

Agronomy – Rabi Crops

Alfalfa

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LUCERNE OR ALFALFA

Botanical name: *Medicago sativa* L.

Family: Fabaceae (Leguminosae)

Chromosome number: $2n = 4x = 32$

Lucerne, known as '*rijka*' in northern India, is a perennial plant and may supplies green fodder continuously for 3-4 years from the same sowing. It is generally raised in areas where water supply is inadequate for berseem. Being a deep rooted crop, it extracts water from the deeper zone of the soil. It can be raised both as rainfed or irrigated crop in high water table areas. Lucerne is relished by all kinds of livestock, because it yields nutritious and palatable green fodder, which possesses about 16-25% crude protein and 20-30% fibre. Owing to its high protein and vitamin A content, it is included as a feed component in poultry and piggery. It can also be easily converted into silage and hay. Lucerne supplies green fodder for a longer period (November-June) in comparison to berseem (December-April).



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

Origin and History

Lucerne is one of the oldest cultivated fodder crops in the world. It was known to Greeks and Romans in about 470 BC. It is generally believed that lucerne originated in South-West Asia. It was first cultivated in Persia (Iran), the name alfalfa being an Arabic word. From Iran it was taken to Greece in about 500 BC and from there it spread to Italy. The Spainards introduced it to America. Lucerne was introduced in India from north-west sometime in 1900. It has now become very popular forage crop.

Geographic Distribution

Lucerne is grown world-wide on 35 m ha of which 8.8 m ha is in USA alone. Besides USA, India, Australia, New Zealand, France, Italy and Russia are other important countries producing Lucerne.

In India, lucerne is cultivated in about 1 m ha mostly in irrigated areas of Punjab, Haryana, Uttar Pradesh, Gujarat, Maharashtra and Tamil Nadu.

Botanical Description

Lucerne plant parts are described below.

Root system: Lucerne has a deep root system consisting of strong main tap root and number of lateral roots that makes the plant drought tolerant.



Root nodules on roots of bur clover, *Medicago* spp. (From Stern, *Introductory Plant Biology*, 8th ed., © 2000, McGraw-Hill Companies.)

Stem: The stem is erect and the branches arise from the crown, which is a woody base on stem near ground level. The number of branches may be as high as 40.

Leaves: The leaves are trifoliate, the middle leaflet possesses a short petiole, a characteristic which distinguishes it from berseem. The long leaflets are sharply toothed on upper one third of margin.



Flowers: The flowers are usually purple, but it may be blue, yellow or white. They are fertilized by insects, especially bees.



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

Seed: The seeds are kidney shaped, very light in weight and yellowish brown with a shiny surface.



Source: www.extension.umn.edu/.../DC5963c.html



Source : http://commons.wikimedia.org/wiki/Image:Illustration_Medicago_sativa0.jpg

Climatic Requirements

Although a native of temperate regions of South-west Asia, but it is raised successfully even in most of the countries of the tropics. A long day plant and performs well in cooler and dry climate than cloudy, humid and wet conditions. It can also be raised in some regions below sea level, as well as at elevations of 2,500 m altitude. If the high temperatures are accompanied with high humidity, the crop suffers drastically. It can also withstand fairly low temperatures.

Soil and its preparation

Lucerne can be raised on a wide range of soils. However, well drained fertile soils with neutral pH are ideal. It can not thrive on alkaline soil, but can be raised on acid soils with liberal application of lime. It does not thrive well on very heavy and waterlogged soils.

Lucerne needs a fine well levelled seed-bed with adequate moisture. Therefore, field should be prepared thoroughly and levelled properly. All the weeds and stubbles should be removed from the field before sowing. Plough the field once with mould board plough and 3-4 times with country plough, followed by planking each time to secure a firm and fine seedbed. A fine seedbed ensures better contact of seeds with soil particles and facilitates quick and better germination.

Seeds and Sowing

Seed rate and method of sowing

In case of broadcast method, a seed rate of 20-25 kg/ha should be used. In this method, care should be taken to cover the seed with 1-2 cm layer of soil. After broadcast, mixing could be done either with rake or spike tooth harrow with zero cut. Seed may be broadcast after last harrowing and then covered with planking. Care should be taken that seed should not go more than one cm deep as seed size of lucerne is very small.

In Maharashtra, particularly on heavy soils, it is grown on ridges 45-60 cm apart. This method could be adopted in some areas of north India also. This method is called as Haward method.

For obtaining high yield, especially from the first cut, of the annual crop, broadcast oats seed @ 35 kg/ha and mix it in soil with a cultivator before sowing lucerne. Alternatively broadcast 1.5 kg of mustard seed/ha along with the full seed of lucerne.

Time of sowing

Middle of October is the best time for sowing lucerne. However, it can be sown from the end of September to early December.

Varieties

The improved varieties of lucerne along with their characteristics of some of the important commonly grown varieties are given below.

Sirsa 8: This annual variety was developed at Fodder Research Station, Sirsa (Haryana). Its yield potential is about 35-40 t/ha of green fodder and 0.2-0.3 t/ha seed. It is suitable for Punjab, Haryana, Delhi and Uttar Pradesh.

Anand-3: Annual type, suitable for Himachal Pradesh and Gujarat. Green fodder yield is 60-95 t/ha.

Lucerne No. 9-L: This variety has been developed at Punjab Agricultural University, Ludhiana. It is a quick growing variety with deep green foliage, slender stalks and purple

flowers. It grows well for a period of 5-7 years. Its yield potential is about 75 t/ha of green fodder/year. It yields 57.7 t/ha of green fodder up to July during the first year.

LL composite 5: Synthesized selecting 125 downy mildew resistant clones from Kutch Lucerne at PAU, Ludhiana; released in 1981 for Punjab. It is tall, erect, fast growing annual variety. It gives 8 cuttings up to first week of July and it has a yield potential about 72 t/ha fodder and 0.3-0.5 t/ha seed.

Rambler: It is a recent introduction from Canada and has been found successful in hilly areas of the country. It is tolerant to very low temperatures. Its yield potential is about 60-90 t of green fodder/ha/year.

LL composite 3: Synthesized from 20 clones selected for fast growth, high yield and downy mildew resistant from germplasm collected from Gujarat. Released in 1985 for entire country. It is resistant to lodging and frost with 39 t/ha green fodder yield in *rabi* season and 0.32 t/ha seed yield.

Chetak (S-244): A selection from local material of Maharashtra. Suitable for Punjab, Haryana, Uttar Pradesh and Gujarat. It has quick regeneration capacity with resistance to aphids. It yields 142 t/ha green fodder.

RL 87-1, RL 88: Suitable for Maharashtra, Madhya Pradesh and Uttar Pradesh. Green fodder yield: 80-95 t/ha.

NDRI Selection No. 1: It has thick roots which penetrate deep into soil. It is a selection from material from Saurashtra and Kutch. It has turgid stems. The leaves are smaller in size when compared to other lucerne varieties. This variety has the capacity of maintaining itself in its pure stands over 5-6 years without getting degenerated due to the infestation of weeds. The crop is ready for first cut after 60-70 days of sowing. Its green fodder yield potential is about 100 t/ha.

Sirsa Type 9: This perennial variety has also been developed at Fodder Research Station, Sirsa. It is a quick growing variety with deep green foliage. Its yield potential is about 30-40 t/ha of green fodder and 0.25 to 0.43 t/ha seed.. It is most suitable for growing in north India.

Co-1: Perennial lucerne cultivar suitable for Tamil Nadu and Karnataka. Green fodder yield is 60-80 t/ha.

T 9: Perennial Lucerne cultivar, suitable for entire lucerne areas of country. Fodder yield is 80-95 t/ha.

Anand-2 (GAUL-1): A selection from perennial type lucerne grown in Bhuj area of Kutch (Gujarat). Released in 1975, suitable for Gujarat, Rajasthan and Madhya Pradesh. Yield 80-100 t/ha green fodder in 10-12 cuts/year and 0.2-0.3 t/ha of seed may be obtained.

Besides the above varieties, there are also some promising varieties like *Moopa*, *IGFRI S-54*, *IGFRI S-244*, *IFGRI 112* (Suitable for all areas), *Nimach 1*, *Nimach 2*, *Composite 3*, *T8* and *T15*.

Manures and Fertilizers

Being a legume crop, it fixes the atmospheric N in soil through symbiotic bacteria. Seed inoculation with *Rhizobium meliloti* is promising for crop performance especially in soils where lucerne is being cultivated for the first time. Besides as starter dose of 20 kg N/ha, 60-75 kg P₂O₅/ha and 40 kg K₂O/ha are also applied at the time of sowing. Lucerne responds well to FYM on sandy loam soils. Being a perennial crop, it is beneficial to apply 20 tonnes of FYM/ha every year.

Boron deficiency is generally noticed in leached and coarse textured soils. The leaves develop numerous pale-yellow spots leading to disorder known as Lucerne yellow. Spray of 0.2% borax can overcome this deficiency. Iron deficiency, leading to chlorosis, is fairly common in poorly drained alkaline soils. Liming the soil well in advance of sowing is helpful in areas where soil is acidic. Application of 20 kg/ha each of S and Zn along with 2 kg/ha of Mo may enhance the effectiveness of biological nitrogen fixation.

Water management

To obtain good germination, pre-sowing irrigation (*palewa*) is essential. Since lucerne takes a long time to establish at early stage, very frequent irrigations may be required at the interval of 7-10 days. Later on, this interval may be extended to 25-30 days as its root system gets well established. During summer, interval of irrigation should be reduced to 15-20 days. The crop requires about 15-20 irrigations in a year. Water requirement is quite high, being 858 litres of water/kg of dry matter produced.

Weed Control

Lucerne takes a long time to establish itself and gives ample scope for weed infestation up to the first cutting. It is very difficult to control weeds in broadcast crop. If crop is sown in lines, weeding and hoeing become easier. First weeding should be done 20-25 days after sowing. For seed production, the weeding of crop is a must. In seed crop Amer bel or dodder (*Cuscuta*) is most important weed. It may reduce seed yield by 60%. For certified seed production of Lucerne, its population should be <0.05% (20 *Cuscuta* seeds/kg lucerne seed). Pendimethalin 1-2 kg /ha (pre-emergence) or diquat @ 6-10 kg/ha 5-10 days after sowing effectively controls *Cuscuta*. 'T 9' cultivar is found highly susceptible to this weed, while 'LLC 6' and 'LLC 7' are moderately tolerant to *Cuscuta* infestation.

Pre-sowing application of diuron @ 2.0 kg/ha or fluchloralin @ 1 kg/ha or EPTC @ 3.0 kg/ha or MCPB @ 0.75 kg/ha after 30 DAS or pronamide @ 1.0 kg/ha just after sowing controls the weeds in lucerne crop.

Cropping Systems

It is usually raised after harvest of *kharif* crops, such as sorghum, paddy, soybean, maize, cowpea, clusterbean etc. It can be raised in rotation with almost every grain or forage crop. The most common crop rotations adopted in north India are given below:

Maize-lucerne	Paddy-lucerne	Sorghum-lucerne
Greengram-lucerne	Soyabean-lucerne	Cowpea + maize (fodder)-lucerne
Sorghum (grain)-lucerne-maize (fodder)		

It is intercropped with napier grass. Sometimes it is raised mixed with berseem to get the continuous supply of green fodder till May-June, where berseem is completely finished in hot months of April and May.

Plant protection measures

Diseases

Rust (*Uromyces striatus*)

It is most common disease of Lucerne. The disease appears on small brown spots that are toothed at the outer margins with a black/brown colour at the centre. Rust pustules cause severe yield reduction.

Dithane M-45 (0.25%) spray is effective for rust control.

Leaf spot (*Pseudopezia medicagenis*).

It is an air borne common disease of lucerne severe in north and central India. Diseased plant turns yellow and leaves drop off.

Early cut can cure the crop to some extent. Dithane M-45 or 0.1% Chlorothalonil is effective for its control.

Harvesting

The first cut should be taken 50-55 days after sowing and the subsequent cuts at an interval of 25-35 days when crop attains the height of 60 cm from the surface of the soil. In a year, 7-8 cuts can be taken between October-April.

Yield

The average green fodder yield of Lucerne varies from 80-120 t/ha.

Seed Production

West and south-central India is ideal location for lucerne seed production. Higher seed yields are obtained from plant crop, which is not cut for fodder. In case of established crop, take the last cut of fodder in January. Stop irrigation after full blooming to arrest further vegetative growth and thus ensure good seed yield. The seed crop should be sown in rows 50 cm apart. Foliar spray of 0.5% borax at pre-flowering stage is found promising for seed production. The harvesting of mature crop should not be delayed to avoid the shedding of pods. Harvest the crop when two-thirds of the pods become dry. The seed yields usually vary from 0.2-0.3 t/ha.