

Processing Technology of Legumes and Oilseeds

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Legumes

Oilseed Legumes

Higher fat and calorie content



- Soybeans
- Peanuts



Fresh Legumes

Eaten as fresh vegetables



- Fresh beans
- Fresh peas/pods



Pulses

*Dried, edible seeds of grain legumes;
low-fat, high-fiber, high-protein*

Common beans

*A type of pulse;
many varieties*

- Black beans
- Pinto beans
- Kidney beans



Lentils



Dry peas



Chickpeas



- **Legumes** are flowering plants having pods which contain beans or peas

Rich source of protein and carbohydrate

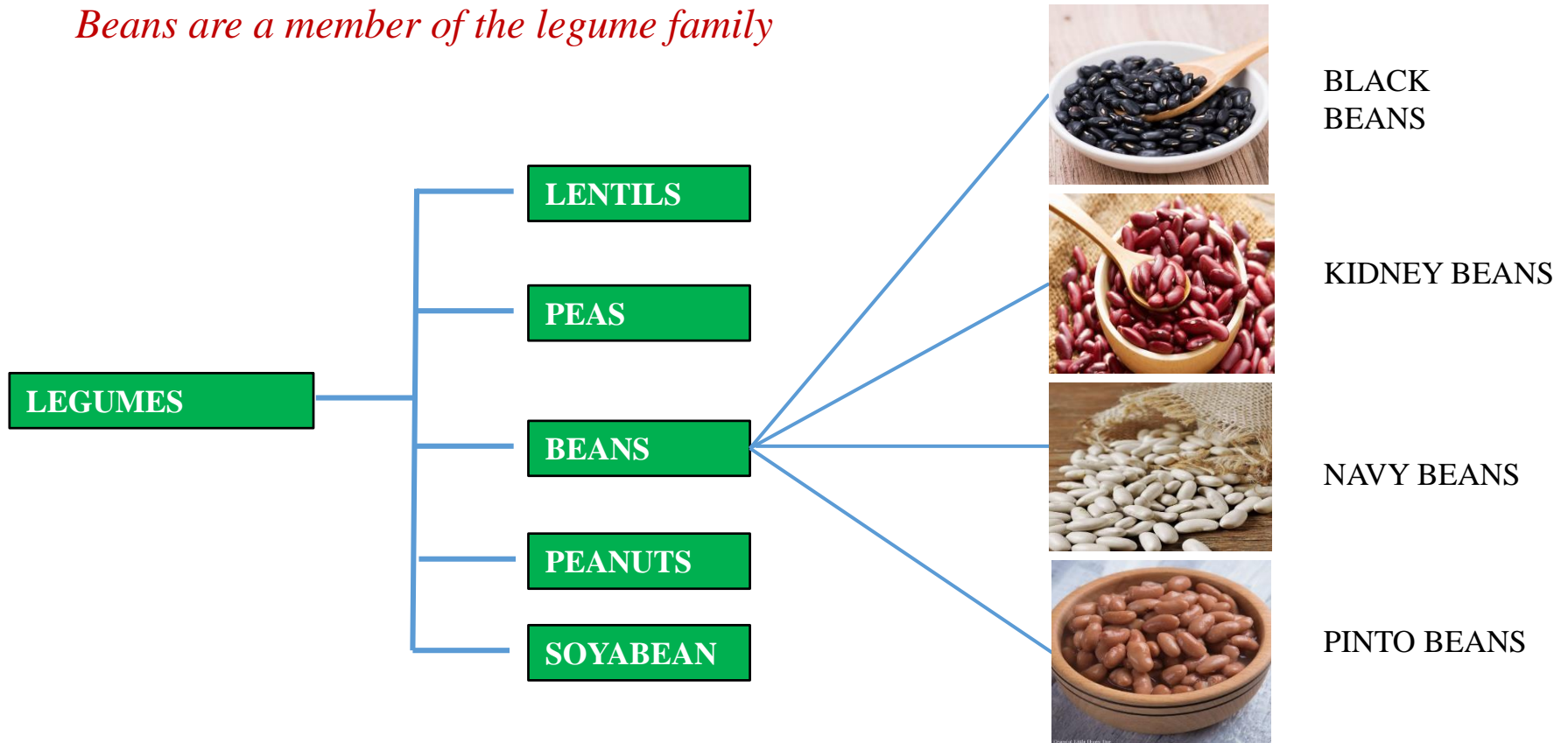
- It provides protein and energy to much of the world's population

Protein- 20-25% i.e. 2-3 times more protein than wheat and rice

Contain carbohydrate (65-72%)

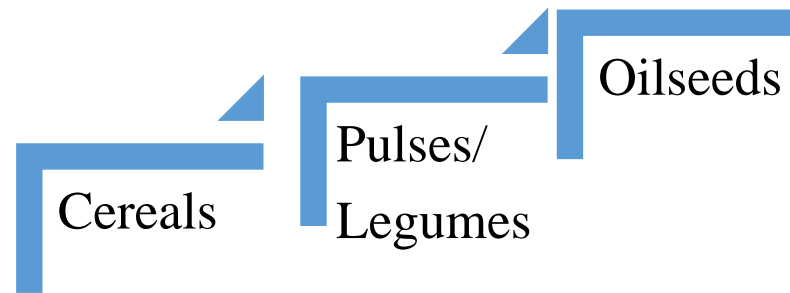
- **Oil seeds** are seeds which contain a high oil content and are widely grown as a source of oil

Beans are a member of the legume family



Present Status and Future Prospects of Legumes and Oilseeds

India has reached to a level of self-sufficiency in the production of cereals, pulses and oilseeds after the green revolution.



Difference between Pulses and legumes

- Pulses are edible seeds that grow on a legume
- Pulses are the seeds of a legume and are a main food staple in the human diet
- Pulses and legumes are part of the pea, bean and lentil families.

- Legumes are next to cereals as an important source of proteins.
- They are flowering plants having pods which contain bean or peas. There are basically two groups of legumes.
- First is **high-protein high-oil** group like soybean, groundnut, lupine, etc. which are mainly used for processing and contains high protein (~ 35%) and oil content (15- 45%).
- The second group comprises the **moderate- protein low-oil** types like cowpea, gram, pea, lentil etc. India is one of the largest legumes growing countries in the World. Different pulses grown in India are chickpea (bengal gram/chana), pigeon pea (tur/arhar), green gram (moong), black gram (urad), lentils (masur).

Present status of legumes

- Currently, we are in the mid-way of self-sustaining in pulses production as we are world leader in production, consumption and import as well.
- India import 2-3 million tons of pulses during 2010-11, causing huge hard foreign earning India is the largest producer and consumer of pulses in the world accounting for about 29 per cent of the world area and 19 per cent of the world's production.

Table 1. Global legumes area, production and yield

	Dry bean	Chickpea	Cowpea	Pigeonpea	Lentil	Faba bean	Soybean	Groundnut
Area harvested (million ha)								
1994–96	25.9	10.9	8.2	4.1	3.4	2.3	62.0	22.1
2008–10	27.4	11.5	10.4	4.7	3.7	2.5	99.4	24.0
% change	6	5	27	15	10	8	60	9
Growth rate (%)	0.7	0.2	1.7	1.1	0.8	0.6	3.5	0.4
Production (million tons)								
1994–96	17.1	8.1	2.7	2.8	2.8	3.6	131.2	29.4
2008–10	21.7	9.9	5.3	3.7	3.7	4.2	238.6	37.4
% change	27	23	91	35	35	18	82	27
Growth rate	1.9	1.3	4.7	2.1	2.3	1.4	4.4	1.7
Yield (kg/ha)								
1994–96	659	739	339	684	822	1,565	2,115	1,331
2008–10	793	864	508	800	1,003	1,701	2,399	1,558
% change	20	17	50	17	22	9	13	17
Growth rate	1.2	1.1	2.9	1.0	1.5	0.8	0.9	1.3

Note: Percentage change and growth rate pertains to the period between 1994 and 2010. Also, growth rate is an annual figure.

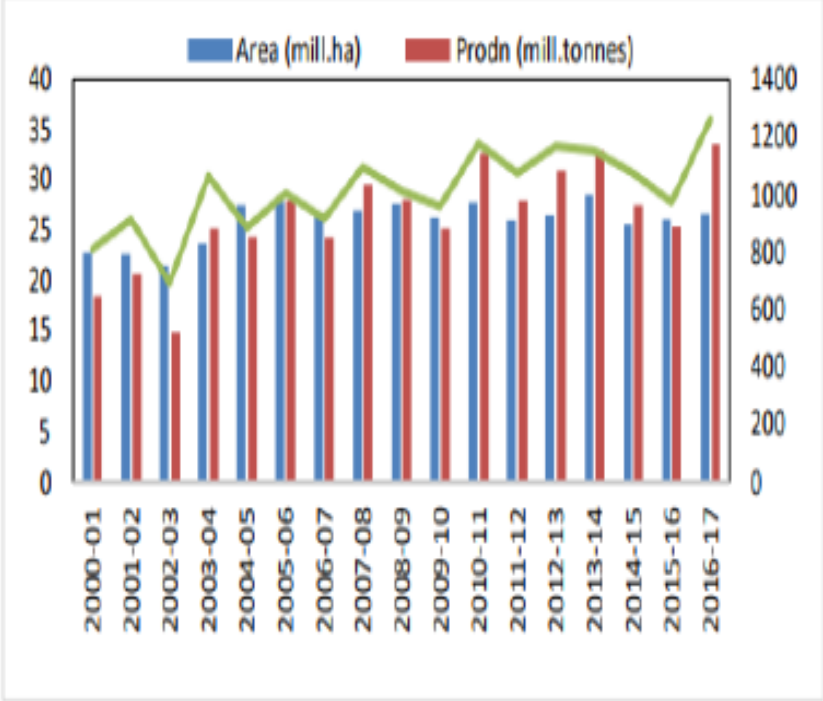
Future Prospects of legumes

- Drought tolerant leguminous cropping system has to be improvised.
- Location specific weather data have to be interpretation with the past ten years data, with this proper sowing should be undertaken.
- Pressurized micro irrigation system should be evolved under water scarcity condition using advanced soil moisture measurements.
- Drought tolerant Rhizobium strains could be used for pre treatment at field level.
- Ongoing resource conservation technologies (Zero tillage, Minimum tillage, Permanent soil organic cover etc.,) should be practiced under rainfed ecosystem in general but, particularly in drought condition.

PRESENT STATUS OF OILSEEDS

- The self-sufficiency in oilseeds attained through “Yellow Revolution” during early 1990’s, could not be sustained beyond a short period. Despite being the **fifth largest oilseed crop producing country** in the world, **India** is also one of the largest importers of vegetable oils today.
- The demand-supply gap in the edible oils has necessitated huge imports accounting for 60 per cent of the country’s requirement (2016-17: import 14.01 million tonnes; cost Rs. 73,048 crore).
- In India, annual oilseeds are cultivated over 26.67 million hectares of area producing 30.06 million tonnes annually.
- **Soybean and castor crops** have registered positive and high growth rates and rapeseed-mustard registered higher rate of production (Table.1). The higher productivity driving the production (and profitability) and area expansion of castor is the best situation for oilseeds.
- Vegetable oil production is around 7.0 million tonnes from about 30.0 million tonnes of oilseeds necessitating import to the tune of 10-14 million tonnes.

Fig 1: Trends in area, production and yield of annual oilseeds in India (2000-2017)



Source: DFI Committee Estimates based on data compiled from DACNET

Table 1. Growth in XII Plan over XI Plan

Crops	Per cent increase/decrease		
	Area	Yield	Production
Castor	+11.10	+16.00	+27.00
Linseed	-24.60	+20.80	-7.72
Niger	-29.58	+15.10	-18.80
Groundnut	-14.00	+13.40	-2.44
Sesame	-7.70	+13.50	+5.00
Rapeseed & Mustard	+0.23	+7.20	+7.40
Soybean	+18.00	-10.00	+6.24

- Oilseeds have become an increasingly important agriculture commodity, with a steady increase in annual production worldwide.
- Oilseeds are seeds which contain high oil content and are widely grown as a source of edible oil. Major oilseeds grown in India are **groundnut, cottonseed, mustard, rapeseed, soybean, sunflower and sesame seed**. The coconut (copra) is also an important oilseed.

FUTURE PROSPECTS OF OILSEEDS

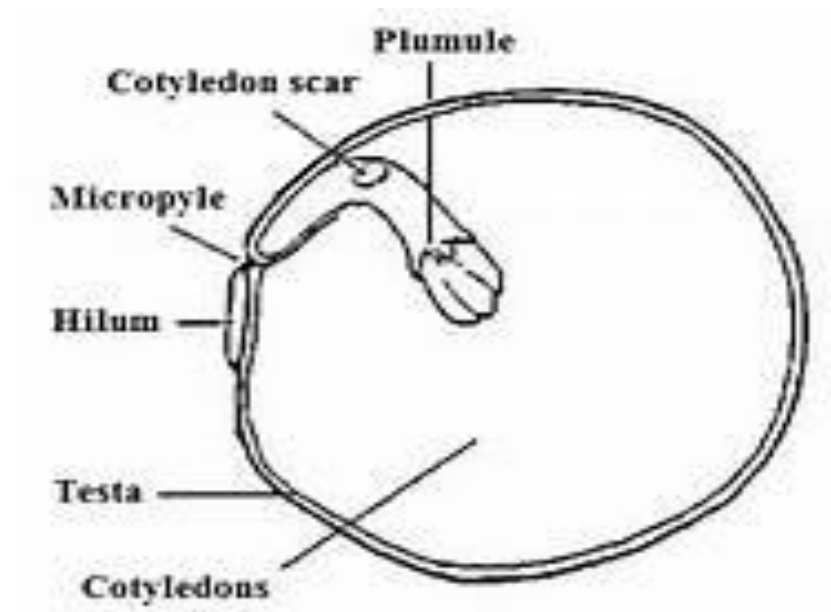
- Genetic engineering of oilseeds will allow sustainable production and will increase the nutritional value and quality
- New biotechnology methods will allow modification of genes that will increase the level of fatty acid.
- Collection of forest oilseed such as sal, mowrah etc. needs to be intensified.
- To make up the deficit of oil, rice bran oil, corn oil, and other non-conventional oils are to be made available at maximum extent.

Morphological structure and chemical composition of Legumes and Oilseeds

MORPHOLOGY OF LEGUMES

Legume seeds has 3 parts Major parts :

1. seed coat (hull),
2. cotyledons, and
3. hypocotyl (including plumule).



- In many of the legumes, the cotyledons constitute about 90% of the seed.

The seed coat is the next largest fraction, but because it is high in fiber.

Distribution of seed parts in legumes

Legume	Proportion of Whole Seed		
	Seed Coat (%)	Cotyledons (%)	Hypocotyl (%)
Pea (<i>Pisum sativum</i>) ¹	10.0	89.3	1.3
Lentil (<i>Lens esculenta</i>) ¹	8.1	90.0	2.0
French bean (<i>Phaseolus vulgaris</i>) ¹	8.6	90.4	1.0
Mung bean (<i>Phaseolus aureus</i>) ¹	12.1	85.6	2.3
Soybean (<i>Glycine max</i>) ²	7.3	90.3	2.4

¹Singh *et al.* (1968).

²Kawamura (1967).

TABLE 10.4
PROXIMATE COMPOSITIONS OF SOYBEANS AND SEED PARTS¹

Fraction	Protein (N X 5.71) (%)	Fat (%)	Carbohydrate (%)	Ash (%)
Whole bean (100%)	40	21	34	5
Seed coat (8%)	9	1	86	4
Cotyledon (90%)	43	23	29	5
Hypocotyl (2%)	41	11	44	4

CHEMICAL COMPOSITION OF LEGUMES

Legume	Protein ² (%)	Fat (%)	Ash (%)	Fiber (%)	Carbohydrate ³ (%)
Chick pea (<i>Cicer arietinum</i>)	20.6	5.4	2.8	10.3	61
Lentil (<i>Lens esculenta</i>)	29.6	3.1	2.4	3.2	62
Pea (<i>Pisum sativum</i>)	27.9	3.2	2.8	5.9	60
Broad bean (<i>Vicia faba</i>)	31.8	0.9	3.6	8.5	55
Peanut (<i>Arachis hypogaea</i>)	30.0	50.0	2.1	3.0	14
Soybean (<i>Glycine max</i>)	43.9	21.0	4.9	— ⁴	30 ⁴

Major oilseed crops are grown in India



Groundnut



Safflower



Sunflower



Soybean



Linseed



Mustard



caster



Sesame

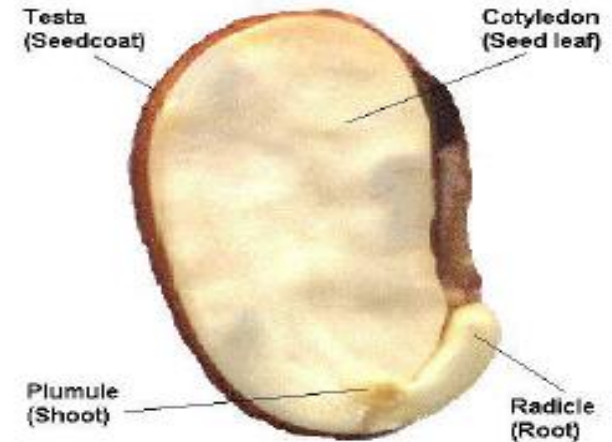


Niger

MORPHOLOGY OF OILSEEDS

Oilseeds are made up of three basic parts:

1. The seed coat,
2. The embryo, and
3. One or more food storage structures.



- The seed contains two pieces of cotyledons that function as food reserve structures.
- The basic function of the coat is to protect the embryo from fungi and bacterial infection.
- The entire hull of oilseeds is the germ.

Oilseeds	Composition (%)						Energy (Cal/100 g kernel)
	Moisture	Protein	Oil	Ash	Fiber	Carbohydrates	
Groundnut	5.0	28.5	47.5	2.9	2.8	13.3	595
Mustard	8.5	20.0	39.7	4.2	1.8	23.8	541
Niger	4.2	23.9	39.0	4.9	10.9	17.1	515
Sunflower	5.5	19.8	52.1	3.7	1.0	17.9	620
Sesamum	5.3	18.3	43.3	5.2	2.9	25.0	563
Safflower	5.5	13.5	25.6	2.6	34.9	17.9	356
Soyabean	8.1	43.2	19.5	4.6	3.7	20.9	432

CHEMICAL COMPOSITION OF OILSEEDS

Item	Ingredient					
	Oat hay	Soybean meal	Ground corn	Flaxseed	Sunflower	Canola
Dry matter (%)	91.15	89.41	92.42	93.15	94.37	91.88
Organic matter (%DM)	98.84	93.33	98.89	96.99	98.37	97.00
Crudeprotein (%DM)	15.85	49.56	8.68	22.41	17.96	22.75
Ether extract (%DM)	1.45	2.10	3.29	26.96	40.65	36.21
Neutral detergent fiber (%DM)	50.62	14.85	11.34	40.52	31.32	27.45
Acid detergent fiber (%DM)	42.50	10.32	3.92	26.95	20.89	20.98