

Chickling Pea (*Lathyrus sativus* L.): An Environmentally Successful Robust Legume

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SUMMARY

Chickling pea (*Lathyrus sativus* L.) is a multipurpose robust grain legume crop with an indeterminate growth habit. It has the potentiality to grow in adverse weather conditions like drought, water logged situation and poor soils due to its hardy and penetrating root systems, high air temperature etc. and is mainly grown as utera crop in winter season under residual soil moisture with minimum inputs. It has a high nutritional value; protein content ranging from 25 to 30%, being important both for human food and animal feed. However, the crop is unpopular due to presence of small amounts of a toxin namely β -N-ozalyl-l- α , β -diaminopropanoic acid (ODAP). Even though it is rightly considered as a model crop for sustainable agriculture and despite the lathyrism stigma, development of new breeding technologies and growing interest in its use in Mediterranean type environments all over the world, will provide a bright future to this crop.

INTRODUCTION

Chickling pea (*Lathyrus sativus* L., $2n=14$) is a food, feed and fodder crop belonging to the genus *Lathyrus* within family Leguminosae/Fabaceae, subfamily Papilionoideae/Faboideae and tribe Viciae/Fabeae along with genera *Pisum*, *Vicia*, *Lens* and *Vavilovia* (Schaefer *et al.*, 2012; Smýkal *et al.*, 2011). The word *Lathyrus* is derived from the Greek word “Lathuros” meaning a plant probably a pulse and *Sativus* comes from Latin verb “serere” which means to sow or to cultivate, thereby is indicative of that which is cultivated. The genus *Lathyrus* is large with recognized 187 species and subspecies. Besides *Lathyrus sativus*, there are some other economically important species including *L. cicera* and *L. tingitanus* for grain and *L. orcus*, *L. latifolius* and *L. sylvestris* as forage species. The common names for the species in various countries are kesare, khesari, karas, karli, kasar, khesari dal, khasra, lang, chural, latri, teora, chickling vetch, chickling pea, batura, lakhori, santal etc. in India; khesari in Bangladesh and Nepal; matri, matra in Pakistan; mutter pea in Myanmar; dog-toothed pea in Cyprus; san lee dow in China and sabberi, guaya in Ethiopia. There are two types of khesari in India: i) the smaller seeded known as lakhori which was considered harmless (possibly low in neurotoxin) and ii) lakh which was considered dangerous because it caused paralysis. The darker coloured seeds were reported poisonous while the yellow ones were non-poisonous. The improved varieties of *Lathyrus* (Nirmal, Ratan, Prateek etc.) have been released to avoid harmful effect of ODAP on human body and now it is coming back into favour due to several advantages, such as its very low input requirement and low cost of cultivation, suitability for conservation agriculture, adaptation to adverse environments such as drought, heat, excess water, poor soil quality and crucially dual purpose use. There is great scope for the expansion in the utilization of chickling pea in dry areas and zones which are becoming more drought prone as a result of climate change. It has the potential to grow in rice-fallows and out of a total of 11.6 m ha fallows, at least 0.5 m ha can be brought under chickling pea as a second crop to boost income for farmers. Southern Europe and western Asia are said to be the origin of *Lathyrus*. It is cultivated in central, south and east Europe, Iran, Middle East and South America. In India, chickling pea occupies 4% area and 3% production of total pulses. It is mainly cultivated in Chhattisgarh, Madhya Pradesh, Bihar, West Bengal, Maharashtra, Jharkhand, Orissa and Himalayas up to a height of 1300 meters above MSL.

Morphological characteristics of chickling pea

Lathyrus is a multipurpose grain legume with an indeterminate growth habit, semi-erect to spreading, well-branched, annual herbaceous plant. The taproot is well developed and the rootlets are covered with small, cylindrical nodules with *Rhizobium leguminosarum* which fix atmospheric nitrogen symbiotically. The stem is slender and quadrangular with winged margins. Stipulate are prominent, narrowly triangular to ovate with a basal appendage. Leaves are alternate, pinnate with terminal leaflets.



Fig.: Plants, flowers and grains of Chickling pea

Inflorescence is axillary with solitary, erect and spreading flower and flower colour varies from white, light pink, blue to reddish purple. Pods are flat, oblong, slightly bulging over the seeds and the dorsal part of the pod is two winged, shortly beaked having 3-5 seeds. Seeds are angled and wedge shaped of white, brownish grey, yellow colour. Germination is hypogeal in nature. The seeds of lathyrus are hardy and can be stored for more than two years without appreciable loss in germinability and vigour.

Uses of chickling pea

- Chickling pea seeds are used as a complementary or sole source of calories and proteins, mostly by the poor farmers and landless labourers.
- In India, the grains are sometimes boiled whole, but are most often processed through a dal mill to obtain split dal.
- The flour, made from grinding either the whole or split seeds, is sold as besan.
- In many parts of Bangladesh, roti (unleavened bread) made out of chickling pea flour is a staple food for the landless labourers.
- Chickling pea flour is being used increasingly to adulterate the higher priced legume flours such as chickpea and mung bean.
- The seed coat colour can also affect the nutritional value of the seed.
- The young plants are used as a fodder for cattle or for grazing.
- Normally, the fields are allowed to be strip grazed by cattle before the crop is allowed to regrow and then harvested for seed.
- *Lathyrus* has great potential as a fodder crop.
- The stems and chaff remaining after harvest is often the most important factor for producing the crop in South East Asia.
- The plants are normally pulled while they are still green but after the pods have filled which allows maximum food value to remain in the biomass and at the same time produces good seed yields.
- In India, it is found that the animal feed value of the crop is more important than that for human food in determining the production of this crop.

Nutritional value of chickling pea

- Chickling pea provides a source of protein (25.6-28.4%) when other crops have been destroyed by drought and other natural disasters such as flooding (Campbell *et al.*, 1993).
- Moreover, the seeds of chickling pea contain water (7.5-8.2%), starch (48.0-52.3%), fat (0.58-0.8%), calcium (0.07-0.12 mg/kg), phosphorus (0.37-0.49 mg/kg), lysine (18.4-20.4 mg/kg), threonine (10.2-11.5 mg/kg), methionine (2.5-2.8 mg/kg), cysteine (3.8-4.3 mg/kg) (Rotter *et al.*, 1991).

Climatic and soil requirement of chickling pea

- Chickling pea is a drought tolerant hardy crop capable of growing in extreme moisture stress condition and it thrives with minimal external inputs.
- This is a temperate crop.
- In general, it also grows well under the high temperature conditions of the subtropics as a winter crop.
- The crop, under these conditions, is generally sown in October/ November and harvested in March.
- It is cultivated in cold winter months (*Rabi* season) in Indian subcontinent.
- It can grow well under moderate temperature ranging from 10-30°C.
- Seeds germinate best at an optimum temperature of 20°C.
- Higher temperatures inhibit germination.
- It can be grown in areas of low rainfall (300-500 mm) and also in areas of high rainfall (up to 1500 mm) such as in Bangladesh.
- *Lathyrus* can be cultivated over many types of soils ranging from very poor marginal soils to rich black cotton soils.
- It can withstand short drought periods and moderate soil salinity, better than peas.
- Acidic soils are not suitable for this crop.

Problems of chickling pea

- The seeds and plant parts of chickling pea contain a neurotoxin, ODAP or BOAA (β -N-oxalyl-L- α , β -diaminopropionic acid) which can cause irreversible paralysis, known as 'lathyrism' due to prolonged over consumption of chickling pea seeds for 3-4 months as a staple food.
- The other undesirable nutritional constituents are Folic acid, HCN, Maltose, Oxalic acid, Pantothenic acid, Quercetin and Saponin.
- Due to these toxins, its marketing has been banned in India, but not cultivation.
- Because of this trade ban, farmers are discouraged to grow chickling pea on a large scale and only growing for family consumption.

General production technologies of chickling pea

- *Lathyrus* is one crop that requires only minimum tillage.
- In uplands (medium to high lands) one to two ploughings may be given depending on the farmer's choice.
- In many areas of South East Asia and China where chickling pea production occurs, the crop is either grown under 'utera' condition and utilizes residual soil moisture or is sown on rainfed areas where it must exist on minimum moisture until harvest.
- The crop normally is considered to require low or zero inputs and therefore not only utilize residual soil moisture but also must utilize the residual soil nutrients.
- In general, seeds are broadcasted either into a standing crop of rice 5-6 days before harvest, or directly into stubbles after harvest of rice without tillage operation.
- The crop when sown in upland conditions with tillage, line sowing may be done.
- Seed rate varies from 30 to 50 kg/ha for a sole crop.
- Under adverse condition such as low soil moisture, farmers tend to give a higher seed rate to compensate the poor germination.
- Being sown by broadcasting, it is not possible to specify the spacing.
- In case of line sowing, row spacing of 30 cm is maintained.
- *Lathyrus* receives little weeding and cultivation attention by the farmers.
- Research conducted at JNKVV, Jabalpur, India, has indicated that *Lathyrus* responds to 20 kg N/ha and 40 kg P₂O₅/ha.
- Traditionally, *Lathyrus* is not irrigated.
- Sometimes one or two irrigation is provided during severe moisture stress.

- The mature plants are normally pulled out or cut with sickle near the base.
- The plants are then stacked and allowed to dry on the threshing floor for 7-8 days.
- The plants are spread out on the threshing floor and beaten with sticks.
- It is common practice to use cattle for trampling to help in threshing the pods.
- The seed is then winnowed and cleaned.
- Drying of seeds for 1-2 days may be necessary before it is stored.
- A well-managed crop can easily give 8-10 q/ha yields under direct sowing and 3-4 q/ha under utera cultivation.

Recommendation to achieved higher production

- Deep summer ploughing once in 3 years.
- Seed treatment should be done before sowing.
- Application of fertilizer should be based on soil test value.
- Foliar spray of 2% urea or 20 ppm Salicylic acid at flowering and pod formation stage increases the yield.
- Weed control should be done at right time.
- Adopt integrated approach for plant protection.

CONCLUSION

Grass pea is a plant with a combination of exceptional agronomic properties, such as tolerance to drought, flooding, salinity; high nitrogen fixation capacity that increases the yield of subsequent crops; easy cultivation with minimal inputs and adaptability to different climatic conditions and soil types. As a legume, it is also a highly nutritious food and fodder crop. Being one of the most climate resilient crops, grass pea is the only crop that survives in the field during severely dry years, providing no alternative to many low income communities but to over consume the seeds as the only dietary component. Thousands of people who have survived famines thank grass pea; hence it is considered as a life saver crop. However, overconsumption of grass pea has caused the crippling disease neurolathyrism in many European countries in historical times and more recently in Asia and Africa. The forced overuse of grass pea in diets during severe famines has given it its present undeserved reputation of being a toxic plant. Chickling pea holds a tremendous potential as a source of multiple stress tolerant genes for general crop improvement. The basis of high tolerance to drought and salinity should be further investigated and the crop could be used as an elite germplasm resource for traits to adapt the world's most important crops to new climatic conditions.

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