TESTING AND EVALUATION OF COWPEAS

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I am concerned principally with the yield testing phase of the cowpea breeding program. Materials for yield testing come from several sources:

1. Germplasm collections
2. Tested stocks from other breeders
3. Single plant selections from population improvement and the pedigree crossing program
4. Mass selection out of existing lines, and eventually
5. By feedback of materials co-developed with collaborator's stations and national programs.

Materials are first tested in a preliminary yield trial. This season there are 92 entries in three trials. Each trial consists of about 30 lines replicated twice. All plots are of a standard size (4 meter 4 row plots with 75 cm between rows and 20 cm between plots within the row). Preliminary trials are grown only at IITA. The best of the material from these trials, and material fed in by other subprograms, are tested in advanced yield trials consisting of about 25 lines with 4 replications. This season there are 100 entries in four trials. Advanced Trial No. 1 contains the best material from previous years' advanced trials and is grown both at IITA and other stations. Uniform trials are made up of the top entries from the previous seasons' advanced yield trial No. 1 and uniform trials.

The orders of priority in yield testing will be the following:

1. Increasing the efficiency of the yield tests
2. Evaluation of the level of precision of the present system
3. Increasing the number of lines being tested for yield, and
4. Developing different kinds of trials for specific purposes.

In order to increase the efficiency of the present testing procedure an in-depth analysis of the present 4m four row plot has been undertaken in an experiment which also explores the use of hill plots. The questions being asked are:

1. Is the four meter four row plot big enough to accurately predict yield potential?
2. Does one border row at each side of the plot offer enough protection from "border" effect?
3. Are four replications enough considering soil variability?
4. Can small or "hill" plots be sampled to predict yield at the preliminary testing stage, and
5. Can whole plots be harvested and yield figures derived from ground cover and a conversion factor if optimum population density remains constant.

The precision of the present system can be found by looking at the goal of higher potential and stability of yield. Photo and temperature-sensitively can be indicated by days to 50% flower and days to maturity. Much more can be accomplished through cooperation with institutes in studies involving growth chambers. The precision needs to be greatly increased with studies of genotype by environment interactions. Plant efficiency and plant architecture are looked at through leaf size and shape, plant type, and pods per peduncle, but more extensive tests need to be conducted and correlations run between such characteristics as gas exchange, photosynthetic efficiency, peduncles per plant, light penetration, light utilization, and other plant characteristics. Studies of this type may well hold the key which will one day unlock the resistance of legumes to the greater genetic advance which has been enjoyed in the field of cereals.

Resistance to disease has always been a deterent to higher yields. Great strides have already been made in the identification of diseases and the location of resistance. Unfortunately, as better plants are bred, the pathogens also undergo genetic evolution, and breeding for resistance will always be necessary. Much the same can be said for insect pests, although insecticides give a greater leverage against pests. However, we need to continue to locate genetic resistance, determine how the resistant reaction works, and apply the principle of biotic parallelism in identifying new and different sources of resistance. The simple notes on resistance taken by a breeder alone are necessary but not sufficient.

The three avenues through which material with highest yield in our tests flow out from IITA are:

1. As genetic stocks from the germplasm collection or breeding program in various stages of generation advancement

2. As bulked seed from our population improvement program to collaborating scientists, and

3. As varieties through either uniform coordinated yield trials or germplasm "description".

In addition most high yielding materials will be recycled through the IITA population improvement program and into varietal improvement crossing programs. These materials also will have been processed through other sub-programs in GLIP for testing and evaluation of seed cooking quality, nutritional value, physiological characteristics and disease and insect reaction.

New materials are now flowing out of our testing program. A large backlog of promising materials are available for evaluation, and much duplication can be observed in the early stages. As testing inevitably expands we must efficiently process much larger numbers of genetic stocks at both advanced and preliminary levels.

The objectives of GLIP are to increase grain legume usage in the lowland tropics, and to increase yield potential and stability of grain legumes. From observations of the "green revolution" in other parts of the world, the

first objective is easily obtainable, provided a new variety can be produced with increased yield potential and stability and of acceptable consumer quality. Unfortunately, protein quality and quantity are not usually considered by consumers as they have no method of measuring it. However, there exists a responsibility to insure high protein quality and quantity in all new materials generated.

Cowpeas have at least three major uses, mono-cropping, multiple cropping, and ground cover. Each use requires a different type of plant which is stable over a different set of environments. New methodology must be developed to find which plant fits into which environment, placing even greater stress on the need for studies measuring genotype by environmental interactions. Then the question "Do you want broad adaptivity and stability of yield per se or merely to determine where each variety is best adapted?" must still be answered.