

Weed control

Important weeds found in lentil are *Chenopodium album* (*Bathua*), *Fumaria parviflora* (*Gajri*), *Vicia sativa* (*ankari*), *Lathyrus aphaca* (*chatri matri*), *Anagallis arvensis* (*Krishna neel*), etc. Lentil being slow in growth in early stages suffers adversely from competition with weeds. They can be controlled by 2 hoeing at 30 and 60 days after sowing. It also helps to conserve moisture. 45-60 days of weed free period should be maintained for proper crop stand and yield.

Disease management

Wilt (*Fusarium oxysporum* f.sp. *lentis*): The disease appears in patches at both seedling and reproductive stages. It is characterized by sudden drooping, drying of leaves and seedling death. The roots appear healthy, with reduced proliferation and nodulation and usually no internal discoloration of the vascular system. The reproductive stage wilt symptoms appear from flowering to late pod-filling stage and are characterized by sudden drooping of top leaflets of the affected plant, leaflet closure without premature shedding, dull green foliage followed by wilting of the whole plant or individual branches. Seeds from plants affected in mid-pod-fill to late pod-fill are often shrivelled. The best method to control wilt is to use resistant varieties. Deep ploughing of the field during summer reduces wilt infestation. Crop rotation with non-host cereal crops is advantageous. Use of antagonistic microflora like *Bacillus subtilis*, *Trichoderma harzianum*, *T. viride* reduce wilt infection.



Insect management

Pulse beetle (*Calosobruchus* sp.): The infestation of pulse beetle starts from the field itself. Grubs eat the entire seed content and make cavity. Adults do not feed. It attacks whole grain pulses, beans and grams. The beetle is brownish grey with ivory coloured erupted spots. Elytra do not cover the abdomen fully. It lays 80-100 eggs singly and glued on the surface of the pod or grain. Grub is fleshy white and seen inside the grain. The larval duration lasts for 30-50 days.



Management: Solar heating of seeds, splitting of grain, admixture with inert dust, low temperature and creating modified atmosphere by increasing CO₂ concentration are used against pulse beetle. Mixing vegetable oil @ 1 L per 100 kg of grain before storing gives good protection against pulse beetle. *Neem*, groundnut, corn, sunflower, sesame, coconut and palm oil are used against bruchids.

Dashparni extract is useful to manage all kind of insect-pests. 5-6 litres of *dashparni* extract is diluted in 250 litres of water for spraying one ha crop area.

Harvesting, threshing and storage

Lentil should be harvested when plants begin to turn yellow and the lower pods become brown to yellow-brown in colour. Pods can readily shatter, therefore harvesting should not be done during hot, dry periods of the day. Lentil has a weak stalk and tends to lodge badly. This means that low cut is required in order to minimize losses. When more than 80% pod matures, it should be cut with a sickle, dried on the threshing floor and threshed by beating with sticks or trampling with bullocks. Lentils are dried up to 12% moisture content for storage.

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Organic Farming of Rainfed Lentil in Hills



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Lentil is one of the oldest food crops. Its cultivation dates back to beginning of agriculture itself. It is the most important pulse crop of *rabi* season in Uttarakhand hills as well as the North-Western Himalayas (NWH). It is also utilized as fodder for cattle and for soil conservation. In general, lentil can tolerate more cold and frost compared to other *rabi* field crops in hills. It can tolerate drought and moderate rainfall fairly. It is cultivated as mixed or intercropping with wheat under rainfed condition in hills. Dehulled lentil seeds contain 24-26% protein, 1.3% fat, 2.2% ash, 3.2% fibre and 57% carbohydrate. It is a rich source of calcium (6.8 mg/kg), phosphorus (30 mg/kg) and iron (0.7 mg/kg). It is also rich in vitamin C and riboflavin.

Lentil is broadly classified as small seeded (microsperma) and bold seeded (macrosperma). The small seeded are small rounded seeds, 2-6 mm in diameter. The bold seeded have large size seeds (6-9 mm diameter) which are more flattened. The small seeded is generally grown in NWH, but, slowly the bold seeded is gaining importance. It is cultivated in an area of 9.1 thousand ha in the hills of Uttarakhand. The productivity is only around 6.98 q/ha, which is quite less than the national average (10.32 q/ha). Lentil is mostly grown as rainfed crop in the NWH. However, the yield of lentil under rainfed condition can be enhanced by improving water holding capacity and soil health with following proper organic management. The minimum support price of lentil increased 2.3 times during last ten years from 2250 to 5100 rupees. Hence, production of organic lentil is highly profitable with addition of small amount of premium price also.

Climate

Lentil requires a cold climate. It can be grown successfully up to the altitude of 3000 m above mean sea level. It can be grown with the moisture conserved in the soil during the rainy season. It required cold temperature during its vegetative growth and warm temperature at the time of maturity. The optimum temperature for growth is 18-30 °C.

Soil

A Well drained, deep soil free from excessive soluble salts with pH 6.0 to 8.5 and soil texture sandy loam to sandy clay loams considered ideal for lentil cultivation. Acidic soils are not fit for growing lentils.

Field preparation

Water conservation from previous monsoon rain is the most important for optimum germination of lentil, as it is grown under rainfed situation. Early harvesting of *kharif* crop, deep tillage before the beginning of rains followed by 1-2 light cultivations before the withdrawal of monsoon rains help in

conserving profile moisture. Frequent shallow cultivation late in the evening to expose more surface area to capture dew during early winter season and planking next morning is generally practised to conserve moisture. Lentil generally does not need fine seedbed. A good seedbed should have friable, but compact soil with adequate moisture.

A firm, smooth seedbed with most of the previous crop residue incorporated is best for lentil. Uneven surfaces, large clods, rocks or protruding crop residue can interfere with seed placement and germination. On heavy soils, one deep ploughing followed by 2-3 cross harrowing should be done. Light soils may require less tillage and harrowing. There should be proper moisture in the soil at the time of sowing for good germination.

Level of organic manure and treatment

Application of 16-20 tons per hectare well decomposed farmyard manure (FYM) (3.2-4 quintals per *nali*) is recommended for lentil crop. The FYM should be broadcast and mixed thoroughly in the soil. 2.5 kg of *Trichoderma* powder should be mixed thoroughly with 2 quintals well decomposed farmyard manure or any compost 10-15 days before application. This inoculated heap of FYM or compost should be covered through jute sack or straws to keep it air tight. This inoculated FYM should be uniformly spread over one hectare area before sowing. The diseases caused by fungus can be effectively controlled by using *Trichoderma*. Application of 250 kg per hectare of *ghanjeevamrit* (prepared from indigenous cow dung, jaggery, pulse flour, indigenous cow urine and undisturbed soil from forest) at the time of sowing enhances the soil health and yield.

High yielding variety suitable for organic farming

VPKAS, Almora has developed a number of varieties suitable for rainfed organic farming. Generally, the small seeded varieties are preferred for cultivation in the NWH.

Types of lentil	Variety
Small seeded	VL Masoor 125, VL Masoor 126, VL Masoor 133
Bold seeded	VL Masoor 507, VL Masoor 514, VL Masoor 516

VL Masoor 133 and VL Masoor 516 have tremendous potential under rainfed organic situation in hills among small and bold seeded varieties, respectively.

Sowing Time

Sowing time is the most important non-monetary input having profound effect on crop growth, phenological development,

moisture availability and weed infestation, etc. Lentil should be sown after the harvest of *kharif* crop from the mid-October to mid-November for better growth and higher yield. Delay sowing loses moisture from soil and there will be very poor germination. Early sowing of lentil produces flowers very early, which coincides with frost period and grain yield is drastically reduced due to the negative effect of frost. Frost period must coincide with vegetative period.

Seed rate, spacing and depth of sowing

A seed rate of 30-40 kg per hectare is recommended depending on the seed size. The sowing of lentil should be in line. A row spacing of 30 cm is recommended. This could be done either by using a seed drill or by seeding behind *desi* (country) plough. The seed rate should be increased to 50 to 60 kg per hectare in case of late sowing. Row spacing should also be reduced to 20 to 25 cm in case of late sown crop. Lentil should be planted at a shallow depth (3-4 cm). Because of the small seed size, lentil cannot emerge if planted too deep or if the soil has formed crust. Lentil has hypogeal emergence, which means that the growing point emerges but the cotyledons remain in the soil.

Seed treatment

Moisten the seed recommended for one acre (12-16 kg) with minimum amount of water. Mix thoroughly one packet (200 g) each of *Rhizobium*, phosphate solubilizing bacteria (*Pseudomonas fragii*) and plant growth promoting rhizobacteria (PGPR) (PGERS17) with it. The *beejamrit* (prepared from indigenous cow dung, lime, undisturbed soils from forest and indigenous cow urine) can also be used as seed treatment. Allow the treated seeds to dry in shade. Sow the seed within one hour after inoculation.

Method of Sowing

Most of the farmers broadcast lentil seeds during sowing. Germination of seed is very poor in broadcasting. The plant density is not uniform also.

North-south row orientation is generally beneficial over east-west orientation as in the former case there is better interception of light in crop rows.

Crop management

Growing of lentil crop as intercrop with wheat enhances the profit of small and marginal farmers under rainfed situation in the NWH. Spraying of *jeevamrit* (prepared from cow dung, cow urine, jaggery, chickpea flour and undisturbed forest soil) @ 500 litres per ha twice a month enhances the yield. Spraying of 3% *panchagavya* and vermiwash during pre-flowering and flowering stages enhances the soil health and grain yield.