GOALS AND PROGRESS IN GLIP - JUNE 1975

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The basic objective of the Grain Legume Improvement Program is to improve the quantity and quality of food from legumes in the lowland tropics. After nearly four years of intensive activity at IITA there has not been any considerable improvement in national yields of grain legumes in the lowland tropics. However, I am hopeful that we will see some impact of our collective efforts on tropical agriculture within five years. I suggest we remind ourselves of our objectives regularly. It is one of the purposes of this meeting to do so.

We should bear in mind that only a start has been made on the principal species being worked on at IITA: cowpeas, soybeans, pigeon peas and lima beans. In fact, we are only now beginning to understand how to proceed in improving these crops. In some areas such as plant architecture we can only conjecture possible ideotypes to be developed. Even when such plant types are established, only a start has been made towards incorporating additive effects and increasing tolerance to various stress factors.

I would therefore propose future goals for improving tropical grain legumes as stabilizing productivity in the short term and increasing yield potential in the long term. Implicit in this short term goal is the incorporation of high disease and pest resistance as well as stress tolerance into conventional plant forms. The long term goal would involve development of new plant types designed to respond to high populations under sole cropping, or to fit more efficient farming systems. They should have higher disease and pest resistance and seeds with improved quality, acceptability and nutritional value.

In considering long term problems in a crop such as cowpea, perhaps the most difficult and persistent group of diseases to deal with in the lowland tropics will be viruses. Among insect pests, the pod borers are particularly intractable since they damage the fruit directly and inside the pod where they are usually protected from chemical sprays. Development of robust erect cowpea plants will depend on the ability to incorporate strong stem and roots, something we know very little about at present.

Further, I would suggest that we not overlook the indeterminate (both photosensitive and insensitive) viny climbers. Previous experience at IITA and elsewhere indicates that extraordinary seed yields are possible from several legume species when efficiently supported. Consistent dry seed yields over 2500 kg/ha have been obtained here with cowpeas; some strains of lima beans and mucuna beans exceed 4-5 tons/ha. Last year at CIAT, trellised field beans (*Phaseolus vulgaris*) produced up to six tons of dry seeds per ha. We need to determine why viny strains perform so much better than bush types and to develop trellised cropping both with living supports like trees, *Leucaena* or pigeon peas and on artificial trellises of poles, stick and wires.

RESEARCH DEVELOPMENTS

Our annual reports and other papers describe some of the advances that have been made: development of three elite germplasm lines of both cowpeas and pigeon peas, field tolerance of thrips and leafhoppers, new multiple disease resistance strains of cowpeas, minimal insecticidal practices, information on dry matter partitioning and photosynthesis, techniques for daylength and temperature response, and more effective crop management. However, these advances are now history and we wish to draw attention to the most recent or imminent developments not mentioned or only briefly touched on in our papers. These are as follows:

1. Population improvement. New breeding technology applicable to grain legumes permits much more rapid and sustained advance than previously possible. It also allows exploitation of additive gene effects and breaking of linkages. Utilizing male sterility (MS-2) developed at IITA in elite germplasm back-grounds makes it possible to produce tens of thousands of crosses in a single season.

2. New germplasm. Some of the new elite strains with specific desirable attributes include:

COWPEAS	SOYBEANS	PIGEON PEAS	LIMAS
TVu 1977-OD	TGm 282-2	TUc 2705-3d	TPl 95E
TVu 4557	TGm 245-4	TUc 2705-3T	TPl 170-33
TVx 30-3e	TGm 273-2	TUc 2432-1	TPl 183A-1
TVx 1836-66E	TGm 263-1	TUc 1381-1	

There are also widely adapted winged beans TPt 1, 2 and 6; Mucuna -BG; and African yam beans - TSs 33.

3. Physiological efficiency. The joint efforts by the physiologist and cowpea breeders in searching for and utilizing genetic characters like more rapid and robust (large) plant development, delayed pod filling, increased size of pods and seeds, multiple pods per peduncle, multiple peduncles per node, shorter peduncles, restricted or transformed branching and strong stems and root systems will provide the means to dramatically restructure the cowpea plant.

4. Soytype pigeon pea. A new family of variable height (60-220 cm), non-branching, photo-period/temperature insensitive, short duration (90-115 days), determinate and profuse podding pigeon pea lines derived from the population TUc 2705 have been developed. These may provide a new basis for improving this highly promising species and allow extraordinary high populations of up to half a million or more plants/ha.

5. Improved multiple resistance. New strains combining multiple disease resistance with high yields include selections from TVu 76 x 1190 (TVx 1836), TVu 2616P-02D, 347, 1595, 2004 and 1065.

6. Insect resistance. Interesting new cowpea stocks with apparent field tolerance to leafhoppers and thrips under development by the entomologist include TVx 4-5C, TVu 4557 and 662 (in addition to VITA 1 and 3). Increasing attention is also given to screening for pod borer resistance in partially tolerant lines like TVu 1629 and 1886.

7. Chemical protectants. Minimal use of foliage sprays of both systemics (Azodrin) and contacts (Gammalin) has proven feasible as well as the fungicide Chloroneb (Demosan) and the insecticide Furadan as seed dressings or placed in the seed furrow. Encapsulization of seed furrow protectants together with small quantities of plant nutrients and other materials also appears promising.

8. Growth processes. Rapidly expanding information on photosynthetic processes (especially in cowpeas), partitioning of assimilates, effects of environmental factors (light, temperature, moisture and soils) and compensatory mechanisms will have an increasing influence on both plant improvement and management aspects.

9. Better management. Several improvements are under development that appear promising and include optimizing populations and spatial arrangements for different plant forms over a range of environments, better associated and relay cropping systems for different species and plant types, harvesting dynamics, minimal tillage combined with both "dead" and "live" (Arachis prostrate) mulches, and utilization of plant nutrient seed treatments. Other possibilities being explored include living trellises of Leucaena leucocephala and pigeon peas.

10. Quality improvement. A vast amount of information has been collected on protein content and quality especially in cowpeas. This provides an opportunity to start a population improvement scheme aimed at further increasing protein content and content of sulfur amino acids. Continuing studies on cooking and organoleptic qualities provide the means for concurrent improvement of acceptability.

PROGRAM EXPANSION

Establishment of a viable program is evidenced by an increasing flow of improved genetic stocks, more effective plant protection measures and more efficient cultural practices. Sustaining this turn out of improvements will depend in part on expanding germplasm exploration and on the testing of germplasm and cultural practices over a broad range of environments. Closely allied to these activities is training both in applied research and on theoretical aspects. Specific areas of expansion over the next several months will include the following:

1. Germplasm exploration. A project for exploring and evaluating grain legume germplasm in Tropical Africa has recently been proposed and accepted by the International Board of Plant Genetic Resources (IBPGR). This will involve a project centered at IITA and with two field collecting units. Funding is available for 1975 and 1976. A project leader is being recruited.

2. High rainfall substation. The recent acquisition of a substation in a very humid region near Port Harcourt will considerably expand GLIP's capability for improving grain legumes under high rainfall and depleted acid soil conditions.

3. GLIP research network. A proposal to establish small teams of 1 to 3 scientists in key regions to conduct yield trials and other offsite research, in cooperation with national agencies; is under consideration by potential donors. Placement of such teams in Northern Nigeria, Upper Volta, Cameroons, Liberia and Sierra Leone has been suggested for 1976/77.

4. Cooperative testing. Uniform cooperative testing is expected to continue increasing, although hopefully not at the same rate as during 1972 to 1974:

YEAR	COWPEAS	SOYBEANS	PIGEON PEAS	TOTAL
1972	6	4	-	10
1973	39	4	-	43
1974	80(2)	44(2)	28	152

Distribution of seeds in addition to the above increased to 954 separate seed lots shipped to 235 requestors in 51 countries (85% in tropics) during 1974. This was up from 153 seed lots distributed to requestors in 24 countries in 1973.

PERSONNEL CHANGES

Change seems inevitable and GLIP will lose two of its members by mid-August. I would like to acknowledge the outstanding contributions made by Drs. Rawal and Williams.

Dr. K. Rawal has added several thousand accessions to the GLIP germplasm collection of Vignas, Cajanus, *Phaseolus lunatus*, *Dolichos* and other species, as well as a wide knowledge in the cultivation and use of these crops. However, his major contribution may well be the progress he has made in population improvement in cowpeas and the exploitation of genetic male sterility toward effecting massive recombination. We will greatly miss Kanti's delightfully enthusiastic personality and bright, sparkling (though earthy) wit. We wish him well in his new position in the Taximetrics Unit at the University of Colorado at Boulder.

Dr. R. J. Williams has made solid contributions toward understanding and controlling several major diseases of cowpeas in this region. Perhaps his major achievement will be the search and development of multiple disease resistant strains. This development alone has placed cowpeas in a new perspective for the humid tropics. We will miss Rob's many contributions toward the GLIP team including help in editing manuscripts, organising program meetings and generally vigorous and enthusiastic support for all our activities. We wish him all success on his pathological investigations on sorghum and millets at ICRISAT.

Editor's Note (by RAL)

It must also be mentioned that the leader of GLIP, K.O. Rachie, will be leaving IITA in November to take up new duties as Director of Research at the international center CIAT in Colombia. The present success of GLIP is due in no small measure to the acute scientific judgment, the enthusiastic leadership and the sheer hard work of Ken Rachie. As a first-rate plant breeder and geneticist with long experience in the tropics, he has been able to direct an imaginative and forceful attack on the virtually unstudied tropical grain legumes. His numerous publications, plus the new legume varieties growing in experimental fields around the world, bear witness to the progress he has made. As leader of an interdisciplinary group of independent scientists, he has welded them into an integrated team working towards grain legume improvement in all of its several aspects. As a man with great capacity for hard work, he has managed to combine a vast amount of administrative office work with frequent trips to the experimental fields. Ken has made GLIP the vigorous effort that it is today. We shall miss him here at IITA, but we know that he will continue in his new post to make important contributions to tropical agriculture around the world.