

Oil seeds and their importance

What is fat penalty?

- Oil seeds are energy rich crop
- 1g of photosynthate is converted as:
 - 0.70 g of cereal
 - 0.64g of pulses
 - 0.42g of oil / fat
- Energy content MJ/kg
 - Oil - 39.8
 - Protein - 23.9
 - CHO - 16.8

Table 2: Estimated domestic production, import and total availability of edible oils during last 3 years (November to October) (Quantity in lakh tonnes)

Vegetable oils	2014-15		2015-16		2016-17	
	Oils	Oilseeds	Oils	Oilseeds	Oils	Oilseeds
Primary source (A)						
R-M	19.47	62.82	21.08	67.97	24.74	79.77
Soybean	16.6	103.74	13.73	85.70	22.10	137.94
Ground nut	17.02	74.02	15.27	67.33	17.16	75.65
Sunflower	1.43	4.34	0.98	2.96	0.80	2.41
Sesame	2.57	8.68	2.65	8.50	2.45	7.84
Niger seed	0.23	0.76	0.21	0.74	0.24	0.83
Safflower	0.27	0.90	0.15	0.53	0.22	0.78
Castor	7.48	18.70	6.16	17.52	4.99	14.21
Linseed	0.47	1.55	0.32	1.25	0.39	1.54
Sub-total (A)	65.54	275.51	60.55	252.50	73.09	320.97
Secondary source (B)						
Coconut	4.80		4.32		5.32	
Palm oil	1.71		1.98		2.30	
Cotton seed	12.15		10.05		12.24	
Rice bran	9.20		9.90		10.31	
SEO	3.00		3.50		2.85	
Tree & Forest origin	1.60		1.50		1.50	
Sub Total	32.46		31.25		34.40	
Total (A+B)						
Less exports & Industrial use	5.94		5.50		6.50	
NDA of edible oils	92.06		86.30		100.99	
Import of edible oils	138.53		148.50		153.17	
Total consumption of edible oils	230.59		234.80		254.16	

Source: DGCIS, Department of commerce

Table 3: India's Imports of oilseed and vegetable oil Products

(Quantity: '000 tonnes), (Value Rs. Crore)

Commodity	2015-16 (P)	
	Quantity	Value
Sesame seeds	23.60	179.66
Niger seeds	5.78	44.14
Groundnut	0.11	0.31
Other oil seeds	62.51	218.62
Vegetable oils	15642.33	68676.62
Oil meals	148.30	210.38
Castor oil	0.14	2.23
Total	15882.77	69331.96

Source: DES, DAC&FW

Table 4: India's Exports of Oilseed and Vegetable oil Products

(Quantity: '000 tonnes), (Value Rs. Crore)

Commodity	2015-16 (P)	
	Quantity	Value
Sesame seeds	328.46	3012.31
Niger seeds	14.12	123.27
Groundnut	542.73	4075.63
Other oil seeds	204.62	964.47
Vegetable oils	30.60	522.94
Oil meals	6578.17	16519.53
Castor oil	565.99	4309.82
Total	8264.69	29527.97

Share of vegetable oil consumption in India

- o 70's
 - Peanut – 53%
 - Rapeseed – 25%
 - Cotton seed oil – 9%
 - Palm, soybean, & sunflower – 4%
- o 1999-2000
 - Palm – 38%
 - Soybean – 21%

Historical oil seeds in India

- Coconut, sesame, mustard, cotton seed, linseed, castor, Niger, safflower

Newly introduced oil seeds

- Groundnut, soybean, sunflower, oil palm

Byproducts of cultivated crops

- Rice bran, tapioca seed, maize germ, tobacco seeds, rubber seeds, tung(*Aleurites fordii*), jute seeds, spent coffee grounds, tea seeds
- Plus many more

Importance of oilseeds in Indian agriculture

- The crops that are cultivated for the production of oils are known as oilseed crops.
- Oilseeds are the raw materials for vegetable oils and they are energy rich crops.
- Oilseed crops are the most important commercial crops in India.
- The Rapeseed and Mustard, Sesamum, Sunflower, Safflower, Linseed, Soybean, Niger, Groundnut and Castor are the most important oil seed crops of India.

Classification

- The oilseed crops are classified according to the nature of oil produced
- **Edible oilseed crops**
 - The most important source of supply of edible oils are the seeds known as edible oil.
 - E.g., Rapeseed & mustard, sesamum, groundnut, Niger, sunflower, safflower, soybean etc.
- **Non-edible oil seed crops**
 - The most important source of supply of non-edible oils are the seeds known as non-edible
 - E.g., Castor, Linseed etc.
- **Nutritional value of oilseeds**
 - The bio-chemical composition and quality of the oilseeds and their products are important for the food and feed purposes.
 - Edible oils are the concentrated sources of energy. The energy content of oil is much higher (39.80 MJ/kg) than protein (23.88 MJ/kg) or carbohydrate (16.76 MJ/kg).
 - They contain useful carbohydrates, essential fatty acids and vitamins A, D, E and K and provide essential fatty acids.
 - Oil cakes/ oil meals are rich sources of protein (40-60%) to human and animals. They can also be used as organic manures.
 - Oil quality for food purpose can be described in terms of Saturated Fatty Acid (SFA), Monounsaturated Fatty Acid (MUFA) and Poly Unsaturated Fatty Acid (PUFA).
 - Saturated Fatty Acid (SFA) - Palmitic and Stearic acid. They have direct relation with blood cholesterol and coronary heart diseases as it increases low density lipoprotein that is harmful.
 - Unsaturated Fatty Acid (SFA) - Oleic, Linoleic, Linolenic and Erucic acids.
 - Linoleic & Linolenic acids (Poly Unsaturated Fatty Acids – PUFA) are Essential fatty acids (not synthesized by human body and are to supplied from outside).
 - Groundnut, coconut, sesame and sunflower oils have moderate amounts of saturated

fatty acid but lack in one essential fatty acid i.e. linolenic acid.

- Soybean, safflower and mustard oils have both essential fatty acids as Linoleic and Linolenic acids.

➤ **Importance of oil seed in Indian economy**

- In terms of vegetable oils, India is the fourth largest oil economy in the World after USA, China and Brazil.
- The oil seeds contain 20 – 60 % oil, which is chiefly consumed as food and energy source.
- They are energy rich and cash value crops.
- Oil seed crops can serve as pasture, cover and green manure crops. They are also used as fodder and for silage.
- Vegetable oils have medicinal and therapeutic value and also used as laxatives. E.g., Castor, Safflower & Sunflower oil.
- Safflower tea – prevents cardiovascular diseases and gynecological disorders. If consumed daily, it reduces blood pressure.
- Certain oil seed cakes have vermifugal action & it is used for pest control purposes. E.g., Mustard, Castor.
- Vegetable oils and its derivatives are biodegradable and eco-friendly thus they can be used as diesel substitutes.
- The edible oils are used as cooking oil, vanaspati and proteins.

Rapeseed-Mustard

Brassicacae sp.

Brassicacae are grown next to peanut in India. Rapeseed-mustard is a common name to three Genera :

- *Brassica*
- *Eruca*
- *Sinapsis*

- o Brassica is more important

Importance of Brassicacae in India

- o It is main Rabi season crop in India
- o Green tender plant is used as vegetable
- o Whole seed is for preparing pickles and flavoring vegetables and curries
- o Oil for cooking, frying and pickles
- o Oil is also used for vegetable ghee, hair oil, soap, lubricating oil, and tanning industries
- o Seed & oil have peculiar pungency
 - o Due to presence of glucose sinigrin
- o Oil cake is a cattle feed to be fed at smaller quantity

Canola

- o It is a trade name to rapeseed oils which possess
 - o <2% erucic acid
 - o Solid components should contain
 - <30 micromoles /g of glucosinolates
- o May be Canadian oil like "Mazola" (maize oil – Corn oil), "Sanola" sunflower oil(again brand name for PUFA content)
- o Of late refers to 'generic' but
 - o Those rapeseed varieties meeting above the specification (Erucic acid causes heart lesions and Glucosinolates cause thyroid enlargement)

Brassicacae grown in India

Taxonomic name	Common name	Hindi	Oil Content
<i>B. Campestris</i>	Turnip rape	Brown sarson	Kali sarson
<i>Var. brown sarson</i>	Brown sarson	Kali sarson	43%
<i>Var. yellow sarson</i>	Yellow sarson	Peeli sarson	45%
<i>Var. toria</i>	Indian rape	Toria	35%
<i>B. napus</i>	Swede, summer, winter rape	Gobhi sarson	Oilseed
<i>B. Juncea</i>	Indian mustard Mustard	Rai, Raya Laha	35%
<i>B. toumefortii</i>	Wild mustard	Jungli rai	18%

<i>B. carinata</i>	Ethiopian mustard	Karan rai	Oilseed
<i>B. nigra</i>	Black mustard	Banarsi rai	29% Condiment
<i>B. Oleracea</i>			Vegetables
<i>Eruca sativa</i>	Rocket	Taramira	28%

Rapeseed vs. Mustard

Character	Rapeseed (Sarson/Toria/Lahi)	Mustard (Rai, Raya, Laha)
Plant height (cm)	45 – 150	90-200
Leaves	Sessile, leaf lamina clasps the stalk	Leaves stalked but do not clasp
Siliquae (pod)	Short or thicker	Long & slender
Pollination	Cross pollinated	Self pollinated
Seed coat	Smooth	Rough

Brown sarson vs. Yellow sarson

Character	Brown sarson	Yellow sarson
Leaves	Pale, thin	Dark green and fleshy
Branching	Erect, spreading	Erect
Siliquae (pod)	Thin, narrow	Thick and broad
Seed coat	Dark brown to reddish brown & mucilaginous	Yellow & non mucilaginous

Origin

- Rai – China
- Toria – East Afghanistan
- Brown sarson – E. Afghanistan & adjoining Indian sub-continent
- Yellow sarson – N.E. India

Rapeseed-Mustard: Area cultivated in the world (1997) – (Million ha & million t)

Country	Area	Production	Productivity
India	6.81	6.96	1.02
China	6.79	9.54	1.41
Canada	4.84	6.19	1.29
France	0.99	3.49	3.53
Germany	0.92	2.84	3.10
World	24.2	35.15	1.45

Rapeseed-Mustard : Area in India (1997) (Million ha & million t)

State	Area	Production	Productivity
Rajasthan	2.96	2.65	0.99
UP	1.43	1.47	1.03
Gujarat	0.34	0.47	1.37
Haryana	0.61	0.89	1.46
MP	0.82	0.75	0.91
WB	0.32	0.28	0.89
Assam	0.28	0.14	0.51
Punjab	0.09	0.11	1.27
India	6.81	6.96	1.02

Brassicas Area in India

- Till independence area remained constant (2.0million ha)
- From 50's area rose steadily
 - Due to increase in irrigated area
 - Increased productivity, varieties and agronomic practices
 - Maximum area was in 6.87 million ha -96-97
- Major states growing are
 - Rajasthan, UP, Gujarat, Haryana, MP, WB, Assam & Punjab

Climate

- A crop of temperate
- Can be in higher elevation of tropics
- Rabi season crop in India,
 - Sep-Oct to Mar-Apr
- Temperature range 3 to 40°C
- Optimum 18-25°C with cool, dry clear weather
- High RF, high humidity, cloudy atmosphere at flowering undesirable
- Most susceptible to frost

Season

- Sowing starts from August ends in November
- Sowing of rapeseed is ahead of mustard
- Taramira is sown from mid-Sep to Oct end
- Region wise season varies

Varieties

- Mustrad
 - Varuna (T 59), TM 2, TM 4, Seetha
- Brown sarson
 - KNS 3, KOS 1
- Yellow sarson
 - PUSA GOLD, YS 93
- Toria
 - Jawahar Toria, Panchali, TS 29
- Taramira
 - RTM 13, TMC 1

Soil

- Varying soil from sandy loam to clay
- Thrives well in light soil
- Mustard on any soil but rapeseed in light
- Well drained soil is more suitable
- Waterlogging should not be
- Saline alkaline soils are unsuitable
- pH 6.5 to 7.5, neutral soil is ideal

Land preparation

- Fine seed bed since seeds are small
- Flat bed to perform ferti cum seed drill

Seed rate & spacing

- 4-6 kg depending upon seed weight
 - 3-5 g/1000 depending upon crop and variety
- 30 x 10 to 30 x 15cm
 - 22.2 to 33.3 plants m⁻²

Sowing

- Treat the seeds with fungicides well before sowing
- May be behind the country plough
- Ferti cum seed drill
- Depth of sowing 3-4cm
- Avoid shallow sowing
- Cover the seeds after sowing
- Sowing may be on conserved soil moisture

Manuring

- Oil seed crops removes huge nutrients
- S is removed in large and needs return
- General recommendation varies to States
- 60-40-40 for irrigated
 - Half N 30 DAS
 - If SSP is applied S is taken care, if not
 - 20-40kg elemental sulphur, if soil analyzed with <10ppm
- 30-20-20 for rainfed (half of irrigated)
 - All basal
- Nutrient requirement may be calculated by critical concentration
 - 6.07 – 6.62% N in top 2-3rd leaf at 60 DAS
 - 0.408 – 0.412% S in 4-5th leaf from top
- Integration with biofertilizer 'Azotobactor' is desirable

Irrigation

- Total water requirement - 400mm
- Moisture at pre-flowering and pod filling stage is critical
 - Two irrigations for mustard
 - One at rosette stage (20-30DAS)
 - Another at siliqua atage (50-60DAS)

- In light soils three irrigations, the third at 90DAS
- IW/CPE ratio of 0.6 is optimum

Weed management

- Dominant weeds
 - *Chenopodium album*
 - *C. murale*
 - *Convolvulus arvensis*
 - *Melilotus alba*
- Intercultural operation 5-10days after 1st irrigation
 - Hand hoeing is desirable, it aerates the soil
 - Soil aeration is to conserve soil moisture
- Herbicides can also be used
 - Pendimethalin pre-emergence 0.5-1.5 kg/ha based on soil
 - Fluchloralin 1.25kg pre-plant incorporation
 - Post emergence Isoproturan 0.75 kg /ha for
 - Wheat+mustard mixed systems

Harvesting maturity

- Color of leaves, stem and silique turn green to pale yellow
- Lower silique looks – dried appearance
- Upper may be green
- Seeds in the silique makes rattling sound
 - Silique with 2 carpels and a false septum
 - During over maturity the two carpels split and seeds shed
 - Premature harvest leads to shriveled grains

Threshing

- After sun drying for few hours
- Beating pods along with the plants
 - Either manually
 - Machine
 - Walking bullocks, or running tractor
- Cleaning and drying to 8-10% moisture for storage
- Average yield

▪ Irrigated rapeseed	1.5 to 2.0 t
▪ Rainfed rapeseed	1.0 to 1.5t
▪ Irrigated mustard	2.0 to 2.5 t
▪ Rainfed mustard	1.5 to 2.0t

Cropping systems

- Fallow / millets / pulses – mustard
- Rice – rapeseed
- Intercroppings
 - Mustard + chickpea
 - Mustard + sugarcane
 - Mustard + barley / wheat / chickpea
 - Potato + mustard