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Traditional and Alternative Uses of Pigeonpea in China

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Pigeonpea (*Cajanus cajan*) was introduced to China from the eastern parts of India about 1500 years ago (Zhoujie 1997). Traditionally, it has been used for lac production, fuel wood, soil conservation, fodder, food, and medicine. Its food uses are constrained by some prominent defects in the landraces. These include long-duration (more than 300 days), inherent low seed yield (750 kg ha^{-1}), small seed size, and high amount of trypsin inhibitor. To overcome these constraints, new varieties of pigeonpea have been introduced recently into China from ICRISAT. These varieties are showing good adaptation and have many useful traits (Shiying et al. 1999). Therefore, new uses of this crop need to be identified. This paper reviews the traditional uses of pigeonpea in China and highlights the potential uses identified recently from the research work done in this area.

Lac Production

The most important purpose of pigeonpea cultivation in China is to inoculate the lac insect (*Kerria lacca* Kerr.) on the shoots of one-year-old pigeonpea plants for production of lac. Pigeonpea is preferred for lac production because it has relatively faster growth rate that allows lac harvest at least one year ahead of other perennial hosts. According to Yude et al. (1993) pigeonpea not only produces high yields (750 kg ha^{-1}) of lac but the quality of lac is also superior which fetches better price in international market. A survey of Yunnan Province, China conducted in 1989, showed that pigeonpea occupied about 3500 ha land and majority of it was under lac cultivation. For over 40 years, pigeonpea was a major income generating source for the farmers in the southern provinces of China.

Fuel Wood

Pigeonpea produces a significant amount of biomass and after the primary use of the crop, its dry shoots are invariably used as fuel wood. In the lac-growing areas, after harvesting lac resin from the shoots the pigeonpea plants are chopped and dried for use as fuel. On average, 1 ha of pigeonpea crop produces about 6 t of fuel wood (Zhenghong and Fuji 1997). According to Yude et al. (1993) the quality of pigeonpea fuel wood has been estimated to be excellent, yielding energy at the rate of 4350 K cal kg^{-1}. In the low mountain ranges of China, where pigeonpea is not cultivated for lac production, the farmers grow pigeonpea on wastelands and field bunds. After harvesting seeds for feed purpose, the plants are cut and used for fuel. Pigeonpea, therefore, has contributed significantly in providing relief from the energy crises. In rural China, pigeonpea fulfils the needs of fuel wood and helps in arresting deforestation.

Soil Conservation

In the recent past, the ecology of arid-hot regions of southern China has been severely damaged, and scientists believe that its recovery is not easy due to prevailing climatic and soil conditions and high population pressure. Screening of suitable forest tree species for these harsh climates is also not meeting with desired success. This problem has bothered the forestry department for many years. Some shrub species such as *Emblica officinalis*, *Dodonaea viscosa*, and *Tephrosia candida* used for forestation, grow slowly and have low or no economic value. Pigeonpea not only grows well in these areas due to its better adaptability to degraded soils and drought tolerance but also grows relatively faster to cover the bare land. The crop can easily be adopted by local people due to its potential uses. Therefore, pigeonpea has been

Figure 1. Pigeonpea grown on riverbed in China to control soil erosion.

identified as an important species for afforestation in China. At present, there are more than 700 ha of forest land planted with perennial pigeonpea for soil conservation in Yunnan Province. It has also been selected as the forestation species in the major government reconstruction projects such as "Protection of forest in the upper-middle reaches of Yangzi River", "Protection of forest in Lancangjiang River", and "Protection of natural forest" (Fig. 1).

Forestry Product

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 was 1.28–1.92 MPa and it was higher than that of soybean glue. These parameters meet the National Standards. Jianyun and Yun (1998) also recommended that pigeonpea could be used as a substitute for soybean in plywood processing. In comparison to soybean (*Glycine max*) the glue processing technology using pigeonpea is relatively simpler and economical.

Folk Medicine

According to Dihua et al. (1985) and Shaomei et al. (1995) the old Chinese literature has description of significant curative effects of various pigeonpea plant parts. The root is used to treat febrile diseases and relieve internal fever, constrict tissue for controlling bleeding, and destroy internal worms. The leaves can be used to treat jaundice, trauma, and cough. Some hospitals in Hainan Province are still using pigeonpea to treat trauma, burn infection, and bedsore. Dihua et al. (1985) identified some useful chemical compounds in pigeonpea leaves such as salicylic acid, hentricacontane, 2-carboxyl-3-hydroxy-4-iso-prenyl-5-methoxy-stilbene, laccerol, longistyline A, pinostrobin, sitosterol, longistyline C, naringenin-4', 7-dimethyl ether, and ß-amyrin. The pharmacology and toxicology tests conducted on rats demonstrated that the curative effects of cajanian on inflammation are more prominent than that of salicylic acid and its toxicity is less than that of salicylic acid (Shaomei et al. 1995).

Fodder and Feed

Use of pigeonpea seeds and green foliage as feed and fodder is a common practice in rural China. As feed, the seed is primarily fed to pigs and chickens and sometimes to cattle and goats too. For pigs, the boiled seeds of pigeonpea are used to prepare feed mixtures with other ingredients while raw seeds are fed to chickens. Generally, cattle and goat graze on the standing pigeonpea crop and eat its fresh young leaves and tender branches.

In 1992, the Institute of Insect Resources and Agricultural University of Yunnan jointly studied the nutritional value of pigeonpea feed experiments. In this experiment pigs were fed with feed mixtures prepared with different levels of pigeonpea (Fuji et al. 1995). The results showed that during the entire period of experimentation the health of the test animals was normal with no sign of illness. It was also reported that meal mixture containing 6–12% pigeonpea increased meat mass. The gain in the meat mass production was 78 g day^{-1} with a ratio of meat mass to feed input of 3.54:1. This efficiency mark achieved with pigeonpea matched with the National Standards. Based on this information, Fuji et al. (1995) developed various feed mixtures using pigeonpea seed (22% protein) and dry leaf powder (19% protein) as major source of protein.

Food

Although pigeonpea was not liked by Chinese as food, during the famine years of 1950s and 1960s the local people in parts of China ate pigeonpea seeds in their main cuisine. As a substitute for soybean it was also used in making sauce and bean curd. Generally speaking, the seeds of landraces are not acceptable as food due to their small size, high amount of trypsin inhibitor, long cooking time, and puckery and odd taste in green (immature) and

dry seed respectively. In the on-going pigeonpea development program in Yunnan Province ICRISAT's new varieties are performing well and their seed quality is acceptable. Therefore, to make their production sustainable new uses of its consumption need to be invented.

Several new processing technologies of products such as spicy-crisp pigeonpea, sweet bean paste, and pigeonpea starch were developed in China (Jianyun et al. 2000). The spicy-crisp pigeonpea was made through procedures of steeping, selection, and frying. The product is crisp and has nice taste with special flavor which met the National Standards. The sweet bean paste is of golden yellow color and tastes good and feels smooth. The starch products made from pigeonpea were found better in sensory index when compared with broad bean (*Vicia faba*).

Other Potential Uses

Vegetable. Chinese generally consume a great deal of fresh legume vegetables everyday. Owing to their large seed size, pleasant flavor (sweet), and green color of immature seeds, the recent ICRISAT pigeonpea varieties have a potential of becoming a popular vegetable in China. The range of maturity available in the germplasm can provide fresh peas for consumption over a long period of time. The short-duration types can be grown around in peri-urban areas. The medium-duration types could be intercropped with cereals in farm lands while long-duration types are ideal for soil conservation. The green pods in these cropping systems can be harvested as a vegetable. Vegetable pigeonpea is very nutritive (Faris et al. 1987) and this will provide much needed vital nutrients to the rural masses.

Snacks. At present a variety of snacks made from cereals, legumes, and fruits are available in the Chinese market. Since pigeonpea seed contains 22% protein and 8 important amino acids, necessary for the human body, its snacks and other processed products will be able to compete well in this enormous market. Some of the products which have good potential include spicy-crisp grains, pigeonpea sweet paste, and noodles. The processing technology for spicy-crisp pigeonpea is established and it could be utilized immediately. There is a great deal of demand for sweet bean paste in China before the Mid-Autumn Festival every year. In the past China had imported pigeonpea sweet paste to produce high-grade "moon" cake. There is an apparent demand for this product in the market.

In China, legume noodles are made from mung bean (*Vigna radiata*) and broad bean and they have a good market. At ICRISAT, a technology to prepare high quality noodles from pigeonpea has been developed and it can be transferred to China. It is believed that this product will certainly find a place in the market.

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