OILSEED CROPS

Vegetable oils, besides being a cooking and frying medium also serve as an important source of energy in the daily diet of both rural and urban inhabitants. These oils are obtained from crops commonly designated as oilseeds. However, the indigenous production of these crops in insufficient to meet our requirements of vegetable oils.

SESAMUM

Sesamum is an important oilseed crop of Himachal Pradesh. Occupying an area of 5400 hectares, it produced 3200 tonnes of grain 1996-97. Though the crop is distributed throughout the State, except the districts of Kinnaur, Kullu and Lahaul & Spiti. Major chunk of the area (70%) falls in Kangra district alone. Sesamum is mainly a rainfed crop and is grown on marginal, dry and slopy lands. Average yield in the state is about 5.9 quintals/ ha, but much improvement can be made in its production by following the recommended practices.

Variety

Brajeshwari (LTK-4): It is a new high yielding variety recommended for all the sesamum growing areas of H.P. Plants are medium tall having more branching. It contains 48-49% oil. Av. Yield is 6-8 q/ha.

Punjab Till No. 1: This variety has been developed out of the local material through selection and is recommended for cultivation in the State. It is a branching type with bold white seeds containing 52% oil. On an average, it yields 500 kg/ha.

Soil

This crop thrives best on loam and sandy loam soils.

Sowing time and seed rate

Being a rainfed crop, sesamum is sown with the onset of monsoon in the end of June or beginning of July. However, July sowing is always better as the late sown crop escapes the attack on phyllody disease. Wherever possible, the crop should be sown in lines 30 cm apart with *pora* or drill. A plant distance of 15-20 cm is the best for branching varieties like Punjab Til No. 1and Brajeshwari. Even when sown by broadcast, the crop should be thinned well to get good yields. A seed rate of 5 kg/ha is recommended.

Manuring

The crop is generally relegated to lands to low fertility and where no manuring done. On the other hand, this crop does not tolerate excessive fertilization which causes luxuriant vegetative growth and renders it susceptible to disease and lodging. However to obtain good yield, manuring with 60 kg N, 40 kg P_2O_5 and 20 kg K_2O per hectare at the time of sowing the crop is necessary. About 30 tonnes of farm yard manure (FYM) should be applied before sowing. The nutrient dose should be reduced to half under un-irrigated conditions.

Interculture

When sown pure, one thorough hoeing should be done to remove the weeds after three weeks of sowing. The crop should also be thinned at this stage.

Harvesting and threshing

As the crop is susceptible to shattering, timely harvest is important to avoid losses. It should be harvested when the capsules turn pale yellow and then tied in small bundles. Alteast 2 shakings are necessary to get full recovery.

Plant Protection

Sign of attack/symptom	Control
Insect-pests	
Hairy caterpillar: they feed gregariously on plant foliage and soft stem.	1. Collect and destroy the congregating caterpillars. 2. Spray 900 ml endosulfan (Thiodan 35 EC) or 325 ml cypermethrin (Cyperkill 20 EC) in 650 L/ha water when caterpillars are of 2 mm size (second instar larval stage)
Jassid: They suck sap from underside of leaves, thus the leaves curl upwards along the tips and margins, turn yellow and dry up.	Spray dimethoate (Rogor 30 EC) or methyl demeton (Metasystox 25 EC) @ 750 ml in 750 L water/ha.
Diseases	
Leaf spot: Brown spots of different sizes appear on leaves resulting in premature defoliation. The first appearance of the disease.	Spray the crop with Indofil Z-78 or Indofil M-45 (0.2%) at fortnightly interval with
Phyllody: Floral parts are malformed. Profuse branching occurs and no seed is formed.	1. Diseased plants should be rogued out and destroyed. 2. Spray dimethoate (Rogor 30 EC) or methyl demeton (Metasystox 25 EC) @ 750 ml in 750 L water/ha for the control of jassids.

SOYBEAN

Soybean, which is traditionally grown as a food crop in some parts of the State, is another oilseed crop of great promise. With about 20 per cent oil, the crop can be raised with profit both in monoculture as well as in mixture with other crops like maize, ragi and other millets. Besides its use as a source of oil, soybean is used for preparing milk, curd, cheese and many other useful foodstuffs. The soybean cake is very rich source of protein and is very useful as feed for mulch cattle. In HP, soybean is cultivated on 500 hectares with a production of 200 tonnes 1997-98.

Varieties

Shivalik (Himso-333) : This is high yielding variety recommends for cultivation in low hills upto 900 m asl. Its attains an height of 90-100 cm. It has the same maturity duration as that of Bragg. Light creamy pubescene is present on all plant parts and the flower colour is white. The seeds are medium bold, yellow with dark brown hilum and have 18.6 per cent oil and 38 per cent protein. The variety is resistant to yellow mosaic virus which is a serious disease in lower areas of the State. Its average yield is 15-20 q/ha.

Punjab No. 1 : On an average, this variety is capable of yielding about 15 q/ha as a sole crop. The grains are medium in size and have yellow colour. The seed contains 43 per cent protein and 19 per cent oil. It takes about 110 days to mature. The plant grows about 70-80 cm tall and bears 60-70 pods, each normally bearing 2 grains. It

is recommended for cultivation in mid and low hills. However in lower hills, it is moderately susceptible to yellow mosaic virus.

Lee : It performs well in areas about 1,000 m asl where it out yields Punjab No. 1. As compared to Punjab No. 1, it is about a week earlier in maturity. The plant has determinate type of growth habit and foliage is completely darker than the other varieties. The plant is about 70 cm tall and it has only a few branches. The seeds are yellow and medium in size. This variety is resistant to many diseases, viz. purple seed strain and bacterial pustule.

Bragg : This high yielding variety is recommended for cultivation in the low hills. It attains an height of about 80 cm, bears 50-60 pods per plant, each pod generally containing three grains. The grains are bold, yellow and attractive and have 20 per cent oil and 37 per cent protein. As compared to Punjab No. 1, it is late in maturity by 5-7 days. Though resistant to many diseases, it is moderately susceptible to yellow mosaic virus, so it should not be cultivated in lower areas.

Harit soya (P-4-2): It is a new high yielding variety recommended for mid hills. It has green colour grains. It matures within 123 days. It has resistance to bacterial and brown spots, lodging and grain shattering. Average yield is 18 q/ha.

Palam soya (P 30-1-1): It is a new variety recommended for mid hills of H.P. It is suitable for early and timely sowing. It matures within 120-125 days and gives an average yield of 15-20 q/ha. It is moderately resistant to many disease.

Soil

Well drained sandy loam to loam soils are best for soybean cultivation. The soil with pH 6 to 6.5 is preferred by the nodulating bacterial for efficient nitrogen fixation.

Sowing

The crop should be sown with the first pre-monsoon shower (mid June). Delayed sowing results in poor plant stand. A seed rate of 75 kg/ha may be used to ensure good stand. Under rainfed conditions, the seed rate should be increased to 100 kg/ha. The crop may be sown in rows 45 cm apart. The plant should be spaced at 10-15 cm. Seedling is always preferred under optimum moisture conditions and the seed should not be placed deeper than 3-4 cm in the soil.

Manuring

	Kg/bigha			Kg/ha		
	Urea	SSP	MOP	N	P_2O_5	K_2O
High rainfall areas	3.5	30	5	20	60	40
Low rainfall areas	3.5	15	4	20	30	30

The whole of the nutrient dose should be applied at the sowing time. In acidic soils, use of lime @ 3 tonnes/ha alongwith *Rhizobium* culture has been found to increase the yield significantly by about 5 q/ha.

In acidic soil (pH below 6), application of P_2O_5 @ 90 kg/ha through ground Mussorrie Rock Phosphate proved as effective as superphosphate in increasing yield. As such,, rock phosphate may be adopted as a suitable @ 60 kg/ha (P_2O_5) in place of superphosphate.

Interculture and weed control

Two hoeings and weedings be given in the early stages on growth in order to control the weeds. Basalin @ 2 L/ha should be sprayed in 750-800 L water as pre-emergence. To avoid photodecomposition of Bavistin, it must be incorporated in upper soil layer of 3-4 cm or the spray should be done in the evening.

The weeds can also be effectively controlled by the pre-emergence application of Goal @ L/ha or Saturn @ 3 L/ha or Stomp @ 4.5 L/ha or post - or - pre-emergence application of Blazer @ 1 L/ha.

Harvesting and threshing

The crop is harvested when the leaves turn yellow and fall off and pods change colour. Harvesting should be done in time to avoid losses through shattering.

Storage

Before storing, the threshed grains should be dried and moisture reduced to 11% and then the grains should be kept in dry seed bins. If the storing is properly done, the seed remains viable for one year.

Seed production

The following practices should be adopted for growing soybean for seed purpose.

Selection of seed

The seed should be true to type, healthy and free from diseases. It should be procured from some certified agency.

Sowing

The land should be prepared as in the case of pure soybean crop but the sowing should not be done earlier than the first week of July. Slightly higher seed rate i.e. 100 kg/ha should be used and the seed should be sown 30 cm apart in lines by *kera* method.

Roguing

The off-type plants should be removed at the flowering time to maintain the purity of seed.

The other agronomic practices should be followed as being done in case of pure soybean crop.

Plant Protection

Insect-pests : For soybean insect-pests, seed pulse crops chapter.

Diseases:

Symptom	Control
Brown spot : The disease appears at the flowering time. Spots are reddish brown and angular in shape with chlorotic magrin. Defoliation occurs in severe attack.	1. Disease free seed should be used for sowing. 2. Sow moderately resistant varieties like Lee and Bragg.
Bacterial pustule : Yellow pustular outgrowths which later change to reddish brown appear on both surfaces of leaves. Small reddish brown spots also occurs on pods.	1. Do not grow Punjab No. 1 variety in disease prone areas. 2. Sow resistant varieties like Lee and Bragg.
Yellow mosaic : Mosaic mottling of leaves accompanied with a slight wrinkling and reduction in size. Plants are stunted and set few seeds only.	1. Use virus free seed. 2. Rogue out the infected plants as early as possible. 3. Avoid sowing variety Bragg in warmer areas like Dhaulakuan. 4. Sow Shivalik variety in lower areas.

GROUNDNUT

Groundnut or peanut is not a widely cultivated crop of Himachal Pradesh. However in recent years, some farmers in the areas adjoining the states of Punjab and Haryana in the foot-hills of Una, Nalagarh and Paonta valley have taken up the cultivation of this crop. The total area under this crop is roughly 500 hectares with production of 665 tonnes (1997-98). This crop is very specific in its soil and climatic requirements. A warm and dry climate with fairly distributed rainfall in July and August provides conducive conditions for raising a good groundnut crop. Groundnut being a legume crop, can be best raised in rotation with cereals like wheat and barley.

Soil

In Himachal Pradesh, this crop is cultivated under rainfed conditions. A well drained sandy soil with a layer of loamy sub-soil is considered ideal for this crop. Under irrigated conditions, the crop can be raised in the sandy loam and loamy soil as well. Growing the crop repeatedly in the same soil year after year should be avoided to discourage the build-up of soil borne diseases. The land should be ploughed twice and left open to sunlight in May-June after the harvest of the previous crop.

Varieties

In Himachal Pradesh, no research has been conducted on this crop. However, in the adjoining State of Punjab, some good varieties are being grown, whose description is as below :

Punjab Groundnut No. 1: This is a spreading variety and is suitable for growing on sandy soil under rainfed conditions. It matures in about 130 days yielding about 19q nuts/ha. With a shelling out-turn of 69%, the kernels weigh 60 g/hundred seed and yield 45% oil.

M-45 : This is also a spreading variety but its lateral spread is smaller than that of Punjab Groundnut No. 1. It is suitable for cultivation on sandy soils both under rainfed and irrigated conditions . It matures about a week earlier than P.G. No. 1 and is superior to the later in yield per unit area as well as shelling percentage and oil content.

M-13 : This variety is also spreading with vigorous growth and profuse lateral branching. It is suitable for cultivation in sandy soils under irrigated conditions. Under assured irrigation, it is a high yielding variety giving about 30 q pods/ha. It matures about a week later than P.G. 1 No. 1. Its shelling is 68% and oil content is 49%. It has bold kernels with a test weight of 78 g per hundred kernels.

C-501 : It is semi-spreading variety and can be cultivated in sandy loam and loamy soils under irrigated conditions. It matures alongwith P.G. No. 1 and yields about 17 q nuts/ha. Its shelling out turn in 68% and oil content is 48%. The 100 kernel weight is 46 g.

M-37 : This variety has been developed and released for cultivation in Punjab only recently. It is also spreading in growth habit with profuse trailing branches. It matures earlier than all over varieties, just in four months and much suitable for cultivation in sandy soils under rainfed conditions. If yields about 16 q pods/ha. With a shelling percentage of 69% and test weight of 45 g/100 kernel, its oil content is 50.5%.

Preparation and treatment of seed

For sowing purposes, select healthy and well developed pods. These should be shelled by hand about two weeks before sowing. Diseased kernels, if any, should be removed and the healthy ones should be treated with 3 g Captan or 5 g Thiram/kg kernels.

Time and method of sowing

The rainfed crop should be sown at the earliest with the advent of monsoon in the end of June or beginning of July. Wherever irrigation is available, the crop may be sown by applying a pre-sowing irrigation around 20th June.

The seed should be placed in the soil about 5 cm deep in rows 30 cm apart. The plant to plant distance may be kept 15 to 22 cm depending upon the varieties. It is better to sow the crop by *kera* behind the plough.

Seed rate

The seed rate (kernels required for sowing per unit area) varies depending upon the seed size of the kernels and plant to plant distance kept while sowing. The following table shows seed rate (kernels) and spacing for different varieties :

Varieties	Spacing plant to plant (in cm)	Seed rate per bigha (in kg)	(kernels) per kanal (in kg)
P.G. No.1	22	7	3.5
M-45	15	9	4.5
M-13	22	9	4.5
C-501	15	8	4.0
M-37	15	5	2.5

Manuring

Being a leguminous crop, groundnut requires only an initial dose of nitrogen but like all other legumes, its requirements for phosphatic fertilizer is more. The fertilizer should be drilled before sowing in the soil. The following doses of fertilizers are recommended for the crop.

Nutrients			Fertilizers					
Kg/kanal			Kg/bigha					
N	P_2O_5	K_2O	CAN	SSP	MOP	CAN	SSP	MOP
16	40	25	64	250	40	5	20	3

Inteculture

In order to keep the weed population down and the soil soft, the crop should be given atleast two hoeings (3 and 6 week of sowing).

Harvesting and threshing

The crop is ready for harvest in the beginning of November. When all the leaves start yellowing and older leaves begin to shed, the crop can be said to have reached maturity. The plants should be dug out and stacked in small heaps for curing for 3-4 days.

After curing and drying of the stalks and leaves, the crop may be collected in the threshing floor and beaten with sticks to separate pods from the stalks. After removal of stalks, the pods and leaves should be heaped and winnowed to get rid of the leaves from the produce. Before storing, the pods should be dried in sun for about a week.

Plant protection

Sign of attack/symptom	Control
Insect- pests	
Aphids : They are black in colour and cause damage by sucking growing shoots.	Spray 625 ml malathion (Cythion 50 EC) or 375 ml dimethoata (Rogor 30 EC) or 375 ml methyl demeton (Metasystox 25 EC) in 375 L water/ha as soon as the pest appears
White grub : It damages the roots and the plants wither gradually in the soil at sowing time in areas prone to infestation.	Mix 2 L chloropyriphos 20 EC mixed with 25 kg of sand per ha.

Disease	
Tikka disease/leaf spot: Dark spots, surrounded by a bright yellow halo, appear on the leaves. Few spots also occur on the petiole and stem. Premature shedding of the leaves is the most striking feature of the disease.	Spray the crop with Copper oxychloride or Blitox 50 (0.3%) or Indofil M-45 (0.2%) with the first appearance of disease. Repeat the sprays at 15 day interval.

SUNFLOWER

Sunflower popularly know as *"Surajmukhi"* is a familiar plant and has been grown for its ornamental value in the hills of Chamba, Kullu, Shimla and Kinnaur districts. Sunflower, as an oilseed crop, is a new introduction and has very high promise because of its short duration, photo-insensitivity, wide adaptability and drought tolerance.

Since it has got 45-60 per cent good quality oil, rich in vitamin A and D and high amount of quality protein in its cake therefore, it can play a major role in ameliorating the nutritional status of the hill people. The cake ideally provides a nutritious feed for cattle and poultry. It is also used for manufacturing baby foods. The oil has a good keeping quality and utilized in the manufacture of vegetable ghee, soaps and medicines. The sunflower kernels are eaten raw or roasted.

Varieties

Two exotic varieties viz EC-68413 and EC-68415 are available and both of them can be grown successfully in the State. It has been found that variety EC-68413 is more suitable for growing in summer while EC-68415 is good as a spring crop.

Agronomic Practices

The crop requires a cool climate during germination and seedling growth. Seedlings tolerate frost moderately well untill they reach four to six leaf stages of development. It requires warmer weather from the seedling stage to flowering stage and warm and sunny days during flowering to maturity.

Soil

Sunflower can be grown on wide range of soils and tolerate a moderate pH range. It thrives best on deep loam soils with good drainage and irrigation facilities.

Field preparation

The seed bed should be prepared well and stubbles of the previous crop removed. Ensure sufficient moisture at the time of sowing.

Time of sowing

(A) Spring Crop : In the low and mid-hills, the spring crop may be sown in the second fortnight of February. In high hills, sowing may be done in the end of March or beginning of April.

(B) Summer Crop : In low rainfall areas, the summer crop may be sown with the onset of monsoon (June-July). In areas of high rainfall, a delayed sowing in the month of July is advisable as three should be no rains at the ripening time otherwise the seed is likely to decay in the disc.

Seed rate and method of sowing

A seed rate of 10-12 kg per hectare is sufficient to ensure good crop stand. The seed before sowing should be treated with Captan at the rate of three gram per kg seed. Bold and certified seed should be used.

Sunflower should be sown 60 cm apart in lines with a plant to plant spacing of 25-30 cm. The seed should be sown at 3-4 cm depth for better stand. If moisture is deficient in the soil, the seed may be soaked in water for 6-8 hours before sowing. After 10-12 days of germination, extra seedlings should be uprooted to provide a space of 25-30 cm between plants in rows.

Manuring

Sunflower is an exhaustive crop and responds well to fertilizers. However, high doses of nitrogen lead to luxuriant vegetative growth and reduction in oil content. In general, 40 kg nitrogen and 60 kg P_2O_5 per hectare may be drilled before sowing. If the crop shows poor growth, another dose of 20 kg nitrogen per hectare may be top-dressed one month after germination.

Water management

Summer crop does not require irrigation in areas receiving good precipitation. On the other hand, good drainage is necessary as this crop is sensitive to water logging. Water should, therefore be not allowed to stand in the field. In areas of low rainfall, 1-2 irrigations may be given, if available. Spring crop can be taken only in irrigated areas in low and mid-hills, whereas there is hardly any need of irrigation at high altitude. Flowering stage is the most critical period for water.

Hoeing and weeding

The crop should be kept clean of weeds. First hoeing may be done three weeks after sowing and the second a month thereafter. The crop may be lightly earthed to save it from lodging. Use of Basalin at the rate of 1 kg a.i. per hectare in 800-1000 L water as pre-planting spray has been found effective in controlling weeds in sunflower crop.

Harvesting

The spring crop takes about 120-125 days to mature, while the summer crop matures in 90-100 days. The crop should be harvested when the back of the capitulum turns yellow and central portion of the disc turns brown. The heads at maturity may be cut with sickle, dried in the sun for a few days and threshed. The threshed seed may be further dried for 2-3 days before storing.

Yield : The average yield is 10-15 q/ha

Insect-Pest

Sign of attack	Control
Capitulum borer : The larvae feed on the growing seed in the flower heads.	Spray endosulfan (Thiodan 35 EC) @ 1500 ml in 750 L water/ha.
NOTE : The crop should be sprayed during evening hours to avoid mortality to pollinators.	