1. **Rapeseed and mustard**

**Botany and importance**

These belong to family Cruciferae and locally known as canola, sarsoon, raya and Toria. These are second most important oilseed crops after cotton. Young leaves are used as vegetables and also as fodder. Oil of these crops is used in cooking and in making pickles, and also in industry as a lubricant. Export of this oil may increase in country economy.

**Climate**

These crops are well adapted to temperate regions of country and do well in average daily temperatures of 30 degrees. s

**Varieties**

Zaid-Kharif (Toria-A, Raya Anmol, AARI Canola)

Rabi (Sarsoon-DGL, Chakwal raya, Kanpur raya, Super raya, Chakwal sarsoon, Roohi sarsoon, Punjab Canola, Faisal Canola, PARC canola hybrid)

**Soil and seedbed preparation**

Heavy loam soils with good water drainage are more suitable for these crops cultivation. However, more salt-affected and water-logging soils are not suitable for cultivation. Soil is ploughed with a moldboard plough to a depth of about 30 cm, followed by cold-crushing and levelling. One or two ploughings are then carried out, followed by planking.

**Sowing time**

|  |  |  |
| --- | --- | --- |
|  | **Zaid-kharif Varieties** |  |
| **Variety** | **Area** | **Sowing Time** |
| Toria-A | All Punjab | 15 Aug- 30 Sep |
| Raya anmol | All Punjab | 25 Aug- 15 Sep |
| AARI canola | All Punjab | 25 Aug- 15 Sep |
|  | **Rabi Varieties** |  |
| **Variety** | **Area** | **Sowing Time** |
| Punjab canola, Faisal canola, PARC canola hybrid and other hybrid varieties | All Punjab | 20 Aug- 31 Oct |
| Kanpur raya, super raya | All Punjab | 1st Oct- 31 Oct |
| Chakwal raya | All Punjab | 20 Sep- 31 Oct |
| Chakwal sarson | All Punjab | 20 Sep- 15 Oct |
| Sarson DGL, Roohi sarson | All Punjab | 1st Oct- 31 Oct |

**Seed rate**

Use 11/2-2 kg/acre with more than 80% germination percentage. In case of low soil moisture, use more seed than recommended. In rainfed areas, use 2-21/2 kg seed.

**Sowing method**

* Cultivation of Punjab canola, Faisal canola, Toria and Raya anmol is done with drill in rows 30-45 cm apart with 2-4 cm depth.
* Cultivation of Kanpur raya, super raya, Chakwal raya, Chakwal sarson, Sarson DGL and Roohi sarson is done with drill in rows 45 cm apart.

**Fertilizer application**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Crop** | **N** | **P** | **K** | **Fertilizer**  |
| Kanpur raya, super raya, Chakwal raya, AARI canola, Raya anmol, Sarson DGL, Roohi sarson | 25 | 30 | 12 | 11/4 bag DAP+1 bag urea+1/2 bag SOP |
| Toria  | 23 | 23 | 12 | 1 bag DAP+3/4 bag urea +1/2 bag SOP |
| Punjab canola, Faisal canola, PARC canola hybrid | 25 | 35 | 35 | 11/2 bag DAP+1 bag urea+1 bag SOP |
| Chakwal raya, Chakwal sarson | 35 | 23 | 12 | 11/4 bag DAP+1 bag urea+1/2 bag SOP |

* In rainfed areas, all nitrogen and phosphors fertilizers are used at sowing time.
* In irrigated areas, all nitrogenous fertilizers are divided in two splits, one is used at sowing time and other before flowering stage.
* Phosphors and potash base fertilizers are used at sowing time.

**Irrigation**

Normally, 3 irrigations are applied.

* Ist irrigation is applied after one month of sowing.
* 2nd irrigation is applied at flowering.
* 3rd irrigation is applied at seed formation stage.

**Thinning**

* Uproot weak and damaged plants at four leaf stage and maintain PxP distance 10-15 cm apart.
* Thinning is done before 1st irrigation.

**Weeds**

Itsit, jawai, dumbi Sitti, lashkni booti, bathu, krund and shahtra.

* Daab method and hoeing are traditional methods to control weeds.
* Use Pendimethaline @ 800ml/L to control by chemical method.

**Diseases**

Alternaria blight, white rust, downy mildew, stem rot and bacterial black rot are most serious disease which can be controlled by seed treatment with fungicide.

* Concern to extension workers and use recommended chemicals.

**Insects**

Termite, grass hopper, aphid, mustard sawfly, cabbage butterfly and painted bug.

* Use recommended insecticides to control these insects.

**Time of harvesting**

These crops are ready for harvest when their stems and pods become yellow. Raya and canola are harvested when about 75% and 50% of the pods tern yellowish, respectively.

1. **Taramira (*Eruca sativa*)**

**Botany and importance**

These belong to family Crucifera and locally known as taramira. Its seed has about 30-35% oil contents. Young leaves are used as vegetables(Saag) and also as fodder. Its oil is best for stomach problems, acidity and joints.

**Climate**

This crop is fairly adapted to Thal and Cholistan regions.

**Soil and seedbed preparation**

Light loam soils with good water drainage are more suitable for these crops cultivation. However, it can be grown in salt-affected and water-logging soils. Soil is ploughed with a mouldboard plough to a depth of about 30 cm, followed by cold-crushing and levelling. One or two ploughings are then carried out, followed by planking.

**Sowing time**

|  |  |  |
| --- | --- | --- |
| **Variety** | **Area** | **Sowing Time** |
| Taramira | Bakhar, Khushab, R.Y.Khan, Mianwali, Bahawalnagar, and Bahawalpur | Mid-Aug – End-Oct (rainfed areas)Start-Oct - Mid-Nov (irrigated areas) |
| Taramira | Rawalpindi Division | Mid-Aug - Mid-Sep |

**Seed rate**

Use 11/2-2 kg/acre with more than 80% germination percentage. In case of low soil moisture, use more seed than recommended. In rainfed areas, use 2-21/2 kg seed.

**Sowing method**

Cultivation of Taramira is done with drill in rows 30-45 cm apart with 2-4 cm depth. However, some farmers are using still broadcast method.

**Fertilizer application**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Crop** | **N** | **P** | **K** | **Fertilizer**  |
| Taramira | 12 | 12 | 12 | 1/2 bag DAP+1/4 bag urea+1/2 bag SOP/MOP |

* In rainfed areas, all nitrogen and phosphors fertilizers are used at sowing time.
* In irrigated areas, all nitrogenous fertilizers are divided in two splits, one is used at sowing time and other before flowering stage.
* Phosphors and potash base fertilizers are used at sowing time.

**Irrigation**

Normally, 3 irrigations are applied.

* Ist irrigation is applied after one month of sowing.
* 2nd irrigation is applied at flowering.
* 3rd irrigation is applied at seed formation stage.

**Weeds**

Itsit, jawai, dumbi Sitti, lashkni booti, bathu, krund and shahtra.

* Daab method and hoeing are traditional methods to control weeds.
* Use Pendimethaline @ 800ml/L to control by chemical method.

**Diseases**

Alternaria blight, white rust, downy mildew, stem rot and bacterial black rot are most serious disease which can be controlled by seed treatment with fungicide.

* Concern to extension workers and use recommended chemicals.

**Insects**

Termite, grass hopper, aphid, mustard sawfly, cabbage butterfly and painted bug.

* Use recommended insecticides to control these insects.

**Time of harvesting**

These crops are ready for harvest when their stems and pods become yellow. It is harvested when about 75% of the pods tern yellowish.

**Groundnut (*Archis hypogea L.*)**

**A) Crop Botany:**

It belongs to family Fabaceae.

**B) Agro-meteorology:**

i) Climate: It is warm climate crop. 25°C temperature is required for germination. It can be successfully grown in area where 250-300 mm rainfall during April-September.

ii) Soil: well drained, coarse textured and sandy loam soil. Clay soil may result in crust formation and the pegs may not be able to penetrate into the soil for fruiting. pH ranges from 6-6.5.

**C) Economic Importance:**

Groundnut is very important cash crop of Kharif season in arid zone. Groundnut seed has 44-56% good quality edible oil and 22 to 30% protein content. If its vegetable oil is used so it will have positive impact on country’s economy. In order to fulfill the country need lot of money is spending to import vegetable oil. Average production is 1067kg/ha, total area under production is 97500 ha and total production is 104,000 tons.

**D) Production Technology:**

**1) Seed bed preparation:** Deep tillage with Moldboard Plough in early to mid-February. This operation preserves the moisture from subsequent rains. Moldboard plough should be followed by disc or harrow to level and pack the soil.

**2) Sowing time:** It is Kharif season crop. 25°C or more temperature is required for germination. So the best time for sowing is March to April but it can be planted in May and June after Wheat Harvesting. Optimum Planting time in Punjab is April and in Sindh is May. In irrigated conditions it is planted in early March and harvested in August.

**3) Seed rate:** Spreading and semi spreading types: 75- 80kg/ ha.

Bunch and semi bunch type: 95-100 kg/ ha.

Seed inoculation is done before planting with efficient rhizobium strain to obtain higher yield.

**4) Sowing method:** In barani areas: Line sowing with Pora or drill. Seed should be at the depth of 2-3 inch. Row to row distance is 11/2 feet and plant to plant distance should be 6-8 inches. Broadcasting should never be done to sow groundnut.

For Bunch, Semi Bunch varieties:

R x R 45cm P x P 10 cm

On sandy soils (in low rainfall zones) plant to plant spacing should be increased to 15cm.

For spacing and semi spreading type varieties:

R x R 60cm P x P 10 cm

In sandy soils or medium to low rainfall zones, plant spacing with rows should be 15cm.

**5) Fertilizer:**

Organic Fertilizers: FYM should be applied about one month before sowing and incorporated properly in the soil.

Chemical Fertilizers: N : P : K

 30: 80 : 30 kg/ha

If soil is more sandy, 40kg/ ha is recommended. As it is leguminous crop it produces 80% nitrogen from atmosphere. Chemical fertilizers are applied before drilling.

Gypsum 400-500 kg/ha just at beginning time of monsoon season. In more sandy soils higher rates of gypsum are required due to increased leaching. Calcium is needed by the peanuts to ensure well-filled pods, reduce pod rots caused by imbalances of other nutrients.

**6) Irrigation:** It requires 6 irrigations:

Rouni irrigation

First irrigation 3 to 4 weeks of sowing

2nd at flowering

3rd at peg formation

4th at pod development

5th about one month before digging.

**E) Plant protection measures:**

**i) Weeds:** chemical control Fusilade (Fluazifop P-Butyl) a selective (post emergence herbicide) @1-2 litter/ha

**ii) Insect-pests:** termites, cutworm, aphid, chrotogonous, thrips, jassid and red hairy caterpillar.

**iii) Diseases:** Early leaf spot lesions, blight, stem rot, wilt, peanut bud necrosis, peanut clump virus, leaf spot and fungal attack.

**9) Harvesting and Storage:** early digging results in lower maturity and lower yield. Late digging results in more leftover losses in the soils and high digging cost due to dry and hard soil. Manual threshing for this purpose, a PTO driven FMI thresher, commercially available.

**Varieties:**

BARI-2000 (semi bunch)

BARD-479 (semi spreading)

GOLDEN (semi bunch)

Late planting after wheat

Chakori (bunch)

BARI-89 (spreading)

Swat Phali (bunch)

**Drying and Curing:**

Sun drying for about 6-8 days to maintain the desirable flavor and quality. At the time of digging, pods contain about 40-50% moisture which should be reduced to 8 to 10% by curing for safe storage. Dried peanuts should not exceed 10% moisture content in storage or molds and fungi may develop.

**Uses:**

its high oil content 44-56%, protein content 22-30% after extraction of oil it is fed to livestock. The nutty nut is used in preparing vegetable dishes. The seed is used in bakery products. Roasted seed is used in nimko mix. Peanut oil is used for making soaps, cosmetics and lubricants. Being a leguminous plant, nitrogen is fixed by bacteria in root nodules. Cooking agent, paint, varnishes, lubricating oil, soap, furniture polish etc. It also contains vitamin E and vita. B complex.