

PROCESSING TECHNOLOGY OF LEGUMES AND OILSEEDS

ASFE-3102

LEGUMES



OILSEEDS



INTRODUCTION

Importance of legumes

- Legumes are great sources of fat, protein and carbohydrates. These foods are a staple of vegetarian diets.
- Break cereal disease cycle
- Food and forage

Importance of OILSEEDS

Seeds that are grown to produce oil.

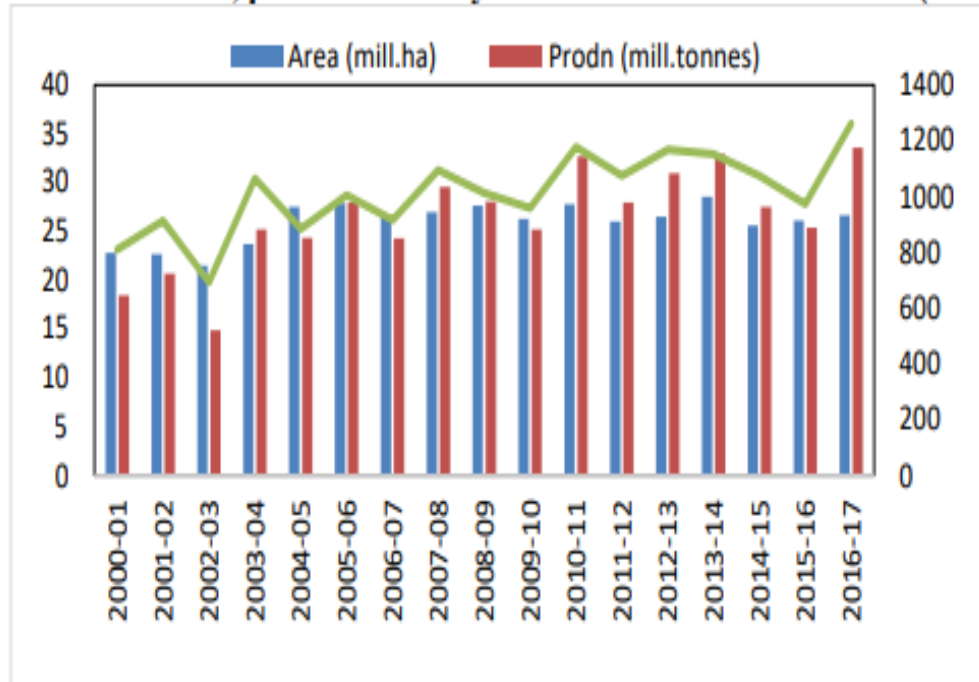
- High economic value
- Bio-fuel
- Stabilizes green house gases

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 |

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.

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.

MORPHOLOGY OF LEGUMES AND OILSEEDS

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➤ Legume seeds has **3 parts** major parts :

1. seed coat (hull)

2. Cotyledons

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 and is high in fiber.

DISTRIBUTION OF SEED PARTS

| LEGUME | SEED COAT(%) | COTYLEDON(%) | HYPOCOTYL(%) |
|-------------|--------------|--------------|--------------|
| PEA | 10 | 89.30 | 1.3 |
| LENTIL | 8.1 | 90 | 2 |
| FRENCH BEAN | 8.6 | 90.4 | 1 |
| SOYBEAN | 7.3 | 90.3 | 2.4 |

CHEMICAL COMPOSITION OF LEGUMES

| LEGUME | PROTEIN(%) | FAT(%) | FIBRE(%) | CARBOHYDRATE(%) |
|----------|------------|--------|----------|-----------------|
| CHICKPEA | 20.6 | 5.4 | 10.3 | 61 |
| LENTIL | 29.6 | 3.1 | 3.2 | 62 |
| PEA | 27.9 | 3.2 | 5.9 | 60 |
| PEANUT | 30 | 40 | 3 | 15 |
| SOYBEAN | 43.9 | 21 | 9 | 30 |

➤ **Oilseeds** are made up of three basic parts:

1. The seed coat,

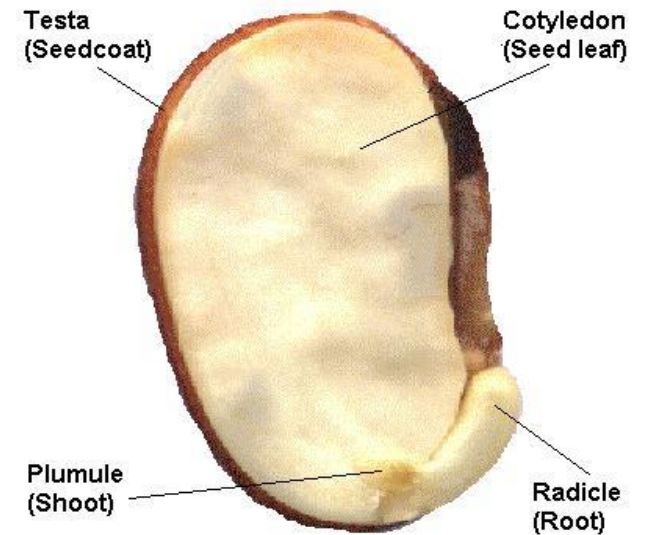
2. The embryo, and

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 |
|-----------|-----------------|---------|------|-----|-------|---------------|-----------------|
| | Moisture | Protein | Oil | Ash | Fiber | Carbohydrates | g kernel) |
| 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 |