ICP-6997, ST-1, ICP-1 and No.148 gave good yields across locations.

Management of early-duration varieties has received little attention in West Africa inspite of the fact that the International Institute of Tropical Agriculture (IITA) tried to popularize a number of early-duration varieties of the Cita series in 1974-75. Recently, at Nyankpala, Ghana, 45 early-duration types were planted in two replications during the 1st week of August. One replication was sprayed four times with monocrotophos at the time of flowering and at 7-day intervals following flowering. In the sprayed plots up to 2000 kg/ha of grain were harvested, while in the unsprayed plots grain yield was negligible. This indicates that early-duration pigeonpeas are difficult to grow without insecticide protection, unless planted very late in the season after the insect population has decreased substantially.

However, early varieties (120-130 days) may be profitably cultivated in areas of 300-400 mm/year rainfall in northern Senegal and Mali. Studies on planting dates, plant population, and insecticide spray schedules should be conducted to develop appropriate agronomic practices for specific areas and cropping systems.

Observations in Ghana and Mali (1000-1300 mm/year rainfall zone) have shown that thrips (*Megalurothrip sgostedi*) cause heavy damage to buds and flowers and pod setting is delayed until late November or early December, when soil moisture becomes a limiting factor. Besides thrips, borers (*Heliothis armigera* and *Maruca testulalis*) are major pests on the flowers and pods of pigeonpeas. Preliminary observations at Nyankpala have indicated that the damage caused by these pests is heavy in close plantings when compared with the damage in the very sparse plantings of the traditional cropping system.

Among diseases wilt is the only one that has been observed to any extent at experiment stations and in farmers' fields.

In most of West Africa, traditional subsistence cropping systems based on shifting cultivation are being slowly replaced by continuous farming as population pressure increases. This change to continuous cropping calls for the development of alternative systems for replenishing and maintaining soil productivity. At present the sole-cropping of cereal, and cropping it in rotation, or intercropped in space and time, is the common practice. Pigeonpea can be an important component in rotations or in cereal-legume intercrops. Besides maintaining soil fertility and providing nutritionally good grain, pigeonpea stalks are a valuable fuel.

In the humid tropics of Nigeria IITA scientists are evaluating pigeonpea along with other leguminous shrubs in "alley cropping", as an alternative system to the traditional bush-fallow.

Pigeonpeas, with a wide range of maturity (annual-perennial) and plant types, and the ability to use residual soil moisture effectively during the dry season, can fit well into short- as well as long-duration cropping systems.

Mr. Serafini, ICRISAT agronomist at Bamako, Mali, has begun extensive studies on the agronomic aspects of the crop and has shown that pigeonpeas have considerable promise for that area. The National program in Mali has already taken up seed multiplication of the promising types for distribution to farmers.

In West Africa pigeonpeas are traditionally cooked and eaten as whole grains. Cooking of the whole grain takes a long time and, in storage, the whole grain is difficult to protect against bruchids.

The grains can be easily decorticated by soaking them in water overnight, and after complete drying, dehulling them in a traditional mortar and pestle, or by rough-grinding them in stone grinders. Soup or sauce made from decorticated seeds has been found to be greatly appreciated by the local population.

Although cultivation of pigeonpeas in West Africa is presently negligible, its proven usefulness in the cropping systems of the savanna ecosystem means that pigeonpeas are likely to receive much more attention in the future.

- *D. Sharma (GTZ, Ghana)*

Genetic Resources

Pigeonpea Genetic Resources at ICRISAT

The basis of an intensive breeding program obviously starts with the assembly of a large diverse germplasm collection. ICRISAT's pigeonpea germplasm collecting activity started in 1974 with the acquisition of existing collections at IARI's Regional Station at Rajendranagar and at various universities in India. New field explorations were started in Madhya Pradesh, where much diversity exists. Virtually all states within India where pigeonpeas are important have since been visited at least once. In Nepal, Sri Lanka, and Kenya special pigeonpea collection tours have been carried out. Other countries, especially in Africa, South-East Asia, and the Americas are not yet represented, but will be explored when time and funds permit.

Up to March 1981 there were 8815 pigeonpea accessions from 32 countries. A majority (8189 accessions) came from India.

When the accessions are needed for evaluation or rejuvenation, they are grown from the onset of the monsoon onwards. At present only the Patancheru location (near Hyderabad in India) is used for this planting. Several morphological and agronomic features are observed: days to flowering and maturity; flower color; plant habit; number of branches; yield characters; pod and seed colors; and harvest index. All data are entered in a computer file, and are available for retrieval to supply information on those traits of interest. A catalog is not printed because of the need to update it every year, and its excessive bulk. But the computer file serves as a catalog, and researchers are welcome to request any pigeonpea material, with specific characters, for collaborative research work.

In addition to the cultivars of pigeonpea (*Cajanus cajan* [L.] Millsp.), its wild relatives receive attention and special efforts are made to collect, maintain, and make use of wild species of *Cajaninae*, the subtribe to which the pigeonpea belongs. These are species of *Atylosia, Rhynochosia, Dunbaria, Flemingia,* and *Paracalyx.* Some other genera in the subtribe are not yet represented at ICRISAT. Except for a few, the species collected so far have posed no maintenance problems, and many produce viable hybrids with pigeonpea. Interspecific hybrids between wild species sometimes appear to be better forage species than the parent species, but this needs testing. It is hoped to transfer desirable traits such as disease and pest resistance, both found in one or more species, to the pigeonpea. Seed is available in small quantity to interested workers.

- *L.J.G. van der Maesen (ICRISAT)*

Collection Efforts

In pigeonpea, and pulses in general, collection of germplasm from the field tends to be more difficult than in cereals. In the first place a head of sorghum or an ear of wheat yields many more seeds than a pigeonpea pod or cluster of pods, from which four to eight seeds only can be expected. Secondly, cereals tend to be cultivated more extensively, thus increasing the opportunities for collecting more diverse material within a given area.

Wild species of pigeonpea are also rather difficult to find because only a few species are of frequent occurrence. The trailing creeper *Atylosia scarabaeoides* is found almost ubiquitously within the area of the genus' distribution. The bushy *A. lineata* is fairly common in the Western Ghats of India. *A. grandifolia* is relatively common in Queensland and the Northern Territory of Australia. But most species have become restricted to ecological niches such as reserve forests, ledges unapproachable by cattle, or mountain areas where pressure from human beings and their domestic animals has been absent or less than that in the plains. Even in recent history these species were probably more common than today.

Labels of herbarium specimens indicate to us pigeonpea and wild pigeonpea locations. Statistics show the extent to which pigeonpeas are grown, but occurrences of less than 1000 ha per country are usually not reported, in which cases herbarium data are a useful alternative source of information. FAO no longer reports pigeonpea statistics separately.

Outside the Indian subcontinent pigeonpeas are important in at least four African countries: Kenya, Uganda, Tanzania, and Malawi. Except from Kenya, little germplasm is available. From the West Indies many accessions are available, but more are required to represent the area adequately. Germplasm is also needed from areas where pigeonpea is only of local importance as a garden crop or hedge contributing a little protein or vegetable to the diet. From those countries (in W. and S. Africa, Sudan, S.E. Asia, Central and S. America) germplasm could be obtained by collection; but using pigeonpea as the only target is uneconomical. On the other hand, if pigeonpeas are collected along with other crops, pigeonpeas tend to be accorded low priority because of lack of time and/or interest, and the pigeonpea season may not coincide entirely with those of the other crops being collected.

Pigeonpea is not under as much pressure of genetic erosion as cereals (maize, wheat, rice) may be and, therefore, more time is available to rescue its genetic diversity. However, the day will come when primitive landraces will have been pushed out by improved cultivars. It is important that the collection of pigeonpea germplasm be actively pursued wherever possible, and genetic resources workers would appreciate assistance from any source. It is essential that all samples should be brought together in one place where facilities are available for long-term preservation, with a complete duplicate elsewhere for insurance purposes.

If you have any lines that you feel should be preserved, ICRISAT will be pleased to enter them into its world collection of pigeonpeas. Please send up to 50 g of seed to the Genetic Resources Unit at ICRISAT.

- *L.J.G. van der Maesen (ICRISAT)*

Breeding

Pigeonpea Breeding—The Caribbean Experience

In breeding pigeonpeas, whether for nontraditional production systems or for year-round planting, a major selection criterion had been, until recently, the ability of the plant to initiate flowers and produce a crop within limits set by the production system; or in the case of year-round production, uninhibited flowering and fruiting in natural long-day environments. Following this approach, genotypes that are capable of initiating flowers in 60-120 days when planted in the Caribbean at any time of the year, and possessing acceptable seed yield potential, were selected. Our experience with such selections in the past 3-4 years, however, is that the canopy height fluctuates considerably from season to season, making mechanical harvesting and other cultural operations difficult. Further, the intensity of flowering and synchrony of anthesis are adversely affected. It therefore seems that selection for low variability of plant height is as important as selection for floral initiation.

Ali and Ariyanayagam (in press) showed that long days and high ambient temperature delayed flowering and promoted vegetative growth. Ariyanayagam (1981) further demonstrated that even small differences of 3-5°C each day during the growth of the crop would cause canopy heights to differ markedly. Interaction of daylength effects with temperature further accentuated canopy height differences. Temperature variations of 3-5°C between days within similar growing periods in different years are not uncommon in the tropics. Therefore, efforts are being made to identify genotypes that are low in sensitivity to temperature fluctuations.

A procedure for field screening against daylength and temperature sensitivity was proposed by Ariyanayagam (1980). The procedure employs solar radiation to raise the temperature around the crop canopy using an open-sided plastic covering. An interesting aspect of the method is that the temperature around the canopy constantly fluctuates, just as under ambient conditions. This allows the crop to grow in a more realistic environment than in a growth chamber (where such screening is usually attempted). It is an inexpensive screening method as well.

By using this screening method it has been possible to identify genotypes that are low in sensitivity to daylength but that are highly sensitive to temperature, as well as others that show the reverse trend.

It appears that only on reducing the sensitivity of the crop to daylength and temperature, and probably other factors as well (Ariyanayagam et al. in press) can a meaningful effort to improve harvest index, grain size, synchrony of flowering, etc., be made. A major breakthrough in productivity is unlikely until the attainment of the features just stated. Research at the University of the West Indies is primarily concerned with these considerations.

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