Agronomy – Rabi Crops

Lentil

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LENTIL

Botanical Name : *Lens culinaris* Medik
Chromosome Number : 2n=14

Lentil is one of the important and most nutritious *rabi* pulses. It has the potential to cover the risk of rainfed farming. It is also used as a cover crop to check the soil erosion in problem areas. The plants are ploughed back into the soil as green manure also. It derives the name *Lens* from the lens shaped seeds.

It is mostly eaten as '*dal*'. The *dal* is made by splitting the grain in 2 cotyledons, which are deep orange red or orange yellow in colour. The whole grain is also used in some of the dishes. It is also rich in calcium (560 ppm), iron, and niacin. It has the lowest content of lectins and trypsin inhibitors among legumes. Since it is a leguminous crop, it improves the fertility of soil biological nitrogen fixation. Lentil seeds also provide a source of starch for textiles and printing. Lentil residues form important livestock feed. Lentil floor is used for thickening of soups. It is mixed with wheat flour in bread and cake production.

Origin and History

Lentil is considered to have its primary area of diversity in south-west Asia and Mediterranean region. The archaeological proofs indicate near-east Arc as place of primary domestication.

Geographic Distribution

The important lentil-growing countries of the world are India, Canada, Turkey, Bangladesh, Iran, China, Nepal and Syria (Table 1).

Table 1. Area, production and productivity of lentil in various countries of the world

Continent/country	Area (m ha)	Production (m t)	Productivity (kg/ha)
Africa	0.118	0.078	653
North-central America	0.891	1.161	1304
Europe	0.058	0.055	947
Asia	2.758	2.366	858
India	1.450	1.100	759
Canada	0.751	0.962	1282
Turkey	0.439	0.540	1230
Bangladesh	0.155	0.122	789
Iran	0.250	0.125	500
Nepal	0.187	0.159	847
Syria	0.137	0.125	912
China	0.069	0.150	2174
Australia	0.119	0.083	698
World	**3.958**	**2.753**	**948**

Source: FAO Production Year Book, 2004

India ranks first in the world in respect of production (0.99 m tonnes) as well as acreage (1.47 m ha). In India, lentil is mostly grown in northern plains, central and eastern parts of India. The major lentil producing areas are situated in Madhya Pradesh, Uttar Pradesh, Bihar and West Bengal (Table 2).

Table 2. Area, production and productivity of lentil in different states of India (2004-05)

State	Area (lakh ha)	Production(lakh tonnes)	Productivity (kg/ha)
Assam	0.205	0.115	561
Bihar	1.787	1.270	711
Chhattisgarh	0.172	0.044	256
Haryana	0.086	0.082	953
Jammu & Kashmir	0.002	0.001	500
Madhya Pradesh	4.977	2.477	498
Maharashtra	0.055	0.014	255
Punjab	0.033	0.016	485
Rajasthan	0.288	0.286	993
Tripura	0.004	0.002	500
Uttar Pradesh	6.130	5.014	818
Utttarakhand	0.142	0.079	556
West Bengal	0.627	0.379	604
India	14.730	9.942	676

Source: Departmant of Agriculture and Cooperation, Ministry of Agriculture, India

Classification

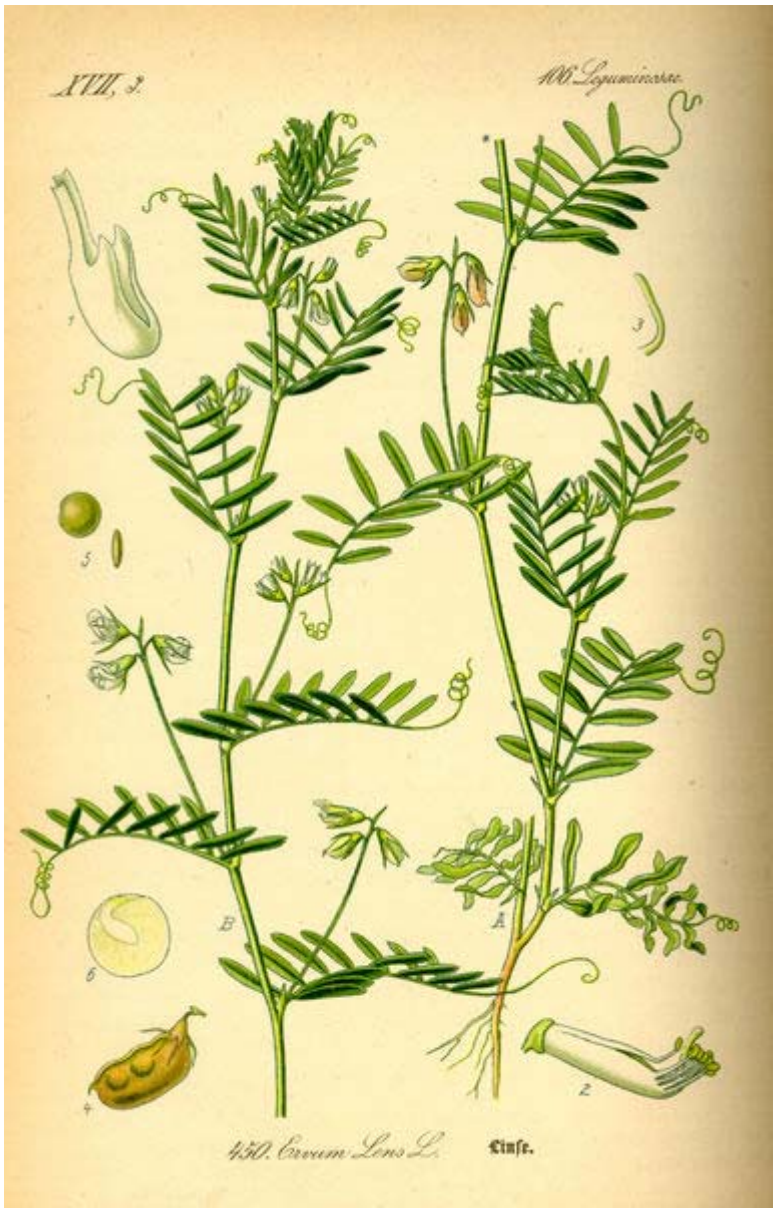
There are two cultivated species of genus *Lens* i.e. *Lens esculenta* Moench and *Lens culinaris* Medik. The wild species include *L. orientalis* (Boiss) Hand-Mazz, *L. nigricans*, *L. erroids* and *L. montbretti*. The cultivated species *L. esculenta* are classified into 2 sub groups according to size of the seed.

1. **Sub-species** *microsperma*: They have small seed of 2-6 mm diameter and are produced in India, Africa and Asia. Pods are complex and small.
2. **Sub-species** *macrosperma***:** They have large seeds of 6-9 mm diameter and are grown in Mediterranean region and North America. Mostly pods are flat and large.

Botanical Description

Lentil is a herbaceous annual plant, mostly erect and bushy type with 4-6 primary branches. Lentil has well developed root system including a central tap root with several lateral branches spread out in all directions. The stem is weak and quadrangular. The leaves are small, compound and pinnate. The end of leaflets sometimes forms tendrils. The inflorescence is a receme of 2-4 flowers. Flowers are small, white tinged with blue violet or

pink. Flowers consist of 5 sepals, 5 petals comprising of 1 standard, 2 wings and 2 keels, 10 stamens, 9 fused to form a staminal column. Ovary is short with 1 or 2 ovules, style curved and hairy on its inner surface. Pods are short, flattened, 1-1/2 cm long with curved beak. Pods contain mostly 2 seeds. Seeds are often light brown in colour and lens shaped. The crop is generally self-pollinated.



Source: http://commons.wikimedia.org/wiki/Image:Illustration_Lens_culinaris0.jpg

Climatic Requirement

The growth of lentil crop is adversely affected at temperatures above 27°C. Hence, it is grown as a winter season crop in semi-arid tropics. It can be raised successfully from sea level to an elevation of 3,000 m. Unlike gram, it remains unaffected by rain at any stage of its growth including flowering and fruiting. It can be raised successfully with the moisture conserved in the soil during the monsoon season. The plant is hardy and can tolerate frost and severe winter to a great extent. It is moderately drought tolerant crop. Lentil requires cold temperature during its vegetative growth and warm temperature at the time of maturity. The optimum temperature for growth is 18^{o}-30^{o}C,

Soils and its Preparation

Lentil is raised on light loams and alluvial soils in upper India, and on well-drained, moderately-deep, light-black soils in Madhya Pradesh and Maharashtra. It is also grown on low-lands, poor soils. In Punjab, it is often cultivated on inundated lands. The crop can withstand moderate alkalinity. It con not tolerate waterlogging.

Soil should be made friable and weed free so that seed could be placed at a uniform depth. In case of light soils, less tillage is required to prepare an ideal seed-bed. In heavy soils, one deep ploughing followed by 2-3 cross harrowings should be given. After harrowing, the field should be leveled by giving a gentle slope for easy irrigation. There should be proper

moisture in the soil at the time of sowing for proper germination of seeds. In *utera/paira* cropping system of rice-lentil in eastern Uttar Pradesh, Bihar, Orissa, Madhya Pradesh, seeds are sown in standing rice crop and therefore no tillage is done.

Varieties

The bold and small seeded varieties suitable for different states/zones and their characteristics are given in Table 3 and Table 4.

Table 3. High yielding bold seeded varieties of lentil recommended for different states

Variety	Duration (days)	Yield (q/ha)	Recommended for	Special characteristics
Pant L 234	130-150	15-20	Uttar Pradesh	Tolerant to wilt and rust diseases
NFL 92 (Narendra Masoor 1)	120-130	15-20		Resistant to rust and tolerant to wilt
JLS 1	120-130	10-15	Central plateau region	Tolerant to wilt
Bombay 18	130-140	10-12	Maharashtra, Punjab and Haryana	
DPL 15 (Priya)	130-140	14-16	North-western plains zone	Resistant to rust and tolerant to wilt
DPL 62 (Sheri)	130-140	15-20	North-western plains zone	Resistant to rust and tolerant to wilt
L-4632			North western plains zone	Extra bold seeded variety
IPL 81(Noori)	110-120	10-15	Central zone	Tolerant to wilt and rust
K 75 (Malika)	120-125	14-16	North-eastern plains zone and central zone	
Pusa 4076 (Shivalik)	130-135	25-28	North-western plains zone and central zone	Resistant to rust and less affected from drought in comparison to *deshi masoor*
Pusa 1	100-110	15-20	Bihar, Uttar Pradesh, Madhya Pradesh, Haryana and Orissa	
Pusa 4	130-140	20-25	Uttar Pradesh, Bihar and West Bengal	
Pusa 830	120-125	20-25	U.P. and Uttarakhand	Disease susceptible variety
LL56	150-160	12-13	Delhi	Good cooking quality
L-9		7-10		

Table 4. High yielding small seeded varieties of lentil recommended for different states

Variety	Duration (days)	Yield (q/ha)	Recommended for	Special characteristics
BR 25	125-130	15-20	Bihar and Madhya Pradesh	
L 4147 (Pusa Vaibhav)	130-135	17.8	North-western plains zone	Resistant to rust and tolerant to pod borer
T 36	130-140	16-18	Uttar Pradesh	Highly susceptible to wilt
Pusa 6	130-135	20-25	Delhi, UP, Haryana, Punjab, Bihar and West Bengal	
Pant L 406	125-130	20-25	UP, Bihar, Punjab, North-eastern hills and north-western plains	Resistant to rust and some races of wilt
L 4584			North-western plains zone	
L 830	120-125	8-12		
PL 81-17 (Pant Lentil 4)	130-140	14-18		Resistant to rust and wilt
LH 84-8	130-140	14-16		Resistant to rust
VL 4	150-160	10-12	Hilly areas of northern, western and eastern states	Tolerant to wilt
Asha	125-130	14-16	West Bengal	
B-17	120-125	15-20		
B 177,S 256, S 177	125-130	15-20		
B-235, C31,Ranjan	116-120	16-18		
Pant L 639	130-140	18-20	North western plains Zone, north-eastern plains zone and central zone	Moderately resistant to shattering, resistant to rust and wilt complex
LH 82-6 (Garima)	130-140	12-15	Haryana	Tolerant to rust and blight
PL 77-12 (Arun)	125-130	12-15	Bihar	Tolerant to wilt
BR 26	125-130	20-25	North Bihar	
LL 147	135-140	12-16	Punjab	Resistant to rust
L-9-12	125-130	15-20		
VL-1	165	10-12	Hilly areas of Uttar Pradesh and other states	
VL-3	160-165	10-12	Uttar Pradesh	Tolerant to *Ascochyla* blight
T8	120-125	18-20		Susceptible to rust

Other varieties:

JLS 3, Sehore 74-3, VL Masoor 44, VL Masoor 103

Seeds and Sowing

Seed rate: The optimum seed rate for normal sown crop is 30-40 kg/ha. Seed rate should be increased to 50-60 kg/ha in case of late sowing.

Treat the seed with benomyl or agrosan GN @ 2 g/kg of seed before sowing.The lentil seed should be treated with *Rhizobium* culture before sowing. After wetting the seed recommended for 1 ha with minimum amount of water, mix it thoroughly with 3 packets *Rhizobium* inoculant, dry in shade and sow the seed thereafter immediately.

Time of sowing

The optimum time of sowing is the second fortnight of October. Delay in planting causes reduction in yield, but the magnitude of reduction is greater after 15 November. The reduction in yield could be minimized up to a certain extent by relatively closer spacing and use of higher seed rate. In central zone, where moisture is a limitation, early planting in mid-October is recommended to ensure proper germination. In north-west plains zone, end of October and in north-east zone, second fortnight of November is the optimum time of sowing under adequate moisture.

Method of sowing

The crop should be sown in lines 30 cm apart by *pora* method. It can be sown by seed broadcast after the rice crop, where shortage of time and excess moisture condition do not allow good land preparation. Under late-sown conditions, the row spacing should be reduced to 20 cm. Lentil seed should be sown at a depth of 3-4 cm.

Manure and Fertilizers

Generally lentil is raised without manure and fertilizers under rainfed conditions. There may be a need for small quantity of fertilizer N to serve as starter dose for a few weeks of initial growth or till the nodules are developed. In soils deficient in N and P_2O_5, significant responses of starter N (20-25 kg/ha) and moderate level of P_2O_5 (50-60 kg/ha) have been obtained. If soil test is not possible, apply 20-30 kg N and 50-60 kg P_2O_5/ha in medium to low fertile soils as basal. The crop also responds to 20 kg S/ha under both rainfed and irrigated conditions. Favourable crop responses to B and Mo have been reported in non-acidic and acid soils, respectively.

Lentils are often grown in rotation with rice. It is well known fact that rice fields are deficient in zinc. Therefore, it could be worthwhile watching the lentil crop for likely zinc deficiency. In initial stages of zinc deficiency, the leaflets start fainting-off. The deficiency can be rectified by spraying a solution of 0.5% zinc sulphate and 0.25% lime at the appearance of early symptoms.

Water Management

The crop is mostly grown in rainfed areas. Pod formation followed by flower initiation is critical stages for irrigation. Irrigation is important especially under late sown conditions due to poor root development. The crop requires 200 mm of water depending on soil and climate. Lentil requires 1-2 irrigations depending upon the rains during the growing season. First irrigation is applied 6 weeks after sowing and the second at flowering or pod formation stage.

Weed control

Lentil, being slow in growth in early stages, suffers adversely from competition with weeds. The period from 30 to 60 days after sowing is most critical for competition with weeds. The major weeds found in lentil fields are *Chenopodium album* (*Bathua*), *Lathyrus* spp. (*chatrimatri*), *Vicia sativa* (*ankari*), *Melilotus alba* (*senji*) and *Cirsium arvense* (*kateli*), *Convolvulus arvensis* L. and *Pluchea lanceolata*. Maintenance of weed free period of 45-60 days from sowing is important. Two weedings 30 and 60 days after sowing are adequate.

Weedicides like fluchloralin (pre-palnt incorporation) and pendimethalin (pre-emergence) @ 0.75-1.0 kg/ha can be used for effective weed control.

Cropping Systems

Lentil is grown mixed with barley, *toria*, rape and mustard crops. It is also raised as an intercrop in autumn sugarcane. Two lines of lentil may be sown 30 cm apart in the center of 2 sugarcane rows. The distance between sugarcane and lentil rows should be 30 cm. Intercropping of linseed+lentil (2:1), lentil+mustard (4-6:1) in Bundelkhand region of Uttar Pradesh is also promising. Lentil is relatively more shade loving than gram. Hence, it performs better in mixed and intercropping systems.

Generally lentil is grown after the harvest of *kharif* crops or as the sole crop of the year. Rice-lentil is the most common rotations. The other lentil-based rotations are given below:

Groundnut – lentil

Pearlmillet – lentil

Cotton – lentil

Rice – lentil + mustard – maize (fodder)

Sorghum – lentil

Maize – Lentil

Kharif fallow – lentil (rainfed areas)

Harvesting and Threshing

Lentil should be harvested when the plants dry up and pods are matured. The plants should not be allowed to become over ripe as large quantity of produce may be lost due to shattering. Threshing is done either by beating the plants with sticks or trampling by bullocks. After threshing, seed is cleaned and dried in sun to bring moisture content to 12% for safe storage.

Yield

A well-managed crop yields about 1.8-2.0 tonnes grain and 3.0-4.0 tonnes/ha of straw.The mean yield attributes of lentil are:

Attributes	**Value**
Pods/plant	55
1,000 seed weight (g)	
Small seeded	<26
Bold seeded	>30
Fat%	1.8
Carbohydrate%	60.8