Pigeonpea Production and Utilization in

R Tabo[1], **M I Ezueh**[2], **O Ajayi**[1], **J E Asiegbu**[2], and **Laxman Singh**[3]
(1. ICRISAT, Nigeria; 2. Department of Crop Science, Faculty of Agriculture, University of Nigeria, Nsukka, Nigeria; 3. ICRISAT Asia Center)

Pigeonpea is a multipurpose legume crop that provides food, fuelwood, and fodder for small-scale farmers in subsistence agriculture. It also enhances soil fertility through its leaf drop. Little seems to be known about production levels in Nigeria, and there has not been a systematic attempt to evaluate production practices, constraints, and utilization of the crop. Surveys were therefore conducted in Oct 1991, Nov/Dec 1992, and Jan/Feb 1993 to identify pigeonpea production areas and practices, as well as uses of the crop, and changes needed for improving production.

Information was collected through field visits, questionnaires and discussions with farmers, State extension officers, university and Ministry of Agriculture staff, and market women. The following States were visited during the three surveys: in 1991, Benue, Enugu and Kogi; in 1992, Adamawa, Bauchi, Benue, Cross River, Kaduna, Niger, Plateau and Taraba States, and the Federal Capital Territory, Abuja (FCT); and in 1993, Anambra, Benue, Delta, Edo, Enugu, Kaduna, Kogi, Niger, and Plateau States (Fig. 1). The survey team consisted of two agronomists, a plant breeder, and two entomologists. In addition to surveying farmers' fields, research stations with pigeonpea trials were also visited.

Pigeonpea was observed growing in a variety of cropping systems in all of the States visited. In the south-central part of the country (Kogi, Enugu, and Benue States) pigeonpea is grown on small fields (<1 ha) as a hedge, sole crop or intercrop. All of the following were observed as pigeonpea intercrops: cassava, yams, cocoyams, maize, sorghum, rice, cowpea, bambara nuts, melons, and castor.

Pigeonpea was seen in homegardens and as a border crop in parts of Kaduna, Plateau, Benue, Cross River, Taraba, Adamawa, and Bauchi States. Larger plantings either as an intercrop or sole crop were observed in parts of Benue, Kaduna, and Plateau States. The Cross River Agricultural Development Program (ADP) at Ogoja is using pigeonpea as the hedge rows in an alley crop system with yam and cassava. The Taraba ADP at Jalingo is testing pigeonpea and other legumes in maize-based ing farmers to use pigeonpea as livestock feed.

Perennial types with white or brown seeds and 3–4 seeds per pod are most commonly grown, and remain in the field for two years. Plants mature in 7–8 months and grow to a height of 2–3 m. Farmers retain seeds or purchase from the market for sowing in the following season.

Land is usually prepared manually. Sowing is done on the flat from May to Jul, depending on the locality, and ridges are formed later at the time of the second weeding. Row to row spacings vary from 1–1.5 m and within row spacings from 0.3–1 m. Plant stand is highly variable, even on the same field, with an average of about 2–3 plants per stand. There is virtually no use of fertilizers and pesticides.

Mixed cropping, as noted above, is the predominant cropping system but sole cropping was also observed. Sorghum is the main companion crop where rainfall is limiting while maize and cassava predominate in areas with better rainfall. Some farmers sow the companion crops in the same row in Apr/May while others sow pigeonpea after the maize crop is about 1 m tall. Maize is harvested in Aug/Sep, while sorghum, which is often late maturing is harvested in Nov/Dec. Pigeonpea is harvested from Jan to Mar.

Farmers in many places harvested pigeonpea by picking the pods. In some places, stem harvesting was practiced. The stems were cut at 25-30 cm from the base and pods were picked later at home. Most farmers began to harvest when 90% or more of the pods became dry to minimize losses due to shattering and dry season bush fires. Pods may be harvested 2-3 times, especially on large farms. Homestead plantings were not harvested as promptly as those located in the farms.

Pods are stored for <72 hours before threshing, and the grain is stored as whole seeds. Seed samples from Nsukka and Ankpa markets were infested by the cowpea weevil, *C. maculatus*, while samples collected from farmers were not infested in spite of the lack of any form of storage chemical or device. In Lokoja a farmer indicated that he stored his seeds in an open calabash without any damage by storage beetles. Most farmers claimed that they were able to store their seeds for more than three years under ambient conditions.

Dry grains are boiled to tenderness before peeled yam is added together with palm oil and other ingredients (e.g., pepper, onion, maggi cubes, salt, and crayfish). This yam porridge meal is served with vegetables and meat or fish.

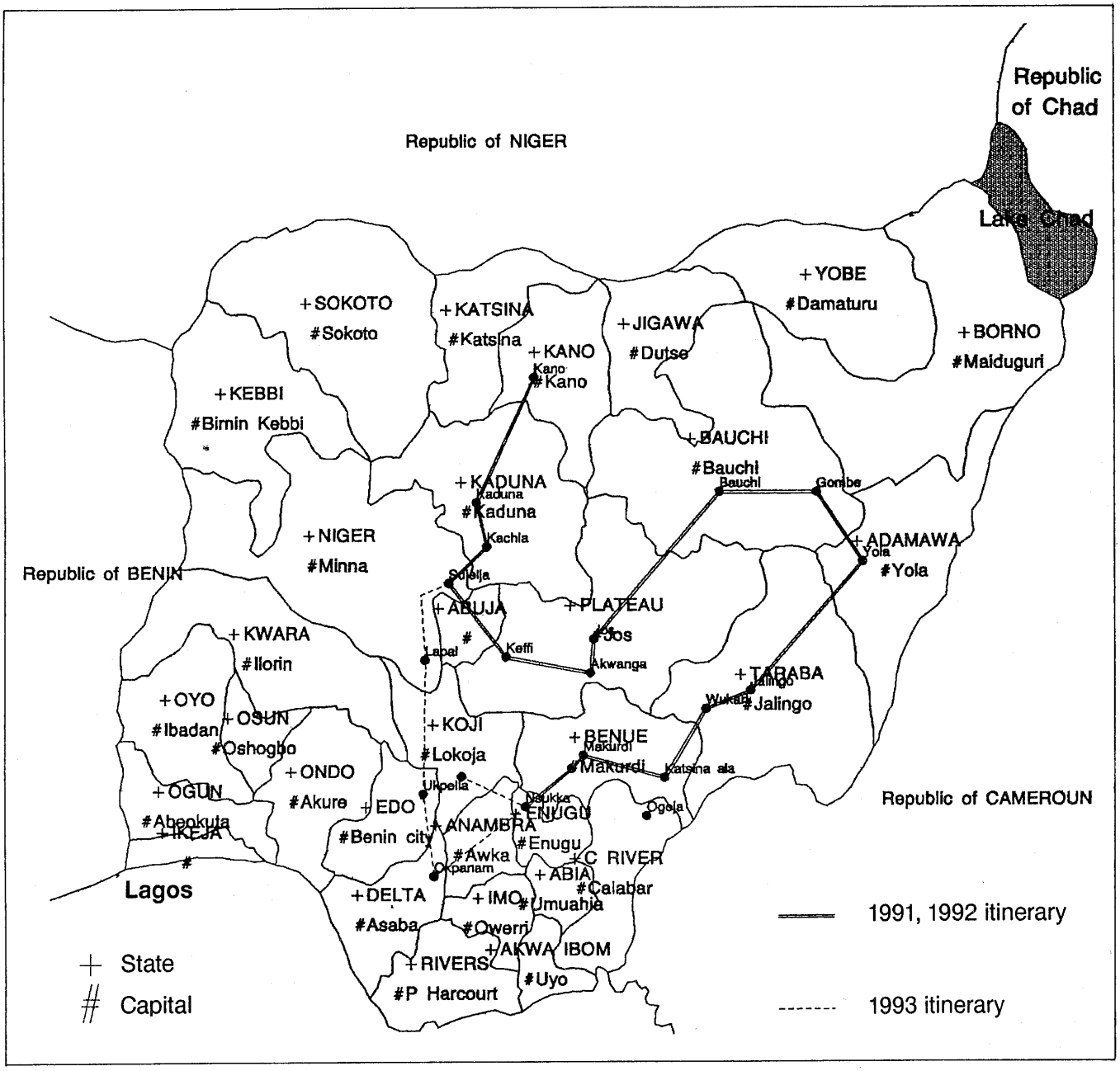

Figure 1. Itinerary during the survey of pigeonpea growing areas in Nigeria, 1991, 1992, and 1993.

Maize/pigeonpea porridge (*ayalaya*) is another popular preparation, and is considered a special treat in some areas. Pigeonpea is boiled to tenderness. Partially milled maize grain is put in a basket or perforated container lined with unshredded vegetable leaves. The basket is then put in the pot of boiling pigeonpea grain but without immersing the milled maize in the boiling water. The milled maize, heated by the steam, swells, and when tender, is added to pigeonpea for further boiling. Additional ingredients such as fried palm oil, onion, pepper, salt, and shredded leaf vegetables are also added. This is one of the most common forms in which pigeonpea is eaten by Nsukka people.

Pigeonpea is also used as a soup thickener, substituted for cowpea in *akara* balls (grinding the cotyledons into a paste and deep frying), cooked as *moi-moi* and fermented to produce *dawa dawa* for food seasoning.

A number of non-food uses were also reported. Leaves are fed to livestock. It is especially important during the dry season when forage becomes scarce, although it is not grown solely as fodder. Dried stems are used as fuel and to stake yam beans.

Farmers were aware of the benefit of pigeonpea on soil fertility and mentioned the accumulation of leaf litter on the soil surface and nitrogen-fixing root nodules in the soil.

Farmers asked for high yielding, shorter duration varieties with softer, faster cooking grains, and varieties suitable for alley cropping. Yields and grain quality could be improved with optimal sowing dates, plant population, fertilizer and pest control, and processing techniques. Research into alternative uses (e.g. vegetable types like the *dawa dawa* food condiment) and cooking qualities could also enhance pigeonpea production in Nigeria.

Acknowledgement. We thank ICRISAT for providing funds through the DDG Africa funds. The active participation of Mr S.A. Salako, Technical Assistant (entomology) at ICRISAT during the survey is also acknowledged.

Breeding/Genetics

Effect of Different Population Improvement Schemes on Correlations Among Yield Traits in Pigeonpea

A P Singh, R Raina, U P Singh, and **R M Singh** (Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221 005, Uttar Pradesh, India)

Pigeonpea is grown predominantly in mixed cropping systems in India. Productivity levels are low, and vary widely. There is a need to bring about a stable improvement in the productivity of this important crop.

Pigeonpea has generally been regarded as a self-pollinated crop; breeding procedures have been confined to line selection from germplasm and hybridization followed by pedigree selection. But because of the fairly high degree of outcrossing, such procedures fail to raise Yield is a complex trait, governed by several component traits which may or may not be positively associated with yield. It is now known that pods per plant is the most important yield-contributing trait in pigeonpea (e.g., Upadhyay and Saharia 1980; Didhu et al. 1985; Sinha et al. 1987; Bhongale and Raut 1987; Patel et al. 1988). However, before formulating breeding procedures, the nature and magnitude of correlations between important yield traits should be known. The present study assesses the effect of different population improvement approaches on trends of correlations between yield, and some of its component traits.

A base population (B_0) was synthesized by mixing equal quantities of F_2 seeds of 12 pigeonpea hybrids produced by involving two genetic male sterile lines as female parents. These hybrids were obtained from ICRISAT Asia Center. Four population improvement schemes were followed with nearly 4500 plants maintained in each scheme as given below:

(a) Mass selection without gridding (P_0) in which plants were selected, irrespective of sterility or fertility;

(b) Mass selection with gridding (P_1) involving selection of superior male sterile and fertile plants from different blocks made in this population;

(c) Selection among selfed progeny (P_2) involving the harvesting of male fertile plants, and their testing in the next season with half of the seeds. The remaining seeds of superior plants were bulked;

(d) Selection among half-sib families (P_3) involving the same procedure as mentioned above except that only male sterile plants were harvested individually.

In this way, four elite populations were developed. In the final evaluation, data were recorded on 40 plants selected randomly from each of these populations, grown in two replications for plant height, number of primary branches, pods per plant, and seed yield per plant. The genotypic and phenotypic correlation coefficients between various traits were calculated by the method suggested by Panse and Sukhatme (1967).

Analysis of variance revealed that variances due to treatments (genotypes) were highly significant for all the traits in all the populations (Tables 1 and 2). The data on genotypic and phenotypic correlation coefficients are presented in Table 3.

Highly significant positive correlations between all the character pairs were observed in all the populations, both at genotypic and phenotypic levels. The maximum positive correlation at the genotypic level was noticed for pods per plant, and seed yield per plant in base population, and in four developed populations. Use of different selection schemes did not cause a significant change in the association pattern of different traits. However, from this study it may be concluded that in any selection scheme to increase the yield levels in pigeonpea, the maximum weight should be given to two traits, pods per plant, and number of primary branches.