

Pigeonpea : A Potential Multi-purpose Crop for the Mountains of Southern China

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Introduction

About 90% of the land in southern China is covered with mountains and most of it is arid. The agriculture in such areas, characterised by low and unstable yields, depends primarily on short and erratic rainfall. Efforts are being made to identify a plant species that is capable of conserving soil nutrients and water, and that could grow well in the harsh environment to provide food and fuel to human beings, and fodder and feed to animals. This search has resulted in the selection of a food legume crop, popularly known as pigeonpea (*Cajanus cajan* (L.) Millsp). Pigeonpea was introduced to China about 1500 years ago from India, but its cultivation was abandoned due to poor adaptation and unacceptable seed quality traits. To overcome these constraints, new germplasm was introduced from the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT).

Besides highlighting the characteristic traits of pigeonpea, this paper discusses its role in the development of mountain regions where people lack adequate nutrition.

The Pigeonpea Plant

Pigeonpea is a short-lived, perennial legume, often cultivated by smallholder dry land farmers as an annual crop. Pigeonpea is primarily consumed as dry split peas ('dhal'), and its immature seeds are cooked as a vegetable that can also be processed for canning and freezing. The drought tolerance, perenniality, and fast ratooning traits make pigeonpea an ideal plant for providing food, fodder, and fuel. Pigeonpea is outstanding in the depth and lateral spread of its root system, which enable it to tolerate drought. Its deep root system not only breaks the plough pans but also helps in recycling nutrients. Pigeonpea can adapt to a wide range of soil types from gravelly stones to heavy clay loams of close texture and high moisture content. Farmers often grow pigeonpea on poor soils where they have problems growing other food crops.

Soil Amelioration and Conservation

Pigeonpea provides several benefits to the soil. Being a legume, it fixes nitrogen. The leaf fall at maturity not only adds to the organic matter in the soil, but also provides approximately 40 kg N ha⁻¹ (Kumar Rao et al. 1981). Pigeonpea seems to have special mechanisms to extract phosphorus from the soil to meet its needs. The recovery of ecology in hill areas is not easy due to prevailing climatic and soil conditions, high

population pressure, and the difficulties in finding a fast-growing forest tree species. These problems have bothered the forestry department for many years. Some shrub species such as *Phyllanthus emblica* (Linn), *Dodonaea viscosa* (L.), and *Tephrosia candida* (DC.) now used for afforestation grow slowly and have little or no economic value. In contrast, pigeonpea not only performs well in these degraded soils but also grows faster to cover the bare land. The crop is easily adopted by farmers due to its multiple uses. Therefore, pigeonpea holds great promise for afforestation in China. At present, there are more than 700 ha of forest land planted with pigeonpea for soil conservation in Yunnan province alone. It has also been selected as an afforestation species in major government reconstruction projects such as 'Protection of Forest in the Upper-middle Reaches of Yangtze River', 'Protection of Forest in Lancang Jiang River', and 'Protection of Natural Forest'.

Fodder and Feed

In Guangxi province, the rural economy relies heavily on animal husbandry. Availability of quality fodder and feed throughout the year is essential. At present the provincial government is spending considerable resources to import maize and rice from other provinces and international markets to feed the livestock. On the other hand, large mountain areas lie fallow because they are unfit for growing crops. At present, the animal population in the province is about 8 million, and to increase it further the government has decided to reduce emphasis on feeding animals grain and to increase the population of fodder-eating animals such as goats, cattle, and buffalo. To achieve this, they have launched a special 'Million Goat Project' in Hechi Prefecture in which the population of goats will be increased to one million within a target period of three years. To meet the anticipated needs for fresh quality fodder, pigeonpea has been identified as it grows well in the area and provides good quality of fodder under dry conditions. Its ability to allow 3-5 fodder cuttings makes it a very useful crop for stall feeding also. An evaluation of new pigeonpea varieties in Langan County showed that ICPL 93047 produced 54 tonnes per ha of fresh and 29 tonnes per ha of dry fodder in a year in five cuttings (Shiyang et al. 1999). This experiment also showed that pigeonpea can grow well during winter when the normal fodder supply is adversely affected. Goats and cattle prefer dry pigeonpea forage to green matter. It is estimated that in Guangxi province alone about 6.5 million ha of waste mountain slopes are available for exploitation by crops like pigeonpea.

As a feed, pigeonpea grain is primarily fed to pigs, chicken, cattle, and goats. Boiled seeds are used to prepare feed mixtures with other ingredients for pigs, while raw seeds are fed to chickens. Fuji et al. (1995) reported that pigs fed a meal mixed with 6%-12% pigeonpea gained 78 g per day of meat, with a ratio of meat mass to feed input of 3.5:1.

Other Uses of Pigeonpea

Firewood

Pigeonpea produces a large amount of biomass and after harvesting seeds for feed, the plants are cut and used for fuel. On average, one hectare of pigeonpea produces about 6-10 tonnes of fuelwood. According to Yude et al. (1993), the quality of pigeonpea fuelwood is excellent; 1 kg of wood yields 4350 kCal of energy.

Forestry products

Pigeonpea plants are preferred for inoculating of lac insects (*Kerria lacca* Kerr.) because they grow faster and allow harvesting of lac resin a year ahead of other hosts. Jianyun and Yun (1998) conducted studies on the processing technology of plywood bond using pigeonpea glue. The results showed that the bond strength of the plywood ranged from 1.28-1.92 M Pa and that it was higher than that of soybean glue.

Adaptation of New Introductions

The new pigeonpea introductions from ICRISAT had good adaptability in different agro-ecological zones of Yunnan and Guangxi provinces. Besides high seed yield (2.3 t ha⁻¹), these lines matured early (<150 days), had resistance to major diseases, and produced good quality seeds. Some lines grew faster and produced the higher biomass essential for fodder and fuel production. The trials also showed that pigeonpea is ideally suited for soil conservation in unproductive degraded rainfed lands, and that the plants covered the ground within 6-8 months.

The major constraint in this endeavour is the identification of suitable varieties for different agro-ecological zones. In some areas, freezing temperatures injure the plants. In a recently concluded study in Yunnan Province, pigeonpea grew successfully in environments with minimum temperatures falling as low as -1 °C. Some genotypes also tolerated temperatures down to -4 °C, but only for a limited period. At present, screening of germplasm is targeted to identification of freezing-tolerant cultivars. The high level of adaptation of the new pigeonpea germplasm in degraded and fragile soils, its utility in environmental conservation, and its quality fodder have generated interest among farmers, scientists, extension workers, and policymakers in China. The area under pigeonpea has risen from zero in 1998 to 2000 ha in 2000. In 2001, pigeonpea is expected to be grown on 10,000 ha, and the government plans to extend pigeonpea cultivation to 250,000 ha by 2005. Serious efforts are being made jointly by ICRISAT and local governments to overcome the major production constraints and to promote pigeonpea for the development of hill areas of southern China.

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