

OIL SEEDS



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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

1. 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.

2. 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 **vermicidal 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

(Brassica spp.)

IMPORTANCE

- Rapeseed and mustard are the major **Rabi oilseed crops** of India.
- They occupy a prominent place next to groundnut, both in area and production.
- **India is the largest producer** of rapeseed and mustard in the world.
- Rapeseed contributes for **18 %** of total oilseeds production of the country.
- Common names are sarson, rai or raya, toria or lahi.
- While sarson and toria are generally termed as rapeseeds, rai or raya or laha is termed as mustard.
- The oil content varies from **37-49%**.
- The seed and oil are used as condition in the preparation of pickles and for flavoring curries and vegetables.
- Rapeseed oil is used in the manufacture of greases.
- The oilcake is used as a cattle feed and manure.
- Green stems and leaves are a good source of green fodder for cattle.
- The leaves of young plants are used as green vegetables.
- The pungent smell of Mustard oil is due to a sulphur containing compound named **Allyl isothiocyanate** ($\text{CH}_2\text{CHCH}_2\text{NCS}$) or 3-Isothiocyanato-1-propene (IUPAC).

- Internationally, the word **Canola** represents rapeseed and mustard, although, canola includes turnip rape (*Brassica rapa*), besides commonly considered species like *napus*, *juncea* and *campestris*.
- But, canola oil represents the oil, low in anti-nutritional ingredient **erucic acid** in oil and such oil is frequently referred to as **rapeseed 00** oil or **Double zero rapeseed** oil indicating that it has zero erucic acid.

Why the word 'Rape' is used in the rapeseed...?

The word is derived from Latin name *rapa* or *rapum* representing the seeds of turnip. As the mustard and other species of *Brassica* looked like turnip, the seeds of such crop were called **Rapeseed**. This word has no relation, whatsoever, with the word **Rape**, popularly associated with the sexual exploitation of women.

Area and distribution

- India, china, Canada, Pakistan, Sweden are the major producing countries.
- In India it is cultivated in UP, Rajasthan, MP, Haryana, Punjab, West Bengal, Assam and Bihar.
- India: Area is 5.80 m ha, Production is 6.28 million t, Yield is 1370 kg/ha.
- UP ranks first in productivity.
- Rajasthan rank first in area and production.
- **Indian mustard:** Assam, Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, MP, North Eastern states, Odisha Punjab, Rajasthan, UP, WB and Maharashtra
- **Brown sarson:** Himachal Pradesh and Kashmir Valley
- **Yellow sarson:** Assam, Bihar, UP, WB and North Eastern states (Meghalaya and Sikkim)
- **Toria:** Assam, Odisha, WB, Meghalaya, Tripura, Haryana, Himachal Pradesh, Jammu, MP and Rajasthan.
- **Taramira:** It is confined to drought prone area of Haryana, Himachal Pradesh, Punjab and Rajasthan
- **Gobhi sarson:** Himachal Pradesh, Haryana, Punjab and Rajasthan

Classification

Difference between rapeseed & mustard

	Rapeseed	Mustard
Scientific name	<i>Brassica campestris var. sarson and toria.</i>	<i>Brassica juncea - rai or laha.</i>
Plant height	Tall 45-150 cm	Short 90-200 cm.
Stem	Covered with waxy deposit.	No waxy deposit
Leaves	Sessile, glabrous and hairy.	Stalked, broad and pinnatifid
Fruits (pods)	Thicker	slender
Seed color	yellow or brown	Brown or dark brown.
Seed coat	Smooth	Rough

CLASSIFICATION OF RAPESEED-MUSTARD

A. Sorson: International Common Name Indian rape

Brassica campestris var. yellow sorson (yellow sorson)

Brassica campestris var. brown sorson (brown sorson)

Brassica napus (Gobi sorson)

B. Toria: International Common Name Rape/ Toria

Brassica campestris var. yellow toria

Brassica campestris var. black toria

Eruca sativa (Taramira)

C. Rai: International Common Name Mustard

Brassica juncea (Indian mustard)

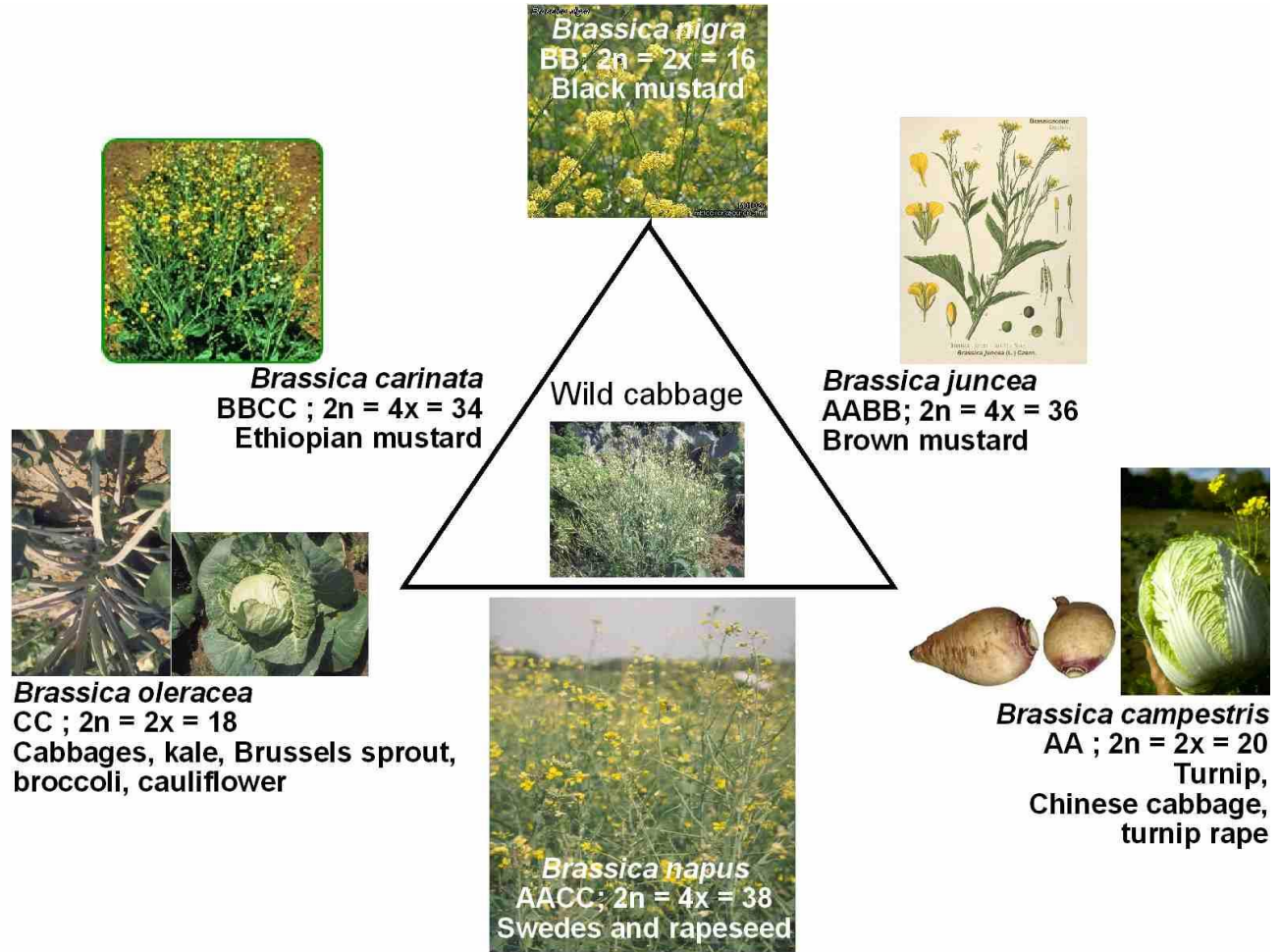
Brassica carinata (African mustard/ Karan rai)

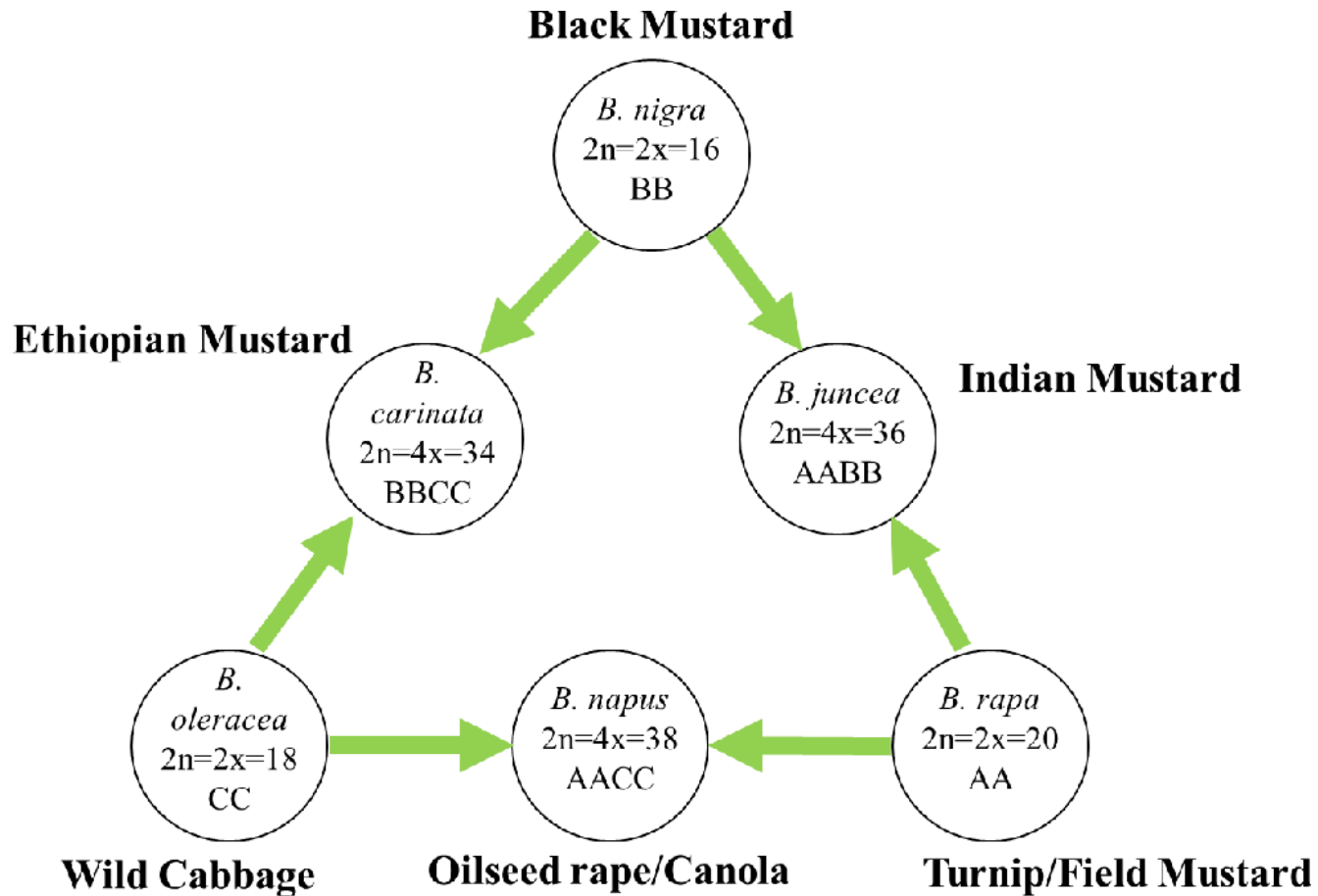
Brassica juncea var. rugosa (Pahari Rai)

Brassica nigra (Black mustard/ Banarasi rai)

Triangle of 'U' rule

The triangle of U (/u:/OO) is a theory about the evolution and relationships among members of the plant genus *Brassica*. The theory states that the genomes of three ancestral diploid species of *Brassica* combined to create three common tetraploid vegetables and oilseed crop species.





Characteristics Features of Few Important Types

➤ **Yellow and Brown Sarson (*Brassica campestris*)**

It is widely grown in North and Central India. There are two main types – yellow and brown sarson, so named because of its seed colour. It is high yielding than Toria. The crop is sown in October and harvested in March/April after about 150-160 days.

Yellow sarson	Brown sarson
Dark, glaucous, fleshy leaves	Pale, glaucous, thin leaves
Thick and broad pods	Thin and narrow pods
Dingy white or yellow, non-mucilaginous seeds.	Dark brown, brown or reddish brown, mucilagenous seeds.
Late maturing	Early maturing

➤ **Indian Mustard (*Brassica juncea*)**

It is very widely grown in India. The crop is sown in October/November and harvested in March/April, after about 140-160 days period. This type gives better yield than *Brassica napus*.

➤ **Toria/Lahi (*Brassica campestris var. olifera*)**

It is a **short duration** crop, popularly used as catch crop or intercrop sown in September and harvested in December. It is obviously low yielder.

Sarson	Toria
Lower leaves and lower part of the stem are hairy with thin leaves	Leaves and stems glabrous, leaves somewhat fleshy
Dark coloured, mucilagenous seeds	Light coloured, non-mucilaginous seeds
Matures at least 1-2 months later than toria	Matures 1-2 months earlier than sarson
It is sown in Oct/Nov and harvested in Mar/Apr as <i>rabi</i> crop	It is a late <i>kharif</i> season crop, sown in Sep and harvested in Dec
It is used as soilseed, fodder, vegetable oil and preferred for cullinary purpose	Grown for oil purpose; plants are not good for vegetable purpose

➤ **Gobi sarson (*Brassica napus*)**

It is grown as an **autumn crop**. This variety is susceptible to cold and is sown early in the middle or late September and takes about 75-100 days to mature. This variety is obviously low yielding, but it responds to irrigation.

➤ **Taramira (*Eruca sativa*)**

It is relatively of recent introduction into India. It is believed to be native of South Europe and North Africa. It is relatively low yielding cruciferous oilseed crop grown in Northern India and very often grouped with rape and mustard crops. The variety is particularly adapted to poor soils and low rainfall areas.

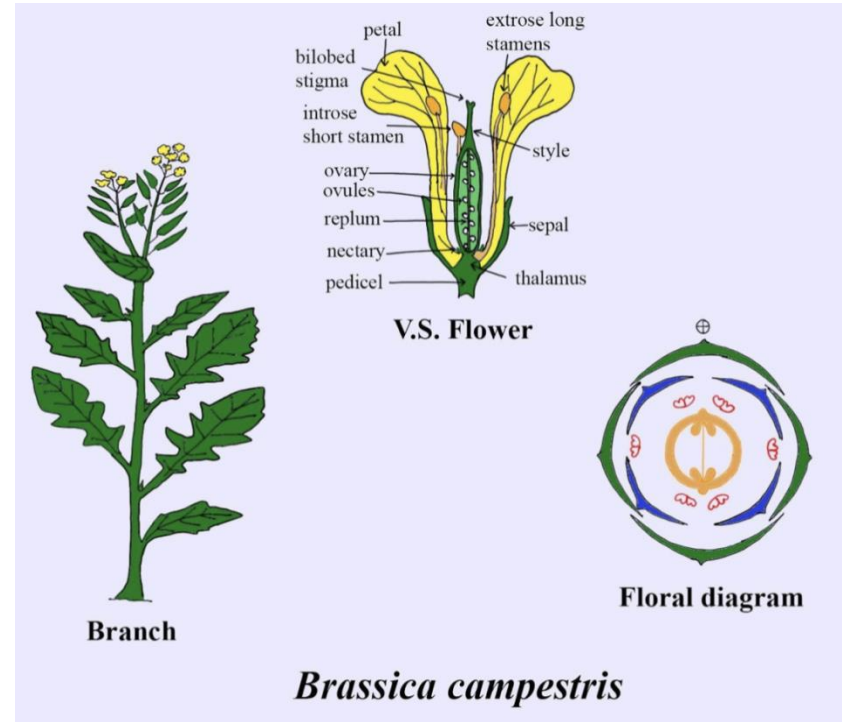
Origin and History

- Mustard is cultivated in many countries since olden days.
- ***Brassica campestris*** and ***B. juncea*** (Toria, Rai, yellow sarson, brown sarson) were originated in **Afghanistan**, which was a part of Northern Western areas of Indian subcontinent. It spread to other parts of world, including China from this region.
- **Black mustard (*B. nigra*)** is believed to have been originated in **Eastern Europe**.
- ***B. Napus* (Gobi sarson)** is believed to have been originated in **Sothern Europe**,
- ***B. carinata* (Karan Rai)** was originated in **Ethiopia**,
- ***Eruca sativa* (Taramira)** was originated in **Southern Europe and North Africa**.
- Historically, mentions about the use of mustard oil in Ayurbeva samhita and many Vedic literature are common. It was being used as lamp oil as well as cooking media. The use of mutard oil is recorded in the last few centuries of the pre-Christian era. Its description is found in Sanskrit, Roman, Bible Scriptures and Chinese old literatures.

Botanical Description

Rape and mustard belong to *Cruciferae* family and genus *Brassica*. *Brassica* includes the following important oilseed species.

Rape (*Brassica campestris* var. *sarson* and *toria*): It is a herbaceous annual plant. The plant is shorter than mustard (rai). The height of the plant ranges between 45 and 150 cm. The stems are generally covered with a waxy deposit. Plants are easily distinguished from mustard (rai) plants by the character of leaves. In rape, leaves are borne sessile and are glabrous and hairy. The lower part of the blade (lamina) grasps the stalk partially or completely. Fruits are thicker than those of mustard (rai) and are laterally compressed, with a beak one-third to half their length. Seeds are either yellow or brown with a smooth seed coat.



Mustard (*Brassica juncea*): It is known as rai or laha: The plants are tall (90-200 cm), erect and much branched. The leaves are not dilated at the base and clasping as in the case of rape but are stalked, broad and pinnatifid. The fruits (pods) are slender and only 2 – 6.5 cm long, strong ascending or erect with short and stout beaks. The colour of the seed is brown or dark brown. Seed coat is rough.

Both rape and mustard are self pollinated but cross pollination also takes place to some extent. Flowers of both the species have four sepals and four petals of deep yellow to pale yellow colour. Each flower has six stamens; four with long and two with short filaments. The pistil is compound and the ovary matures into a two celled fruit (a silique). It is made up of two carpels, which are separated by a false septum, thus providing two chambers.



6 VEGETABLES THAT ARE ACTUALLY THE SAME PLANT

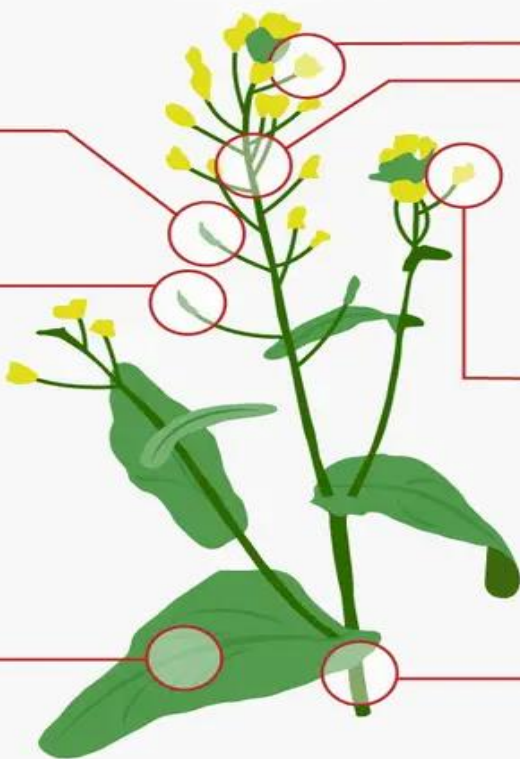
Brussels sprouts

Lateral leaf buds



Wild Mustard Plant

Brassica Oleracea



Broccoli

Flower buds/stems



Cabbage

Terminal leaf bud



Kale

Leaves



Cauliflower

Flower buds



Kohlrabi

Stem



Soil and Climatic Requirements

Climate

- Rapeseed and mustard crops are of tropical and temperate zones and require cool and dry weather.
- Require cool and dry weather and a fair supply of soil moisture during the growing period and a dry clear weather at the time of maturity. In India they are grown in Rabi season from September-October to February-March.
- Toria is more liable to suffer from the frost and cold.
- They are not tolerant to drought and water logging.
- During sowing: daily mean temperature 26-28°C.

Soil

- Sandy loam to clay loam soils but thrive best on light loam soils.
- Do not tolerate water logging conditions or heavy soils.
- Soil having neutral pH is ideal for their proper growth and development.



Varieties

Suitable for West Bengal, Odisha, Jharkhand, Chattishgarh, Asom, Bihar and Manipur

- Mustard: Pusa Bold, Pusa Agrani, Pusa Bahar, Pusa Sivani, JD 6, Surya, Bhagirathi, Sarama, Varuna
- Toria: M 27, Agrani, Anuradha, Parvati
- Yellow sorson: Binoy (B 9), Jhumka, Ragini, YSH 401

Suitable for Karnataka, Tamilnadu, AP

- Mustard: Pusa Agrani, GM 2, JM 1, Vardan, Varuna

Varieties with abiotic stress tolerance

Drought Tolerant

Aravali, Geeta, GM 1, PBR 97, Pusa Bahar, Pusa Bold, RH 781, RH 819, Shivani, Vaibhab

High temperature Tolerant

Ashirwad, Swarn jyoti, Vardan, Navgold, CS 56, Kanti, Urvashi, Pusa Mustard 25, Pusa Mustard 27

Salinity Tolerant

CS 52, CS 54, Narendra Rai 1

Frost Tolerant

RH 781, RH 7868, RH 819, RGN 13, RGN 48

Varieties with pest-disease tolerance

Alternaria blight Tolerant

Aravali, Geeta, Divya, JMM 915

White rust Tolerant

Basanti, JM 1, JM 2

Aphids Tolerant

RH 7846, RH 7847, T 6342

Cropping systems

- Maize –Toria - Wheat
- Maize – Toria – Sugarcane
- Pearl millet – Toria- Barley
- Maize – Toria – Cotton
- Green gram – brown or yellow sarson/rai
- Black gram – Sarson / rai
- Maize – Sarson / rai
- Early Rice – Sarson / rai

Field Preparation

- A clean and well pulverized seedbed of good tilth is needed for better germination.
- The land should be well-prepared first by ploughing deep with soil turning plough, followed by two cross harrowings.
- Each ploughing should be followed by planking so that the soil well-puverized and leveled.
- Care should be taken to see that weeds and stubbles are well-removed from the field and the soil contains adequate moisture to ensure good germination.

Seed and Sowing

Sowing time

- Toria – 2nd fort night of September.
- Sarson /rai – 1st fortnight of October.
- Late sowing results in attack of aphids.

Seed rate and spacing

- Toria: 30 cm
- Mustard/ Sarson : 40- 45 cm for inter cropping 1.8 – 2.4 m row spacing is given
- Seed treatment with Thiram or Captan @ 2.5 g/kg seed.
- Seed rate : 5-6 kg/ha for sole cropping for intercropping 2-3 kg/ha seed is sufficient

Sowing Depth ➤ 2.5 – 3 cm

Nutrient management

- The application of 15-20 t/ha FYM and 60-90 kg N, 60 kg P₂O₅ and 40 kg K₂O kg/ha.
- Under irrigated conditions half of nitrogen and full dose of P and K should be applied as basal dose at the time of sowing. Remaining half N should be applied at the time of 1st irrigation.
- In rainfed area, half of the recommended dose of fertiliser is required.
- Rapeseed and mustard have higher requirement for sulphur, therefore nitrogen should preferably be applied through Ammonium Sulphate and phosphorous from SSP.
- Rapeseed & mustard responds well to Zn and B. Foliar application of micronutrients is beneficial. Rai responds well to foliar spray of N.

Water management

- Usually raised as rainfed on conserved moisture. Rapeseed and mustard responds well to irrigation.
- Water requirement: 30-40cm.
- Consumptive Use: 20-30 cm
- Two irrigations at **branching (30 DAS)** and **siliqua formation (65 DAS)** stages are beneficial.

Weed management

- Weeds cause 20-30 % yield reduction in rapeseed and mustard.
- Critical period for crop-weed competition is **20-40 DAS**.
- Most common weeds are *Chenopodium album*, *Lathyrus spp.*, *Melilotus indica*, *Argemone mexicana*, *Cirsium arvense*.
- One intercultural operation is beneficial.
- Besides this creating a soil mulch and thus reducing moisture losses through evaporation helps in better growth and development of crop plants.
- Apply Nitrofen @ 1-1.5 kg/ha or Isoproturon @ 1 kg/ha in 800-1000 liters of water as pre emergence herbicide application.

Plant Protection

Diseases

Alternaria blight, Downy mildew

Insect Pests

Mustard saw fly, Mustard aphid, Cabbage butterfly and Bihar hairy caterpillar

Control

Spray the crop with one of the following insecticides in the aphid appearance;
Imidacloprid 17.8% @ 0.25 ml/l, Thiamethoxam 25 WG @ 0.2g/l, Dimethoate 30EC @ 1 ml/l
of water.

Harvesting and threshing

- Harvest the crop when the pod turns to yellowish- brown.
- The crop is liable to shattering so harvesting should be done before the pods open in order to avoid losses.
- Sarson is less liable to shattering as compared to toria and mustard.
- Moisture content at storage should be 8 %.

Yield

The yield of rapeseed 14-20 q/ha and 20-25 q/ha for mustard.



THANK YOU...

