**Chickpea (*Cicer arietinum L*.):**

**A) Crop Botany:**

It belongs to family Fabaceae.

**B) Agro-meteorology:**

i) Climate: Chickpea is cool season food legume and grown as a winter crop. It is sensitive to high (maximum daily temperature >35°C) as well as low (mean of maximum and minimum daily temperatures <15°C) temperatures at the reproduction stage. Both extremes of temperatures lead to flower drop and reduced pod set. It is grown in arid and low rainfall areas.

ii) Soil: Chickpea can be successfully grown in variety of soil types including coarse-textured sandy to fine-textured deep black soils (vertisols). However, the best suited soils are deep loams or silty clay loams. pH ranging from 6.0 to 8.0.

**C) Economic Importance:**

Chickpea (*Cicer Arietinum* L.) is the largest produced food legume in South Asia. Chickpea is grown in more than 50 countries (89.7% area in Asia, 4.3% in Africa, 2.6% in Oceania, 2.9% in Americas and 0.4% in Europe). It is grown on 22 lac acre in Punjab which is total of 80% land cultivated. As it is leguminous crop it fixes nitrogen from air and provide to the plants. Kabuli chickpea needs more water than desi chickpea. Chickpea is a good alternative to meat as it has much more protein content than any other crop.

**D) Production Technology:**

**1) Seed bed preparation:** 1-2 ploughings, 2 cultivations followed by planking are sufficient to prepare seed bed. Chickpea plants are highly sensitive to poor aeration in the soil. Seedling emergence and plant growth are hindered if field surface is compact. Therefore, the field should have loose tilth and good drainage.

**2) Sowing time:** It is rabi season crop. In barani areas: 20th October – 10th November

In irrigated areas, optimum sowing time is 1st November – 15th November

**3) Seed rate:** 30-35 kg / acre. If germination is less than 90%, then seed rate should be increased.

**4) Sowing method:** In barani areas: Line sowing with pora or drill

In irrigated areas: Sowing with automatic rabi drill is best. Row to row spacing of 30cm and plant to plant spacing of 10cm are generally used.

The optimum plant population of chickpea is about 33 plants per m2. 330,000plants ha-1.

**5) Fertilizer:**

20-30 kg nitrogen (N) and 40-60 kg Phosphorous (P) ha-1. If soils are low in potassium (K), an application of 17 to 25kg ha-1.

**6) Irrigation:** it requires 2 irrigations.

Two irrigations, one each at branching and pod filling stages, are recommended for higher yield. Higher number of irrigations may lead to excessive vegetative growth. Kabuli chickpea’s 1st irrigation is applied after 50-60 days after sowing and 2nd irrigation after flowering.

**E) Plant protection measures:**

**i) Weeds:** Chickpea is a poor competitor with weeds at all stages of growth.

Pre-emergence herbicides, such as Fluchloralin @ 1 kg a.i. ha-1or pendimethalin @ 1.0 to 1.5 kg a.i ha-1 were found effective in controlling early flush of weeds.

Mechanical and/or manual weeding can be done where wide row spacing is used.

**ii) Insect-pests:** Pod borer (Helicoverpa armigera). It is most important pest of chickpea which causes nearly 20-30% annual yield losses. Termite, grass hopper, cut worm, aphid and army worm etc.

**iii) Diseases:** Fusarium wilt (*Fusarium oxysporum f*. sp ciceri) it is a vascular disease that causes browning and blackening of xylem. Blight (*Ascochyta rabie*), Root rot (*Rhizoctonia sp)*, and Grey Mold *(Botrytis cinerea).*

**Management:** Use resistant varieties (e.g. Dasht, Parbat, Balkaser, Batal 98, CM98, Nifa 88 etc.). Seed treatment with Benlate @ 2g per kg of seed has been found effective in reducing incidence of wilt.

**9) Harvesting and Storage:** The time of harvesting is crucial in maintaining the quality of seeds. The crop should be harvested when leaves start to senesce and start shedding, pods turn yellow, plants are dry, and seed feels hard and rattles within the pod. Threshing can be done using commercially available power threshers.

**Varieties:**

Punjab 2008

NAIB CH 16,

Bhakkar 2011

Batal 2016

Noor 2013

Taman 2013

Noor 2009

CM 2008

Noor 91

**Lentil *(Lens culinaris L.)*:**

**A) Crop Botany:**

It belongs to family leguminosae.

**B) Agro-meteorology:**

i) Climate: Lentil is basically a temperate climate crop. Temperature requirements ranges from 15-24°C from germination to maturity. The crop responds positively to moderate rainfall, but negatively to heavy rainfall. It is draught tolerant and can be grown in area of low rainfall. It can tolerate prolonged extreme cold and hot climate.

ii) Soil: sandy to clay soils of medium fertility. High fertility soils cause excessive vegetative growth of lentil plant which in turn leads to lodging.

**C) Economic Importance:**

It is cultivated on 21000 acres’ land in Punjab which is total of 70% area of Pakistan. 25% protein is found in lentil. It is nutritivly very important crop. This is mostly cultivated in Narowal, Sialkot, Chakwal, Rawalpindi and Gujrat. This is also grown in Faisalabad, Dera Ghazi Khan, Layyah, Jhang, Sargodha, Rajanpur and Muzaffargarh etc. uneven distribution of rainfall increase the weeds which results in lower production. The area sown to lentil in Pakistan is about 45000-106,000 hectare. This is about 5-11% of total area sown to grain legumes. Pakistan contributes about 8% of the total lentil produced in the world. The annual production of the country shows an increase of about 26,000 to 30,000 tones. Lentil may yield up to 500kg/ha.

**D) Production Technology:**

**1) Seed bed preparation:** Two to three ploughings followed by planking and land levelling is enough. In barani areas, deep ploughing and planking after rainfall are important for moisture conservation.

**2) Sowing time:** It is planted at the beginning of winter season.

Oct-mid Nov.

**3) Seed rate:** 2-3 kg / acre in case of low moisture. Seed should be clean, healthy and free from diseases.

**4) Sowing method:** In barani areas: Line sowing with pora or drill. In case of broadcasting, yield of lentil decreases, while the recommended one is line sowing.

In heavy rainfall areas R x R 30 cm

In sandy soils R x R 22.5 cm P x P 8-10 cm

Yield of lentil can be calculated as:

No. of plants per sq. Meter x pods/plant x seeds/pod x seed mass (g).

**5) Fertilizer:**

For better yield of lentil fertilizer requirements are as follows

DAP= 1 bag

Potassium Sulphate= ½ bag or SSP= 2.5 bags

**6) Irrigation:** It requires 1-2 irrigations:

**E) Plant protection measures:**

**i) Weeds**

weeds can be controlled by two method

1. Mechanical method: harrowing and rotary hoeing fields after emergence is recommended only if there is serious weed problem.
2. Chemical method: glyphosate can be used as preplow treatment in the fall or spring quack grass. Stomp herbicide.

**ii) Insect-pests:** Grasshoppers, cutworm, aphid, pod borer, army worm and termite.

Spray of suitable insecticides is recommended before grain development.

**iii) Diseases:** Ascochyta blight, Schlerotinia (white mold), Fusarium root rot, grey mold, rust, collar and root rot and Rhizoctonia. No effective treatment is available for these diseases.

**9) Harvesting and Storage:** In Pakistan, lentil is harvested and threshed by traditional method using bullocks or manual labor. It should be swathed when planting begins to turn yellow and lower pods become brown to yellow. Lentils are considered dry at 14% moisture content.

**Varieties:**

NIAB Masoor- 2002, 2006

Punjab Masoor- 2009

Masoor-93

Chakwal Masoor

Markaz 2009

**Mung bean *(Vigna radiate* L*.)*:**

**A) Crop Botany:**

It belongs to family Fabaceae.

**B) Agro-meteorology:**

i) Climate: it is warm season crop. Adequate rainfall is required. Late planting will reduce yield. High humidity result in disease problems and harvesting losses due to delayed maturity. Same climatic areas as soybean, dry bean and cowpea. Short day hasten flowering and long days’ delay it.

ii) Soil: sandy, loam soils with good internal drainage. pH between 6.2 and 7.2.

**C) Economic Importance:**

Mung bean and mash bean are very important crops of Kharif season. They have almost 20-24% protein content in it. Mung bean begin very digestible is very healthy for children and patients. They have bacteria in their roots which makes nodules and fix nitrogen form atmosphere. After decomposing they increase the soil fertility. They can be grown in irrigated as well as barani areas. In one year it can be grown twice once in spring season and other in Kharif season. It can also be intercropped with sugarcane, rice and cotton etc. in Punjab 372.63 acre is sown for mung bean. Its total production is 113 thousand tons and average production is 764 kg/ ha.

**D) Production Technology:**

**1) Seed bed preparation:** soil should be tilled. The final seedbed needs to firm with a surface free of clods and debris to allow a good distribution of seeds. If moisture is short, keep preplant tillage to a minimum to prevent drying out the top two or three inches.

**2) Sowing time:** For spring season 1st week to last week of March. Best time is 1st two weeks of March. For Kharif 25 May to 15 June.

**3) Seed rate:** 12 kg / acre and for hybrid varieties 8-10 kg/ acre.

**4) Sowing method:** Flat sowing, Ridge sowing and bed sowing.

R x R 30 cm

P x P 8-10 cm

**5) Fertilizer:**

N : P : K 9 : 23 : 25 kg/acre or half bag of urea + one bag of TSP + one bag of potassium Sulphate.

* Mungbean require phosphorus, potassium and certain micronutrients at levels similar to other field beans.
* If the field has been previously inoculated with the proper Rhizobium for nitrogen fixation, additional nitrogen is not required.
* Mungbean require slightly acid soil for best growth.
* For best results, lime should be applied one year prior to growing mungbeans and thoroughly incorporated.

**6) Irrigation:** It requires 2- 3 irrigations.

1st at three weeks after sowing

2nd at flowering

3rd at pod formation

**E) Plant protection measures:**

**i) Weeds**

weeds can be controlled by two method

1. Pre emergence spray: methylene 1000ml/ acre.
2. Post emergence spray: fumasafin or loafing for broad leaf and kezylofop methyl for narrow leaf weeds @ 150ml/acre.

**ii) Insect-pests:** Dhora beetle, khapra beetle, lesser grain beetle, red flour beetle, termite, grass hopper, cutworm, spinola bug, pod borer, army worm, white fly, aphid, jassid, thrips and mealy bugs.

**iii) Diseases:** Schlerotinia (white mold), Rhizoctonia, mildew, bacterial rots and phytophthora, mung bean yellow mosaic virus, urdbean leaf crinkle virus and anthracnose.

Proper rotation, tillage practices and water management.

**9) Harvesting and Storage:** Generally, harvest should begin when one half to two-thirds of the pods are mature.

Seeds might be between 13%–15% moisture at this time

Direct combining can be done in weed free, uniformly mature fields of the upright growth habit

In developing countries, the mungbean are handpicked as the pods mature

**Varieties:**

* NIAB-2006
* AZRI-2006, 2018
* Chakwal M-6
* NIAB- 2011, 2016
* PRI mung 2018
1. **Mash bean (*Vigna mungo* L.)**

**Botany and importance**

Mash bean having diploid chromosomes number belongs to family Leguminosae. It is also called black gram and an important pulse crop in many Asian countries including Pakistan. It is grown mainly for its edible seeds, which are cooked, fermented, roasted, sprouted, or milled. It is high in protein and digestible. Seed protein content averages 20-24%. Leaves, stalks and husks are used as fodder, and the whole plant can be ploughed under as green manure for soil improvement. In symbiotic association with specific soil rhizobia, root nodules develop on the root in which atmospheric nitrogen is converted into available nitrogen forms.

**Climate**

Mash bean is a crop of tropics and subtropics and requires a relatively high temperature.

**Varieties**

Mash-97, Urooj-2011, NAPC Mash-3, Chakwal mash.

**Soil and seedbed preparation**

Well-drained sandy loam to clayey soils are best for mash cultivation. However, more salt-affected and water-logging soils are not suitable for its cultivation.

**Sowing time**

* In irrigated areas, whole month of July is suitable for cultivation.
* In rainfed areas, cultivation should be done in last week of June to end week of July.

**Seed rate**

Use 08-10 kg/acre healthy and certified seed with more than 80% germination percentage. Plant population should be 160000-1800000/acre.

**Sowing method**

* Cultivation of mash bean is done with drill in rows 30 cm apart. Pora and kera methods are also used.

**Fertilizer application**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Crop** | **N** | **P** | **K** | **Fertilizer before sowing** |
| Mash bean | 09 | 23 | 12 | 11/4 bag DAP+1/2 bag SOP |

**Irrigation**

Normally, 3-4 irrigations are applied.

* Ist irrigation should be applied after three to four weeks of sowing.
* 2nd irrigation should be applied at flowering initiation.
* 3rd irrigation should be applied at pod initiation stage.
* 4th irrigation should be applied as per need.

**Thinning**

* Uproot weak and damaged plants at four leaf stage before 1st irrigation and after 8-10 days after germination in irrigated and rainfed areas, respectively. and maintain PxP distance 08-10 cm apart.
* PxP distance should be 8-10 cm.

**Weeds**

Itsit, Tandla, Deela and other broadleaf weeds.

* Use Pendimethaline @ 1000ml/L to control by chemical method.
* Use recommended chemical to control weeds.

**Diseases**

Mash bean Yellow Mosaic virus, Urdbean Leaf Crinkle virus, Anthracnose, Cercospora leaf spot, Wilt, Stem and Root rot and Collar rot are disease which can be controlled by seed treatment with fungicide.

* Concern to extension workers and use recommended chemicals.

**Insects**

Whitefly, Thrip, Aphid, Jassid, Mille bug, Termite, Grass hopper, Cut worm, Pod borer and Army worm.

* Use recommended insecticides to control these insects.

**Time of harvesting**

Harvesting of mash bean should be done in morning time when 80-90% of the pods mature. Harvested crop should then be left in the fields in small heaps. Threshing should be done when plants are fully dried.