

## PULSE CROPS

Pulses constitute an important part of human food. Pulses are valued for their high protein content and protein quality and thus, supplement the cereal based diets. The protein content of most pulses ranges from 17-24 per cent which is almost 2-3 times more than that found in cereals. In Himachal Pradesh, *Kharif* pulses are grown on an approximate area of 61.0 thousand hectares. Among *Kharif* pulses, mash, kulthi and rajmash are the most important. Arhar and mung are also grown on a very limited area. The average yield, however, is very low. The important reasons for such low yields are lack of high yielding varieties of wider adaptability and stability, susceptibility to various diseases and pests and lack of responsiveness to higher levels of management.

### **MASH**

#### **Varieties**

**UG-218** : It is an early maturing variety taking on an average, 81 days to mature. It is suitable for cultivation in sub-montane low-hill sub-tropical zone. It can also be cultivated as zaid crop in summer season under irrigated conditions when sown during first fortnight of March. It has determinate plant type with plant height ranging 30-40 cm. Pods are in cluster of 3-5 and each pod has 5-7 seeds which are bold. Pods are pubescent. It has resistance against yellow mosaic and tolerance against *Cercospora* leaf spot. Its average yield is 12 q/ha.

**Pant U-19**: It is suitable for cultivation in Zone I with the onset of first monsoon showers. It matures in 85 days and has resistance to yellow mosaic but moderately resistant to leaf spot disease. Its average yield is 8-10 q/ha.

**PDU-1**: It is semi-tall variety and possesses profuse branching, large pods with bold seeds. It is also suitable for inter-cropping with maize and recommended only for Kullu valley. Its average yield is 10-12 q/ha.

**T-9** : It matures in 95-100 days, erect, dwarf, leaves dark green and yellow flowers. Pods are medium long, smooth, straight, green in early stage and black at maturity. Seeds are black, medium in size with 23 per cent protein. Average yield is 8-10 q/ha. It is suitable for cultivation in low hilly areas.

### **MUNG**

#### **Varieties**

**Suketi (DPM 8909)** : It is high yielding and matures within 85 days at a time. It has resistance to yellow mosaic and tolerance to leaf disease. Its average yield is 10 q/ha.

**Shinning Mung No. 1**: It is an early maturing variety with bold, shinning and attractive grains. It matures in 70-80 days and gives an average yield of 6/ha. It is moderately resistant various diseases.

**Pusa Baisakhi** : It is also maturing (65-75 days) variety, suitable for summer and *Kharif* cultivation. It gives an average yield of 6 q/ha. In warmer parts of the State, it can be grown as a cash crop after wheat harvest wherever irrigation facilities are available.

#### **Soil**

A well drained loam to light loam soil is suitable for mung and mash. It has, however, been observed that mung thrives well on light soils and mash on heavy soils and both should be sown on drained soils.

#### **Sowing time and seed rate**

These are usually sown with the advent of monsoon in the end of June or beginning of July. The crop should be sown in lines by *keri*. Seed rate should be kept at 18 to 20 kg/ha. Higher seed rate should not be used

and row spacing should be maintained at 30 cm. In case of mixed cropping, the seed rate should not exceed 10 kg/ha.

### Manuring

Nutrients (kg/ha)			Fertilizers					
N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	kg/ha			kg/bigha		
			Urea/CAN	SSP	MOP	Urea/CAN	SSP	MOP
20	40	20	45/80	250	33	3.5/6	20	25

Apply whole of nitrogen, phosphorus and potash at the time of sowing of the pure crop of mash. In case of mixed cropping, initial dose of nitrogen is not necessary. Liming @ 1.5 tonnes/ha has been found beneficial in case of acidic soils.

Inoculation with rhizobium culture further increase the mash yield by about 10 per cent. The inoculation with rhizobium culture hardly increases the cost of cultivation by 5-8 rupees per hectare.

### Harvesting and threshing

The crop should be harvested at proper maturity to avoid losses due to shattering. When the plants turn half yellow and pods turn black, the crop is ready for harvesting. Before threshing, the pods may be dried in sun. Store seeds at 9% moisture after proper drying and cleaning.

## KULTHI

### Variety

**HPK-4 (Baizu):** It is a selection from the elite population of germplasm collection. It is early in maturity (100-125 days) and semi-spreading with climbing growth habit. Pod length is 4-5 cm and each pod contains 4-5 seeds. Seed colour is dark grey with dotted spots. Its average yield is 17-18 q/ha. It is resistant to shattering and leaf spot diseases. Suitable for cultivation for all the areas of H.P. where kulthi is grown.

### Soil

All types of soils are suitable for its cultivation. But it should be ensured that there is proper arrangement for the drainage of water in the fields. It does fairly well on the slopy lands. The land should be well prepared by giving two to three ploughings followed by plankings.

### Sowing and seed rate

The crop should be sown 30 cm apart in lines by *kera* method with the start of monsoon in the end of June or beginning of July. The seed rate should be kept at 18-20 kg/ha but it should be 8-10 kg/ha when sown mixed with maize.

### Manuring

Nutrients (kg/ha)			Fertilizers			
N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	kg/ha		kg/bigha	
			Urea/CAN	SSP	Urea/CAN	SSP
15	45	-	32/60	280	2.5/5	22

Apply whole of nitrogen and phosphorus at the time of sowing. There is no need to apply nitrogen, when sown mixed with maize.

### **Interculture**

Two weedings and hoeings are recommended to control weeds.

### **Harvesting**

The crop should be harvested when the plants turn half yellow and the pods start drying.

## **RAJMASH**

### **Varieties**

**K-198 (Triloki Rajmash)** : It has determinate bushy growth, white flowers, broad dark green leaves, bold and creamish yellow coloured seeds with good cooking quality and taste. The height is 45-55 cm and matures in 98-100 days. It is resistant to bacterial blight, angular leaf spot and anthracnose in whole in Zone IV except in Sangla valley where it is moderately susceptible to anthracnose. It is tolerant to shattering. Average yield is 25-27 q/ha.

**KRC-8 (Baspa)** : It is a semi-dwarf variety and matures in 110-120 days. It is recommended for high hill areas of H.P. It is resistant to bean anthracnose. It has attractive magenta coloured bold grains with good cooking quality. Its average yield is 18-20 q/ha.

**HPR-12 (Jwala)** : It is early maturing (75-85 days) and is erect and dwarf having compact plant type. Pod length is 8-10 cm and each pod contains 3-4 seeds. Its 100 seed weight is 38-40 g. It yields, on an average, 12-15 q/ha. It is resistance to shattering. The strain has attractive scarlet seed colour. Suitable for cultivation in Kullu, Barot, Shimla and Chamba valleys between 1100-1800 m.

**Him-1** : It is a dwarf and early maturing (80-90 days) variety. Pods are 10-13 cm long containing 4-5 seeds per pod. The seeds are light pinkish with dark red spots. Besides, this variety is good flavoured. Its average yield is 9 q/ha.

**HPR-35 (Kanchan)** : It is semi-dwarf, determinate and early maturing variety (7-10 days earlier than Him 1 and Jawala) and recommended for mid and high hill areas. It is better suited both under monoculture and intercropping with maize. It has mottled deep pink bold grains with good cooking quality. Its yield is 12-15 q/ha.

### **Soil**

It can be grown successfully on any type of soil, from sandy loam to heavy loam to heavy clay. However, loam soils are the most suitable ones for its growth. Land should be levelled and well drained. One cross ploughing is sufficient.

### **Sowing and seed rate**

The crop should be sown in rows 25-30 cm apart with the onset on monsoon under unirrigated conditions, while under irrigated conditions, the crop should be sown from June 15 to 30. The recommended seed rate is 100 kg/ha. In case of mixed cropping, not more than 50 kg/ha seed should be used.

### **Manuring**

It requires 20 kg N and 60 kg P<sub>2</sub>O<sub>5</sub> per hectare. This should be applied at sowing.

### **Interculture**

Two weedings and hoeings should be done to control weeds.

### **Harvesting**

The crop should be harvested at proper maturity and the same should be stored when it is sufficiently dry.

## ARHAR

It is grown on an area of about 400 hectares with an average production of 4.8 q/ha. Though it is not widely grown in the State as the area indicates, there is a considerably scope of extension introduction in the low hill areas of marginal lands under rainfall conditions. Good quality seed of local varieties may be grown. It is mostly cultivated in Nurpur area of Kangra district, Poanta area of Sirmour and Hamirpur districts.

### Variety

**ICPL-85010(Sarita)** : It is suitable for all arhar growing areas particularly under arhar - wheat rotation. It is early determinate type and matures in 150-155 days. The average yield is 15 q/ha. It is suitable for lower mid hill drier parts of Zone II in addition to Zone I.

### Soil

This crop grows well on all types of soils but loam to sandy loam soil is suitable. This crop also does well in slopy lands in the mid-hills.

### Sowing and seed rate

The seed rate is 15 kg/ha. Tall varieties of arhar should be sown in rows at a distance of 50 cm while dwarf varieties like HPA-92 should be shown at 30-35 cm row spacing with seed to seed spacing of 15-20 cm. The crop gives much higher yield if, it is sown in last week of May. One row of mach can also be successfully grown in between two rows of arhar.

In Zone I, paired row planting of arhar and sesamum gives higher return. In case of paired row planting, two rows of arhar should be sown at 30 cm spacing followed by two rows of sesamum sown at 20 cm spacing. The seed rate and fertilizer doses to the sesamum crop should be reduced to half of the recommended for pure sesamum crop.

### Manuring

15 kg N and 45 kg P<sub>2</sub>O<sub>5</sub> per hectare is sufficient for this crop.

### Interculture

Two weedings and hoeings are essential for the crop.

### Harvesting

When nearly 75% of the pods get matured at a time, the crop should be harvested.

### Rhizobial inoculation

The legume crop have unique capacity of utilizing atmospheric nitrogen through nitrogen fixing bacteria *Rhizobium* spp. in the root nodules. The local strains of the *Rhizobium* may not be efficient. It is, therefore, recommended to artificially inoculate the seed with an appropriate strain of *Rhizobium*. The artificial inoculation is very cheap and it increases the efficiency of the plant to fix free elemental nitrogen from the atmosphere. Inoculation serves as an insurance for getting a good pulse crop.

### Method of rhizobial inoculation

About 50 g of sugar or gur molasses are dissolved thoroughly in half a litre of water. To this solution, a culture packet (250 g) is mixed so as to form a slurry. 10 kg seed free from dust is mixed thoroughly with the culture with clean hands, taking care that all the seeds are equally coated with the product. This coated seed material is spread on the polythene sheet or a clean cloth in the shade and the whole material is allowed to dry.

The coated seeds are thereafter sown in afternoon and are immediately covered with soil with the help of a *sohaga* so as to avoid direct exposure of the coated seeds to sunlight.

### Plant Protection

Sign of attack/symptom	Control
<b>Insect-pests</b>	
<b>Hairy caterpillar</b> : They first of all feed on leaves in clusters and later on disperse in the field. Often skeletonize the plant completely. Appear in epidemic form at the onset of monsoon.	1. Collect and destroy the young gregarious caterpillars. 2. Give spot treatment by dusting 5% malathion at 35-40 kg/ha against gregarious caterpillars. Spray 1250 ml endosulfan (Thiodan/Endocel 35 EC) or 625 ml dichlorvos (Nuvan 100) in 625 L water/ha for advance staged larvae.
<b>Blister beetle</b> :Adults feed voraciously on flowers and tender terminals.	Spray 1250 ml endosulfan (Thiodan/ Endocel 35 EC) or 625 ml methyl parathion (Metacid 50 EC) in 625 L water/ ha at the pre-bloom and flowering stages.
<b>Bean bug</b> : Both nymphs and adults such sap from foliage and lower the vitality of the plant. Small whitish or yellowish spots on the upper leaf surface confirm the damage by the pest.	Spray 625 ml monocil/Milphos 36 SL (Monocrotophos) in 625 L water/ha in addition to the chemicals recommended for blister beetle.
<b>Diseases</b>	
<b>(A) Mash and Mung</b> <b>Cercospora leaf spot</b> : Brown or black, circular to angular spots are formed on leaves. During humid weather, the spots become so numerous that they merge with each other to form large irregular spots. At this stage the leaves wither, die prematurely and fall.	Spray the crop with Indofil M-45 (0.25%) or Bavistin (0.05%) at fortnightly interval starting after 45 days of sowing or when the first symptoms of the disease appear. 2-3 sprays give better and economical control.
<b>Ascochyta leaf spot</b> : Dark coloured, circular lesions with concentric rings are present on leaves. In severe cases, shot holes surrounded by remnants of concentric rings are formed.	As above
<b>Colletotrichum leaf spot</b> : Crescent-shaped, dark brown lesions are formed on leaves. In severe cases, the lesions may coalesce resulting in brunt appearance.	As above
<b>Powdery mildew</b> : A white powdery growth occurs on the leaves spreading to cover the stem and other plant parts. The disease is more severe when the plants are in flowering stage and persists until harvest.	Dust the crop with sulphur @ 20 kg/ha. If the crop has been sprayed with Bavistin, there is no need to sulphur dusting.
<b>Yellow mosaic</b> : The leaves show yellow patches alternating with green areas which also turn yellow and gradually change to whitish shade and finally become necrotic. Affected plants are dwarfed. Flowering and seed setting	1. Obtain seed from disease free crop or from disease free areas such as higher hills. 2. Rogue out diseased plants in early stages. 3. Control insect vectors with sprays of Metasystox/ Dime cron/Rogor @ 1 ml/L water.

is very poor.	
<b>(B) Rajmash</b> <b>Anthracnose</b> : All plant parts above ground level and at any stage of plant growth are attacked. The most prominent symptom is a characteristic spotting on the pods. Water soaked lesions appear on the pods which become brown and enlarge to form circular spots of varying sizes. The spots are usually depressed with dark centres and bright red, yellow or orange margins. In moist weather, pink masses of spores are present on the spots.	<ol style="list-style-type: none"> <li>1. Obtain seed from disease free locations.</li> <li>2. Treat seed with Bavistin @ 2.5 g/kg seed.</li> </ol>
<b>Angular leaf spot</b> : Numerous small, angular, brown spots appear on foliage and on pods, dark brown to black, circular spots are formed. Some times pods are deformed.	<ol style="list-style-type: none"> <li>1. Use healthy seed.</li> <li>2. Treat seed with Bavistin @ 2.5 g/kg</li> <li>3. Spray the crop with Bavistin (0.1%) at fortnightly intervals starting from flowering or when the first symptoms of the disease appear. 2-3 sprays should be done which are economical.</li> </ol>
<b>Floury leaf spot</b> : White powdery growth resembling flour appears on lower surface of leaves when the crop is in flowering stage. The diseased leaves are shed prematurely.	As above
<b>Bacterial/Fuscous blight</b> : The disease appears early in the season. Translucent water-soaked spots are formed on leaves which turn yellow and die. Lesions of various shapes and sizes are visible on dead leaves. Small spots also appear on pods.	<ol style="list-style-type: none"> <li>1. Obtain seed from disease free area.</li> <li>2. Follow crop rotation of 3 years</li> </ol>
<b>(C) Arhar</b> <b>Sterility mosaic</b> : In the beginning, plants look pale, there is reduced and bushy plant growth as a result of profuse branching. Mild motting appears on leaflets. The plants may be partially or wholly sterile.	<ol style="list-style-type: none"> <li>1. Collect seed from healthy crop.</li> <li>2. Repeated cultivation in the same field should be avoided.</li> </ol>