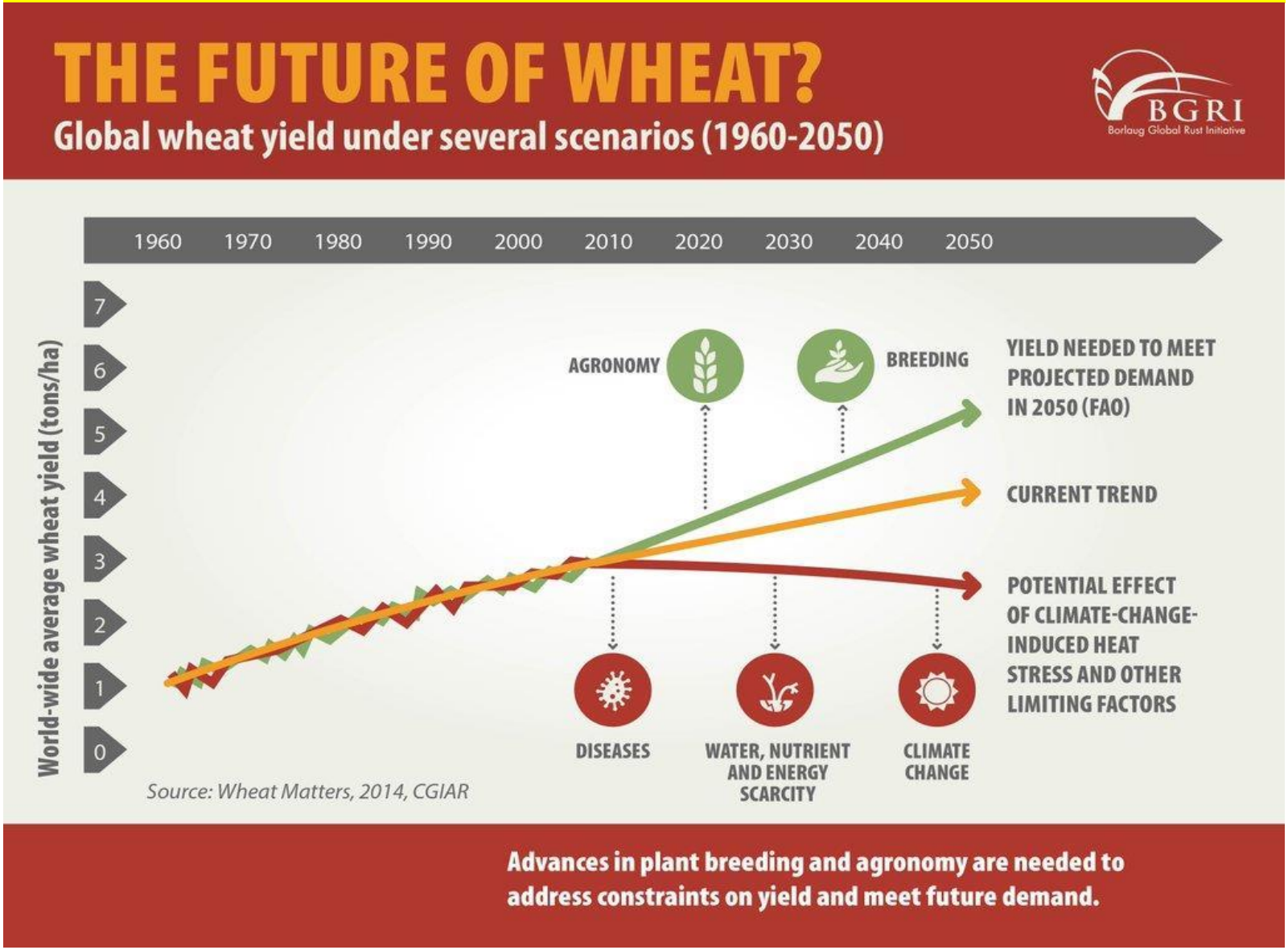
To feed 2050's global population, need 60 to 70 percent additional food production which comes around 4500 million tons

Nepal
Production of major food security crops (000' tons)

Year	Rice (milled)	Maize	Wheat	Millet	Barley	Buckwheat
2000	2811	1484	1158			
2005	2806	1734	1394			
2010	2973	2068	1746			
2015	2863	2145	1737			
2018	3330	2550	1786			
2020	3654	2998	2127	326	29	16
2050*	5846	4796	3400	521	46	26

*Projected based on 2020 production

Challenges to future Global Food security



Food security situation at Global level

- ✓ In 2022, world hunger rose to as many as 825 million people are still undernourished at global level.
- ✓ 11.7 % of the 8 billion global population facing food insecurity.
- ✓ Number of people unable to get healthy diet to almost 3.1 billion
- ✓ In Asia and the Pacific the figure is 520 million, 62 percent of the world's total), out of which 281 million in the Southern Asia sub-region.
- ✓ 149 million children under five years of age across the world still suffer from stunted growth, out of whom (87 million) live in Asia.

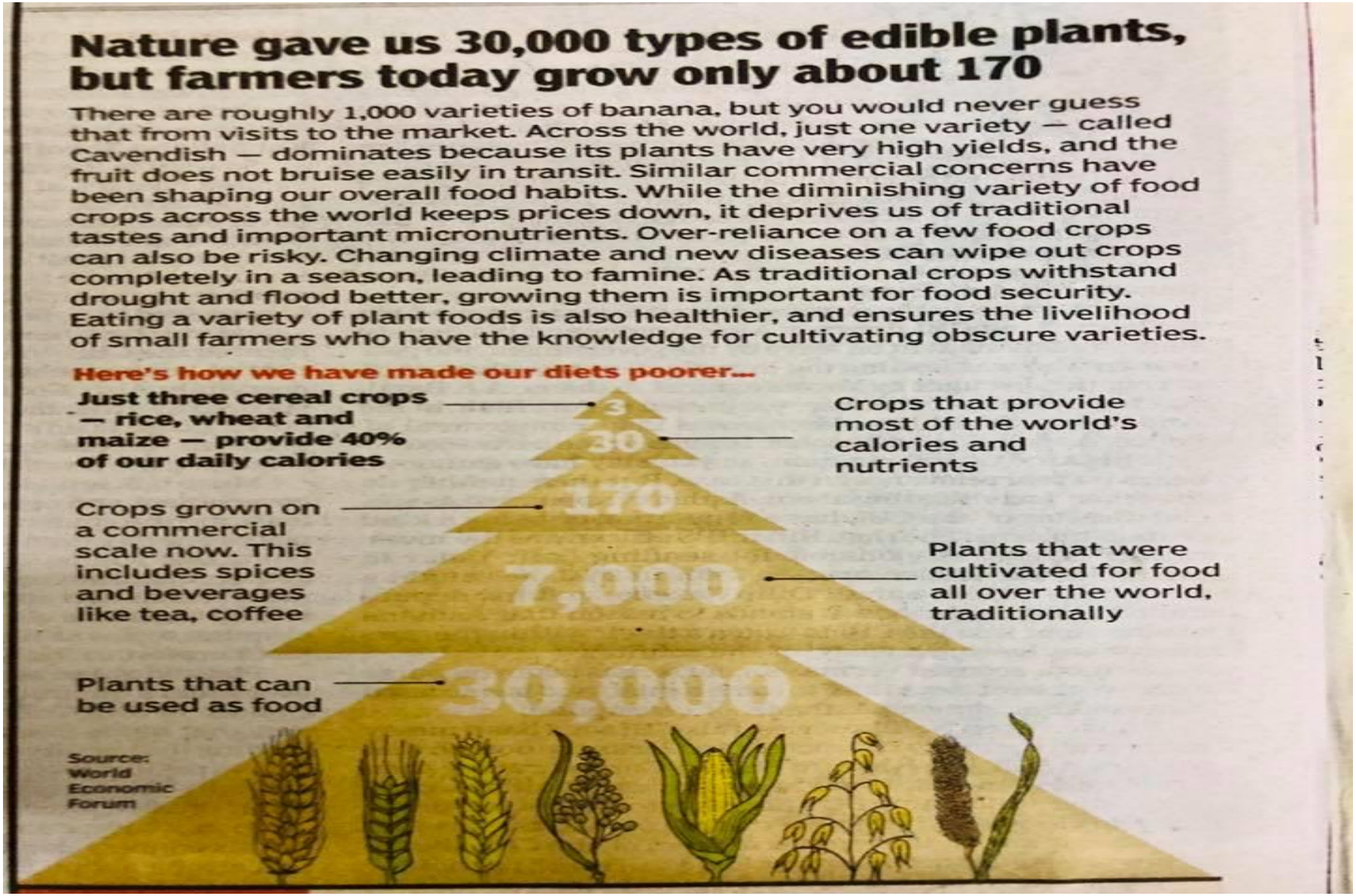
Source: State of food security and nutrition in the world 2022

Food security situation at Global level

- Globally, only four crops— rice, wheat, maize and Potato covered 555 million ha of arable land, delivering more than 60% of the world's consumption of calories
- And these crops are now highly vulnerable to climate change and new aggressive pathogens of diseases.
- About 95% of the world's food needs are provided by just 30 species of plants, while at least 170 crops including spices, beverages, tea and coffee are presently cultivated
- Traditionally more than 7000 plants were cultivated for food over the world
- While More than 30,000 plants can be used as food around the world.

Source: World economic forum

Agrobiodiversity for human diets

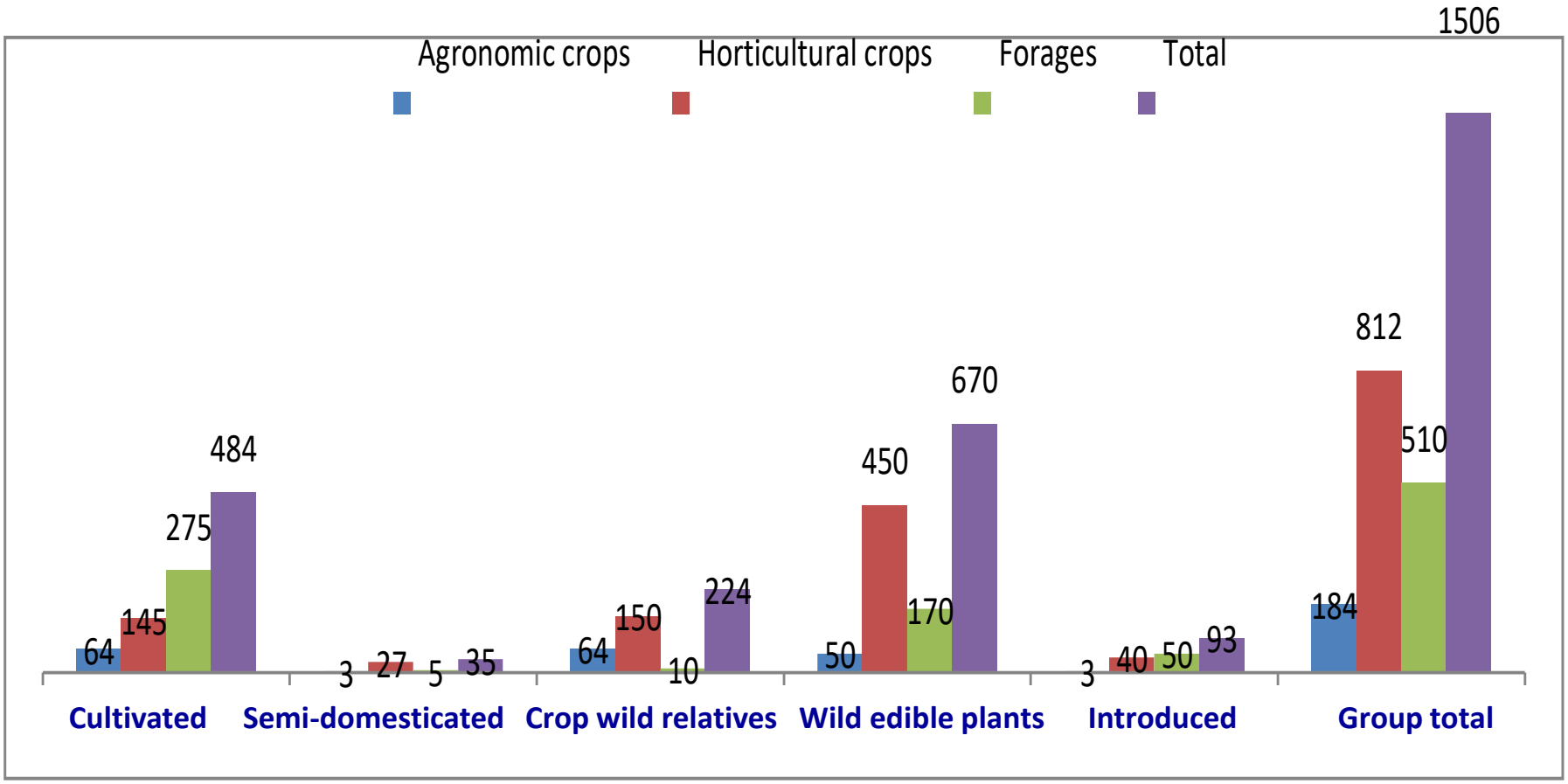


Agrobiodiversity rich country Nepal

- **0.03 % of global land area**
- **Harbors 3% of world flora and 1 % fauna**
- **Out of 24300 reported biological species 28% (6618) sp. belong to agricultural (Flora represent 2833 while fauna 3785 species)**
- **Crop and forage species together represent 1506**
- **Crop components 1026 species**
- **484 cultivated native crop species**
- **64 - Agronomic sp**
- **145 - Horticultural sp**
- **275 - Forage and fodder sp**

83 % of Nepal's total cultivated area of 3,091,000 ha is occupied by three major crops Rice, maize and wheat

Agrobiodiersity status Nepal



- **Number of crop species under different groups (wild edible plants also included, 170 wild forage species and ornamental plants are not included).**
- ***Source: Joshi 2017***

Some of the Important Smart crops of Nepal for strengthening food security (34 crops)

Cereals/pe seudo cereals/Millets	1. Setaria italica (Foxtail millet) 2. Panicum miliaceum (Proso millet) 3. Sorghum bicolor (Sorghum) 4. Hordium vulgare var nudum (Naked barley) ऊवा 5. Grain Amaranth *Amaranthus caudatus* (लट्टे) 6. Fagopyrum spp (Buckwheat) फापर
Roots and Tubers	1. Colocasia esculenta (Taro) 2. Dioscorea alata (Greater yam, white yam) 3. Amorphophallus paeoniifolius (Elephant foot yam) 4. Dioscorea nepalensis (Deltoid yam) 5. Ipomoea batatas (Sweet potato)
Nuts and Pulses	1. Vigna umbellata (Rice bean) मस्यांग २. Vigna radiata (Mungbean/Green gram) मुंग 3. Macrotyloma uniflorum (Horse gram) गहत 4. Lathyrus sativus (Grass pea) खेसारी 5. Pisum sativum (Small pea) – indigenous to Nepal 6. Vicia faba (Faba bean) – small and large

Horticulture	1. Sechium edule (Chayote) 2. Moringa olifera (Drumstick) सितल 3. Benincasa hispida (Ash gourd) 4. Trigonella foenum-graecum (Fenugreek) 5. Chenopodium album (Lamb's quarter) 6. Amaranthus gracilis (Green amaranth) 7. Phytolacca acinosa (Sweet belladonna) 8. Artocarpus heterophyllus (Jackfruit) 9. Aegle marmelos (Wood apple) 10. Emblica officinalis (Amla,ndian gooseberry) 11. Annona squamosa (Custard apple) 12. Tamarindus indica (Imili)
Oilseeds and Spices	1. Linum usitaissimum (Linseed) 2. Guizotia abyssinica (Niger) 3. Bassia latifolia (Nepali butter tree, fruit tree) 4. Perilla frutescens (Silam) 5. Zanthoxylum armatum (Nepal pepper)

Priority criteria for selecting Smart crops

1) Nutrition	➢ Nutritional value and health benefits
2) Production	➢ Local knowledge, availability and seasonality
3) Ecology	➢ Agro-ecology ➢ Adaptation to local climate and soil types
4) Socio-Economic	➢ Cultural acceptance and consumer preferences ➢ Access to market and potential income generation

• International Finger Millet Year 2022

- How many new F. millet varieties released or identified ?
- How much quality seeds produced and distributed ?
- Increased F. millet production compared to previous year?
- Product diversification for consumer preference ?
- Future strategy developed to increase production ?

Smart crops important for food, nutrition and environment

- **Cereals, pseudo cereals and millets**

1. **Buckwheat**
2. **Naked barley**
3. **Grain amaranth**
4. **Proso millet**

Roots and tubers

1. **Colocasia esculenta (Taro)**
2. **Dioscorea alata (Greater yam, white yam)**
3. **Ipomoea batatas (Sweet potato)**

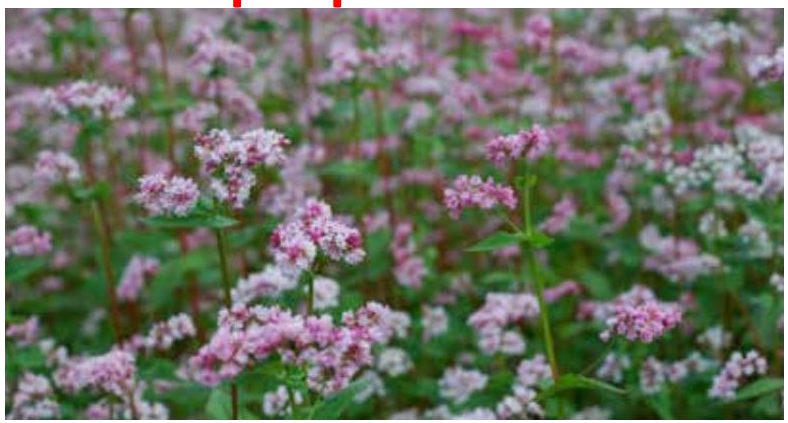
Product diversification in Yam

Buckwheat *Fagopyrum spp.*

- **Gluten free pseudo cereal having global significance.**
- **Buckwheat is available throughout the year and can be served as an alternative to rice or other cereals.**

Bhate/Tite phapar

Mithe phapar



Why buckwheat?

Human, health and environmental perspectives

Nutritional value:

- **Buckwheat has an excellent protein quality of 18-20 essential amino acids with biological values including lysine and tryptophan**
- **Dietary minerals like zinc, copper, magnesium, manganese and iron.**

Buckwheat as medicinal value:

- **Buckwheat products particularly for patients with diabetic, jaundice, cold, fever, intestinal disorder, pneumonia and gastritis are highly valued.**
- **Rutin as a drug for treatment of cardiovascular disorder**

- **Better Blood Sugar Control and a Lowered Risk of Diabetes**
- **Helps Prevent Gallstones**

Nutrient benefits to the soil

- **Buckwheat improves soil fertility by accumulating phosphorus and potassium**
- **Environmental benefits:**
- **Only the field crop that produces**

  UV absorbing compounds
- **Buckwheat serves as an important ecosystem servicer as an apple pollinators and in honey making.**

The Guardian recently published
Global pollinator losses causing 500,000 early deaths a year – study 2022

Insect declines mean reduced yields of healthy foods like fruit and vegetables and increased disease in people

- **The global loss of pollinators is already causing about 500,000 early deaths a year by reducing the supply of healthy foods, a study has estimated.**
- **Three-quarters of crops require pollination but the populations of many insects are in sharp decline. The inadequate pollination that results has caused a 3%-5% loss of fruit, vegetable and nut production, the research found. The lower consumption of these foods means about 1% of all deaths can now be attributed to pollinator loss, the scientists said.**
- **Deaths from heart disease, stroke, diabetes, and some cancers, all of which can be reduced with healthier diets**

Buckwheat recipes

Preparation of traditional food recipes

Buckwheat recipes are popular in Pokhara

Ways of offering special recipes in Jumla

Source: Rijal, Deepak et al. 2001

Rice bean and Mungbean (summer green cover)

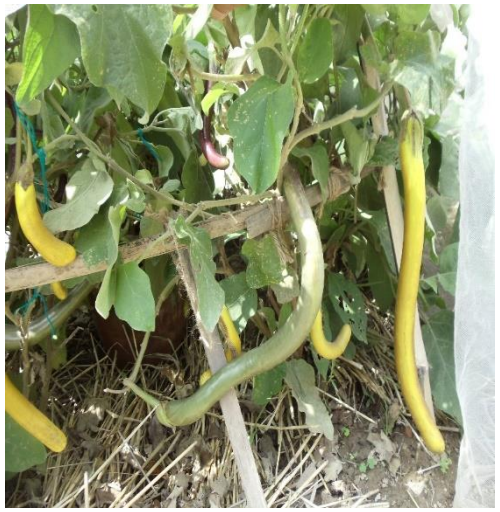
- **Drought tolerant fast growing legumes: Cowpea, Mungbean, Ricebean chief and rich source of protein and minerals, soil fertility build up**
- **excellent green cover crops protecting environments during extreme summer**
- **Need product diversification**

Smart vegetable crops

Beans

Local Fruit Tomato

Local Brinjal varieties



Local Okra

- **Better than any hybrid okra**
- **Highly prolific (two fruits in one leaf angle)**
- **Very long fruit up to 11”**
- **Better taste than imported hybrids**

Product diversification and Value addition for smart food crops: non breeding approach

- Linking biodiversity to markets
- Marketing information for local products
- Value addition for niche markets
- Improve access of locally adapted unique plants/ seed/saplings
- Apply commodity chain to create new markets/products or promote smart food culture
- Contribution to family dietary diversity, nutrition, quality food and health

Few promotional strategy

- Nepal may not get any food items from India in near future as India's population is just surpassing to that of China and there would be more domestic demand of food.
- There is little hope that Nepal can become self-sufficient in food production relying only on Rice, Maize and Wheat, there is increased trend of importation of these cereals each year from outside.
- Develop strategy to increase production of Smart food crops to save country before entering into hunger.
- Develop Smart Food based parks/restaurants, develop publicity.
- Like Banana park in Tikapur- conservation by utilization.
- Product diversification each smart crops
- Food fair in all provinces and districts
- Develop Buckwheat, Finger millet, Amaranth, Yams, Colocasia, Beans, Chayote recipe based restaurants and related parks

Promotional…

- **Heavy import of Oat related foods in the country- why not to import good oat germplasm from outside and start breeding research or increase purple Naked Barley production and develop products similar to Oat that can replace oat import.**
- **Develop province wise production strategy based on abundance and adaptability of smart crops,ex Proso millet, Buckwheat and foxtail millet for Karnali province**

Thanks