Indian Journal of Ecology (2022) 49(3) (SI): 1011-1022
DOI: https://doi.org/10.55362/IJE/2022/3629

Manuscript Number: 3629
NAAS Rating: 5.79

Agriculture Food Crops Diversity of India: A Scenario

Acharya Balkrishna, Bhasker Joshi[1], Anupam Srivastava[1] and Seema Bisht[1*]

Department of Allied Sciences, University of Patanjali, Haridwar-249 405, India
[1]Patanjali Herbal Research Department, Patanjali Research Institute, Haridwar- 249 405, India
**E-mail: seema.bisht@prft.co.in*

***Abstract*:** Agriculture 'the life line of India' have broad diversity of food crops which are cultivated in the rural crop fields of country. It plays a significant role in the development of India and continues to be a major driver of economy with 16-17% national GDP and largest employment providing sector (59% employment to national workforce). Various types of crops are native to the country and have been cultivated since ancient times. Agriculture diversity includes various types of indigenous varieties of Rice (*Oryza sativa* L.) Millets- Finger Millet [*Eleusine coracana* (L.) Gaertn.], Foxtail millets [*Setaria italica* (L.) P. Beauv.], Sorghum [*Sorghum bicolor* (L.) Moench], Pear millet [*Cenchrus americanus* (L.) Morrone], Banyard millet [*Echinochloa crus-galli* subsp. *utilis* (Ohwi & Yabuno) T. Koyama], Wheat (*Triticum aestivum* L.), Barley (*Hordeum vulgare* L.), and Maize (*Zea mays* L.), Chickpea (*Cicer arietinum* L.) and Moth bean [*Vigna aconitifolia* (Jacq.) Maréchal]. This paper discussed the consequences of the green revolution in agriculture production and impacts on indigenous crop varieties with their conservation needs.

Keywords: Agriculture, Crop diversity, Agriculture produces

India is the second largest country from the sight of population in the world and has wide diversity of climate, topography, land use, flora & fauna with socio-economic conditions. By the largest land use in agriculture India became one of the largest producing countries in agriculture supplies worldwide (Hinz et al 2020). In India, Agriculture is the most important sector and it is the life line of Indian economy. One-third of the population of India is dependent upon agriculture to sustain livelihood. More than half number of jobs from agriculture sector are available in India. By sharing in national income, being biggest employment providing sector, providing raw material to industries and market for industrial products, agriculture shows the importance in Indian economy. This sector shares 16-17% of national GDP with 10% total export and 59% employment to national workforce (Arjun 2013, Goyal et al 2016, Hand book of Agriculture 2017, Hinz et al 2020).

Agriculture biodiversity: India has rich agriculture biodiversity that's why it is the backbone of sustainable agricultural growth that includes different types of farming systems. Agro-biodiversity includes the variability of many economically important plant and animals with agroforestry, crops and cropping systems, orchards, live-stock, fisheries, poultry etc. These systems provide food, fodder, fibre, shelter, fuel, medicines, income and livelihood. It plays an essential role for sustainable improvement in Food and Nutrition Security (Hand book of Agriculture 2017, Natarajan et al 2018). It is most significant component of biodiversity which holds a key to the foundation of agriculture and food and nutritional security. The genetic diversity of kingdom and species increase the productivity of farming system. The management of genetic resource includes some actions like collection and exploration of plants, characterization & evaluation, conservation, germplasm exchange and genetic enhancement (Natarajan et al 2018).

Indian gene center is one of the 17 megadiverse countries in the world which includes more than 8% identified plants and nearly 2.5% global land mass. Approximately 17500 higher plant species were estimated and occurs in 16 vegetation types. There are more than 380 cultivated/ semi-cultivated crop species and 130 breeds of domesticated animals and poultry in the country (Hand book of Agriculture 2017). It is crucial in the conservation of different inherited traits of cultivated plants, wild species of cultivated crop plants and domesticated farm animals (Chaudhuri 2005, Natarajan et al 2018).

Field crops of India: Agrobiodiversity is a vital subset of biodiversity which includes agro-ecosystems, crops varieties/ species, livestock and fish species, plant and animal germplasm, soil micro-organisms and cultivated fields, wild species, traditional knowledge and bio-control agents for crops/ livestock pest (Natarajan et al 2018) (Fig. 1). At the time of independence, India faced the shortage of food grains due to low farm productivity. The area for food grains was 97.32 M ha in which only 18% were irrigated in 1950-51. After green revolution, when agriculture adapted modern methods and technology, it improved and increased the growth of food grains production. Consequently, India

has become self-sufficient in food grains. Cereals occupied largest crop area than other crops in India. In India, rice (*Oryza sativa* L.), maize (*Zea mays* L.), wheat (*Triticum sps*. L.), barley (*Hordeum vulgare* L.), pulses and oilseeds are major crops grown in cereal-based production system in India which supports the Indian economy. These crops are cultivated in different states of India viz. Andhra Pradesh, Bihar, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. India is the second largest producer of rice, wheat and millets in the world. Rice is the third important crop of the world and staple food crop of India followed by wheat and other cereals. In India, cereals play the dominant role in Indian diets as an energy source and more than half population depended on these crops for their survival (Hand book of Agriculture 2017).

Introduced and naturalized crop diversity: A unique combination of living species, habitats and ecosystems which make rich and fascinating diversity of India. This diversity includes various Agro-Climatic Zone of India, types of forest plant species herbs, grasses, shrubs, forages and ornamental plants. Presently cultivated plants in the country have been derived from two sources, viz. indigenous and introduced. The later have come from various continents and countries like Asia, Africa, China, North and South America, Southeast Asia and Pacific Islands, and the Europe. Over the past few centuries some new crops were introduced in the country by Moughals, Spanish, Portuguese and British explorers. These crops are apple, peach, pear, grape, pine apple, papaya, almond, date palm, apricot, tomato, potato, sweet potato, beans, onion, garlic, chilies, maize and lentil etc. (Hand book of Agriculture 2017).

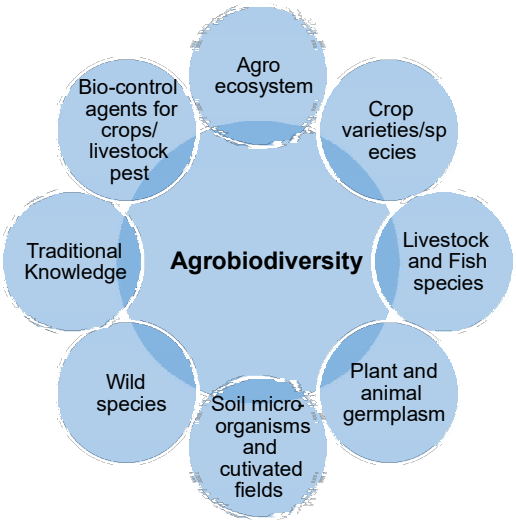

Fig. 1. Agro-biodiversity-a subsets of biodiversity

Indigenous crop: In India, approximately 49 major and minor crops are estimated which includes rice, wheat, maize, minor millets, pulses, Indian mustard, tuber crops, vegetables, fruits, spices, sugar crops, fiber crops and many medicinal plants. The advantage of cultivation of indigenous crops is that, they are highly adapted to environmental condition, makes the agriculture genetically diverse and sustainable and consumption reduces the dependency on imports and maintain the food varieties and micro-nutrient in diet (Nelson et al 2019). Some cultivated food crops are listed on the basis of Indian origin, which are as follow-

Rice (*Oryza sativa* L.), Finger millets [*Eleusine coracana* (L.) Gaertn.], Chickpea (*Cicer arietinum* L.), Moth bean [*Vigna aconitifolia* (Jacq.) Maréchal], Rice bean [*Vigna umbellata* (Thunb.) Ohwi & H.Ohashi], Horse gram [*Macrotyloma uniflorum* (Lam.) Verdc.], Asparagus bean [*Vigna unguiculata* (L.) Walp.], Eggplant (*Solanum melongena* L.), Rat's tail radish [*Raphanus raphanistrum* subsp. *sativus* (L.) Domin], Taro yam [*Colocasia esculenta* (L.) Schott], Cucumber (*Cucumis sativus* L.), Tree cotton (*Gossypium arboreum* L.), Jute (*Corchorus olitorium* L.), Pepper (*Piper nigrum* L.), Tea [*Camellia sinensis* (L.)

Table 1. Area and production of all major crops of the country 1950-2020

Major crops of India	Area in MHa					Production in MT				
	1950-51	1990-91	2012- 13	2016-17	2019-20	1950-51	1990-91	2012-13	2016-17	2019-20
Rice	30.81	42.69	42.75	43.19	43.78	20.58	74.29	105.23	110.15	118.43
Wheat	9.75	24.17	30.00	30.60	31.45	6.46	55.14	93.51	98.38	107.6
Nutri/Coarse cereals	37.67	36.32	24.76	24.77	24.02	15.38	32.70	40.04	44.19	47.5
Pulses	19.09	24.66	23.26	29.46	28.34	8.41	14.26	18.34	22.95	23.2
Oilseeds	10.73	24.15	26.48	26.20	27.04	5.16	18.61	30.94	32.10	33.4
Sugarcane	1.71	3.69	5.00	4.38	4.57	57.05	241.05	341.20	306.72	355.7
Cotton	5.88	7.44	11.98	10.84	13.37	3.04	9.84	34.22	33.09	35.5
Jute & Mesta	0.57	1.02	0.86	0.76	0.68	3.31	9.23	10.93	10.60	9.9

Source: *Pocket Book of agricultural statistics 2017*- Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare Directorate of Economics & Statistics New Delhi https://agricoop.nic.in/sites/default/files/pocketbook_0.pdf
Abbreviation: MT: Million Tons; MHa: Million Hectare

Table 2. Status of agro-climatic zone of India with sub-regions and crop distribution

Agro-climatic zone	Sub-regions	Climate type	Rainfall (mm)	Soil type	Agriculture produces
Western Himalayas Region	High altitude temperate	Humid to cold arid	165	Hill soils, mountain, meadow skeletal, tarai	Rice, wheat, barley, maize, oats, ragi, sugarcane and potato etc. Fruits: almond, apricot, cherry, litchis, peaches, pears, walnut, saffron etc.
	Valley temperate	Sub-humid	400	Sub-mountain, mountain skeletal, meadow	
	Sub-tropical	Semi-arid to humid	1030	Alluvial (Recent), brown hills	
	Hill temperate	Humid	2000	Brown hill	
Eastern Himalayas Region	Lower Brahmaputra	Per humid to humid	1840	Alluvial, red loamy, tarai soils	Rice, wheat, maize, ragi, rapeseed, sesame, sugarcane, potato, tea and jute. Fruits: pineapple, litchi, oranges and lime etc.
	Himalayan Hills	Per humid to Humid	2641	Brown Hills	
	Southern Hills	Per humid to humid	2052	Acidic soils	
	Upper Brahmputra	Humid to per humid	2809	Alluvial, red loamy	
	North-East Hills	Per humid to humid	3528	Red sandy laterite	
Lower Gangetic Plains Region	Rarh Plains	Most sub-humid to dry sub-humid	1302	Red and yellow red loamy	Rice, wheat, maize, rapeseed, sesame, jute, potato and pulses
	Central Alluvial Plains	Most sub-humid to dry sub-humid	1449	Red and yellow, Deltaic, alluvium, red loamy	
	Barind Plains	Most sub-humid & dry sub humid	1587	Red and yellow alluvial (Recent)	
	Alluvial Coastal Saline Plains	Dry sub-humid to moist sub-humid	1607	Red and yellow deltaic, alluvial	
Middle Gangetic Plains Region	North-West Alluvial	Moist sub-humid to dry sub-humid	1211	Alluvial (Recent), Calcareous	Rice, wheat, maize, barley, millets, sugarcane, peas, gram, mustard and potato
	North-East Alluvial	Dry sub-humid to moist sub-humid	1470	Alluvial, Tarai	
Upper Gangetic Plains Region	South-Western Plains	Semi-arid	721	Alluvial	Rice, wheat, bajra, sugarcane, maize, potato, pulses and oils seed.
	North-Western Plains	Dry sub-humid to semi-arid	907	Alluvial, Tarai	
	Central Plains	Dry sub-humid to semi-arid	979	Alluvial	
Trans-Gangetic Plains Region	Scarce Rainfall arid region	Arid and Extreme arid	360	Calcareous, Sierozemic, Alluvial (Recent), desert	Rice, wheat, sugarcane, maize, millets, cotton, pulses and oilseeds.
	Plains	Semi-arid to Dry sub-humid	561	Alluvial (Recent) calcareous	
	Foothills of Shivalik & Himalayas	Semi-arid to Dry sub-humid	890	Alluvial (Recent) calcareous	
Eastern Plateau and Hills Region	Eastern Plain	Dry sub-humid	1271	Medium to deep black red and yellow	Rice, maize, ragi, millet, potato, groundnut, gram, tur, urd, soyabean, castor, niger and oilseeds etc.
	North Central Plateau	Moist sub-humid to dry sub-humid	1296	Red sandy, red and yellow	
	Tribal	Moist sub-humid to dry sub-humid	1338	Red sandy, red and yellow, red loamy laterite	
	Eastern Plateau	Moist sub-humid to dry sub-humid	1369	Red & yellow, Red loamy	
	Eastern Highland	Moist sub-humid to dry sub-humid	1436	Red sandy, red and yellow	
Central Plateau and Hills Region	Transitional Plain	Semi-arid (Wetter half)	490	Desert soil, grey brown	Rice, wheat, maize, linseed, sorghum & other millets, gram, pigeon pea, cotton, groundnut, rapeseeds, sunflower, niger, soybean and other oilseed crops.
	Southern Plains & Aravalli Hills	Semi-arid (Wetter half)	500	Red and yellow, grey brown	
	Semi-arid Eastern Plains	Semi-arid (Drier half)	500	Alluvial	

Cont...

Table 2. Status of agro-climatic zone of India with sub-regions and crop distribution

Agro-climatic zone	Sub-regions	Climate type	Rainfall (mm)	Soil type	Agriculture produces
	Flood Prone Eastern Plain	Semi-arid (drier half)	500	Alluvial (Recent)	
	Gird	Semi-arid (half drier & wetter half)	670	Medium black, Alluvial	
	Bundelkhand (MP)	Dry sub-humid to semi-arid	700	Mixed red & black	
	South Eastern Plains	Semi-arid (wetter half)	760	Medium black	
	Southern Plains	Semi-arid to arid	760	Medium red and black, grey brown	
	Bundelkhand (UP)	Dry sub-humid to arid	780	Dry sub-humid to arid	
	Kymore Plateau Satpura hills	Dry sub-humid	1100	Dry sub-humid	
	Vindhya Plateau	Dry sub-humid	1130	Dry sub-humid	
	Satpura Plateau	Dry sub-humid	1220	Dry sub-humid	
	Central Narmada Valley	Dry sub-humid	1300	Dry sub-humid	
	North Hills	Moist sub-humid to dry sub-humid	1570	Moist sub-humid to dry sub-humid	
Western Plateau and Hills Region	Scarcity region	Semi-arid	602	Medium black, deep black	Rice, wheat, sorghum & millets, sugarcane, gram, cotton, groundnut oilseeds etc. Fruits: oranges, grapes and bananas.
	Plateau region	Semi-arid (wetter half)	874	Medium black, deep black and mixed red	
	Hill region	Semi-arid	988	Medium to deep, Black shallow red and red loamy	
	Plateau region south	Semi-arid to dry sub-humid	1040	Medium black and shallow black	
Southern Plateau and Hills Region	Sub-region-1	Semi-arid	677	Red loamy, medium black, red sandy, coastal alluvium, laterite	Rice, wheat, maize, sorghum & millets, cotton, pulses, coffee, tea, cardamom and castor, groundnut & oilseeds and spices crops
	Sub-region-2	Semi-arid & arid	725	Red sandy, medium to deep black	
	Sub-region-3	Semi-arid to Dry sub-humid	841	Mixed red and black red loamy, deltaic alluvium	
	Sub-region-4	Semi-arid	865	Red loamy, red sandy	
	Sub-region-6	Semi-arid (wetter half)	1001	Deep black, medium black	
East Coast Plains & Hills Region	South Coastal Tamil Nadu	Semi-arid (drier half)	780	Mixed Red & Black, coastal alluvium	Rice, bajra, ragi, sorghum, jute, tobacco, maize, sugarcane, sesame, groundnut, cotton and tobacco.
	South coastal Andhra Pradesh	Semi-arid	996	Deltaic alluvium, deep black, red, sandy, red & black	
	North Coastal Tamil Nadu	Semi-arid	1036	Red loamy, red sandy, Coastal alluvium	
	Tanjavur	Semi-arid to dry sub-humid	1113	Deltaic alluvium, red loamy	
	North coastal Andhra	Dry sub-humid	1128	Red loamy, laterite medium black, red, sandy, coastal alluvial	
	North Odisha Coast	Moist sub-humid	1287	Deltaic alluvial, coastal alluvial, laterite, red loamy	
West Coast Plains & Ghats Region	Hilly	Per Humid	226	Laterite, red loamy, Coastal alluvium	Rice, ragi, coconut, sesame, groundnut, niger oilseeds, sugarcane, tapioca, pulses and cotton. Fruits: Mango, banana, pineapple and jack fruit etc.

Cont...

Table 2. Status of agro-climatic zone of India with sub-regions and crop distribution

Agro-climatic zone	Sub-regions	Climate type	Rainfall (mm)	Soil type	Agriculture produces
Gujarat Plains & Hills Region	North-West arid	Arid to semi-arid	340	Grey brown, deltaic alluvium	Rice, wheat, maize, bajra, sorghum, sugarcane, arhar, groundnut, cotton and tobacco.
	North Saurashtra	Dry sub-humid	537	Medium black	
	North Gujarat	Arid to semi-arid	735	Grey brown, Coastal alluvium	
	South Saurashtra	Dry sub-humid	844	Coastal alluvium, medium black	
	Middle Gujarat	Semi-arid	904	Medium black	
	South Gujarat	Semi-arid to dry humid	974	Deep black, Coastal alluvium	
	South Gujarat (Heavy rainfall)	Semi-arid to dry sub-humid	1793	Coastal alluvium, medium black	
Western Dry Region	Western Dry	Arid to extremely arid	395	Dessert soil, grey brown	Bajra, jowar, moth bean, wheat and gram
Island Region (Sub-regions not delineated)	Andaman-Nicobar (including region)	---	3,000	Medium to very deep red loamy soils and including marine alluvium derived soils along the coast	Rice, maize, millets, pulses, arecanut, turmeric and cassava
	Lakshadweep (including regions)	---	1,600	highly calcareous and sandy in nature	

***Source*:** Planning Commission (Khanna 1989) has identified 15 resource development regions in the country, 14 in the main land and remaining one in the islands of Bay of Bengal and Arabian Sea.
Abbreviation: mm: Milimeter

Kuntze], Pigeon pea [*Cajanus cajan* (L.) Huth], Sesame (*Sesamum indicum* L.), Cardamomum [*Elettaria cardamomum* (L.) Maton] and Lemon [*Citrus* × *limon* (L.) Osbeck] (Hand book of Agriculture 2017).

Effect of green revolution in indigenous crop: In the past, India faced the era of chronic food shortage due to population explosion and low farm activity. At that time Indian annual food imports were 8-10 MT. After independence, to overcome the shortage of food and self-sufficiency in food-grains was the first or foremost challenge for India. This could be accomplished only by the increasing agricultural production and minimizing dependence on food imports (Hand book of Agriculture 2017). In 1960, Green Revolution was initiated in India with major outcome. Many technologies were developed with great outcomes in the agriculture sector which improved farm productivity. The introduction of high yield varieties, fertilizer use and water & pest management techniques increased the agriculture production. Specially rice and wheat varieties, which made India self-sufficient in food grains. These genetically improved varieties were developed by the contribution of many research centers viz. International Maize and Wheat Improvement Centre (CIMMYT), Mexico, and the International Rice Research Institute (IRRI), Philippines, respectively. These high yielding varieties are more grain-producing and highly fertilizer responsive than earlier varieties. Consequently, between 1950 and 1990, the global production of cereals increased 174% (Nelson et al 2019). On the other hand, the green revolution's effect on indigenous crop varieties is the loss of local varieties and species due to preference of high yielding varieties for better production. Actions initiated by government for increasing the grain production is very beneficial but also destroyed the gene pool diversity. Maximum use of chemical fertilizer, pesticide and lack of crop rotation make the soil infertile (Nelson et al 2019).

Production scenario (1950-2020): According to the 4th Advance Estimates for 1950-51, total food grain production was 50.82 MT and new estimate for 2019-20, total food gran production is 296.65 MT. The estimate of 2019-20 in higher than all previous years (1950-51 to 2018-19) which shows the growth in agriculture production of the country. Report shows the estimated area and production of crops (Table 1) with comparison of other major crops. In which, total rice production in 1950 was 20.58 MT which increased year by year and reached at 118.43 MT in 2019-20. Like rice, other crops show changes in area and production (*Pocket Book of agricultural statistics* 2017, Annual report 2020-21).

Agro-Climatic zone of India: The extension of climate for suitability to agriculture or the land unit in terms of climate which is suitable for certain crop and cultivar is known as Agro-Climatic Zone of India. It is characterized by agro-ecological diversities in soil, rainfall, temperature and cropping system. India has divided into fifteen (15) major agro-climatic zones by Planning Commission of India. These agriculture zones are based on many agro-climatic features like soil type, geological formation, climate, irrigation, cropping pattern and mineral resources (Alagh 1990, Singh 2006, Balasubramanian 2013). The 15 Agro-climatic zones in India in which different Cereal & Millet Crops, Pulses crops, Oilseed crops and sugar crop are found is described as follows (Table 2 and 3).

Table 3. Food grain crops of India with their performance in cultivation states

Cereal & millet crops	Common name	Native range	Ranking among growing countries in the world	Highest producing state of India	Composition of Nutrient (gm)	Economic aspects
Rice (*Oryza sativa* L.)	Hindi: Dhan English: Rice, Chaval Sanskrit: Dhanya, Dhanyah, Garuda	China (China North-Central, China South-Central, China Southeast)	China, India, Bangladesh, Indonesia, Thailand, Vietnam, Myanmar, Philippines, Brazil, Japan, Pakistan, United states and Egypt	West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Bihar, Chhattisgarh, Odisha, Assam, Karnataka	Carbohydrate: 28.73-81.63g Protein (g): 6.8-7.5 Fiber (g): 3.4-4.1 Crude Fat (g): 0.5-2.7 Energy (kcal): 384 Moisture %: 14.0 (Das et al 2011, Kumar et al 2016, Chaudhari et al 2018)	Used as staple food; in making bread, snacks, cookies and biscuits; livestock feed and organic fertilizer (compost); manufacturing in fatty acids and medicines.
Maize (*Zea mays* L.)	Hindi: Makka English: Maize, Corn Sanskrit: --	Guatemala , Mexico	United states, China, Brazil, Argentina, Ukraine, India	Karnataka, Madhya Pradesh, Bihar, Andhra Pradesh, Telangana & Bihar, T. N., Maharashtra, U. P and Rajasthan	Carbohydrate (g): 60.9-74.3 Protein (g): 9.4- 9.8 Fiber (g): 9.0 Crude Fat (g): 4.9 Energy (kcal): 396 Moisture %: 14.0 Starch: 65% (Das et al 2011, Kumar et al 2016, Kaul et al 2017, Chaudhari et al 2018, Huma et al 2019)	Dry milling used for flour, livestock feed; fermentation and many pharmaceutical and cosmetic industrial uses; syrup used in manufacturing of jams, jellies, and other sweets and as an additive for cane sugar and maple syrup
Wheat (*Triticum aestivum* L.)	Hindi: Gehun English: Wheat Sanskrit: arupa, bahudugdha, godhuma	Medit. to Central Asia and NW. India, Ethiopia.	China, India, Russia, United States	Uttar Pradesh, Punjab, Haryana, Rajasthan, Bihar, West Bengal, Assam, Parts of Madhya Pradesh, Himachal Pradesh, Jammu & Kashmir	Carbohydrate (g): 61.6-71.2 Protein (g): 10.6- 11.8 Fiber (g): 12.5 Crude Fat (g): 1.9 Energy (kcal):375 Moisture %: 14.0 (Das et al 2011, Kumar et al 2016, Chaudhari et al 2018)	Staple food; flour for making chapatti, bread biscuits, cookies; used in preparation of starch, gluten, malt, and distilled spirit; manufacturing of beer and other alcoholic beverages
Sorghum (*Sorghum bicolor* (L.) Moench)	Hindi: Jowar English: Sudan Grass Sanskrit: Devadhanya	Africa	United States, India, Nigeria, Mexico, Sudan and Argentina	Maharashtra, Karnataka, Madhya Pradesh, Andhra Pradesh, Rajasthan, Tamil Nadu and Gujarat	Carbohydrate (g): 72.1 Protein (g): 8.3-10.6 Fiber (g): 13.8 Crude Fat (g): 3.9 Energy (kcal): 384 Moisture %: 14.0 (Das et al 2011, Kumar et al 2016, Chaudhari et al 2018)	Used as in the production of sugar, alcohol, syrup, fodder, fuel, bedding, roofing, fencing, and paper; in production of starch, glucose and liquid glucose used as pasture, hay, green chop, or silage for livestock
Barley (*Hordeum vulgare* L.)	Hindi: Jav. English: Barley Sanskrit: Aksata, Akshata, Dhanyaraja	Israel	Russia, Canada, Ukraine, Australia and Turkey	Uttar Pradesh, Rajasthan, Punjab, Madhya Pradesh, Haryana, Bihar, Himachal Pradesh, West Bengal and Jammu Kashmir	Carbohydrate (g): 77.7 Protein (g): 9.9 Fiber (g): 15.6 Crude Fat (g): 1.2 Energy (kcal): 352 Moisture %: 10.1 (Das et al 2011, Kumar et al 2016, Chaudhari et al 2018)	Fodder crop & large use in animal feed and; hull less barley grain is preferred for chapatti used in malting Industry for bear, whisky and other products

Cont...

Table 3. Food grain crops of India with their performance in cultivation states

Cereal & millet crops	Common name	Native range	Ranking among growing countries in the world	Highest producing state of India	Composition of Nutrient (gm)	Economic aspects
Oats (*Avena sativa* L.)	Hindi: Jav English: Oat Sanskrit:- karambhaka or karambha	Iran and Iraq	Russia	Uttar Pradesh, Punjab, Madhya Pradesh, Haryana, Rajasthan, Bihar, Gujarat, Maharashtra, Uttarakhand and H.P	Carbohydrate (g): 63.0 Protein (g): 9.3-16.9 Fiber (g): 5.5 Crude Fat (g): 5.9 Energy (kcal): 389 Moisture %: 8.2 (Das et al 2011, Kumar et al 2016, Chaudhari et al 2018)	Whole grain consumed as human food; forage and fodder; straw for bedding, hay, haylage, silage and chaff; in bakery industry.
Pearl millet (*Cenchrus americanus* (L.) Morrone)	Hindi: Bajra English: Pearl millet Sanskrit: --	Central tropical Africa	India, Nigeria, Chad, Tanzania, Mali, Niger, Ethiopia, China and Russia	Rajasthan, Maharashtra, Uttar Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh and Tamil Nadu	Carbohydrate (g): 67.5 Protein (g): 11.6 Fiber (g): 11.3 Crude Fat (g): 5 Energy (kcal): 361 Moisture %: 12.4 (Das et al 2011, Kumar et al 2016, Chaudhari et al 2018)	Used as staple food and cooked like rice, porridges, boiled or steamed foods; livestock producers for grazing, silage, hay, and green chop; in manufacturing of alcoholic beverages
Finger millet (*Eleusine coracana* (L.) Gaertn.)	Hindi: mandwa English: Finger Millet/ African millet Sanskrit: Madhulika	Ethiopia	India, Nigeria, Niger, China	Karnataka, Tamil Nadu, Uttarakhand, Andhra Pradesh, Odisha, Gujarat, West Bengal and Bihar	Carbohydrate (g): 72.6 Protein (g): 7.7 Fiber (g): 11.3 Crude Fat (g): 1.5 Energy (kcal): 336 Moisture %: 13.1 (Das et al 2011, Adhikari 2012, Kumar et al 2016, Chaudhari et al 2018)	Used for foods (roti or unleavened breads, ambali or thin porridge and mudde); Manufacturing of wine
Foxtail Millet (*Setaria italica* (L.) P.Beauv.)	Hindi: Kangani English: Green Foxtail Sanskrit:	China	China and India	Telangana, Andhra Pradesh., Karnataka, Rajasthan, Madhya Pradesh	Carbohydrate (g): 60.9 Protein (g): 12.3 Fiber (g): 2.4 Crude Fat (g): 4.3 Energy (kcal): 331 Moisture %: 11.2 (Das et al 2011, Kumar et al 2016, Chaudhari et al 2018)	Used for human food; fodder for animal & birds feeding; mixed with cake, cookies, bread, and biscuits to provide proteins and micro-nutrients
Proso millet (*Panicum miliaceum* L.)	Hindi: English: Sanskrit:	China	India and China	Bihar, North East, Tamil Nadu, Karnataka and Maharashtra	Carbohydrate (g): 70.4 Protein (g): 12.5 Fiber (g): -- Crude Fat (g): 1.1 Energy (kcal): 341 Moisture %: 11.9 (Das et al 2011, Kumar et al 2016, Chaudhari et al 2018)	Consumed as human food; Livestock feed, forage and fuel
Kodo millet (*Paspalum scrobiculatum* L.)	Hindi: English: Sanskrit:	India	India, Nigeria, Niger, China	Madhya Pradesh, Chhattisgarh, Maharashtra, Tamil Nadu, Karnataka	Carbohydrate (g): 66.6 Protein (g): 10.6 Fiber (g): 10.2 Crude Fat (g): 4.2 Energy (kcal): 353 Moisture %: 11.6 (Deshpande et al 2015, Bunker et al 2021)	Used as staple food in south India & used in recipes by tribal populations; Livestock feed and poultry.

Cont...

Table 3. Food grain crops of India with their performance in cultivation states

Cereal & millet crops	Common name	Native range	Ranking among growing countries in the	Highest producing state of India	Composition of Nutrient (gm)	Economic aspects
Barnyard millet (*Echinochloa crus-galli* subsp. *utilis* (Ohwi & Yabuno) T.Koyama)	Hindi: Sanwa and Jhangora English: Barnyard millet Sanskrit: Shyama	Japan	India, Niger, and China	Uttarakhand, Uttar Pradesh, Karnataka, Madhya Pradesh., North East and Tamil Nadu	Carbohydrate (g): 68.8 Protein (g): 10.5 Fiber (g): 6.6 Crude Fat (g): 3.6 Energy (kcal): 398 Moisture %: 8.7 (Kaur, and Sharma 2020).	Used for food, snacks and porridge.
Little millet (*Panicum sumatrense* Roth)	Hindi: Shavan English: Indian Millet Sanskrit:	Tropical & Subtropical Asia	India, Niger, and China	Karnataka, Maharashtra, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Jharkhand, Orissa, Gujarat and Chhattisgarh	Carbohydrate (g): 74.75 Protein (g): 8.42 Fiber (g): 12.51 Crude Fat (g): 2.10 Energy (kcal): 351.65 Moisture %: 14.23 (Kalal et al 2019, Maitra and shankar, 2019)	Grains flour used for food; Used as sole forage crops
Buck Wheat (*Fagopyrum esculentum* Moench)	Hindi: Kotu, Kuktu, English: Buck Wheat Sanskrit:	China	Russia, China, Ukraine, France	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, West Bengal, Sikkim, Meghalaya, Arunachal Pradesh and Manipur	Carbohydrate (g): 33.5 Protein (g): 5.68 Fiber (g): --- Crude Fat (g): --- Energy (kcal): --- Moisture %: ---	Used in food and bakery product

Status of Pulses crop

Pulses	Common name	Native range	Ranking among growing countries in the world	Highest producing state of India	Composition of Nutrient (gm)	Economic note
Green Gram (*Vigna radiata* L.)	Hindi: Moong English: Moong Bean Sanskrit: Mudga	India	India, Burma, Sri-lanka, Pakistan, China	Maharashtra, Uttar Pradesh, Madhya Pradesh, Andhra Pradesh, Gujarat and Karnataka	Carbohydrate (g): 60 Protein (g): 24 Fiber (g): 1 Fat (g): 1 Energy (kcal): 348 Moisture %: 10 Calcium (mg): 75 Phosphorus (mg): 405 Iron (mg): 4 (Asif et al 2013, Singh et al 2016)	Used as food, splited or whole seed eaten as snack and dhal; Bread and bakery; Livestock feed
Horse Gram (*Macrotyloma uniflorum* L.)	Hindi: Gaheth, Kulat English: Horse Gram, Madras Gram Sanskrit: Kulatthah	India	India, --- Myanmar, Nepal, Malaysia, Mauritius and Sri Lanka	Karnataka, Andhra Pradesh, Orissa, Tamil Nadu, M.P., Chhattisgarh, Bihar, W.B., Jharkhand, and in foot hills of Uttarakhand	Carbohydrate (g): 57 Protein (g): 22 Fiber (g): 5 Fat (g): 0 Energy (kcal): 321 Moisture %: 12 Calcium (mg): 287 Phosphorus (mg): 311 Iron (mg): 7 (Asif et al 2013, Singh et al 2016)	Used as food; splited or whole seed eaten as snack and dhal; Bread and bakery; Livestock feed
Black Gram (*Vigna mungo* (L.) Hepper)	Hindi: Urad English: black gram Sanskrit: Mashah	India	India, Myanmar and Pakistan	Madhya Pradesh (16.50 lakh ha), Uttar Pradesh (7.01 lakh ha), Rajasthan (4.56 lakh ha), Maharashtra (2.87 lakh ha), Karnataka (0.687 lakh ha) and Andhra Pradesh (0.11 lakh ha)	Carbohydrate (g): 60 Protein (g): 24 Fiber (g): 1 Fat (g): 1 Energy (kcal): 347 Moisture %: 11 Calcium (mg): 154 Phosphorus (mg): 385 Iron (mg): 4 (Asif et al 2013, Singh et al 2016)	Used as food; splited or whole seed eaten as snack and dhal; Bread and bakery; Livestock feed

Cont...

Status of Pulses crop

Pulses	Common name	Native range	Ranking among growing countries in the world	Highest producing state of India	Composition of Nutrient (gm)	Economic note
Bengal Gram (*Cicer arietinum* L.)	Hindi: Chana English: Chickpea, Bengal gram Sanskrit: Jivana, Chanakah	Iran, Iraq	India, Pakistan, Turkey and Iran	Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Andhra. Pradesh and Karnataka	Carbohydrate (g): 61 Protein (g): 17 Fiber (g): 1 Fat (g): 5 Energy (kcal): 360 Moisture %: 10 Calcium (mg): 202 Phosphorus (mg): 312 Iron (mg): 5 (Asif et al 2013)	Used as food; splited or whole seed eaten as dal, snack, sweets, and namkeen; Leaves are used as vegetable; Livestock feed
Cowpea (*Vigna unguiculata* (L.) Walp.)	Hindi: Lobiya English: Blackeyed Pea; Cowpea Sanskrit: Mahamasah, rajamasah	Central Africa	Nigeria	Punjab, Haryana, Delhi, West U.P and Rajasthan, Karnataka, Kerala, Tamil Nadu, Maharashtra and Gujarat	Carbohydrate (g): 54 Protein (g): 24 Fiber (g): 3 Fat (g): 1 Energy (kcal): 323 Moisture %: 13 Calcium (mg): 77 Phosphorus (mg): 414 Iron (mg): 9 (Ezeagu, 2009, Asif et al 2013, Singh et al 2016)	Used as feed, forage, hay, and silage for livestock, and green manure
Lentil (*Vicia lens* (L.) Coss. & Germ.)	Hindi: Masur English: Lentil Sanskrit: Masura, mangalaya	Turkey to South Iran	Canada, India, Australia, Turkey, United States, Nepal, Ethiopia, China	Bihar, W.B. Jharkhand	Carbohydrate (g): 59 Protein (g): 25 Fiber (g): 1 Fat (g): 1 Energy (kcal): 293 Moisture %: 12 Calcium (mg): 69 Phosphorus (mg): 293 Iron (mg): 7 (Asif et al 2013, Singh et al 2016)	Splited or whole seeds are used as dal and curry; flour used to make bread, cake and baby foods
Kidney Bean (*Phaseolus vulgaris* L.)	Hindi: Rajma, Rajmah English: Kidney Bean, Common Bean Sanskrit:	Central and South America	India, Myanmar, Brazil	Gujarat, Jharkhand, Tamil Nadu, Karnataka, Uttar Pradesh, Andhra Pradesh, West Bengal, Bihar, Madhya Pradesh	Carbohydrate (g): 61 Protein (g): 23 Fiber (g): 5 Fat (g): 1 Energy (kcal): 346 Moisture %: 12 Calcium (mg): 260 Phosphorus (mg): 410 Iron (mg): 5 (Asif et al 2013, Singh et al 2016)	Staple food; dry seeds used as Dal; Bakery and livestock feed
Pigeon Pea (*Cajanus cajan (L.) Huth*.)	Hindi: Arhar, toor dal English: Red gram, Pigeon pea Sanskrit: Adhaki, Kakshi, Tuvari	India, West Himalaya	India, Myanmar, China, Nepal	Maharashtra, Karnataka, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Gujarat, Odisha, Tamil Nadu, Chhattisgarh and Bihar	Carbohydrate (g): 58 Protein (g): 22 Fiber (g): 1 Fat (g): 2 Energy (kcal): 335 Moisture %: 13 Calcium (mg): 73 Phosphorus (mg): 304 Iron (mg): 2 (Asif et al 2013, Singh et al 2016)	Split or whole seeds used as Dal; Green seeds & pods used as vegetable; livestock feed (Handbook of Agriculture; Joshi et al 2001)
Garden pea (*Pisum sativum* L.)	Hindi: Matar English: Garden pea, English pea Sanskrit: Renuka, Satila	Western Asia	China, Ethiopia and Australia		Carbohydrate (g): 16 Protein (g): 7 Fiber (g): 4 Fat (g): 0 Energy (kcal): 93 Moisture %: 73 Calcium (mg): 20 Phosphorus (mg): 139 Iron (mg): 1 (Asif et al 2013, Singh et al 2016)	Split or whole seeds used as Dal, salad and soup; Roasted seeds used as coffee; Green seeds used as vegetable; livestock feed
Indian Bean (*Lablab purpureus* (L.) Sweet)	Hindi: Bhatvas, Shimi, Sem English: Indian bean Sanskrit: Nispavah	India or South-East Asia	----	Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra	Carbohydrate (g): - Protein (g): 20-35%. Fiber (g): Fat (g): - Energy (kcal): - Moisture %: - Calcium (mg): - Phosphorus (mg): - Iron (mg): -	Pulse, vegetable, and forage

Status of Oilseed crop

Linseed (*Linum usitatissimum* L.)	Hindi: Alsi English: Flax seed, linseed Sanskrit: Atasi	Fertile Crescent, 'an area east to Mediterranean Sea towards India'	Canada, India, China, USA	Madhya Pradesh, Maharashtra, Chhattisgarh, Uttar Pradesh, Jharkhand, Bihar, Odisha, Karnataka, Nagaland, Assam, West Bengal, Himachal Pradesh, and Rajasthan	Oil content (%): 38 Carbohydrate (g): 28.8 Protein (g): 18.3 Fiber (g): 27.3 Fat (g): 42.16 Energy (kcal): 534 Kcal Moisture %: - Calcium (mg): 255 Phosphorus (mg): 622 mg Iron (mg): 5.73 (Sonawane and Arya 2012), Goyal et al 2014, Saini et al 2020)	Rich oil source; used in snack and as topping in corn snack, cake, tortilla, ice cream, yogurt and fibre textile
Soybean (*Glycine max* (L.) Merr.	Hindi: Soya bean English: Bhat, Bhatwar, Bhetmas Sanskrit: ---	Russian Far East to China and Temp. E. Asia.	United States, Brazil, Argentina, and China, India	Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, and Telangana.	Oil content (%): 20% Carbohydrate (g): 19.8 Protein (g): 42.9 Fiber (g): 21.77–30.31 Fat (g): 19.8 Energy (kcal): --- Moisture %: 6.9 Calcium (mg): 245 Phosphorus (mg): 131-205 Iron (mg): 9.6 (Ezeagu 2009, Sharma et al 2014, Bhartiya et al 2020, Saini et al 2020)	Human food beverages; oil sources; industrial uses; biodiesel
Niger (*Guizotia abyssinica* (L.f.) Cass.)	Hindi: Ramtil English: Niger Sanskrit: ---	North East Tropical Africa.	South India, Ethiopia	Madhya Pradesh, Odisha, Maharashtra, Karnataka and Chhattisgarh	Oil content: 30-40% Protein (%):10-25 Fiber (%):10-20 (crude) Fat (%):20-31 Energy (kcal): - Moisture %: 10-11 Calcium (mg): 50-587 Phosphorus (mg): 180-800 Iron (mg): 56.7 mg (Jagtap 2015, Jain and Singla 2016)	Oil source; animal's and bird's feed; Biofuel
Safflower (*Carthamus tinctorius* L.)	Hindi: Kusum or Kardi English: Safflower Sanskrit:---	Asia, the Middle East, and Africa	India, USA, Mexico and China	Maharashtra, Karnataka and parts of Andhra Pradesh, Madhya Pradesh, Odisha, Bihar	Oil content (%): 33 Protein (%): 17.9 (crude) Fiber (%):16.4 Calcium (mg): 59.00-101.50 Phosphor (Mg): 663.00-770.40 Potassium (K): 156.15-203.60 (Mahdi and Hassanabadi 2010, Al Surmi NY et al 2016)	Vegetable oil; in coloring food and cosmetics; biofuel and in medicines
Sunflower (*Helianthus annus* L.)	Hindi: Surajmukhi English: Sunflower Sanskrit: ---	North America	Ukraine, Russia, European union, Argentina, Turkey	Karnataka, Andhra Pradesh and Maharashtra	Oil content %: 29 Carbohydrate (g): 18.72 Protein (g): 19.69 Fiber (g): 0.96 Fat (g): 53 Energy (kcal): 534 Moisture %: 3.1 Calcium (mg): 277 Phosphorus (mg): 667.66 Iron (mg): 4.9 (Aishwarya and Anisha 2014, Saini et al 2020)	Vegetable oil; used to create biodiesel; livestock and poultry feeds
Sesame (*Sesamum indicum* L.)	Hindi: Safed til English: Sesame Sanskrit: ---	Tropical & Subtropical Old World	India, Tanzania, Nigeria, China	Gujarat, Tamil Nadu, West Bengal, Karnataka and Madhya Pradesh.	Oil content: 50% Carbohydrate (g): 24-35 Protein (g): 18.08 Fiber (g): 5.5 Fat (g): 50.87 Moisture %: 3.1 Calcium (mg): 960 Phosphorus (mg): 659 Iron (mg): 19.2 (Prasad et al 2012; Kumar et al 2010)	Oil source; food and confectionery & biscuit; Livestock and poultry feed; Used in pharmaceutical
Coconut (*Cocos nucifera* L.)	Hindi: Nariyal English: Coconut Sanskrit: Kalpa vriksha	Central Malesia to SW. Pacific	Indonesia, Philippines, India, Sri Lanka, Vietnam, Mexico, Thailand and Malaysia.	Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, West Bengal, Odisha, Gujarat, Assam, Maharashtra and Bihar	Oil content: 50% Carbohydrate (g): 87.10(juice)- 88.65(milk) Protein (g): 7.50 (milk); 3.05(juice) Fiber (g): 3.35 (milk); 2.35(juice) Fat (g): 50.87 Energy (kcal): 304(milk); 334.21 (juice) Moisture %: 8.33 Calcium (mg): 26 Phosphorus (mg): 36 Iron (mg): 0.7 (DebMandal and Mandal 2011, Belewu et al 2014)	

Status of sugare crop

Sugarcane (*Saccharum officinarum* L.)	Hindi: Ganna, Ikh, English: Sugarcane Sanskrit: Ikshu	Central and E. U.S.A. and Central and E. Asia to Tropical and Subtropical	India, Brazil, EU-28, Thailand, China, USA, Russian, Mexico, Pakistan	Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Maharashtra and Gujrat	Carbohydrate (g): 58.55 Protein (g): 3.20 (crude) Fiber (g): 29.88 (crude) Fat (g): 1.68 Moisture: 82.91% Total Sugar(g): 16.32% Calcium (mg): 18 (Sankhla et al 2012, Williams et al 2016)	Use in making sugar jaggery; manufacturing in alcohols and beverages and leaves used as livestock feed.
Sugar beet (*Beta vulgaris* L.)	Hindi: Chukander English: Beet root Sanskrit: Palanki	Middle East	Russia, France, the United States, Germany, and Turkey	Haryana, Uttar Pradesh, Himachal Pradesh, West Bengal and Maharashtra	Carbohydrate (g): 9.96 Protein (g): 1.68 Fiber (g): 2.0 (dietary) Fat (g): 0.18 Energy (kcal): 43 Sugar(g): 9.2 Calcium (mg): 16 Phosphorus (mg): 38 Potassium (mg): 305 Iron (mg): 0.79 (Yashwant, 2015; Neha et al 2018)	Alcohol, pharmaceutic als and baker yeast industries
Tapioca (*Manihot esculenta* Crantz)	Hindi: Shakarkand English: Cassava, Tapioca Sanskrit: Tarukandah	W. South America to Brazil	Nigeria, Brazil, Thailand and Indonesia	Tamil Nadu, Kerala, Andhra Pradesh, Nagaland and Assam	Carbohydrate (g): 39.06 Protein (g): 1.36 Fiber (g): 0.28 (dietary) Fat (g): 0.18 Moisture %: 59.68 Energy (kcal): 160 Calcium (mg): 16 Phosphorus (mg): 27 Iron (mg): 0.27 (Salvador et al 2014)	Human food; bakery and biofuel.

***Abbreviations*:** g: gram; mg: milligram; Kcal: Kilocalorie

CONCLUSION

India is a population rich country where more than half people belongs to rural areas which are totally dependent on the agriculture farming for livelihood. In the past farm productivity was low and depended on imports for domestic need of food items. In 1950-51, the total irrigated area was 18% and food grains cultivation was 97.32 Mha. The productivity was 522 kg/ha and production stood 51 MT with 361.1 million populations which increased to 439.2 MT in 1961 at growth rate of 1.96%. The demand of food-grains was increased due to high population. After 1960, Green revolution efforts in research and development resulted in the introduction of high yielding seeds of wheat and rice which were called as miracle seeds. Many technologies were developed which increased the farm productivity and made India self-sufficient in food grains. The use of pesticide, fertilizer and irrigation methods solved many problems like disease, nutrition and drought. In addition to being produced, many crops were introduced from other countries. Many indigenous crops which are discussed in this paper were cultivated from ancient times. Consequently, agriculture becomes one of the largest contributors in national Gross Domestic Product (GDP).

The disadvantage of the modern management techniques of agriculture are loss of indigenous varieties due to focusing on high yield producing plants which destroyed the diversified gene pool. The maximum use of chemical fertilizer and pesticides make soil infertile and loss of nutrients from grains. It also reduced the organic trend of farming by the dependency on chemicals and pesticides for the resistant of diseases. These grains affect the human health. So, the intensive research work with a proper planning should be initiated for the conservation of the traditional varieties because of their nutritional benefits, these kinds and techniques should be included in the nation's food and nutrition security strategies.

REFERENCES

Adhikari RK 2012. Economics of finger millet (*Elecusine coracana* G.) production and marketing in peri urban area of Pokhara valley of Nepal. *Journal of Development and Agricultural Economics* **4**(6): 151-157.

Aishwarya S and Anisha V 2014. Nutritional composition of sunflower seeds flour and nutritive value of products prepared by incorporating sunflower seeds flour. *International Journal of Pharmaceutical Research & Allied Sciences* **3**(3): 45-49.

Alagh YK 1990. Agro-climatic planning and regional development. *Indian Journal of Agricultural Economics* **45**(3): 244-268.

Al-Surmi NY, El-Dengawy RAH and Khalifa AH 2016. Chemical and nutritional aspects of some safflower seed varieties. *Journal of Food Processing and Technology* **7**(5): 1-5.

Annual Report 2020-21. Department of Agriculture, Cooperation & Farmers' Welfare Ministry of Agriculture & Farmers' Welfare Government of India https://agricoop.nic.in/sites/default/files/Web%20copy%20of%20AR%20%28Eng%29_7.pdf

Arjun KM 2013. Indian agriculture-status, importance and role in

Indian economy. *International Journal of Agriculture and Food Science Technology* **4**(4): 343-346.

Asif M, Rooney LW, Ali R and Riaz MN 2013. Application and opportunities of pulses in food system: A review. *Critical Reviews in Food Science and Nutrition* **53**(11): 1168-1179.

Balasubramanian A 2013. *Agro-Ecological Zones of India*. Centre for Advanced Studies in Earth Science. University of Mysore https://www.researchgate.net/publication/314206350_AGROECOLOGICAL_ZONES_OF_INDIA

Belewu M, Muhammed LA, Abdulsalam K, Belewu K and Belewu NO 2014. Date-coconut drink: Physico-chemical and sensory qualities. *Daffodil International University Journal of Science and Technology* **9**(2): 1-6.

Bhartiya A, Aditya JP, Pal RS, Chandra N, Kant L and Pattanayak A 2020. Bhat (Black Soybean): A traditional legume with high nutritional and nutraceutical properties from NW Himalayan region of India. *Indian Journal of Traditional Knowledge* **19**(2): 307-319.

Bunkar DS, Goyal SK, Meena KK and Kamalvanshi V 2021. Nutritional, Functional Role of Kodo Millet and its Processing: A Review. *International Journal of Current Microbiology and Applied Sciences* **10**(01): 1972-1985.

Chaudhari PR, Tamrakar N, Singh L, Tandon A and Sharma D 2018. Rice nutritional and medicinal properties: *A. Journal of Pharmacognosy and Phytochemistry* **7**(2): 150-156.

Chaudhuri SK 2005. Genetic erosion of agrobiodiversity in India and intellectual property rights: Interplay and some key issues. *Patentmatics* **5**(6):1-10.

Das S, Khound R, Santra M and Santra DK 2019. Beyond bird feed: Proso millet for human health and environment. *Agriculture* **9**(3): 64.

DebMandal M and Mandal S 2011. Coconut (*Cocos nucifera* L.: Arecaceae): In health promotion and disease prevention. *Asian Pacific journal of tropical medicine* **4**(3): 241-247.

Deshpande SS, Mohapatra D, Tripathi MK and Sadvatha RH 2015. Kodo millet nutritional value and utilization in Indian foods. *Journal of Grain Processing and Storage* **2**(2): 16-23.

Ezeagu IE 2009. Nutritional value of tropical plant seeds, pp 39-53. In: Krishnan H B (eds). *Modification of seed composition to promote health and nutrition*. Agronomy Monographs.

Goyal A, Sharma V, Upadhyay N, Gill S and Sihag M 2014. Flax and flaxseed oil: an ancient medicine & modern functional food. *Journal of Food Science and Technology* **51**(9): 1633-1653.

Goyal S, Prabha, Rai JP and Singh SR 2016. Indian Agriculture and Farmers-Problems and Reforms, pp 79-87. In: Goyal SK, Rai JP and Kumar S (eds). *Indian Agriculture and Farmers*. Poddar Publication. BHU, Varanasi, India.

Handbook of Agriculture 2017. India: Indian Council of Agricultural Research, New Delhi.

Hinz R, Sulser TB, Hüfner R, Mason-D'Croz D, Dunston S, Nautiyal S, Ringler C, Schüngel J, Tikhile P, Wimmer F and Schaldach R 2020. Agricultural development and land use change in India: A scenario analysis of trade-offs between UN Sustainable Development Goals (SDGs). *Earth's Future* **8**(2): DOI:10.1029/2019EF001287.

Huma B, Hussain M, Ning C and Yuesuo Y 2019. Human benefits from maize. *Scholar Journal of Applied Sciences and Research* **2**(2): 04-07.

Jagtap PK 2015. Niger: A life line of tribal agriculture in India. *Rashtriya Krishi* **10**(1): 51-52.

Jain R and Singla N 2016. Formulation and nutritional evaluation of food products supplemented with niger seeds. *Nutrition & Food Science* **46**(4): 604-614.

Kalal S, Thummakomma K, Maheswari K U and Rani N 2019. Nutritional Composition of Little Millet Flour. *International Research Journal of Pure and Applied Chemistry* **20**(4): 1-4

Kaul J, Kumar R, Nara U, Jain K, Olakh D, Tiwari T, Yadav O P and Dass S 2017. Development of Database of Maize Hybrids and Open Pollinated Varieties Released and Notified for Cultivation in India. *Journal of Agricultural Science* **9**(10): 105-113.

Received 30 January, 2022; Accepted 04 June, 2022

Kaur H and Sharma S 2020. An overview of Barnyard millet (Echinochloa frumentacea). *Journal of Pharmacognosy and Phytochemistry* **9**(4): 819-822.

Kumar AKR, Pal A, Khanum F and Bawa A 2010. Nutritional, Medicinal and Industrial Uses of Sesame (Sesamum indicum L.) Seeds: An Overview. *Agriculturae Conspectus Scientificus* **75**(4): 159-168.

Kumar A, Metwal M, Kaur S, Gupta AK, Puranik S, Singh S, Singh M, Gupta S, Babu B, Sood S and Yadav R 2016. Nutraceutical value of finger millet [*Eleusine coracana* (L.) Gaertn.], and their improvement using omics approaches. *Frontiers in Plant Science* **7**: 934.

Mahdi M and Hassanabadi A 2010. Nutritional evaluation of full-fat Safflower seed for broiler chickens. *Italian Journal of Animal Science* **9**(e52): 268-272

Maitra S and Shankar T 2019. Agronomic management in little millet (*Panicum sumatrense* L.) for enhancement of productivity and sustainability. *International Journal of Bioresource Science* **6**(2): 91-96.

Natarajan S, Sunil N, Kumar R and Reddy M 2018. Agrobiodiversity in India: Status and Concerns, pp 121-138. In: Kumar B and Singh R (eds). *Sustainable Agriculture for Food Security: Concepts and Approaches*. Biotech Books, New Delhi, India.

Neha P, Jain SK, Jain NK, Jain HK and Mittal HK 2018. Chemical and functional properties of Beetroot (*Beta vulgaris* L.) for product development: A review. *International Journal of Chemical Studies* **6**(3): 3190-3194.

Nelson ARLE, Ravichandran K and Antony U 2019. The impact of the Green Revolution on indigenous crops of India. *Journal of Ethnic Foods* **6**(1): 1-10.

Pocket Book of agricultural statistics 2017- Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare Directorate of Economics & Statistics New Delhi. https://agricoop.nic.in/sites/default/files/ pocketbook_0.pdf

Prasad MN, Sanjay KR, Prasad DS, Vijay N, Kothari R and Shivananju NS 2012. A review on nutritional and nutraceuticals properties of sesame. *Journal of Nutrition and Food Sciences* **2**(2): 1-6.

Saini P, Singh, C, Kumar P, Bishnoi SK and Francies RM 2020. Breeding for Nutritional Quality Improvement in Field Crops, pp 200-264. In: Kumar A, Prasad B and Kumar A (eds). *Classical and Molecular Approaches in Plant Breeding*, Narendra Publishing House. Sector 9, Rohini, Delhi, India

Salvador EM, Steenkamp V and McCrindle CM 2014. Production, consumption and nutritional value of cassava (Manihot esculenta, Crantz) in Mozambique: An overview. *Journal of Agricultural Biotechnology and Sustainable Development* **6**(3): 29-38.

Sankhla S, Chaturvedi A, Aparna K, Dhanlakshmi K and Mulinti S 2012. Preservation of Sugarcane Juice Using Hurdle Technology. *Sugar Tech* **14**(1): 26-39.

Sharma D, Gupta R and Joshi I 2014. Nutrient analysis of raw and processed soybean and development of value added soybean noodles. *Inventi Rapid: Life Style* **1**: 1-5.

Singh AK, Gautam US, Chahal VP, Singh NP, Singh A, Dubey SK and Yemul SN 2016. *Demonstrational performance of pulses in India: Experiences of KVKs under NFSM (2015-16),* Indian Council of Agriculture Research, New Delhi.

Singh P 2006. Agro-climatic zonal planning including agriculture development in north-eastern India. Final Report of the Working Group on agriculture XI five-year Plan (2007-2012), Volume 1-Main report. Planning commission, Government of India, New Delhi.

Sonawane S and Arya S 2012. Flaxseed: Health benefits and application. *Food marketing and technology of India* **3**: 24-28.

Williams IO, Onyenweaku EO and Atangwho IJ 2016. Nutritional and antimicrobial evaluation of Saccharum officinarum consumed in Calabar, Nigeria. *African Journal of Biotechnology* **15**(33): 1789-1795.

Yashwant K 2015. Beetroot: A super food. *International Journal of Engineering Studies Technical Approach* **1**(3): 20-26.