

NewCROP FactSHEET***Lathyrus sativus* L.**

Contributors: F.J. Muehlbauer and Abebe Tullu

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Common Names

Grasspea, Chickling pea, Indian vetch (UK and N. America), Almorta (Spain), khesari or Batura (India), Alverjas (Venezuela), Gilban (Sudan), Guaya (Ethiopia), Matri (Pakistan), Gesette (France), Pisello bretonne (Italy).

Scientific Names**Species:** *Lathyrus sativus* L.**Family:** Leguminosae**Uses**

The seeds are boiled and consumed as a pulse, can be used in dahl preparation and bread making. They are made into paste balls, put in curry, or boiled and eaten like a pulse. "Grasspea seeds are used in India, Ethiopia and other developing countries as part of the diet of the poor in times of famine. It can be used in making local beverages. Leaves can be used as a pot-herb and can be consumed as a vegetable after boiling. Seeds are dehusked and parched before use" (Kay, 1979). "Plants are valued for green manure but have weedy tendencies.

Mixed with oil cake and salts, seeds are used as a nutritive feed for poultry and livestock. Primarily grasspea is cultivated as a cold weather forage crop" (Duke, 1981).

Traditional Medicinal Uses

"Oil from the seeds of grasspea is a powerful and dangerous cathartic that contains a poisonous principle, probably an acid-salt of phytic acid. The seeds are used locally in homeopathic medicine" (Duke, 1981).

Chemistry

"Germination of grasspea seeds enhances content of vitamins, especially folic acid, biotin and pyridoxine. Normal vitamins are carotene, thiamine, riboflavin, nicotinic acid, biotin, pantothenic acid, folic acid, pyridoxine, inositol, ascorbic acid, and dehydroascorbic acid. Seeds contain 18.2-34.6% protein, 0.6% fat, 58.2% carbohydrate (about 35% starch)" (Duke, 1981; Williams et al., 1994). The seeds also contain 1.5% sucrose, 6.8% pentosans, 3.6% phytin, 1.5% lignin, 6.69% albumin, 1.5% prolamine, 13.3% globulin, and 3.8% glutelin. The essential amino acids are (in grams per 16 grams of nitrogen): arginine 7.85, histidine 2.51, leucine 6.57, isoleucine 6.59, lysine 6.94, methionine 0.38, phenylalanine 4.14, threonine 2.34, tryptophane 0.40, and valine 4.68 (Like other cool season food legumes, grasspea is deficient in methionine and tryptophane) (Duke, 1981; Williams et al., 1994). "Leaf analysis gave the following values: moisture 84.2%; crude protein 6.1%; fat (ether extraction) 1.0%; carbohydrates 7.6%; ash 1.1%; Ca 0.16% and P, 0.1%; Fe 7.3 mg; and carotene (as vitamin A), 6,000 IU/100 g. Green plant analysis of grasspea, cut at the flowering stage was reported to provide on a dry weight basis: protein 17.3%; fiber 36.6%; fat 4.47%; ash; 6.0%; P₂O₅ 0.51%; and CaO, 1.08%" (Duke, 1981).

People and livestock consuming grasspea as the principal diet for months develop a paralytic disease known as "Lathyrism". Livestock that consume grasspea seeds (30-50% of the diet) for 3-6 months develop Neurolathyrism, a disease that leads to microgliosis in the anterior horns and lateral cords and partial degeneration of the motor tracts of the spinal cord and death in extreme cases (Williams et al., 1994; Smartt et al., 1994). Amino acid derivatives from the seeds of other species of the genus *Lathyrus* and of some species of the genus *Vicia* produced similar effects on experimental animals (Duke, 1981; Williams et al., 1994). Beta-N-oxalyl-L-alpha-beta-diamino-propionic acid (ODAP) also referred as Beta-N-oxalylamino-L-alanine (BOAA) occurs in grasspea and is a neurotoxin which causes paralysis (Smartt et al., 1994; Williams et al., 1994). ODAP concentrations vary widely (from 0.2 to greater than 1.01 mg per gram of seed) among a total of 1262 accessions collected from India and Ethiopia, and also the ODAP distribution in embryo was the greatest (400) followed by cotyledon (126 mg per gram), seed coat (81 mg per gram), stem (64 mg per gram), leaf (60 mg per gram), pod (24 mg per gram) and root (14 mg per gram) (Campbell et al., 1994). Occasional use is harmless. Seeds, if soaked in water for 24 hr before cooking, are not toxic (Duke, 1981).

Origin

Grasspea is found in Eurasia, North America, temperate South America and East Africa (Smartt, 1990). The origin of *Lathyrus sativus* is unknown; however, its presumed center of origin is Southwest and Central Asia (Smartt, 1990). Its chromosome complement is $2n = 2x = 14$ (Smartt et al., 1994).

Botany

Taxonomy, Morphology and Floral Biology

There are about 150 species in the genus *Lathyrus* that comprise 15 sections among which grasspea is one (Smartt et al., 1994). Relationship studies between species of the section *Lathyrus* indicated that only two species, *L. amphicarpos* and *L. cicera* gave viable hybrids while six others produced pods when crossed with the

cultivated species but produced shriveled seeds or aborted (Smartt, 1990; Smartt et al., 1994). Grasspea is a much-branched suberect, straggling or climbing herbaceous winter annual; stems are 0.6-9.0 m tall and the leaves are pinnately compound with usually two leaflets (linear-lanceolate 25-150 mm long, 3-9 mm broad) (Kay, 1979; Duke, 1981; Manmetje, 1980). The upper leaflets often have modified tendrils. Flowers are solitary, axillary and are borne on peduncles 30-60 mm long; corolla 12-24 mm long, and are reddish-purple, pink, blue or white (Kay, 1979). Pods are oblong, 2.5-4.0 cm long, flat and slightly curved and each pod has 3-5 seeds that are white, grayish-brown or yellowish and usually spotted or mottled (Duke, 1981).

Ecology

The crop is widely cultivated in Central, South, and East Europe, the Mediterranean and Africa. In many parts of India, it is cultivated up to 1,300 meters (Duke, 1981) while in some parts of Ethiopia the elevation can go up to 2500-3000 m with rainfall averaging to 1000mm. Grasspea grows well on almost all types of soil and in areas receiving 380-650 mm. It thrives best in areas with 10-25°C (Kay, 1979). In Ethiopia, grasspea is grown in regions where chickpea and lentils are growing in semi-arid regions (warm winters and dry, hot summers with occasional rains) (Telaye, 1988). The mean temperature fluctuations during the growing season ranges from 30 to 10°C with annual rainfall ranging from 600-1200 mm (Telaye, 1988). The crop is tolerant to extremely dry conditions in drought prone areas as in Ethiopia and also tolerant to excessive floods as in Bangladesh (Smartt et al., 1994). It is a hardy crop suited to dry climates, producing good seed crops on poor soils. Grasspea is commonly cultivated on heavy clay soils. Black deep retentive soils are considered best for grasspea" (Duke, 1981; Campbell et al., 1994). It is sensitive to acidity, and requires lime on acid soils (Duke, 1981).

Crop Culture

Field Cultivation

Grasspea is extensively cultivated in Iraq, Iran, Afghanistan, Syria and Lebanon in Middle East, France and Spain in Europe and Algeria, Egypt, Ethiopia, Libya and Morocco in Africa (Campbell et al., 1994). "It is propagated by seed. Some say inoculation is essential before sowing, especially in virgin soil; others say it appears unnecessary. In some temperate regions, grasspea is sown after rye, or on fallow land. Seeding rates vary from 45-90 kg per hectare depending on the method of cultivation, whether in pure stand or intercropped, purpose of cropping (food or feed) and seed size. Seeds may be sown broadcast or in furrows about 3 cm apart in a well-prepared field. The crop comes up as a thick mass over the entire surface and under ideal conditions can smother out weeds. Except for lime on acid soils, other nutrients are rarely needed. Phosphorus application is recommended in India, Pakistan, Nepal and Bangladesh, the crop may be sown as pure or in mixed stand often into a standing rice crop one to two weeks before rice is ready to harvest. Grasspea is reported to add 67 kg per hectare of nitrogen to the soil from symbiosis with *Rhizobium* sp." (Kay, 1979; Duke, 1981; Campbell et al., 1994).

Harvesting

Seeds of grasspea ripen in 4-6 months and are harvested as soon as the leaves begin to turn yellow and when pods are not fully ripe as fully ripe pods dehisce and scatter the seeds (Kay, 1979). It is harvested with sickle or uprooted, left to dry for a few days in heaps and then threshed and winnowed. "The crop can be cut and fed green, or the standing crop may be pastured; it is not fit for silage but can be cured into hay under mild climatic conditions. When fed alone, fresh young plants are reported to be harmful to horses; however, cattle, rabbits, and sheep can consume large amounts without ill effects" (Kay, 1979; Duke, 1981).

Yields and Economics

Seed yields of grasspea crops range from 900-1,500 kg per hectare; while crops sown from inoculated seeds yielded up to 2,000 kg ha⁻¹ in the United States (Kay, 1979; Duke, 1981). "Yields are proportional to the seeding rates used. An average crop at a seeding rate of 40 kg per hectare yields about 925 kg per hectare of pulse and 3.2 metric tons per hectare of forage in India. At the seeding rate of about 14 kg per hectare in mixed cultivation, yield per hectare is about 300 kg of pulse and 0.5 metric tons of straw. Ukrainian experiments with sewage irrigation gave yields of 3120 kg seeds per hectare. The sewage irrigation slightly decreased the 1,000-seed weight, but markedly increased seed N, P, and K concentrations and nutritive values of fresh forage and hay. In India, grasspea occupies about 4% of the total pulse crop and constitutes about 0.3% of the total pulse production, with about 1.6 million hectares, producing about 0.5 million metric tons of seeds" (Duke 1981). With the identification of high yielding and low ODAP lines, production is expected to increase in the future" (Smartt et al., 1994).

Biotic Factors

Major fungal diseases of grasspea are grey mold (*Botrytis* sp.), rust (*Uromyces fabae*) powdery mildew (*Erysiphe polygoni*) and downy mildew (*Peronospora lathi-palustris*) (Duke, 1981; Smartt et al., 1994). "Fungi reported on grasspea include: *Ascochyta orobi*, *Ascochyta pisi*, *Erysiphe communes*, *Fusarium orthocercus*, with var. *ciceri* and var. *lathyri*, *Glomerella cingulata*, *Leveillula taurica*, *Macrophomina phaseoli*, *Mycosphaerella ontarioensis*, *Peronospora viciae*, *Pleosphaerulina hyalospora*, *Uromyces pisi*. Plants are also attacked by the bacterium *Pseudomonas cannabina* and parasitized by *Cuscuta pentagona*. Nematodes attacking this plant include *Heterodera goettingiana*, *H. schachtii* and *H. tyifolii*. Rootknot nematodes are not usually serious" (Duke, 1981).

Germplasm

The genus *Lathyrus* constitutes 187 species and subspecies but only *L. sativus* is widely cultivated as a food crop (Jackson and Yunus, 1984). The authors reported that about 56 types have been distinguished in India alone (45 *L. cyaneus*, 10 *L. roseus*, 1 *L. albus*). "Grasspea plants are classified on the basis of color of flowers, markings on pods and size and color of seeds. There is a tremendous variation for morphological traits, such as leaf length as opposed to less variation for floral characteristics" (Jackson and Yunus, 1984). Based on geographic distribution, the blue flowered lines are concentrated in southwest Asia and Ethiopia whereas the white and mixed color lines are found in the west, the Canary islands and countries of the former USSR (Jackson and Yunus, 1984). The development of large leafed varieties may have emerged from selection of forage types (Campbell et al., 1994). This widespread distribution is due to its extensive utilization as a fodder crop and its tolerance to adverse environmental conditions such as drought and waterlogging (Jackson and Yunus, 1984; Smartt, 1990). It is also reported to exhibit tolerance to abiotic factors such as heavy soils, high pH, low pH, poor soil, and to biotic factors such as rust and virus (Duke, 1981). The total number of grasspea accessions maintained at the International Center for Agricultural Research in the Dry Areas (ICARDA) was 301, most of which are weedy forms found in crop fields and West Asia and North Africa regions (Robertson et al., 1996). The Regional Plant Introduction Station located at Pullman, Washington, USA maintains 625 accessions. Fourteen other gene banks also reportedly maintain a considerable number of germplasm accessions (Campbell et al., 1994). No satisfactory result has been found in screening *Lathyrus sativus* for cold tolerance, but one accession of *L. ochrus*, IFLA-109, from Portugal was reported to have a high level of cold tolerance (Robertson et al., 1996). Scanty information is available on resistance to insects, pests and diseases. Germplasm lines have not been critically evaluated to estimate losses due to biotic factors; however, lines from India have been found to be highly resistant to downy mildew and moderately resistant to powdery mildew (Campbell et al., 1994).

The International Network for the Improvement of *Lathyrus sativus* and the Limitation of Lathyrism (INILSEL) coordinates its activities in Pau, France. It includes lists of germplasm, processing of passport data and preparation of descriptors for the crop (Campbell et al., 1994).

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Selected Experts

F.J. Muehlbauer
Research geneticist, USDA-ARS
Pullman, WA 99164-6439
Tel: (509) 335-9521
Fax: (509) 335-7692
E-mail: muehlbauer@wsu.edu

W.J. Kaiser
Regional Plant Introduction Station
USDA-ARS
59 Johnson Hall, WSU
Pullman, WA 99164-6402
Tel: (509) 335-1502
Fax: (509) 335-6654
E-mail: kaiser@wsu.edu

R.M. Hannan
Regional Plant Introduction Station, USDA-ARS
Washington State University, 59 Johnson Hall
Pullman, Washington 99164-6402
Tel: (509)335-3763
Fax: (509)335-6654
E-mail: hannan@wsuunix.wsu.edu

A.E. Slinkard
Crop Development Center
University of Saskatchewan, Saskatoon,
Saskatchewan S7N 0W0, Canada
Tel: (306)966-4978
Fax: (306)966-5015

Contributors: F.J. Muehlbauer and Abebe Tullu

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Last update Tuesday, February 24, 1998 by aw