Pigeonpea: An Excellent Host for Lac Production

Li Zhenghong[1], **K B Saxena**[2], **Zhou Chaohong**[1], **Zhang Jianyun**[1], **Gu Yong**[1], **Zong Xuxiao**[3], and **Yang Shiying**[4] (1. Chinese Academy of Forestry, Kunming, China; 2. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru 502 324, Andhra Pradesh, India; 3. Institute of Crop Germplasm Resources, Chinese Academy of Agricultural Sciences, Beijing, China; 4. Institute of Crop Germplasm Resources, Guangxi Academy of Agricultural Sciences, Nanning, China)

Pigeonpea (*Cajanus cajan*) was introduced into China sometime in the 6th century from India and since then it was cultivated sporadically in the southern provinces. In the 1950s, pigeonpea was identified as a favorable host for lac insect (*Kerria lacca* Kerr.) in Yunnan Province, China because it was found to have good characters such as fast growth, and high yields of quality lac. Also, the crop is easily cultivated. Scientists at the Lac Research Station, located in Jingdong in Yunnan Province, played a leading role in the research and development of this crop. During the past 50 years, a lot of research has been conducted on various aspects of lac production and most reports and research papers have been published in Chinese language in the local journals. To benefit pigeonpea researchers outside China, an attempt has been made to review the major research findings related to the use of pigeonpea as host for lac production.

In Yunnan Province, pigeonpea cultivation became popular among the farmers. According to Yude et al. (1993), in the Yunnan Province alone pigeonpea occupied about 3500 ha in 1989. The average lac yield was about 750 kg ha^{-1} (Anonymous 1978, Yunzheng et al. 1980, Lisa and Kaigui 1980). The high profitability of the crop helped spreading pigeonpea cultivation in the neighboring provinces. In the next decade pigeonpea cultivation met with a serious set back due to severe downfall in the demand of lac in the international market and this resulted in abandoning of the commercial cultivation of pigeonpea in China.

Adaptation and Agronomy

Pigeonpea cultivation in China was restricted to the frost-free areas of arid, semi-arid tropical, and sub-tropical regions of southern provinces. Traditionally, the crop is sown during rainy season which begins in the month of May and extends up to July. The sowings were done in hills, with inter-row spacing of 120–150 cm and plant spacing of 100 cm. Some farmers also adopted intensive cultivation with inter-row spacing of 200 cm and plants within rows spaced at 50 cm. About 3–5 seeds of pigeonpea were sown in each hill applied with about 500 g of farmyard manure before sowing. After one month, thinning was done and only two seedlings were retained in each hill. Generally two weedings were carried out and the plants were pinched (removing growing tips of the seedlings) during early stages of growth to enhance the production of primary branches.

For lac production, one-year-old plants were used. For summer crop of lac, the brood lac was bound on the stem below the first branch in May. Similarly for a winter crop, the broods were bound in the month of October. For this purpose 5–9 suitable branches with more than 0.8 cm diameter were selected. Since the brood lac is bound below the first primary branch, larvae of the lac insect swarm spontaneously to settle down on the branches to secrete lac which is deposited around the branches or stem. The summer crop of lac is harvested in October while the lac harvesting of winter crop is done in May.

Population Responses

Traditionally, long-duration pigeonpea was cultivated at 1×1.5 m spacing at two plants per hill resulting in a population of 13320 plants ha^{-1}. From this crop, an estimated 39960 suitable branches can be obtained for lac production with a total branch length of 35164 m ha^{-1}. Yunzheng et al. (1980) compared different pigeonpea population densities by using spacing 0.5×2 m (19980 plants ha^{-1}), 1×1.5 m (13320 plants ha^{-1}), and 1×2 m (9990 plants ha^{-1}) for the total branch length available for lac production. The results showed positive relationship between plant population and number and total length of useful branches. At the population of 19980 plants ha^{-1}, 79920 suitable branches were produced with a total branch useful length of 80719 m ha^{-1}. It was interesting to note that a plant population of 9990 plant ha^{-1} produced more number (49950) of usable branches with more (46153 m) total branch length than higher plant population (13320), which yielded only 39960 branches and 35165 m branch length in one hectare.

Comparison with Other Hosts

Lisa and Kaigui (1980) compared the response of pigeonpea to brood lac production with other hosts such

Table 1. Comparative response of pigeonpea (*Cajanus cajan*) to brood lac production in Jingdong, China, 1964.

Description	Summer crop	Winter crop
Suitable parasitic rate[1] (%)	40–50	20–25
Suitable brood lac quantity per plant[2]		
Dalbergia szemaoensis	1/56	1/310
C. cajan	1/51	1/270
Eriolaena malvacea	1/30	1/150
Propagation capacity of brood lac[3]		
D. szemaoensis	1/73.6	1/29.8
C. cajan	1/70.5	1/31.5
E. malvacea	1/60.4	1/13.1
Lac yield (g $plant^{-1}$)		
D. szemaoensis	370	220
C. cajan	270	40
E. malvacea	255	30

1. Calculated from ratio of shoot length settled by lac insects and the length of effective shoots. Effective shoots are those shoots with >0.8 cm diameter.
2. Ratio of the shoot length bound by brood lac and the length of effective shoots.
3. Ratio of the brood lac area and the settlement area by its descendants.

as *Dalbergia szemaoensis* and *Eriolaena malcacea*. They concluded that the suitable parasitic rate for each pigeonpea plant was 40–50% in summer crop and 20–25% in winter crop; the suitable brood lac quantity for each plant varied when different brood lac was used, and the best one was from *D. szemaoensis* due to the high gravid quantity per lac insect on it (Table 1).

Derrong and Wenliang (1985) compared the quality of lac harvested from pigeonpea plants for three years. They concluded that the quality of this lac was up to the National Standards. The important parameters of the lac produced on pigeonpea plants are summarized in Table 2.

Effect of Flower Removal on Yield and Quality of Brood Lac

Long-duration pigeonpea plants bear a lot of flowers and have a long blooming period in winter and early spring seasons. So they also produce a large number of pods. This results in depletion in the deposits of important inorganic elements and consequently the growth of lac insects reared on such plants is also restricted. This adversely affects the yield and quality of lac. Kaiwei et al. (1988) studied the effect of flower removal on the yield and quality of lac produced on pigeonpea. They reported that nitrogen, phosphorus (P), potassium, copper, molybdenum, and boron contents in the leaves increased

Table 2. The quality parameters of lac produced on pigeonpea plants during 1979–81 summer crop at Jingdong, China.

Year	Color index	Soluble material in cold alcohol (%)	Lac wax (%)	Water (%)	Softening point
1979	27.7	85.52	5.84	3.36	69.1
1980	30.3	76.38	7.17	2.15	69.4
1981	22.8	18.17	6.07	4.50	65.7
Mean	26.9	79.02	6.36	3.34	68.1

and plants produced stronger branches due to manual flower removal or by spraying 0.3% ethrel and 2% carbamide on the deflowered plants. These treatments resulted in significant improvement in yield and quality of lac. Since pigeonpea flowers store maximum P, their removal from the plants increased P level within the plant system (Kaiwei et al. 1988). The lac insects reared on pigeonpea plants with no flowers and pods not only produced lac of high quality but also more yields. This is a significant observation since at ICRISAT pigeonpea scientists have developed long-duration lines in which the pod setting is inhibited due to the presence of genetic/ cytoplsamic male-sterility systems (Saxena and Kumar 1999). The use of such materials in lac production may help in increasing yield and quality of lac for a longer period without manual removal of the flowers.

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