

Rabi pulses:

multiple security and prosperity

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Crop diversification, including the adoption of rabi pulses, can help Indian agricultural production systems to be more sustainable. Pulses, in particular, are crops that can assist both agriculture and the food industry to become more eco-friendly by reducing greenhouse gas emissions and absorbing more carbon. Lock-in has hampered the development of minor crops today, as main crops have been co-developed to a greater level in farming and food production systems. All of these characteristics make pulse-based farming systems ideal candidates for climate-resilient crops.

Keywords: Intercropping, Nutritional profile, Pulses

PULSES are a major source of protein for India’s vegetarian and rural populations, providing food, nutritional, environmental, economic and job stability. Pulses are well-known in food cultures all over the world and the nickname “little marvels” is apt, not least due to their substantial health benefits. Rice and wheat are major cereal crops that provide only food security, whereas pulses can give various security benefits i.e. food, fodder, nutrition, livelihood and environmental sustainability. Pulses are highly adaptable to a wide range of weather conditions. Food and nutritional security are considered to be attained when enough food (in terms of quality, quantity, safety and socioeconomic suitability) is available and accessible at all times for all people to live a healthy life.

Pulses cultivation has several advantages including abiotic (drought, temperature, salinity) and biotic (pest/disease) stress tolerance, short-duration, labour efficiency, and cheap input costs. Because few insect pests are attracted to pulses, just a small amount of pesticides is required to manage insect pests, making it a pest-free crop. Pulse crops absorb more carbon and emit fewer GHGs than other crops.

All of these characteristics make pulse-based farming systems ideal candidates for climate-resilient crops. Climate change has posed a significant challenge to agriculture’s production system, resulting in unpredictably low rainfall, lower water availability and increased hunger, and malnutrition. As a result, we need crops that can endure adverse climate change while also fitting into any farming system; one such crop could be a pulse. The purpose of this article is to examine how contemporary societal trends in the agricultural production system provide new prospects for pulses,

as well as how parallel changes in consumption and production can assist multiple securities.

Nutritional profile of rabi pulses

Pulses are an important group of food crops that can help to solve national food and nutritional security while also addressing a variety of issues. Table 1 shows the nutritional profile of some pulses.

Pulses for sustainability

In India, pulses are usually cultivated in poor soils, with minimal resource use and low water consumption. They are an important

Table 1. Tolerance limit of pests and diseases at the time of last inspection

Name of foodstuff	Chickpea	Lentil	Fieldpea	Lathyrus	Kulthi	Mung	Urd
Protein (%)	20	25	22	31	22	25	24
Vit. A (I.U.)	316	450	31	200	119	83	64
Vit. C	3	-	-	-	1	-	-
Vit. K	0.29	0.25	-	-	-	-	0.19
Thiamine	0.3	0.45	0.47	0.39	0.42	0.72	0.41
Riboflavin	0.51	0.49	0.21	0.41	0.2	0.15	0.37
Nicotinic-acid	2.1	1.5	3.5	2.2	1.5	2.4	2
Biotin (g/100 g)	10	13.2	-	7.5	-	-	7.5
Choline	194	299	-	-	-	-	206
Folic-acid (g/100 g)	125	107	-	100	-	-	144
Inositol	240	130	-	140	-	-	90
Pantothenic-acid	1.3	1.6	-	2.6	-	-	3.5

(Source: Adopted from the Nutritive value of Indian Foods & the planning of satisfactory Diets ICMR)

part of cropping and dietary habits. Of the total net sown area of 141.4 mha, 52% i.e. 73.2 mha is under rainfed in pulses. Rainfed areas of the country sustain 40% of the human population and two-thirds of cattle. Rainfed agriculture accounts for 90% of nutri-cereals (millets), 80% pulses, 74% oilseeds, 65% cotton and 48% rice crops. Pulses play a bigger role in the rainfed farming economy in a variety of ways. It fits well in mixed/inter-cropping, crop rotation, dry-farming and provides green vegetables (pods/beans), and nutritious fodder for cattles, contributing toward a more sustainable food system. Pulse cultivation provides a method to fix atmospheric nitrogen to nitrogen compounds in their root nodules, resulting in 72–350 kg N/ha/year, which meets their own nitrogen demands to a significant extent. Pulses are only cultivated under irrigation for roughly 20% of their cropped area, with the remaining 80% being grown under rainfed conditions. Gram with 35% area under irrigation is the highest pulse crop followed by other pulses crops. Food legumes play an important role in improving food and nutritional security. Dried pulse seeds can be stored for long periods of time without losing nutritional content, leading to increased availability of food until new arrivals. Growers of pulses have a choice of self-consumption as well as cash crops as a source of revenue.

National Rabi Pulse Scenario

Total acreage under all pulses is around 299.93 lakh ha, with a production of 252.4 lakh tonnes. *Rabi* pulse acreage and production is 159 lakh ha and >158 lakh tonnes across India. *Rabi* pulses account for 53% of overall pulse production and 63% of the total area in the country. The significant contribution of *rabi* pulse to the total pulse basket opens up the possibility of providing several levels of protection. Chickpea is the most important pulse, ranking first in terms of area (65%), production (72%) and productivity, followed by lentil and field pea at the national level. Gram (chickpea),

Table 2. Production and contribution of *rabi* pulses in India

State	Production (Lakh tonnes)	Contribution (%)
Madhya Pradesh	58.30	36.69
Rajasthan	17.45	10.98
Maharashtra	18.36	11.55
Uttar Pradesh	15.75	9.91
Karnataka	7.87	4.95
Andhra Pradesh	10.42	6.56
Gujarat	4.03	2.54
Chhattisgarh	4.59	2.89
Bihar	3.74	2.36
Jharkhand	4.41	2.77
Other	13.99	8.80
All India	158.90	-

(Source: DES, Ministry of Agri. & FW (DAC&FW), Govt. of India; 2017–18* - IVth Adv. Estimates)

lentil (masur), field pea (matar), urdbean, mungbean and Rajmash are *rabi* pulse crops. Table 2 shows the participation of 10 states to >91% of *rabi*/summer pulse output.

Strategy to augment *rabi* pulse production

Cropping system, utilization of rice-fallow land and intercropping strategy to inculcate pulses under new habitats could all be the part of accompanying areas expansion strategy:

Utilization of potential area of rice-fallow lands: Rice-fallows can be found across rainfed ecosystems of eastern, central and peninsular India, as well as NEH region. Approx 3.0 mha of additional land in pulses can be converted to *rabi* pulses cultivation. Productivity improvement of pulses or rice fallows is important for exploring the potential of rice fallows. Relay cropping is a common practice in standing rice. Early-maturing crop types, relay cropping, greater seeding rates, seed priming, seed inoculation with rhizobium culture, seed pelleting, mulching, and foliar nutrient spraying are all recommended procedures that need to be enhanced and standardized for various environments.

Promotion of intercropping and utera cultivation: Intercropping of pulses is the most effective way to increase pulse production by expanding horizontally. Pulses are traditionally grown by farmers in rainfed states of Karnataka, Gujarat,

Madhya Pradesh, Chhattisgarh, Maharashtra, and Andhra Pradesh (Table 3). In addition to improving the total productivity of the system, legumes help to conserve resources, particularly nitrogen fertilizers. Mung/Urd bean, on other hand, is an excellent intercrop with spring-planted sugarcane in irrigated/rainfed. Cotton, summer sunflower, lentil, field pea, chickpea and rajmash are other good intercrops with sugarcane, grown in the winter and under irrigated conditions.

Opportunities: Potential to be harnessed

- Pulses are optimal for maximising soil carbon sequestration potential by incorporating them into cropping systems i.e. intercropping/crop rotations, as opposed to mono-crop systems.
- A commodity is ideal for organic farming because it meets the most significant criterion for selecting crop/varieties with a highly valuable crop and low nutritional needs (Pulses meet both of these criteria: they are high-value crops, with prices typically 2–3 times higher than cereals, and they have low nutrient requirements).
- With a higher MSP, CACP, Government of India, and good trade options, employment creation and pulse processing may produce employment in rainfed areas.

Table 3. Prominent intercropping systems adopted in *rabi* pulses

States	Intercropping systems
Andhra Pradesh	Rice+urdbean/mungbean, Tapioca+mungbean/urdbean, Pigeonpea+castor/ groundnut, Chickpea+Sunflower
Bihar	Pigeonpea+maize/turmeric/small millets, Rice+pigeonpea, Lentil+mustard, Chickpea+Linseed/Mustard, Potato+common bean, Fieldpea+mustard
Gujrat	Cotton+pigeonpea, Pigeonpea+groundnut, Castor+urdbean/cowpea/mungbean /horsegram, Pearl millet+mothbean
Himachal Pradesh	Maize+Urdbean/Common bean/Soybean/Cowpea
Karnataka	Chickpea+sunflower, Pigeonpea+horsegram/Cowpea/small millets/Groundnut, Finger millet+horse Gram, Tapioca+mungbean/urdbean
Madhya Pradesh	Field pea+Mustard, Chickpea+Mustard/Wheat/Barley/Linseed, Pigeonpea+Pearlmillet/Soybean/Sorghum/ Mungbean/Urdbean/Castor, Pearl millet+Mungbean/Urdbean, Cotton+Pigeonpea, Lentil+Mustard/Linseed/ Barley
Maharashtra	Groundnut+Pigeonpea, Pigeonpea+Sorghum/Maize, Cotton+Pigeonpea/Urdbean/ Mungbea
Orissa	Tapioca+Urdbean/Mungbean , Pigeonpea+Ground nut
Punjab and Haryana	Pigeonpea+Urdbean/Mungbean, Maize+Soybean, Chickpea+Wheat/Mustard/Linseed/Barley, Urdbean+Maize, Sugarcane+Summer Mungbean/Urdbean /Chickpea
Rajasthan	Chickpea+Barley/Mustard/Wheat, Pearl millet+Urdbean/Mothbean/Mungbean/Cowpea, Sorghum+Mothbean, Clusterbean+Mothbean
Tamil Nadu	Pigeonpea+Sorghum, Sugarcane+Urdbean, Tapioca+ Urdbean/ Mungbean
Uttar Pradesh	Pigeonpea+Pearlmillet/Sorghum/Castor/Maize/Urdbean/Mungbean, Chickpea+wheat/linseed/mustard/barley, Pearl millet+Mungbean/Urdbean, Sugarcane+ Field pea/Urdbean/Mungbean/Chickpea
West Bengal	Sunflower+mungbean, Jute+urdbean, Chickpea+mustard/lentil

(Source: Adopted from GOI, Ministry of Agriculture & Farmers Welfare Dept of Agri.)



Rice-Wheat-Mungbean system



Maize-Toria-Mung system



Lentil



Lathyrus



Bajra-Chickpea system



Jowar-Chickpea system

SUMMARY

Pulses have been taken in various forms around the world for thousands of years. They include a variety of nutritious components, including protein, minerals and vitamins, all of which are necessary for human health. Besides these, it also comprises phytochemicals

including polyphenol bioactive substances i.e. saponin/phytosterols, which have antioxidant properties and so, assist to reduce the risk of obesity, diabetes, hypertension, cancer, cardiovascular illnesses. Micronutrient malnutrition has become a big concern for the world, particularly for disadvantaged/

malnourished rural people, as the world's population grows fast. As a result of biofortification in pulses and legumes, micronutrient bio-accessibility can be enhanced.

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